APPENDICES

Appendix A – POTABLE WATER SERVICING

A.1 DOMESTIC WATER DEMAND CALCULATIONS

455 McArthur Avenue - Domestic Water Demand Estimates

Based on Site Plan from Hobin Architecture dated October 2018

Population densities as per City of Ottawa Guidelines:

2 Bedroom	2.1	ppu
1 Bedroom	1.4	ppu

Unit Type	Area (m^2)	Population	Daily Demand Rate (L/cap/day)	Avg Day Demand		Max Day Demand [1, 2]		Peak Hour Demand [1, 2]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
2 Bedroom	-	13	350	3.2	0.05	7.9	0.13	17.4	0.29
1 Bedroom	-	9	350	2.2	0.04	5.5	0.09	12.0	0.20
Total Site :		**22**		**5.3**	**0.09**	**13.4**	**0.22**	**29.4**	**0.49**

1 Water demand criteria used to estimate peak demand rates for residential areas are as follows:
maximum daily demand rate = 2.5 x average day demand rate
peak hour demand rate = 2.2 x maximum day demand rate

A.2 FIRE FLOW REQUIREMENTS PER OBC GUIDELINES

Fire Flow Calculations as per Ontario Building Code 2006 (Appendix A)

Job#	160401521	Designed by:	DJC
Date	28-Oct-19	Checked by:	TR
		Description:	455 McArthur Ave

$$Q = KVS_{tot}$$

Q = Volume of water required (L)
V = Total building volume (m3)
K = Water supply coefficient from Table 1
S_{tot} = Sotal of spatial coefficeint values from property line exposures on all sides as obtained from the formula

$$S_{tot} = 1.0 + [S_{side1} + S_{side2} + S_{side3} + S_{side4}]$$

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	height of ceiling (m)	Total Building Volume (m^3)
	223	4	3.1	2,765
3	Side	Exposure Distance (m)	Spatial Coefficient	Total Spatial Coeffiecient
	North	10.5	0	2
	East	2.5	0.5	
	South	26	0	
	West	1	0.5	
4	Established Fire Safety Plan?	Reduction in Volume (%)		Total Volume Reduction
	no	0%		0%
5				**Total Volume 'Q' (L)**
				127,190
				Minimum Required Fire Flow (L/min)
				3,600

Building is 3 storeys tall with units in the basement (i.e. 4 floors per OBC volume calculations)

Type of construction assumed based on building height (3 storeys) and building use (residential).
Average floor to ceiling height of 3.1m assumed based on maximum building height of 10.5m.

A.3 BOUNDARY CONDITIONS

From:	Wessel, Shawn
To:	Chochlinski, Daniel
Subject:	FW: 455 McArthur Ave - Request for Information in Preparation of Servicing Report/Design Package
Date:	Wednesday, September 4, 2019 9:17:27 AM
Attachments:	455 Mcarthur Sept 2019.pdf

Good morning Mr. Chochlinski

The following are boundary conditions, HGL, for hydraulic analysis at 455 Mcarthur (zone 1E) assumed to be connected to the 406mm on Mcarthur. See attached PDF for location.

Min HGL = 109.8m

Max HGL = 118.2m

MaxDay + FireFlow (60 L/s) = 112.0m

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.

Out of Office Notice:

Please be advised that I will be away from the office September 11, 2019 returning on the 17th.

If you require additional information or clarification, please do not hesitate to contact me anytime.

Thank you

Regards,

Shawn Wessel, A.Sc.T.,rcji
Project Manager - Infrastructure Approvals
Gestionnaire de projet – Approbation des demandes d'infrastructures

Development Review Central Branch | Direction de l'examen des projets d'aménagement, Centrale
Planning, Infrastructure and Economic Development Department | Direction générale de la planification de l'infrastructure et du développement économique
City of Ottawa | Ville d'Ottawa
110 Laurier Ave. W. | 110, avenue Laurier Ouest, Ottawa ON K1P 1J1
(613) 580 2424 Ext. | Poste 33017
Int. Mail Code | Code de Courrier Interne 01-14
shawn.wessel@ottawa.ca

From: Chochlinski, Daniel <Daniel.Chochlinski@stantec.com>
Sent: August 30, 2019 10:23 AM
To: McCreight, Andrew <Andrew.McCreight@ottawa.ca>; Wessel, Shawn <shawn.wessel@ottawa.ca>
Cc: Moroz, Peter <peter.moroz@stantec.com>
Subject: RE: 455 McArthur Ave - Request for Information in Preparation of Servicing Report/Design Package

Hi Andrew,

Thank you for your help. We'll consult with Shawn going forward.

Shawn,

Please let me know if you require any other information from us (beyond what I sent via email yesterday).

Have a great long weekend,

Daniel Chochlinski
Engineering Intern, Community Development

Direct: 613-784-2253
Mobile: 343-961-9619
daniel.chochlinski@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

□□□□□

From: McCreight, Andrew <Andrew.McCreight@ottawa.ca>
Sent: Friday, August 30, 2019 9:58 AM
To: Chochlinski, Daniel <Daniel.Chochlinski@stantec.com>
Cc: Moroz, Peter <peter.moroz@stantec.com>; Wessel, Shawn <shawn.wessel@ottawa.ca>
Subject: RE: 455 McArthur Ave - Request for Information in Preparation of Servicing Report/Design Package

Hi Daniel,

Shawn Wessel has been assigned to the pre-consultation file and can assist with your inquiry.

Regards,
Andrew

Andrew McCreight MCIP RPP
Planner III /Urbaniste III
Development Review Central/Examen des demandes d'aménagement secteur centre
Planning, Infrastructure and Economic Development
Services de planification, d'infrastructure et de développement économique
110 Laurier Ave West | 4th Floor | Ottawa, ON | K1P 1J1
City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 22568
ottawa.ca/planning / ottawa.ca/urbanisme

From: Chochlinski, Daniel <Daniel.Chochlinski@stantec.com>
Sent: August 29, 2019 4:06 PM
To: McCreight, Andrew <Andrew.McCreight@ottawa.ca>
Cc: Moroz, Peter <peter.moroz@stantec.com>
Subject: 455 McArthur Ave - Request for Information in Preparation of Servicing Report/Design Package

Hi Andrew,

Stantec is preparing a submission package for the proposed development at 455 McArthur Avenue as part of the site plan approval application. Karen Griffith from Hobin Architecture forwarded us your name indicating you were looking after this project.

Before we continue with our submission, we are requesting the following information:

- The site's stormwater management requirements
- Any requirements/restrictions for the wastewater servicing
- The boundary conditions for the watermain service off McArthur Avenue

The proposed development is a three-storey residential building with a total of 12 units: 6 one-bedroom units and 6 two-bedroom units. The site is expected to be serviced from McArthur Avenue by an existing 406 mm dia. ductile iron watermain.

Estimated domestic demands and fire flow requirements for the site are as follows:

- Average Day Demand: 0.09 L/s
- Maximum Day Demand: 0.22 L/s
- Peak Hour Demand: 0.49 L/s
- Fire Flow Requirement per the Ontario Building Code: 60 L/s

I have included our calculations for the domestic water demand and fire flow, as well as a key plan showing the site location.

Thank you in advance for your time.

Regards,

Daniel Chochlinski
Engineering Intern, Community Development

Direct: 613-784-2253
Mobile: 343-961-9619
daniel.chochlinski@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

'

'

Appendix B- WASTEWATER SERVICING

B.1 SANITARY SEWER DESIGN SHEET

SITE: 455 McArthur Avenue	
DATE:	10/28/2019
REVISION:	1
DESIGN BY:	DJC
CHECKED BY:	DCT

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401521

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)
R1A	BLDG	TEE	0.050	0	6	6	22	0.05	22	3.50	0.25	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.050	0.05	0.02	0.27	16.7	150	PVC	DR 28	1.00	15.3	**1.74%**	0.86	0.28

Appendix C - STORMWATER MANAGEMENT

C.1 STORM SEWER DESIGN SHEET

Stantec	455 McArthur Avenue	STORM SEWER DESIGN SHEET (City of Ottawa)	DESIGN PARAMETERS
	DATE: 2021-03-26		$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)
	REVISION: 2		
	DESIGNED BY: DJC	FILE NUMBER: 160401521	
	CHECKED BY: DCT		

	1:5 yr	1:100 yr				
a =	998.071	1735.688	MANNING'S n =	0.013	BEDDING CLASS =	B
b =	6.053	6.014	MINIMUM COVER:	2.00	m	
c =	0.814	0.820	TIME OF ENTRY	10	min	

LOCATION			DRAINAGE AREA																PIPE SELECTION												
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (ROOF) (ha)	C (-)	ACCUM. AREA (5YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	ACCUM. AREA (100YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$Q_{CONTROL}$ (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	CBMH-1	Ex. Main	0.052	0.00	0.00	0.81	0.052	0.042	0.042	0.00	0.000	0.000	10.00	104.19	178.56	0.0	0.0	12.2	15.0	200	200	CIRCULAR	PVC	DR 28	1.00	33.3	**36.60%**	1.05	0.81	0.31
						.							**10.31**																	

C.2 MODIFIED RATIONAL METHOD CALCULATIONS

Stormwater Management Calculations

File No: **160401521**
Project: **455 McArthur Avenue**
Date: **2021-03-26**

SWM Approach:
Post-development to Pre-development flows

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table								
Catchment Type	**Sub-catchment Area ID / Description**		**Area (ha) "A"**		**Runoff Coefficient "C"**	**"A x C"**		**Overall Runoff Coefficient**
Controlled - Tributary	STRM-1	Hard	0.018		0.9	0.016		
		Soft	0.004		0.2	0.001		
	Subtotal			0.022			0.0167	0.76
Roof	ROOF	Hard	0.024		0.9	0.021		
		Soft	0.000		0.2	0.000		
	Subtotal			0.024			0.0214	0.90
Uncontrolled - Non-Tributary	UNC-1 - UNC-2	Hard	0.004		0.9	0.003		
		Soft	0.002		0.2	0.000		
	Subtotal			0.006			0.0038	0.65
Total				**0.052**			**0.042**	
Overall Runoff Coefficient= C:								**0.81**

Total Roof Areas	**0.024 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**0.022 ha**
Total Tributary Area to Outlet	**0.046 ha**
Total Uncontrolled Areas (Non-Tributary)	**0.006 ha**
Total Site	**0.052 ha**

Project #160401521, 455 McArthur Avenue
Roof Drain Design Sheet, Area 'ROOF'
Standard Watts Model 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	0.0006	0	0.025	6	0	0	0.025
0.050	0.0006	0.0013	0	0.050	22	0	0	0.050
0.075	0.0007	0.0014	1	0.075	50	1	1	0.075
0.100	0.0008	0.0016	3	0.100	90	2	3	0.100
0.125	0.0009	0.0017	6	0.125	140	3	6	0.125
0.150	0.0009	0.0019	10	0.150	202	4	10	0.150

Drawdown Estimate

Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.3	259.1	0.3	0.07198
1.2	625.2	0.9	0.24565
2.9	1095.8	1.7	0.55003
5.8	1642.3	2.8	1.00622
10.0	2245.8	4.3	1.63006

Rooftop Storage Summary

Total Building Area (sq.m)		237.4
Assume Available Roof Area (sq.m)	85%	201.79
Roof Imperviousness		0.99
Number of Roof Drains		2
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		10
Estimated 100 Year Drawdown Time (h)		1.3

* 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

	5yr	100yr	Available
Qresult (cu.m/s)	0.002	0.002	-
Depth (m)	0.101	0.136	0.150
Volume (cu.m)	3.1	7.7	10.1
Draintime (hrs)	0.6	1.3	

Stormwater Management Calculations

Project #160401521, 455 McArthur Avenue
Modified Rational Method Calculatons for Storage

5 yr Intensity $I = a/(t + b)^c$
City of Ottawa

a =	998.071
b =	6.053
c =	0.814

t (min)	I (mm/hr)
10	104.19
20	70.25
30	53.93
40	44.18
50	37.65
60	32.94
70	29.37
80	26.56
90	24.29
100	22.41
110	20.82
120	19.47

5 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.052
C: 0.50 (Per requirements from City of Ottawa staff)

Typical Time of Concentration

tc (min)	I (5 yr) (mm/hr)	Qtarget (L/s)
10	104.19	**7.48**

5 YEAR Modified Rational Method for Entire Site

Subdrainage Area: STRM-1 Controlled - Tributary
Area (ha): 0.022
C: 0.76

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	6.40	2.70	3.70	2.22
20	70.25	4.85	2.84	2.00	**2.41**
30	53.93	4.08	2.79	1.29	2.33
40	44.18	3.60	2.68	0.91	2.19
50	37.65	3.25	2.57	0.68	2.04
60	32.94	3.00	2.47	0.53	1.90
70	29.37	2.79	2.37	0.42	1.77
80	26.56	2.61	2.27	0.34	1.63
90	24.29	2.45	2.17	0.28	1.50
100	22.41	2.31	2.08	0.23	1.38
110	20.82	2.15	1.97	0.19	1.25
120	19.47	2.02	1.86	0.16	1.12

Storage: Storage provided in 23.5m-long 525mm dia. HDPE storage pipe (BOSS 2000) between CB-1 and CBMH-1. Refer to Drawing SSP-1 for details.

Orifice Diameter: LMF85
Invert Elevation 69.30 m
T/G Elevation 71.27 m
Max Storage Depth 0.20 m
Downstream W/L 68.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	69.50	0.20	2.84	2.41	5.61	OK

Subdrainage Area: ROOF Roof
Area (ha): 0.024 Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	6.19	1.56	4.63	2.78	96.9	0.00
20	70.25	4.17	1.58	2.59	**3.11**	101.0	0.00
30	53.93	3.20	1.57	1.63	2.94	99.2	0.00
40	44.18	2.62	1.54	1.08	2.60	94.3	0.00
50	37.65	2.24	1.50	0.73	2.20	88.5	0.00
60	32.94	1.96	1.47	0.49	1.77	82.3	0.00
70	29.37	1.74	1.43	0.32	1.34	76.1	0.00
80	26.56	1.58	1.37	0.21	0.99	67.4	0.00
90	24.29	1.44	1.32	0.13	0.68	58.7	0.00
100	22.41	1.33	1.27	0.07	0.39	50.6	0.00
110	20.82	1.24	1.19	0.05	0.33	47.0	0.00
120	19.47	1.16	1.11	0.04	0.30	44.2	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	101.03	0.10	1.58	3.11	10.09	0.00

Subdrainage Area: UNC-1 - UNC-2 Uncontrolled - Non-Tributary
Area (ha): 0.006
C: 0.65

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	1.11	1.11		
20	70.25	0.75	0.75		
30	53.93	0.58	0.58		
40	44.18	0.47	0.47		
50	37.65	0.40	0.40		
60	32.94	0.35	0.35		
70	29.37	0.31	0.31		
80	26.56	0.28	0.28		
90	24.29	0.26	0.26		
100	22.41	0.24	0.24		
110	20.82	0.22	0.22		
120	19.47	0.21	0.21		

Project #160401521, 455 McArthur Avenue
Modified Rational Method Calculatons for Storage

100 yr Intensity $I = a/(t + b)^c$
City of Ottawa

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): 0.052
C: 0.50

	(L/s)	
5-Year Pre Development Discharge	7.48	L/s
Target Release Rate	**7.48**	**L/s**

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: STRM-1 Controlled - Tributary
Area (ha): 0.022
C: 0.95

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	12.12	4.13	7.99	4.79
20	119.95	8.76	4.36	4.40	**5.28**
30	91.87	7.14	4.29	2.85	5.13
40	75.15	6.17	4.15	2.02	4.84
50	63.95	5.50	4.00	1.50	4.50
60	55.89	5.02	3.86	1.16	4.17
70	49.79	4.65	3.73	0.92	3.86
80	44.99	4.35	3.61	0.74	3.57
90	41.11	4.10	3.49	0.61	3.30
100	37.90	3.89	3.38	0.51	3.05
110	35.20	3.70	3.27	0.43	2.84
120	32.89	3.54	3.16	0.38	2.76

Storage: Storage provided in 23.5m-long 525mm dia. HDPE storage pipe (BOSS 2000) between CB-1 and CBMH-1. Refer to Drawing SSP-1 for details.

Orifice Diameter: LMF85
Invert Elevation 69.30 m Available volume in D/S CBMH: 1.13 m3/m
T/G Elevation 71.27 m
Max Storage Depth 0.46 m
Downstream W/L 68.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	69.76	0.46	4.36	5.28	5.61	OK
					0.33	

Subdrainage Area: ROOF Roof
Area (ha): 0.024 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	11.78	1.74	10.04	6.03	126.1	0.00
20	119.95	7.92	1.79	6.13	7.35	133.9	0.00
30	91.87	6.06	1.80	4.26	**7.67**	135.8	0.00
40	75.15	4.96	1.80	3.16	7.58	135.3	0.00
50	63.95	4.22	1.79	2.43	7.30	133.6	0.00
60	55.89	3.69	1.77	1.91	6.89	131.20	0.00
70	49.79	3.29	1.76	1.53	6.42	128.4	0.00
80	44.99	2.97	1.74	1.23	5.91	125.4	0.00
90	41.11	2.71	1.71	1.00	5.41	121.2	0.00
100	37.90	2.50	1.68	0.82	4.91	116.8	0.00
110	35.20	2.32	1.66	0.67	4.41	112.4	0.00
120	32.89	2.17	1.63	0.54	3.91	108.1	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	135.76	0.14	1.80	7.67	10.09	0.00

Subdrainage Area: UNC-1 - UNC-2 Uncontrolled - Non-Tributary
Area (ha): 0.006
C: 0.81

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	2.39	2.39		
20	119.95	1.60	1.60		
30	91.87	1.23	1.23		
40	75.15	1.00	1.00		
50	63.95	0.86	0.86		
60	55.89	0.75	0.75		
70	49.79	0.67	0.67		
80	44.99	0.60	0.60		
90	41.11	0.55	0.55		
100	37.90	0.51	0.51		
110	35.20	0.47	0.47		
120	32.89	0.44	0.44		

Stormwater Management Calculations

Project #160401521, 455 McArthur Avenue
Modified Rational Method Calculatons for Storage

SUMMARY TO OUTLET

			Vrequired	Vavailable*	
Tributary Area	0.046	ha			
Total 5yr Flow to Sewer	2.84	L/s	5.51	15.70 m^3	Ok
Non-Tributary Area	0.006	ha			
Total 5yr Flow Uncontrolled	1.11	L/s			
Total Area	0.052	ha			
Total 5yr Flow	3.96	L/s			
Target	7.48	L/s			

Project #160401521, 455 McArthur Avenue
Modified Rational Method Calculatons for Storage

SUMMARY TO OUTLET

			Vrequired	Vavailable*	
Tributary Area	0.046	ha			
Total 100yr Flow to Sewer	4.36	L/s	12.95	15.70 m^3	Ok
Non-Tributary Area	0.006	ha			
Total 100yr Flow Uncontrolled	2.39	L/s			
Total Area	0.052	ha			
Total 100yr Flow	6.75	L/s			
Target	7.48	L/s			

C.3 PCSWMM OUTPUT FILES

100-YEAR CHICAGO STORM INPUT FILE

```
[OPTIONS]
;;Options            Value
;;------------------ ------------
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        YES
SKIP_STEADY_STATE    NO
START_DATE           04/01/2020
START_TIME           00:00:00
REPORT_START_DATE    04/01/2020
REPORT_START_TIME    00:00:00
END_DATE             04/01/2020
END_TIME             06:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:01:00
DRY_STEP             00:01:00
ROUTING_STEP         1
RULE_STEP            00:00:00
INERTIAL_DAMPING     PARTIAL
```

```
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4

[EVAPORATION]
;;Type          Parameters
;;------------- ----------
CONSTANT     0.0
DRY_ONLY     NO

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
RG1              INTENSITY 0:10   1.0    TIMESERIES 100C
```

100-YEAR CHICAGO STORM INPUT FILE

```
[SUBCATCHMENTS]
;;                                                 Total    Pcnt.             Pcnt.    Curb     Snow
;;Name           Raingage         Outlet           Area     Imperv   Width    Slope    Length   Pack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- --------
ROOF             RG1              ROOF-S           0.0238   100      21.2     1.5      0
STRM-1           RG1              CB1              0.0218   100      10.4     1        0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
ROOF             0.013      0.025      1.57       4.67       0          OUTLET
STRM-1           0.013      0.025      1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   MaxRate    MinRate    Decay      DryTime    MaxInfil
;;-------------- ---------- ---------- ---------- ---------- ----------
ROOF             76.2       13.2       4.14       7          0
STRM-1           76.2       13.2       4.14       7          0

[JUNCTIONS]
;;               Invert     Max.       Init.      Surcharge  Ponded
;;Name           Elev.      Depth      Depth      Depth      Area
;;-------------- ---------- ---------- ---------- ---------- ----------
J1               69.34      1.96       0          0          0
```

```
[OUTFALLS]
;;               Invert     Outfall      Stage/Table      Tide
;;Name           Elev.      Type         Time Series      Gate Route To
;;-------------- ---------- ------------ ---------------- ---- ----------------
OF1              68.75      FREE                          NO

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve                                Evap.
;;Name           Elev.    Depth    Depth    Curve      Params                               Frac.    Infiltration parameters
;;-------------- -------- -------- -------- ---------- -------- -------- -------- -------- -------- -----------------------
CB1              69.69    1.61     0        FUNCTIONAL 0.36     0        0        0        0
CBMH1            69.3     1.97     0        FUNCTIONAL 1.13     0        0        0        0
ROOF-S           75       0.15     0        TABULAR    ROOF-V                     0        0

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet      Outlet     Init.      Max.
;;Name           Node             Node             Length     N          Offset     Offset     Flow       Flow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ----------
BOSS             J1               CBMH1            23.5       0.013      69.34      69.31      0          0
CBLEAD           CB1              J1               2.019      0.013      69.69      69.67      0          0

[OUTLETS]
;;               Inlet            Outlet           Outflow    Outlet           Qcoeff/                     Flap
;;Name           Node             Node             Height     Type             QTable           Qexpon     Gate
;;-------------- ---------------- ---------------- ---------- ---------------- ---------------- ---------- ----
LMF              CBMH1            OF1              69.3       FUNCTIONAL/HEAD  6.407            0.5        NO
```

```
ROOF-O           ROOF-S           J1               75         TABULAR/HEAD     ROOF-Q                     NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
BOSS             CIRCULAR     0.525            0          0          0          1
CBLEAD           CIRCULAR     0.2              0          0          0          1

[LOSSES]
;;Link           Inlet      Outlet     Average    Flap Gate  SeepageRate
;;-------------- ---------- ---------- ---------- ---------- ----------

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
ROOF-Q           Rating     0          0
ROOF-Q                      0.025      0.631
ROOF-Q                      0.05       1.262
ROOF-Q                      0.075      1.42
ROOF-Q                      0.1        1.577
ROOF-Q                      0.125      1.735
ROOF-Q                      0.15       1.893

ROOF-V           Storage    0          0
ROOF-V                      0.025      6
ROOF-V                      0.05       22
```

```
ROOF-V                      0.075      50
ROOF-V                      0.1        90
ROOF-V                      0.125      140
ROOF-V                      0.15       202

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
100C                        0:00       0
100C                        0:10       6.05
100C                        0:20       7.54
100C                        0:30       10.16
100C                        0:40       15.97
100C                        0:50       40.65
100C                        1:00       178.56
100C                        1:10       54.05
100C                        1:20       27.32
100C                        1:30       18.24
100C                        1:40       13.74
100C                        1:50       11.06
100C                        2:00       9.29
100C                        2:10       8.02
100C                        2:20       7.08
100C                        2:30       6.35
100C                        2:40       5.76
100C                        2:50       5.28
```

```
100C                        3:00       4.88


[REPORT]
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL


[TAGS]


[MAP]
DIMENSIONS       371777.796504889 5032872.75194287 371797.605273536 5032909.60059279
UNITS            Meters


[COORDINATES]
;;Node           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
J1               371792.913       5032901.534
OF1              371795.967       5032874.427
CB1              371792.661       5032903.819
CBMH1            371795.799       5032876.528
ROOF-S           371790.335       5032895.245


[VERTICES]
;;Link           X-Coord          Y-Coord
```

```
;;-------------- ---------------- ----------------


[SYMBOLS]
;;Gage           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
```

100-YEAR CHICAGO STORM REPORT FILE

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.013)
--------------------------------------------------------------



*************
Element Count
*************
Number of rain gages ...... 1
Number of subcatchments ... 2
Number of nodes ........... 5
Number of links ........... 4
Number of pollutants ...... 0
Number of land uses ....... 0



****************
Raingage Summary
****************
                                                    Data       Recording
Name                 Data Source                    Type       Interval
------------------------------------------------------------------------
RG1                  100C                           INTENSITY   10 min.



********************
```

100-YEAR CHICAGO STORM REPORT FILE

Subcatchment Summary

****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
ROOF	0.02	21.20	100.00	1.5000	RG1	ROOF-S
STRM-1	0.02	10.40	100.00	1.0000	RG1	CB1

****

Node Summary

****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	69.34	1.96	0.0	
OF1	OUTFALL	68.75	0.00	0.0	
CB1	STORAGE	69.69	1.61	0.0	
CBMH1	STORAGE	69.30	1.97	0.0	
ROOF-S	STORAGE	75.00	0.15	0.0	

****

Link Summary

****

Name	From Node	To Node	Type	Length	%Slope	Roughness

BOSS	J1	CBMH1	CONDUIT	23.5	0.1277	0.0130
CBLEAD	CB1	J1	CONDUIT	2.0	0.9906	0.0130
LMF	CBMH1	OF1	OUTLET			
ROOF-O	ROOF-S	J1	OUTLET			

****

Cross Section Summary

****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
BOSS	CIRCULAR	0.53	0.22	0.13	0.53	1	153.67
CBLEAD	CIRCULAR	0.20	0.03	0.05	0.20	1	32.65

****

NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.

****

****

Analysis Options

****

```
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 04/01/2020 00:00:00
Ending Date .............. 04/01/2020 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:01:00
Routing Time Step ........ 1.00 sec
Variable Time Step ....... NO
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
```

100-YEAR CHICAGO STORM REPORT FILE

Runoff Quantity Continuity	hectare-m	mm
**************************	---------	-------
Total Precipitation	0.003	71.667
Evaporation Loss	0.000	0.000
Infiltration Loss	0.000	0.000
Surface Runoff	0.003	70.189
Final Storage	0.000	1.575
Continuity Error (%)	-0.135	

**************************	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
**************************	---------	---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.003	0.032
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.003	0.032
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****

Highest Flow Instability Indexes

****

All links are stable.

****

Routing Time Step Summary

****

Minimum Time Step : 1.00 sec

Average Time Step : 1.00 sec

Maximum Time Step : 1.00 sec

Percent in Steady State : 0.00

Average Iterations per Step : 2.00

Percent Not Converging : 0.00

****

Subcatchment Runoff Summary

****

	Total	Total	Total	Total	Imperv	Perv	Total	Total	Peak	Runoff
	Precip	Runon	Evap	Infil	Runoff	Runoff	Runoff	Runoff	Runoff	Coeff
Subcatchment	mm	mm	mm	mm	mm	mm	mm	10^6 ltr	LPS	

ROOF	71.67	0.00	0.00	0.00	70.21	0.00	70.21	0.02	11.80	0.980
STRM-1	71.67	0.00	0.00	0.00	70.17	0.00	70.17	0.02	10.81	0.979

****

Node Depth Summary

****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.11	0.59	69.93	0 01:19	0.59
OF1	OUTFALL	0.00	0.00	68.75	0 00:00	0.00
CB1	STORAGE	0.02	0.24	69.93	0 01:19	0.24
CBMH1	STORAGE	0.12	0.63	69.93	0 01:20	0.63
ROOF-S	STORAGE	0.05	0.14	75.14	0 01:25	0.14

****

Node Inflow Summary

****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.00	12.53	0 01:08	0	0.032	0.016
OF1	OUTFALL	0.00	5.08	0 01:20	0	0.032	0.000
CB1	STORAGE	10.81	10.81	0 01:10	0.0153	0.0153	-0.002
CBMH1	STORAGE	0.00	9.62	0 01:08	0	0.032	-0.074
ROOF-S	STORAGE	11.80	11.80	0 01:10	0.0167	0.0167	-0.000

****

Node Surcharge Summary

****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
J1	JUNCTION	0.24	0.059	1.371

****

Node Flooding Summary

****

No nodes were flooded.

****

Storage Volume Summary

****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
CB1	0.000	1	0	0	0.000	15	0 01:19	10.81
CBMH1	0.000	6	0	0	0.001	32	0 01:20	5.08
ROOF-S	0.002	20	0	0	0.008	80	0 01:25	1.83

****

Outfall Loading Summary

****

	Flow	Avg	Max	Total

Outfall Node	Freq Pcnt	Flow LPS	Flow LPS	Volume 10^6 ltr
OF1	56.31	2.63	5.08	0.032
System	56.31	2.63	5.08	0.032

****

Link Flow Summary

****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
BOSS	CONDUIT	9.62	0 01:08	0.25	0.06	1.00
CBLEAD	CONDUIT	10.81	0 01:08	0.93	0.33	1.00
LMF	DUMMY	5.08	0 01:20			
ROOF-O	DUMMY	1.83	0 01:25			

****

Flow Classification Summary

****

Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		---------- Fraction of Time in Flow Class ----------								
BOSS	1.00	0.07	0.00	0.00	0.48	0.00	0.00	0.45	0.04	0.00
CBLEAD	1.00	0.07	0.00	0.00	0.11	0.00	0.00	0.82	0.01	0.00

****

Conduit Surcharge Summary

****

Conduit	--------- Hours Full -------- Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
BOSS	0.25	0.25	0.31	0.01	0.01
CBLEAD	0.21	0.21	0.24	0.01	0.01

Analysis begun on: Fri May 22 08:29:17 2020

Analysis ended on: Fri May 22 08:29:17 2020

Total elapsed time: < 1 sec

100-YEAR SCS STORM INPUT FILE

```
[OPTIONS]
;;Options            Value
;;------------------ ------------
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        YES
SKIP_STEADY_STATE    NO
START_DATE           07/23/2009
START_TIME           00:00:00
REPORT_START_DATE    07/23/2009
REPORT_START_TIME    00:00:00
END_DATE             07/23/2009
END_TIME             12:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:01:00
DRY_STEP             00:01:00
ROUTING_STEP         1
RULE_STEP            00:00:00
INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
```

```
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4

[EVAPORATION]
;;Type          Parameters
;;------------- ----------
CONSTANT     0.0
DRY_ONLY     NO

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
RG1              INTENSITY 0:15   1.0    TIMESERIES 100S

[SUBCATCHMENTS]
;;                                                 Total    Pcnt.             Pcnt.    Curb     Snow
;;Name           Raingage         Outlet           Area     Imperv   Width    Slope    Length   Pack
```

```
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- --------
ROOF             RG1              ROOF-S           0.0238   100      21.2     1.5      0
STRM-1           RG1              CB1              0.0218   100      10.4     1        0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
ROOF             0.013      0.025      1.57       4.67       0          OUTLET
STRM-1           0.013      0.025      1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   MaxRate    MinRate    Decay      DryTime    MaxInfil
;;-------------- ---------- ---------- ---------- ---------- ----------
ROOF             76.2       13.2       4.14       7          0
STRM-1           76.2       13.2       4.14       7          0

[JUNCTIONS]
;;               Invert     Max.       Init.      Surcharge  Ponded
;;Name           Elev.      Depth      Depth      Depth      Area
;;-------------- ---------- ---------- ---------- ---------- ----------
J1               69.34      1.96       0          0          0

[OUTFALLS]
;;               Invert     Outfall      Stage/Table      Tide
;;Name           Elev.      Type         Time Series      Gate Route To
;;-------------- ---------- ------------ ---------------- ---- ----------------
```

```
OF1              68.75      FREE                          NO

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve                                Evap.
;;Name           Elev.    Depth    Depth    Curve      Params                               Frac.    Infiltration parameters
;;-------------- -------- -------- -------- ---------- -------- -------- -------- -------- -------- -----------------------
CB1              69.69    1.61     0        FUNCTIONAL 0.36     0        0        0        0
CBMH1            69.3     1.97     0        FUNCTIONAL 1.13     0        0        0        0
ROOF-S           75       0.15     0        TABULAR    ROOF-V                     0        0

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet      Outlet     Init.      Max.
;;Name           Node             Node             Length     N          Offset     Offset     Flow       Flow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ----------
BOSS             J1               CBMH1            23.5       0.013      69.34      69.31      0          0
CBLEAD           CB1              J1               2.019      0.013      69.69      69.67      0          0

[OUTLETS]
;;               Inlet            Outlet           Outflow    Outlet           Qcoeff/                     Flap
;;Name           Node             Node             Height     Type             QTable           Qexpon     Gate
;;-------------- ---------------- ---------------- ---------- ---------------- ---------------- ---------- ----
LMF              CBMH1            OF1              69.3       FUNCTIONAL/HEAD  6.407            0.5        NO
ROOF-O           ROOF-S           J1               75         TABULAR/HEAD     ROOF-Q                      NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
```

```
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
BOSS             CIRCULAR     0.525            0          0          0          1
CBLEAD           CIRCULAR     0.2              0          0          0          1

[LOSSES]
;;Link           Inlet      Outlet     Average    Flap Gate  SeepageRate
;;-------------- ---------- ---------- ---------- ---------- ----------

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
ROOF-Q           Rating     0          0
ROOF-Q                      0.025      0.631
ROOF-Q                      0.05       1.262
ROOF-Q                      0.075      1.42
ROOF-Q                      0.1        1.577
ROOF-Q                      0.125      1.735
ROOF-Q                      0.15       1.893

ROOF-V           Storage    0          0
ROOF-V                      0.025      6
ROOF-V                      0.05       22
ROOF-V                      0.075      50
ROOF-V                      0.1        90
ROOF-V                      0.125      140
ROOF-V                      0.15       202
```

```
[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
100C                        0:00       0
100C                        0:10       6.05
100C                        0:20       7.54
100C                        0:30       10.16
100C                        0:40       15.97
100C                        0:50       40.65
100C                        1:00       178.56
100C                        1:10       54.05
100C                        1:20       27.32
100C                        1:30       18.24
100C                        1:40       13.74
100C                        1:50       11.06
100C                        2:00       9.29
100C                        2:10       8.02
100C                        2:20       7.08
100C                        2:30       6.35
100C                        2:40       5.76
100C                        2:50       5.28
100C                        3:00       4.88

100S             07/23/2009 00:00:00   2.4
100S             07/23/2009 00:15:00   2.4
```

100S	07/23/2009 00:30:00	2.4
100S	07/23/2009 00:45:00	2.4
100S	07/23/2009 01:00:00	2.4
100S	07/23/2009 01:15:00	2.4
100S	07/23/2009 01:30:00	2.4
100S	07/23/2009 01:45:00	2.4
100S	07/23/2009 02:00:00	2.88
100S	07/23/2009 02:15:00	2.88
100S	07/23/2009 02:30:00	2.88
100S	07/23/2009 02:45:00	2.88
100S	07/23/2009 03:00:00	3.84
100S	07/23/2009 03:15:00	3.84
100S	07/23/2009 03:30:00	3.84
100S	07/23/2009 03:45:00	3.84
100S	07/23/2009 04:00:00	5.76
100S	07/23/2009 04:15:00	5.76
100S	07/23/2009 04:30:00	7.68
100S	07/23/2009 04:45:00	7.68
100S	07/23/2009 05:00:00	11.52
100S	07/23/2009 05:15:00	11.52
100S	07/23/2009 05:30:00	46.08
100S	07/23/2009 05:45:00	126.72
100S	07/23/2009 06:00:00	17.28
100S	07/23/2009 06:15:00	17.28
100S	07/23/2009 06:30:00	7.68
100S	07/23/2009 06:45:00	7.68

```
100S            07/23/2009 07:00:00   5.76
100S            07/23/2009 07:15:00   5.76
100S            07/23/2009 07:30:00   5.76
100S            07/23/2009 07:45:00   5.76
100S            07/23/2009 08:00:00   3.36
100S            07/23/2009 08:15:00   3.36
100S            07/23/2009 08:30:00   3.36
100S            07/23/2009 08:45:00   3.36
100S            07/23/2009 09:00:00   3.36
100S            07/23/2009 09:15:00   3.36
100S            07/23/2009 09:30:00   3.36
100S            07/23/2009 09:45:00   3.36
100S            07/23/2009 10:00:00   1.92
100S            07/23/2009 10:15:00   1.92
100S            07/23/2009 10:30:00   1.92
100S            07/23/2009 10:45:00   1.92
100S            07/23/2009 11:00:00   1.92
100S            07/23/2009 11:15:00   1.92
100S            07/23/2009 11:30:00   1.92
100S            07/23/2009 11:45:00   1.92
100S            07/23/2009 12:00:00   0

[REPORT]
INPUT       YES
CONTROLS    NO
SUBCATCHMENTS ALL
```

```
NODES ALL

LINKS ALL


[TAGS]


[MAP]

DIMENSIONS       371777.796504889 5032872.75194287 371797.605273536 5032909.60059279

UNITS            Meters


[COORDINATES]

;;Node           X-Coord          Y-Coord

;;-------------- ---------------- ----------------

J1               371792.913       5032901.534

OF1              371795.967       5032874.427

CB1              371792.661       5032903.819

CBMH1            371795.799       5032876.528

ROOF-S           371790.335       5032895.245


[VERTICES]

;;Link           X-Coord          Y-Coord

;;-------------- ---------------- ----------------



[SYMBOLS]

;;Gage           X-Coord          Y-Coord

;;-------------- ---------------- ----------------
```

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.013)

****

Element Count

****

Number of rain gages 1

Number of subcatchments ... 2

Number of nodes 5

Number of links 4

Number of pollutants 0

Number of land uses 0

****

Raingage Summary

****

Name	Data Source	Data Type	Recording Interval
RG1	100S	INTENSITY	15 min.

****

100-YEAR SCS STORM REPORT FILE

```
Subcatchment Summary
********************
Name                     Area     Width   %Imperv    %Slope Rain Gage            Outlet
----------------------------------------------------------------------------------------------------------
ROOF                     0.02     21.20    100.00    1.5000 RG1                  ROOF-S
STRM-1                   0.02     10.40    100.00    1.0000 RG1                  CB1


************
Node Summary
************
                                         Invert      Max.    Ponded    External
Name                 Type                 Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------------
J1                   JUNCTION             69.34      1.96       0.0
OF1                  OUTFALL              68.75      0.00       0.0
CB1                  STORAGE              69.69      1.61       0.0
CBMH1                STORAGE              69.30      1.97       0.0
ROOF-S               STORAGE              75.00      0.15       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
---------------------------------------------------------------------------------------------
```

BOSS	J1	CBMH1	CONDUIT	23.5	0.1277	0.0130
CBLEAD	CB1	J1	CONDUIT	2.0	0.9906	0.0130
LMF	CBMH1	OF1	OUTLET			
ROOF-O	ROOF-S	J1	OUTLET			

****

Cross Section Summary

****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
BOSS	CIRCULAR	0.53	0.22	0.13	0.53	1	153.67
CBLEAD	CIRCULAR	0.20	0.03	0.05	0.20	1	32.65

****

NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.

****

****

Analysis Options

****

```
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 07/23/2009 00:00:00
Ending Date .............. 07/23/2009 12:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:01:00
Routing Time Step ........ 1.00 sec
Variable Time Step ....... NO
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
```

```
Runoff Quantity Continuity     hectare-m         mm
**************************     ---------    -------
Total Precipitation ......         0.004     96.000
Evaporation Loss .........         0.000      0.000
Infiltration Loss ........         0.000      0.000
Surface Runoff ...........         0.004     94.261
Final Storage ............         0.000      1.820
Continuity Error (%) .....        -0.084


**************************        Volume     Volume
Flow Routing Continuity        hectare-m   10^6 ltr
**************************     ---------  ---------
Dry Weather Inflow .......         0.000      0.000
Wet Weather Inflow .......         0.004      0.043
Groundwater Inflow .......         0.000      0.000
RDII Inflow ..............         0.000      0.000
External Inflow ..........         0.000      0.000
External Outflow .........         0.004      0.043
Flooding Loss ............         0.000      0.000
Evaporation Loss .........         0.000      0.000
Exfiltration Loss ........         0.000      0.000
Initial Stored Volume ....         0.000      0.000
Final Stored Volume ......         0.000      0.000
Continuity Error (%) .....         0.000
```

```
*******************************
Highest Flow Instability Indexes
*******************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     1.00 sec
Average Time Step           :     1.00 sec
Maximum Time Step           :     1.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     2.00
Percent Not Converging      :     0.00


***************************
Subcatchment Runoff Summary
***************************

--------------------------------------------------------------------------------------------------------------------------------
                               Total      Total      Total      Total     Imperv       Perv      Total       Total     Peak  Runoff
                              Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff      Runoff   Runoff   Coeff
Subcatchment                      mm         mm         mm         mm         mm         mm         mm   10^6 ltr      LPS
```

ROOF	96.00	0.00	0.00	0.00	94.33	0.00	94.33	0.02	8.38	0.983
STRM-1	96.00	0.00	0.00	0.00	94.18	0.00	94.18	0.02	7.67	0.981

****

Node Depth Summary

****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.06	0.58	69.92	0 06:01	0.58
OF1	OUTFALL	0.00	0.00	68.75	0 00:00	0.00
CB1	STORAGE	0.02	0.23	69.92	0 06:01	0.23
CBMH1	STORAGE	0.06	0.62	69.92	0 06:01	0.62
ROOF-S	STORAGE	0.03	0.14	75.14	0 06:02	0.14

****

Node Inflow Summary

****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.00	9.39	0 05:55	0	0.043	0.182
OF1	OUTFALL	0.00	5.04	0 06:01	0	0.0429	0.000
CB1	STORAGE	7.67	7.67	0 06:00	0.0205	0.0205	0.029
CBMH1	STORAGE	0.00	8.21	0 05:59	0	0.0429	-0.039
ROOF-S	STORAGE	8.38	8.38	0 06:00	0.0224	0.0224	0.013

****

Node Surcharge Summary

****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
J1	JUNCTION	0.09	0.049	1.381

****

Node Flooding Summary

****

No nodes were flooded.

****

Storage Volume Summary

****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
CB1	0.000	1	0	0	0.000	14	0 06:01	7.67
CBMH1	0.000	3	0	0	0.001	31	0 06:01	5.04
ROOF-S	0.001	8	0	0	0.008	74	0 06:02	1.80

****

Outfall Loading Summary

****

	Flow	Avg	Max	Total

Outfall Node	Freq Pcnt	Flow LPS	Flow LPS	Volume 10^6 ltr
OF1	93.67	1.06	5.04	0.043
System	93.67	1.06	5.04	0.043

****

Link Flow Summary

****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
BOSS	CONDUIT	8.21	0 05:59	0.25	0.05	1.00
CBLEAD	CONDUIT	7.67	0 05:55	0.85	0.24	1.00
LMF	DUMMY	5.04	0 06:01			
ROOF-O	DUMMY	1.80	0 06:02			

****

Flow Classification Summary

****

Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		---------- Fraction of Time in Flow Class ----------								
BOSS	1.00	0.06	0.00	0.00	0.26	0.00	0.00	0.69	0.04	0.00
CBLEAD	1.00	0.06	0.00	0.00	0.04	0.00	0.00	0.90	0.00	0.00

****

Conduit Surcharge Summary

****

Conduit	Hours Full Both Ends	Hours Full Upstream	Hours Full Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
BOSS	0.10	0.10	0.15	0.01	0.01
CBLEAD	0.07	0.07	0.09	0.01	0.01

Analysis begun on: Fri May 22 08:40:39 2020

Analysis ended on: Fri May 22 08:40:39 2020

Total elapsed time: < 1 sec

C.4 RECORD OF CONSULTATION WITH RVCA

Pre-Consul Meeting Notes to the File Lead - Andrew McCreight September 10, 2019
Re: 445 McArthur Avenue.

Infrastructure:

McArthur:

A 406 mm dia. DI Watermain (c. 1999) is available

A 225 mm dia. Conc. Sanitary Sewer (c. 1972) is available, which drains to Rideau River Trunk Collector on North River Road and to the Interceptor Sewer.

A 375 dia. mm ConR. Storm Sewer (c. 1972) is available which drains to Vanier Parkway Storm . Trunk Sewer and then into the MacKay Storm Trunk Sewer and outlets to the Ottawa River at Princess Avenue.

Please note:
Applicant to contact Rideau Valley Conservation Authority (RVCA) for possible restrictions due to quality control. Provide correspondence in Report.

The following apply to this site and any development within a separated sewer area:

- Total (San & Stm) allowable release rate will be 5 year pre-development rate if:
  a) Not within a partially separated sewer area
  b) Sewer Pipe is newer than 1970 or within Vanier Area where no less than 450mm dia.

otherwise use 2 year pre-dev. Rate

- Coefficient (C) of runoff will need to be determined **as per existing conditions** but in no case more than 0.5
- TC = 20 minutes or can be calculated
  TC should be not be less than 10 minutes, since IDF curves become unrealistic at less than 10 min.
- Any storm events greater than 5 year, up to 100 year, and including 100 year storm event must be detained on site.
- Two separate sewer laterals (one for sanitary and other for storm) will be required.

  Please note:
  Foundation drains are to be independently connected to sewermain (separated or combined) unless being pumped with appropriate back up power, sufficient sized pump and back flow prevention.

Roof drains are to be connected downstream of any incorporated ICD within the SWM system.

Boundary Conditions will be provided at request of consultant after providing Average Daily Demands, Peak Hour Demands & Max Day + Fire Flow Demands

Other:

Environmental Noise Study is required due to within 100m proximity of McArthur Avenue and St. Laurent Street.

Stationary Noise Study – consultant to speak to this in their report as per City NCG and NPC 300 Guidelines.

Capital Projects listed in the area on GeoOttawa or Envista:
McArthur - Road Resurfacing and Renewal Work 3-5 years
St. Laurent – Road Resurfacing and Renewal Work 1-2 years

Water Supply Redundancy – Fire Flow:

Applicant to ensure that a second service with an inline valve chamber be provided where the average daily demand exceeds 50 m^3 / day (0.5787 l/s per day)
FUS Fire Flow Criteria to be used unless a low rise building, where OBC requirements may be applicable.

Where underground storage (UG) and surface ponding are being considered:

Show all ponding for 5 and 100 year events

Above and below ground storage is permitted although uses ½ Peak Flow Rate or is modeled. Please confirm that this has been accounted for and/or revise.

Rationale:

The Modified Rational Method for storage computation in the Sewer Design Guidelines was originally intended to be used for above ground storage (i.e. parking lot) where the change in head over the orifice varied from 1.5 m to 1.2 m (assuming a 1.2 m deep CB and a max ponding depth of 0.3 m). This change in head was small and hence the release rate fluctuated little, therefore there was no need to use an average release rate.

When underground storage is used, the release rate fluctuates from a maximum peak flow based on maximum head down to a release rate of zero. This difference is large and has a significant impact on storage requirements. We therefore require that an average release rate be used to estimate the required volume. Alternatively, the consultant may choose to use a submersible pump in the design to ensure a constant release rate.

In the event that there is a disagreement from the designer regarding the required storage, The City will require that the designer demonstrate their rationale utilizing dynamic modelling, that will then be reviewed by City modellers in the Water Resources Group.

Note that the above will added to upcoming revised Sewer Design Guidelines to account for underground storage, which is now widely used.

Further to above, what will be the actual underground storage provided during the major (100 year) and minor (2 year) storm events?

Please provide information on UG storage pipe. Provide required cover over pipe and details, chart of storage values, capacity etc. How will this pipe be cleaned of sediment and debris?

Note - There must be at least 15cm of vertical clearance between the spill elevation and the ground elevation at the building envelope that is in proximity of the flow route or ponding area. The exception in this case would be at reverse sloped loading dock locations. At these locations, a minimum of 15cm of vertical clearance must be provided below loading dock openings. Ensure to provide discussion in report and ensure grading plan matches if applicable.

Provide information on type of underground storage system including product name and model, number of chambers, chamber configuration, confirm invert of chamber system, top of chamber system, required cover over system and details, interior bottom slope (for self-cleansing), chart of storage values, length, width and height, capacity, entry ports (maintenance) etc.

Provide a cross section of underground chamber system showing invert and obvert/top, major and minor HWLs, top of ground, system volume provided during major and minor events. UG storage to provide actual 2 and 100 year event storage requirements.

In regard to all proposed UG storage, ground water levels (and in particular HGW levels) will need to be reviewed to ensure that the proposed system does not become surcharged and thereby ineffective.

Modeling can be provided to ensure capacity for both storm and sanitary sewers for the proposed development by City's Water Distribution Dept. – Modeling Group, through PM and upon request.

For proposed depressed driveways or developments with private lanes, parking areas or with entrances etc. lower than roadway…

S18.pdf S18.1.pdf

A gas blow-off station is required now for buildings that exceed 12 units. Be sure to include this on the Grading, Site Servicing, SWM and Landscape plans.

Gas Blow Off Station.pdf

Re Provided Info:
Please be advised that it is the responsibility of the applicant and their representatives/consultants to verify information provided by the City of Ottawa.
Please contact City View and Release Info Centre at Ext. 44455

Environmental Source Information:

City of Ottawa - Historical Land Use Inventory (HLUI) - Required

Rationale:

The HLUI database is currently undergoing an update. The updated HLUI will include additional sources beyond those included in the current database, making the inclusion of this record search even more important.
Although a municipal historic land use database is not specifically listed as required environmental record in O. Reg 153/04, Schedule D, Part II states the following:

The following are the specific objectives of a records review:

1. To obtain and review records that relate to the Phase I (One) property and to the current and past uses of and activities at or affecting the Phase I (One) property in order to determine if an area of potential environmental concern exists and to interpret any area of potential environmental concern.

2. To obtain and review records that relate to properties in the Phase I (One) study area other than the Phase I (One) property, in order to determine if an area of potential environmental concern exists and to interpret any area of potential environmental concern.

It is therefore reasonable to request that the HLUI search be included in the Phase I ESA to meet the above objectives.
Please submit.

Existing buildings require a CCTV inspection and report to ensure existing services to be re-used are in good working order and meet current minimum size requirements. Located services to be placed on site servicing plans.

CCTV Scan
Guideline.pdf

All existing reports and plans will need to be revised if older than 2 years and must reflect current City Standards, Guidelines, By-laws and Policies.

Please refer to City of Ottawa website portal **for "Guide to preparing Studies and Plans"** at https://ottawa.ca/en/city-hall/planning-and-development/information-developers/development-application-review-process/development-application-submission/guide-preparing-studies-and-plans.

Please ensure you are using the current guidelines, bylaws and standards including materials of construction, disinfection and all relevant reference to OPSS/D and AWWA guidelines - all current and as amended, such as:

City of Ottawa Sewer Design Guidelines (**CoOSDG**) complete with ISTDB 2012-01, 2014-01, 2016-01 & 2018-01 technical bulletin updates as well as current Sewer, Landscape & Road Standard Detail Drawings as well as Material Specifications (MS Docs).
Sewer Connection (2003-513) & Sewer Use (2003-514) By-Laws.

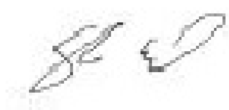
City of Ottawa Water Distribution Design Guidelines (**CoOWDDG**) complete with ISTDB 2010-02, 2014-02 & 2018-02 technical bulletin updates as well as current Watermain/

Services Material Specifications (MS Docs) as well as Water and Road Standard Detail Drawings.
FUS Fire Flow standards
Water (2018-167) By-Law

Ensure to include version date and add “(as amended)” when referencing all standards, detail drwaings, by-Laws and guidelines.

Contact me at 613-580-2424, Ext. # 33017 or e-mail shawn.wessel@ottawa.ca if you have any questions.

Sincerely,



Shawn Wessel, A.Sc.T., rcji
Project Manager
Development Review, Central Branch

C.5 CITY PRE-CONSULTATION NOTES

Chochlinski, Daniel

From: Jamie Batchelor <jamie.batchelor@rvca.ca>
Sent: Thursday, November 14, 2019 1:12 PM
To: Moroz, Peter
Cc: Chochlinski, Daniel
Subject: RE: 455 McArthur Avenue - RVCA Contact on File

Good Afternoon Peter,

Based on the plans provided, there are only 3 surface parking spaces being proposed. Therefore with this in consideration, the RVCA would accept that no further onsite water quality controls are required save and except best management practices.

Jamie Batchelor, MCIP, RPP
Planner, ext. 1191
Jamie.batchelor@rvca.ca

Rideau Valley Conservation Authority
3889 Rideau Valley Drive
PO Box 599, Manotick ON K4M 1A5
T 613-692-3571 | 1-800-267-3504 F 613-692-0831 | www.rvca.ca

From: Moroz, Peter <peter.moroz@stantec.com>
Sent: Tuesday, November 12, 2019 9:50 AM
To: Jamie Batchelor <jamie.batchelor@rvca.ca>
Cc: Chochlinski, Daniel <Daniel.Chochlinski@stantec.com>
Subject: FW: 455 McArthur Avenue - RVCA Contact on File

Jamie, we are working on site plan for 455 McArthur Avenue in support of the proposed infill development would replace an existing two-storey, multi-unit residential property and separated four-car garage with a three-storey, 12-unit residential building. Attached is the existing condition plan and proposed drainage plan for the site. The City directed us to confirm quality control criteria for the site with RVCA, although most of the drainage from the site is coming off the roof and is directed to underground storage pipe for quantity control. Can you please let me know who at the RVCA office can provide us with some guidance/clearance for the development with respect to the quality control for the site.

Thank you,

Peter

Peter Moroz P.Eng., MBA

Managing Principal, Community Development

Stantec
400 - 1331 Clyde Avenue Ottawa ON K2C 3G4

Phone: (613) 724-4082
Cell: (613) 294-2851

peter.moroz@stantec.com

From: Wessel, Shawn <shawn.wessel@ottawa.ca>
Sent: Tuesday, November 12, 2019 9:25 AM
To: Chochlinski, Daniel <Daniel.Chochlinski@stantec.com>
Cc: Moroz, Peter <peter.moroz@stantec.com>
Subject: RE: 455 McArthur Avenue - RVCA Contact on File

Good morning Mr. Chochlinski and thank you for your email inquiry.

I have forwarded your request to our Water Resources Dept. for their comments/concerns etc.

As for RVCA, I am unsure of the contact person for this area.

Please call their office to inquire.

If you require additional information or clarification, please do not hesitate to contact me anytime.

Thank you

Regards,

Shawn Wessel, A.Sc.T.,rcji
Project Manager - Infrastructure Approvals
Gestionnaire de projet – Approbation des demandes d'infrastructures

Development Review Central Branch | Direction de l'examen des projets d'aménagement, Centrale
Planning, Infrastructure and Economic Development Department | Direction générale de la planification de l'infrastructure et du développement économique
City of Ottawa | Ville d'Ottawa
110 Laurier Ave. W. | 110, avenue Laurier Ouest, Ottawa ON K1P 1J1
(613) 580 2424 Ext. | Poste 33017
Int. Mail Code | Code de Courrier Interne 01-14
shawn.wessel@ottawa.ca

From: Chochlinski, Daniel <Daniel.Chochlinski@stantec.com>
Sent: November 11, 2019 3:53 PM
To: Wessel, Shawn <shawn.wessel@ottawa.ca>
Cc: Moroz, Peter <peter.moroz@stantec.com>
Subject: 455 McArthur Avenue - RVCA Contact on File

CAUTION: This email originated from an External Sender. Please do not click links or open attachments unless you recognize the source.

ATTENTION : Ce courriel provient d'un expéditeur externe. Ne cliquez sur aucun lien et n'ouvrez pas de pièce jointe, excepté si vous connaissez l'expéditeur.

Hi Shawn,

In preparing the servicing report for the proposed site at 455 McArthur Avenue, we are looking to confirm the storm water quality control requirements for the site (if any). May you please tell us who from the RVCA is the contact for this site?

Thank you,

Daniel Chochlinski
Stantec
'

'

C.6 CORRESPONDENCE WITH CITY

From:	Wessel, Shawn
To:	Chochlinski, Daniel
Subject:	FW: 455 McArthur Ave - Request for Information in Preparation of Servicing Report/Design Package
Date:	Wednesday, September 4, 2019 10:11:50 AM

Good morning Mr. Chochlinski

Please see comments from Water Resources Dept. below for your proposed development.

Out of Office Notice:

Please be advised that I will be away from the office September 11, 2019 returning on the 17th.

If you require additional information or clarification, please do not hesitate to contact me anytime.

Thank you

Regards,

Shawn Wessel, A.Sc.T.,rcji

Project Manager - Infrastructure Approvals

Gestionnaire de projet – Approbation des demandes d'infrastructures

Development Review Central Branch | Direction de l'examen des projets d'aménagement, Centrale
Planning, Infrastructure and Economic Development Department | Direction générale de la planification de l'infrastructure et du développement économique
City of Ottawa | Ville d'Ottawa
110 Laurier Ave. W. | 110, avenue Laurier Ouest, Ottawa ON K1P 1J1
(613) 580 2424 Ext. | Poste 33017
Int. Mail Code | Code de Courrier Interne 01-14
shawn.wessel@ottawa.ca

From: Tousignant, Eric <Eric.Tousignant@ottawa.ca>
Sent: September 03, 2019 2:18 PM

To: Wessel, Shawn <shawn.wessel@ottawa.ca>
Subject: RE: 455 McArthur Ave - Request for Information in Preparation of Servicing Report/Design Package

Hi Shawn

We don't have detail modelling info at this location but I would suggest the following;

- The areas is a non-controlled storm system, therefore the storm system could surcharge during critical events. They will need to consider this when designing their internal storm system.
- The allowable storm release rate should be computed based on the 5-year event using a C=0.5.
- The sanitary system is partially separated and could therefore surcharge during critical events, however there is no historical flooding cluster at this location.
- I have no concern with the future flow from the proposed development.

Eric

Eric Tousignant, P.Eng.
Senior Water Resources Engineer
Infrastructure Services
613-580-2424 ext 25129

From: Wessel, Shawn <shawn.wessel@ottawa.ca>
Sent: August 30, 2019 10:44 AM
To: Tousignant, Eric <Eric.Tousignant@ottawa.ca>
Subject: FW: 455 McArthur Ave - Request for Information in Preparation of Servicing Report/Design Package

Good morning Eric.

Could you please provide san and storm HGL information for McArthur and May Streets?

Is there flooding issues or surcharge conditions in this area?

I believe the proposal is for a 12 unit 3-storey residential building and is currently a Lexus car dealership.

Have a great weekend!

Out of Office Notice:

Please be advised that I will be away from the office September 11, 2019 returning on the 17th.

If you require additional information or clarification, please do not hesitate to contact me anytime.

Thank you

Regards,

Shawn Wessel, A.Sc.T.,rcji
Project Manager - Infrastructure Approvals
Gestionnaire de projet – Approbation des demandes d'infrastructures

Development Review Central Branch | Direction de l'examen des projets d'aménagement, Centrale
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From: Chochlinski, Daniel <Daniel.Chochlinski@stantec.com>
Sent: August 29, 2019 4:06 PM
To: McCreight, Andrew <Andrew.McCreight@ottawa.ca>
Cc: Moroz, Peter <peter.moroz@stantec.com>

Subject: 455 McArthur Ave - Request for Information in Preparation of Servicing Report/Design Package

CAUTION: This email originated from an External Sender. Please do not click links or open attachments unless you recognize the source.

ATTENTION : Ce courriel provient d'un expéditeur externe. Ne cliquez sur aucun lien et n'ouvrez pas de pièce jointe, excepté si vous connaissez l'expéditeur.

Hi Andrew,

Stantec is preparing a submission package for the proposed development at 455 McArthur Avenue as part of the site plan approval application. Karen Griffith from Hobin Architecture forwarded us your name indicating you were looking after this project.

Before we continue with our submission, we are requesting the following information:

- The site's stormwater management requirements
- Any requirements/restrictions for the wastewater servicing
- The boundary conditions for the watermain service off McArthur Avenue

The proposed development is a three-storey residential building with a total of 12 units: 6 one-bedroom units and 6 two-bedroom units. The site is expected to be serviced from McArthur Avenue by an existing 406 mm dia. ductile iron watermain.

Estimated domestic demands and fire flow requirements for the site are as follows:

- Average Day Demand: 0.09 L/s
- Maximum Day Demand: 0.22 L/s
- Peak Hour Demand: 0.49 L/s
- Fire Flow Requirement per the Ontario Building Code: 60 L/s

I have included our calculations for the domestic water demand and fire flow, as well as a key plan showing the site location.

Thank you in advance for your time.

Regards,

Daniel Chochlinski
Engineering Intern, Community Development

Direct: 613-784-2253
Mobile: 343-961-9619
daniel.chochlinski@stantec.com

Stantec
400 - 1331 Clyde Avenue
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Appendix D - GEOTECHNICAL INVESTIGATION

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

patersongroup

Geotechnical Investigation

Proposed Multi-Storey Building
455 McArthur Avenue
Ottawa, Ontario

Prepared For

Prestwick Building Corp.

January 8, 2020

Report PG5177-1

Paterson Group Inc.
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Canada K2E 7J5

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Prestwick Building Corp. to conduct a geotechnical investigation for the proposed multi-storey building to be located at 455 McArthur Avenue in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objectives of the investigation were to:

❑ Determine the subsoil and groundwater conditions at this site by means of boreholes.

❑ Provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

2.0 Proposed Project

Based on the available drawings, it is understood that the proposed residential building will consist of a multi-storey structure with 1 basement level and 1 sub-basement level which extends to an approximate geodetic elevation of 67.5 m. It is anticipated that the proposed development will also include asphalt-paved access lanes and parking areas around the proposed building. It is further understood that the proposed building will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the investigation was conducted on November 29 and December 6, 2019 and consisted of 3 boreholes advanced to a maximum depth of 6.7 m below the existing ground surface. The borehole locations were distributed in a manner to provide general coverage of the subject site. The approximate locations of the boreholes are shown on Drawing PG5177-1 - Test Hole Location Plan included in Appendix 2.

Borehole BH 1 was advanced using a truck-mounted auger drill rig while boreholes BH 2 and BH 3 were completed using portable drilling equipment, both of which were operated by a two-person crew. All fieldwork was conducted under the full-time supervision of our personnel under the direction of a senior engineer. The drilling procedure consisted of augering to the required depths at the selected locations, and sampling and testing the overburden.

Sampling and In Situ Testing

Soil samples were collected from the boreholes using two different techniques, namely, sampled directly from the auger flights (AU) or collected using a 50 mm diameter split-spoon (SS) sampler. All samples were visually inspected and initially classified on site and subsequently placed in sealed plastic bags. All samples were transported to our laboratory for further examination and classification. The depths at which the auger and split spoon samples were recovered from the boreholes are shown as AU and SS, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

A Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split spoon samples. The SPT results are recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Rock samples were recovered from boreholes BH2 and BH3 using a core barrel and diamond drilling techniques. The depths at which rock core samples were recovered from the boreholes are shown as RC on the Soil Profile and Test Data sheets in Appendix 1.

A recovery value and a Rock Quality Designation (RQD) value were calculated for each drilled section (core run) of bedrock and are shown on the borehole logs. The recovery value is the ratio, in percentage, of the length of the bedrock sample recovered over the length of the drilled section (core run). The RQD value is the ratio, in percentage, of the total length of intact rock pieces longer than 100 mm in one core run over the length of the core run. These values are indicative of the quality of the bedrock.

The subsurface conditions observed in the test holes were recorded in detail in the field. The soil profiles are presented on the Soil Profile and Test Data sheets in Appendix 1 of this report.

Groundwater

Groundwater monitoring wells were installed in all boreholes to permit monitoring of the groundwater levels subsequent to the completion of the sampling program.

Sample Storage

All samples will be stored in the laboratory for a period of one month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The test hole locations were selected by Paterson to provide general coverage of the proposed development taking into consideration the existing site features and underground utilities. The test hole locations and ground surface elevation at each test hole location were surveyed by Paterson. The ground surface elevations at the borehole locations were referenced to a temporary benchmark (TBM), consisting of the top grate of the catch basin located on the south side of McArthur Avenue with a geodetic elevation of 71.06 m. The location of the test holes and ground surface elevation at each test hole location are presented on Drawing PG5177-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. Soil samples will be stored for a period of one month after this report is completed, unless otherwise directed.

3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The sample was analyzed to determine its concentration of sulphate and chloride along with its resistivity and pH. The laboratory test results are shown in Appendix 1 and the results are discussed in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site is currently occupied by a two storey residential building fronting onto McArthur Avenue and a single storey garage on the north end of the site. An asphalt-paved access lane is located along the eastern edge of the property and a small parking area is located directly behind the residential building. The site is bordered by McArthur Avenue to the south, commercial properties to the east and west, and a residential property to the north. The ground surface across the site is relatively level and at-grade with McArthur Avenue at approximate geodetic elevation 71.3 m.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile at the test hole locations consists of an approximate 1.1 to 2.7 m thickness of fill at ground surface or underlying the asphalt surface. The fill was generally observed to consist a brown silty sand with trace silty clay and some gravel and crushed stone.

A glacial till deposit was observed underlying the fill consisting of a loose to compact, brown sandy silt to silty clay with fragments of weathered bedrock.

Bedrock

Bedrock was encountered underlying the glacial till at approximate depths of 1.8 to 3.1 m below the existing ground surface. The bedrock encountered at borehole BH1 was augered to an approximate depth of 6.7 m. Bedrock was cored at boreholes BH2 and BH3 to approximate depths of 4.0 to 4.7 m. The bedrock consisted of a severely weathered shale and based on the RQDs of the recovered rock core, the weathered bedrock can be classified as very poor in quality.

Based on available geological mapping, the bedrock at the subject site consists of shale of the Billings formation with a drift thickness of 2 to 5 m.

4.3 Groundwater

Groundwater levels were measured in the monitoring wells installed in the boreholes on December 11, 2019. The observed groundwater levels are summarized in Table 1.

Table 1 - Summary of Groundwater Level Readings				
Test Hole Number	**Ground Surface Elevation (m)**	**Groundwater Depth (m)**	**Groundwater Elevation (m)**	**Recording Date**
BH 1	71.20	3.92	67.28	December 11, 2019
BH 2	71.30	2.37	68.93	December 11, 2019
BH 3	71.38	3.50	67.88	December 11, 2019

It should be noted that the groundwater levels could be influenced by surface water infiltrating the backfilled boreholes. Long-term groundwater levels can also be estimated based on the observed colour and consistency of the recovered soil samples. Based on these observations, the long-term groundwater table can be expected at approximately 3 to 4 m below ground surface. The recorded groundwater levels are noted on the applicable Soil Profile and Test Data sheet presented in Appendix 1.

It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed multi-storey building. It is expected that the proposed building will be constructed using conventional shallow footings bearing on the undisturbed, weathered shale bedrock.

Removal of the weathered bedrock will be required to complete the excavation for the proposed building. This is discussed further in Section 5.2.

Expansive shale bedrock could be present on site. Precautions should be provided during construction to reduce the risks associated with the potentially heaving shale bedrock. This is discussed further in Section 6.8.

The above and other considerations are further discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil, asphalt and fill, containing deleterious or organic materials, should be stripped from under any building, paved areas, pipe bedding and other settlement sensitive structures. Under paved areas, existing construction remnants, such as foundation walls, pipe ducts, etc., should be excavated to a minimum depth of 1 m below final grade.

Bedrock Removal

In consideration of the very poor quality of the weathered bedrock encountered within the proposed depth of excavation, it is anticipated that bedrock removal will be possible using hoe-ramming and conventional excavation techniques.

Vibration Considerations

Construction operations could be the cause of vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels as much as possible should be incorporated in the construction operations to maintain a cooperative environment with the residents.

The following construction equipments could be the source of vibrations: hoe ram, compactor, dozer, crane, truck traffic, etc. Vibrations caused by construction operations could be the cause or the source of detrimental vibrations on the adjoining buildings and structures. Therefore, it is recommended that all vibrations be limited.

Two parameters determine the permissible vibrations, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz). These guidelines are for current construction standards. These guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, a pre-construction survey is recommended to minimize the risks of claims during or following the construction of the proposed building.

Fill Placement

Fill used for grading beneath the proposed building should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. This material should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the building should be compacted to at least 98% of the material's standard Proctor maximum dry density (SPMDD).

Non-specified existing fill, along with site-excavated soil, can be used as general landscaping fill where settlement of the ground surface is of minor concern. This material should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If this material is to be used to build up the subgrade level for areas to be paved, it should be compacted in thin lifts to at least 95% of the material's SPMDD.

Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless used in conjunction with a composite drainage membrane.

5.3 Foundation Design

Bearing Resistance Values

Footings placed directly on the undisturbed, weathered bedrock can be designed using a bearing resistance value at SLS of **500 kPA** and a factored bearing resistance value at ULS of **1,000 kPa**.

An undisturbed bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed material, whether in-situ or not, have been removed, under dry conditions, prior to the placement of concrete for the footings.

Footings designed using the above-noted bearing resistance value at SLS will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to a weathered bedrock above the groundwater table when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C**. If a higher seismic site class is required (Class A or B), a site specific shear wave velocity test may be completed to accurately determine the applicable seismic site classification for foundation design of the proposed building, as presented in Table 4.1.8.4.A of the Ontario Building Code (OBC) 2012.

Soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the OBC 2012 for a full discussion of the earthquake design requirements.

5.5 Sub-Basement Floor Slab

Based on the anticipated depth of the proposed basement level, the bearing medium for the sub-basement floor slab will consist of weathered bedrock.

It is recommended that the upper 200 mm of sub-slab fill consists of 19 mm clear crushed stone. All backfill material within the footprint of the proposed building should be placed in maximum 300 mm thick loose layers and compacted to at least 95% of its SPMDD.

A sub-floor drainage system, consisting of lines of perforated drainage pipe subdrains connected to a positive outlet, should be provided in the clear crushed stone backfill under the lower basement floor. This is discussed further in Subsection 6.1.

5.6 Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the subject structure. However, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a bulk (drained) unit weight of 20 kN/m^3.

Where undrained conditions are anticipated (i.e. below the groundwater level), the applicable effective (undrained) unit weight of the retained soil can be taken as 13 kN/m^3, where applicable. A hydrostatic pressure should be added to the total static earth pressure when using the effective unit weight.

Lateral Earth Pressures

The static horizontal earth pressure (p_o) can be calculated using a triangular earth pressure distribution equal to $K_o \cdot \gamma \cdot H$ where:

K_o = at-rest earth pressure coefficient of the applicable retained soil (0.5)
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)

An additional pressure having a magnitude equal to $K_o \cdot q$ and acting on the entire height of the wall should be added to the above diagram for any surcharge loading, q (kPa), that may be placed at ground surface adjacent to the wall. The surcharge pressure will only be applicable for static analyses and should not be used in conjunction with the seismic loading case.

Actual earth pressures could be higher than the “at-rest” case if care is not exercised during the compaction of the backfill materials to maintain a minimum separation of 0.3 m from the walls with the compaction equipment.

Seismic Earth Pressures

The total seismic force (P_{AE}) includes both the earth force component (P_o) and the seismic component (ΔP_{AE}).

The seismic earth force (ΔP_{AE}) can be calculated using $0.375 \cdot a_c \cdot \gamma \cdot H^2/g$ where:

a_c = $(1.45 - a_{max}/g)a_{max}$
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)
g = gravity, 9.81 m/s^2

The peak ground acceleration, (a_{max}), for the Ottawa area is 0.32g according to OBC 2012. Note that the vertical seismic coefficient is assumed to be zero.

The earth force component (P_o) under seismic conditions can be calculated using $P_o = 0.5\ K_o\ \gamma\ H^2$, where $K_o = 0.5$ for the soil conditions noted above.

The total earth force (P_{AE}) is considered to act at a height, h (m), from the base of the wall, where:

$h = \{P_o \cdot (H/3) + \Delta P_{AE} \cdot (0.6 \cdot H)\}/P_{AE}$

The earth forces calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per OBC 2012.

5.7 Pavement Structure

Car only parking areas and access lanes are anticipated at this site. The proposed pavement structures are presented in Tables 2 and 3.

Table 2 - Recommended Pavement Structure - Car Only Parking Areas

Thickness (mm)	Material Description
50	Wear Course - HL-3 or Superpave 12.5 Asphaltic Concrete
150	BASE - OPSS Granular A Crushed Stone
300	SUBBASE - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill	

Table 3 - Recommended Pavement Structure - Access Lanes

Thickness (mm)	Material Description
40	Wear Course - HL-3 or Superpave 12.5 Asphaltic Concrete
50	Binder Course - HL-8 or Superpave 19.0 Asphaltic Concrete
150	BASE - OPSS Granular A Crushed Stone
450	SUBBASE - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill	

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of the material’s SPMDD using suitable vibratory equipment.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is recommended that a perimeter foundation drainage system be provided for the proposed building. The system should consist of a 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Where insufficient room is available for exterior backfill, it is suggested that the composite drainage system (such as Delta Drain 6000 or equivalent) be secured against the shoring system extending to a series of drainage sleeve inlets through the building foundation wall. The drainage sleeves should be at lease 150 mm diameter and be spaced 3 m along the perimeter foundation walls. An interior perimeter drainage pipe should be placed along the building perimeter along with the sub-slabdrainage system. The perimeter drainage pipe and sub-slab drainage system should direct water to sump pit(s) within the lower garage area.

Sub-slab Drainage

Sub-slab drainage will be required to control water infiltration. For preliminary design purposes, we recommend that 100 or 150 mm perforated pipes be placed at approximate 6 m centres. The spacing of the sub-slab drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

Foundation Backfill

Where sufficient space is available, backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a drainage geocomposite, such as Delta Drain 6000, connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose. A waterproofing system should be provided for any elevator pits (pit bottom and walls).

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effects of frost action. A minimum of 1.5 m of soil cover should be provided for adequate frost protection for heated structures.

Exterior unheated footings, such as those for isolated exterior piers, are more prone to deleterious movement associated with frost action than the exterior walls of the heated structure and require additional protection, such as soil cover of 2.1 m or an equivalent combination of soil cover and foundation insulation.

6.3 Excavation Side Slopes

The side slopes of excavations in the overburden materials and weathered bedrock should be either cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. Based on the depth of the proposed structure and the proximity to property lines, it is anticipated that a temporary shoring system will be required to support the excavation on the south, east and west sides.

Unsupported Excavations

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be excavated at 1H:1V or shallower. The shallower slope is required for excavation below groundwater level. The subsurface soils are considered to be a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

A trench box is recommended to protect personnel working in trenches with steep or vertical sides. Services are expected to be installed by “cut and cover” methods and excavations should not remain open for extended periods of time.

Temporary Shoring

Temporary shoring is anticipated to be required to support the overburden soils and the weathered bedrock. The design and approval of the shoring system will be the responsibility of the shoring contractor and the shoring designer who is a licensed professional engineer and is hired by the shoring contractor. It is the responsibility of the shoring contractor to ensure that the temporary shoring is in compliance with safety requirements, designed to avoid any damage to adjacent structures and include dewatering control measures. In the event that subsurface conditions differ from the approved design during the actual installation, it is the responsibility of the shoring contractor to commission the required experts to re-assess the design and implement the required changes. Furthermore, the design of the temporary shoring system should take into consideration a full hydrostatic condition which can occur during significant precipitation events.

The temporary shoring system may consist of a soldier pile and lagging system which could be cantilevered, anchored or braced. The shoring system is recommended to be adequately supported to resist toe failure, if required, by means of rock bolts or extending the piles into the bedrock through pre-augered holes, if a soldier pile and lagging system is the preferred method.

Any additional loading due to street traffic, construction equipment, adjacent structures and facilities, etc., should be added to the earth pressures described below. The earth pressures acting on the shoring system may be calculated using the following parameters.

Table 4 - Soil Parameters

Parameters	Values
Active Earth Pressure Coefficient (K_a)	0.33
Passive Earth Pressure Coefficient (K_p)	3
At-Rest Earth Pressure Coefficient (K_o)	0.5
Unit Weight (γ), kN/m^3	21
Submerged Unit Weight (γ), kN/m^3	13

The active earth pressure should be calculated where wall movements are permissible while the at-rest pressure should be calculated if no movement is permissible. The dry unit weight should be calculated above the groundwater level while the effective unit weight should be calculated below the groundwater level.

The hydrostatic groundwater pressure should be included to the earth pressure distribution wherever the effective unit weight are calculated for earth pressures. If the groundwater level is lowered, the dry unit weight for the soil/bedrock should be calculated full weight, with no hydrostatic groundwater pressure component.

For design purposes, the minimum factor of safety of 1.5 should be calculated.

6.4 Pipe Bedding and Backfill

At least 150 mm of OPSS Granular A should be used for pipe bedding for sewer and water pipes. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe, should consist of OPSS Granular A or Granular B Type II with a maximum size of 25 mm. The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to 98% of the material's standard Proctor maximum dry density.

It should generally be possible to re-use the site materials above the cover material if the operations are carried out in dry weather conditions.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.5 m below finished grade) and above the cover material should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 225 mm thick loose lifts and compacted to a minimum of 95% of the material standard Proctor maximum dry density.

6.5 Groundwater Control

It is anticipated that groundwater infiltration into the excavations should be controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Groundwater Control for Building Construction

A temporary Ministry of Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required if more than 400,000 L/day of ground and/or surface water are to be pumped during the construction phase. At least 4 to 5 months should be allowed for completion of the application and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

Impacts on Neighbouring Properties

Based on our observations, localized groundwater lowering may be required under short-term conditions due to construction of the proposed building. It should be noted that the extent of any significant groundwater lowering will take place within a limited range of the subject site due to the minimal temporary groundwater lowering.

Further, due to the presence of shallow glacial and/or bedrock at, and in the vicinity of, the subject site, the neighbouring structures are expected to be founded on the glacial till or bedrock. Therefore, no issues are expected with respect to groundwater lowering that would cause long term damage to adjacent structures surrounding the proposed building.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project.

The subsoil conditions at this site mostly consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters, tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

The trench excavations should be carried out in a manner to avoid the introduction of frozen materials, snow or ice into the trenches.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of an aggressive to very aggressive corrosive environment.

6.8 Protection of Potentially Expansive Bedrock

The presence of potentially expansive shale is anticipated to be encountered at the subject site. To reduce the long term deterioration of the shale, exposure of the bedrock surface to oxygen should be kept as low as possible. The bedrock surface within the proposed building footprint should be protected from excessive dewatering and exposure to ambient air. Therefore, a 50 mm thick concrete mud slab, consisting of 15 MPa lean concrete, should be placed on the exposed bedrock surface within a 48 hour period of being exposed.

Another option for protecting the shale from deterioration is placing granular fill over the exposed surface within a 48 hour period after exposure. Preventing the dewatering of the shale bedrock will also prevent the rapid deterioration and expansion of the shale bedrock.

7.0 Recommendations

A materials testing and observation services program is a requirement for the provided foundation design data to be applicable. The following aspects of the program should be performed by the geotechnical consultant:

- ❏ Observation of all bearing surfaces prior to the placement of concrete.
- ❏ Sampling and testing of the concrete and fill materials used.
- ❏ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❏ Observation of all subgrades prior to backfilling.
- ❏ Field density tests to determine the level of compaction achieved.
- ❏ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued, upon request, following the completion of a satisfactory materials testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations provided in this report are in accordance with our present understanding of the project. We request permission to review our recommendations when the drawings and specifications are completed.

A geotechnical investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, we request immediate notification to permit reassessment of our recommendations.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine its suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than the Prestwick Building Corp. or their agents is not authorized without review by Paterson for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Kevin A. Pickard, EIT.

Scott S. Dennis, P.Eng.

Report Distribution

- ❑ Prestwick Building Corp. (e-mail copy)
- ❑ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
455 McArthur Avenue
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME 55 Power Auger

DATE 2019 November 29

FILE NO. PG5177

HOLE NO. BH 1

SOIL DESCRIPTION	Strata depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	71.20
Asphaltic concrete	0.04						
FILL: Dark brown silty sand, some gravel, trace clay	1.07	AU	1				
		SS	2	88	9	1	70.20
GLACIAL TILL: Dark brown sandy silt with shale fragments	2.29	SS	3	100	18	2	69.20
GLACIAL TILL: Brown silty clay with shale fragments, trace sand	3.05	SS	4	100	19	3	68.20
BEDROCK: Very poor quality, black shale	6.70	SS	5	100	76		
		SS	6	100	50+	4	67.20
		SS	7	67	50+		
		SS	8	0	50+	5	66.20
		SS	9	0	50+	6	65.20
End of Borehole							
(GWL @ 3.92m - Dec. 6, 2019)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
455 McArthur Avenue
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Portable Drill

DATE 2019 December 6

FILE NO. PG5177

HOLE NO. BH 2

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	71.30
FILL: Brown silty sand, trace topsoil and asphalt 0.30	AU	1				
FILL: Brown silty sand, trace gravel 0.60	SS	2	71			
FILL: Brown silty sand, some clay, trace gravel	SS	3	54		1	70.30
	SS	4	83		2	69.30
2.74	SS	5	96			
BEDROCK: Very poor quality, black shale	RC	1	64	0	3	68.30
4.72	RC	2	46	0	4	67.30
End of Borehole						
(GWL @ 2.37m - Dec. 11, 2019)						

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
455 McArthur Avenue
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Portable Drill

DATE 2019 November 29

FILE NO. PG5177

HOLE NO. BH 3

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	71.38
FILL: Brown silty sand, trace topsoil, organics 0.30	AU	1				
FILL: Brown silty sand, trace gravel	SS	2	92			
	SS	3	50		1	70.38
1.52						
GLACIAL TILL: Brown silty sand with shale fragments 1.83	SS	4	100			
BEDROCK: Very poor quality, black shale	RC	1	35	0	2	69.38
					3	68.38
	RC	2	90	0	4	67.38
4.57 End of Borehole						
(GWL @ 3.50m - Dec. 11, 2019)						

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, usually inferred from the results of the Standard Penetration Test (SPT) ‘N’ value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

Compactness Condition	‘N’ Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

Consistency	Undrained Shear Strength (kPa)	‘N’ Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic Limit, % (water content above which soil behaves plastically)
PI	-	Plasticity Index, % (difference between LL and PL)
Dxx	-	Grain size at which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay (more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

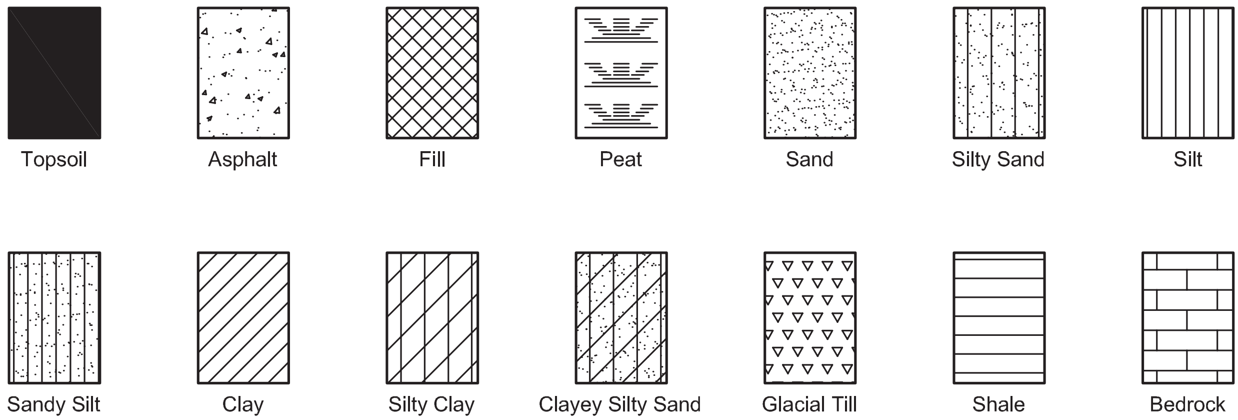
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

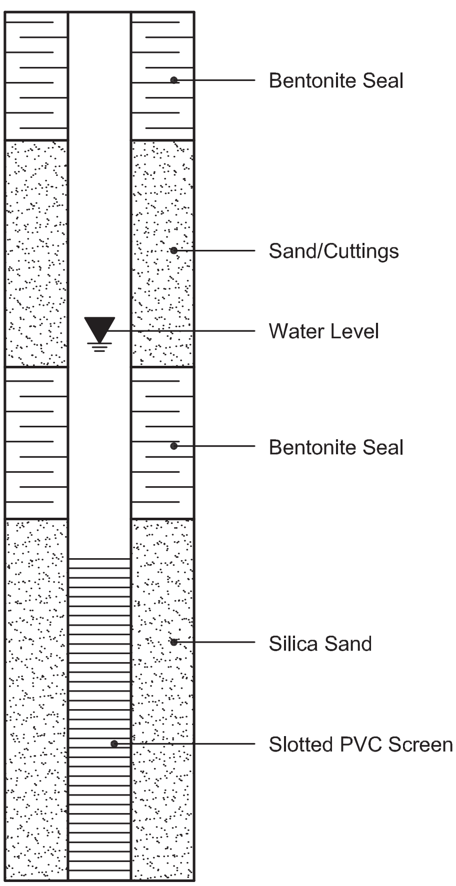
SYMBOLS AND TERMS (continued)

STRATA PLOT

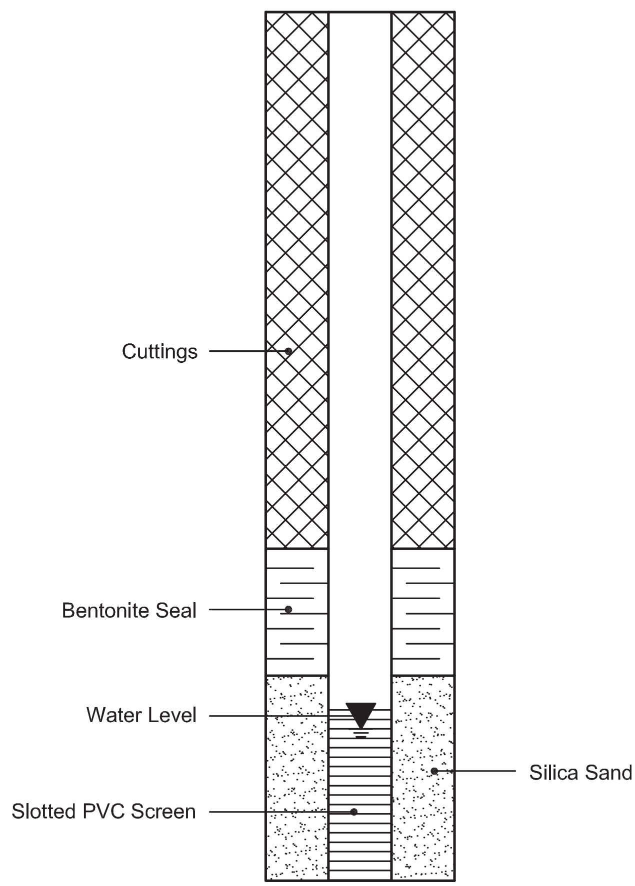


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 27097

Report Date: 04-Dec-2019
Order Date: 29-Nov-2019
Project Description: PG5177

	Client ID:	BH1-SS3	-	-	-
	Sample Date:	29-Nov-19 10:00	-	-	-
	Sample ID:	1948646-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	80.3	-	-	-
General Inorganics					
pH	0.05 pH Units	6.68	-	-	-
Resistivity	0.10 Ohm.m	58.2	-	-	-
Anions					
Chloride	5 ug/g dry	61	-	-	-
Sulphate	5 ug/g dry	14	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG5177-1 - TEST HOLE LOCATION PLAN

FIGURE 1

KEY PLAN

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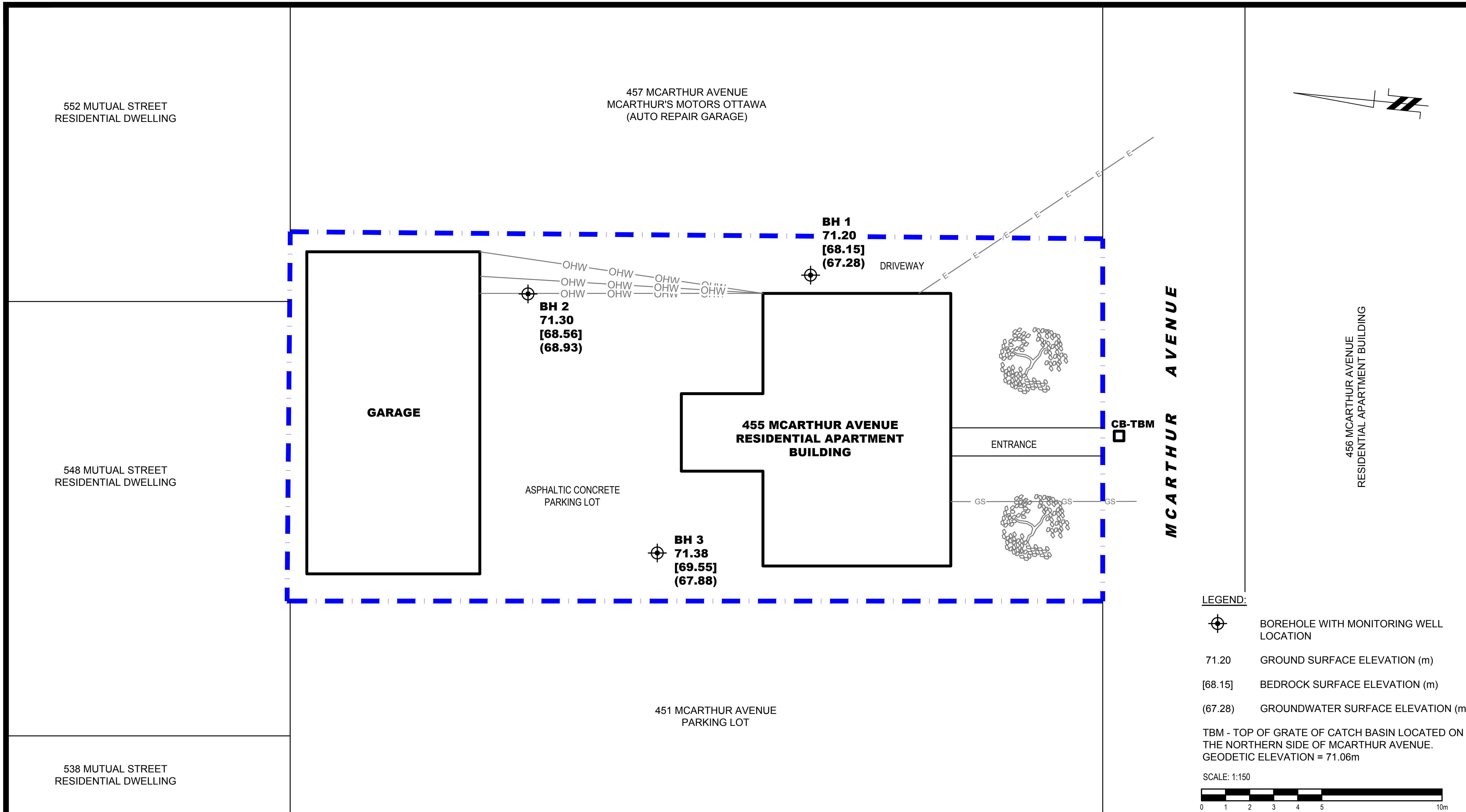

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NO.	REVISIONS	DATE	INITIAL

PRESWICK BUILDING CORPORATION

GEOTECHNICAL INVESTIGATION
455 MCARTHUR AVENUE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale:	1:150	Date:	01/2020
Drawn by:	NFRV	Report No.:	PG5177-1
Checked by:	KP	Dwg. No.:	PG5177-1
Approved by:	DJG	Revision No.:	

p:\autocad drawings\geotechnical\pg51xx\pg5177\pg5177-1 thlp.dwg

Appendix E- EXCERPTS FROM PHASE II ESA

EXECUTIVE SUMMARY

Assessment

A Phase II ESA was conducted for the property addressed 455 McArthur Avenue in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the area of environmental concern (APEC) that was identified on the Phase II Property during the Phase I ESA.

The Phase II ESA was carried out in conjunction with a Geotechnical Investigation and consisted of drilling three (3) boreholes on the Phase II Property, all of which were constructed with groundwater monitoring well installations.

The soil profile generally consisted of an asphaltic concrete pavement structure or topsoil, followed by a fill material, underlain by glacial till with traces of shale and terminated in shale bedrock at a maximum depth of 6.70 m below the ground surface. Soil samples were obtained from the boreholes and screened using vapour measurements along with visual and olfactory observations. No visual or olfactory evidence of deleterious materials or contamination were identified during the subsurface investigation.

Based on the screening results in combination with sample depth and location, three (3) soil samples were submitted for laboratory analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX) and petroleum hydrocarbons (PHCs, F_1-F_4), and metals. BTEX, PHC and metal parameters were identified in the soil. All results were in compliance with the MECP Table 3 Residential Standards, with the exception of PHC (F1 fraction) in BH2-SS4, which was marginally in excess of the selected MECP Standards.

Groundwater samples were recovered and analyzed for BTEX, PHCs and/or VOCs. No free-phase product was observed on the groundwater at any of the monitoring well locations during the groundwater sampling events. No BTEX, PHC and VOC parameter concentrations were detected in the groundwater samples analyzed. All groundwater results are in compliance with the MECP Table 3 Standards.

Recommendations

Soil

Based on the findings of the Phase II ESA, soil on the northeast corner of the Phase II Property contains marginal PHC impacts. It is our recommendation that the impacted fill material be removed from the subject site during the redevelopment process. The excavation of the soil from the property should be monitored and confirmed by Paterson. Any impacted soil being removed from the property is to be disposed of at an approved waste disposal facility.

Monitoring Wells

If the monitoring wells installed on the subject site are not going to be used in the future, or will not be entirely removed, they should be abandoned according to Ontario Regulation 903. The wells will be registered with the MECP under this regulation.

1.0 INTRODUCTION

At the request of Prestwick Building Corporation, Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment for the property addressed 455 McArthur Avenue, in the City of Ottawa, Ontario, herein referred to as the Phase II Property. The purpose of this Phase II ESA was to address areas of potential environmental concern (APECs) identified on the Phase II Property, during the Phase I ESA conducted by Paterson.

1.1 Site Description

Address:	455 McArthur Avenue, Ottawa, Ontario
Legal Description:	Part of Lot 146 West, McArthur North, on Plan 300, in the City of Ottawa.
Property Identification Number (PIN):	04244-0156
Location:	The Phase II Property is located on the north side of McArthur Avenue, 120m west of where McArthur Avenue transects with St. Laurent Boulevard, in the City of Ottawa, Ontario. Refer to Figure 1 - Key Plan in the Figures section following the text.
Latitude and Longitude:	45° 25' 58.48" N, 75° 38' 36.89" W
Zoning:	TM – Traditional Mainstreet Zone.
Configuration:	Rectangular
Area:	514m^2 (approximately)

1.2 Property Ownership

Paterson was retained to complete this Phase II ESA by Mr. Allan Bateman of Prestwick Building Corporation, the current property owner. Mr. Bateman can be reached by telephone at (613) 859-0933.

1.3 Current and Proposed Future Uses

The Phase II Property is currently occupied by a two (2) storey residential building and a private parking garage. It is our understanding that the proposed site redevelopment for the Phase II Property consists of a three (3) storey residential building with a basement level. The footprint of the development will cover the majority of the site and it will be municipally serviced with water and sewer.

1.4 Applicable Site Condition Standard

The site condition standards for the property were obtained from Table 3 of the document entitled “Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act”, prepared by the Ministry of the Environment, Conservation and Parks (MECP), April 2011. The selected MECP Table 3 Standards are based on the following considerations:

- ❑ Coarse-grained soil conditions
- ❑ Full depth generic site condition
- ❑ Non-potable groundwater conditions
- ❑ Residential land use

These standards were selected based on the future land use of the subject site. Coarse-grained soil standards, which are considered conservative, were chosen to represent the current site conditions of the Phase II Property.

No VOC parameter concentrations were identifed in the groundwater samples analyzed. All VOC test results are in compliance with the selected MECP Table 3 Standards.

Analytical results of BTEX, PHC and VOCs in the groundwater with respect to borehole locations are shown on Drawing PE4808-5- Analytical Testing Plan – Groundwater.

No parameter concentrations in groundwater were detected above the laboratory method detection limits.

5.7 Quality Assurance and Quality Control Results

All samples submitted as part of the November 29 through December 11, 2019 sampling events were handled in accordance with the Analytical Protocol with respect to preservation method, storage requirement, and container type.

Overall, the quality of the field data collected during this Phase II-ESA is considered to be sufficient to meet the overall objectives of this assessment.

5.8 Phase II Conceptual Site Model

The following section has been prepared in general accordance with the requirements of O.Reg. 153/04, as amended by the Environmental Protection Act. Conclusions and recommendations are discussed in a subsequent section.

Site Description

Potentially Contaminating Activity and Areas of Potential Environmental Concern

As indicated in Section 2.2 of this report, PCA 52 was identifed at 457 McArthur Avenue, which resulted in an APEC on the Phase II Property:

❒ APEC 1: Resulting from an existing off-site automotive repair garage situated immediately east of the Phase I Property (PCA 52, as per O.Reg 153/04, Table 2).

The existing PCA was verified through the historical review and site visit.

Contaminants of Potential Concern

Based on the APEC identified on the Phase II Property, the contaminants of potential concern (CPCs) present in soil and/or groundwater include:

- Benzene, ethylbenzene, toluene and xylenes (BTEX);
- Petroleum hydrocarbons (PHCs, Fractions F_1-F_4);
- Volatile Organic Compounds (VOCs); and
- Metals

Subsurface Structures and Utilities

Underground utility services on the subject land include natural gas, electricity, water and sewer services. These services enter the Phase II Property from McArthur Avenue.

Drilling locations, particularly on the northeast corner of the Phase II Property were limited due to the above ground service lines running from the northeast corner of the residence to the southeast corner of the private garage.

The approximate locations of above and below ground services are shown on Drawing PE4808-3–Test Hole Location Plan.

Physical Setting

Site Stratigraphy

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is illustrated on Drawings PE4808-5A–Cross-section A-A' – Soil and PE4808-5B–Cross-section A-A'– Groundwater. The site stratigraphy consists of:

- Asphaltic concrete with an approximate thickness of 0.04 m underlain by crush stone and gravel. Groundwater was not encountered in this layer.

- Fill material consisting off silty sand with reworked native soils was encountered in BH1 and BH2. Fill material consisting of trace of topsoil/organics was encountered in BH3 and extended to depths ranging from 1.07 to 2.74 mbgs. Groundwater was encountered in this layer at BH2.

- Glacial till consisting of silty clay with shale fragments was encountered in BH1 and BH3 and extended to depths ranging from 1.83 to 3.05 mbgs. Groundwater was not encountered in this layer.

- ❒ Shale bedrock was encountered in all boreholes and extended to depth ranging from 4.57 to 6.70 mbgs. Groundwater was encountered in this layer at BH1 and BH3.

Hydrogeological Characteristics

Groundwater at the Phase II Property was generally encountered in the shale bedrock ranging at depths of approximately 1.83 to 3.05 mbgs. Groundwater flow was measured in a south/southwesterly direction with a hydraulic gradient of 0.14 m/m. Groundwater contours are shown on Drawing PE4808-3–Test Hole Location Plan.

Approximate Depth to Water Table

Depth to the water table at the subject site varies between approximately 2.37 to 3.92 mbgs.

Approximate Depth to Bedrock

Bedrock was confirmed during the drilling program at depths ranging from 1.83 to 3.05 mbgs. All boreholes were completed in shale bedrock at depths ranging between 4.57 to 6.70 mbgs.

Well records for the immediate area of the Phase II Property indicated that the site is situated in an area consisting of plain till (soil), underlain by shale and sometimes limestone.

Sections 41 and 43.1 of the Regulation

Section 41 of the Regulation does not apply to the Phase II Property, in that the subject property is not within 30m of an environmentally sensitive area.

Section 43.1 of the Regulation does not apply to the Phase II Property as the subject land is not within 30 m of a natural body of water.

Fill Placement

Based on the findings of the subsurface investigation, the fill material encountered consisted of a mixture of silty sand with some gravel, crushed stones with traces of clay and/or organics. The upper fill was considered to be a gravel base for the asphalt while the lower fill was reworked native soil. No visual or olfactory evidence of deleterious materials or contamination were identified in the fill material.

Existing Buildings and Structures

The Phase I Property is occupied by a two (2)-storey residential building and a private parking garage. Both buildings were constructed with a poured concrete foundation and exteriors finished in red brick.

Proposed Buildings and Other Structures

The proposed development for the Phase II Property includes a three (3) storey residential building with a basement level. The footprint of the development will cover the majority of the site and it will be municipally serviced with water and sewer.

Water Bodies and Areas of Natural Significance

No water bodies or areas of natural significance were identifed on the Phase II Property or within the Phase I Study Area.

Environmental Condition

Areas Where Contaminants are Present

Based on the analytical results, the PHC (F1 fraction) in soil sample BH2-SS4 marginally exceeds the selected MECP Table 3 Standards, as shown on Drawing PE4808-4 – Analytical Testing Plan–Soil. It should be noted that soil sample BH2-SS4 exhibiting the F1 exceedance was retrieved at the approximate groundwater level, and the groundwater did not contain any PHC impact. Based on our findings, the extent of the F1 impact is considered o be relatively isolated to the northeast corner of the Phase II Property.

Types of Contaminants

Based on the analytical results for soil and groundwater, the contaminants of concern include PHCs, specifically the PHC (F1 fraction).

Contaminated Media

Based on the findings of the Phase II ESA, the fill material at location BH2 is impacted with PHC.

What Is Known About Areas Where Contaminants Are Present

Based on the subsurface investigation, a very limited area of the material appears to be impacted in the vicinity of BH2. No PHCs were identified in the groundwater.

Distribution and Migration of Contaminants

Based on the findings of the Phase II ESA, no significant distribution or migration of contaminants is considered to have occurred. The soil impact is considered to be limited at the northeast corner of the Phase II Property with no indications of groundwater impact on site. Based on the groundwater levels, vertical migration is not expected to have occurred.

Discharge of Contaminants

The PHC impact at BH2 is considered most likely to have resulted from an automotive leak on-site, and not the adjacent garage, since the groundwater is clean.

Climatic and Meteorological Conditions

In general, climatic and meteorological conditions have the potential to affect contaminant distribution. Two (2) ways by which climatic and meteorological conditions may affect contaminant distribution include the downward leaching of contaminants by means of the infiltration of precipitation, and the migration of contaminants via groundwater levels and/or flow, which may fluctuate seasonally.

Since the majority of the site is covered with buildings or asphaltic concrete and the groundwater is clean, climatic and meteorological conditions are not considered to have contributed to contaminant transport in the past.

Potential for Vapour Intrusion

Based on the findings of the Phase II ESA, there is no potential for vapour intrusion on the Phase II Property.

6.0 CONCLUSIONS

Assessment

A Phase II ESA was conducted for the property addressed 455 McArthur Avenue in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the area of environmental concern (APEC) that was identified on the Phase II Property during the Phase I ESA.

The Phase II ESA was carried out in conjunction with a Geotechnical Investigation and consisted of drilling three (3) boreholes on the Phase II Property, all of which were constructed with groundwater monitoring well installations.

The soil profile generally consisted of an asphaltic concrete pavement structure or topsoil, followed by a fill material, underlain by glacial till with traces of shale and terminated in shale bedrock at a maximum depth of 6.70 m below the ground surface. Soil samples were obtained from the boreholes and screened using vapour measurements along with visual and olfactory observations. No visual or olfactory evidence of deleterious materials or contamination were identified during the subsurface investigation.

Based on the screening results in combination with sample depth and location, three (3) soil samples were submitted for laboratory analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX) and petroleum hydrocarbons (PHCs, F_1-F_4), and metals. BTEX, PHC and metal parameters were identified in the soil. All results were in compliance with the MECP Table 3 Residential Standards, with the exception of PHC (F1 fraction) in BH2-SS4, which was marginally in excess of the selected MECP Standards.

Groundwater samples were recovered and analyzed for BTEX, PHCs and/or VOCs. No free-phase product was observed on the groundwater at any of the monitoring well locations during the groundwater sampling events. No BTEX, PHC and VOC parameter concentrations were detected in the groundwater samples analyzed. All groundwater results are in compliance with the MECP Table 3 Standards.

Recommendations

Soil

Based on the findings of the Phase II ESA, soil on the northeast corner of the Phase II Property contains marginal PHC impacts. It is our recommendation that the impacted fill material be removed from the subject site during the redevelopment process. The excavation of the soil from the property should be monitored and confirmed by Paterson. Any impacted soil being removed from the property is to be disposed of at an approved waste disposal facility.

Monitoring Wells

If the monitoring wells installed on the subject site are not going to be used in the future, or will not be entirely removed, they should be abandoned according to Ontario Regulation 903. The wells will be registered with the MECP under this regulation.

7.0 STATEMENT OF LIMITATIONS

This Phase II - Environmental Site Assessment report has been prepared in general accordance with O.Reg. 153/04, as amended, and meets the requirements of CSA Z769-00. The conclusions presented herein are based on information gathered from a limited sampling and testing program. The test results represent conditions at specific test locations at the time of the field program.

The client should be aware that any information pertaining to soils and all test hole logs are furnished as a matter of general information only and test hole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those of the test holes themselves.

Should any conditions be encountered at the subject site and/or historical information that differ from our findings, we request that we be notified immediately in order to allow for a reassessment.

This report was prepared for the sole use of Prestwick Building Corporation. Notification from Prestwick Building Corporation and Paterson Group will be required to release this report to any other party.

Paterson Group Inc.

Mandy Witteman, B.Eng., M.A.Sc.

Mark D’Arcy, P.Eng., QP$_{ESA}$

LICENSED PROFESSIONAL ENGINEER
M. S. D'ARCY
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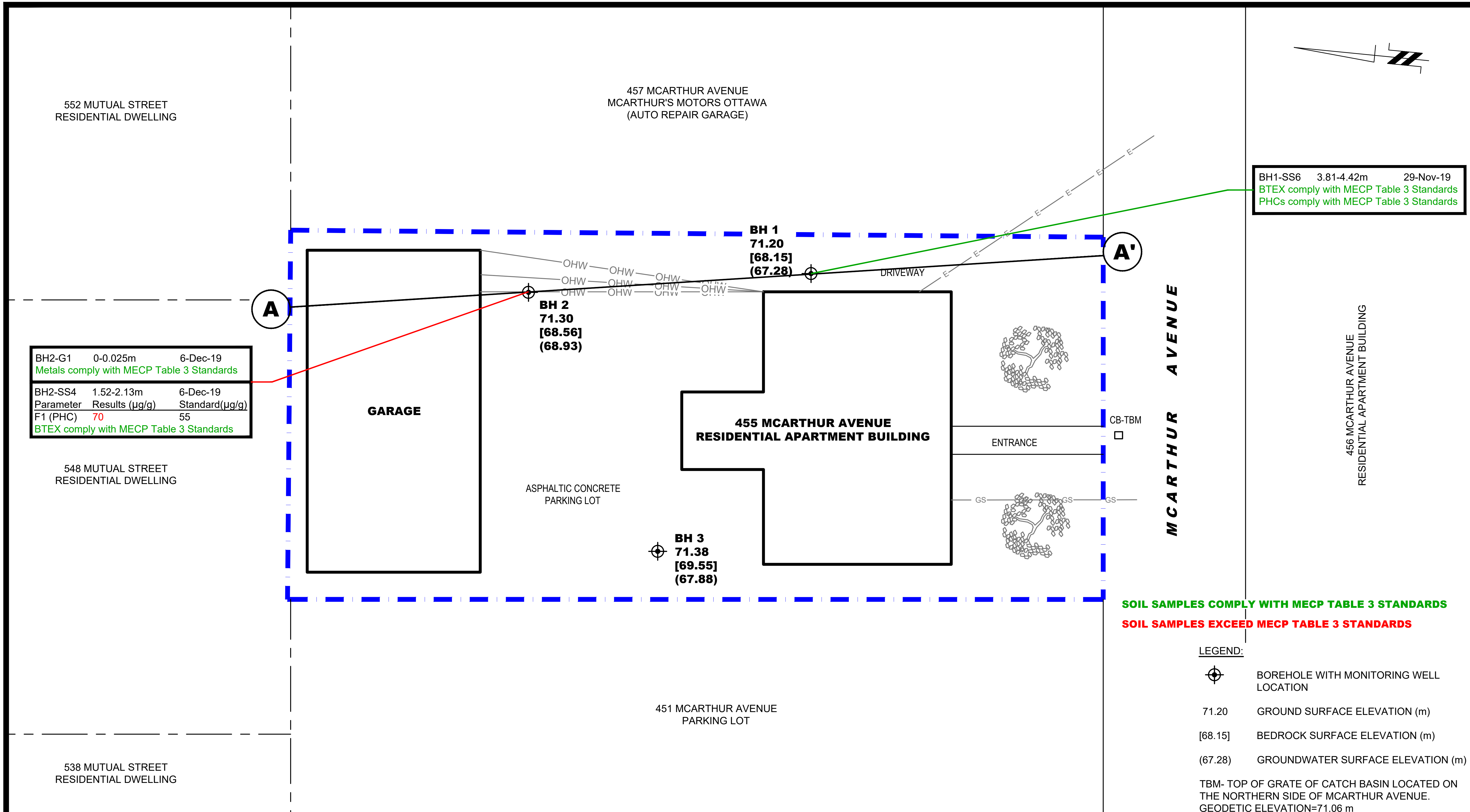

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NO.	REVISIONS	DATE	INITIAL

PRESTWICK BUILDING CORPORATION

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
455 MCARTHUR AVENUE

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN-SOIL(BTEX, PHC, METALS)

Scale: 1:150	Date: 01/2020
Drawn by: YA	Report No.: PE4808-2
Checked by: MW	Dwg. No.: PE4808-4A
Approved by: MSD	Revision No.:

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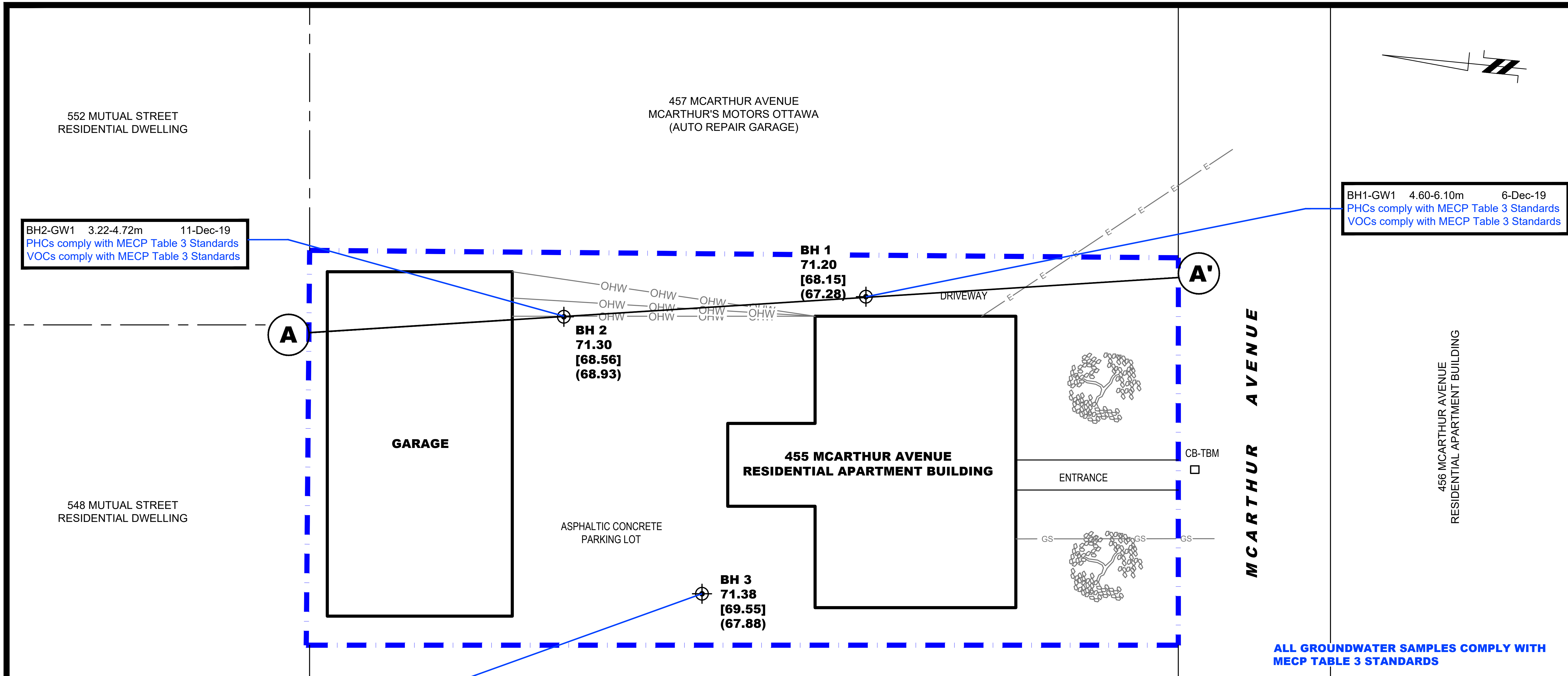

LEGEND:

⊕	BOREHOLE WITH MONITORING WELL LOCATION
71.20	GROUND SURFACE ELEVATION (m)
[68.15]	BEDROCK SURFACE ELEVATION (m)
(67.28)	GROUNDWATER SURFACE ELEVATION (m)

TBM- TOP OF GRATE OF CATCH BASIN LOCATED ON THE NORTHERN SIDE OF MCARTHUR AVENUE. GEODETIC ELEVATION=71.06 m

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PRESTWICK BUILDING CORPORATION
PHASE II - ENVIRONMENTAL SITE ASSESSMENT
455 MCARTHUR AVENUE
OTTAWA, ONTARIO

Title:
ANALYTICAL TESTING PLAN-GROUNDWATER (BTEX, PHC, AND VOC)

Scale: 1:150	Date: 01/2020
Drawn by: YA	Report No.: PE4808-2
Checked by: MW	Dwg. No.: PE4808-4B
Approved by: MSD	Revision No.:

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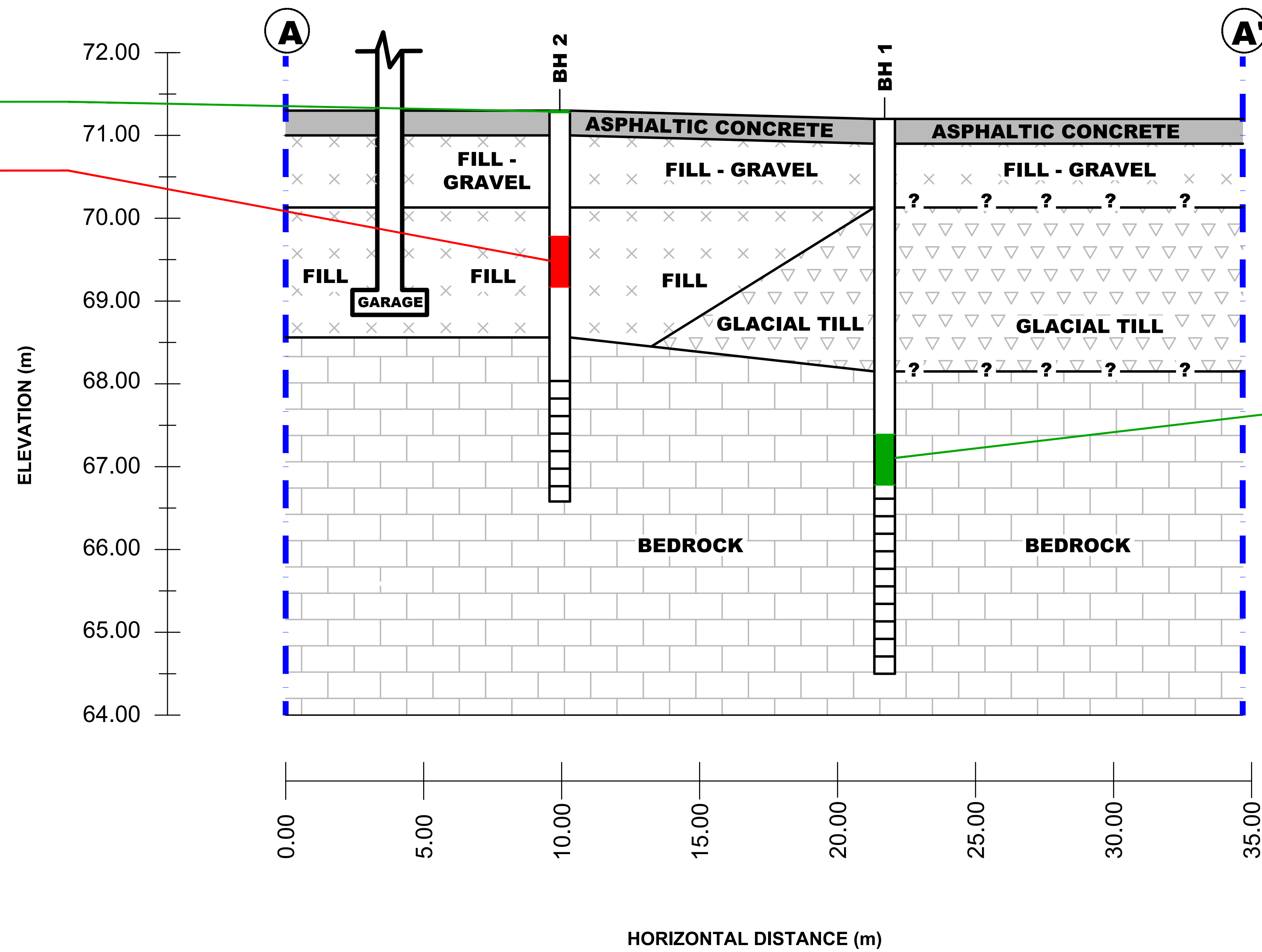
BH2-G1	0-0.025m	6-Dec-19
Metals comply with MECP Table 3 Standards		

BH2-SS4	1.52-2.13m	6-Dec-19
Parameter	Results (µg/g)	Standard(µg/g)
F1 (PHC)	70	55
BTEX comply with MECP Table 3 Standards		



BH1-SS6	3.81-4.42m	29-Nov-19
BTEX comply with MECP Table 3 Standards		
PHCs comply with MECP Table 3 Standards		

SOIL SAMPLES COMPLY WITH MECP TABLE 3 STANDARDS

SOIL SAMPLES EXCEED MECP TABLE 3 STANDARDS

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PRESTWICK BUILDING CORPORATION

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
455 MCARTHUR AVENUE

OTTAWA, ONTARIO

Title:

CROSS SECTION A-A-SOIL (BTEX, PHC, METALS)

Scale: AS SHOWN	Date: 01/2020
Drawn by: YA	Report No.: PE4808-2
Checked by: MW	Dwg. No.: PE4808-5A
Approved by: MSD	Revision No.:

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Appendix F - DRAWINGS