Appendix A WATER SUPPLY SERVICING

A.1 DOMESTIC WATER DEMAND ESTIMATE

2025 Mer Bleue Road - Domestic Water Demand Estimates

Building ID	Area (m^2)	Daily Rate of Demand [1] ($L/m^2/day$)	Avg Day Demand [2]		Max Day Demand [3]		Peak Hour Demand [3]	
			(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
BLDG J	520	5	1.8	0.03	3.3	0.05	4.9	0.08
BLDG K	647	5	2.2	0.04	4.0	0.07	6.1	0.10
BLDG N	357	5	1.2	0.02	2.2	0.04	3.3	0.06
BLDG H	6521	5	22.6	0.38	40.8	0.68	61.1	1.02
BLDG M	829	5	2.9	0.05	5.2	0.09	7.8	0.13
BLDG L	585	5	2.0	0.03	3.7	0.06	5.5	0.09
Total Site :			**32.8**	**0.55**	**59.1**	**0.99**	**88.7**	**1.48**

1 For the purpose of this study it is predicted that commercial facilities will be operated 12 hours per day.

2 Water demand criteria used to estimate peak demand rates for commercial areas are as follows:

maximum day demand rate = 1.8 x average day demand rate

maximum hour demand rate = 1.5 x maximum day demand rate

A.2 FIRE FLOW REQUIREMENTS PER FUS

Stantec

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 160401148
Project Name: 2025 Mer Bleue Road
Date: October 19, 2017
Data input by: Dustin Thiffault

Fire Flow Calculation #: 1
Building Type/Description/Name: BLDG J

Notes:
Building Classification A Div. 2

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.5	Ordinary construction	1	m	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Other (Comm, Ind, Apt etc.)	1	Units	
			Townhouse - indicate # of units	8				
			Other (Comm, Ind, Apt etc.)	1				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement):			1	1	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			520 / Square Metres (m2)	520	Area in Square Meters (m^2)	
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						5,000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Combustible	0	N/A	5,000
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	Adequate Sprinkler conforms to NFPA13	-0.3	N/A	-1,500
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is standard for sprinkler and fire dept. hose line	-0.1	N/A	-500
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	45.1m or greater	0	0.15	m	750
			East Side	10.1 to 20.0m	0.15			
			South Side	45.1m or greater	0			
			West Side	45.1m or greater	0			
6	Obtain Required Fire Flow, Duration & Volume	*Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:*						**4,000**
		Total Required Fire Flow (above) in L/s:						**67**
		Required Duration of Fire Flow (hrs)						**1.50**
		Required Volume of Fire Flow (m^3)						**360**

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 160401148
Project Name: 2025 Mer Bleue Road
Date: October 19, 2017
Data input by: Dustin Thiffault

Fire Flow Calculation #: 2
Building Type/Description/Name: BLDG K

Notes:
Building Classification A Div. 2

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.5	Ordinary construction	1	m	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Other (Comm, Ind, Apt etc.)	1	Units	
			Townhouse - indicate # of units	8				
			Other (Comm, Ind, Apt etc.)	1				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement):			1	1	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			647 Square Metres (m2)	647	Area in Square Meters (m^2)	
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						6,000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Combustible	0	N/A	6,000
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	Adequate Sprinkler conforms to NFPA13	-0.3	N/A	-1,800
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is standard for sprinkler and fire dept. hose line	-0.1	N/A	-600
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	45.1m or greater	0	0.2	m	1,200
			East Side	30.1 to 45.0m	0.05			
			South Side	45.1m or greater	0			
			West Side	10.1 to 20.0m	0.15			
6	Obtain Required Fire Flow, Duration & Volume	***Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:***						**5,000**
		Total Required Fire Flow (above) in L/s:						**83**
		Required Duration of Fire Flow (hrs)						**1.75**
		Required Volume of Fire Flow (m^3)						**525**

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 160401148
Project Name: 2025 Mer Bleue Road
Date: October 19, 2017
Data input by: Dustin Thiffault

Fire Flow Calculation #: 3
Building Type/Description/Name: BLDG N

Notes:
Building Classification E

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method								
Step	**Task**	**Term**	**Options**	**Multiplier Associated with Option**	**Choose:**	**Value Used**	**Unit**	**Total Fire Flow (L/min)**
		Framing Material						
1	**Choose Frame Used for Construction of Unit**	Coefficient related to type of construction (C)	Wood Frame	1.5	Ordinary construction	1	m	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	**Choose Type of Housing (if TH, Enter Number of Units Per TH Block)**	Type of Housing	Single Family	1	Other (Comm, Ind, Apt etc.)	1	Units	
			Townhouse - indicate # of units	8				
			Other (Comm, Ind, Apt etc.)	1				
2.2	**# of Storeys**	Number of Floors/Storeys in the Unit (do not include basement):			1	1	Storeys	
3	**Enter Ground Floor Area of One Unit**	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			357 Square Metres (m2)	357	Area in Square Meters (m^2)	
4	**Obtain Required Fire Flow without Reductions**	Required Fire Flow (without reductions or increases per FUS) ($F = 220 * C * \sqrt{A}$) Round to nearest 1000L/min						**4,000**
5	**Apply Factors Affecting Burning**	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	**Choose Combustibility of Building Contents**	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Combustible	0	N/A	**4,000**
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	**Choose Reduction Due to Presence of Sprinklers**	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	None	0	N/A	**0**
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is not standard or N/A	0	N/A	**0**
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	**0**
			Sprinkler not fully supervised or N/A	0				
5.3	**Choose Separation Distance Between Units**	Exposure Distance Between Units	North Side	45.1m or greater	0	0.15	m	**600**
			East Side	20.1 to 30.1m	0.1			
			South Side	45.1m or greater	0			
			West Side	30.1 to 45.0m	0.05			
6	**Obtain Required Fire Flow, Duration & Volume**	***Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:***						**5,000**
		Total Required Fire Flow (above) in L/s:						**83**
		Required Duration of Fire Flow (hrs)						**1.75**
		Required Volume of Fire Flow (m^3)						**525**

Stantec

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 160401148
Project Name: 2025 Mer Bleue Road
Date: October 19, 2017
Data input by: Dustin Thiffault

Fire Flow Calculation #: 4
Building Type/Description/Name: BLDG H

Notes:
Building Classification E

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.5	Non-combustible construction	0.8	m	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Other (Comm, Ind, Apt etc.)	1	Units	
			Townhouse - indicate # of units	8				
			Other (Comm, Ind, Apt etc.)	1				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement):			1	1	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			6,521 Square Metres (m2)	6,521	Area in Square Meters (m^2)	
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						**14,000**
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Combustible	0	N/A	**14,000**
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	Adequate Sprinkler conforms to NFPA13	-0.3	N/A	**-4,200**
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is standard for sprinkler and fire dept. hose line	-0.1	N/A	**-1,400**
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	**0**
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	45.1m or greater	0	0.15	m	**2,100**
			East Side	10.1 to 20.0m	0.15			
			South Side	45.1m or greater	0			
			West Side	45.1m or greater	0			
6	Obtain Required Fire Flow, Duration & Volume	***Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:***						**11,000**
		Total Required Fire Flow (above) in L/s:						**183**
		Required Duration of Fire Flow (hrs)						**2.25**
		Required Volume of Fire Flow (m^3)						**1,485**

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 160401148
Project Name: 2025 Mer Bleue Road
Date: October 19, 2017
Data input by: Thakshika Rathnasooriya

Fire Flow Calculation #: 5
Building Type/Description/Name: BLDG L

Notes:
Building Classification A Div. 2

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.5	Ordinary construction	1	m	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Other (Comm, Ind, Apt etc.)	1	Units	
			Townhouse - indicate # of units	8				
			Other (Comm, Ind, Apt etc.)	1				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement):			1	1	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			585 Square Metres (m2)	585	Area in Square Meters (m^2)	
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						5,000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Combustible	0	N/A	5,000
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	Adequate Sprinkler conforms to NFPA13	-0.3	N/A	-1,500
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is standard for sprinkler and fire dept. hose line	-0.1	N/A	-500
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	45.1m or greater	0	0.1	m	500
			East Side	30.1 to 45.0m	0.05			
			South Side	45.1m or greater	0			
			West Side	30.1 to 45.0m	0.05			
6	Obtain Required Fire Flow, Duration & Volume	*Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:*						**4,000**
		Total Required Fire Flow (above) in L/s:						**67**
		Required Duration of Fire Flow (hrs)						**1.50**
		Required Volume of Fire Flow (m^3)						**360**

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 160401148
Project Name: 2025 Mer Bleue Road
Date: October 19, 2017
Data input by: Thakshika Rathnasooriya

Fire Flow Calculation #: 6
Building Type/Description/Name: BLDG M

Notes:
Building Classification A Div. 2

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.5	Ordinary construction	1	m	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Other (Comm, Ind, Apt etc.)	1	Units	
			Townhouse - indicate # of units	8				
			Other (Comm, Ind, Apt etc.)	1				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement):			1	1	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			829 Square Metres (m2)	829	Area in Square Meters (m^2)	
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						6,000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Combustible	0	N/A	6,000
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	Adequate Sprinkler conforms to NFPA13	-0.3	N/A	-1,800
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is standard for sprinkler and fire dept. hose line	-0.1	N/A	-600
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	45.1m or greater	0	0.1	m	600
			East Side	30.1 to 45.0m	0.05			
			South Side	45.1m or greater	0			
			West Side	30.1 to 45.0m	0.05			
6	Obtain Required Fire Flow, Duration & Volume	***Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:***						**4,000**
		Total Required Fire Flow (above) in L/s:						**67**
		Required Duration of Fire Flow (hrs)						**1.50**
		Required Volume of Fire Flow (m^3)						**360**

A.3 BOUNDARY CONDITIONS

Boundary Conditions at 2025 Mer Bleue

Information Provided:

Date provided: 07 July, 2016

Criteria	Demand (L/s)
Average Demand	0.49
Maximum Daily Demand	0.87
Peak Hourly Demand	1.31
Fire Flow Demand	83, 100, 183
Maximum Daily + Fire Flow Demand	83.87, 100.87, 183.87

Location:

-

Results

Connection:

Criteria	Head (m)	Pressure (psi)
Max HGL	130.8	60.0
PKHR	128.2	56.3
MXDY + Fire Flow (83.87 L/s)	128.4	56.6
MXDY + Fire Flow (100.87 L/s)	128.5	56.9
MXDY + Fire Flow (183.87 L/s)	128.0	56.2

Connection:

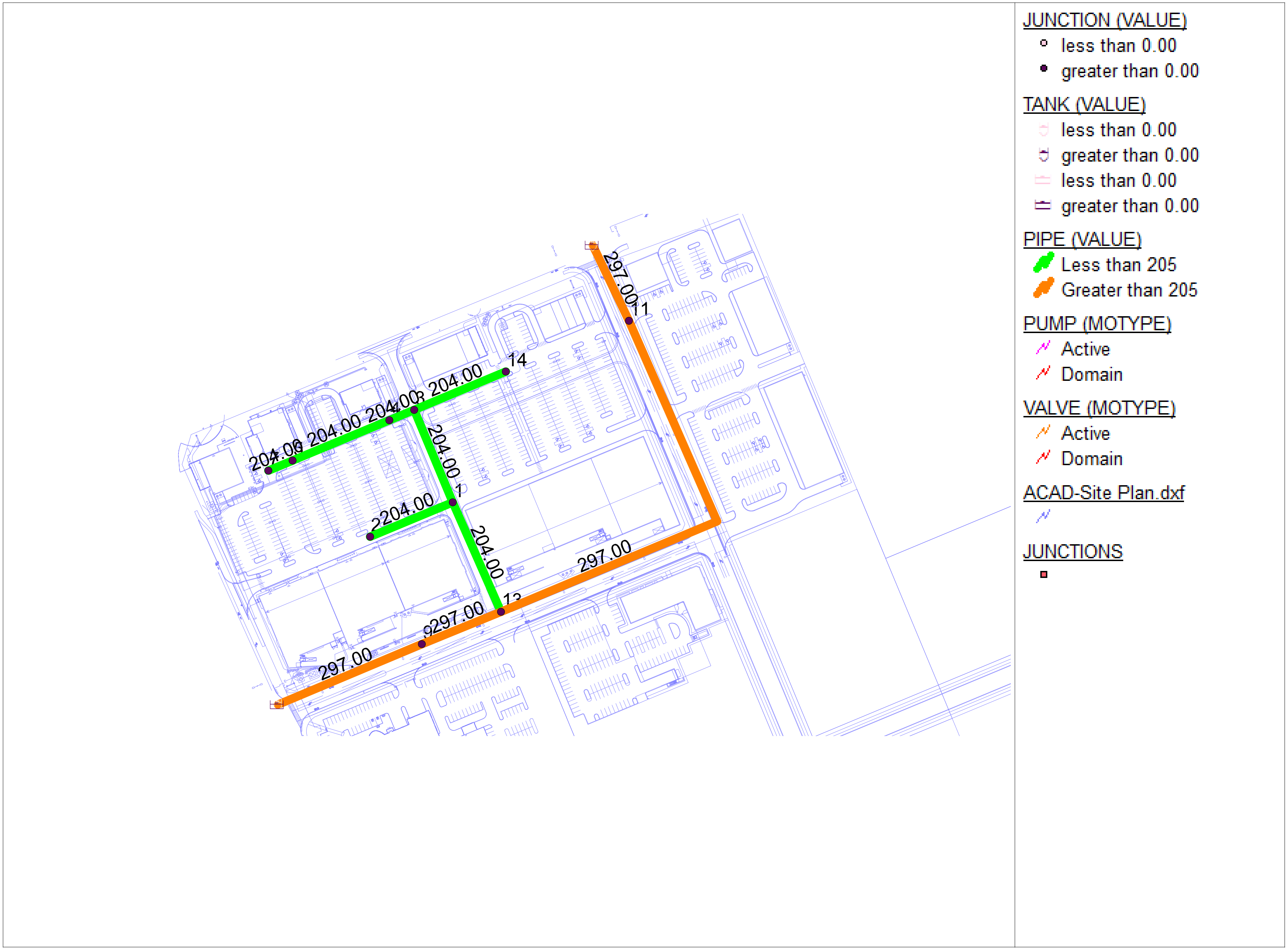
Criteria	Head (m)	Pressure (psi)
Max HGL	130.6	60.5
PKHR	127.3	55.8
MXDY + Fire Flow (83.87 L/s)	128.0	56.8
MXDY + Fire Flow (100.87 L/s)	128.2	57.1
MXDY + Fire Flow (183.87 L/s)	127.3	55.8

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. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

A.4 HYDRAULIC ANALYSIS RESULTS

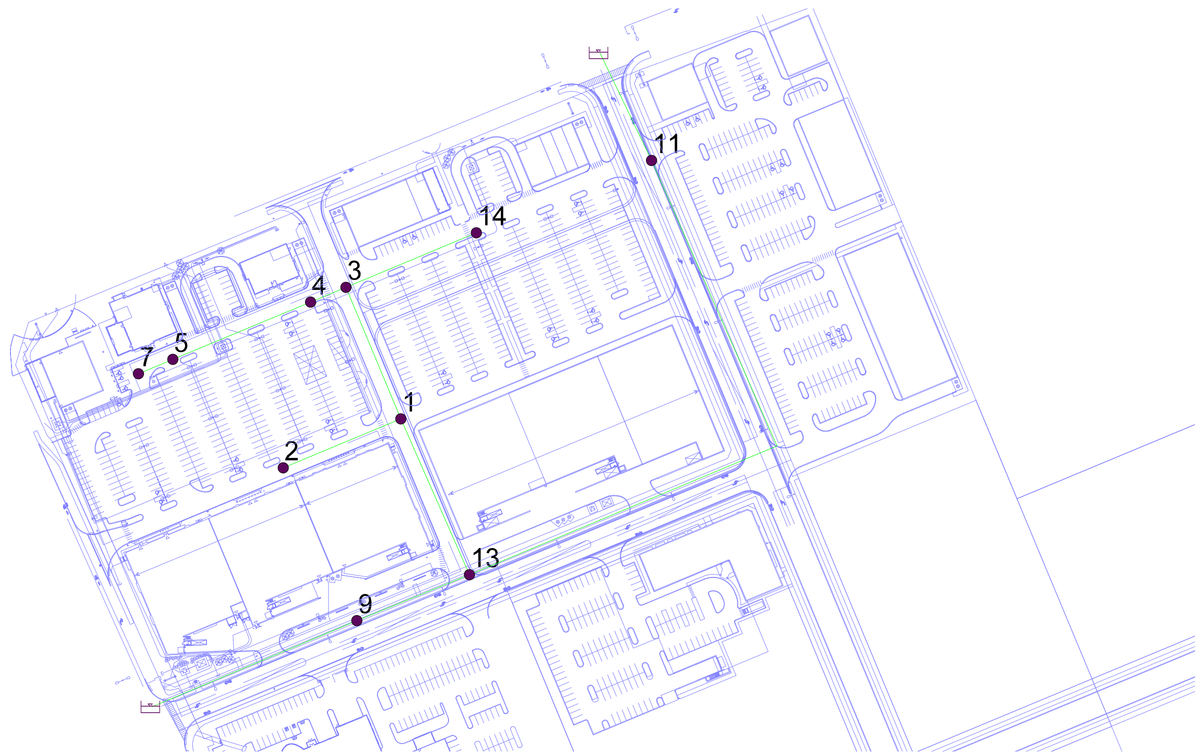
160401242-PH2



Prepared By:

Date: Friday, October 20, 2017

160401242-PH2



JUNCTION (VALUE)
- less than 0.00
- greater than 0.00

TANK (VALUE)
- less than 0.00
- greater than 0.00
- less than 0.00
- greater than 0.00

PIPE (VALUE)
- Less than 1
- Greater than 1

PUMP (MOTYPE)
- Active
- Domain

VALVE (MOTYPE)
- Active
- Domain

ACAD-Site Plan.dxf

JUNCTIONS

Prepared By:

Date: Friday, October 20, 2017

Hydraulic Model Results – Average Day Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
1	0	89.44	130.74	58.71	404.79
11	0	88.51	130.62	59.86	412.72
13	0	88.96	130.74	59.39	409.48
14	0.08	88.93	130.74	59.43	409.76
2	0	89.65	130.74	58.41	402.73
3	0	89.3	130.74	58.9	406.10
4	0.02	89.41	130.74	58.75	405.07
5	0.04	89.77	130.74	58.24	401.55
7	0.03	89.95	130.74	57.98	399.76
9	0.38	88.92	130.76	59.48	410.10

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
1	13	1	79.71	204	110	0.17	0.01
14	11	7006	55.82	297	110	17.91	0.26
16	13	11	301.97	297	110	17.91	0.26
2	1	2	59.61	204	110	0	0
20	7008	9	104.10	297	110	18.46	0.27
22	9	13	56.91	297	110	18.08	0.26
24	5	7	17.80	204	110	0.03	0
25	3	14	62.10	204	110	0.08	0
3	1	3	66.73	204	110	0.17	0.01
4	3	4	17.91	204	110	0.09	0
5	4	5	69.90	204	110	0.07	0

Hydraulic Model Results – Peak Hour Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
1	0	89.44	127.91	54.69	377.08
11	0	88.51	127.40	55.28	381.14
13	0	88.96	127.91	55.37	381.77
14	0.22	88.93	127.91	55.41	382.04
2	0	89.65	127.91	54.39	375.01
3	0	89.30	127.91	54.89	378.46
4	0.06	89.41	127.91	54.73	377.35
5	0.1	89.77	127.91	54.22	373.84
7	0.08	89.95	127.91	53.96	372.04
9	1.02	88.92	128.01	55.57	383.14

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
1	13	1	79.71	204	110	0.46	0.01
14	11	7006	55.82	297	110	40.28	0.58
16	13	11	301.97	297	110	40.28	0.58
2	1	2	59.61	204	110	0.00	0.00
20	7008	9	104.10	297	110	41.76	0.60
22	9	13	56.91	297	110	40.74	0.59
24	5	7	17.80	204	110	0.08	0.00
25	3	14	62.10	204	110	0.22	0.01
3	1	3	66.73	204	110	0.46	0.01
4	3	4	17.91	204	110	0.24	0.01
5	4	5	69.90	204	110	0.18	0.01

Hydraulic Model Results – Max Day and Fire Flow Analysis

ID	Static Demand	Static Pressure		Static Head	Fire-Flow Demand	Residual Pressure		Available Flow at Hydrant	Available Flow Pressure	
	(L/s)	(psi)	(Kpa)	(m)	(L/s)	(psi)	(Kpa)	(L/s)	(psi)	(Kpa)
14	0.15	55.22	380.73	127.78	67	46.40	319.92	144.09	20	137.90
4	0.04	54.54	376.04	127.78	83	44.21	304.82	160.94	20	137.90
5	0.07	54.03	372.53	127.78	83	39.66	273.45	133.11	20	137.90
7	0.05	53.77	370.73	127.78	67	43.25	298.20	127.61	20	137.90
9	0.68	55.35	381.63	127.85	183	53.16	366.53	853.95	20	137.90

Appendix B WASTEWATER SERVICING

B.1 SANITARY SEWER DESIGN SHEET

SUBDIVISION:

Orleans II Development - Phase 2A

DATE: 10/19/2017
REVISION: 4
DESIGN BY: TR
CHECKED BY: DT

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401242

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	350 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	50,000 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 (COMM., INST.):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	50,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.28 l/s/Ha		
PERSONS / APARTMENT	1.8				

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)	UNITS SINGLE	UNITS TOWN	UNITS APT	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)
C3M	BLDG M	98	0.00	0	0	0	0	0.00	0	4.00	0.0	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.09	0.09	0.0	0.1	9.3	150	PVC	DR 28	1.00	15.3	**0.66%**	0.86	0.21
C3L	BLDG L	94	0.00	0	0	0	0	0.00	0	4.00	0.0	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.06	0.06	0.0	0.1	4.1	150	PVC	DR 28	1.00	15.3	**0.47%**	0.86	0.19
C4J	BLDG J	4	0.00	0	0	0	0	0.00	0	4.00	0.0	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.06	0.06	0.0	0.1	31.4	135	PVC	DR 28	1.00	11.5	**0.56%**	0.80	0.18
C4K	BLDG K	4	0.00	0	0	0	0	0.00	0	4.00	0.0	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.06	0.06	0.0	0.1	3.1	135	PVC	DR 28	1.00	11.5	**0.58%**	0.80	0.18
G4A, C4N	4	3	1.71	0	0	0	0	1.71	0	4.00	0.0	0.04	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.3	1.75	2.01	0.6	0.8	87.8	250	PVC	SDR 35	0.60	47.2	**1.75%**	0.95	0.31
C3A	94	FUT STUB	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.3	0.00	0.06	0.0	0.3	85.2	250	PVC	SDR 35	0.25	30.3	**0.93%**	0.61	0.16
	FUT STUB	98	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.3	0.00	0.06	0.0	0.3	0.7	250	PVC	SDR 35	0.25	30.3	**0.93%**	0.61	0.16
	98	3	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.3	0.00	0.15	0.0	0.3	17.3	250	PVC	SDR 35	0.25	30.3	**1.01%**	0.61	0.16
	3	2	0.00	0	0	0	0	1.71	0	4.00	0.0	2.47	3.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.7	2.47	4.64	1.3	4.0	80.0	250	PVC	SDR 35	0.25	30.3	**13.11%**	0.61	0.35
	2	1A	0.00	0	0	0	0	1.71	0	4.00	0.0	0.00	3.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.7	0.00	4.64	1.3	4.0	55.9	250	PVC	SDR 35	0.25	30.3	**13.11%**	0.61	0.35
C5H	BLDG H	5	0.00	0	0	0	0	0.00	0	4.00	0.0	0.66	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.6	0.66	0.66	0.2	0.8	9.9	150	PVC	DR 28	1.00	15.3	**4.94%**	0.86	0.37
G5A	5	1A	0.71	0	0	0	0	0.71	0	4.00	0.0	0.00	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.6	0.71	1.37	0.4	1.0	55.3	250	PVC	SDR 35	0.50	43.0	**2.23%**	0.87	0.30
	1A	1	0.00	0	0	0	0	2.42	0	4.00	0.0	0.00	3.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.2	0.00	6.01	1.7	4.9	22.1	250	PVC	SDR 35	0.25	30.3	**16.26%**	0.61	0.37
																												250							

B.2 BACKGROUND REPORT EXCERPTS (SANITARY DRAINAGE)

5.0 Sanitary Drainage

For the purposes of this serviceability study the sanitary drainage sewers have been designed to service the proposed commercial development. Detailed design of the sanitary sewer network will be completed during the detailed design phase. Sanitary sewer connection is available at the existing 525mm diameter municipal main at the intersection of Lanthier Drive and Vanguard Drive. Sewage will be directed along Vanguard Drive to Tenth Line Road and south along Tenth Line Road to the Tenth Line Road pumping station. The development will include extension of the sanitary trunk sewer from Lanthier Drive along future Vanguard extension at the south property line of the proposed site. A sanitary stub will be provided to service the development to the south of the proposed site (see **Drawing SAN-1**).

For detailed information regarding the wastewater servicing and pump station improvements please refer to the appended excerpts of the Stantec Consulting Ltd. "*Gloucester and Cumberland East Urban Community Expansion Area and Bilberry Creek Industrial Park Master Servicing Update*", dated July, 2006

5.1 SANITARY SEWER

A 375mm dia. extension is proposed for the Vanguard Drive sanitary trunk in order to connect to the existing 525mm diameter sanitary main at the intersection of Lanthier Drive and Vanguard Drive. The proposed sanitary sewer network for the site consists of 200mm and 250mm diameter sewers with gravity feed to sanitary manhole SAN 6 in Vanguard Drive; roughly 90m northeast of the site access road off Vanguard Drive. See the attached **Drawing SAN-1** for details.

Design flows for the proposed site were developed in accordance with the City of Ottawa Sewer Design Criteria using standard commercial flow estimates and total land area of 24.0ha. Total peak flow estimates were based on a commercial peaking factor of 1.5 and an infiltration rate of 0.28L/s/ha. Flow estimates of a nearby 16.83ha industrial land draining to the site sanitary sewer network were also included in the flow estimate using a peaking factor of 2.4. Building footprint areas were not included in the total area used for infiltration flows. The proposed site falls within drainage boundaries as presented in the 2006 Master Servicing Update.

The total flow through the proposed Pharand Lands development site was estimated to be approximately 49.6L/s. This flow estimate includes flows of approximately 21 L/s from the nearby industrial area and offsite flows generated along Vanguard Drive between the site sanitary service network connection at sanitary manhole SAN6 and the connection to the existing sewer at Lanthier Drive. The capacity of the Tenth Line Rd pumping station is sufficient to handle the flows generated by the proposed development as the pumping station was designed to accommodate the entire 85ha of the BCIP. The sanitary sewer design sheets for the proposed site are included in **Appendix C.2**.

Appendix C STORMWATER MANAGEMENT

C.1 STORM SEWER DESIGN SHEET AND ROOF STORAGE CALCULATIONS

Stantec

Orleans II Phase 2A	
DATE:	2017-10-23
REVISION:	4
DESIGNED BY:	TR
CHECKED BY:	DT

FILE NUMBER: 160401242

STORM SEWER DESIGN SHEET
(City of Ottawa)

DESIGN PARAMETERS

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

	1:2 yr	1:5 yr	1:10 yr	1:100 yr
a =	732.951	998.071	1174.184	1735.688
b =	6.199	6.053	6.014	6.014
c =	0.810	0.814	0.816	0.820

MANNING'S n = 0.013

BEDDING CLASS = B

MINIMUM COVER: 2.00 m

TIME OF ENTRY 10 min

LOCATION / DRAINAGE AREA

AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)
BLDG K	BLDG K	206	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	2.8	2.8	2.8
																				10.11							
BLDG J	BLDG J	207	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	3.7	3.7	3.7
																				10.19							
L207A	207	206	0.16	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.081	0.081	0.000	0.000	0.000	0.000	0.000	0.000	10.19	76.07	103.18	120.95	176.81	0.0	3.7	20.8
																				10.63							
	206	204	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.081	0.000	0.000	0.000	0.000	0.000	0.000	10.63	74.47	100.98	118.35	172.99	0.0	6.6	23.3
																				11.31							
	205B	205A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0
	205A	205	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0
L205A	205	204	0.37	0.00	0.00	0.00	0.00	0.81	0.00	0.00	0.00	0.303	0.303	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	64.7
																				10.54							
L204A	204A	204	0.32	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.287	0.287	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	61.2
																				10.07							
L204B	204	203	0.36	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.323	0.994	0.000	0.000	0.000	0.000	0.000	0.000	11.31	72.13	97.76	114.57	167.43	0.0	6.6	205.8
																				12.52							
BLDG N	BLDG N	208	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	2.5	2.5	2.5
	208	203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.22	75.99	103.07	120.82	176.61	0.0	2.5	2.5
																				11.51							
L203A	203A	203	0.31	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.281	0.281	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	60.0
																				10.07							
L203B	203	STUB	0.07	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.059	1.335	0.000	0.000	0.000	0.000	0.000	0.000	12.52	68.31	92.52	108.40	158.37	0.0	9.0	262.4
																				13.13							
BLDG L	BLDG L	201CBMH	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	2.8	2.8	2.8
																				10.69							
BLDG M	BLDG M	201CBMH	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	4.9	4.9	4.9
																				10.40							
L203C	201CBMH	STUB	0.05	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.045	0.045	0.000	0.000	0.000	0.000	0.000	0.000	10.69	74.26	100.69	118.02	172.50	0.0	0.0	9.3
																				12.01							
BLDG H	BLDG H	106	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	29.0	29.0	29.0
																				10.25							
L106A	106A	106	0.03	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.026	0.026	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	5.4
																				11.90							
L107B	107B	107	0.14	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.130	0.130	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	27.7
																				10.21							
L107A	107A	107	0.02	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.021	0.021	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	4.4
																				10.08							
	107	106	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.000	0.021	0.000	0.000	0.000	0.000	0.000	0.000	10.21	76.01	103.09	120.85	176.66	0.0	0.0	4.4
																				11.09							
L106B	106	105	0.02	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.021	0.067	0.000	0.000	0.000	0.000	0.000	0.000	11.90	70.21	95.13	111.47	162.88	0.0	29.0	42.0
C105A	105	104	0.00	0.45	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.000	0.067	0.287	0.287	0.000	0.000	0.000	0.000	12.32	68.91	93.34	109.36	159.79	0.0	29.0	116.3
E104A, C104A	104	103	0.00	0.21	0.00	0.00	0.00	0.90	0.73	0.00	0.00	0.000	0.067	0.153	0.440	0.000	0.000	0.000	0.000	13.39	65.84	89.13	104.41	152.52	214.2	243.2	364.4
																				14.43							
PHASE 2	201	STC750	2.18	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	1.962	1.962	0.000	0.000	0.000	0.000	0.000	0.000	13.13	66.56	90.12	105.58	154.23	0.0	0.0	362.8
	STC750	101	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.000	1.962	0.000	0.000	0.000	0.000	0.000	0.000	13.31	66.06	89.43	104.77	153.04	0.0	0.0	360.0
																				13.58							
C103A	PH 2	103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	43.5	43.5	43.5
	103	102	0.00	0.16	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.000	0.067	0.121	0.561	0.000	0.000	0.000	0.000	14.43	63.14	85.44	100.07	146.15	0.0	286.7	431.7
																				15.43							
	83	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0
																				10.00							
C102A	102	101	0.00	0.17	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.000	0.067	0.129	0.690	0.000	0.000	0.000	0.000	15.43	60.78	82.20	96.26	140.56	1500.9	1787.6	1956.6
																				16.56							
PHASE 3	PH 3	101	1.83	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	1.643	1.643	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	350.6
																				10.18							
C101A	101	100	0.00	0.17	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.000	3.672	0.126	0.816	0.000	0.000	0.000	0.000	16.56	58.31	78.83	92.30	134.74	0.0	1787.6	2561.2
																				17.13							

PIPE SELECTION

AREA ID NUMBER	FROM M.H.	TO M.H.	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)
BLDG K	BLDG K	206	4.6	150	150	CIRCULAR	PVC	-	2.00	21.6	**13.07%**	1.22	0.70	0.11
BLDG J	BLDG J	207	8.7	150	150	CIRCULAR	PVC	-	2.00	21.6	**17.23%**	1.22	0.75	0.19
L207A	207	206	24.2	250	250	CIRCULAR	PVC	-	1.00	60.4	**34.50%**	1.22	0.92	0.44
	206	204	38.9	250	250	CIRCULAR	PVC	-	1.00	60.4	**38.59%**	1.22	0.96	0.68
	205B	205A	28.7	250	250	CIRCULAR	CONCRETE	-	0.50	42.7	**0.00%**	0.86	0.00	0.00
	205A	205	38.6	200	200	CIRCULAR	PVC	-	2.30	50.5	**0.00%**	1.59	0.00	0.00
L205A	205	204	35.6	300	300	CIRCULAR	PVC	-	0.65	77.5	**83.48%**	1.10	1.10	0.54
L204A	204A	204	5.6	300	300	CIRCULAR	PVC	-	1.00	96.2	**63.68%**	1.37	1.26	0.07
L204B	204	203	68.4	600	600	CIRCULAR	CONCRETE	-	0.20	286.5	**71.83%**	0.98	0.94	1.22
BLDG N	BLDG N	208	8.6	150	150	CIRCULAR	PVC	-	2.00	21.6	**11.46%**	1.22	0.67	0.22
	208	203	38.9	250	250	CIRCULAR	PVC	-	1.00	60.4	**4.11%**	1.22	0.50	1.29
L203A	203A	203	5.6	300	300	CIRCULAR	PVC	-	1.00	96.2	**62.45%**	1.37	1.25	0.07
L203B	203	STUB	32.7	675	675	CIRCULAR	CONCRETE	-	0.15	339.6	**77.25%**	0.92	0.90	0.61
BLDG L	BLDG L	201CBMH	22.0	200	200	CIRCULAR	PVC	-	1.00	33.3	**8.53%**	1.05	0.53	0.69
BLDG M	BLDG M	201CBMH	15.0	200	200	CIRCULAR	PVC	-	1.00	33.3	**14.80%**	1.05	0.62	0.40
L203C	201CBMH	STUB	56.3	300	300	CIRCULAR	PVC	-	1.00	96.2	**9.71%**	1.37	0.71	1.32
BLDG H	BLDG H	106	15.6	250	250	CIRCULAR	PVC	-	1.00	60.4	**48.05%**	1.22	1.03	0.25
L106A	106A	106	73.6	200	200	CIRCULAR	PVC	-	1.00	33.3	**16.34%**	1.05	0.65	1.90
L107B	107B	107	13.2	200	200	CIRCULAR	PVC	-	1.00	33.3	**83.07%**	1.05	1.04	0.21
L107A	107A	107	3.0	200	200	CIRCULAR	PVC	-	1.00	33.3	**13.22%**	1.05	0.60	0.08
	107	106	30.9	300	300	CIRCULAR	PVC	-	1.00	96.2	**4.53%**	1.37	0.58	0.88
L106B	106	105	18.7	900	900	CIRCULAR	CONCRETE	-	0.42	1223.9	**3.44%**	1.86	0.74	0.42
C105A	105	104	70.1	900	900	CIRCULAR	CONCRETE	-	0.58	1444.3	**8.05%**	2.20	1.09	1.07
E104A, C104A	104	103	59.2	900	900	CIRCULAR	CONCRETE	-	0.15	731.2	**49.83%**	1.11	0.95	1.04
PHASE 2	201	STC750	10.4	900	900	CIRCULAR	CONCRETE	-	0.15	731.4	**49.60%**	1.11	0.95	0.18
	STC750	101	15.2	900	900	CIRCULAR	CONCRETE	-	0.15	731.4	**49.23%**	1.11	0.94	0.27
C103A	PH 2	103	16.5	450	450	CIRCULAR	CONCRETE	-	1.00	297.4	**14.63%**	1.81	1.07	0.26
	103	102	78.6	900	900	CIRCULAR	CONCRETE	-	0.33	1084.7	**39.80%**	1.65	1.31	1.00
	83	102	14.5	1200	1200	CIRCULAR	CONCRETE	-	0.25	2033.7	**0.00%**	1.74	0.00	0.00
C102A	102	101	121.7	1350	1350	CIRCULAR	CONCRETE	-	0.25	2784.1	**70.28%**	1.88	1.79	1.13
PHASE 3	PH 3	101	14.9	600	600	CIRCULAR	CONCRETE	-	0.40	405.1	**86.54%**	1.39	1.40	0.18
C101A	101	100	66.1	1350	1350	CIRCULAR	CONCRETE	-	0.25	2784.1	**91.99%**	1.88	1.93	0.57
				1350	1350									

Project #PROJECT #160401242, INNES ROAD COMMERCIAL PHASE 1 and 2A
Roof Drain Design Sheet, Area BLDG J
Standard Watts Drainage Model R1100 Accuflow Roof Drains

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	0.0009	0	0.025	16	0	0	0.025
0.050	0.0006	0.0019	1	0.050	66	1	1	0.050
0.075	0.0008	0.0024	4	0.075	148	3	4	0.075
0.100	0.0009	0.0028	9	0.100	263	5	9	0.100
0.125	0.0011	0.0033	17	0.125	411	8	17	0.125
0.150	0.0013	0.0038	30	0.150	592	12	30	0.150

Drawdown Estimate

Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
1.0	506.8	1.0	0.14078
3.6	1100.5	2.6	0.44648
8.6	1785.9	5.1	0.94258
17.0	2523.8	8.4	1.64362
29.5	3294.3	12.5	2.55871

Rooftop Storage Summary

Total Building Area (sq.m)		740
Assume Available Roof Area (sq.	80%	592
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		3
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		30
Estimated 100 Year Drawdown Time (h)		2.5

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

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

From Watts Drain Catalogue

Head (m)	L/s Open	75%	**50%**	25%	Closed
0.025	0.3155	0.3155	**0.3155**	0.3155	0.3155
0.050	0.6309	0.6309	**0.6309**	0.6309	0.6309
0.075	0.9464	0.8675	**0.7886**	0.7098	0.6309
0.100	1.2618	1.1041	**0.9464**	0.7886	0.6309
0.125	1.5773	1.3407	**1.1041**	0.8675	0.6309
0.150	1.8927	1.5773	**1.2618**	0.9464	0.6309

Calculation Results

	5yr	100yr	Available
Qresult (cu.m/s)	0.003	0.004	-
Depth (m)	0.111	0.147	0.150
Volume (cu.m)	12.5	28.3	29.6
Draintime (hrs)	1.3	2.5	

Project #PROJECT #160401242, INNES ROAD COMMERCIAL PHASE 1 and 2A
Roof Drain Design Sheet, Area BLDG K
Standard Watts Drainage Model R1100 Accuflow Roof Drains

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	0.0009	0	0.025	13	0	0	0.025
0.050	0.0006	0.0019	1	0.050	53	1	1	0.050
0.075	0.0007	0.0021	3	0.075	120	2	3	0.075
0.100	0.0008	0.0024	7	0.100	213	4	7	0.100
0.125	0.0009	0.0026	14	0.125	333	7	14	0.125
0.150	0.0009	0.0028	24	0.150	480	10	24	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.8	410.9	0.8	0.11415
2.9	991.5	2.1	0.38955
7.0	1737.7	4.1	0.87224
13.8	2604.4	6.8	1.59567
23.9	3561.4	10.1	2.58496

Rooftop Storage Summary

Total Building Area (sq.m)		600
Assume Available Roof Area (sq.	80%	480
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		3
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		24
Estimated 100 Year Drawdown Time (h)		2.5

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

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

From Watts Drain Catalogue

Head (m)	L/s Open	75%	50%	**25%**	Closed
0.025	0.3155	0.3155	0.3155	**0.3155**	0.3155
0.050	0.6309	0.6309	0.6309	**0.6309**	0.6309
0.075	0.9464	0.8675	0.7886	**0.7098**	0.6309
0.100	1.2618	1.1041	0.9464	**0.7886**	0.6309
0.125	1.5773	1.3407	1.1041	**0.8675**	0.6309
0.150	1.8927	1.5773	1.2618	**0.9464**	0.6309

Calculation Results

	5yr	**100yr**	**Available**
Qresult (cu.m/s)	0.002	0.003	-
Depth (m)	0.111	0.149	0.150
Volume (cu.m)	10.1	23.5	24.0
Draintime (hrs)	1.2	2.5	

Project #PROJECT #160401242, INNES ROAD COMMERCIAL PHASE 1
Roof Drain Design Sheet, Area BLDG L
Standard Watts Drainage Model R1100 Accuflow Roof Drains

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	0.0009	0	0.025	14	0	0	0.025
0.050	0.0006	0.0019	1	0.050	56	1	1	0.050
0.075	0.0007	0.0021	3	0.075	125	2	3	0.075
0.100	0.0008	0.0024	7	0.100	222	4	7	0.100
0.125	0.0009	0.0026	14	0.125	347	7	14	0.125
0.150	0.0009	0.0028	25	0.150	500	11	25	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.8	428.1	0.8	0.1189
3.0	1032.8	2.2	0.40579
7.3	1810.1	4.3	0.90858
14.4	2712.9	7.1	1.66216
24.9	3709.8	10.5	2.69267

Rooftop Storage Summary

Total Building Area (sq.m)		625
Assume Available Roof Area (sq.	80%	500
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		3
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		25
Estimated 100 Year Drawdown Time (h)		2.7

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

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

From Watts Drain Catalogue

Head (m) L/s

Head (m)	Open	75%	50%	**25%**	Closed
0.025	0.3155	0.3155	0.3155	**0.3155**	0.3155
0.050	0.6309	0.6309	0.6309	**0.6309**	0.6309
0.075	0.9464	0.8675	0.7886	**0.7098**	0.6309
0.100	1.2618	1.1041	0.9464	**0.7886**	0.6309
0.125	1.5773	1.3407	1.1041	**0.8675**	0.6309
0.150	1.8927	1.5773	1.2618	**0.9464**	0.6309

Calculation Results

	5yr	100yr	Available
Qresult (cu.m/s)	0.002	0.003	-
Depth (m)	0.112	0.150	0.150
Volume (cu.m)	10.7	24.8	25.0
Draintime (hrs)	1.3	2.7	

Project #PROJECT #160401242, INNES ROAD COMMERCIAL PHASE 1
Roof Drain Design Sheet, Area BLDG M
Standard Watts Drainage Model R1100 Accuflow Roof Drains

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	0.0013	0	0.025	20	0	0	0.025
0.050	0.0006	0.0025	1	0.050	78	1	1	0.050
0.075	0.0008	0.0032	4	0.075	176	3	4	0.075
0.100	0.0009	0.0038	10	0.100	314	6	10	0.100
0.125	0.0011	0.0044	20	0.125	490	10	20	0.125
0.150	0.0013	0.0050	35	0.150	706	15	35	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
1.1	453.1	1.1	0.12585
4.2	983.8	3.1	0.39912
10.3	1596.5	6.0	0.84259
20.3	2256.0	10.0	1.46926
35.1	2944.9	14.9	2.28728

Rooftop Storage Summary

Total Building Area (sq.m)		882
Assume Available Roof Area (sq.	80%	706
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		4
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		35
Estimated 100 Year Drawdown Time (h)		2.1

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

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

From Watts Drain Catalogue

Head (m) L/s

Head (m)	Open	75%	**50%**	25%	Closed
0.025	0.3155	0.3155	**0.3155**	0.3155	0.3155
0.050	0.6309	0.6309	**0.6309**	0.6309	0.6309
0.075	0.9464	0.8675	**0.7886**	0.7098	0.6309
0.100	1.2618	1.1041	**0.9464**	0.7886	0.6309
0.125	1.5773	1.3407	**1.1041**	0.8675	0.6309
0.150	1.8927	1.5773	**1.2618**	0.9464	0.6309

Calculation Results

	5yr	100yr	Available
Qresult (cu.m/s)	0.004	0.005	-
Depth (m)	0.109	0.145	0.150
Volume (cu.m)	14.2	32.4	35.3
Draintime (hrs)	1.1	2.1	

Project #PROJECT #160401242, INNES ROAD COMMERCIAL PHASE 1 and 2A
Roof Drain Design Sheet, Area BLDG N
Standard Watts Drainage Model R1100 Accuflow Roof Drains

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	11	0	0	0.025
0.050	0.0006	0.0013	1	0.050	43	1	1	0.050
0.075	0.0008	0.0016	2	0.075	96	2	2	0.075
0.100	0.0009	0.0019	6	0.100	171	3	6	0.100
0.125	0.0011	0.0022	11	0.125	267	5	11	0.125
0.150	0.0013	0.0025	19	0.150	384	8	19	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.6	493.1	0.6	0.13698
2.3	1070.8	1.7	0.43442
5.6	1737.7	3.3	0.9171
11.0	2455.5	5.4	1.5992
19.1	3205.3	8.1	2.48955

Rooftop Storage Summary

Total Building Area (sq.m)		480
Assume Available Roof Area (sq.	80%	384
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		2
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		19
Estimated 100 Year Drawdown Time (h)		2.4

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

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

From Watts Drain Catalogue

Head (m) L/s

Head (m)	Open	75%	**50%**	25%	Closed
0.025	0.3155	0.3155	**0.3155**	0.3155	0.3155
0.050	0.6309	0.6309	**0.6309**	0.6309	0.6309
0.075	0.9464	0.8675	**0.7886**	0.7098	0.6309
0.100	1.2618	1.1041	**0.9464**	0.7886	0.6309
0.125	1.5773	1.3407	**1.1041**	0.8675	0.6309
0.150	1.8927	1.5773	**1.2618**	0.9464	0.6309

Calculation Results

	5yr	100yr	Available
Qresult (cu.m/s)	0.002	0.002	-
Depth (m)	0.111	0.147	0.150
Volume (cu.m)	8.0	18.2	19.2
Draintime (hrs)	1.2	2.4	

Project #PROJECT #160401242, INNES ROAD COMMERCIAL PHASE 1
Roof Drain Design Sheet, Area BLDG H
Standard Watts Drainage Model R1100 Accuflow Roof Drains

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	0.0073	1	0.025	145	1	1	0.025
0.050	0.0006	0.0145	10	0.050	580	8	10	0.050
0.075	0.0008	0.0181	33	0.075	1304	23	33	0.075
0.100	0.0009	0.0218	77	0.100	2318	45	77	0.100
0.125	0.0011	0.0254	151	0.125	3622	74	151	0.125
0.150	0.0013	0.0290	261	0.150	5216	110	261	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
8.5	582.5	8.5	0.16179
31.4	1264.8	22.9	0.51311
76.1	2052.5	44.7	1.08324
149.7	2900.4	73.7	1.88891
259.6	3786.0	109.9	2.94056

Rooftop Storage Summary

Total Building Area (sq.m)		6520
Assume Available Roof Area (sq.	80%	5216
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		23
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		261
Estimated 100 Year Drawdown Time (h)		3.0

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

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

From Watts Drain Catalogue

Head (m) L/s

Head (m)	Open	75%	**50%**	25%	Closed
0.025	0.3155	0.3155	**0.3155**	0.3155	0.3155
0.050	0.6309	0.6309	**0.6309**	0.6309	0.6309
0.075	0.9464	0.8675	**0.7886**	0.7098	0.6309
0.100	1.2618	1.1041	**0.9464**	0.7886	0.6309
0.125	1.5773	1.3407	**1.1041**	0.8675	0.6309
0.150	1.8927	1.5773	**1.2618**	0.9464	0.6309

Calculation Results

	5yr	100yr	Available
Qresult (cu.m/s)	0.024	0.029	-
Depth (m)	0.113	0.150	0.150
Volume (cu.m)	116.2	260.7	260.8
Draintime (hrs)	1.5	3.0	

Adjustable Accutrol Weir

Tag: ____________

Adjustable Flow Control for Roof Drains

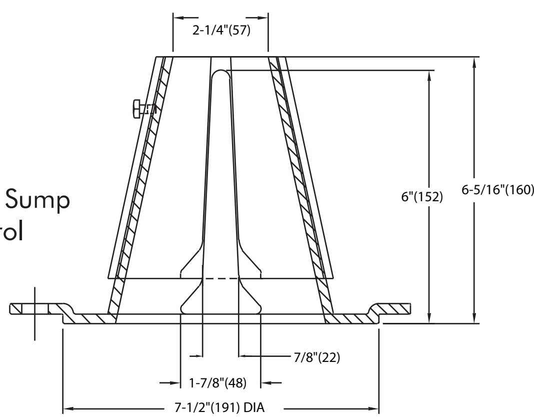
ADJUSTABLE ACCUTROL(for Large Sump Roof Drains only)

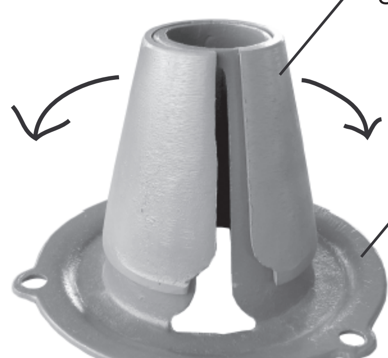
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the flow rate for depths over 2" of head, set the slot in the adjustable upper cone according to the flow rate required. Refer to Table 1 below.
Note: Flow rates are directly proportional to the amount of weir opening that is exposed.

EXAMPLE:

For example, if the adjustable upper cone is set to cover 1/2 of the weir opening, flow rates above 2" of head will be restricted to 2-1/2 gpm per inch of head.

Therefore, at 3" of head, the flow rate through the Accutrol Weir that has 1/2 the slot exposed will be:
[5 gpm(per inch of head) x 2 inches of head] + 2-1/2 gpm(for the third inch of head) = 12-1/2 gpm.





1/2 Weir Opening Exposed Shown Above

TABLE 1. Adjustable Accutrol Flow Rate Settings

Weir Opening Exposed	Head of Water 1"	2"	3"	4"	5"	6"
	Flow Rate (gallons per minute)					
Fully Exposed	5	10	15	20	25	30
3/4	5	10	13.75	17.5	21.25	25
1/2	5	10	12.5	15	17.5	20
1/4	5	10	11.25	12.5	13.75	15
Closed	5	10	10	10	10	10

Job Name ____________ Contractor ____________

Job Location ____________ Contractor's P.O. No. ____________

Engineer ____________ Representative ____________

C.2 SAMPLE PCSWMM MODEL INPUT (100YR 3HR CHICAGO)

```
[TITLE]

[OPTIONS]
;;Options            Value
;;------------------ ------------
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
START_DATE           11/23/2016
START_TIME           00:00:00
REPORT_START_DATE    11/23/2016
REPORT_START_TIME    00:00:00
END_DATE             11/23/2016
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             00:05:00
ROUTING_STEP         1
ALLOW_PONDING        YES
INERTIAL_DAMPING     PARTIAL
VARIABLE_STEP        0
LENGTHENING_STEP     0
MIN_SURFAREA         0
NORMAL_FLOW_LIMITED  BOTH
SKIP_STEADY_STATE    NO
FORCE_MAIN_EQUATION  H-W
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              8

[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 100yr_3h_10m_CHI

[SUBCATCHMENTS]
;;                                                 Total    Pcnt.             Pcnt.    Curb     Snow
;;Name           Raingage         Outlet           Area     Imperv   Width    Slope    Length   Pack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- --------
BLDG_H           RG1              BLDG_H-S         0.652139 100      146.7    1.5      0

BLDG_J           RG1              BLDG_J-S         0.05573  100      16.7     1.5      0

BLDG_K           RG1              BLDG_K-S         0.057422 100      13.6     1.5      0

BLDG_L           RG1              BLDG_L-S         0.062465 100      34.9     1.5      0

BLDG_M           RG1              BLDG_M-S         0.088255 100      45.7     1.5      0

BLDG_N           RG1              BLDG_N-S         0.037655 100      15.1     1.5      0

C100A            RG1              100A             0.127878 75.714   102.5    2        0

C101A            RG1              101A             0.169953 77.143   141.6    1.3      0

C102A            RG1              102A             0.174368 77.143   146.2    1.1      0

C103A            RG1              103A             0.16413  77.143   133.8    1.2      0

C104A            RG1              104A             0.208936 75.714   166      1        0

C105A            RG1              105A             0.449128 62.857   288.7    1.2      0

L106A            RG1              106A             0.028351 100      24       3        0

L106B            RG1              106A             0.022933 100      27       3        0

L107A            RG1              107              0.022935 100      27       3        0

L107B            RG1              107A             0.144123 100      142.1    2        0

L203A            RG1              203A             0.299172 100      68.6     1.5      0

L203B            RG1              203B             0.065882 100      70.7     2        0

L203C            RG1              203C             0.050266 100      32.1     1.5      0

L204A            RG1              204A             0.318876 100      70.2     1.5      0

L204B            RG1              204B             0.371887 100      85       1.5      0
```

L205A	RG1	205	0.374461	87.143	81.8	1.5	0
L207A	RG1	207A	0.161938	42.857	30.9	3.5	0
PHASE_2	RG1	201	2.18442	24.28	269.4	1.5	0
U100A	RG1	U100A-OF	0.026276	32.857	5.9	3	0
U100B	RG1	U100B-OF	0.078053	31.429	13.6	3	0
U100C	RG1	U100C-OF	0.123248	31.42	25.6	2	0

[SUBAREAS]

;;Subcatchment	N-Imperv	N-Perv	S-Imperv	S-Perv	PctZero	RouteTo	PctRouted
BLDG_H	0.013	0.25	1.57	4.67	0	OUTLET	
BLDG_J	0.013	0.25	1.57	4.67	0	OUTLET	
BLDG_K	0.013	0.25	1.57	4.67	0	OUTLET	
BLDG_L	0.013	0.25	1.57	4.67	0	OUTLET	
BLDG_M	0.013	0.25	1.57	4.67	0	OUTLET	
BLDG_N	0.013	0.25	1.57	4.67	0	OUTLET	
C100A	0.013	0.25	1.57	4.67	0	OUTLET	
C101A	0.013	0.25	1.57	4.67	0	OUTLET	
C102A	0.013	0.25	1.57	4.67	0	OUTLET	
C103A	0.013	0.25	1.57	4.67	0	OUTLET	
C104A	0.013	0.25	1.57	4.67	0	OUTLET	
C105A	0.013	0.25	1.57	4.67	0	OUTLET	
L106A	0.013	0.25	1.57	4.67	0	OUTLET	
L106B	0.013	0.25	1.57	4.67	0	OUTLET	
L107A	0.013	0.25	1.57	4.67	0	OUTLET	
L107B	0.013	0.25	1.57	4.67	0	OUTLET	
L203A	0.013	0.25	1.57	4.67	0	OUTLET	
L203B	0.013	0.25	1.57	4.67	0	OUTLET	
L203C	0.013	0.25	1.57	4.67	0	OUTLET	
L204A	0.013	0.25	1.57	4.67	0	OUTLET	
L204B	0.013	0.25	1.57	4.67	0	OUTLET	
L205A	0.013	0.25	1.57	4.67	0	OUTLET	
L207A	0.013	0.25	1.57	4.67	0	OUTLET	
PHASE_2	0.013	0.25	1.57	4.67	0	OUTLET	
U100A	0.013	0.25	1.57	4.67	0	OUTLET	
U100B	0.013	0.25	1.57	4.67	0	OUTLET	
U100C	0.013	0.25	1.57	4.67	0	OUTLET	

[INFILTRATION]

;;Subcatchment	MaxRate	MinRate	Decay	DryTime	MaxInfil
BLDG_H	76.2	13.2	4.14	7	0
BLDG_J	76.2	13.2	4.14	7	0
BLDG_K	76.2	13.2	4.14	7	0
BLDG_L	76.2	13.2	4.14	7	0
BLDG_M	76.2	13.2	4.14	7	0
BLDG_N	76.2	13.2	4.14	7	0
C100A	76.2	13.2	4.14	7	0
C101A	76.2	13.2	4.14	7	0
C102A	76.2	13.2	4.14	7	0
C103A	76.2	13.2	4.14	7	0
C104A	76.2	13.2	4.14	7	0
C105A	76.2	13.2	4.14	7	0
L106A	76.2	13.2	4.14	7	0
L106B	76.2	13.2	4.14	7	0
L107A	76.2	13.2	4.14	7	0
L107B	76.2	13.2	4.14	7	0
L203A	76.2	13.2	4.14	7	0
L203B	76.2	13.2	4.14	7	0
L203C	76.2	13.2	4.14	7	0
L204A	76.2	13.2	4.14	7	0
L204B	76.2	13.2	4.14	7	0
L205A	76.2	13.2	4.14	7	0
L207A	76.2	13.2	4.14	7	0
PHASE_2	76.2	13.2	4.14	7	0
U100A	76.2	13.2	4.14	7	0
U100B	76.2	13.2	4.14	7	0
U100C	76.2	13.2	4.14	7	0

[JUNCTIONS]

;;	Invert	Max.	Init.	Surcharge	Ponded
;;Name	Elev.	Depth	Depth	Depth	Area
100	81.73	5.78	0	0	0.01
;2400mm					
101	81.943	6.438	0	0	0.01
102	82.24064	6.605	0	0	0.01
103	82.64986	6.15	0	0	0.01
104	82.34001	9.326	0	0	0.01
;2400mm					
105	84.44812	4.582	0	0	0.01
;1200mm					
106	85.18676	4.036	0	0	0.01
106A	86.39202	2.338	0	0	0.01
;1200mm					
107	86.42539	2.626	0	0	0.01
201	84.736	3.264	0	0	0.01
201CB	85.9	2.93	0	0	0.01
202	85.2	3.02	0	0	0.01

```
;1500mm
203              84.948     4.194      0          0          0.01
;1200mm
204              85.96      3.232      0          0          0.01
;1200mm
206              86.698     3.229      0          0          0.01
;1200mm
207              87         3.143      0          0          0.01
207A             86.893     3.29       0          0          0.01
;1200mm
208              86.972     2.646      0          0          0.01
;1800mm
STC              84.4157    3.828      0          0          0.01

[OUTFALLS]
;;               Invert     Outfall      Stage/Table      Tide
;;Name           Elev.      Type         Time Series      Gate Route To
;;-------------- ---------- ------------ ---------------- ---- ----------------
OF-MJ            87.87      FREE                          NO
OF-MN            81.99      FREE                          NO
U100A-OF         0          FREE                          NO
U100B-OF         0          FREE                          NO
U100C-OF         0          FREE                          NO

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve                                      Ponded   Evap.
;;Name           Elev.    Depth    Depth    Curve      Params                                     Area     Frac.
Infiltration parameters
;;-------------- -------- -------- -------- ---------- -------- -------- -------- -------- --------
----------------------
100A             86.25    2.15     0        FUNCTIONAL 0        0        0        0        0
100A-1           88.56    0.1      0        FUNCTIONAL 0        0        0        0        0
101A             86.48    2.25     0        FUNCTIONAL 0        0        0        0        0
101A-1           88.67    0.1      0        FUNCTIONAL 0        0        0        0        0
102A             86.56    2.25     0        FUNCTIONAL 0        0        0        0        0
102A-1           88.69    0.1      0        FUNCTIONAL 0        0        0        0        0
103A             86.66    2.25     0        FUNCTIONAL 0        0        0        0        0
103A-1           88.84    0.1      0        FUNCTIONAL 0        0        0        0        0
104A             86.81    2.25     0        FUNCTIONAL 0        0        0        0        0
104A-1           88.92    0.1      0        FUNCTIONAL 0        0        0        0        0
105A             86.44    2.68     0        FUNCTIONAL 0        0        0        0        0
107A             87.25    2.15     0        TABULAR    107                                0        0
203A             87.3     2.15     0        TABULAR    203A                               0.01     0
203B             87.3     2.15     0        TABULAR    203B                               0        0
203C             86.5     2.68     0        TABULAR    203C                               0        0
204A             87.3     2.15     0        TABULAR    204A                               0.01     0
204B             87.3     2.15     0        TABULAR    204B                               0        0
;1200mm
```



```
205              86.491   2.959    0        TABULAR    205                                0.01     0
BLDG_H-S         103      0.3      0        TABULAR    BLDG_H                             0.01     0
BLDG_J-S         103      0.3      0        TABULAR    BLDG_J                             0.01     0
BLDG_K-S         103      0.3      0        TABULAR    BLDG_K                             0.01     0
BLDG_L-S         103      0.3      0        TABULAR    BLDG_L                             0        0
BLDG_M-S         103      0.3      0        TABULAR    BLDG_M                             0        0
BLDG_N-S         103      0.3      0        TABULAR    BLDG_N                             0.01     0

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet      Outlet     Init.
Max.
;;Name           Node             Node             Length     N          Offset     Offset     Flow
Flow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ----------
----------
C1               203C             202              93         0.013      88.94      88.12      0          0

C10              203B             202              5          0.025      89.25      88.12      0          0

C11              204B             203A             34.2       0.013      89.4       89.4       0          0

C12              100A-1           100A             52.2       0.013      88.56      88.05      0          0

C13              100A             OF-MJ            5          0.013      88.05      87.77      0          0

C14              105A             104A-1           25.5       0.013      88.77      88.92      0          0

C15              104A             103A-1           30         0.013      88.61      88.84      0          0

C16              103A             102A-1           37.7       0.013      88.46      88.69      0          0

C17              102A             101A-1           26.1       0.013      88.36      88.67      0          0

C18              101A             100A-1           22.8       0.013      88.28      88.56      0          0

C2               104A-1           104A             52.78      0.013      88.92      88.61      0          0

C3               107A             104A-1           15         0.013      89.2       88.92      0          0

C4               103A-1           103A             30         0.013      88.84      88.46      0          0

C5               102A-1           102A             47.6       0.013      88.69      88.36      0          0

C6               101A-1           101A             48         0.013      88.67      88.28      0          0

C7               205              204A             35.1       0.013      89.4       89.4       0          0

C8               204A             204B             34.2       0.013      89.4       89.4       0          0
```

C9	203A	203B	23.8	0.013	89.4	89.4	0	0
DITCH	202	201	109.778	0.013	85.2	84.74	0	0
Pipe_1	100	OF-MN	9.826	0.013	82.03	81.99	0	0
Pipe_10	103	102	78.55105	0.013	83.94736	83.68814	0	0
Pipe_11	104	103	59.15049	0.013	84.04059	83.95186	0	0
Pipe_12	203	202	32.71349	0.013	85.249	85.2	0	0
Pipe_13	204	203	68.4	0.013	86.25987	86.12307	0	0
Pipe_14	206	204	38.85	0.013	86.99837	86.60987	0	0
Pipe_16	207	206	24.18535	0.013	87.30022	87.05837	0	0
Pipe_19	208	203	38.85022	0.013	87.27157	86.88307	0	0
Pipe_23	106A	106	74.48216	0.013	86.93159	86.18676	0	0
Pipe_25	107	106	33.86366	0.013	86.7254	86.38676	0	0
Pipe_41	207A	207	14.24878	0.013	87.49271	87.35023	0	0
Pipe_49	105	104	70.10165	0.013	84.74812	84.33813	0	0
Pipe_50	106	105	18.72275	0.013	85.48676	85.40813	0	0
Pipe_53	STC	101	15.24184	0.013	84.71571	84.69285	0	0
Pipe_76	201CB	202	56.3	0.013	86.5	85.94	0	0
Pipe_8	101	100	73.773	0.013	82.24284	82.05	0	0
Pipe_9	102	101	119.12	0.013	82.54814	82.25034	0	0

[ORIFICES]

;;Name	Inlet Node	Outlet Node	Orifice Type	Crest Height	Disch. Coeff.	Flap Gate	Open/Close Time
105A-O	105A	105	SIDE	86.44	0.572	NO	0
107-O	107A	107	SIDE	87.25	0.572	NO	0
201-O	201	STC	SIDE	84.736	0.61	NO	0
203A-O	203A	203	SIDE	87.3	0.572	NO	0

203B-O	203B	203	SIDE	87.3	0.572	NO	0
204A-O	204A	204	SIDE	87.3	0.572	NO	0
204B-O	204B	204	SIDE	87.3	0.572	NO	0
205-O	205	204	SIDE	86.791	0.572	NO	0
OL1	203C	201CB	SIDE	86.5	0.572	NO	0

[OUTLETS]

;;Name	Inlet Node	Outlet Node	Outflow Height	Outlet Type	Qcoeff/ QTable	Qexpon	Flap Gate
100A-O	100A	100	86.25	FUNCTIONAL/HEAD	7.154	0.5	NO
100A-O1	100A	100	86.25	FUNCTIONAL/HEAD	7.154	0.5	NO
101A-O	101A	101	86.48	FUNCTIONAL/HEAD	7.154	0.5	NO
101A-O1	101A	101	86.48	FUNCTIONAL/HEAD	7.154	0.5	NO
102A-O	102A	102	86.56	FUNCTIONAL/HEAD	7.154	0.5	NO
102A-O1	102A	102	86.56	FUNCTIONAL/HEAD	7.154	0.5	NO
103A-O	103A	103	86.66	FUNCTIONAL/HEAD	7.154	0.5	NO
103A-O1	103A	103	86.66	FUNCTIONAL/HEAD	7.154	0.5	NO
104A-O	104A	104	86.81	FUNCTIONAL/HEAD	7.154	0.5	NO
104A-O1	104A	104	86.81	FUNCTIONAL/HEAD	7.154	0.5	NO
BLDG_H_OUT	BLDG_H-S	106	103	TABULAR/HEAD	BLDG_H_O		NO
BLDG_J_OUT	BLDG_J-S	207	103	TABULAR/HEAD	BLDG_J_O		NO
BLDG_K_OUT	BLDG_K-S	206	103	TABULAR/HEAD	BLDG_K_O		NO
BLDG_L_OUT	BLDG_L-S	201CB	103	TABULAR/DEPTH	BLDG_L_O		NO
BLDG_M_OUT	BLDG_M-S	201CB	103	TABULAR/DEPTH	BLDG_M_O		NO
BLDG_N_OUT	BLDG_N-S	208	103	TABULAR/HEAD	BLDG_N_O		NO

[XSECTIONS]

;;Link	Shape	Geom1	Geom2	Geom3	Geom4	Barrels

```
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
C1               TRAPEZOIDAL  0.05             20         20         20         1
C10              TRAPEZOIDAL  0.1              2          20         20         1
C11              TRAPEZOIDAL  0.05             20         20         20         1
C12              IRREGULAR    24mROW           0          0          0          1
C13              IRREGULAR    24mROW           0          0          0          1
C14              IRREGULAR    24mROW           0          0          0          1
C15              IRREGULAR    24mROW           0          0          0          1
C16              IRREGULAR    24mROW           0          0          0          1
C17              IRREGULAR    24mROW           0          0          0          1
C18              IRREGULAR    24mROW           0          0          0          1
C2               IRREGULAR    24mROW           0          0          0          1
C3               IRREGULAR    24mROW_OS        0          0          0          1
C4               IRREGULAR    24mROW           0          0          0          1
C5               IRREGULAR    24mROW           0          0          0          1
C6               IRREGULAR    24mROW           0          0          0          1
C7               TRAPEZOIDAL  0.05             20         20         20         1
C8               TRAPEZOIDAL  0.05             20         20         20         1
C9               TRAPEZOIDAL  0.05             20         20         20         1
DITCH            TRAPEZOIDAL  3                1          3          3          1
Pipe_1           CIRCULAR     1.35             0          0          0          1
Pipe_10          CIRCULAR     0.9              0          0          0          1
Pipe_11          CIRCULAR     0.9              0          0          0          1
Pipe_12          CIRCULAR     0.675            0          0          0          1
Pipe_13          CIRCULAR     0.6              0          0          0          1
Pipe_14          CIRCULAR     0.25             0          0          0          1
Pipe_16          CIRCULAR     0.25             0          0          0          1
Pipe_19          CIRCULAR     0.25             0          0          0          1
Pipe_23          CIRCULAR     0.2              0          0          0          1
Pipe_25          CIRCULAR     0.3              0          0          0          1
Pipe_41          CIRCULAR     0.2              0          0          0          1
Pipe_49          CIRCULAR     0.9              0          0          0          1
Pipe_50          CIRCULAR     0.9              0          0          0          1
Pipe_53          CIRCULAR     0.9              0          0          0          1
Pipe_76          CIRCULAR     0.3              0          0          0          1
Pipe_8           CIRCULAR     1.35             0          0          0          1
Pipe_9           CIRCULAR     1.35             0          0          0          1
105A-O           CIRCULAR     0.14             0          0          0
107-O            CIRCULAR     0.108            0          0          0
201-O            CIRCULAR     0.2              0          0          0
203A-O           CIRCULAR     0.076            0          0          0
203B-O           CIRCULAR     0.076            0          0          0
204A-O           CIRCULAR     0.076            0          0          0
204B-O           CIRCULAR     0.076            0          0          0
205-O            CIRCULAR     0.076            0          0          0
OL1              CIRCULAR     0.076            0          0          0

[TRANSECTS]
```



```
NC 0.025    0.025    0.013
X1 24mROW           7        6.5      17.5     0.0       0.0       0.0      0.0      0.0
GR 0.35     0        0.15     6.49     0        6.5       0.165     12       0        17.5
GR 0.165    17.51    0.35     24

NC 0.025    0.025    0.013
X1 24mROW_OS        4        6.5      12       0.0       0.0       0.0      0.0      0.0
GR 0.35     0        0.15     6.49     0        6.5       0.165     12

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

[INFLOWS]
;;                                                 Param    Units    Scale    Baseline Baseline
;;Node           Parameter        Time Series      Type     Factor   Factor   Value    Pattern
;;-------------- ---------------- ---------------- -------- -------- -------- -------- --------
101              FLOW             ""               FLOW     1.0      1        91.3
102              FLOW             ""               FLOW     1.0      1        1500.9
103              FLOW             ""               FLOW     1.0      1        43.5
104              FLOW             ""               FLOW     1.0      1        214.235

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
BLDG_H_O         Rating     0.000      0.0000
BLDG_H_O                    0.025      7.2554
BLDG_H_O                    0.050      14.5107
BLDG_H_O                    0.075      18.1384
BLDG_H_O                    0.100      21.7661
BLDG_H_O                    0.125      25.3938
BLDG_H_O                    0.150      29.0215

BLDG_J_O         Rating     0.000      0.0000
BLDG_J_O                    0.025      0.9464
BLDG_J_O                    0.050      1.8927
BLDG_J_O                    0.075      2.3659
BLDG_J_O                    0.100      2.8391
BLDG_J_O                    0.125      3.3122
BLDG_J_O                    0.150      3.7854

BLDG_K_O         Rating     0.000      0.0000
BLDG_K_O                    0.025      0.9464
BLDG_K_O                    0.050      1.8927
BLDG_K_O                    0.075      2.1293
BLDG_K_O                    0.100      2.3659
BLDG_K_O                    0.125      2.6025
```

BLDG_K_O		0.150	2.8391
BLDG_L_O	Rating	0	0
BLDG_L_O		0.025	0.9464
BLDG_L_O		0.050	1.8927
BLDG_L_O		0.075	2.1293
BLDG_L_O		0.100	2.3659
BLDG_L_O		0.125	2.6025
BLDG_L_O		0.150	2.8391
BLDG_M_O	Rating	0	0
BLDG_M_O		0.025	1.2618
BLDG_M_O		0.050	2.5236
BLDG_M_O		0.075	3.1545
BLDG_M_O		0.1	3.7854
BLDG_M_O		0.125	4.4163
BLDG_M_O		0.150	5.0472
BLDG_N_O	Rating	0.000	0.0000
BLDG_N_O		0.025	0.6309
BLDG_N_O		0.050	1.2618
BLDG_N_O		0.075	1.5773
BLDG_N_O		0.100	1.8927
BLDG_N_O		0.125	2.2082
BLDG_N_O		0.150	2.5236
107	Storage	0	0
107		1.8	0
107		1.90	38
107		1.91	0
107		2.15	0
107A	Storage	0	0
107A		1.8	0
107A		2.27	14.27
107A		2.28	0
107A		2.47	0
203A	Storage	0	0
203A		1.8	0
203A		2.1	1009.3
203A		2.11	0
203A		2.15	0
203B	Storage	0	0
203B		1.8	0
203B		1.95	88
203B		1.96	0

203B		2.15	0
203C	Storage	0	0
203C		2.33	0
203C		2.44	94.54
203C		2.441	0
203C		2.68	0
204A	Storage	0	0
204A		1.8	0
204A		2.1	757.3
204A		2.11	0
204A		2.15	0
204B	Storage	0	0
204B		1.8	0
204B		2.1	1252.7
204B		2.11	0
204B		2.15	0
205	Storage	0	0
205		2.609	0
205		2.909	592
205		2.919	0
205		2.959	0
BLDG_H	Storage	0.000	0
BLDG_H		0.025	145
BLDG_H		0.050	580
BLDG_H		0.075	1304
BLDG_H		0.100	2318
BLDG_H		0.125	3622
BLDG_H		0.150	5216
BLDG_J	Storage	0.000	0
BLDG_J		0.025	16
BLDG_J		0.050	66
BLDG_J		0.075	148
BLDG_J		0.100	263
BLDG_J		0.125	411
BLDG_J		0.150	592
BLDG_K	Storage	0.000	0
BLDG_K		0.025	13
BLDG_K		0.050	53
BLDG_K		0.075	120
BLDG_K		0.100	213
BLDG_K		0.125	333

```
BLDG_K                       0.150      480

BLDG_L          Storage      0          0
BLDG_L                       0.025      14
BLDG_L                       0.050      56
BLDG_L                       0.075      125
BLDG_L                       0.1        222
BLDG_L                       0.125      347
BLDG_L                       0.150      500

BLDG_M          Storage      0          0
BLDG_M                       0.025      20
BLDG_M                       0.050      78
BLDG_M                       0.075      176
BLDG_M                       0.100      314
BLDG_M                       0.125      490
BLDG_M                       0.150      706

BLDG_N          Storage      0.000      0
BLDG_N                       0.025      11
BLDG_N                       0.050      43
BLDG_N                       0.075      96
BLDG_N                       0.100      171
BLDG_N                       0.125      267
BLDG_N                       0.150      384

[TIMESERIES]
;;Name          Date       Time       Value
;;-------------- ---------- ---------- ----------
002yr_3hr_10m_CHI             00:00      2.5321
002yr_3hr_10m_CHI             00:10      3.1503
002yr_3hr_10m_CHI             00:20      4.2327
002yr_3hr_10m_CHI             00:30      6.6600
002yr_3hr_10m_CHI             00:40      17.7749
002yr_3hr_10m_CHI             00:50      76.7691
002yr_3hr_10m_CHI             01:00      24.1097
002yr_3hr_10m_CHI             01:10      12.7439
002yr_3hr_10m_CHI             01:20      8.6587
002yr_3hr_10m_CHI             01:30      6.5830
002yr_3hr_10m_CHI             01:40      5.3317
002yr_3hr_10m_CHI             01:50      4.4959
002yr_3hr_10m_CHI             02:00      3.8977
002yr_3hr_10m_CHI             02:10      3.4481
002yr_3hr_10m_CHI             02:20      3.0975
002yr_3hr_10m_CHI             02:30      2.8161
002yr_3hr_10m_CHI             02:40      2.5851
002yr_3hr_10m_CHI             02:50      2.3919
```



```
005yr_3hr_10m_CHI             0:00       3.68223
005yr_3hr_10m_CHI             0:10       4.58232
005yr_3hr_10m_CHI             0:20       6.15055
005yr_3hr_10m_CHI             0:30       9.6141
005yr_3hr_10m_CHI             0:40       24.17035
005yr_3hr_10m_CHI             0:50       104.193
005yr_3hr_10m_CHI             1:00       32.03692
005yr_3hr_10m_CHI             1:10       16.3375
005yr_3hr_10m_CHI             1:20       10.96479
005yr_3hr_10m_CHI             1:30       8.28693
005yr_3hr_10m_CHI             1:40       6.68897
005yr_3hr_10m_CHI             1:50       5.6279
005yr_3hr_10m_CHI             2:00       4.87167
005yr_3hr_10m_CHI             2:10       4.30483
005yr_3hr_10m_CHI             2:20       3.8637
005yr_3hr_10m_CHI             2:30       3.51028
005yr_3hr_10m_CHI             2:40       3.22046
005yr_3hr_10m_CHI             2:50       2.97831

100yr_3h_10m_CHI             00:00      6.04573
100yr_3h_10m_CHI             00:10      7.54219
100yr_3h_10m_CHI             00:20      10.15880
100yr_3h_10m_CHI             00:30      15.96889
100yr_3h_10m_CHI             00:40      40.65497
100yr_3h_10m_CHI             00:50      178.55900
100yr_3h_10m_CHI             01:00      54.04853
100yr_3h_10m_CHI             01:10      27.31870
100yr_3h_10m_CHI             01:20      18.24039
100yr_3h_10m_CHI             01:30      13.73692
100yr_3h_10m_CHI             01:40      11.05876
100yr_3h_10m_CHI             01:50      9.28521
100yr_3h_10m_CHI             02:00      8.02389
100yr_3h_10m_CHI             02:10      7.08022
100yr_3h_10m_CHI             02:20      6.34698
100yr_3h_10m_CHI             02:30      5.76029
100yr_3h_10m_CHI             02:40      5.27978
100yr_3h_10m_CHI             02:50      4.87871

100yr_3hr_10m_CHI+20%             00:00      7.255
100yr_3hr_10m_CHI+20%             00:10      9.051
100yr_3hr_10m_CHI+20%             00:20      12.191
100yr_3hr_10m_CHI+20%             00:30      19.163
100yr_3hr_10m_CHI+20%             00:40      48.786
100yr_3hr_10m_CHI+20%             00:50      214.271
100yr_3hr_10m_CHI+20%             01:00      64.858
100yr_3hr_10m_CHI+20%             01:10      32.782
100yr_3hr_10m_CHI+20%             01:20      21.888
100yr_3hr_10m_CHI+20%             01:30      16.484
```

```
100yr_3hr_10m_CHI+20%            01:40      13.271
100yr_3hr_10m_CHI+20%            01:50      11.142
100yr_3hr_10m_CHI+20%            02:00      9.629
100yr_3hr_10m_CHI+20%            02:10      8.496
100yr_3hr_10m_CHI+20%            02:20      7.616
100yr_3hr_10m_CHI+20%            02:30      6.912
100yr_3hr_10m_CHI+20%            02:40      6.336
100yr_3hr_10m_CHI+20%            02:50      5.854

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

[TAGS]
Link       C1               MJ
Link       C10              MJ
Link       C11              MJ
Link       C12              MJ
Link       C13              MJ
Link       C14              MJ
Link       C15              MJ
Link       C16              MJ
Link       C17              MJ
Link       C18              MJ
Link       C2               MJ
Link       C3               MJ
Link       C4               MJ
Link       C5               MJ
Link       C6               MJ
Link       C7               MJ
Link       C8               MJ
Link       C9               MJ
Link       DITCH            MJ

[MAP]
DIMENSIONS       382649.8485      5035353.39135    383052.1735      5035696.09965
UNITS            Meters

[COORDINATES]
;;Node           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
100              382946.8         5035663
101              382972.4         5035602
102              383018.1         5035492
103              382945.7         5035462
```



```
104              382891           5035439
105              382826.6         5035412
106              382819.4         5035429
106A             382746.8         5035409
107              382850.7         5035442
201              382948.8         5035593
201CB            382892.484       5035626.787
202              382847.4         5035550
203              382817.3         5035538
204              382754.1         5035512
206              382739.2         5035547
207              382716.8         5035538
207A             382711.4         5035551
208              382802.3         5035574
STC              382958.4         5035597
OF-MJ            382938.128       5035670.793
OF-MN            382943.135       5035671.836
U100A-OF         382707.974       5035456.554
U100B-OF         382778.31        5035605.304
U100C-OF         382908.649       5035655.655
100A             382940.646       5035664.246
100A-1           382957.522       5035624.077
101A             382965.518       5035604.744
101A-1           382984.454       5035558.554
102A             382995.564       5035531.165
102A-1           383008.975       5035498.123
103A             382981.224       5035484.559
103A-1           382954.976       5035473.2
104A             382925.912       5035460.317
104A-1           382878.332       5035441.444
105A             382851.479       5035431.124
107A             382854.728       5035442.877
203A             382819.4         5035533
203B             382840.524       5035540.867
203C             382888.465       5035633.416
204A             382756.3         5035506
204B             382787.823       5035518.428
205              382724           5035493
BLDG_H-S         382813.8         5035442
BLDG_J-S         382713.3         5035537
BLDG_K-S         382737.4         5035552
BLDG_L-S         382919.1         5035641
BLDG_M-S         382843.4         5035615.1
BLDG_N-S         382797.8         5035585

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

```
C5               383009.066       5035497.884
100A-O1          382943.56        5035665.113
101A-O1          382969.048       5035604.92
102A-O1          383007.015       5035514.595
103A-O1          382966.585       5035473.11
104A-O1          382911.438       5035449.396

[POLYGONS]
;;Subcatchment   X-Coord          Y-Coord
;;-------------- ---------------- ----------------
BLDG_H           382738.242       5035406.31
BLDG_H           382718.296       5035454.232
BLDG_H           382718.296       5035454.232
BLDG_H           382752.858       5035468.618
BLDG_H           382752.858       5035468.618
BLDG_H           382784.857       5035481.936
BLDG_H           382784.857       5035481.936
BLDG_H           382816.431       5035495.078
BLDG_H           382816.431       5035495.078
BLDG_H           382840.389       5035505.05
BLDG_H           382840.389       5035505.05
BLDG_H           382842.626       5035505.981
BLDG_H           382842.626       5035505.981
BLDG_H           382843.779       5035503.211
BLDG_H           382843.779       5035503.211
BLDG_H           382863.755       5035455.216
BLDG_H           382863.755       5035455.216
BLDG_H           382853.734       5035451.045
BLDG_H           382853.734       5035451.045
BLDG_H           382850.444       5035458.948
BLDG_H           382850.444       5035458.948
BLDG_H           382822.078       5035447.141
BLDG_H           382822.078       5035447.141
BLDG_H           382813.474       5035443.559
BLDG_H           382813.474       5035443.559
BLDG_H           382785.106       5035431.752
BLDG_H           382785.106       5035431.752
BLDG_H           382788.395       5035423.85
BLDG_H           382788.395       5035423.85
BLDG_H           382778.717       5035419.822
BLDG_H           382778.717       5035419.822
BLDG_H           382775.654       5035427.18
BLDG_H           382775.654       5035427.18
BLDG_H           382769.907       5035424.788
BLDG_H           382769.907       5035424.788
BLDG_H           382746.32        5035414.971
BLDG_H           382746.32        5035414.971
BLDG_H           382746.675       5035407.143
```



```
BLDG_H           382746.675       5035407.143
BLDG_H           382746.696       5035406.693
BLDG_H           382746.696       5035406.693
BLDG_H           382738.242       5035406.31
BLDG_J           382699.645       5035553.88
BLDG_J           382705.496       5035539.822
BLDG_J           382705.496       5035539.822
BLDG_J           382709.405       5035530.431
BLDG_J           382709.405       5035530.431
BLDG_J           382689.144       5035521.998
BLDG_J           382689.144       5035521.998
BLDG_J           382679.385       5035545.448
BLDG_J           382679.385       5035545.448
BLDG_J           382699.645       5035553.88
BLDG_K           382718.843       5035573.906
BLDG_K           382727.121       5035577.351
BLDG_K           382727.121       5035577.351
BLDG_K           382734.496       5035580.421
BLDG_K           382734.496       5035580.421
BLDG_K           382743.822       5035558.015
BLDG_K           382743.822       5035558.015
BLDG_K           382723.197       5035549.1
BLDG_K           382723.197       5035549.1
BLDG_K           382717.614       5035562.513
BLDG_K           382717.614       5035562.513
BLDG_K           382715.692       5035561.713
BLDG_K           382715.692       5035561.713
BLDG_K           382715.633       5035561.854
BLDG_K           382715.633       5035561.854
BLDG_K           382711.597       5035571.55
BLDG_K           382711.597       5035571.55
BLDG_K           382718.609       5035574.469
BLDG_K           382718.609       5035574.469
BLDG_K           382718.843       5035573.906
BLDG_L           382909.694       5035625.358
BLDG_L           382901.495       5035645.056
BLDG_L           382901.495       5035645.056
BLDG_L           382928.525       5035656.306
BLDG_L           382928.525       5035656.306
BLDG_L           382936.723       5035636.608
BLDG_L           382936.723       5035636.608
BLDG_L           382909.694       5035625.358
BLDG_M           382828.429       5035597.166
BLDG_M           382820.23        5035616.864
BLDG_M           382820.23        5035616.864
BLDG_M           382858.419       5035632.759
BLDG_M           382858.419       5035632.759
BLDG_M           382866.618       5035613.061
```

BLDG_M	382866.618	5035613.061
BLDG_M	382828.429	5035597.166
BLDG_N	382776.122	5035582.13
BLDG_N	382772.794	5035590.127
BLDG_N	382772.794	5035590.127
BLDG_N	382783.815	5035594.714
BLDG_N	382783.815	5035594.714
BLDG_N	382794.837	5035599.301
BLDG_N	382794.837	5035599.301
BLDG_N	382801.171	5035584.082
BLDG_N	382801.171	5035584.082
BLDG_N	382780.066	5035575.298
BLDG_N	382780.066	5035575.298
BLDG_N	382777.06	5035582.521
BLDG_N	382777.06	5035582.521
BLDG_N	382776.122	5035582.13
C100A	382944.638	5035643.074
C100A	382935.463	5035665.112
C100A	382935.463	5035665.112
C100A	382928.901	5035667.867
C100A	382928.901	5035667.867
C100A	382955.824	5035678.663
C100A	382955.824	5035678.663
C100A	382960.46	5035680.522
C100A	382960.46	5035680.522
C100A	382957.741	5035674.045
C100A	382957.741	5035674.045
C100A	382975.462	5035631.48
C100A	382975.462	5035631.48
C100A	382965.643	5035627.393
C100A	382965.643	5035627.393
C100A	382953.304	5035622.257
C100A	382953.304	5035622.257
C100A	382949.913	5035630.401
C100A	382949.913	5035630.401
C100A	382947.215	5035629.743
C100A	382947.215	5035629.743
C100A	382945.953	5035637.482
C100A	382945.953	5035637.482
C100A	382944.638	5035643.074
C101A	383002.674	5035566.097
C101A	382980.521	5035556.877
C101A	382980.521	5035556.877
C101A	382953.304	5035622.257
C101A	382953.304	5035622.257
C101A	382965.643	5035627.393
C101A	382965.643	5035627.393
C101A	382975.462	5035631.48

C101A	382975.462	5035631.48
C101A	382992.253	5035591.135
C101A	382992.253	5035591.135
C101A	383002.674	5035566.097
C102A	383002.269	5035500.733
C102A	383003.078	5035502.692
C102A	383003.078	5035502.692
C102A	382980.521	5035556.877
C102A	382980.521	5035556.877
C102A	383002.674	5035566.097
C102A	383002.674	5035566.097
C102A	383012.699	5035542.012
C102A	383012.699	5035542.012
C102A	383033.886	5035491.105
C102A	383033.886	5035491.105
C102A	383019.929	5035493.439
C102A	383019.929	5035493.439
C102A	383002.269	5035500.733
C103A	383001.46	5035498.774
C103A	383002.269	5035500.733
C103A	383002.269	5035500.733
C103A	383019.929	5035493.439
C103A	383019.929	5035493.439
C103A	383033.886	5035491.105
C103A	383033.886	5035491.105
C103A	383014.608	5035474.996
C103A	383014.608	5035474.996
C103A	383010.684	5035476.617
C103A	383010.684	5035476.617
C103A	382961.962	5035456.422
C103A	382961.962	5035456.422
C103A	382952.75	5035478.584
C103A	382952.75	5035478.584
C103A	383001.46	5035498.774
C104A	382879.983	5035448.423
C104A	382952.75	5035478.584
C104A	382952.75	5035478.584
C104A	382961.962	5035456.422
C104A	382961.962	5035456.422
C104A	382900.618	5035430.996
C104A	382900.618	5035430.996
C104A	382885.487	5035424.724
C104A	382885.487	5035424.724
C104A	382877.239	5035444.005
C104A	382877.239	5035444.005
C104A	382866.779	5035448.316
C104A	382866.779	5035448.316
C104A	382874.894	5035460.048

C104A	382874.894	5035460.048
C104A	382879.983	5035448.423
C105A	382740.894	5035390.257
C105A	382737.828	5035390.374
C105A	382737.828	5035390.374
C105A	382746.696	5035406.693
C105A	382746.696	5035406.693
C105A	382746.675	5035407.143
C105A	382746.675	5035407.143
C105A	382769.512	5035408.179
C105A	382769.512	5035408.179
C105A	382769.907	5035424.788
C105A	382769.907	5035424.788
C105A	382775.654	5035427.18
C105A	382775.654	5035427.18
C105A	382778.717	5035419.822
C105A	382778.717	5035419.822
C105A	382788.395	5035423.85
C105A	382788.395	5035423.85
C105A	382793.618	5035417.54
C105A	382793.618	5035417.54
C105A	382809.839	5035424.292
C105A	382809.839	5035424.292
C105A	382826.06	5035431.043
C105A	382826.06	5035431.043
C105A	382850.788	5035441.333
C105A	382850.788	5035441.333
C105A	382865.589	5035447.494
C105A	382865.589	5035447.494
C105A	382866.779	5035448.316
C105A	382866.779	5035448.316
C105A	382877.239	5035444.005
C105A	382877.239	5035444.005
C105A	382885.487	5035424.724
C105A	382885.487	5035424.724
C105A	382823.461	5035399.015
C105A	382823.461	5035399.015
C105A	382750.971	5035368.969
C105A	382750.971	5035368.969
C105A	382751.178	5035372.691
C105A	382751.178	5035372.691
C105A	382743.42	5035388.691
C105A	382743.42	5035388.691
C105A	382745.468	5035389.517
C105A	382745.468	5035389.517
C105A	382744.206	5035391.126
C105A	382744.206	5035391.126
C105A	382742.672	5035390.568

C105A	382742.672	5035390.568
C105A	382740.894	5035390.257
L106A	382746.675	5035407.143
L106A	382746.32	5035414.971
L106A	382746.32	5035414.971
L106A	382769.907	5035424.788
L106A	382769.907	5035424.788
L106A	382769.512	5035408.179
L106A	382769.512	5035408.179
L106A	382746.675	5035407.143
L106B	382788.395	5035423.85
L106B	382785.106	5035431.752
L106B	382785.106	5035431.752
L106B	382813.474	5035443.559
L106B	382813.474	5035443.559
L106B	382809.5	5035432.634
L106B	382809.5	5035432.634
L106B	382788.395	5035423.85
L107A	382822.078	5035447.141
L107A	382850.444	5035458.948
L107A	382850.444	5035458.948
L107A	382853.734	5035451.045
L107A	382853.734	5035451.045
L107A	382832.629	5035442.261
L107A	382832.629	5035442.261
L107A	382822.078	5035447.141
L107B	382813.474	5035443.559
L107B	382822.078	5035447.141
L107B	382822.078	5035447.141
L107B	382832.629	5035442.261
L107B	382832.629	5035442.261
L107B	382853.734	5035451.045
L107B	382853.734	5035451.045
L107B	382863.755	5035455.216
L107B	382863.755	5035455.216
L107B	382843.779	5035503.211
L107B	382843.779	5035503.211
L107B	382847.601	5035504.802
L107B	382847.601	5035504.802
L107B	382856.14	5035505.107
L107B	382856.14	5035505.107
L107B	382874.894	5035460.048
L107B	382874.894	5035460.048
L107B	382866.779	5035448.316
L107B	382866.779	5035448.316
L107B	382865.589	5035447.494
L107B	382865.589	5035447.494
L107B	382850.788	5035441.333

L107B	382850.788	5035441.333
L107B	382826.06	5035431.043
L107B	382826.06	5035431.043
L107B	382809.839	5035424.292
L107B	382809.839	5035424.292
L107B	382793.618	5035417.54
L107B	382793.618	5035417.54
L107B	382788.395	5035423.85
L107B	382788.395	5035423.85
L107B	382809.5	5035432.634
L107B	382809.5	5035432.634
L107B	382813.474	5035443.559
L203A	382780.066	5035575.298
L203A	382801.171	5035584.082
L203A	382801.171	5035584.082
L203A	382794.837	5035599.301
L203A	382794.837	5035599.301
L203A	382800.336	5035605.561
L203A	382800.336	5035605.561
L203A	382805.138	5035606.831
L203A	382805.138	5035606.831
L203A	382821.445	5035567.646
L203A	382821.445	5035567.646
L203A	382838.813	5035525.916
L203A	382838.813	5035525.916
L203A	382836.083	5035515.395
L203A	382836.083	5035515.395
L203A	382840.389	5035505.05
L203A	382840.389	5035505.05
L203A	382816.431	5035495.078
L203A	382816.431	5035495.078
L203A	382780.066	5035575.298
L203B	382843.779	5035503.211
L203B	382842.626	5035505.981
L203B	382842.626	5035505.981
L203B	382840.389	5035505.05
L203B	382840.389	5035505.05
L203B	382836.083	5035515.395
L203B	382836.083	5035515.395
L203B	382838.813	5035525.916
L203B	382838.813	5035525.916
L203B	382821.445	5035567.646
L203B	382821.445	5035567.646
L203B	382828.926	5035570.489
L203B	382828.926	5035570.489
L203B	382856.14	5035505.107
L203B	382856.14	5035505.107
L203B	382847.601	5035504.802

L203B	382847.601	5035504.802
L203B	382843.779	5035503.211
L203C	382872.707	5035630.817
L203C	382878.128	5035643.586
L203C	382878.128	5035643.586
L203C	382886.863	5035647.222
L203C	382886.863	5035647.222
L203C	382889.284	5035641.406
L203C	382889.284	5035641.406
L203C	382890.592	5035640.867
L203C	382890.592	5035640.867
L203C	382894.469	5035642.481
L203C	382894.469	5035642.481
L203C	382902.461	5035623.28
L203C	382902.461	5035623.28
L203C	382886.674	5035616.706
L203C	382886.674	5035616.706
L203C	382880.2	5035632.263
L203C	382880.2	5035632.263
L203C	382876.99	5035630.927
L203C	382876.99	5035630.927
L203C	382872.707	5035630.817
L204A	382741.995	5035584.915
L204A	382784.857	5035481.936
L204A	382784.857	5035481.936
L204A	382752.858	5035468.618
L204A	382752.858	5035468.618
L204A	382720.604	5035546.111
L204A	382720.604	5035546.111
L204A	382723.197	5035549.1
L204A	382723.197	5035549.1
L204A	382743.822	5035558.015
L204A	382743.822	5035558.015
L204A	382734.496	5035580.421
L204A	382734.496	5035580.421
L204A	382741.995	5035584.915
L204B	382772.794	5035590.127
L204B	382776.122	5035582.13
L204B	382776.122	5035582.13
L204B	382777.06	5035582.521
L204B	382777.06	5035582.521
L204B	382780.066	5035575.298
L204B	382780.066	5035575.298
L204B	382816.431	5035495.078
L204B	382816.431	5035495.078
L204B	382784.857	5035481.936
L204B	382784.857	5035481.936
L204B	382741.995	5035584.915

L204B	382741.995	5035584.915
L204B	382762.687	5035593.528
L204B	382762.687	5035593.528
L204B	382768.138	5035592.623
L204B	382768.138	5035592.623
L204B	382772.794	5035590.127
L205A	382735.03	5035396.614
L205A	382710.33	5035451.67
L205A	382710.33	5035451.67
L205A	382716.839	5035457.407
L205A	382716.839	5035457.407
L205A	382711.613	5035468.795
L205A	382711.613	5035468.795
L205A	382705.572	5035468.996
L205A	382705.572	5035468.996
L205A	382689.356	5035507.956
L205A	382689.356	5035507.956
L205A	382693.511	5035509.686
L205A	382693.511	5035509.686
L205A	382693.888	5035510.601
L205A	382693.888	5035510.601
L205A	382689.144	5035521.998
L205A	382689.144	5035521.998
L205A	382709.405	5035530.431
L205A	382709.405	5035530.431
L205A	382705.496	5035539.822
L205A	382705.496	5035539.822
L205A	382720.604	5035546.111
L205A	382720.604	5035546.111
L205A	382752.858	5035468.618
L205A	382752.858	5035468.618
L205A	382718.296	5035454.232
L205A	382718.296	5035454.232
L205A	382738.242	5035406.31
L205A	382738.242	5035406.31
L205A	382746.696	5035406.693
L205A	382746.696	5035406.693
L205A	382737.828	5035390.374
L205A	382737.828	5035390.374
L205A	382735.673	5035394.86
L205A	382735.673	5035394.86
L205A	382736.331	5035395.115
L205A	382736.331	5035395.115
L205A	382735.749	5035396.778
L205A	382735.749	5035396.778
L205A	382735.03	5035396.614
L207A	382674.224	5035562.349
L207A	382724.671	5035583.252

L207A	382724.671	5035583.252
L207A	382726.203	5035579.555
L207A	382726.203	5035579.555
L207A	382727.121	5035577.351
L207A	382727.121	5035577.351
L207A	382718.843	5035573.906
L207A	382718.843	5035573.906
L207A	382718.609	5035574.469
L207A	382718.609	5035574.469
L207A	382711.597	5035571.55
L207A	382711.597	5035571.55
L207A	382715.633	5035561.854
L207A	382715.633	5035561.854
L207A	382715.692	5035561.713
L207A	382715.692	5035561.713
L207A	382717.614	5035562.513
L207A	382717.614	5035562.513
L207A	382723.197	5035549.1
L207A	382723.197	5035549.1
L207A	382720.604	5035546.111
L207A	382720.604	5035546.111
L207A	382705.496	5035539.822
L207A	382705.496	5035539.822
L207A	382699.645	5035553.88
L207A	382699.645	5035553.88
L207A	382679.385	5035545.448
L207A	382679.385	5035545.448
L207A	382689.144	5035521.998
L207A	382689.144	5035521.998
L207A	382693.888	5035510.601
L207A	382693.888	5035510.601
L207A	382693.511	5035509.686
L207A	382693.511	5035509.686
L207A	382689.356	5035507.956
L207A	382689.356	5035507.956
L207A	382685.428	5035506.321
L207A	382685.428	5035506.321
L207A	382685.091	5035506.929
L207A	382685.091	5035506.929
L207A	382684.177	5035507.967
L207A	382684.177	5035507.967
L207A	382682.849	5035509.474
L207A	382682.849	5035509.474
L207A	382668.953	5035540.603
L207A	382668.953	5035540.603
L207A	382668.136	5035542.433
L207A	382668.136	5035542.433
L207A	382674.224	5035562.349

PHASE_2	382805.138	5035606.831
PHASE_2	382812.522	5035609.903
PHASE_2	382812.522	5035609.903
PHASE_2	382814.607	5035614.523
PHASE_2	382814.607	5035614.523
PHASE_2	382820.23	5035616.864
PHASE_2	382820.23	5035616.864
PHASE_2	382828.429	5035597.166
PHASE_2	382828.429	5035597.166
PHASE_2	382866.618	5035613.061
PHASE_2	382866.618	5035613.061
PHASE_2	382875.338	5035616.69
PHASE_2	382875.338	5035616.69
PHASE_2	382877.83	5035617.728
PHASE_2	382877.83	5035617.728
PHASE_2	382872.707	5035630.817
PHASE_2	382872.707	5035630.817
PHASE_2	382876.99	5035630.927
PHASE_2	382876.99	5035630.927
PHASE_2	382880.2	5035632.263
PHASE_2	382880.2	5035632.263
PHASE_2	382886.674	5035616.706
PHASE_2	382886.674	5035616.706
PHASE_2	382902.461	5035623.28
PHASE_2	382902.461	5035623.28
PHASE_2	382894.469	5035642.481
PHASE_2	382894.469	5035642.481
PHASE_2	382890.592	5035640.867
PHASE_2	382890.592	5035640.867
PHASE_2	382889.284	5035641.406
PHASE_2	382889.284	5035641.406
PHASE_2	382886.863	5035647.222
PHASE_2	382886.863	5035647.222
PHASE_2	382889.416	5035648.284
PHASE_2	382889.416	5035648.284
PHASE_2	382901.495	5035645.056
PHASE_2	382901.495	5035645.056
PHASE_2	382909.694	5035625.358
PHASE_2	382909.694	5035625.358
PHASE_2	382936.723	5035636.608
PHASE_2	382936.723	5035636.608
PHASE_2	382928.525	5035656.306
PHASE_2	382928.525	5035656.306
PHASE_2	382934.148	5035658.646
PHASE_2	382934.148	5035658.646
PHASE_2	382942.247	5035639.188
PHASE_2	382942.247	5035639.188
PHASE_2	382945.953	5035637.482

PHASE_2	382945.953	5035637.482
PHASE_2	382947.215	5035629.743
PHASE_2	382947.215	5035629.743
PHASE_2	382949.913	5035630.401
PHASE_2	382949.913	5035630.401
PHASE_2	382953.304	5035622.257
PHASE_2	382953.304	5035622.257
PHASE_2	382980.521	5035556.877
PHASE_2	382980.521	5035556.877
PHASE_2	383003.078	5035502.692
PHASE_2	383003.078	5035502.692
PHASE_2	383002.269	5035500.733
PHASE_2	383002.269	5035500.733
PHASE_2	383001.46	5035498.774
PHASE_2	383001.46	5035498.774
PHASE_2	382952.75	5035478.584
PHASE_2	382952.75	5035478.584
PHASE_2	382879.983	5035448.423
PHASE_2	382879.983	5035448.423
PHASE_2	382874.894	5035460.048
PHASE_2	382874.894	5035460.048
PHASE_2	382856.14	5035505.107
PHASE_2	382856.14	5035505.107
PHASE_2	382828.926	5035570.489
PHASE_2	382828.926	5035570.489
PHASE_2	382821.445	5035567.646
PHASE_2	382821.445	5035567.646
PHASE_2	382805.138	5035606.831
U100A	382687.429	5035502.717
U100A	382685.428	5035506.321
U100A	382685.428	5035506.321
U100A	382689.356	5035507.956
U100A	382689.356	5035507.956
U100A	382705.572	5035468.996
U100A	382705.572	5035468.996
U100A	382711.613	5035468.795
U100A	382711.613	5035468.795
U100A	382716.839	5035457.407
U100A	382716.839	5035457.407
U100A	382710.33	5035451.67
U100A	382710.33	5035451.67
U100A	382687.429	5035502.717
U100B	382794.837	5035599.301
U100B	382783.815	5035594.714
U100B	382783.815	5035594.714
U100B	382772.794	5035590.127
U100B	382772.794	5035590.127
U100B	382768.138	5035592.623

U100B	382768.138	5035592.623
U100B	382762.687	5035593.528
U100B	382762.687	5035593.528
U100B	382741.995	5035584.915
U100B	382741.995	5035584.915
U100B	382734.496	5035580.421
U100B	382734.496	5035580.421
U100B	382727.121	5035577.351
U100B	382727.121	5035577.351
U100B	382726.203	5035579.555
U100B	382726.203	5035579.555
U100B	382724.671	5035583.252
U100B	382724.671	5035583.252
U100B	382811.8	5035619.355
U100B	382811.8	5035619.355
U100B	382811.012	5035615.702
U100B	382811.012	5035615.702
U100B	382812.137	5035610.827
U100B	382812.137	5035610.827
U100B	382812.522	5035609.903
U100B	382812.522	5035609.903
U100B	382805.138	5035606.831
U100B	382805.138	5035606.831
U100B	382800.336	5035605.561
U100B	382800.336	5035605.561
U100B	382794.837	5035599.301
U100C	382814.607	5035614.523
U100C	382812.522	5035609.903
U100C	382812.522	5035609.903
U100C	382812.137	5035610.827
U100C	382812.137	5035610.827
U100C	382811.012	5035615.702
U100C	382811.012	5035615.702
U100C	382811.8	5035619.355
U100C	382811.8	5035619.355
U100C	382926.339	5035666.816
U100C	382926.339	5035666.816
U100C	382928.901	5035667.867
U100C	382928.901	5035667.867
U100C	382935.463	5035665.112
U100C	382935.463	5035665.112
U100C	382944.638	5035643.074
U100C	382944.638	5035643.074
U100C	382945.953	5035637.482
U100C	382945.953	5035637.482
U100C	382942.247	5035639.188
U100C	382942.247	5035639.188
U100C	382934.148	5035658.646

U100C	382934.148	5035658.646
U100C	382928.525	5035656.306
U100C	382928.525	5035656.306
U100C	382901.495	5035645.056
U100C	382901.495	5035645.056
U100C	382889.416	5035648.284
U100C	382889.416	5035648.284
U100C	382886.863	5035647.222
U100C	382886.863	5035647.222
U100C	382878.128	5035643.586
U100C	382878.128	5035643.586
U100C	382872.707	5035630.817
U100C	382872.707	5035630.817
U100C	382877.83	5035617.728
U100C	382877.83	5035617.728
U100C	382875.338	5035616.69
U100C	382875.338	5035616.69
U100C	382866.618	5035613.061
U100C	382866.618	5035613.061
U100C	382858.419	5035632.759
U100C	382858.419	5035632.759
U100C	382820.23	5035616.864
U100C	382820.23	5035616.864
U100C	382814.607	5035614.523

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

C.3 SAMPLE PCSWMM MODEL OUTPUT (100YR 3HR CHICAGO)

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)
--------------------------------------------------------------

WARNING 04: minimum elevation drop used for Conduit C11
WARNING 03: negative offset ignored for Link C13
WARNING 04: minimum elevation drop used for Conduit C7
WARNING 04: minimum elevation drop used for Conduit C8
WARNING 04: minimum elevation drop used for Conduit C9

*************
Element Count
*************
Number of rain gages ...... 1
Number of subcatchments ... 27
Number of nodes ........... 48
Number of links ........... 61
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                           Data       Recording
Name                 Data Source                           Type       Interval
--------------------------------------------------------------------------------
RG1                  100yr_3h_10m_CHI                      INTENSITY   10 min.


********************
Subcatchment Summary
********************
  Name                          Area     Width   %Imperv    %Slope Rain Gage
Outlet

---------------------------------------------------------------------------------------
-----------------------
  BLDG_H                        0.65    146.70    100.00    1.5000 RG1
BLDG_H-S
  BLDG_J                        0.06     16.70    100.00    1.5000 RG1
BLDG_J-S
  BLDG_K                        0.06     13.60    100.00    1.5000 RG1
BLDG_K-S
  BLDG_L                        0.06     34.90    100.00    1.5000 RG1
BLDG_L-S
  BLDG_M                        0.09     45.70    100.00    1.5000 RG1
BLDG_M-S
  BLDG_N                        0.04     15.10    100.00    1.5000 RG1
BLDG_N-S
  C100A                         0.13    102.50     75.71    2.0000 RG1
100A
  C101A                         0.17    141.60     77.14    1.3000 RG1
101A
  C102A                         0.17    146.20     77.14    1.1000 RG1
102A
  C103A                         0.16    133.80     77.14    1.2000 RG1
103A
  C104A                         0.21    166.00     75.71    1.0000 RG1
104A
  C105A                         0.45    288.70     62.86    1.2000 RG1
105A
  L106A                         0.03     24.00    100.00    3.0000 RG1
```

```
106A
  L106B                      0.02      27.00     100.00    3.0000 RG1
106A
  L107A                      0.02      27.00     100.00    3.0000 RG1
107
  L107B                      0.14     142.10     100.00    2.0000 RG1
107A
  L203A                      0.30      68.60     100.00    1.5000 RG1
203A
  L203B                      0.07      70.70     100.00    2.0000 RG1
203B
  L203C                      0.05      32.10     100.00    1.5000 RG1
203C
  L204A                      0.32      70.20     100.00    1.5000 RG1
204A
  L204B                      0.37      85.00     100.00    1.5000 RG1
204B
  L205A                      0.37      81.80      87.14    1.5000 RG1
205
  L207A                      0.16      30.90      42.86    3.5000 RG1
207A
  PHASE_2                    2.18     269.40      24.28    1.5000 RG1
201
  U100A                      0.03       5.90      32.86    3.0000 RG1
U100A-OF
  U100B                      0.08      13.60      31.43    3.0000 RG1
U100B-OF
  U100C                      0.12      25.60      31.42    2.0000 RG1
U100C-OF
```

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
100	JUNCTION	81.73	5.78	0.0	
101	JUNCTION	81.94	6.44	0.0	Yes
102	JUNCTION	82.24	6.61	0.0	Yes
103	JUNCTION	82.65	6.15	0.0	Yes
104	JUNCTION	82.34	9.33	0.0	Yes
105	JUNCTION	84.45	4.58	0.0	
106	JUNCTION	85.19	4.04	0.0	
106A	JUNCTION	86.39	2.34	0.0	
107	JUNCTION	86.43	2.63	0.0	
201	JUNCTION	84.74	3.26	0.0	
201CB	JUNCTION	85.90	2.93	0.0	
202	JUNCTION	85.20	3.02	0.0	
203	JUNCTION	84.95	4.19	0.0	
204	JUNCTION	85.96	3.23	0.0	
206	JUNCTION	86.70	3.23	0.0	
207	JUNCTION	87.00	3.14	0.0	
207A	JUNCTION	86.89	3.29	0.0	
208	JUNCTION	86.97	2.65	0.0	
STC	JUNCTION	84.42	3.83	0.0	
OF-MJ	OUTFALL	87.87	0.35	0.0	
OF-MN	OUTFALL	81.99	1.35	0.0	
U100A-OF	OUTFALL	0.00	0.00	0.0	
U100B-OF	OUTFALL	0.00	0.00	0.0	
U100C-OF	OUTFALL	0.00	0.00	0.0	
100A	STORAGE	86.25	2.15	0.0	
100A-1	STORAGE	88.56	0.10	0.0	

101A	STORAGE	86.48	2.25	0.0
101A-1	STORAGE	88.67	0.10	0.0
102A	STORAGE	86.56	2.25	0.0
102A-1	STORAGE	88.69	0.10	0.0
103A	STORAGE	86.66	2.25	0.0
103A-1	STORAGE	88.84	0.10	0.0
104A	STORAGE	86.81	2.25	0.0
104A-1	STORAGE	88.92	0.10	0.0
105A	STORAGE	86.44	2.68	0.0
107A	STORAGE	87.25	2.15	0.0
203A	STORAGE	87.30	2.15	0.0
203B	STORAGE	87.30	2.15	0.0
203C	STORAGE	86.50	2.68	0.0
204A	STORAGE	87.30	2.15	0.0
204B	STORAGE	87.30	2.15	0.0
205	STORAGE	86.49	2.96	0.0
BLDG_H-S	STORAGE	103.00	0.30	0.0
BLDG_J-S	STORAGE	103.00	0.30	0.0
BLDG_K-S	STORAGE	103.00	0.30	0.0
BLDG_L-S	STORAGE	103.00	0.30	0.0
BLDG_M-S	STORAGE	103.00	0.30	0.0
BLDG_N-S	STORAGE	103.00	0.30	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	203C	202	CONDUIT	93.0	0.8818	0.0130
C10	203B	202	CONDUIT	5.0	23.2003	0.0250
C11	204B	203A	CONDUIT	34.2	0.0009	0.0130
C12	100A-1	100A	CONDUIT	52.2	0.9771	0.0130
C13	100A	OF-MJ	CONDUIT	5.0	3.6023	0.0130
C14	105A	104A-1	CONDUIT	25.5	-0.5882	0.0130
C15	104A	103A-1	CONDUIT	30.0	-0.7667	0.0130
C16	103A	102A-1	CONDUIT	37.7	-0.6101	0.0130
C17	102A	101A-1	CONDUIT	26.1	-1.1878	0.0130
C18	101A	100A-1	CONDUIT	22.8	-1.2282	0.0130
C2	104A-1	104A	CONDUIT	52.8	0.5874	0.0130
C3	107A	104A-1	CONDUIT	15.0	1.8670	0.0130
C4	103A-1	103A	CONDUIT	30.0	1.2668	0.0130
C5	102A-1	102A	CONDUIT	47.6	0.6933	0.0130
C6	101A-1	101A	CONDUIT	48.0	0.8125	0.0130
C7	205	204A	CONDUIT	35.1		

```
0.0009    0.0130
  C8              204A             204B             CONDUIT            34.2
0.0009    0.0130
  C9              203A             203B             CONDUIT            23.8
0.0013    0.0130
  DITCH           202              201              CONDUIT           109.8
0.4190    0.0130
  Pipe_1          100              OF-MN            CONDUIT             9.8
0.4071    0.0130
  Pipe_10         103              102              CONDUIT            78.6
0.3300    0.0130
  Pipe_11         104              103              CONDUIT            59.2
0.1500    0.0130
  Pipe_12         203              202              CONDUIT            32.7
0.1498    0.0130
  Pipe_13         204              203              CONDUIT            68.4
0.2000    0.0130
  Pipe_14         206              204              CONDUIT            38.9
1.0001    0.0130
  Pipe_16         207              206              CONDUIT            24.2
1.0000    0.0130
  Pipe_19         208              203              CONDUIT            38.9
1.0000    0.0130
  Pipe_23         106A             106              CONDUIT            74.5
1.0001    0.0130
  Pipe_25         107              106              CONDUIT            33.9
1.0001    0.0130
  Pipe_41         207A             207              CONDUIT            14.2
1.0000    0.0130
  Pipe_49         105              104              CONDUIT            70.1
0.5849    0.0130
  Pipe_50         106              105              CONDUIT            18.7
0.4200    0.0130
  Pipe_53         STC              101              CONDUIT            15.2
0.1500    0.0130
  Pipe_76         201CB            202              CONDUIT            56.3
0.9947    0.0130
  Pipe_8          101              100              CONDUIT            73.8
0.2614    0.0130
  Pipe_9          102              101              CONDUIT           119.1
0.2500    0.0130
  105A-O          105A             105              ORIFICE
  107-O           107A             107              ORIFICE
  201-O           201              STC              ORIFICE
  203A-O          203A             203              ORIFICE
  203B-O          203B             203              ORIFICE
  204A-O          204A             204              ORIFICE
  204B-O          204B             204              ORIFICE
  205-O           205              204              ORIFICE
  OL1             203C             201CB            ORIFICE
  100A-O          100A             100              OUTLET
  100A-O1         100A             100              OUTLET
  101A-O          101A             101              OUTLET
  101A-O1         101A             101              OUTLET
  102A-O          102A             102              OUTLET
  102A-O1         102A             102              OUTLET
  103A-O          103A             103              OUTLET
  103A-O1         103A             103              OUTLET
  104A-O          104A             104              OUTLET
  104A-O1         104A             104              OUTLET
  BLDG_H_OUT      BLDG_H-S         106              OUTLET
  BLDG_J_OUT      BLDG_J-S         207              OUTLET
  BLDG_K_OUT      BLDG_K-S         206              OUTLET
```

BLDG_L_OUT	BLDG_L-S	201CB	OUTLET
BLDG_M_OUT	BLDG_M-S	201CB	OUTLET
BLDG_N_OUT	BLDG_N-S	208	OUTLET

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.05	1.05	0.05	22.00	1	997.91
C10	TRAPEZOIDAL	0.10	0.40	0.07	6.00	1	1266.46
C11	TRAPEZOIDAL	0.05	1.05	0.05	22.00	1	31.73
C12	24mROW	0.35	4.20	0.18	24.00	1	10287.69
C13	24mROW	0.35	4.20	0.18	24.00	1	19753.76
C14	24mROW	0.35	4.20	0.18	24.00	1	7982.47
C15	24mROW	0.35	4.20	0.18	24.00	1	9113.13
C16	24mROW	0.35	4.20	0.18	24.00	1	8129.34
C17	24mROW	0.35	4.20	0.18	24.00	1	11343.15
C18	24mROW	0.35	4.20	0.18	24.00	1	11534.15
C2	24mROW	0.35	4.20	0.18	24.00	1	7976.41
C3	24mROW_OS	0.35	2.12	0.18	12.00	1	7156.89
C4	24mROW	0.35	4.20	0.18	24.00	1	11714.03
C5	24mROW	0.35	4.20	0.18	24.00	1	8665.96
C6	24mROW	0.35	4.20	0.18	24.00	1	9381.59
C7	TRAPEZOIDAL	0.05	1.05	0.05	22.00	1	31.32
C8	TRAPEZOIDAL	0.05	1.05	0.05	22.00	1	31.73
C9	TRAPEZOIDAL	0.05	1.05	0.05	22.00	1	38.03
DITCH	TRAPEZOIDAL	3.00	30.00	1.50	19.00	1	195930.87
Pipe_1	CIRCULAR	1.35	1.43	0.34	1.35	1	3405.65
Pipe_10	CIRCULAR	0.90	0.64	0.23	0.90	1	1040.01
Pipe_11	CIRCULAR	0.90	0.64	0.23	0.90	1	701.19
Pipe_12	CIRCULAR	0.68	0.36	0.17	0.68	1	325.35
Pipe_13	CIRCULAR	0.60	0.28	0.15	0.60	1	274.61

```
  Pipe_14           CIRCULAR                 0.25      0.05      0.06      0.25          1
59.47
  Pipe_16           CIRCULAR                 0.25      0.05      0.06      0.25          1
59.47
  Pipe_19           CIRCULAR                 0.25      0.05      0.06      0.25          1
59.47
  Pipe_23           CIRCULAR                 0.20      0.03      0.05      0.20          1
32.80
  Pipe_25           CIRCULAR                 0.30      0.07      0.07      0.30          1
96.71
  Pipe_41           CIRCULAR                 0.20      0.03      0.05      0.20          1
32.80
  Pipe_49           CIRCULAR                 0.90      0.64      0.23      0.90          1
1384.54
  Pipe_50           CIRCULAR                 0.90      0.64      0.23      0.90          1
1173.25
  Pipe_53           CIRCULAR                 0.90      0.64      0.23      0.90          1
701.13
  Pipe_76           CIRCULAR                 0.30      0.07      0.07      0.30          1
96.45
  Pipe_8            CIRCULAR                 1.35      1.43      0.34      1.35          1
2729.02
  Pipe_9            CIRCULAR                 1.35      1.43      0.34      1.35          1
2668.87


  ****************
  Transect Summary
  ****************

  Transect 24mROW
  Area:
              0.0004      0.0016      0.0035      0.0062      0.0097
              0.0140      0.0191      0.0250      0.0316      0.0390
              0.0472      0.0561      0.0659      0.0764      0.0877
              0.0998      0.1127      0.1263      0.1407      0.1560
              0.1719      0.1888      0.2067      0.2258      0.2457
              0.2664      0.2879      0.3102      0.3333      0.3572
              0.3818      0.4072      0.4335      0.4605      0.4883
              0.5169      0.5463      0.5764      0.6074      0.6392
              0.6717      0.7050      0.7391      0.7740      0.8097
              0.8462      0.8835      0.9215      0.9604      1.0000
  Hrad:
              0.0190      0.0380      0.0570      0.0760      0.0949
              0.1139      0.1329      0.1519      0.1709      0.1899
              0.2089      0.2279      0.2469      0.2659      0.2848
              0.3038      0.3228      0.3418      0.3608      0.3798
              0.3988      0.4176      0.4354      0.4604      0.4943
              0.5264      0.5568      0.5857      0.6131      0.6393
              0.6642      0.6881      0.7109      0.7329      0.7539
              0.7742      0.7937      0.8126      0.8308      0.8485
              0.8656      0.8821      0.8982      0.9139      0.9291
              0.9440      0.9585      0.9726      0.9865      1.0000
  Width:
              0.0195      0.0390      0.0584      0.0779      0.0974
              0.1169      0.1364      0.1559      0.1753      0.1948
              0.2143      0.2338      0.2533      0.2727      0.2922
              0.3117      0.3312      0.3507      0.3701      0.3896
              0.4091      0.4340      0.4629      0.4879      0.5076
              0.5273      0.5470      0.5667      0.5864      0.6061
              0.6258      0.6455      0.6652      0.6849      0.7046
              0.7242      0.7439      0.7636      0.7833      0.8030
```

```
            0.8227      0.8424      0.8621      0.8818      0.9015
            0.9212      0.9409      0.9606      0.9803      1.0000

Transect 24mROW_OS
Area:
            0.0004      0.0015      0.0035      0.0062      0.0096
            0.0139      0.0189      0.0247      0.0312      0.0385
            0.0466      0.0555      0.0651      0.0755      0.0867
            0.0987      0.1114      0.1249      0.1391      0.1542
            0.1700      0.1867      0.2048      0.2244      0.2449
            0.2661      0.2881      0.3108      0.3342      0.3585
            0.3834      0.4091      0.4356      0.4628      0.4908
            0.5195      0.5489      0.5791      0.6101      0.6418
            0.6742      0.7074      0.7414      0.7761      0.8115
            0.8477      0.8847      0.9224      0.9608      1.0000
Hrad:
            0.0191      0.0383      0.0574      0.0765      0.0957
            0.1148      0.1339      0.1531      0.1722      0.1913
            0.2104      0.2296      0.2487      0.2678      0.2870
            0.3061      0.3252      0.3444      0.3635      0.3826
            0.4018      0.4205      0.4373      0.4605      0.4929
            0.5237      0.5530      0.5810      0.6077      0.6334
            0.6580      0.6816      0.7043      0.7262      0.7474
            0.7678      0.7875      0.8067      0.8252      0.8432
            0.8607      0.8778      0.8944      0.9105      0.9263
            0.9417      0.9567      0.9715      0.9859      1.0000
Width:
            0.0195      0.0390      0.0584      0.0779      0.0974
            0.1169      0.1364      0.1559      0.1753      0.1948
            0.2143      0.2338      0.2533      0.2728      0.2922
            0.3117      0.3312      0.3507      0.3702      0.3897
            0.4091      0.4394      0.4778      0.5078      0.5268
            0.5457      0.5646      0.5836      0.6025      0.6214
            0.6403      0.6593      0.6782      0.6971      0.7161
            0.7350      0.7539      0.7729      0.7918      0.8107
            0.8296      0.8486      0.8675      0.8864      0.9054
            0.9243      0.9432      0.9621      0.9811      1.0000


*********************************************************
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
Starting Date ............ 11/23/2016 00:00:00
Ending Date .............. 11/23/2016 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
```

```
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 1.00 sec
Variable Time Step ....... NO
Maximum Trials ........... 8
Number of Threads ........ 8
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.467        71.665
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.111        17.028
Surface Runoff ...........         0.350        53.682
Final Storage ............         0.007         1.018
Continuity Error (%) .....        -0.088


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.350         3.501
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         3.996        39.958
External Outflow .........         4.301        43.012
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 ......         0.045         0.455
Continuity Error (%) .....        -0.019


*************************
Highest Continuity Errors
*************************
Node 201 (7.09%)
Node 104A-1 (-6.01%)
Node 202 (4.56%)
Node 104A (2.54%)
Node 204A (-1.42%)


********************************
Highest Flow Instability Indexes
********************************
Link OL1 (35)
Link DITCH (1)


*************************
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 :     2.01
Percent Not Converging      :     0.05
```

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
BLDG_H	71.66	0.00	0.00	0.00	70.14	0.46	323.24	0.979
BLDG_J	71.66	0.00	0.00	0.00	70.16	0.04	27.64	0.979
BLDG_K	71.66	0.00	0.00	0.00	70.15	0.04	28.47	0.979
BLDG_L	71.66	0.00	0.00	0.00	70.19	0.04	30.98	0.979
BLDG_M	71.66	0.00	0.00	0.00	70.18	0.06	43.77	0.979
BLDG_N	71.66	0.00	0.00	0.00	70.17	0.03	18.68	0.979
C100A	71.66	0.00	0.00	10.68	59.91	0.08	61.04	0.836
C101A	71.66	0.00	0.00	10.06	60.50	0.10	81.21	0.844
C102A	71.66	0.00	0.00	10.07	60.49	0.11	83.24	0.844
C103A	71.66	0.00	0.00	10.07	60.49	0.10	78.37	0.844
C104A	71.66	0.00	0.00	10.71	59.86	0.13	99.20	0.835
C105A	71.66	0.00	0.00	16.50	54.27	0.24	202.38	0.757
L106A	71.66	0.00	0.00	0.00	70.21	0.02	14.06	0.980
L106B	71.66	0.00	0.00	0.00	70.21	0.02	11.37	0.980
L107A	71.66	0.00	0.00	0.00	70.21	0.02	11.38	0.980
L107B	71.66	0.00	0.00	0.00	70.21	0.10	71.49	0.980
L203A	71.66	0.00	0.00	0.00	70.14	0.21	148.30	0.979
L203B	71.66	0.00	0.00	0.00	70.21	0.05	32.68	0.980
L203C	71.66	0.00	0.00	0.00	70.19	0.04	24.93	0.979
L204A	71.66	0.00	0.00	0.00	70.14	0.22	158.04	0.979
L204B	71.66	0.00	0.00	0.00	70.14	0.26	184.34	0.979
L205A	71.66	0.00	0.00	5.70	64.65	0.24	180.16	0.902
L207A	71.66	0.00	0.00	26.17	44.88			

```
0.07    56.27   0.626
  PHASE_2                      71.66        0.00        0.00        37.21        34.10
0.74   432.91   0.476
  U100A                        71.66        0.00        0.00        30.85        40.35
0.01     8.26   0.563
  U100B                        71.66        0.00        0.00        31.93        39.29
0.03    22.27   0.548
  U100C                        71.66        0.00        0.00        31.98        39.23
0.05    34.86   0.547
```

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days	Time of Max Occurrence hr:min	Reported Max Depth Meters
100	JUNCTION	1.04	1.09	82.82	0	01:02	1.09
101	JUNCTION	1.10	1.15	83.09	0	01:02	1.15
102	JUNCTION	1.12	1.17	83.41	0	01:01	1.17
103	JUNCTION	1.63	1.71	84.36	0	01:01	1.71
104	JUNCTION	2.06	2.16	84.50	0	01:00	2.16
105	JUNCTION	0.38	0.50	84.95	0	01:00	0.50
106	JUNCTION	0.37	0.47	85.66	0	01:00	0.47
106A	JUNCTION	0.53	0.67	87.06	0	01:00	0.67
107	JUNCTION	0.31	0.44	86.87	0	00:53	0.44
201	JUNCTION	1.25	1.64	86.38	0	02:20	1.64
201CB	JUNCTION	0.61	0.70	86.60	0	01:03	0.70
202	JUNCTION	0.83	1.18	86.38	0	02:19	1.17
203	JUNCTION	1.08	1.44	86.39	0	02:17	1.44
204	JUNCTION	0.43	0.56	86.52	0	01:00	0.56
206	JUNCTION	0.33	0.51	87.21	0	01:00	0.51
207	JUNCTION	0.32	0.50	87.50	0	01:00	0.50
207A	JUNCTION	0.59	1.06	87.95	0	01:00	1.05
208	JUNCTION	0.30	0.33	87.31	0	01:22	0.33
STC	JUNCTION	0.46	0.51	84.92	0	02:18	0.51
OF-MJ	OUTFALL	0.00	0.04	87.91	0	01:00	0.04
OF-MN	OUTFALL	0.74	0.79	82.78	0	01:02	0.79
U100A-OF	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
U100B-OF	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
U100C-OF	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
100A	STORAGE	0.15	1.84	88.09	0	01:00	1.84
100A-1	STORAGE	0.00	0.00	88.56	0	00:00	0.00
101A	STORAGE	0.39	2.00	88.48	0	01:10	2.00
101A-1	STORAGE	0.00	0.00	88.67	0	00:00	0.00
102A	STORAGE	0.48	2.01	88.57	0	01:21	2.01
102A-1	STORAGE	0.00	0.03	88.72	0	01:13	0.03
103A	STORAGE	0.56	2.06	88.72	0	01:14	2.06
103A-1	STORAGE	0.00	0.05	88.89	0	01:04	0.05
104A	STORAGE	0.63	2.08	88.89	0	01:03	2.08
104A-1	STORAGE	0.01	0.08	89.00	0	01:00	0.08
105A	STORAGE	0.27	2.57	89.01	0	01:00	2.57
107A	STORAGE	0.15	2.01	89.26	0	00:52	2.01
203A	STORAGE	1.17	2.06	89.36	0	01:25	2.06
203B	STORAGE	0.18	1.96	89.26	0	01:00	1.96
203C	STORAGE	0.17	2.41	88.91	0	01:00	2.41
204A	STORAGE	1.31	2.12	89.42	0	01:20	2.12
204B	STORAGE	1.59	2.08	89.38	0	01:41	2.08
205	STORAGE	1.60	2.93	89.42	0	01:10	2.93
BLDG_H-S	STORAGE	0.10	0.15	103.15	0	01:32	0.15

BLDG_J-S	STORAGE	0.06	0.13	103.13	0	01:21	0.13
BLDG_K-S	STORAGE	0.08	0.15	103.15	0	01:30	0.15
BLDG_L-S	STORAGE	0.09	0.15	103.15	0	01:31	0.15
BLDG_M-S	STORAGE	0.08	0.15	103.15	0	01:22	0.15
BLDG_N-S	STORAGE	0.07	0.14	103.14	0	01:21	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
100	JUNCTION	0.00	2189.13	0	01:02	0	42.9	0.012
101	JUNCTION	91.30	2169.68	0	01:02	1.97	42.9	0.173
102	JUNCTION	1500.90	1976.78	0	01:01	32.4	39.1	0.232
103	JUNCTION	43.50	455.93	0	01:00	0.94	6.61	0.261
104	JUNCTION	214.24	392.28	0	01:00	4.63	5.55	0.265
105	JUNCTION	0.00	157.67	0	01:00	0	0.778	0.044
106	JUNCTION	0.00	96.02	0	01:00	0	0.591	0.060
106A	JUNCTION	25.44	25.44	0	01:00	0.036	0.036	1.781
107	JUNCTION	11.38	43.83	0	00:53	0.0161	0.0981	0.356
201	JUNCTION	432.91	526.00	0	01:00	0.745	2.22	7.633
201CB	JUNCTION	0.00	24.99	0	01:02	0	0.141	0.739
202	JUNCTION	0.00	351.70	0	00:58	0	1.55	4.773
203	JUNCTION	0.00	144.47	0	01:01	0	1.15	0.255
204	JUNCTION	0.00	111.43	0	01:00	0	0.872	0.153
206	JUNCTION	0.00	61.41	0	01:00	0	0.151	0.234
207	JUNCTION	0.00	59.49	0	01:00	0	0.111	0.317
207A	JUNCTION	56.27	56.27	0	01:00	0.0727	0.0727	0.981
208	JUNCTION	0.00	2.35	0	01:21	0	0.0264	1.344
STC	JUNCTION	0.00	102.41	0	02:20	0	1.81	0.126

OF-MJ	OUTFALL	0.00	41.60	0	01:00	0	0.0209	0.000
OF-MN	OUTFALL	0.00	2189.14	0	01:02	0	42.9	0.000
U100A-OF	OUTFALL	8.26	8.26	0	01:00	0.0106	0.0106	0.000
U100B-OF	OUTFALL	22.27	22.27	0	01:00	0.0307	0.0307	0.000
U100C-OF	OUTFALL	34.86	34.86	0	01:00	0.0484	0.0484	0.000
100A	STORAGE	61.04	61.04	0	01:00	0.0766	0.0766	-0.076
100A-1	STORAGE	0.00	0.00	0	00:00	0	0	0.000 ltr
101A	STORAGE	81.21	81.21	0	01:00	0.103	0.103	0.015
101A-1	STORAGE	0.00	0.00	0	00:00	0	0	0.000 ltr
102A	STORAGE	83.24	83.24	0	01:00	0.105	0.12	-0.273
102A-1	STORAGE	0.00	32.24	0	01:06	0	0.0167	4.247
103A	STORAGE	78.37	92.73	0	01:03	0.0993	0.151	0.250
103A-1	STORAGE	0.00	72.76	0	01:02	0	0.0511	-0.854
104A	STORAGE	99.20	264.15	0	01:00	0.125	0.206	2.605
104A-1	STORAGE	0.00	174.65	0	01:00	0	0.0783	-5.667
105A	STORAGE	202.38	202.38	0	01:00	0.244	0.246	-0.195
107A	STORAGE	71.49	71.49	0	01:00	0.101	0.101	-0.214
203A	STORAGE	148.30	148.30	0	01:00	0.21	0.21	0.004
203B	STORAGE	32.68	32.68	0	01:00	0.0463	0.0463	0.017
203C	STORAGE	24.93	24.93	0	01:00	0.0353	0.0354	0.083
204A	STORAGE	158.04	158.04	0	01:00	0.224	0.249	-1.402
204B	STORAGE	184.34	184.34	0	01:00	0.261	0.281	0.001
205	STORAGE	180.16	180.16	0	01:00	0.242	0.244	3.885
BLDG_H-S	STORAGE	323.24	323.24	0	01:00	0.457	0.457	0.001
BLDG_J-S	STORAGE	27.64	27.64	0	01:00	0.0391	0.0391	0.001
BLDG_K-S	STORAGE	28.47	28.47	0	01:00	0.0403	0.0403	0.001
BLDG_L-S	STORAGE	30.98	30.98	0	01:00	0.0438	0.0438	0.001
BLDG_M-S	STORAGE	43.77	43.77	0	01:00	0.0619	0.0619	0.001
BLDG_N-S	STORAGE	18.68	18.68	0	01:00	0.0264	0.0264	0.001

****
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
207A	JUNCTION	0.12	0.256	2.235

****
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
100A	0.000	0	0	0	0.000	0	0 00:00	60.98
100A-1	0.000	0	0	0	0.000	0	0 00:00	0.00
101A	0.000	0	0	0	0.000	0	0 00:00	20.22
101A-1	0.000	0	0	0	0.000	0	0 00:00	0.00
102A	0.000	0	0	0	0.000	0	0 00:00	20.29
102A-1	0.000	0	0	0	0.000	0	0 00:00	15.77
103A	0.000	0	0	0	0.000	0	0 00:00	52.68
103A-1	0.000	0	0	0	0.000	0	0 00:00	68.02
104A	0.000	0	0	0	0.000	0	0 00:00	93.41
104A-1	0.000	0	0	0	0.000	0	0 00:00	166.50
105A	0.000	0	0	0	0.000	0	0 00:00	197.47
107A	0.000	3	0	0	0.002	100	0 00:52	72.80
203A	0.038	24	0	0	0.110	70	0 01:25	16.33
203B	0.000	4	0	0	0.007	100	0 01:00	32.68
203C	0.000	1	0	0	0.003	51	0 01:00	17.45

204A	0.046	39	0	0	0.117	100	0	01:11	33.34
204B	0.076	39	0	0	0.168	86	0	01:41	16.44
205	0.029	32	0	0	0.092	100	0	01:01	53.42
BLDG_H-S	0.133	8	0	0	0.282	16	0	01:32	29.02
BLDG_J-S	0.007	4	0	0	0.022	11	0	01:21	3.49
BLDG_K-S	0.010	6	0	0	0.024	14	0	01:30	2.82
BLDG_L-S	0.012	7	0	0	0.026	16	0	01:31	2.84
BLDG_M-S	0.013	5	0	0	0.035	15	0	01:22	5.03
BLDG_N-S	0.005	4	0	0	0.015	11	0	01:21	2.35

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
OF-MJ	3.80	25.51	41.60	0.021
OF-MN	99.85	1989.26	2189.14	42.901
U100A-OF	46.93	1.04	8.26	0.011
U100B-OF	48.91	2.90	22.27	0.031
U100C-OF	50.01	4.47	34.86	0.048
System	49.90	2023.19	2289.80	43.012

****
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
C1	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
C10	CONDUIT	16.74	0	01:00	0.81	0.01	0.09
C11	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
C12	CHANNEL	0.00	0	00:00	0.00	0.00	0.05
C13	CHANNEL	41.60	0	01:00	0.99	0.00	0.10
C14	CHANNEL	135.77	0	01:00	0.21	0.02	0.46
C15	CHANNEL	72.76	0	01:02	0.11	0.01	0.48
C16	CHANNEL	32.24	0	01:06	0.07	0.00	0.42
C17	CHANNEL	0.00	0	00:00	0.00	0.00	0.30
C18	CHANNEL	0.00	0	00:00	0.00	0.00	0.28
C2	CHANNEL	166.50	0	01:00	0.22	0.02	0.50
C3	CHANNEL	40.37	0	00:54	1.97	0.01	0.19
C4	CHANNEL	68.02	0	01:04	0.11	0.01	0.43
C5	CHANNEL	15.77	0	01:13	0.12	0.00	0.34
C6	CHANNEL	0.00	0	00:00	0.00	0.00	0.28
C7	CONDUIT	34.90	0	01:10	0.10	1.11	0.37

C8	CONDUIT	16.76	0	01:21	0.08	0.53	0.22
C9	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
DITCH	CONDUIT	318.03	0	01:43	0.27	0.00	0.47
Pipe_1	CONDUIT	2189.14	0	01:02	2.53	0.64	0.58
Pipe_10	CONDUIT	455.71	0	01:01	1.65	0.44	0.45
Pipe_11	CONDUIT	392.25	0	01:00	1.30	0.56	0.48
Pipe_12	CONDUIT	141.34	0	01:00	1.56	0.43	1.00
Pipe_13	CONDUIT	110.18	0	01:01	1.06	0.40	0.40
Pipe_14	CONDUIT	60.47	0	01:00	1.41	1.02	0.82
Pipe_16	CONDUIT	58.75	0	01:00	1.40	0.99	0.80
Pipe_19	CONDUIT	2.35	0	01:22	0.59	0.04	0.14
Pipe_23	CONDUIT	25.44	0	01:00	1.16	0.78	0.66
Pipe_25	CONDUIT	43.83	0	00:53	1.34	0.45	0.47
Pipe_41	CONDUIT	56.26	0	01:00	1.81	1.72	0.97
Pipe_49	CONDUIT	157.48	0	01:00	1.45	0.11	0.23
Pipe_50	CONDUIT	95.98	0	01:00	1.11	0.08	0.19
Pipe_53	CONDUIT	102.43	0	02:20	1.02	0.15	0.21
Pipe_76	CONDUIT	24.99	0	01:03	1.15	0.26	0.61
Pipe_8	CONDUIT	2169.86	0	01:02	2.40	0.80	0.60
Pipe_9	CONDUIT	1976.50	0	01:01	2.09	0.74	0.63
105A-O	ORIFICE	61.70	0	01:00			1.00
107-O	ORIFICE	32.48	0	00:52			1.00
201-O	ORIFICE	102.41	0	02:20			1.00
203A-O	ORIFICE	16.33	0	01:25			1.00
203B-O	ORIFICE	15.94	0	01:00			1.00
204A-O	ORIFICE	16.58	0	01:20			1.00
204B-O	ORIFICE	16.44	0	01:41			1.00
205-O	ORIFICE	18.52	0	01:10			1.00
OL1	ORIFICE	17.45	0	01:00			1.00
100A-O	DUMMY	9.69	0	01:00			
100A-O1	DUMMY	9.69	0	01:00			
101A-O	DUMMY	10.11	0	01:10			
101A-O1	DUMMY	10.11	0	01:10			
102A-O	DUMMY	10.14	0	01:21			
102A-O1	DUMMY	10.14	0	01:21			
103A-O	DUMMY	10.28	0	01:14			
103A-O1	DUMMY	10.28	0	01:14			
104A-O	DUMMY	10.33	0	01:03			
104A-O1	DUMMY	10.33	0	01:03			
BLDG_H_OUT	DUMMY	29.02	0	01:12			
BLDG_J_OUT	DUMMY	3.49	0	01:21			
BLDG_K_OUT	DUMMY	2.82	0	01:30			
BLDG_L_OUT	DUMMY	2.84	0	01:14			
BLDG_M_OUT	DUMMY	5.03	0	01:22			
BLDG_N_OUT	DUMMY	2.35	0	01:21			

```
  ***************************
  Flow Classification Summary
  ***************************


-------------------------------------------------------------------------------------
-
                      Adjusted    ---------- Fraction of Time in Flow Class
----------
                       /Actual         Up    Down   Sub    Sup    Up     Down   Norm
Inlet
  Conduit               Length    Dry   Dry    Dry    Crit   Crit   Crit   Crit   Ltd
Ctrl

-------------------------------------------------------------------------------------
-
```

C1	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C10	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
C11	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C12	1.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C13	1.00	0.96	0.00	0.00	0.00	0.04	0.00	0.00	0.01	0.00
C14	1.00	0.14	0.00	0.00	0.07	0.00	0.00	0.78	0.02	0.00
C15	1.00	0.14	0.02	0.00	0.27	0.00	0.00	0.57	0.19	0.00
C16	1.00	0.14	0.04	0.00	0.22	0.00	0.00	0.60	0.15	0.00
C17	1.00	0.77	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C18	1.00	0.82	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2	1.00	0.14	0.00	0.00	0.29	0.00	0.00	0.57	0.29	0.00
C3	1.00	0.15	0.83	0.00	0.01	0.02	0.00	0.00	0.85	0.00
C4	1.00	0.14	0.02	0.00	0.24	0.00	0.00	0.60	0.24	0.00
C5	1.00	0.14	0.04	0.00	0.19	0.00	0.00	0.63	0.19	0.00
C6	1.00	0.82	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C7	1.00	0.82	0.00	0.00	0.12	0.00	0.03	0.03	0.00	0.00
C8	1.00	0.84	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00
C9	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DITCH	1.00	0.04	0.01	0.00	0.94	0.00	0.00	0.00	0.08	0.00
Pipe_1	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.01	0.00
Pipe_10	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_11	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.01	0.00	0.00
Pipe_12	1.00	0.05	0.00	0.00	0.86	0.09	0.00	0.00	0.00	0.00
Pipe_13	1.00	0.05	0.00	0.00	0.44	0.00	0.00	0.51	0.33	0.00
Pipe_14	1.00	0.08	0.00	0.00	0.00	0.00	0.00	0.92	0.00	0.00
Pipe_16	1.00	0.07	0.00	0.00	0.00	0.00	0.00	0.93	0.00	0.00
Pipe_19	1.00	0.08	0.00	0.00	0.00	0.00	0.00	0.92	0.00	0.00
Pipe_23	1.00	0.07	0.00	0.00	0.00	0.00	0.00	0.93	0.00	0.00
Pipe_25	1.00	0.05	0.00	0.00	0.00	0.00	0.00	0.95	0.00	0.00
Pipe_41	1.00	0.07	0.00	0.00	0.00	0.00	0.00	0.93	0.00	0.00
Pipe_49	1.00	0.00	0.05	0.00	0.03	0.00	0.00	0.92	0.03	0.00
Pipe_50	1.00	0.05	0.00	0.00	0.00	0.00	0.00	0.95	0.00	

```
0.00
  Pipe_53              1.00   0.06  0.00  0.00  0.00  0.00  0.00  0.94  0.00
0.00
  Pipe_76              1.00   0.06  0.00  0.00  0.66  0.01  0.00  0.27  0.67
0.00
  Pipe_8               1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00
0.00
  Pipe_9               1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  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
C7	0.01	0.01	0.01	0.06	0.01
Pipe_12	4.23	4.23	4.37	0.01	0.01
Pipe_14	0.01	0.01	0.01	0.01	0.01
Pipe_41	0.01	0.12	0.01	0.16	0.01
Pipe_76	0.01	0.01	2.73	0.01	0.01

Analysis begun on: Fri Oct 20 13:11:18 2017
Analysis ended on: Fri Oct 20 13:11:19 2017
Total elapsed time: 00:00:01

C.4 OIL/GRIT SEPARATOR SIZING

Stormceptor Design Summary

PCSWMM for Stormceptor

Project Information

Date	30/11/2016
Project Name	Orleans II Development
Project Number	160401242
Location	Ottawa, ON

Designer Information

Company	Stantec Consulting Ltd.
Contact	Dustin Thiffault, P.Eng.

Notes

N/A

Drainage Area

Total Area (ha)	4.269
Imperviousness (%)	97

The Stormceptor System model STC 750 achieves the water quality objective removing 85% TSS for a OK-110 (sand only) particle size distribution.

Rainfall

Name	OTTAWA MACDONALD-CARTIER INT'L A
State	ON
ID	6000
Years of Records	1967 to 2003
Latitude	45°19'N
Longitude	75°40'W

Water Quality Objective

TSS Removal (%)	80

Upstream Storage

Storage (ha-m)	Discharge (L/s)
0.000	00.000
0.130	97.370

Stormceptor Sizing Summary

Stormceptor Model	**TSS Removal %**
STC 300	66
STC 750	**85**
STC 1000	86
STC 1500	86
STC 2000	89
STC 3000	90
STC 4000	92
STC 5000	92
STC 6000	94
STC 9000	96
STC 10000	96
STC 14000	97

Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

OK-110 (sand only)

Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s
1	0	2.65	0.0004					
53	3	2.65	0.0025					
75	15	2.65	0.0040					
88	25	2.65	0.0055					
106	40.8	2.65	0.0077					
125	15	2.65	0.0105					
150	1	2.65	0.0145					

Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor version 1.0
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 300 is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 750 to STC 6000 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 300	STC 750 to STC 6000	STC 9000 to STC 14000
Single inlet pipe	75 mm	25 mm	75 mm
Multiple inlet pipes	75 mm	75 mm	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Imbrium Systems Inc., 1-800-565-4801.

C.5 BACKGROUND REPORT EXCERPTS (STORM DRAINAGE)

Line/Vanguard Intersection (that controls the flow from the N2 pond and the Tenth Line road interconnect).

The release rate from the BCIP was determined by providing a 5 year level of service for the road corridors and controlling the flow from the development parcels. Accounting for the 10 year flow contribution from the Innes and Mer Bleue road corridors and flow contributions from the remainder of the tributary area, it was found that new developments within the BCIP would have to be controlled to 50L/s/ha.

Tributary areas and peak flow contributions to the Wildflower Drive trunk sewer at Innes Road are summarized in **Table 3-1**.

TABLE 3-1
Tributary Areas and Peak Flow Contributions to the Wildflower Trunk Sewer at Innes Road – Major Flows

Tributary Area	Area (ha)	Controlled Flow Rate	
		L/s/ha	Total (L/s)
The BCIP development: • Future Lots (Phases 1 & 2) • Roads (Exist & Future)	 63.8 5.19	 50 100	 3190 519
Innes Road	3.7	235*	869.5
Mer Bleue Road	0.86	111	95.5
Existing Urban Block (south west corner of Innes and Mer Bleue Roads)	1.20	111	133.2
Existing Urban area north of Innes Road west of Prestwick Drive	2.14	150	321
The outflow from N2 SWM pond and Tenth Line Road storm sewer at Vanguard Drive	N/A	N/A	820
Total	76.89		5948

The total peak flow contribution to the Wildflower storm trunk at Innes Road of 5948L/s, shown in **Table 3-1**, represents the 100 year storm condition. For a 5 year storm, the peak flow contribution as shown in the Rational Method calculation provided in **Appendix G** is 5663L/s, which is less than the allowable flow of 5948L/s.

Areas and flow contributions to the BCIP – Innes Road trunk sewer between Tenth Line Road and Wildflower Drive are summarized in **Table 3-2**.

The required BCIP/Innes Road storm trunk size is a 1200mm diameter at Tenth Line Road and increases to a 1650mm on Innes Road at the outlet to Wildflower Drive trunk sewer. The sewer depth varies from 6.0m at Tenth Line Road to 7.2m at Wildflower Drive. The routing of the storm sewers through the BCIP for the preferred concept plan is shown on **Figure 3-3**.

TABLE 3-2
Tributary Areas and Peak Flow Contributions to the BCIP

Tributary Area	Area (ha)	Controlled Flow Rate L/s/ha	Controlled Flow Rate Total (L/s)
The BCIP development: • Future Lots (Phase 1) Including Loblaws Site • Roads (Exist & Future Phase 1)	 25.7 1.74	 50 100	 1285 174
Innes Road Prestwick Dr. to Wildflower Dr.	1.88	235	441.8
Existing Urban area north of Innes Road west of Prestwick Drive	2.14	150	321
The outflow from N2 SWM pond and Tenth Line Road storm sewer at Vanguard Drive	N/A	N/A	820
Total	**31.46**		**3042**

3.1.2.4 Major System

The developments within the BCIP are required to provide onsite storage to reduce the 100 year storm flow to 50L/s/ha. The onsite storage volume requirement for the 100 year storm is 310m^3/ha based on the release rate of 50L/s/ha and an imperviousness ratio of 0.7.

The roads within the BCIP are to be designed to maximize the amount of storage that can be provided at sag points to a maximum of 130m^3/ha. The effective road slopes should be designed to allow major system flow to overflow towards Innes Road or Mer Bleue Road. Inlet control devices are required on catch basins to control sewer flows to the 5 year level of 100L/s/ha. Given that the major system flow from the BCIP area cannot flow across Innes Road, it is proposed to store excess volume in the ditches south of Innes Road and east of Mer Bleue Road. A DDSWMM assessment of the BCIP roadway drainage system was undertaken and it was found that approximately 1330m^3 of excess runoff would be generated during the July 1st, 1979 storm event. If 130m^3/ha of storage is provided in the sag points, 900m^3 of storage will be provided along the 6.93ha of internal roads. The remaining 430m^3 will therefore need to be stored in the ditches south of Innes Road.

The City's current design guidelines, published in November 2004, dictate that the minor system within arterial roads be designed to handle the 10 year peak flow and the flow from residential developments to the minor system be restricted to 85L/s/ha. (Refer to **Appendix H** for a copy of the technical memo explaining the basis for the 85L/s/ha.) As the BCIP storm flows were approved prior to the release of the November 2004 guidelines, the criteria used in sizing the collection system do not match the current guidelines. In addition, as it is intended to upgrade

Mer Bleue Road in 2008, the detailed design of the minor system along Mer Bleue must account for the proposed upgrade.

3.1.2.5 Downstream Impacts

3.1.2.5.1 Cardinal Farm Developments

The Hydraulic Gradeline (HGL) elevations in the Wildflower Drive trunk, which services the Cardinal Farm development, were calculated to determine the impact of major storm flow contributions from the sewershed south of and including Innes Road. The allowable release rates in **Table 3-1** were applied in calculating the flows and HGL elevations in XPSWMM. Peak flows from the Cardinal Farm development, which is tributary to the sewer system, were increased by 20 % for the 5 year event to account for the increased catch basin capture rates during the 100 year storm.

The results of the HGL analysis indicated there is no significant sewer surcharge during the 100 year storm. The maximum flow contribution to the Wildflower trunk from the catchment area south of and including Innes Road is 5.9m^3/s (major storm), which is close to the 5 year allowable flow of 6.16m^3/s. (Refer to **Appendix I** for modeling details.)

3.1.2.5.2 Bilberry Creek

The existing SWM pond at Avenue Des Epinettes, constructed in 1986 was sized to control the flows from the BCIP and the Cardinal Farm development, as well as address erosion and flooding concerns in Bilberry Creek. Therefore, no negative impacts to Bilberry Creek are expected.

Similar to the existing properties within Phase 1 of the BCIP, water quality control measures are to be implemented as part of the City's development site plan control process. It is also of note that the N2 SWM pond provides additional treatment to allow areas downstream of the pond to be released untreated. Therefore, water quality control measures for the section of Innes Road draining to Wildflower and Prestwick trunks are not required.

3.1.2.6 Cost Apportionment – BCIP/Innes Road Storm Trunk

The cost sharing analysis for the BCIP / Innes Road trunk sewer was completed to delineate the costs associated between both the Innes Road and BCIP drainage catchments. The cost sharing considers not only the areas draining directly to the BCIP / Innes Road trunk but also the lands that were allocated capacity in the Prestwick Drive trunk, with the construction of the BCIP / Innes Road trunk. The cost sharing is assessed based on the peak flow contribution from the tributary areas considering the allowable flow to the Prestwick Drive trunk and the total flow from the areas directly tributary to the BCIP – Innes Road trunk sewer. The allowable flow to the Prestwick Drive trunk sewer is 2.6 m^3/s and the total flow contribution to the BCIP – Innes Road trunk sewer is 3.65 m^3/s. Flow contributions from the Innes Road (including Tenth Line Road) and the existing and proposed developments are summarized in **Table 3-3**.

4.0 Storm Drainage

4.1 STORM SEWER CRITERIA

Criteria were established by combining current design practices outlined by the City of Ottawa guidelines (2004) and the supporting servicing studies for the Pharand Lands and Bilberry Creek industrial Park (BCIP). Where the criteria conflicted, the BCIP & Pharand Lands report criteria were given precedence. The following summarizes the criteria, with the source of each criterion indicated in italics:

General

- Use of the dual drainage principle *(City of Ottawa)*
- Wherever feasible and practical, site-level measures should be used to reduce and control the volume and rate of runoff *(City of Ottawa)*
- Assess impact of 5 and 100 year storm (using 3-hour Chicago Storm distribution and City of Ottawa IDF parameters) (*City of Ottawa, Pharand/BCIP Reports*)

Storm Sewer & Inlet Controls

- Size storm sewers to convey 5 year storm event under free-flow conditions using 2004 City of Ottawa I-D-F parameters *(City of Ottawa)*
- 100 year Hydraulic Grade Line (HGL) analysis to be conducted using the boundary condition at outlet of 81.342 m (from BCIP report, Appendix I for node W19) *(Pharand/BCIP Reports)*
- Overall inlet rate to sewer to be restricted to 50 L/s/ha *(Pharand/BCIP Reports)*
- Sewer inlet rate for roads within the BCIP to be restricted to 100 L/s/ha *(Pharand/BCIP Reports)*

Surface Storage & Overland Flow

- No overland flow is allowed from internal sites, however overland flow is expected to occur along roadways
- Maximum 100 year ponding depth of 0.30 m *(City of Ottawa)*
- Sites to provide minimum storage of 200 m^3/ha or sufficient storage to contain 100 year storm on-site, whichever of the two is greater (*Pharand/BCIP Reports*)
- Road storage to be maximized where possible to provide up to 130 m^3/ha of storage (*Pharand/BCIP Reports*)

- Standing water depths at road sags not to cause surface flooding in any building or structure *(City of Ottawa)*
- Maximum ponding spill point elevation to be at least 0.30m below adjacent at-units grades *(City of Ottawa)*
- Subdrains required in swales where longitudinal gradient is less than 1.5% *(City of Ottawa)*
- Provide adequate emergency overflow conveyance off-site (*City of Ottawa*)

4.2 STORMWATER MANAGEMENT

The following sections describe the stormwater management (SWM) design for the Pharand Lands Development in the context of the background documents and governing criteria.

4.2.1 Proposed Conditions

The proposed development will consist of commercial buildings complete with associated transportation and servicing infrastructure. The various commercial blocks are bisected by the proposed internal roadways which connect to the intersection of Wildflower Drive and Innes Road.

The overall drainage area to the proposed outlet sewer is 41.2 ha: Future Development Lands (16.8 ha), Area Tributary to Proposed Dry Pond (9.6 ha), Development block STOR168 (4.3 ha), Remaining Site Area (10.4 ha). At the required rate of 50 L/s/ha, the peak allowable rate at the outlet is 2,060 L/s.

Future development areas (future blocks) have been considered for the purposes of this stormwater management analysis. The previous Stantec Pharand Lands report quantified this future area to the South as 15.2 ha, however using more detailed CAD areas it has been found that this area is actually 16.83 ha in size. For location and extent of this future development block, refer to excerpts of the previous Stantec report in **Appendix D.1**. The future development block will be serviced through the storm sewer trunk at upstream manhole MH200.

It is expected that development designs for these future blocks will be submitted to the City of Ottawa under separate applications. Stormwater Management criteria for the future blocks remain the same as in the BCIP and Pharand lands reports: sites are to provide minimum 200 m^3/ha of active storage in the 100 year event or sufficient storage to contain the 100 year storm on-site, whichever of the two criteria is greater. Inflow rates to the minor system are not to exceed 50 L/s/ha. Precise ponding volumes and final ICD sizes should be determined at the detailed design stage.

It is proposed that a portion of the proposed site drain unrestricted to a storm sewer, which is connected by reverse sloped pipe to a dry pond. An orifice will be placed on the sewer at MH110, causing water to back-up into the proposed dry pond. The orifice will not be in-line with the main trunk that runs from the Future Development Lands in the south to the intersection of Innes Road and Wildflower Drive. See **Figure 4.1** below, showing the proposed site subcatchments, with the proposed area which is tributary to the dry pond highlighted in blue.

The previous storm sewer design included conveying a portion of the Vanguard Road stormwater (drainage areas 132 and 139) through the site. At the City's request this design has been modified to convey these flows to the existing manhole in Vanguard Road. Analysis of the existing storm sewer design indicated that the downstream system (existing nodes 15 to 13) has capacity for 1671L/s and the proposed design would result in an actual flow rate of 1591 L/s. Therefore, there is sufficient capacity within the existing system to accommodate the additional flows from Vanguard Road.

Figure 4.1: PCSWMM Model Subcatchments in light green (area in blue is tributary to the proposed dry pond, area = 9.6 ha)

4.2.2 Design Methodology

The design methodology for the SWM component of the development is as follows:

- Restrict inflows to the sewer to a rate of 50 L/s/ha or less for sites via orifices
- Road CBs to be interconnected and controlled with a 100 mm circular diameter orifice per catchbasin pair, except in areas upstream of MH110 (these areas are tributary to the dry pond and should not have inlet restrictors)
- Produce a combined hydrologic/hydraulic model to provide minor system hydrographs and to model the storm sewer system
- Provide a preliminary volume total for the proposed dry pond based on the proposed outline
- Identify criteria and constraints for development blocks

The roadways are designed using the "dual drainage" principle, whereby the minor (pipe) system is designed to convey the peak rate of runoff from the 5 year design storm and runoff from larger events is to be conveyed by both minor (pipe) and major (overland) channels, such as roadways and walkways, safely off site without impacting proposed or existing downstream properties. A separate DDSWMM model was prepared as part of the BCIP report, dealing with major system flows from the internal roadways in the BCIP. Inlet and storage rates in the roadways should meet BCIP criteria; overflows should be directed to Innes Road, where they are to be stored in roadside ditches. See the BCIP report excerpts included in **Appendix D** for more information. Since the inlet rates for roadways are being met (and exceeded) in this analysis, and that an overland flow model for the roadways has been dealt with by others, the overland routes and downstream off-site storage have not been modeled in this analysis.

Solid covers should be installed on all manholes located in ponding areas to limit inflows to the minor system to that of the ICD.

Drawing SD-1 outlines the proposed storm sewer alignment, ICD locations, drainage divides and labels. The major flow from most of the site is contained within each block; right-of-ways are allowed to have major system flow beyond the five year event. Regardless, all areas will be graded to safely convey extreme flows off-site via engineered (overland) channels such as roadways and walkways. The majority of the site is graded to overflow to Innes Road, however some portions in the east will be directed to Vanguard Extension.

4.2.3 Building Storm Service Surcharging

Because the proposed buildings are slab-on-grade and will not have any basements, flooding will not be an issue. However, the City has expressed concerns regarding building storm services that are attached to the sewer which surcharges into the proposed dry pond. We have agreed to perform SWM modeling using several different storms to determine the maximum HGL (excluding the initial wave pulse). The pipe surcharge is due to water accumulating in the dry pond and is not permanent – the dry pond drains down over several hours. Six storm distributions were run at the 100 year return period: 3, 6, and 12 hour Chicago storms, and 6, 12, and 24 hour SCS storms. The HGLs from the 6 hour SCS storm were used to set the minimum storm service inverts for buildings S and A. HGL for the services to buildings S and A were 86.94 m and 87.14 m for building S and building A, respectively. It is therefore proposed that the storm services to these buildings have inverts not lower than these values and that a similar approach be taken for any future buildings proposed at the detailed design stage, unless these buildings are to have underground parking, in which case they will need to be sump pumped. Any parking garages will be fitted with backflow preventers and pumps, as is standard practice in the City of Ottawa. See **Appendix B.4** for the results of the SWM analysis, or the SWM modeling files that have been included on the CD attached to this report.

4.3 HYDROLOGY / HYDRAULICS

A preliminary integrated hydrologic/hydraulic modeling exercise was completed with PCSWMM, accounting for the sites area and future lands to the south.

Surface storage amounts based on the Pharand and BCIP reports were originally 200 m^3/ha for sites, 130 m^3/ha for right-of-ways. Because the criteria in this report is to provide either these above rates or sufficient storage to contain the 100 year storm on-site, these rates were multiplied by three (an arbitrary number). It is intended that if storage greater than 200 m^3/ha occurs, this preliminary overestimate of storage will allow the total quantity of stored volume to be identified. Actual per hectare rates of required storage are reported later in this report.

The following assumptions were applied to the preliminary PCSWMM model:

- Hydrologic parameters as per Ottawa Sewer Design Guidelines, including Horton infiltration, Manning's 'n', and depression storage values
- 3-hour Chicago Storm distribution for 5 & 100 Year Analysis; July 1, 1979 City of Ottawa Historical Storm used to assess impact of major storm
- Imperviousness assumed as 100% for all site areas excluding the proposed pond and vacant strip of land to its north (these areas were assumed to have 0% imperviousness)
- Subcatchment areas and segment lengths defined from conceptual grading.
- Subcatchment width equal to catchment area divided by subcatchment flow length. Site inflows restricted with inlet-control devices (ICDs) as necessary to meet inlet rate criterion.
- Storage amounts over-predicted to ensure capture of total 'actual storage' volume

Drawing SD-1 presents the proposed subcatchments used in the analysis of the proposed development. The preliminary grading plans are also enclosed for review.

For the purposes of this analysis, the Future Development Lands to the south and the development block in storm area ST168 are considered to be self contained. Hydrographs for area ST168 were generated and routed through that site's storage, with a flow restriction at 50 L/s/ha. The Future Development Land to the south was represented by a static constant inflow of 841.6 L/s at node 200 (i.e. 16.833 ha at 50 L/s/ha).

Zurn Flo-Control Roof Drains are proposed for the flat roofs of the buildings on-site. A brief modified rational method analysis was used to calculate the number of drains required for the buildings, see **Appendix B** for the results. The stage versus flow and storage curves calculated in this analysis were input into the PCSWMM model. Water depths on roofs during the 100 year storm do not exceed 75 mm.

The BCIP proposed inlet restriction rate for the roadways is 100 L/s/ha. It was found that for most road catchments, this could be achieved using a 100 mm circular orifice. In order to meet the criterion for some smaller catchments however, an orifice smaller than the minimum allowable City size would be required; this was not considered to be a viable option. For simplification of construction installation, it is proposed to use this ICD size in all interconnected roadway CBs. Any over-contribution of flow has been offset by reducing the flow from the dry pond tributary area.

The list of proposed inlet control devices is presented below in **Table 4.1**.

Table 4.1: Preliminary Inlet Control Device Schedule

Tributary Area IDs	Located in Structure:	Install Type	Orifice Size, Circular Diameter (mm)	Peak Flow Rate (L/s)
Control for areas to pond	110	PLUG	200	216
ST170, ST174, RF181, RF179, RF176, RF177	167 (on u/s inv. to STM170)	FRAME	175	125
ST199	206	PLUG	100	39
ST167	184	PLUG	100	34
ST197	208	PLUG	100	39
ST188	193	PLUG	100	31
ST190	191	PLUG	100	45
ST106B	228	PLUG	100	37
ST106	226	PLUG	100	35
ST165	212	PLUG	100	34
CB203	201	PLUG	95	36
CB215	214	PLUG	95	33

Tributary Area IDs	Located in Structure:	Install Type	Orifice Size, Circular Diameter (mm)	Peak Flow Rate (L/s)
ST230	230	PLUG	75	32
ST109	217	PLUG	75	30
ST106A	225	PLUG	75	18
CB223, CB224, ST219, CB222, RF220	218	PLUG	150	102

Table 4.2 summarizes the subcatchment areas, node outlets, and peak runoff rates for the proposed development during the 100 year, 3-hour Chicago storm, as well as maximum required storage rates. **Appendix B** summarizes the modeling results for the subject area for the 100 year storm.

Table 4.2: PCSWMM Results (100 Year Storm)

Area Group	Name	Area (ha)	Peak Runoff (L/s)	Outlet	Storage Node	Maximum Storage (cu.m)	Orifice Size, Circular Diameter (mm)	Peak Flow Rate (L/s)
ROW	ST106B	0.088	43	228	228	3	100	37
	ST106	0.324	156	226	226	84	100	35
	ST199	0.369	169	206	206	89	100	39
	ST197	0.385	175	208	208	99	100	39
	ST190	0.108	53	191	191	2	100	45
	ST188	0.383	174	193	193	110	100	31
	ST167	0.341	150	184	184	88	100	34
	ST165	0.483	225	212	212	157	100	34
To_Pond	ST154	0.783	366	154	143	2635	0	0
	CB156	0.479	234	156				
	ST151	0.148	73	151				
	ST135A	0.932	441	136				
	ST132	1.912	907	140				
	ST128A	1.793	849	146				
	ST128	0.137	62	128				
	ST123	0.604	272	123				

Area Group	Name	Area (ha)	Peak Runoff (L/s)	Outlet	Storage Node	Maximum Storage (cu.m)	Orifice Size, Circular Diameter (mm)	Peak Flow Rate (L/s)
	ST118	0.375	173	118				
	CB160	0.076	37	160				
	POND	0.549	68	143				
	FREE_1	0.175	47	POND				
	RF150A	0.271	133	STOR150	STOR150	559		
	RF150	0.886	430	STOR150				
	RF114	0.178	88	STOR114	STOR114	87		
Parcels	ST109	0.419	206	217	217	138	75	30
	ST230	0.401	190	230	230	122	75	32
	ST106A	0.325	156	225	225	116	75	18
	RF231	0.030	15	STOR231	STOR231	15	Zurn	1
	RF211	0.419	208	STOR211	STOR211	204	Zurn	16
	RF210	0.046	23	STOR210	STOR210	23	Zurn	2
	RF195	0.289	143	STOR195	STOR195	141	Zurn	11
	CB215	0.782	350	214	214	309	95	33
	CB203	0.996	414	201	201	406	95	36
Future	ST168	4.328	1700	STOR1	STOR1	1546	TBD	216
NW corner of site, controlled at MH174	ST174	1.159	558	172	169	771	0	0
	ST170	0.983	472	170				
	RF181	0.310	154	STOR181	STOR181	151		
	RF179	0.035	17	STOR179	STOR179	17		
	RF177	0.046	23	STOR177	STOR177	23		
	RF176	0.067	33	STOR176	STOR176	33		
NE corner of site, controlled at MH218	RF220	0.237	117	STOR220	STOR220	115	0	0
	ST219	0.234	114	219	218	454		
	CB224	0.198	98	224				
	CB223	0.338	166	223				
	CB222	0.614	301	222				

Tot. Area: **24.035** **ha**

Max Storage: **8497.52** **cu.m**

Max. Storage per ha: **353.5** **cu.m/ha**

Total Peak Runoff: **10785** **L/s**

Maximum Inflow (L/s): **841.6**

Total peak runoff per hectare: **448.7** **L/s/ha**

Maximum Inflow per ha (L/s/ha): **35.0**

Maximum ICD Inflow from Site (L/s):	**936**	**L/s**
External Flow From Industrial Lands to South (L/s):	**842**	**L/s**
Peak Maximum Inflow with ICDs & External:	**1777**	**L/s**
Actual Peak Flow at outlet from model:	**1946**	**L/s**
Allowable flow:	**2060**	**L/s**
Amount that actual peak flow is below allowable flow:	**114**	**L/s**

As can be seen from the table, the expected required storage rate per hectare for the proposed site is higher than previously estimated (310 m^3/ha from BCIP report versus 354 cu.m/ha). This is mostly due to the change in imperviousness: the subject sites were previously anticipated to be 70% impervious, but now are effectively 100% impervious. Some sites may not be able to contain all of the proposed runoff in surface storage. In these cases, either underground storage or volume reduction methods would be required to meet the criterion.

The proposed dry pond peaks at 0.76 m in depth during the 100 year 3 hour Chicago storm event (2,635 cu.m). This is below the 2.0 m allowable maximum depth the Ministry of the Environment specifies. A detailed pond design should be prepared at the detailed design stage. A preliminary area and depth has been shown on **Drawing GP-1**, which was used in this analysis.

In future, further storage could be gained by placing inlet controls on sites within the dry pond tributary area. Standard practice in the City of Ottawa is to avoid inlet control devices in series such as this, however because the potential storage volumes are at different elevations, ICDs in series would be necessary to take advantage of all of the available storage. Storing more runoff on the individual sites within the dry pond tributary area would reduce the size of the dry pond.

Table 4.3 below presents the peak outflow rates to the trunk sewer on Innes Road for each of the modeled scenarios. During all scenarios, the peak flow rate is below the allowable rate of 2,060 L/s.

Table 4.3: Scenario Peak Outflow Rates

	100 Year, 3 Hour Chicago Storm	5 Year, 3 Hour Chicago Storm	July 1, 1979 Historical Storm
Peak Outflow Rate (L/s) to Innes Road	1946	1834	1905

Peak Outlet Rate per Hectare (L/s/ha)	48	45	47

The City of Ottawa normally requires that during the major storm event, the maximum hydraulic grade line (HGL) be kept at least 0.30 m below the underside-of-footing (USF) of any adjacent units connected to the storm sewer. There are no units with USFs proposed in this commercial development.

Appendix B summarizes the results of the hydraulic modeling and output files for the subject site area during the 100 year storm event. All modeling files and results are contained on the CD enclosed with this report.

Appendix D GEOTECHNICAL INVESTIGATION

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

patersongroup

Geotechnical Investigation

Proposed Commercial Development - Phase 1
2025 Mer Bleue Road
Ottawa, Ontario

Prepared For

SmartReit

Paterson Group Inc.
Consulting Engineers
154 Colonnade Road South
Ottawa (Nepean), Ontario
Canada K2E 7J5

Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

March 2, 2017

Report: PG0811-2 Revision 1

Table of Contents

Page

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by SmartReit to conduct a geotechnical investigation for the current phase of the proposed commercial development to be located at the southeast corner of Innes Road and Mer Bleue Road, in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2).

The objectives of the current investigation were:

❑ to determine the subsurface soil and groundwater conditions by means of boreholes,

❑ to provide geotechnical recommendations pertaining to 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. The report contains the geotechnical findings and recommendations pertaining to the design and construction of the subject development as understood at the time of writing this report.

Investigating the presence or potential presence of contamination on the subject property was not part of the scope of work of this present investigation. Therefore, the present report does not address environmental issues.

2.0 Proposed Development

It is understood that the current phase of the proposed development will consist of several commercial buildings of slab-on-grade construction along with associated car parking areas, access lanes and landscaped areas. It is further understood that the site will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current geotechnical investigation was carried out between November 9 and 11, 2016. At that time, seven (7) boreholes were drilled to a maximum depth of 6.6 m and eleven (11) probeholes were drilled to a maximum depth of 7.6 m below existing ground surface. A previous investigation was conducted by this firm within the subject site during April 2006. The relevant test holes within the subject site from the current and previous investigations are presented on Drawing PG0811-1 - Test Hole Location Plan in Appendix 2. The test hole locations were determined in the field by Paterson personnel taking into consideration site features and underground services.

The test holes were completed with a track-mounted auger drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer from our geotechnical department. The test pits completed during the previous geotechnical investigation consisted of excavating to the required depths at the selected locations and sampling and testing the overburden.

Sampling and In Situ Testing

Soil samples were recovered from the auger flights or a 50 mm diameter split-spoon sampler. The soil from the auger flights and split-spoon samples were classified on site and placed in sealed plastic bags. All samples were transported to our laboratory. The depths at which the auger flight and , split-spoon samples were recovered from the boreholes are depicted as AU and SS, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

The 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.

Undrained shear strength testing, using a vane apparatus, was conducted at regular intervals of depth in cohesive soils.

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

Groundwater

Flexible PVC standpipes 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 located in the field by Paterson personnel. The test hole locations and ground surface elevation at the test hole locations were provided by Stantec Geomatics. The ground surface elevations are understood to be referenced to a geodetic datum. The test hole locations and ground surface elevations of the test hole locations are presented on Drawing PG0811-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

The soil samples recovered from the subject site were examined in our laboratory to review the results of the field logging. Two atterberg limit tests were completed on selected soil samples. The results are presented in Table 1 on the following page.

3.4 Analytical Testing

One soil sample from the subject site was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The analytical test results are presented in Appendix 1 and discussed in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

At the time of our field program, the subject site consisted of agricultural fields with some mature trees and a grassed area within the northwest corner of the site. It should be noted that two existing ditches were observed within the current phase of the proposed development. The subject site is relatively flat and slightly lower than Innes Road and Mer Bleue Road.

Several residential and agricultural buildings were formerly present within the northwest portion of the subject site. Three potable wells (one dug and two drilled) associated with the former buildings were observed during our 2006 inspection. It is recommended that the existing wells be decommissioned at the time of construction of the proposed development. The wells should be abandoned according to Ontario Regulation 903.

4.2 Subsurface Profile

Generally, the soil conditions encountered at the test hole locations consist of topsoil overlying very stiff to stiff brown silty clay crust layer and followed by a firm grey silty clay deposit. A thin layer of fill overtop of the silty clay crust was encountered at BH 1-16 and BH 5-16. Glacial till was encountered below the firm grey silty clay deposit at BH 1-16, BH 2-16, BH 3-16 and BH 5-16. Practical refusal to augering was encountered at depths ranging from 2 m to 7.6 m. Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for the details of the soil profile encountered at each test hole location. The results of the atterberg limit testing on selected silty clay samples are presented in Table 1 below.

Table 1
Summary of Atterberg Limits Tests

Samples	Depth (m)	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index %
BH1-17 SS3	4.6	84.5	87	23	64
BH2-17 G1	1.5	43.0	77	23	54

Based on available geological mapping, the bedrock consists of interbedded limestone and dolomite of the Lindsay Formation and is expected to be encountered at depths ranging from 5 to 15 m.

4.3 Groundwater

Groundwater levels were noted at the test hole locations at the time of drilling and the results are summarized in Table 2. It is important to note that groundwater readings at the piezometers can be influenced by water perched within the borehole backfill material. Long-term groundwater conditions can also be estimated based on the observed colour, moisture levels and consistency of the recovered soil samples. Based on these observations, it is estimated that the long-term groundwater level can be expected between 2 to 3 m below existing ground surface. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could vary at the time of construction.

Table 2 - Measured Groundwater Levels

Test Hole Number	Ground Surface Elevation (m)	Water Level		Date
		Depth (m)	Elevation (m)	
Current Investigation				
BH 1-16	89.78	1.17	88.61	November 24, 2016
BH 2-16	88.54	1.50	87.04	November 24, 2016
BH 3-16	88.52	1.33	87.19	November 24, 2016
BH 4-16	88.38	0.97	87.41	November 24, 2016
BH 5-16	89.62	2.13	87.49	November 24, 2016
BH 6-16	89.32	Damaged	n/a	November 24, 2016
BH 7-16	88.73	Damaged	Surface	November 24, 2016
PH 6-16	88.59	Damaged	n/a	November 24, 2016
PH 7-16	89.48	2.01	87.47	November 24, 2016
Previous Investigation				
BH 1	89.41	Dry	n/a	April 12, 2006
BH 2	87.81	0.60	87.21	April 12, 2006
BH 3	89.00	0.45	88.55	April 12, 2006

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered adequate for the proposed commercial development. It is expected that the proposed buildings can be founded by conventional style shallow foundations placed on an undisturbed, stiff brown silty clay bearing surface.

Due to the presence of a silty clay deposit underlying the subject site, a permissible grade raise restriction will be required.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing organic materials, should be stripped from under any buildings, paved areas, pipe bedding and other settlement sensitive structures. Sideslopes of the existing ditch should be shaped to provide maximum 500 mm high steps to improve the quality of the compaction work during the backfilling program.

Fill Placement

Fill placed for grading beneath the proposed buildings, unless otherwise specified, should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The fill should be tested and approved prior to delivery to the site. The fill should be placed in lifts with a maximum loose lift thickness of 300 mm and compacted with suitable compaction equipment. Fill placed beneath the building areas should be compacted to a minimum of 98% of the Standard Proctor Maximum Dry Density (SPMDD).

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill where settlement is a minor concern. These materials should be spread in maximum lift thickness of 300 mm and at a minimum compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be placed to increase the subgrade level for areas to be paved, the backfill should be compacted in thin lifts to a minimum density of 95% of the SPMDD.

Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls, unless a geocomposite drainage membrane is installed, such as Miradrain G100N or Delta Drain 6000. Consideration should also be given to placing a non-frost susceptible, granular fill against the exterior side of the foundation walls to limit frost heave issues for sensitive areas, such as perimeter sidewalks or exterior entrance slabs.

Bedrock Removal

If bedrock removal is required, consideration should be given to hoe-ramming or controlled blasting. In areas of weathered bedrock and where only a small quantity of bedrock is to be removed, bedrock removal may be possible by hoe-ramming.

Prior to considering blasting operations, the blasting effects on the existing services, buildings and other structures should be addressed. A pre-blast or pre-construction survey of the existing structures located in proximity of the blasting operations should be carried out prior to commencing site activities. The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries/claims related to the blasting operations.

As a general guideline, peak particle velocities (measured at the structures) should not exceed 25 mm per second during the blasting program to reduce the risks of damage to the existing structures.

The blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is also an experienced blasting consultant.

Vibration Considerations

Construction operations are also 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, as much as possible, a cooperative environment with the residents.

5.3 Foundation Design

Conventional Shallow Foundations

Strip footings, up to 2 m wide, and pad footings, up to 5 m wide, founded on an undisturbed, stiff silty clay, glacial till or engineered fill bearing surface can be designed using the bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa**.

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

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

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 silty clay above the groundwater table when a plane extending horizontally and vertically from the footing face at a minimum of 1.5H:1V, passing through in situ soil of the same or higher capacity as the bearing medium soil.

Settlement/Grade Raise

Consideration must be given to potential settlements which could occur due to the presence of the silty clay deposit and the combined loads from the proposed footings, any groundwater lowering effects, and grade raise fill. The foundation loads to be considered for the settlement case are the continuously applied loads which consist of the unfactored dead loads and the portion of the unfactored live load that is considered to be continuously applied.

Due to the silty clay underlying the subject site, a permissible grade raise of **2 m** is recommended for grading within 6 m of the building footprint. A permissible grade raise restriction of **2.5 m** is recommended for the parking areas and access lanes. It should be noted that the permissible grade raise values noted above are measured from the **original ground surface**, below any existing fill observed at select locations on site.

Generally, the potential long term settlement is evaluated based on the compressibility characteristics of the silty clay. The total and differential settlements will be dependent on characteristics of the proposed buildings. For design purposes, the total and differential settlements are estimated to be 25 and 20 mm, respectively. A post-development groundwater lowering of 0.5 m was assumed.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C** for footings placed over a silty clay bearing surface. The soils underlying the proposed shallow foundations are not susceptible to liquefaction. Reference should be made to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Slab on Grade Construction

The in situ soils, approved granular fill or lean concrete mudslab will be considered to be an acceptable subgrade on which to commence backfilling for floor slab construction.

The upper 200 mm of sub-slab backfill is recommended to consist of 19 mm clear crushed stone. All backfill material within the proposed building footprint should be placed in maximum 300 mm thick loose layers and compacted to a minimum of 98% of the SPMDD.

Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any additional backfill. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. All backfill material within the footprint of the proposed building should be placed in maximum 300 mm thick loose layers and compacted to a minimum of 98% of the SPMDD.

5.6 Pavement Structure

For design purposes, the pavement structures presented in the following tables could be used for the design of car only parking areas, heavy truck parking areas and access lanes.

Table 3 - 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
400	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either in situ soil, fill or OPSS Granular B Type I or II material placed over in situ soil	

Table 4 - Recommended Pavement Structure
Heavy Truck Parking Areas and 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 in situ soil, fill or OPSS Granular B Type I or II material placed over in situ soil	

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 I or II material.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the SPMDD using suitable vibratory equipment.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping the contact zone between the subgrade material and the base stone in a dry condition.

Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing the load bearing capacity.

Where silty clay is anticipated at subgrade level, consideration should be given to installing sub-drains at the catch basin locations during the pavement construction. The sub-drain inverts should be approximately 300 mm below subgrade level and extend 3 m along the curblines in both directions. The subgrade surface should be crowned to promote water flow to the drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

It is recommended that a perimeter foundation drainage system be provided for the proposed structures. 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.

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 where frost heave sensitive structures, such as a concrete sidewalk, will be placed. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material may be used for this purpose. A composite drainage system, such as Delta Drain 6000, Miradrain G100 or equivalent, should be placed against the foundation wall to promote drainage toward the perimeter drainage pipe.

6.2 Protection Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effect of frost action. A minimum of 1.5 m thick soil cover (or equivalent) should be provided in this regard.

A minimum of 2.1 m thick soil cover (or equivalent) should be provided for other exterior unheated footings.

6.3 Excavation Side Slopes

The side slopes of excavations in the soil and fill overburden materials 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. It is assumed that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e. unsupported excavations).

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsoil at this site is considered to be mainly 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.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by "cut and cover" methods and excavations will not be left open for extended periods of time.

6.4 Pipe Bedding and Backfill

The pipe bedding for sewer and water pipes should consist of at least 150 mm of OPSS Granular A crushed stone. Where the bedding is located within the firm grey silty clay or directly over the bedrock surface, the thickness of the bedding material should be increased to a minimum of 300 mm. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 95% of its SPMDD. The bedding material should extend at least to the spring line of the pipe.

The cover material, which should consist of OPSS Granular A, should extend from the spring line of the pipe to at least 300 mm above the obvert of the pipe. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 95% of the SPMDD.

It should generally be possible to re-use the moist (not wet) brown silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. Wet silty clay materials will be difficult to re-use, as the high water contents make compacting impractical without an extensive drying period.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the SPMDD.

It is recommended that the subgrade medium be inspected in the field to determine how steeply the bedrock surface, where encountered, drops off. A transition treatment should be provided where the bedrock slopes at more than 3H:1V. At these locations, the bedrock should be excavated and extra bedding be placed to provide a 3H:1V (or flatter) transition from the bedrock subgrade towards the soil subgrade. This treatment reduces the propensity for bending stress to occur in the service pipes.

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches where services are installed within the silty clay deposit. The seals should be at least 1.5 m long (in the trench direction) and should extend from trench wall to trench wall. Generally, the seals should extend from the frost line and fully penetrate the bedding, subbedding and cover material. The barriers should consist of relatively dry and compactable brown silty clay placed in maximum 225 mm thick loose layers and compacted to a minimum of 95% of the SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at no more than 60 m intervals in the service trenches.

6.5 Groundwater Control

It is anticipated that groundwater infiltration into the excavations should be low and 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.

A temporary Ministry of the Environment and Climate Change (MOECC) permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MOECC.

For typical ground or surface water volumes, being pumped during the construction phase, 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 MOECC review of the PTTW application.

6.6 Winter Construction

The subsurface conditions at this site mostly consist of frost susceptible materials. In presence of water and freezing conditions ice could form within the soil mass. Heaving and settlement upon thawing could occur. Precautions should be taken if winter construction is considered for this project.

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 constructed in a manner that will avoid the introduction of frozen materials into the trenches. As well, pavement construction is difficult during winter. The subgrade consists of frost susceptible soils which will experience total and differential frost heaving as the work takes place. In addition, the introduction of frost, snow or ice into the pavement materials, which is difficult to avoid, could adversely affect the performance of the pavement structure. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The analytical test results are presented in Table 5 along with industry standards for the applicable threshold values. The results are indicative that Type 10 Portland cement can be used at the subject site.

Table 5 - Corrosion Potential

Parameter	Laboratory Results BH 2 - SS3	Threshold	Commentary
Chloride	16 µg/g	Chloride content less than 400 mg/g	Negligible concern
pH	7.432	pH value less than 5.0	Neutral Soil
Resistivity	86 ohm.m	Resistivity greater than 1,500 ohm.cm	Low Corrosion Potential
Sulphate	35 µg/g	Sulphate value greater than 1 mg/g	Negligible Concern

6.8 Landscaping Considerations

Tree Planting Restrictions

The proposed development is located in a moderate sensitivity area with respect to tree plantings over a silty clay deposit. The following tree setbacks are recommended for varying types of trees to be planted across the subject site:

❏ Shrubs and trees (max. mature height of 3 m) of low water demand with shallow root systems can be planted within 4.5 m of the foundation.
❏ Low water demand trees with a maximum mature height of 8 m can be placed between 4.51 to 6 m from the foundation
❏ Low water demand trees with a maximum mature height of 12 m can be placed between 6.01 to 7.5 m from the foundation
❏ Typical street trees with low to moderate water demand should be placed greater than 7.5 m from the foundation

It is well documented in the literature, and is our experience, that fast-growing trees located near buildings founded on cohesive soils that shrink on drying can result in long-term differential settlements of the structures. Tree varieties that have the most pronounced effect on foundations are seen to consist of poplars, willows and some maples (i.e. Manitoba Maples) and, as such, they should not be considered in the landscaping design.

.

7.0 Recommendations

It is a requirement for the foundation design data provided herein to be applicable that a materials testing and observation services program including the following aspects be performed by the geotechnical consultant.

- ❑ Review the master grading plan from a geotechnical perspective, once available.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Sampling and testing of the concrete and granular 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 made in this report are in accordance with our present understanding of the project. We request that we be permitted to review the grading plan once available. Also, our recommendations should be reviewed when the project drawings and specifications are complete.

A soils 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 that we be notified immediately in order to permit reassessment of our recommendations.

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 SmartReit or their agent(s) is not authorized without review by this firm for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Faisal I. Abou-Seido, P.Eng.

David J. Gilbert, P.Eng.

LICENSED PROFESSIONAL ENGINEER
March 6-2017
D. J. GILBERT
100116130
PROVINCE OF ONTARIO

Report Distribution:

- ❏ SmartReit (3 copies)
- ❏ 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
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. PG0811

REMARKS

HOLE NO. BH 1-16

BORINGS BY CME 55 Power Auger **DATE** November 9, 2016

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.78
TOPSOIL	0.20	AU	1				
FILL: Brown silty clay, trace sand and gravel	0.91						
GLACIAL TILL: Brown silty clay, trace sand, gravel, cobbles and boulders		SS	2	54	13	1	88.78
		SS	3	17	39	2	87.78
		SS	4	38	31	3	86.78
		SS	5	29	50+		
	4.01	SS	6	50	50+	4	85.78

End of Borehole

Practical refusal to augering at 4.01m depth

(GWL @ 1.17m - Nov. 24, 2016)

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

○ Water Content %

20 40 60 80

Piezometer 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
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE November 10, 2016

FILE NO. PG0811

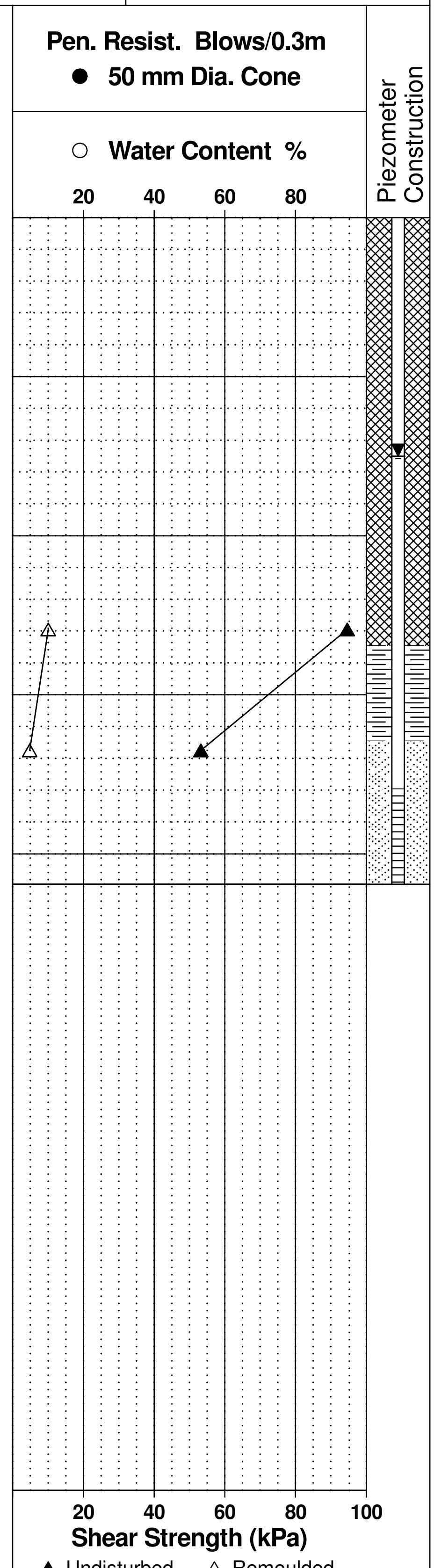
HOLE NO. BH 2-16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.54
TOPSOIL 0.35		AU	1				
		SS	2	100	9	1	87.54
Very stiff to stiff, brown **SILTY CLAY,** trace sand		SS	3	100	6		
						2	86.54
- grey by 3.0m depth						3	85.54
3.50							
GLACIAL TILL: Grey silty clay, trace sand, gravel, cobbles and boulders		SS	4	31	50+	4	84.54
4.19							

End of Borehole

Practical refusal to augering at 4.19m depth

(GWL @ 1.50m - Nov. 24, 2016)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE November 10, 2016

FILE NO. PG0811

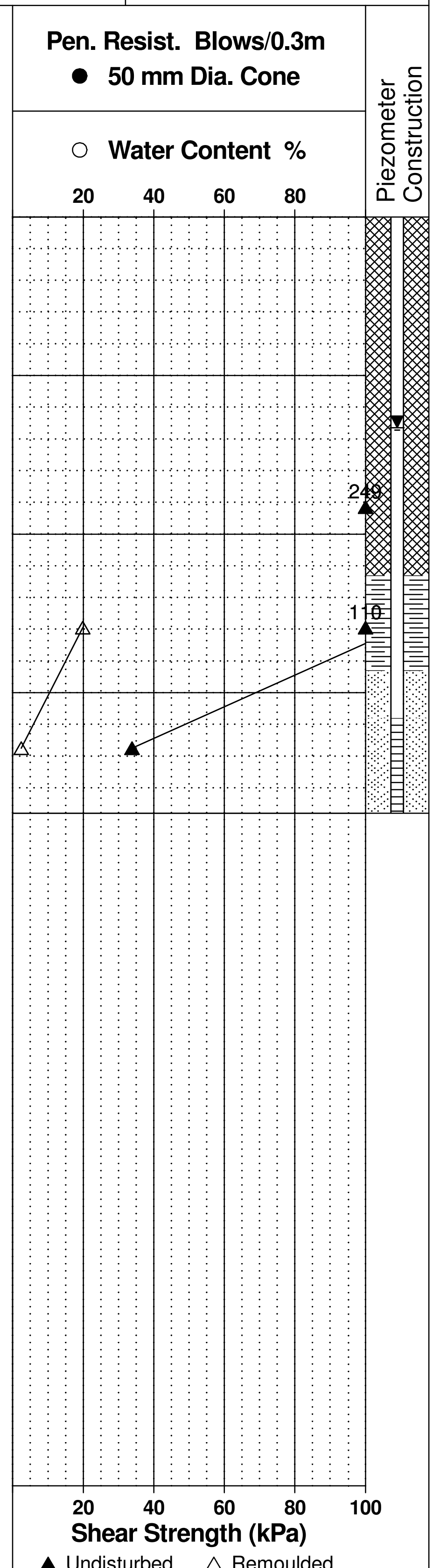
HOLE NO. BH 3-16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.52
TOPSOIL 0.35		AU	1				
		SS	2	100	13	1	87.52
Hard to very stiff, brown **SILTY CLAY,** trace sand						2	86.52
- stiff to firm and grey by 3.0m depth 3.50						3	85.52
GLACIAL TILL: Grey silty clay, trace sand, gravel, cobbles and boulders 3.76							

End of Borehole

Practical refusal to augering at 3.76m depth

(GWL @ 1.33m - Nov. 24, 2016)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE November 10, 2016

FILE NO. PG0811

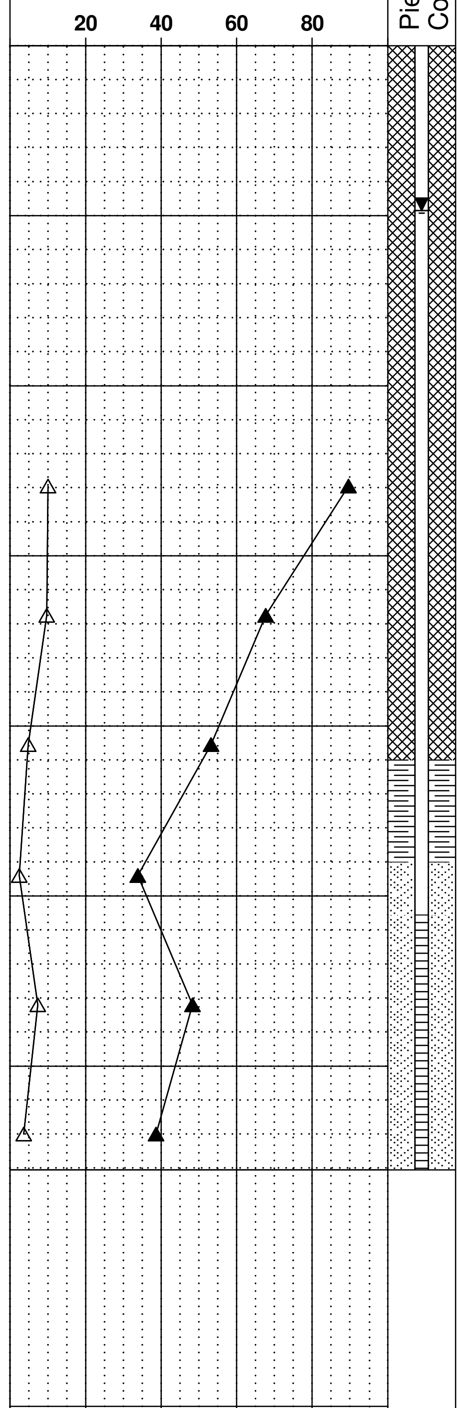
HOLE NO. BH 4-16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.38
TOPSOIL (to 0.30)		AU	1				
Very stiff to stiff, brown **SILTY CLAY,** trace sand		SS	2	100	10	1	87.38
		SS	3	100	8	2	86.38
						3	85.38
						4	84.38
- firm and grey by 4.6m depth						5	83.38
(to 6.61)						6	82.38
End of Borehole							

Practical refusal to augering at 6.61m depth

(GWL @ 0.97m - Nov. 24, 2016)

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



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. PG0811

REMARKS

HOLE NO. BH 5-16

BORINGS BY CME 55 Power Auger **DATE** November 9, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.62
TOPSOIL 0.18							
FILL: Brown silty clay, trace gravel 0.53		AU	1				
Compact, brown **SILTY SAND,** trace clay 1.07		SS	2	67	15	1	88.62
Very stiff, brown **SILTY CLAY** 1.60		SS	3	100	50+		
GLACIAL TILL: Brown silty sand with clay, gravel, cobbles and boulders 2.84		SS	4	83	23	2	87.62

End of Borehole

Practical refusal to augering at 2.84m depth

(GWL @ 2.13m - Nov. 24, 2016)

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

○ Water Content %

20 40 60 80

Piezometer 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
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

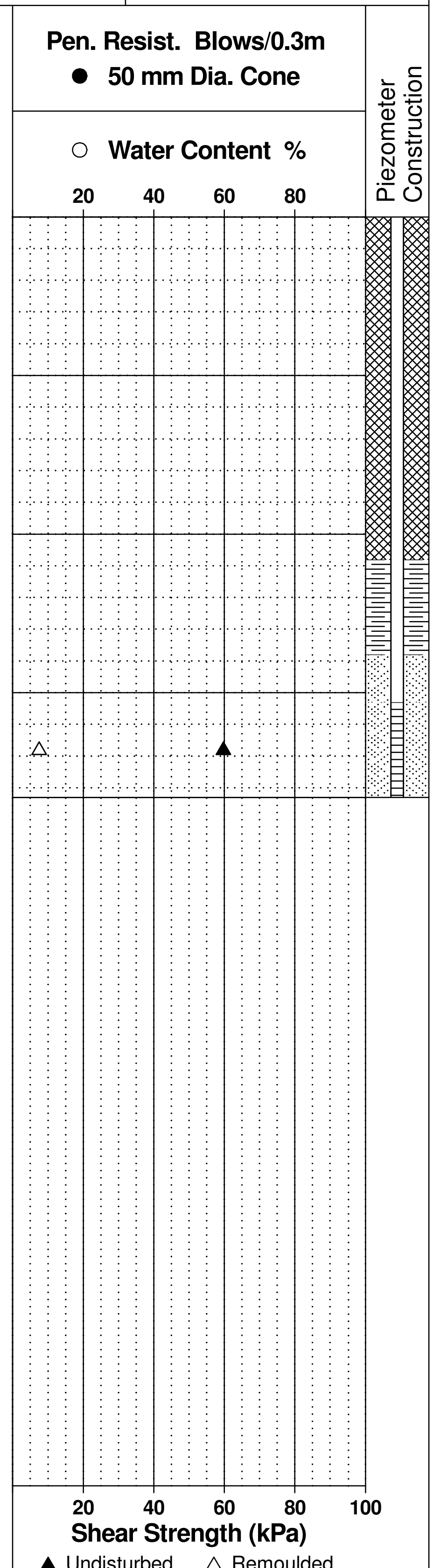
BORINGS BY CME 55 Power Auger

DATE November 9, 2016

FILE NO. PG0811

HOLE NO. BH 6-16

SOIL DESCRIPTION	TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	89.32
TOPSOIL 0.20						
FILL: Brown silty clay, trace sand, gravel, cobbles and asphalt 0.89	AU	1				
Very stiff to stiff, brown **SILTY CLAY,** trace sand	SS	2	0	13	1	88.32
	SS	3	100	10	2	87.32
	SS	4	100	7	3	86.32
3.66	SS	5	100			
End of Borehole (BH dry - Nov. 24, 2016)						



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. PG0811

REMARKS

HOLE NO. BH 7-16

BORINGS BY CME 55 Power Auger

DATE November 9, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	88.75		
TOPSOIL 0.30		AU	1						
Very stiff, brown **SILTY CLAY,** trace sand		SS	2	100	11	1	87.75	▲ 121	
2.03						2	86.75		
End of Borehole Practical refusal to augering at 2.03m depth (Piezometer damaged - Nov. 24, 2016)									

Water Content % axis: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE November 10, 2016

FILE NO. PG0811

HOLE NO. PH 1-16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0	89.19		
						1	88.19		
OVERBURDEN						2	87.19		
						3	86.19		
4.57						4	85.19		
End of Probehole									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE November 10, 2016

FILE NO. PG0811

HOLE NO. PH 2-16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0	88.64		
						1	87.64		
OVERBURDEN						2	86.64		
3.28						3	85.64		
End of Probehole Practical refusal to augering at 3.28m depth									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. PG0811

REMARKS

HOLE NO. PH 3-16

BORINGS BY CME 55 Power Auger

DATE November 11, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE: TYPE	SAMPLE: NUMBER	SAMPLE: % RECOVERY	SAMPLE: N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20, 40, 60, 80)	Piezometer Construction
GROUND SURFACE						0	88.96		
						1	87.96		
OVERBURDEN									
						2	86.96		
2.80									
End of Probehole Practical refusal to augering at 2.80m depth									

Shear Strength (kPa): 20, 40, 60, 80, 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. **PG0811**

REMARKS

HOLE NO. **PH 4-16**

BORINGS BY CME 55 Power Auger

DATE November 11, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20, 40, 60, 80)	Piezometer Construction
GROUND SURFACE						0	88.28		
						1	87.28		
OVERBURDEN						2	86.28		
						3	85.28		
						4	84.28		
4.57									
End of Probehole									

Shear Strength (kPa): 20, 40, 60, 80, 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. PG0811

REMARKS

HOLE NO. PH 5-16

BORINGS BY CME 55 Power Auger

DATE November 11, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0	88.36		
						1	87.36		
OVERBURDEN						2	86.36		
						3	85.36		
						4	84.36		
4.57									
End of Probehole									

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
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE November 10, 2016

FILE NO. PG0811

HOLE NO. PH 6-16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0	88.59		
OVERBURDEN						1	87.59		
2.13						2	86.59		
End of Probehole Practical refusal to augering at 2.13m depth									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

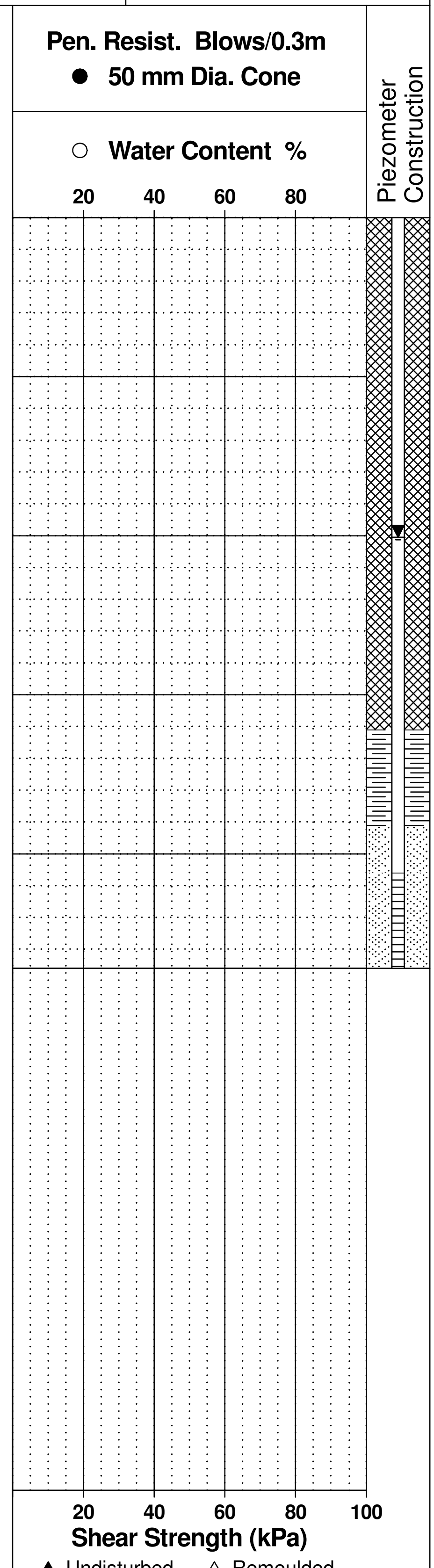
BORINGS BY CME 55 Power Auger

DATE November 10, 2016

FILE NO. PG0811

HOLE NO. PH 7-16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.48
						1	88.48
						2	87.48
OVERBURDEN							
						3	86.48
						4	85.48
4.72							
End of Probehole Practical refusal to augering at 4.72m depth (GWL @ 2.01m - Nov. 24, 2016)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. PG0811

REMARKS

HOLE NO. PH 8-16

BORINGS BY CME 55 Power Auger **DATE** November 10, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % (20, 40, 60, 80)	Piezometer Construction
GROUND SURFACE						0	88.53		
						1	87.53		
						2	86.53		
						3	85.53		
OVERBURDEN						4	84.54		
						5	83.53		
						6	82.53		
						7	81.53		
7.62									
End of Probehole									

Shear Strength (kPa): 20, 40, 60, 80, 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE November 10, 2016

FILE NO. PG0811

HOLE NO. PH 9-16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20, 40, 60, 80)	Piezometer Construction
GROUND SURFACE						0	88.23		
						1	87.23		
OVERBURDEN						2	86.23		
						3	85.23		
						4	84.23		
4.27									
End of Probehole Practical refusal to augering at 4.27m depth									

Shear Strength (kPa): 20, 40, 60, 80, 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. PG0811

REMARKS

HOLE NO. PH10-16

BORINGS BY CME 55 Power Auger **DATE** November 11, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0	88.42		
						1	87.42		
OVERBURDEN						2	86.42		
						3	85.42		
3.58									
End of Probehole Practical refusal to augering at 3.58m depth									

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
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE November 11, 2016

FILE NO. PG0811

HOLE NO. PH11-16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	88.36		
OVERBURDEN						1	87.36		
						2	86.36		
3.15						3	85.36		
End of Probehole Practical refusal to augering at 3.15m depth									

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Pharand Lands - Innes Road at Mer Bleeu Road
Ottawa, Ontario

DATUM Geodetic, as provided by Stantec Consulting Ltd.

REMARKS

BORINGS BY CME 75 Power Auger

DATE 5 Apr 06

FILE NO. PG0811

HOLE NO. BH 1

SOIL DESCRIPTION	Layer bottom depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.41
TOPSOIL	0.08						
FILL: Brown silty clay, some gravel	0.20	SS	1	50	17	1	88.41
Very stiff, brown **SILTY CLAY**	1.42						
GLACIAL TILL: Dense, brown silty sand with clay, gravel, cobbles and boulders	2.03	SS	2	44	50+	2	87.41
End of Borehole							

Practical refusal to augering @ 2.03m depth

(BH dry-Apr. 12/06)

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

○ Water Content %

20 40 60 80

Piezometer 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
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan, Vollebekk Limited.

FILE NO. PG0811

REMARKS

HOLE NO. BH 1-17

BORINGS BY CME 55 Power Auger **DATE** January 26, 2017

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	88.17
TOPSOIL (to 0.25)						
	AU	1				
					1	87.17
					2	86.17
FILL: Brown silty clay, trace gravel						
					3	85.17
	SS	2	8			
					4	84.17
(to 4.78) Stiff, grey **SILTY CLAY,** trace sand	SS	3	83	4		
(to 5.18)					5	83.17
End of Borehole (GWL @ 1.8m depth based on field observations)						

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

○ Water Content %

20 40 60 80

Piezometer Construction

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan, Vollebekk Limited.

FILE NO. PG0811

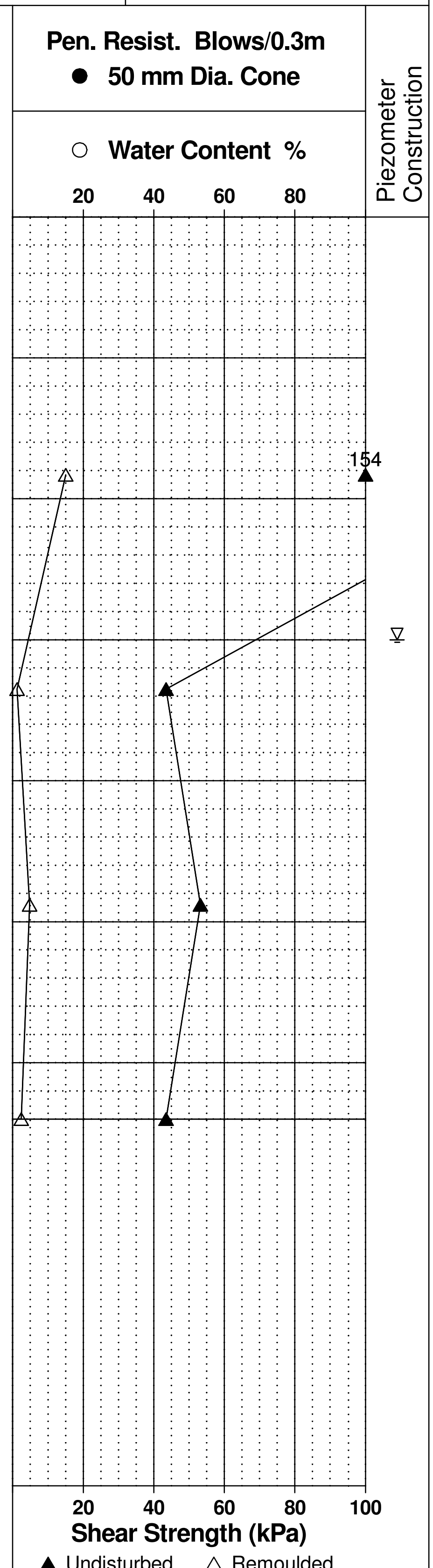
REMARKS

HOLE NO. BH 2-17

BORINGS BY CME 55 Power Auger **DATE** January 25, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.35
TOPSOIL (to 0.28)							
		AU	1			1	87.35
		SS	2	92	P	2	86.35
Very stiff to firm, brown **SILTY CLAY,** trace sand						3	85.35
						4	84.35
- grey by 4.6m depth						5	83.35
						6	82.35
(to 6.40) End of Borehole							

(GWL @ 3.0m depth based on field observations)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan, Vollebekk Limited.

FILE NO. PG0811

REMARKS

HOLE NO. BH 3-17

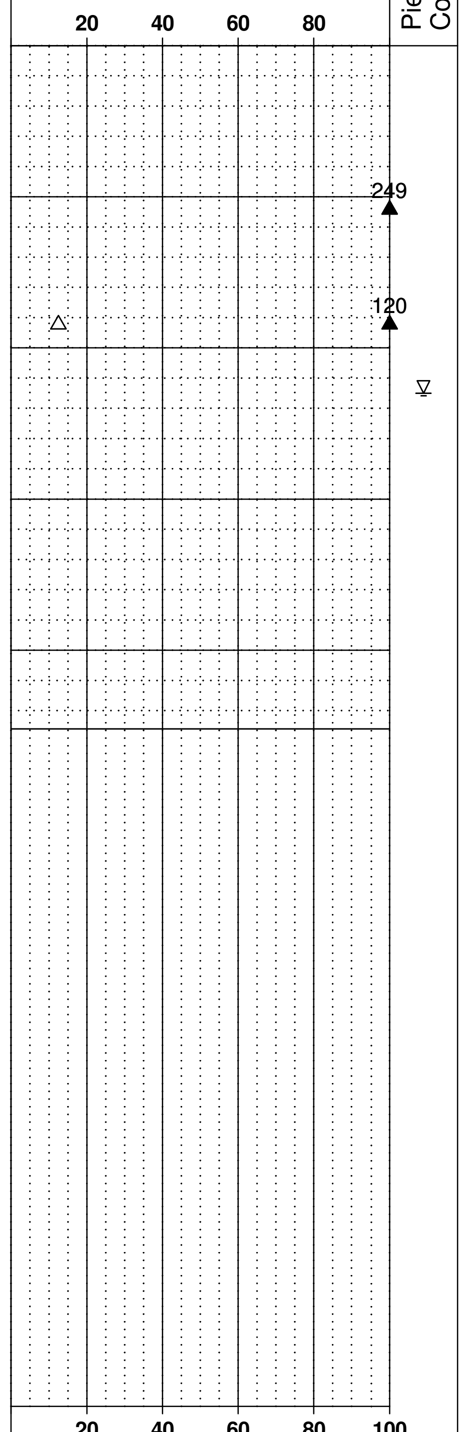
BORINGS BY CME 55 Power Auger **DATE** January 25, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.60
TOPSOIL 0.33							
Hard to very stiff, brown **SILTY CLAY,** trace sand						1	87.60
						2	86.60
3.05						3	85.60
GLACIAL TILL: Grey silty sand with clay, gravel, cobbles and boulders		SS	1	100	11		
						4	84.60
4.52							
End of Borehole Practical refusal to augering at 4.52m depth (GWL @ 2.3m depth based on field observations)							

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

○ Water Content %

Piezometer Construction



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan, Vollebekk Limited.

FILE NO. **PG0811**

REMARKS

HOLE NO. **BH 4-17**

BORINGS BY CME 55 Power Auger

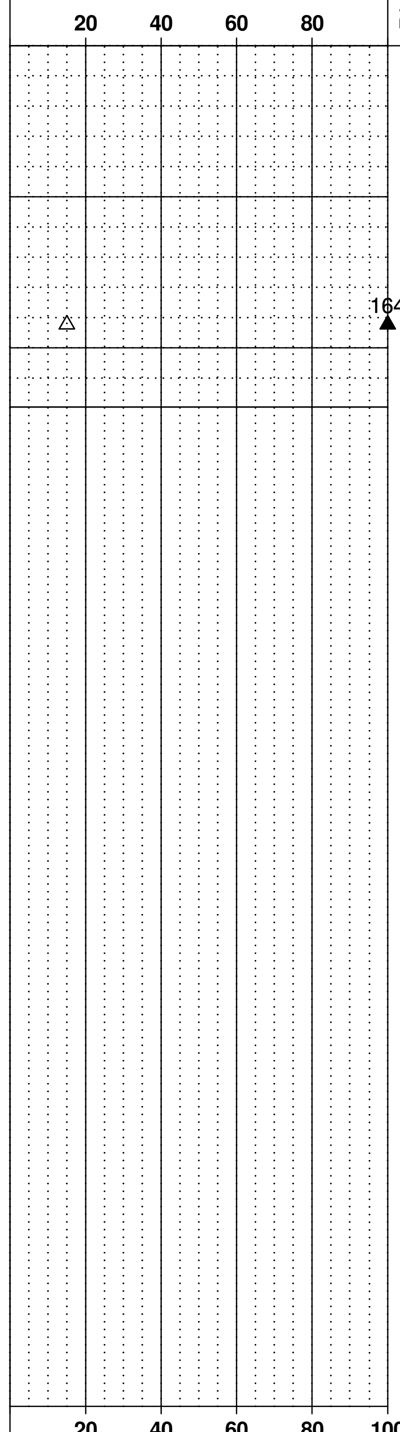
DATE January 25, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.24
TOPSOIL 0.30							
Very stiff, brown **SILTY CLAY,** trace sand						1	87.24
2.39						2	86.24
End of Borehole Practical refusal to augering at 2.39m depth (BH dry upon completion)							

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

○ Water Content %

Piezometer Construction



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan, Vollebekk Limited.

FILE NO. **PG0811**

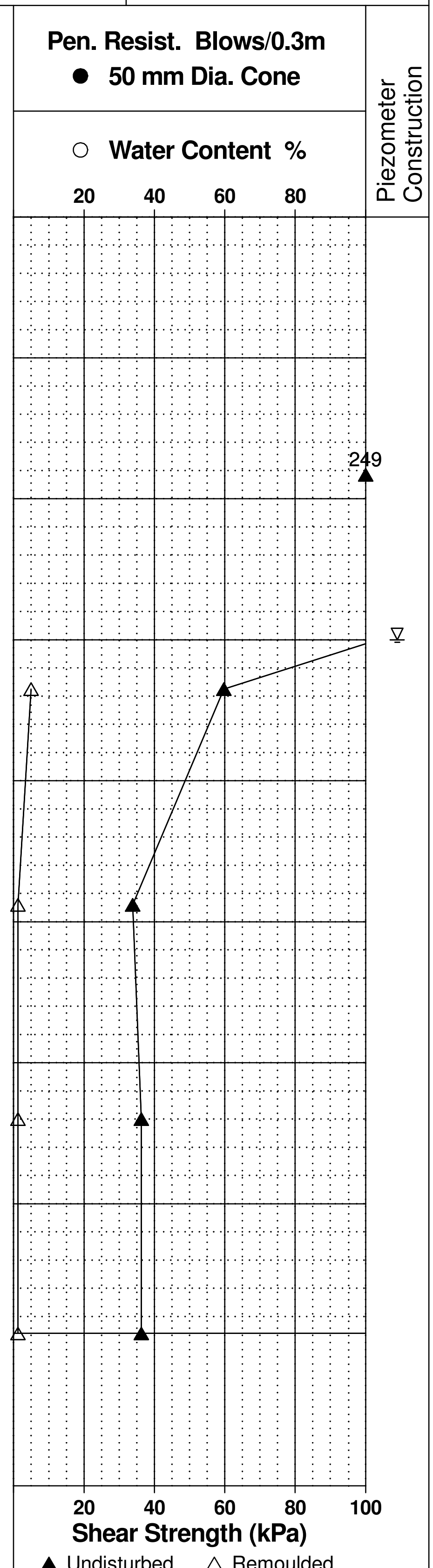
REMARKS

HOLE NO. **BH 5-17**

BORINGS BY CME 55 Power Auger

DATE January 25, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.11
TOPSOIL 0.27							
						1	87.11
						2	86.11
						3	85.11
Hard to stiff, brown **SILTY CLAY,** trace sand							
						4	84.11
- firm and grey by 4.6m depth							
						5	83.11
						6	82.11
						7	81.11
7.92							
End of Borehole							
(GWL @ 3.0m depth based on field observations)							



patersongroup Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan, Vollebekk Limited.

FILE NO. PG0811

REMARKS

HOLE NO. PH 1-17

BORINGS BY CME 55 Power Auger

DATE January 26, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0	88.32		
						1	87.32		
						2	86.32		
OVERBURDEN						3	85.32		
						4	84.32		
						5	83.32		
6.10						6	82.32		
End of Probehole									

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan, Vollebekk Limited.

FILE NO. PG0811

REMARKS

HOLE NO. PH 2-17

BORINGS BY CME 55 Power Auger

DATE January 26, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20, 40, 60, 80)	Piezometer Construction
GROUND SURFACE						0	88.02		
						1	87.02		
						2	86.02		
OVERBURDEN						3	85.02		
						4	84.02		
						5	83.02		
6.10						6	82.02		
End of Probehole									

Shear Strength (kPa): 20, 40, 60, 80, 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan, Vollebekk Limited.

FILE NO. PG0811

REMARKS

HOLE NO. PH 3-17

BORINGS BY CME 55 Power Auger

DATE January 25, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20, 40, 60, 80)	Piezometer Construction
GROUND SURFACE						0	88.53		
						1	87.53		
						2	86.53		
OVERBURDEN						3	85.53		
						4	84.53		
						5	83.53		
6.10						6	82.53		
End of Probehole									

Shear Strength (kPa): 20, 40, 60, 80, 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan, Vollebekk Limited.

FILE NO. PG0811

REMARKS

HOLE NO. PH 4-17

BORINGS BY CME 55 Power Auger **DATE** January 25, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0	88.53		
						1	87.53		
						2	86.53		
OVERBURDEN						3	85.53		
						4	84.53		
						5	83.53		
6.10						6	82.53		
End of Probehole									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan, Vollebekk Limited.

FILE NO. PG0811

REMARKS

HOLE NO. PH 5-17

BORINGS BY CME 55 Power Auger **DATE** January 25, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0	88.66		
OVERBURDEN						1	87.66		
1.75									
End of Probehole Practical refusal to augering at 1.75m depth									

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
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan, Vollebekk Limited.

REMARKS

BORINGS BY CME 55 Power Auger

DATE January 25, 2017

FILE NO. PG0811

HOLE NO. PH 6-17

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20, 40, 60, 80)	Piezometer Construction
GROUND SURFACE						0	88.52		
OVERBURDEN						1	87.52		
2.01						2	86.52		
End of Probehole Practical refusal to augering at 2.01m depth									

Shear Strength (kPa): 20, 40, 60, 80, 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan, Vollebekk Limited.

FILE NO. PG0811

REMARKS

HOLE NO. PH 7-17

BORINGS BY CME 55 Power Auger **DATE** January 25, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	87.89		
						1	86.89		
						2	85.89		
OVERBURDEN						3	84.89		
						4	83.89		
						5	82.89		
5.36									
End of Probehole Practical refusal to augering at 5.36m depth									

Water Content % axis: 20, 40, 60, 80

Shear Strength (kPa): 20, 40, 60, 80, 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan, Vollebekk Limited.

FILE NO. PG0811

REMARKS

HOLE NO. PH 8-17

BORINGS BY CME 55 Power Auger **DATE** January 25, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20, 40, 60, 80)	Piezometer Construction
GROUND SURFACE						0	88.13		
						1	87.13		
						2	86.13		
OVERBURDEN						3	85.13		
						4	84.13		
						5	83.13		
5.72									

End of Probehole

Practical refusal to augering at 5.72m depth

Shear Strength (kPa): 20, 40, 60, 80, 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan, Vollebekk Limited.

FILE NO. PG0811

REMARKS

HOLE NO. PH 9-17

BORINGS BY CME 55 Power Auger

DATE January 25, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	87.72		
						1	86.72		
						2	85.72		
						3	84.72		
OVERBURDEN						4	83.72		
						5	82.72		
						6	81.72		
						7	80.72		
7.62									
End of Probehole									

Water Content % axis: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan, Vollebekk Limited.

FILE NO. PG0811

REMARKS

HOLE NO. PH10-17

BORINGS BY CME 55 Power Auger

DATE January 26, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0	87.95		
						1	86.95		
OVERBURDEN						2	85.95		
						3	84.95		
						4	83.95		
4.57									
End of Probehole									

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
Prop. Commercial Dev. - Innes at Mer Bleue Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan, Vollebekk Limited.

REMARKS

BORINGS BY CME 55 Power Auger

DATE January 26, 2017

FILE NO. PG0811

HOLE NO. PH11-17

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0	88.38		
						1	87.38		
OVERBURDEN						2	86.38		
						3	85.38		
						4	84.38		
4.57 End of Probehole									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Pharand Lands - Innes Road at Mer Bleeu Road
Ottawa, Ontario

DATUM Geodetic, as provided by Stantec Consulting Ltd.

FILE NO. PG0811

REMARKS

HOLE NO. TP 1

BORINGS BY Backhoe

DATE 12 Apr 06

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.57
TOPSOIL 0.15							
FILL: Dark brown silty clay, trace organic matter 1.10		G	1			1	88.57
Very stiff to stiff, grey-brown **SILTY CLAY** 2.10		G	2			2	87.57
GLACIAL TILL: Grey-brown sandy silt with gravel, cobbles and boulders 2.40		G	3				
End of Borehole							
TP terminated on bedrock surface @ 2.40m depth							
(Open hole GWL @ 1.2m depth)							

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

○ Water Content %

20 40 60 80

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

Piezometer Construction

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Pharand Lands - Innes Road at Mer Bleeu Road
Ottawa, Ontario

DATUM Geodetic, as provided by Stantec Consulting Ltd.

REMARKS

BORINGS BY Backhoe

DATE 12 Apr 06

FILE NO. PG0811

HOLE NO. TP 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	89.83		
FILL: Crushed gravel — 0.15									
Brown SILTY SAND		G	1						
		G	2			1	88.83		
- grey-brown by 1.3m depth									▽
— 2.10		G	3			2	87.83		
End of Test Pit TP terminated on bedrock surface @ 2.10m depth (Open hole GWL @ 1.3m depth)									

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Pharand Lands - Innes Road at Mer Bleeu Road
Ottawa, Ontario

DATUM Geodetic, as provided by Stantec Consulting Ltd.

REMARKS

BORINGS BY Backhoe

DATE 12 Apr 06

FILE NO. PG0811

HOLE NO. TP 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	89.34		
TOPSOIL — 0.20									
Brown SANDY SILT — 0.90						1	88.34		
Very stiff to stiff, grey-brown SILTY CLAY — 2.90						2	87.34		▽
End of Test Pit TP terminated on bedrock surface @ 2.90m depth (Open hole GWL @ 1.4m depth)									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Pharand Lands - Innes Road at Mer Bleeu Road
Ottawa, Ontario

DATUM Geodetic, as provided by Stantec Consulting Ltd.

REMARKS

BORINGS BY Backhoe

DATE 12 Apr 06

FILE NO. PG0811

HOLE NO. TP 4

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20, 40, 60, 80)	Piezometer Construction
GROUND SURFACE						0	89.54		
TOPSOIL 0.30									
GLACIAL TILL: Brown sandy silt with gravel, cobbles and boulders 2.20						1	88.54		∇
						2	87.54		
End of Test Pit TP terminated on bedrock surface @ 2.20m depth (Open hole GWL @ 1.1m depth)									

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

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Pharand Lands - Innes Road at Mer Bleeu Road
Ottawa, Ontario

DATUM Geodetic, as provided by Stantec Consulting Ltd.

REMARKS

BORINGS BY Backhoe **DATE** 12 Apr 06

FILE NO. PG0811

HOLE NO. TP 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20, 40, 60, 80)	Piezometer Construction
GROUND SURFACE						0	88.89		
TOPSOIL 0.20									
Stiff, brown **SILTY CLAY** 1.40		G	1			1	87.89		∇
GLACIAL TILL: Brown clayey silt with sand, gravel, cobbles and boulders 2.70		G	2			2	86.89		
End of Test Pit TP terminated on bedrock surface @ 2.70m depth (Open hole GWL @ 1.2m depth)									

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

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Pharand Lands - Innes Road at Mer Bleeu Road
Ottawa, Ontario

DATUM Geodetic, as provided by Stantec Consulting Ltd.

REMARKS

BORINGS BY Backhoe

DATE 12 Apr 06

FILE NO. PG0811

HOLE NO. TP 6

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	88.81		
TOPSOIL 0.20									
Grey-brown **SILTY CLAY** 1.20						1	87.81		
GLACIAL TILL: Brown clayey silt with sand, gravel, cobbles and boulders 2.00						2	86.81		
End of Test Pit TP terminated on bedrock surface @ 2.00m depth (TP dry upon completion)									

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Pharand Lands - Innes Road at Mer Bleeu Road
Ottawa, Ontario

DATUM Geodetic, as provided by Stantec Consulting Ltd.

FILE NO. PG0811

REMARKS

HOLE NO. TP 7

BORINGS BY Backhoe

DATE 12 Apr 06

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0	88.71		
TOPSOIL 0.20									
Very stiff to stiff, brown **SILTY CLAY** 1.40						1	87.71		
GLACIAL TILL: Brown clayey silt with sand, gravel, cobbles and boulders 2.20						2	86.71		
End of Test Pit TP terminated on bedrock surface @ 2.20m depth (TP dry upon completion)									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Pharand Lands - Innes Road at Mer Bleeu Road
Ottawa, Ontario

DATUM Geodetic, as provided by Stantec Consulting Ltd.

REMARKS

BORINGS BY Backhoe

DATE 12 Apr 06

FILE NO. PG0811

HOLE NO. TP 8

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	88.02		
TOPSOIL 0.25									
Very stiff to stiff, brown **SILTY CLAY**						1	87.02		
						2	86.02		
- grey by 3.0m depth						3	85.02		▽
3.40		G	1						
End of Test Pit (Open hole GWL @ 3.0m depth)									

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

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Pharand Lands - Innes Road at Mer Bleeu Road
Ottawa, Ontario

DATUM Geodetic, as provided by Stantec Consulting Ltd.

REMARKS

BORINGS BY Backhoe

DATE 12 Apr 06

FILE NO. PG0811

HOLE NO. TP 9

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	88.12		
TOPSOIL 0.20									
Very stiff to stiff, grey-brown **SILTY CLAY** 2.00						1	87.12		
GLACIAL TILL: Grey-brown clayey silt with sand, gravel, cobbles and boulders 3.20						2	86.12		
End of Test Pit (Open hole GWL @ 2.9m depth)						3	85.12		∇

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Pharand Lands - Innes Road at Mer Bleeu Road
Ottawa, Ontario

DATUM Geodetic, as provided by Stantec Consulting Ltd.

REMARKS

BORINGS BY Backhoe

DATE 12 Apr 06

FILE NO. PG0811

HOLE NO. TP10

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20, 40, 60, 80)	Piezometer Construction
GROUND SURFACE						0	89.08		
TOPSOIL 0.60									
						1	88.08		
Very stiff to stiff, grey-brown **SILTY CLAY**									
						2	87.08		
						3	86.08		
3.30									
End of Test Pit TP terminated on Glacial Till @ 3.30 m depth (Open hole GWL @ 2.4m depth)									

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

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Pharand Lands - Innes Road at Mer Bleeu Road
Ottawa, Ontario

DATUM Geodetic, as provided by Stantec Consulting Ltd.

FILE NO. PG0811

REMARKS

HOLE NO. TP11

BORINGS BY Backhoe **DATE** 12 Apr 06

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20, 40, 60, 80)	Piezometer Construction
GROUND SURFACE						0	88.57		
TOPSOIL 0.30									
Very stiff to stiff, grey-brown **SILTY CLAY**						1	87.57		▽
- firm and grey by 2.5m depth						2	86.57		
3.50						3	85.57		
End of Test Pit (Open hole GWL @ 1.6m depth)									

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

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Pharand Lands - Innes Road at Mer Bleeu Road
Ottawa, Ontario

DATUM Geodetic, as provided by Stantec Consulting Ltd.

FILE NO. PG0811

REMARKS

HOLE NO. TP12

BORINGS BY Backhoe **DATE** 12 Apr 06

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	88.95		
TOPSOIL 0.20									
GLACIAL TILL: Brown silty clay with sand, gravel and boulders 1.70						1	87.95		∇
End of Test Pit Bedrock @ 1.7m depth, east of test pit and 0.3m depth at west of test pit (Open hole GWL @ 1.6m depth)									

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers
28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Pharand Lands - Innes Road at Mer Bleeu Road
Ottawa, Ontario

DATUM Geodetic, as provided by Stantec Consulting Ltd.

REMARKS

BORINGS BY Backhoe

DATE 12 Apr 06

FILE NO. PG0811

HOLE NO. TP13

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	88.79		
TOPSOIL 0.30									
						1	87.79		
Very stiff to stiff, brown to grey-brown **SILTY CLAY**									▽
						2	86.79		
						3	85.79		
3.60									
End of Test Pit (Open hole GWL @ 1.5m depth)									

Water Content % axis: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ 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 strength of cohesionless soils is the relative density, 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.

Relative Density	‘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 vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

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 NXL size core. However, it can be used on smaller core sizes, such as BX, 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
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture 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 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

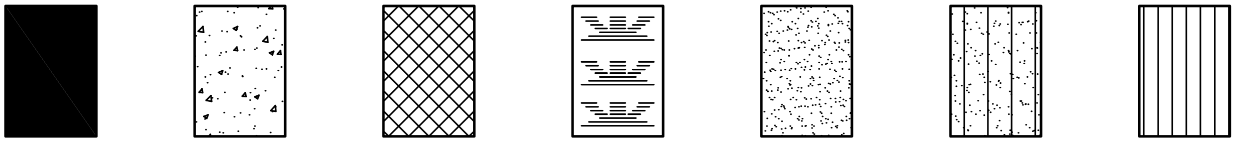
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

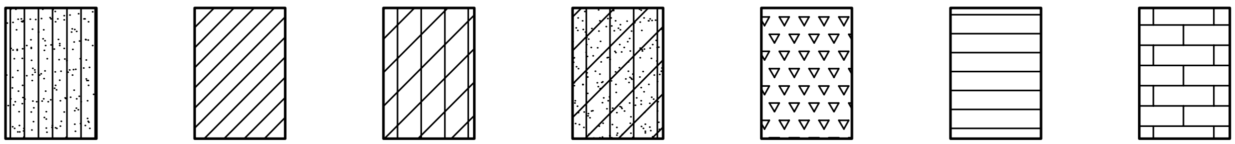
k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during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

SYMBOLS AND TERMS (continued)

STRATA PLOT



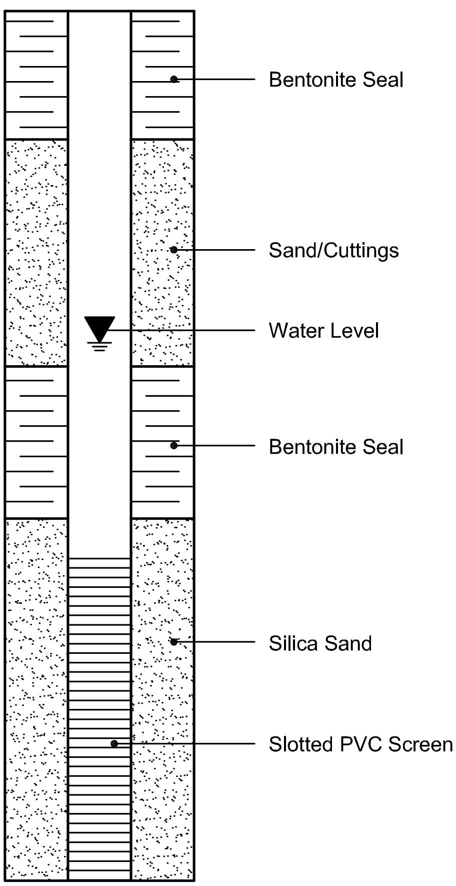
Topsoil | Asphalt | Fill | Peat | Sand | Silty Sand | Silt



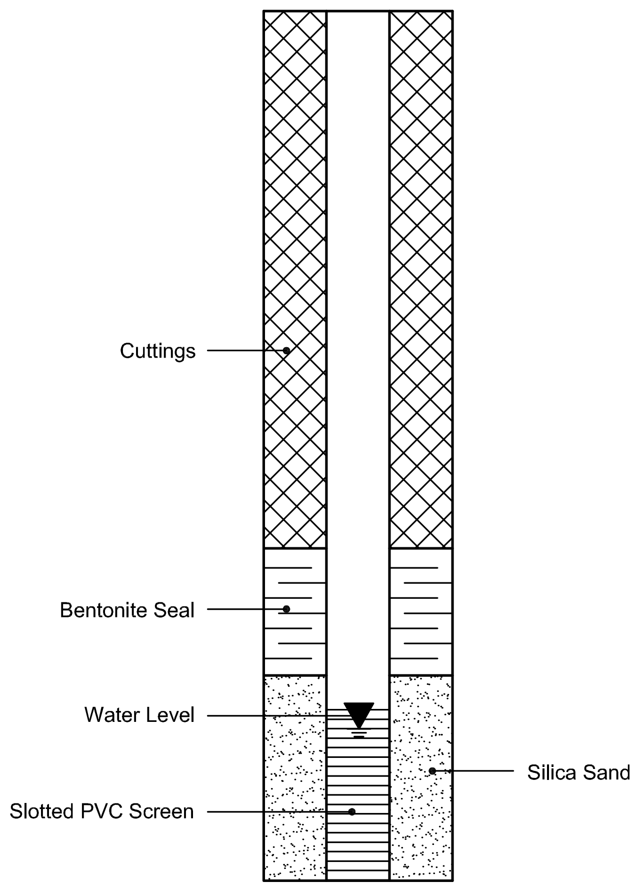
Sandy Silt | Clay | Silty Clay | Clayey Silty Sand | Glacial Till | Shale | Bedrock

MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



PARACEL LABORATORIES LTD.

Order #: 1647058

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 21264

Report Date: 17-Nov-2016

Order Date: 14-Nov-2016

Project Description: PG0811

	Client ID:	BH2-16 SS3	-	-	-
	Sample Date:	10-Nov-16	-	-	-
	Sample ID:	1647058-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	65.1	-	-	-
General Inorganics					
pH	0.05 pH Units	7.32	-	-	-
Resistivity	0.10 Ohm.m	86.0	-	-	-
Anions					
Chloride	5 ug/g dry	16	-	-	-
Sulphate	5 ug/g dry	41	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG0811-1 - TEST HOLE LOCATION PLAN

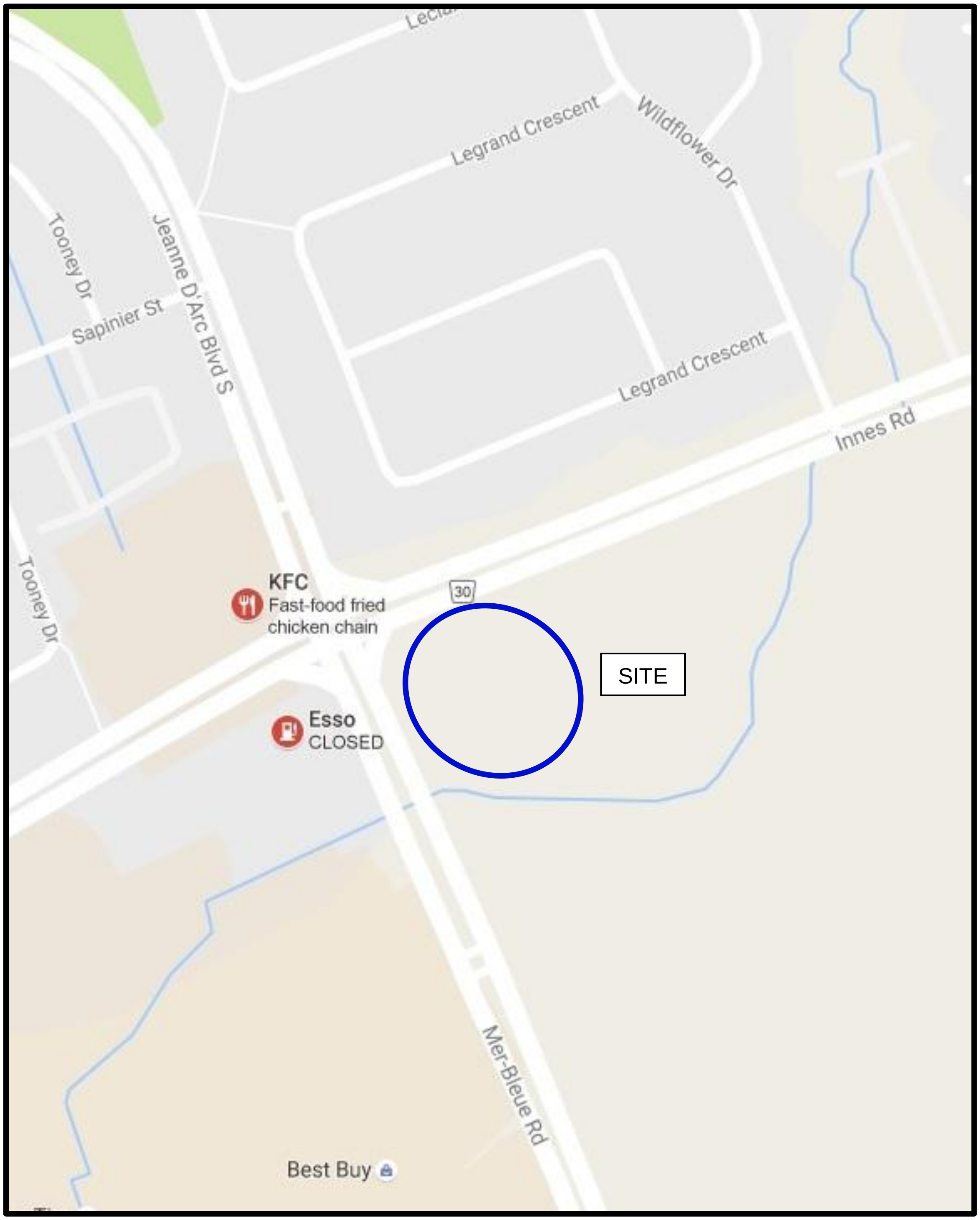
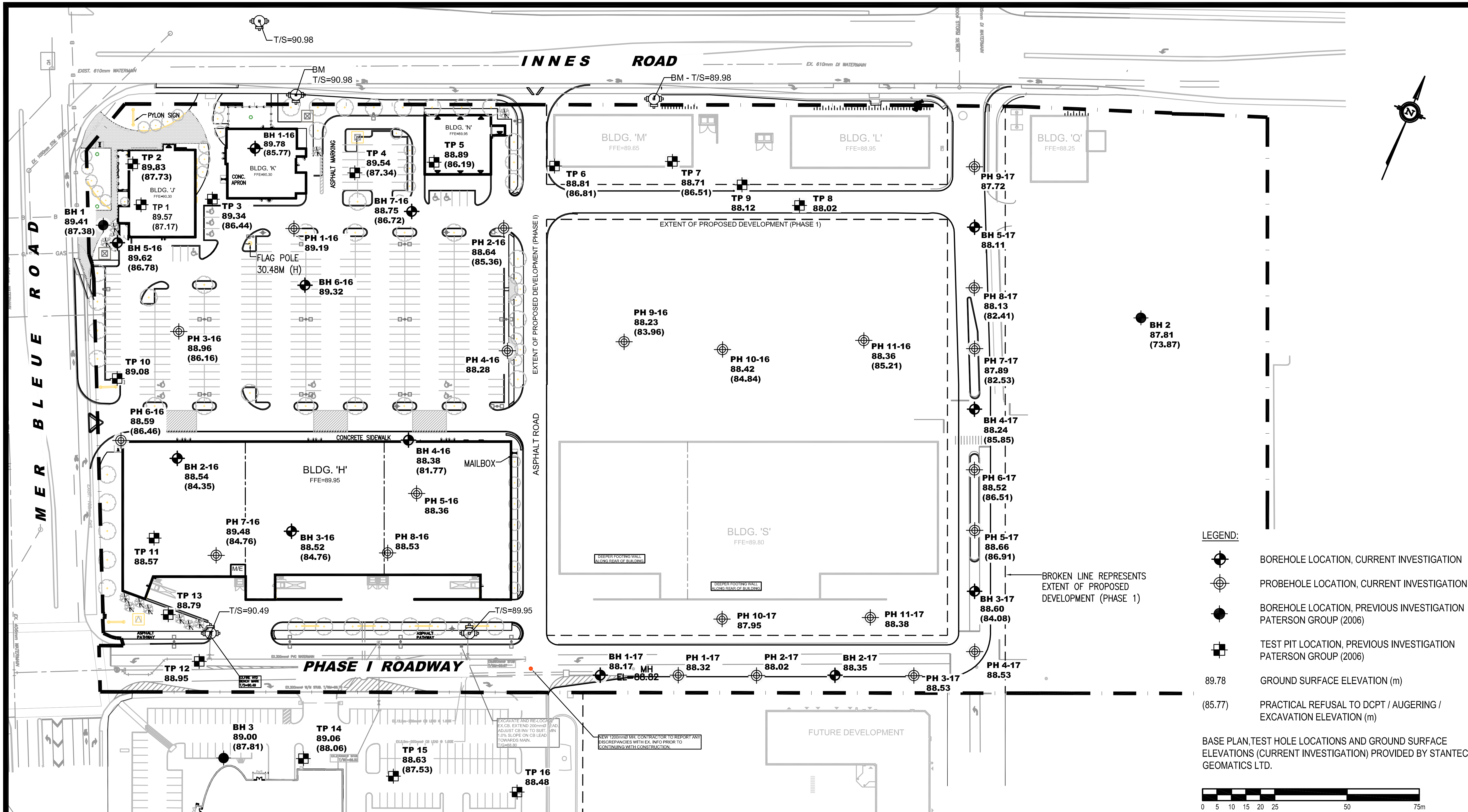


FIGURE 1

KEY PLAN

patersongroup



patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
2	ADDITIONAL PROBEHOLES AND BOREHOLES ALONG SERVICE PIPES	01/02/2017	FA
1	BASE PLAN UPDATED, PROBEHOLES AND BOREHOLES ADDED	29/11/2016	FA

SMART REIT

PROPOSED COMMERCIAL DEVELOPMENT - BUILDING H,J,K & N - PHASE I
MER BLEUE ROAD AND INNES ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:1250	Date: 11/2016
Drawn by: RCG	Report No.: PG0811
Checked by: FA	Dwg. No.: PG0811-1
Approved by: DJG	Revision No.: 2

p:\autocad drawings\geotechnical\pg08xx\pg0811-2 thlp rev1.dwg

Appendix E DRAWINGS