APPENDICES

Appendix A : WATER SUPPLY SERVICING

A.1 DOMESTIC WATER DEMAND ESTIMATE

Campanale Homes Block 15 - Domestic Water Demand Estimates

Based on Site Plan from Paul A. Cooper (Architect) Dated July 24, 2019

Population densities as per City Guidelines:

Townhouse (row)	2.7	ppu
3 Bedroom	3.1	ppu

Building ID	Area (m^2)	Population	Daily Demand Rate [3] (L/cap/day or L/m^2/day)	Avg Day Demand		Max Day Demand [1, 2]		Peak Hour Demand [1, 2]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Townhouse	-	43	350	10.5	0.18	26.3	0.44	57.8	0.96
3 Bedroom	-	37	350	9.0	0.15	22.6	0.38	49.7	0.83
Commercial	1,361		2.8	2.6	0.04	4.0	0.07	7.1	0.12
Total Site :		**80**		**22.2**	**0.37**	**52.8**	**0.88**	**114.6**	**1.91**

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

[2] Water demand criteria used to estimate peak demand rates for commercial areas are as follows:
maximum daily demand rate = 1.5 x average day demand rate
peak hour demand rate = 1.8 x maximum day demand rate

[3] Water demand for commercial units is 28,000 L/ha/d (i.e. 2.8 L/m2/day) under the "other commercial" classification in Table 4.2 in the City of Ottawa Water Distribution Guidelines

A.2 FIRE FLOW REQUIREMENTS PER FUS

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401500
Project Name: Longfields Block 15
Date: 20/9/2019
Fire Flow Calculation #: 1
Description: 16-unit back-to-back townhouse block

Notes: 3-storey tall building with 406 m2 footprint and semi-basement.

<table>
<tr><th>Step</th><th>Task</th><th colspan="6">Notes</th><th>Value Used</th><th>Req'd Fire Flow (L/min)</th></tr>
<tr><td>1</td><td>Determine Type of Construction</td><td colspan="6">Wood Frame</td><td>1.5</td><td>-</td></tr>
<tr><td rowspan="2">2</td><td>Determine Ground Floor Area of One Unit</td><td colspan="6">-</td><td>406</td><td>-</td></tr>
<tr><td>Determine Number of Adjoining Units</td><td colspan="6">Includes adjacent wood frame structures separated by 3m or less</td><td>1</td><td>-</td></tr>
<tr><td>3</td><td>Determine Height in Storeys</td><td colspan="6">Does not include floors >50% below grade or open attic space</td><td>3</td><td>-</td></tr>
<tr><td>4</td><td>Determine Required Fire Flow</td><td colspan="6">(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min</td><td>-</td><td>12000</td></tr>
<tr><td>5</td><td>Determine Occupancy Charge</td><td colspan="6">Limited Combustible</td><td>-15%</td><td>10200</td></tr>
<tr><td rowspan="4">6</td><td rowspan="4">Determine Sprinkler Reduction</td><td colspan="6">None</td><td>0%</td><td rowspan="4">0</td></tr>
<tr><td colspan="6">Non-Standard Water Supply or N/A</td><td>0%</td></tr>
<tr><td colspan="6">Not Fully Supervised or N/A</td><td>0%</td></tr>
<tr><td colspan="6">% Coverage of Sprinkler System</td><td>0%</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Determine Increase for Exposures (Max. 75%)</td><td>Direction</td><td>Exposure Distance (m)</td><td>Exposed Length (m)</td><td>Exposed Height (Stories)</td><td>Length-Height Factor (m x stories)</td><td>Construction of Adjacent Wall</td><td>-</td><td>-</td></tr>
<tr><td>North</td><td>0 to 3</td><td>19.1</td><td>3</td><td>31-60</td><td>Ordinary or Fire Resistive (Blank Wall)</td><td>0%</td><td rowspan="4">0</td></tr>
<tr><td>East</td><td>> 45</td><td>31.4</td><td>3</td><td>91-120</td><td>Wood Frame or Non-Combustible</td><td>0%</td></tr>
<tr><td>South</td><td>> 45</td><td>13.1</td><td>3</td><td>31-60</td><td>Wood Frame or Non-Combustible</td><td>0%</td></tr>
<tr><td>West</td><td>> 45</td><td>31.4</td><td>3</td><td>91-120</td><td>Wood Frame or Non-Combustible</td><td>0%</td></tr>
<tr><td rowspan="4">8</td><td rowspan="4">Determine Final Required Fire Flow</td><td colspan="7">Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min</td><td>10000</td></tr>
<tr><td colspan="7">Total Required Fire Flow in L/s</td><td>166.7</td></tr>
<tr><td colspan="7">Required Duration of Fire Flow (hrs)</td><td>2.00</td></tr>
<tr><td colspan="7">Required Volume of Fire Flow (m^3)</td><td>1200</td></tr>
</table>

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401500
Project Name: Longfields Block 15
Date: 20/9/2019
Fire Flow Calculation #: 2
Description: Mixed-use block with commercial space on ground floor, apartments on floors 2 and 3.
Notes: 1361 m2 footprint for 11-unit commercial block, 1400 m2 footprint for second storey (12 apartment units), 309 m2 for third storey. Using an adjusted ground floor area of 1025 m2.

<table>
<tr><th>Step</th><th>Task</th><th colspan="6">Notes</th><th>Value Used</th><th>Req'd Fire Flow (L/min)</th></tr>
<tr><td>1</td><td>Determine Type of Construction</td><td colspan="6">Ordinary Construction</td><td>1</td><td>-</td></tr>
<tr><td rowspan="2">2</td><td>Determine Ground Floor Area of One Unit</td><td colspan="6">-</td><td>1025</td><td>-</td></tr>
<tr><td>Determine Number of Adjoining Units</td><td colspan="6">-</td><td>1</td><td>-</td></tr>
<tr><td>3</td><td>Determine Height in Storeys</td><td colspan="6">Does not include floors >50% below grade or open attic space</td><td>3</td><td>-</td></tr>
<tr><td>4</td><td>Determine Required Fire Flow</td><td colspan="6">(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min</td><td>-</td><td>12000</td></tr>
<tr><td>5</td><td>Determine Occupancy Charge</td><td colspan="6">Limited Combustible</td><td>-15%</td><td>10200</td></tr>
<tr><td rowspan="4">6</td><td rowspan="4">Determine Sprinkler Reduction</td><td colspan="6">None</td><td>0%</td><td rowspan="4">0</td></tr>
<tr><td colspan="6">Non-Standard Water Supply or N/A</td><td>0%</td></tr>
<tr><td colspan="6">Not Fully Supervised or N/A</td><td>0%</td></tr>
<tr><td colspan="6">% Coverage of Sprinkler System</td><td>0%</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Determine Increase for Exposures (Max. 75%)</td><td>Direction</td><td>Exposure Distance (m)</td><td>Exposed Length (m)</td><td>Exposed Height (Stories)</td><td>Length-Height Factor (m x stories)</td><td>Construction of Adjacent Wall</td><td>-</td><td>-</td></tr>
<tr><td>North</td><td>20.1 to 30</td><td>67.1</td><td>3</td><td>> 120</td><td>Wood Frame or Non-Combustible</td><td>10%</td><td rowspan="4">1836</td></tr>
<tr><td>East</td><td>20.1 to 30</td><td>17.7</td><td>3</td><td>31-60</td><td>Wood Frame or Non-Combustible</td><td>8%</td></tr>
<tr><td>South</td><td>0 to 3</td><td>18.9</td><td>3</td><td>31-60</td><td>Ordinary or Fire Resistive (Blank Wall)</td><td>0%</td></tr>
<tr><td>West</td><td>> 45</td><td>42.2</td><td>3</td><td>> 120</td><td>Wood Frame or Non-Combustible</td><td>0%</td></tr>
<tr><td rowspan="4">8</td><td rowspan="4">Determine Final Required Fire Flow</td><td colspan="7">Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min</td><td>12000</td></tr>
<tr><td colspan="7">Total Required Fire Flow in L/s</td><td>200.0</td></tr>
<tr><td colspan="7">Required Duration of Fire Flow (hrs)</td><td>2.50</td></tr>
<tr><td colspan="7">Required Volume of Fire Flow (m^3)</td><td>1800</td></tr>
</table>

A.3 BOUNDARY CONDITIONS

BOUNDARY CONDITIONS

Boundary Conditions For: Longfield Block 15

Date of Boundary Conditions: 2019-Aug-20

Provided Information:

Scenario	Demand	
	L/min	L/s
Average Daily Demand	22.2	0.4
Maximum Daily Demand	52.8	0.9
Peak Hour	114.6	1.9
Fire Flow #1 Demand	12,000	200.0

Number Of Connections: 1

Location:

BOUNDARY CONDITIONS

Results:

Connection #: 1

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	132.3	55.1
Peak Hour	126.4	46.8
Max Day Plus Fire (12,000) L/min	124.0	43.3

[1] Elevation: **93.530 m**

Notes:

1) As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:

a) If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
b) Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

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.

Appendix B: WASTEWATER SERVICING

B.1 SANITARY SEWER DESIGN SHEET

Stantec

SUBDIVISION:

Longfields Block 15

DATE: 20/9/2019
REVISION: 0
DESIGNED BY: A.J.
CHECKED BY: DT

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401500

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280 l/p/day	MINIMUM VELOCITY	0.60	m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 l/ha/day	MAXIMUM VELOCITY	3.00	m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013	
PEAKING FACTOR (COMM., INST.):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B	
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50	m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.33 l/s/Ha	HARMON CORRECTION FACTOR	0.80	
PERSONS / APARTMENT	3.1					

LOCATION			**RESIDENTIAL AREA AND POPULATION**									**COMMERCIAL**		**INDUSTRIAL (L)**		**INDUSTRIAL (H)**		**INSTITUTIONAL**		**GREEN / UNUSED**		**C+I+I**	**INFILTRATION**			**TOTAL**	**PIPE**								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	SINGLE	UNITS TOWN	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)
BLOCK 15	SITE	SAN 120	0.35	0	16	12	80	0.35	80	4.00	1.0	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.48	0.48	0.2	1.3	7.0	200 200	PVC	SDR 35	1.00	33.4	**3.78%**	1.05	0.42

B.2 BACKGROUND REPORT EXCERPTS (SANITARY DRAINAGE)

Stantec

SUBDIVISION:

Longfields Subdivision

DATE: April 8, 2011
REVISION: May 3, 2011
DESIGNED BY: AR
CHECKED BY: TJW

SANITARY SEWER DESIGN SHEET

(City of Ottawa)

FILE NUMBER: 160400850

DESIGN PARAMETERS

AVG. DAILY FLOW / PERSON = 350 l/p/day
MINIMUM VELOCITY = 0.60 m/s
n = 0.013
MAX PEAK FACTOR = 4.0
MIN PEAK FACTOR = 2.0
Peaking Factor Industrial: 2.4
Peaking Factor Comm. / Inst.: 1.5

COMMERCIAL 0.60 l/s/Ha
INDUSTRIAL 0.40 l/s/Ha
INSTITUTIONAL 0.60 l/s/Ha
INFILTRATION 0.28 l/s/Ha
RESIDENTIAL HARMON PEAKING FACTOR
PERSONS/ Ssingle UNIT = 3.4
PERSONS/ med density unit = 3.1
PERSONS/ back to back unit = 2.7

LOCATION			RESIDENTIAL AREA AND POPULATION									COMM		INDUST		INSTIT		C+I+I	INFILTRATION				PIPE						Pipe % Full (Total/Cap.) (%)
STREET	FROM M.H.	TO M.H.	AREA (ha)	single units	med density units	back to back units	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)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	**TOTAL FLOW (l/s)**	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)	
Private	Stub	15	0.93	0	0	0	317	0.93	317	4.00	5.14		0.00		0.00		0.00	0.00	0.93	0.93	0.260	**5.40**	1.0	200	0.60	25.92	0.81	0.62	20.83
Via Verona Ave	15	4	0.04	0	0	0	0	3.87	683	3.90	0.00		0.00		0.22		0.00	0.00	0.04	4.09	0.011	**12.44**	22.9	200	0.44	22.08	0.69	0.71	56.34
Via Verona Ave	4	3	0.10	0	0	0	0	7.56	937	3.82	0.00		0.00		0.22		0.00	0.00	0.10	7.78	0.028	**17.62**	47.4	200	0.40	21.12	0.66	0.74	83.43
Via Verona Ave	3	2	0.03	0	0	0	0	7.59	937	3.82	0.00		0.00		0.22		0.00	0.00	0.03	7.81	0.008	**17.63**	13.4	200	0.45	22.40	0.70	0.78	78.71
Via Verona Ave	2	1	0.12	0	0	0	0	7.71	937	3.82	0.00		0.00		0.22		0.00	0.00	0.12	7.93	0.034	**17.66**	63.7	200	1.00	33.60	1.05	1.06	52.56
Longfields Drive	1	EX N15b	0.06	0	0	0	0	74.70	5541	3.20	0.00		0.00		0.22		0.00	0.00	0.06	74.92	0.017	**82.59**	20.3	375	0.25	91.20	0.80	0.92	90.56
Longfields Drive	EX N15b	EX N15c	0.17	0	0	0	0	74.87	5541	3.20	0.00		0.00		0.22		0.00	0.00	0.17	75.09	0.048	**82.64**	56.8	375	0.25	91.20	0.80	0.92	90.61
Longfields Drive	EX N15c	EX N15d	0.16	0	0	0	0	75.03	5541	3.20	0.00		0.00		0.22		0.00	0.00	0.16	75.25	0.045	**82.69**	52.8	375	0.25	91.20	0.80	0.92	90.67
Via Chianti Grove	25	24	0.03	0	0	0	0	0.03	0				0.00		0.00		0.00	0.00	0.03	0.03	0.008	**0.01**	11.7	200	0.65	26.88	0.84	0.00	0.04
Via Chianti Grove	24	23	0.16	0	0	0	0	0.19	0				0.00		0.00		0.00	0.00	0.16	0.19	0.045	**0.06**	97.9	200	0.50	23.68	0.74	0.00	0.25
Private	Stub	23	0.65	0	0	34	92	0.65	92	4.00	1.49		0.00		0.00		0.00	0.00	0.65	0.65	0.182	**1.67**	11.7	200	0.60	25.92	0.81	0.42	6.44
Via Chianti Grove	23	22	0.04	0	0	0	0	0.88	92	4.00	0.00		0.00		0.00		0.00	0.00	0.04	0.88	0.011	**1.74**	21.3	250	0.50	44.37	0.87	0.35	3.92
Via Chianti Grove	22	EX N15d	0.02	0	0	0	0	0.90	92	4.00	0.00		0.00		0.00		0.00	0.00	0.02	0.90	0.006	**1.75**	4.5	250	1.55	78.03	1.53	0.61	2.24
Longfields Drive	EX N15d	EX N17	0.19	0	0	0	0	76.12	5633	3.20	0.00		0.00		0.22		0.00	0.00	0.19	76.34	0.053	**84.49**	61.3	375	0.25	91.20	0.80	0.92	92.64
Longfields Drive	EX N17	26	0.04	0	0	0	0	76.16	5633	3.20	0.00		0.00		0.22		0.00	0.00	0.04	76.38	0.011	**84.50**	13.9	375	0.30	100.32	0.88	0.99	84.23
Via Campanale Ave	30	28	0.02	0	0	0	0	0.02	0				0.00		0.00		0.00	0.00	0.02	0.02	0.006	**0.01**	11.5	200	0.65	26.88	0.84	0.00	0.04
Via Campanale Ave	28	27	0.26	0	0	0	51	0.28	51	4.00	0.83		0.00		0.00		0.00	0.00	0.26	0.28	0.073	**0.91**	80.0	200	0.84	30.72	0.96	0.38	2.96
Private	Stub	27	0.53	0	0	0	168	0.53	168	4.00	2.72	0.15	0.15		0.00		0.00	0.14	0.68	0.68	0.190	**3.05**	10.3	200	0.60	25.92	0.81	0.50	11.77
Via Campanale Ave	27	26	0.08	0	0	0	0	0.89	219	4.00	0.00		0.15		0.00		0.00	0.00	0.08	1.04	0.022	**3.98**	58.7	250	1.60	79.56	1.56	0.73	5.00
Longfields Drive	26	EX N17a	0.07	0	0	0	0	77.12	5852	3.18	0.00		0.15		0.22		0.00	0.00	0.07	77.49	0.020	**88.50**	22.1	375	0.30	100.32	0.88	1.00	88.22
Longfields Drive	EX N17a	EX N19	0.36	0	0	21	57	77.48	5909	3.18	0.73	0.05	0.20		0.22		0.00	0.05	0.41	77.90	0.115	**89.40**	61.5	375	0.30	100.32	0.88	1.00	89.11
Longfields Drive	EX N19	EX N310	0.06	0	0	0	0	77.54	5909	3.18	0.00		0.20		0.22		0.00	0.00	0.06	77.96	0.017	**89.42**	23.0	375	0.30	100.32	0.88	1.00	89.13
Private	Stub	30	0.23	0	0	0	58	0.23	58	4.00	0.94		0.00		0.00		0.00	0.00	0.23	0.23	0.064	**1.00**	10.3	200	0.40	21.12	0.66	0.31	4.73
Via Campanale Ave	30	29	0.34	0	66	0	205	0.57	263	4.00	3.32	0.05	0.05		0.00		0.00	0.05	0.39	0.62	0.109	**4.48**	88.1	200	0.65	26.88	0.84	0.60	16.67
Via Campanale Ave	33	32	0.52	0	0	16	43	0.52	43	4.00	0.70		0.00		0.00		0.00	0.00	0.52	0.52	0.146	**0.85**	58.3	200	0.65	26.88	0.84	0.34	3.16
Via Campanale Ave	32	31	0.53	0	0	18	49	1.05	92	4.00	0.79		0.00		0.00		0.00	0.00	0.53	1.05	0.148	**1.79**	60.0	200	0.40	21.12	0.66	0.38	8.48

Stantec

SITE:

LONGFIELDS STATION BUILDING

DATE: September 7, 2012
REVISION: April 2, 2015
DESIGNED BY: SGG
CHECKED BY: TJW

SANITARY SEWER DESIGN SHEET

(City of Ottawa)

Station Building (Block 14)

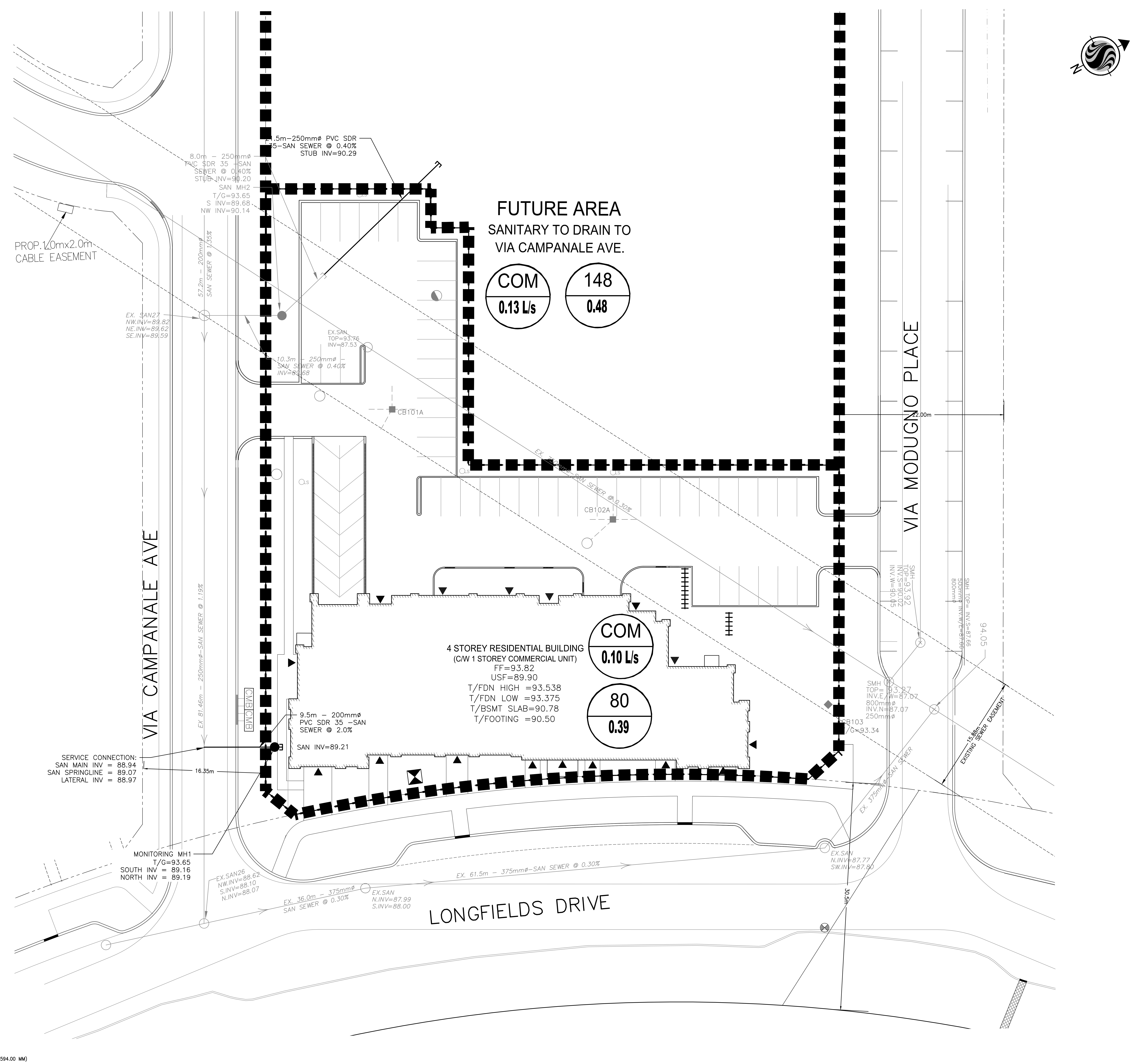
FILE NUMBER: 1604-00850

XML Conversion

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	50,000.00	l/ha/d	MAXIMUM VELOCITY	3.00	m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL	35,000.00	l/ha/d	MANNINGS n	0.013	
PEAKING FACTOR (COMM., INST.):	1.5	INSTITUTIONAL	50,000.00	l/ha/d	BEDDING CLASS	B	
PERSONS / SINGLE UNIT	3.4	INFILTRATION	0.28	l/s/Ha	MINIMUM COVER	2.50	m
PERSONS / TOWNHOME	2.8						
APPARTMENT 2 BEDROOM	2.1						
APPARTMENT 1 BEDROOM	1.4						

LOCATION			RESIDENTIAL AREA AND POPULATION									COMM		INDUST		INSTIT		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL FLOW	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)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL 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)
Station Building	Bldg	Campanale Ave	0.43	0	0	46	63	0.43	63	4.00	1.02	0.12	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.43	0.43	0.12	1.24	9.5	200	PVC	SDR-35	2.00	47.10	2.64	1.48	0.55



W:\active\160400850_Longfields_Subdivision\design\drawing\BLOCK 14–South– Station Bldg Drawings\160400850_DB (Station Building – Block 14).dwg
8/17/2015 10:19:42 AM BY: GILLIS, SHERIDAN

ORIGINAL SHEET: ISO FULL BLEED A1 (841.00 X 594.00 MM)

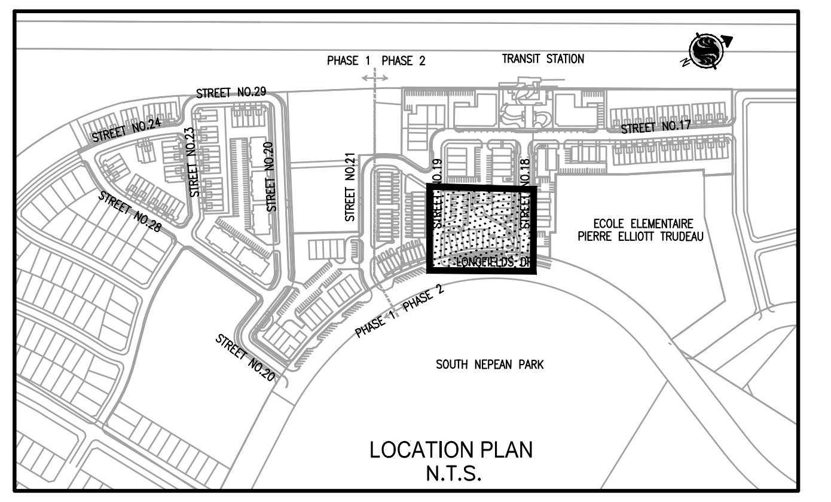
Stantec Consulting Ltd.
1331 Clyde Avenue
Ottawa ON Canada
K2C 3G4
Tel. 613.722.4420
Fax. 613.722.2799
www.stantec.com

Stantec

Legend

—●—	PROPOSED SANITARY SEWER
10	POPULATION
0.09	SANITARY DRAINAGE AREA (ha)
■ ■ ■ ■	LIMIT OF SANITARY DRAINAGE AREA

Notes



LOCATION PLAN
N.T.S.

7.	Revised per City Comments	SGG	PDM	15.08.17
6.	ISSUED FOR CONSTRUCTION	SGG	TJW	15.05.01
5.	REVISED PER SITE PLAN UPDATE	SGG	TJW	15.04.29
4	REVISED AS PER CITY COMMENTS – 13.07.02	GBU	TJW	14.01.03
3	ISSUED FOR REVISED SITE PLAN	DT	TJW	13.12.06
2	REVISED BUILDING FOUNDATION LAYOUT	GBU	TJW	13.05.23
1	ISSUED FOR 2ND SUBMISSION	SGG	TJW	13.03.27
0	ISSUED TO CITY FOR APPROVAL	ATR	TJW	12.09.14
Revision		By	Appd.	YY.MM.DD

File Name: 160400850c–SP	MJS	TJW	MJS	10.05.14
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project

CAMPANALE HOMES
(200 - 1187 BANK STREET, OTTAWA, K1S 2X7, (613) 730-7000)

LONGFIELDS BLOCK 14
STATION BUILDING
(613 Longfields Drive, Ottawa)

Title

SANITARY DRAINAGE PLAN

Project No.
160400850C

Scale
0 2.5 7.5 12.5m
1:250

Drawing No.
SAN-1

Sheet
4 of 5

Revision
7

Appendix C : STORMWATER MANAGEMENT

C.1 STORM SEWER DESIGN SHEET

Longfields Block 14 (Phase 2)

DATE: 2019-09-20
REVISION: 1
DESIGNED BY: DC
CHECKED BY: DT

STORM SEWER
DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401500

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																									PIPE SELECTION											
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)	$I_{2\text{-YEAR}}$ (mm/h)	$I_{5\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$I_{100\text{-YEAR}}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETEI (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
STM-1	1	2	0.11	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.098	0.098	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	20.9	11.6	300	300	CIRCULAR	PVC	-	0.50	68.0	**30.78%**	0.97	0.71	0.27
																				10.27																			
STM-2, STM-3	4	3	0.34	0.00	0.00	0.00	0.00	0.90	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	31.7	300	300	CIRCULAR	PVC	-	0.50	68.0	**95.17%**	0.97	1.00	0.53
	3	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.303	0.000	0.000	0.000	0.000	0.000	0.000	10.53	74.84	101.49	118.96	173.88	0.0	0.0	63.1	22.3	300	300	CIRCULAR	PVC	-	0.50	68.0	**92.74%**	0.97	0.99	0.37
																				10.90																			
	2	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.401	0.000	0.000	0.000	0.000	0.000	0.000	10.90	73.51	99.67	116.81	170.73	0.0	0.0	82.0	21.1	450	450	CIRCULAR	PVC	-	2.00	420.6	**19.49%**	2.56	1.66	0.21
																				11.11									450	450									

C.2 MODIFIED RATIONAL METHOD CALCULATIONS

Stormwater Management Calculations

File No: **160401500**
Project: **Longfields Block 15**
Date: **20-Sep-19**

SWM Approach:
Control to 53 L/s/ha

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table

Sub-catchment Area			Area (ha) "A"		Runoff Coefficient "C"	"A x C"		Overall Runoff Coefficient
Catchment Type	**ID / Description**							
Controlled - Tributary	STM 1	Hard	0.109		0.9	0.098		
		Soft	0.000		0.2	0.000		
		Subtotal		0.109			0.0981	0.900
Controlled - Tributary	STM 2	Hard	0.308		0.9	0.277		
		Soft	0.000		0.2	0.000		
		Subtotal		0.308			0.2772	0.900
Controlled - Tributary	STM 3	Hard	0.029		0.9	0.026		
		Soft	0.000		0.2	0.000		
		Subtotal		0.029			0.0261	0.900
Uncontrolled - Non-Tributary	UNC-1	Hard	0.012		0.9	0.010		
		Soft	0.015		0.2	0.003		
		Subtotal		0.027			0.0135	0.500
Uncontrolled - Non-Tributary	UNC-2	Hard	0.003		0.9	0.003		
		Soft	0.001		0.2	0.000		
		Subtotal		0.004			0.0032	0.800
Total				**0.477**			**0.418**	
Overall Runoff Coefficient= C:								**0.88**

Total Roof Areas	**0.000 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**0.446 ha**
Total Tributary Area to Outlet	**0.446 ha**
Total Uncontrolled Areas (Non-Tributary)	**0.031 ha**
Total Site	**0.477 ha**

Stormwater Management Calculations

Project #160401500, Longfields Block 15
Modified Rational Method Calculatons for Storage

5 yr Intensity
City of Ottawa

$I = a/(t + b)^c$

a = 998.071
b = 6.053
c = 0.814

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

5 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.48
C: 0.20

Control to 53 L/s/ha

Unit Rate (L/s/ha)	Area (ha)	Q100yr (L/s)
53	0.48	**25.4**

5 YEAR Modified Rational Method for Entire Site

Subdrainage Area: STM 1 Controlled - Tributary
Area (ha): 0.109
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.2	28.4	5.4	23.0	13.8
20	70.3	19.2	5.4	13.7	16.5
30	53.9	14.7	5.4	9.3	**16.7**
40	44.2	12.0	5.4	6.6	15.9
50	37.7	10.3	5.4	4.9	14.6
60	32.9	9.0	5.4	3.6	12.8
80	26.6	7.2	5.4	1.8	8.8
100	22.4	6.1	5.4	0.7	4.2
120	19.5	5.3	5.3	0.0	0.0
140	17.3	4.7	4.7	0.0	0.0
160	15.6	4.2	4.2	0.0	0.0
180	14.2	3.9	3.9	0.0	0.0

Storage: Surface Storage Above CB

Orifice Type LMF 70
Invert Elevation 91.82 m
T/G Elevation 93.20 m
Max Ponding Depth 0.20 m
Downstream W/L 86.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	93.40	1.58	5.4	16.7	28.8	OK

Subdrainage Area: STM 2 Controlled - Tributary
Area (ha): 0.308
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.2	80.3	14.0	66.3	39.8
20	70.3	54.1	14.0	40.1	48.2
30	53.9	41.6	14.0	27.6	**49.6**
40	44.2	34.0	14.0	20.0	48.1
50	37.7	29.0	14.0	15.0	45.0
60	32.9	25.4	14.0	11.4	41.0
80	26.6	20.5	14.0	6.5	31.0
100	22.4	17.3	14.0	3.3	19.6
120	19.5	15.0	14.0	1.0	7.2
140	17.3	13.3	13.3	0.0	0.0
160	15.6	12.0	12.0	0.0	0.0
180	14.2	10.9	10.9	0.0	0.0

Storage: Surface Storage Above CB

Orifice Equation: = CdA(2gh)^0.5 Where C = 0.572
Orifice Diameter: 75 mm
Invert Elevation 91.78 m
T/G Elevation 93.16 m
Max Ponding Depth 0.26 m
Downstream W/L 91.00 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	93.42	1.57	14.0	49.6	62.0	OK

Project #160401500, Longfields Block 15
Modified Rational Method Calculatons for Storage

100 yr Intensity
City of Ottawa

$I = a/(t + b)^c$

a = 1735.688
b = 6.014
c = 0.820

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

100 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.48
C: 0.20

Control to 53 L/s/ha

Unit Rate (L/s/ha)	Area (ha)	Q100yr (L/s)
53	0.48	**25.4**

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: STM 1 Controlled - Tributary
Area (ha): 0.109
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	178.6	54.1	5.6	48.0	28.8	0.5
20	120.0	36.3	5.6	24.0	**28.8**	**6.8**
30	91.9	27.8	5.6	16.0	28.8	6.3
40	75.1	22.8	5.6	12.0	28.8	5.2
50	64.0	19.4	5.6	9.6	28.8	4.2
60	55.9	16.9	5.6	8.0	28.8	3.4
80	45.0	13.6	5.6	6.0	28.8	2.0
100	37.9	11.5	5.6	4.8	28.8	1.1
120	32.9	10.0	5.6	4.0	28.8	0.4
140	29.2	8.8	5.6	3.2	27.3	0.0
160	26.2	8.0	5.6	2.4	22.7	0.0
180	23.9	7.2	5.6	1.7	17.9	0.0

Storage: Surface Storage Above CB

Orifice Type LMF 70
Invert Elevation 91.82 m
T/G Elevation 93.20 m
Max Ponding Depth 0.30 m
Downstream W/L 91.00 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	93.50	1.68	5.6	28.8	28.8	OK
					0.00	

Subdrainage Area: STM 2 Controlled - Tributary
Area (ha): 0.308
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	178.6	153.4	15.1	103.3	**62.0**	35.0
20	120.0	109.5	15.1	51.7	**62.0**	**42.7**
30	91.9	84.9	15.1	34.4	**62.0**	35.3
40	75.1	69.5	15.1	25.8	**62.0**	28.6
50	64.0	59.0	15.1	20.7	**62.0**	23.2
60	55.9	51.2	15.1	17.2	**62.0**	18.9
80	45.0	40.6	15.1	12.9	**62.0**	12.5
100	37.9	33.6	15.1	10.3	**62.0**	8.1
120	32.9	28.5	15.1	8.6	**62.0**	4.8
140	29.2	25.0	15.1	7.4	**62.0**	2.5
160	26.2	22.5	15.1	6.5	**62.0**	0.9
180	23.9	20.5	15.1	5.3	57.7	0.0

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 75 mm
Invert Elevation 91.78 m
T/G Elevation 93.16 m
Max Ponding Depth 0.30 m
Downstream W/L 91.00 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	93.46	1.60	15.1	62.0	62.0	OK
					0.00	

Stormwater Management Calculations

Project #160401500, Longfields Block 15
Modified Rational Method Calculatons for Storage

Subdrainage Area: STM 3 — Controlled - Tributary
Area (ha): 0.029
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.2	7.6	3.8	3.7	**2.2**
20	70.3	5.1	3.8	1.3	1.5
30	53.9	3.9	3.8	0.1	0.1
40	44.2	3.2	3.2	0.0	0.0
50	37.7	2.7	2.7	0.0	0.0
60	32.9	2.4	2.4	0.0	0.0
80	26.6	1.9	1.9	0.0	0.0
100	22.4	1.6	1.6	0.0	0.0
120	19.5	1.4	1.4	0.0	0.0
140	17.3	1.3	1.3	0.0	0.0
160	15.6	1.1	1.1	0.0	0.0
180	14.2	1.0	1.0	0.0	0.0

Storage: Surface Storage Above CB

Orifice Type	LMF 60	
Invert Elevation	91.80	m
T/G Elevation	93.18	m
Max Ponding Depth	0.03	m
Downstream W/L	91.00	m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	93.21	1.41	3.8	2.2	22.9	OK

Subdrainage Area: UNC-1 — Uncontrolled - Non-Tributary
Area (ha): 0.027
C: 0.50

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.2	3.9	3.9		
20	70.3	2.6	2.6		
30	53.9	2.0	2.0		
40	44.2	1.7	1.7		
50	37.7	1.4	1.4		
60	32.9	1.2	1.2		
70	29.4	1.1	1.1		
80	26.6	1.0	1.0		
90	24.3	0.9	0.9		
100	22.4	0.8	0.8		
110	20.8	0.8	0.8		
120	19.5	0.7	0.7		

Subdrainage Area: UNC-2 — Uncontrolled - Non-Tributary
Area (ha): 0.004
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.2	1.0	1.0		
20	70.3	0.7	0.7		
30	53.9	0.5	0.5		
40	44.2	0.4	0.4		
50	37.7	0.4	0.4		
60	32.9	0.3	0.3		
70	29.4	0.3	0.3		
80	26.6	0.3	0.3		
90	24.3	0.2	0.2		
100	22.4	0.2	0.2		
110	20.8	0.2	0.2		
120	19.5	0.2	0.2		

SUMMARY TO OUTLET

Tributary Area	0.138	ha
Total 5yr Flow to Sewer	23.3	L/s
Target	25.4	L/s
Non-Tributary Area	0.004	ha
Total 5yr Flow Uncontrolled	5.0	L/s
Total 5yr Major System Flow	0.0	L/s
Total to Dowstream ROW	5.0	L/s
Target	69.0	L/s

Project #160401500, Longfields Block 15
Modified Rational Method Calculatons for Storage

Subdrainage Area: STM 3 — Controlled - Tributary
Area (ha): 0.029
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	178.6	14.4	4.2	10.2	6.1	0.0
20	120.0	9.7	4.2	5.5	**6.6**	0.0
30	91.9	7.4	4.2	3.2	5.8	0.0
40	75.1	6.1	4.2	1.9	4.5	0.0
50	64.0	5.2	4.2	1.0	2.9	0.0
60	55.9	4.5	4.2	0.3	1.1	0.0
80	45.0	3.6	3.6	0.0	0.0	0.0
100	37.9	3.1	3.1	0.0	0.0	0.0
120	32.9	2.7	2.7	0.0	0.0	0.0
140	29.2	2.4	2.4	0.0	0.0	0.0
160	26.2	2.1	2.1	0.0	0.0	0.0
180	23.9	1.9	1.9	0.0	0.0	0.0

Storage: Surface Storage Above CB

Orifice Type	LMF 60	
Invert Elevation	91.80	m
T/G Elevation	93.18	m
Max Ponding Depth	0.30	m
Downstream W/L	91.00	m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	93.48	1.68	4.2	6.6	22.9	OK
					16.32	

Subdrainage Area: UNC-1 — Uncontrolled - Non-Tributary
Area (ha): 0.027
C: 0.63

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.6	8.4	8.4		
20	120.0	5.6	5.6		
30	91.9	4.3	4.3		
40	75.1	3.5	3.5		
50	64.0	3.0	3.0		
60	55.9	2.6	2.6		
70	49.8	2.3	2.3		
80	45.0	2.1	2.1		
90	41.1	1.9	1.9		
100	37.9	1.8	1.8		
110	35.2	1.7	1.7		
120	32.9	1.5	1.5		

Subdrainage Area: UNC-2 — Uncontrolled - Non-Tributary
Area (ha): 0.004
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.6	2.0	2.0		
20	120.0	1.3	1.3		
30	91.9	1.0	1.0		
40	75.1	0.8	0.8		
50	64.0	0.7	0.7		
60	55.9	0.6	0.6		
70	49.8	0.6	0.6		
80	45.0	0.5	0.5		
90	41.1	0.5	0.5		
100	37.9	0.4	0.4		
110	35.2	0.4	0.4		
120	32.9	0.4	0.4		

SUMMARY TO OUTLET

Tributary Area	0.138	ha
Total 100yr Flow to Sewer	24.9	L/s
Target	25.4	L/s
Non-Tributary Area	0.004	ha
Total 100yr Flow Uncontrolled	10.4	L/s
Total 100yr Major System Flow	42.7	L/s
Total to Dowstream ROW	53.0	L/s
Target	110.0	L/s

C.3 BACKGROUND REPORT EXCERPTS (STORM DRAINAGE)

City of Ottawa Historical Storm increased by 20% to test the minor and major systems under extreme events

- Runoff Coefficients in the proposed phase calculated based on actual soft and hard surfaces on each phase, converted to equivalent percent imperviousness using the relationship C = (Imp. x 0.7) + 0.2 (see **Appendix A1**)
- Subcatchment areas and segment lengths defined from high-point to high-point
- Subcatchment width equal to the segment length for ramp and access road catchments, and 225 m/ha times the area for any other catchments
- Number of catchbasins based on servicing plan (**Drawing SD-1**)
- Catchbasin inflow restricted with inlet-control devices (ICDs) as necessary to meet the minor system inflow criteria
- Surface ponding in sag storage calculated using the cone equation (V = Area*Depth/3), based on grading plans (**Drawings GP-1**)
- Different segment cross-section types defined, accounting for parking lot areas, roof areas, ramp and access road areas, and grassed uncontrolled areas (see **Appendices A2 to A4**)
- Future development area was assumed to have a runoff coefficient of 0.80, to restrict minor system peak flows to 25.4 L/s (53 L/s/ha) and to provide 52.8 m^3 of surface storage (110 m^3/ha)

Drawing SD-1 summarizes the discretized subcatchments used in the analysis of the proposed Block 14 of the Longfields Development (LD), shows the proposed ICD schedule, and outlines the major system direction. The grading plan is also enclosed for review.

Tables 2.1 to 2.3 summarize the minor system inflow, the major system sag storage and the overflow peaks for the proposed Block 14 of the LD during the 5 year, 3hr Chicago storm, the July 1st, 1979 storm and the July 1st, 1979 storm increased by 20% respectively. **Appendices A1 to A4** summarize the DDSWMM modeling input and results for the site for the different storm events.

Table 2.1: 5 Year Storm DDSWMM Results

Segment	Peak Flow (m^3/s)	DDSWMM Segment Depth (cm)	Maximum Capture (L/s)	Upstream MH	Overflow Peak[1] (m^3/s)	Max. Storage Used (m^3)	Static Ponding Depth (cm)[4]	Total Dynamic Flow Depth (cm)
BLDG-1	0.037	1.5	3.4	Ex.2100	0.000	45.5	4.0	1.5
BLDG-2	0.005	0.1	4.7	Ex.2100	0.000	0.0	0.0	0.1
PRKG-1	0.085	4.5	2.0	CB101A	0.042	28.6	19.0	23.5
PRKG-2	0.032	3.1	2.0	CB102A	0.001	29.2	26.0	29.1
PATIO	0.006	1.5	4.7	CB103	0.000	0.7	12.0	1.5

Segment	Peak Flow (m^3/s)	DDSWMM Segment Depth (cm)	Maximum Capture (L/s)	Upstream MH	Overflow Peak[1] (m^3/s)	Max. Storage Used (m^3)	Static Ponding Depth (cm)[4]	Total Dynamic Flow Depth (cm)
UNC1	0.003	0.1	0.0	NONE	0.003	0.0	0.0	0.1
UNC2	0.003	0.1	0.0	NONE	0.003	0.0	0.0	0.1
FUTURE	0.132	5.3	25.4	CB101B	0.069	52.8	N/A	N/A
Peak Flow to Minor System[2]:					42 L/s			
Major System Peak Outflow[3]:					48 L/s			

1. Major system overflow from segment
2. Represents the sum of the maximum capture rate of all segments
3. Includes the overflow peak from segment PRKG-1, PATIO, UNC1, UNC2
4. The static ponding depth represents the ponding depth within the sag

Table 2.2: July 1st, 1979 Storm DDSWMM Results

Segment	Peak Flow (m^3/s)	DDSWMM Segment Depth (cm)	Maximum Capture (L/s)	Upstream MH	Overflow Peak[1] (m^3/s)	Max. Storage Used (m^3)	Static Ponding Depth (cm)[4]	Total Dynamic Flow Depth (cm)
BLDG-1	0.036	1.5	5.9	Ex.2100	0.000	79.4	7.6	1.5
BLDG-2	0.004	0.1	4.5	Ex.2100	0.000	0.0	0.0	0.1
PRKG-1	0.177	6.1	2.0	CB101A	0.167	28.6	19.0	25.1
PRKG-2	0.035	3.2	2.0	CB102A	0.032	29.2	26.0	29.2
PATIO	0.006	1.6	5.8	CB103	0.000	0.9	12.0	1.6
UNC1	0.005	0.1	0.0	NONE	0.005	0.0	0.0	0.1
UNC2	0.005	0.1	0.0	NONE	0.005	0.0	0.0	0.1
FUTURE	0.142	5.5	25.4	CB101B	0.110	52.8	N/A	N/A
Peak Flow to Minor System[2]:					46 L/s			
Major System Peak Outflow[3]:					177 L/s			

1. Major system overflow from segment
2. Represents the sum of the maximum capture rate of all segments
3. Includes the overflow peak from segment PRKG-1, PATIO, UNC1, UNC2
4. The static ponding depth represents the ponding depth within the sag

Table 2.3: July 1st, 1979 Storm Increased by 20% DDSWMM Results

Segment	Peak Flow (m^3/s)	DDSWMM Segment Depth (cm)	Maximum Capture (L/s)	Upstream MH	Overflow Peak[1] (m^3/s)	Max. Storage Used (m^3)	Static Ponding Depth (cm)[4]	Total Dynamic Flow Depth (cm)
BLDG-1	0.044	1.8	6.1	Ex.2100	0.010	82.5	7.6	9.4
BLDG-2	0.005	0.1	5.4	Ex.2100	0.000	0.0	0.0	0.1
PRKG-1	0.220	6.5	2.0	CB101A	0.209	28.6	19.0	25.5
PRKG-2	0.042	3.4	2.0	CB102A	0.039	29.2	26.0	29.4

Segment	Peak Flow (m^3/s)	DDSWMM Segment Depth (cm)	Maximum Capture (L/s)	Upstream MH	Overflow Peak[1] (m^3/s)	Max. Storage Used (m^3)	Static Ponding Depth (cm)[4]	Total Dynamic Flow Depth (cm)
PATIO	0.007	1.6	5.8	CB103	0.002	0.9	12.0	13.6
UNC1	0.010	0.1	0.0	NONE	0.007	0.0	0.0	0.1
UNC2	0.001	0.1	0.0	NONE	0.006	0.0	0.0	0.1
FUTURE	0.185	6.0	25.4	CB101B	0.139	52.8	N/A	N/A
Peak Flow to Minor System[2]:					47 L/s			
Major System Peak Outflow[3]:					224 L/s			

1. Major system overflow from segment
2. Represents the sum of the maximum capture rate of all segments
3. Includes the overflow peak from segment PRKG-1, PATIO, UNC1, UNC2
4. The static ponding depth represents the ponding depth within the sag

As can be seen in **Table 2.2**, the overall resulting minor system inflow from the proposed Block 14 of the LD during the July 1, 1979 storm is 46 L/s, thus meeting the 48 L/s minor system target release rate for the area. Major flows from the subject site have been directed to Via Campanale Avenue and Longfields Drive through engineered channels such as roadways and swales. The overall major system storage provided in the proposed Block 14 is equal to 193.9 m^3, thus providing enough storage to mitigate the overall 1979 storm major system overflow peak from the site to 0.177 m^3/s, which is less than the 0.223 m^3/s 1979 storm overflow peak from Block 14 accounted for in the LD SWM Report (see area 127a in Page 4.5 in **Appendix C**). The results of the hydrologic analyses (DDSWMM input and output files) for the different storm events are summarized in **Appendices A2 to A4.**

The following table summarizes the ICD schedule across the proposed phase one of Block 14 of the LD.

Table 2.4: Proposed Phase One ICD Schedule

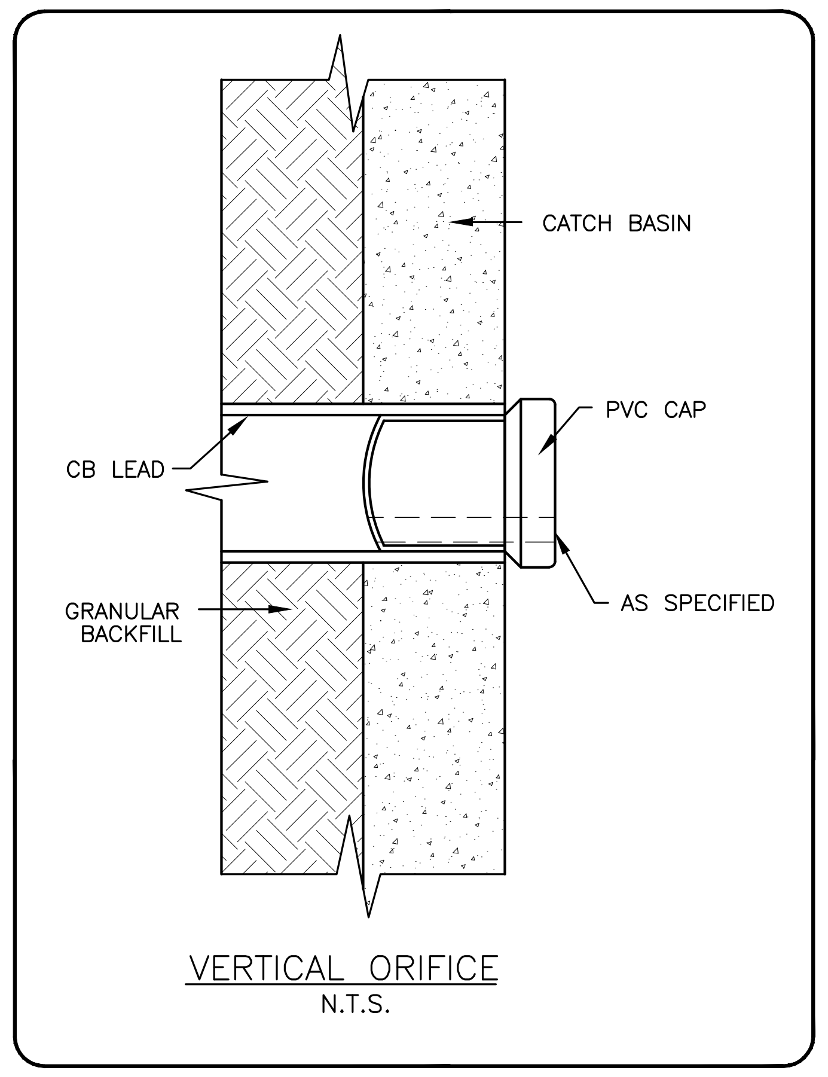
Catchment ID	MH/CB ID	ICD Type / Size	ICD Invert (m)	Max. Release Rate (L/s)
PATIO	CB103	75mm Circular Orifice	91.42	5.8
PRKG-1	CB101A	Hydrovex 50 VHV-1	91.50	2.0
PRKG-2	CB102A	Hydrovex 50 VHV-1	91.46	2.0

1. Hydrovex design curves have been added to **Appendix D**

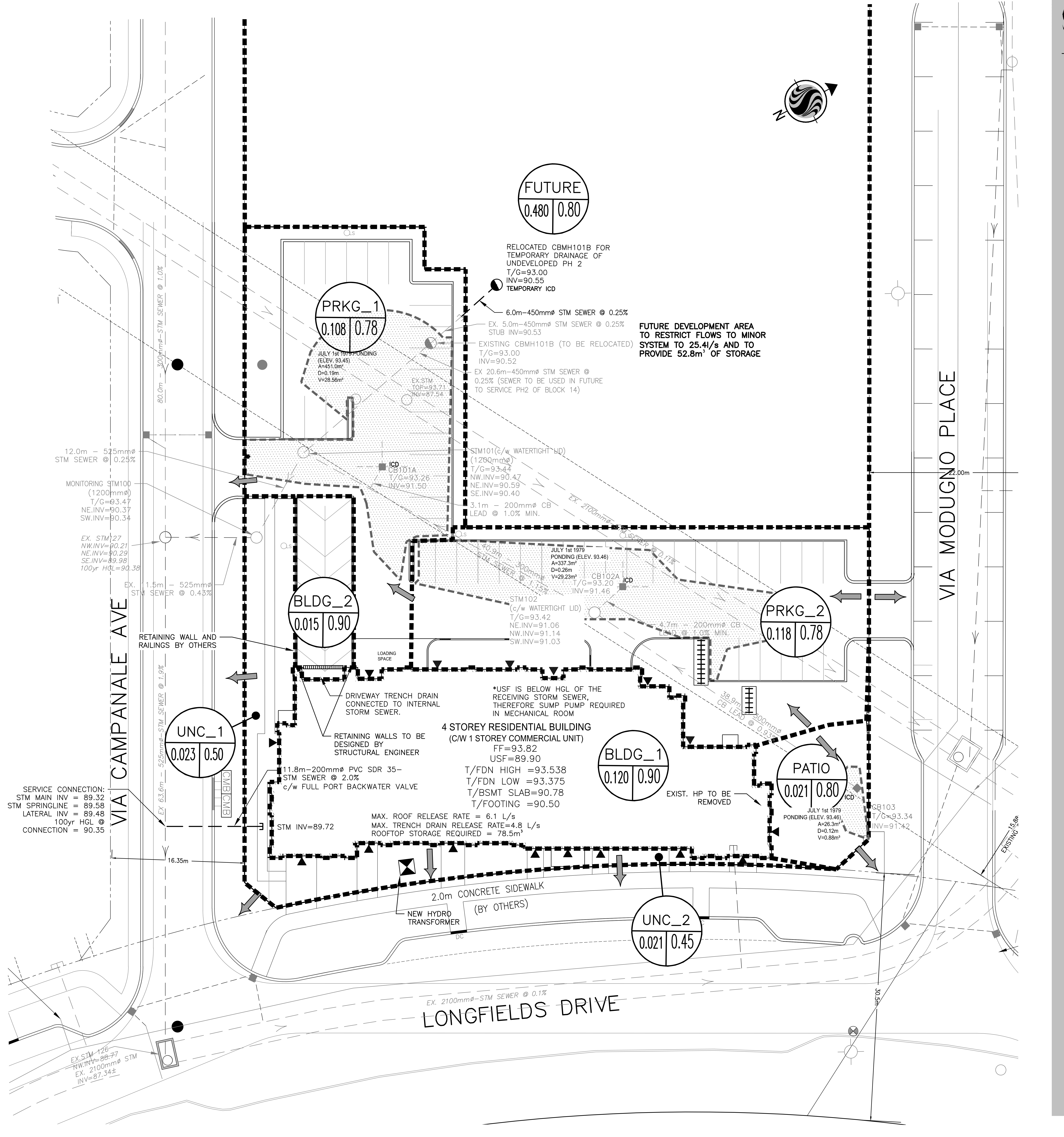
In the interim condition, when area FUTURE is undeveloped, runoff from this area will be captured in an interim catchbasin (CB101B), which will be equipped with an IPEX Type ‘A’ or approved equivalent to restrict runoff to the minor system to 21.0 L/s, which is less than the post development target release rate of 25.4 L/s.

ICD SCHEDULE

AREA ID	CB ID	INV	ICD SIZE (mm) / TYPE	MAX. RELEASE RATE (L/s)
PATIO	CB103	91.42	75 mm	5.8
PRKG-1	CB101A	91.50	HYDROVEX 50 VHV-1	2.0
PRKG-2	CB102A	91.46	HYDROVEX 50 VHV-1	2.0
FUTURE	CB101B	90.55	IPEX 'A'	21.0



VERTICAL ORIFICE
N.T.S.



W:\active\160400850_Longfields_Subdivision\design\drawing\BLOCK 14–South– Station Bldg Drawings\160400850_DB (Station Building – Block 14).dwg
8/17/2015 10:19:35 AM BY: GILLIS, SHERIDAN

ORIGINAL SHEET: ISO FULL BLEED A1 (841.00 X 594.00 MM)

Stantec

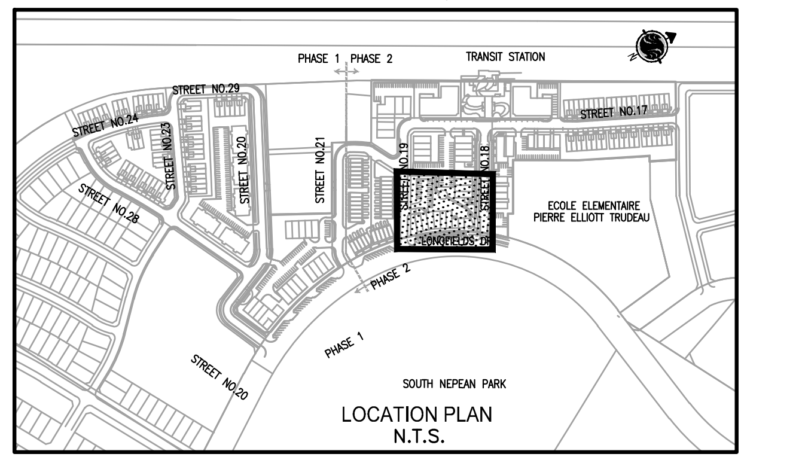
Stantec Consulting Ltd.
1331 Clyde Avenue
Ottawa ON Canada
K2C 3G4
Tel. 613.722.4420
Fax. 613.722.2799
www.stantec.com

Legend

A	DRAINAGE AREA NO.
0.90	RUNOFF COEFFICIENT
0.00	STORM DRAINAGE AREA (ha)
▬ ▬ ▬	DRAINAGE DIVIDE
— —○— —	PROPOSED STORM SEWER
	PROPOSED 250mmø SUBDRAIN AND CAP
— —■— —	PROPOSED CATCH BASIN c/w SUBDRAIN
- - - -	EXISTING STORM SEWER
□	EXISTING CATCH BASIN
⇨	DIRECTION OF OVERLAND FLOW
▨	MAXIMUM PONDING AREA
▲	BUILDING ACCESS

Notes

1. THE ICD SCHEDULE INDICATES THE REQUIRED ICDs TO RESTRICT INFLOWS TO THE STORM SEWER. THE CONTRACTOR IS TO PROVIDE THE ICDs INDICATED IN THE SCHEDULE, OR THEIR APPROVED EQUIVALENT.
2. THE 1979 STORM INFLOW TO THE STORM SEWER AT CB103 IS LESS THAN THE MAXIMUM RELEASE RATE LISTED IN THE ICD SCHEDULE. HOWEVER, A 75mm ORIFICE HAS BEEN SPECIFIED TO PROTECT THE MINOR SYSTEM DURING EXTREME EVENTS.
3. 1979 STORM RUNOFF FROM AREAS BLDG–1 AND BLDG–2 TO BE CAPTURED IN BUILDING'S INTERNAL SYSTEM AND DISCHARGED THROUGH STORM SERVICE TO THE 2100mmø STORM SEWER WITHIN LONGFIELDS DRIVE. Q_{TOTAL} = 10.6 L/s
4. IN THE INTERIM CONDITION, WHEN AREA FUTURE IS UNDEVELOPED, RUNOFF FROM THIS AREA WILL BE CAPTURED IN THE INTERIM CB101B, WHICH WILL BE EQUIPPED WITH AN IPEX TYPE 'A' OR APPROVED EQUIVALENT.



LOCATION PLAN
N.T.S.

		By	Appd.	YY.MM.DD
7.	Revised per City Comments	SGG	PDM	15.08.17
6.	ISSUED FOR CONSTRUCTION	SGG	TJW	15.05.01
5.	REVISED PER SITE PLAN UPDATE	SGG	TJW	15.04.29
4	REVISED AS PER CITY COMMENTS	GBU	TJW	14.01.03
3	ISSUED FOR REVISED SITE PLAN	DT	TJW	13.12.06
2	REVISED BUILDING FOUNDATION LAYOUT	GBU	TJW	13.05.23
1	ISSUED FOR 2ND SUBMISSION	SGG	TJW	13.03.27
0	ISSUED TO CITY FOR APPROVAL	ATR	TJW	12.09.14

Revision

File Name: 160400850c–SP	MJS	AP	MJS	10.05.14
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project

CAMPANALE HOMES
(200 - 1187 BANK STREET, OTTAWA, K1S 2X7, (613) 730-7000)

LONGFIELDS BLOCK 14
STATION BUILDING
(613 Longfields Drive, Ottawa)

Title

STORM DRAINAGE PLAN

Project No.
160400850C

Scale
0 2.5 7.5 12.5m
1:250

Drawing No.	Sheet	Revision
SD-1	3 of 5	7

Appendix D : GEOTECHNICAL INVESTIGATION

patersongroup

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Studies

Supplemental Geotechnical Investigation

Proposed Residential Development
Longfields Drive
Ottawa, Ontario

Prepared For

Campanale Homes

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March 11, 2013

Report: PG2119-2

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APPENDICES

Appendix 1	Soil Profile and Test Data Sheets Symbols and Terms Analytical Testing Results
Appendix 2	Figure 1 - Key Plan Drawing PG2119-2 - Test Hole Location Plan

1.0 INTRODUCTION

Paterson Group (Paterson) was commissioned by Campanale Homes to conduct a supplemental geotechnical investigation for the proposed residential development to be located along Longfields Drive, in the City of Ottawa (refer to Figure 1 - Key Plan presented in Appendix 2).

The objective of the investigation was to:

- ❏ Determine the subsoil and groundwater conditions at this site by means of test pits.
- ❏ Provide geotechnical recommendations for the foundation design for the proposed buildings and pavement structure design for the proposed development including construction considerations which may affect the design.

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

Investigating the presence or potential presence of contamination on the subject property was not part of the scope of work of this present investigation.

2.0 PROPOSED DEVELOPMENT

It is understood that the current phase of the proposed development consists of a four (4) storey residential-commercial building with one (1) underground parking level, which is to be located along Longfields Drive and just south of the existing City of Ottawa service easement, which crosses the site.

It is expected that the future phases of the proposed residential development will consist of residential townhouse blocks, and multi-storey residential buildings. It is also expected that local roadways, access lanes, driveways and parking areas are to be constructed for the proposed development.

3.0 METHOD OF INVESTIGATION

3.1 Field Investigation

The field program for our supplemental investigation was carried out on February 15, 2013 and the original investigation was carried out on May 20, 2010. Fourteen (14) test pits were completed as part of our site investigations. The test hole locations are shown on Drawing PG2119-2 - Test Hole Location Plan included in Appendix 2. The test pits were distributed to provide general coverage of the subject area, at a spacing in compliance with the "Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa" dated September 7, 2007.

The test pits were excavated using a hydraulic shovel operated by a local contractor. The fieldwork was conducted under the full-time supervision of our personnel under the direction of a senior engineer. The test pitting procedure consisted of excavating to the required depths at the selected locations. Sampling and testing the overburden in general accordance with ASTM D5434-12 - Guide for Field Logging of Subsurface Explorations of Soil and Rock.

Sampling and In Situ Testing

Soil samples were recovered along the sidewalls of the test pits by hand during excavation. All soil samples were classified on site, placed in sealed plastic bags and were transported to our laboratory for visual inspection. The depths at which the grab samples were recovered from the test holes are shown as G on the Soil Profile and Test Data sheets in Appendix 1.

Undrained shear strength testing was carried out at regular depth intervals in cohesive soils. Undrained shear strength testing was completed using a handheld, portable vane apparatus (field inspection vane tester Roctest Model H-60). This testing was done in general accordance with ASTM D2573-08 - Standard Test Method for Field Vane Shear Test in Cohesive Soil.

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 of this report.

3.2 Field Survey

The test hole locations completed by Paterson for the most current investigation were surveyed and located in the field by Paterson personnel. Test pits were referenced to a temporary benchmark (TBM), consisting of the top spindle of fire hydrant located near the northeast corner of the subject property, along the east side of Longfields Drive. The provided TBM elevation is referenced to a geodetic datum.

The test pit locations for the original investigation were located and surveyed by Stantec Geomatics. The ground surface elevations at the test pit locations are referenced to a geodetic datum.

The ground surface elevations at the test hole locations are presented on Drawing PG2119-2 - Test Hole Location Plan included in Appendix 2.

3.3 Laboratory Testing

The soil samples recovered from the subject site were visually examined in our laboratory to review the results of the field logging. The subsurface soils were classified in general accordance with ASTM D2488-09a, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

3.4 Analytical Testing

One (1) soil sample 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 sample was submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the sample. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

The sample was selected from the silty clay, which is the predominant subsurface soil that will be encountered at footing and service installation depths. Additionally, fine-grained soils such as silty clay, are considered to have a greater corrosion potential than coarse grained soil.

Paracel Laboratories (Paracel), of Ottawa, performed the laboratory analysis of the soil sample submitted for analytical testing. Paracel is a member of the Standards Council of Canada/Canadian Association for Environmental Analytical Laboratories (SCC/CAEAL). Paracel is accredited and certified by SCC/CAEAL for specific tests registered with the association.

The following testing guidelines were utilized for the submitted soil samples. The anions were analyzed using EPA 300.1, the pH was analyzed using EPA 150.1, the resistivity was analyzed using EPA 120.1, and the percent solids was determined using gravimetrics.

4.0 OBSERVATIONS

4.1 Surface Conditions

At the time of our field investigation, the site was snow covered. The majority of the ground surface across the subject site was relatively flat and grass covered. Several fill piles were noted west of TP 3-13 and TP 2-13. A treed area was noted to the south and east portion of the site. A skateboard park and a Hydro Transformer Station were located within the east and west central portions of the site, respectively.

4.2 Subsurface Profile

Generally, the subsurface profile at the borehole locations consists of topsoil or fill underlain by a very stiff to stiff silty clay followed by a compact to dense glacial till. Practical refusal to excavation was encountered at TP 2 to TP 5.

Fill, consisting of silty clay with sand, gravel, cobbles and boulders, was noted to extend from ground surface to maximum 2.3 m depth at TP 1-13, TP 2-13, TP 3-13, TP 4-13 and TP 5-13.

A brown silty clay deposit was encountered below the topsoil and/or fill layer at each test pit location and extended to depths ranging between 0.9 to 4.9 m depth. TP 4-12 and TP 5-12 were terminated within the silty clay layer at a 4 m depth. Undrained shear strength testing within the silty clay layer resulted in shear strength values between 50 to 130 kPa, which are indicative of a stiff to very stiff consistency.

A thin layer of sandy silt was encountered at TP 3-12, between 3.6 and 3.9 m depth. This layer is considered to be a compact relative density based on field observations.

Glacial till, consisting of silty sand with gravel, cobbles, boulders, and trace clay was encountered below the silty clay or sandy silt at all test pit locations, except TP 4-12, TP 5-12. Based on field observations, the glacial till is considered to be in a compact to dense state of compactness.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for specific details of the soil profiles encountered at each test hole location. Testing procedures performed on subsurface soils are described in Subsection 3.1 - Field Investigation.

Based on available geological mapping (bedrock geology mapping and drift thickness mapping), interbedded sandstone and dolomite of the March formation is present in this area with an overburden thickness ranging between 3 to 10 m. The geological mapping referenced refers to the Urban Geology of the NCR published by the National Resources Canada.

4.3 Groundwater

The groundwater level (GWL) were measured in the test pits at the time of excavation. Groundwater was encountered at depths of 3.2, 2.3, 1.8 and 3.2 m at TP 2, TP 3, TP 8 and TP 9, respectively. The remainder of the test pits were dry upon completion. It should be noted that surface/perched water due to recent precipitation events can lead to higher than typical groundwater infiltration levels. The long-term groundwater level can also be estimated based on moisture levels and colour of the recovered soil samples. Based on these observations at the test pit locations, the long-term groundwater table is expected between a 3 to 4 m depth. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

5.0 DISCUSSION

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed development. It is expected that the proposed residential buildings will be founded on conventional style footings placed on an undisturbed, stiff silty clay or dense glacial till bearing surface. A permissible grade raise restriction is required for the proposed buildings where a silty clay layer is noted below underside of footing.

It is understood that the proposed building for the current phase of development will have one (1) level of underground parking below the building footprint. Due to the proposed building location, it is expected adequate space is available to maintain an open cut excavation during building construction.

The above and other considerations are discussed in the following paragraphs.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and fill, containing deleterious or organic materials, should be stripped from under any buildings and other settlement sensitive structures. Other settlement sensitive structures include, but are not limited to, underground services and paved areas.

Fill Placement

Fill used for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II material, as specified in OPSS 1010 dated November 2003. This material should be tested and approved prior to delivery to the site, as per OPSS 1004 dated November 2012. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the buildings should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If excavated stiff brown silty clay, free of organics and deleterious materials, is to be used to build up the subgrade level for areas to be paved, the silty clay, under dry conditions, should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD. Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

5.3 Foundation Design

Bearing Resistance Values

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, placed on an undisturbed, stiff silty clay can be designed using a bearing resistance value at serviceability limit states (SLS) of **100 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **200 kPa**. A geotechnical resistance factor of 0.5 was applied to the reported bearing resistance values at ULS.

Footings placed on an undisturbed, compact glacial till bearing surface can be designed using a bearing resistance value at SLS of **150 kPa** and a factored bearing resistance value at ULS of **225 kPa**.

An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, have been removed prior to the placement of concrete for footings.

A permissible grade raise restriction of 2 m is recommended for areas where silty clay is encountered below underside of footing level. It should be further clarified that the permissible grade raise restriction noted is a conservative value, which was expected to be sufficient for the proposed development. It is expected that the underlying silty clay deposit can tolerate a higher grade raise without excessive settlement (ie.- less than 25 mm total settlement) occurring. Several properties of the silty clay deposit encountered on site are favourable for significant grade raises without excessive settlement, such as silty clay layer depth, stiffness of the deposit and low moisture levels of the majority of the deposit based on field observations. All of these factors were considered in calculating the permissible grade raise restriction.

The bearing resistance value given for footings at SLS will be subjected to potential post construction total and differential settlements of 25 and 15 mm, respectively.

Lateral Support

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

5.4 Design for Earthquakes

The seismic site classification was based on extrapolating the results of our test hole locations. The average shear wave velocity of the upper 30 m of the subsurface profile below the proposed footing was determined based on the results of previous seismic shear wave velocity tests in similar deposits of silty clay and glacial till within the Ottawa area. Seismic shear wave velocities were determined for each layer based on the recorded N-values and historical seismic testing. A worst case scenario of layer depths was assumed with the abovenoted information and the seismic site classification was determined.

4 m thick layer of stiff silty clay	Vs 200 m/s
5 m thick layer of dense glacial till	Vs 300 m/s
21 m bedrock conservatively	Vs 1500 m/s
30 m	Vs30 592 m/s

Based on the rationale outlined above, a seismic site response **Class C** is applicable for foundation design at the subject site according to the OBC 2006.

It should be noted that the site is not susceptible to liquefaction based on the soil consistency and type encountered, which include a stiff silty clay and compact to dense glacial till deposit. Both of these soil types are not susceptible to liquefaction based on design earthquake data for the Ottawa area. Typical soils of concern for liquefaction potential in the Ottawa area are poorly graded, cohesionless soils in a loose state of compactness with a high groundwater table.

5.5 Basement Slab

With the removal of all topsoil and fill, if any, within the footprint of the proposed buildings, the native soil surface will be considered to be an acceptable subgrade on which to commence backfilling for floor slab construction.

Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill. OPSS Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. It is recommended that the upper 200 mm of sub-floor fill consists of 19 mm clear crushed stone. All backfill material within the footprint of the proposed buildings should be placed in maximum 300 mm thick loose layers and compacted to at least 98% of its SPMDD.

5.6 Pavement Structure

The subgrade materials for the pavement structures are anticipated to be stiff silty clay, or compacted engineered fill. Table 1 presents the California Bearing Ratio (CBR) for the anticipated subgrade materials.

Table 1 - CBR for Subgrade Materials

Soil Type	**CBR Ratio**
Stiff Silty Clay	10
Engineered Fill	70

For residential driveways and car only parking areas, an Ontario Traffic Category A is applicable. For local roadways, an Ontario Traffic Category B should be used for design purposes. For design purposes, the pavement structures presented in the following tables could be used for the design of driveways, car only parking areas and local roadways. It should be noted that the pavement structure design presented in Table 2 is adequate for use for the underground parking garage.

Table 2 - Recommended Pavement Structure - Driveways and Car Only Parking Areas	
Thickness (mm)	**Material Description**
50	**Wear Course** - HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil or OPSS Granular B Type I or II material placed over in situ soil or fill.	

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

Additionally, it is understood that underground parking is being considered for the multi-storey buildings. The following pavement structures presented would be applicable.

Table 4 - Recommended Flexible Pavement Structure - Access Ramp

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

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

The pavement structure subgrade materials are anticipated to be stiff silty clay, compact to dense glacial till or compacted engineered fill. No measures to prevent fines from entering the subbase materials are required for the subject site.

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

It is recommended that a compaction level between 91% and 96.5% be provided for Superpave 19.0. A compaction level between 92% to 97.5% be provided for Superpave 12.5. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the material's 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 its load carrying capacity.

Due to the impervious nature of the subgrade materials, consideration should be given to installing subdrains in the silty clay during the pavement construction. These drains should be installed at each catch basin as per City of Ottawa standards and specifications. The subdrain inverts should be approximately 300 mm below subgrade level. 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 100 mm to 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, unless used in conjunction with a drainage geocomposite, such as Miradrain G100N or Delta Drain 6000, connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should be used for this purpose.

6.2 Protection of Footings Against Frost Action

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

Exterior unheated footings, such as those for isolated exterior piers, are more prone to deleterious movement associated with frost action than the exterior walls of the structure proper and require additional protection. The recommended minimum thickness of soil cover is 2.1 m (or equivalent).

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 Occupational Health and Safety Act and Regulations for Construction Projects defines a Type 2 material as a material that most closely exhibits the following characteristics:

- ☐ is very stiff in consistency, dense in compactive condition, and, if a standard penetration test is performed, has a standard penetration resistance of 30 to 50 blows per 300 mm
- ☐ can be penetrated with moderate difficulty by a small, sharp object
- ☐ is difficult to excavate with hand tools
- ☐ has a low to medium natural moisture content and a damp appearance after it is excavated
- ☐ has no signs of water seepage
- ☐ does not include previously excavated soils

The Occupational Health and Safety Act and Regulations for Construction Projects defines a Type 3 material as a material that most closely exhibits the following characteristics:

- ☐ is stiff in consistency, compact in compactive condition, and, if a standard penetration test is performed, has a standard penetration resistance of 10 to 29 blows per 300 mm
- ☐ can be penetrated with moderate ease by a small, sharp object
- ☐ is moderately difficult to excavate with hand tools
- ☐ exhibits signs of surface cracking
- ☐ exhibits signs of localized water seepage

Type 3 soil can also include previously excavated soil that does not exhibit any of the characteristics of type 4 soil.

Based on observations performed at the test pit locations at the time of the field program and review of the recovered soil samples, 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. The frequency of these periodic inspections will be determined based on the height and slope of the affected area, the proximity to workers, the length of time that the slope is present on the site, and the existing condition of the slope. An initial inspection should occur once the slope is completed, and a schedule of inspections will be determined based on field observations.

It is the responsibility of the site contractor to ensure appropriate safety protection for all workers for the duration of the project. However, 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

Bedding and backfill materials should be in accordance with City of Ottawa standards and specifications.

The pipe bedding for sewer and water pipes should consist of at least 150 mm of OPSS Granular A material. 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 its 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 material’s SPMDD.

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches which are within the silty clay layer. 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 material's 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

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.

The rate of flow of groundwater into the excavation through the overburden should be low to moderate. It is anticipated that pumping from open sumps will be sufficient to control the groundwater influx through the sides of the excavations.

6.6 Winter Construction

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

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

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and 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.

Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The results of analytical testing were evaluated according to industry accepted standards presented by A.B. Chance. It was stated that extremely acid soils (below a pH of 4.5) and very strong alkaline soils (above a pH of 9.1) is considered to have a significantly high corrosion loss rate.

The soil resistivity/corrosion rate potential was evaluated according to the following table:

Table 5 - Corrosion Potential

Resistance Classification	Soil Resistivity (ohm-cm)	Corrosion Potential
Low	0-2,000	Severe
Medium	2,000-10,000	Moderate
High	10,000-30,000	Mild
Very High	Above 30,000	Unlikely

The Canadian Standards Association (CSA) outlines the requirements for sulphate content in A23.1-04, Table 3. AASHTO T290-91 outlines the requirements for chloride content.

The results show that the sulphate content is less than 0.1%. These results are indicative that Type 10 Portland cement (Type GU, or normal cement) would be appropriate for this site. The results of the chloride content, pH and resistivity indicate the presence of an unlikely corrosion potential environment for exposed ferrous metals at this site.

6.8 Landscaping Considerations

Tree Planting Restrictions

The proposed residential buildings are located in a low sensitivity area with respect to tree plantings over a silty clay deposit. It is recommended that trees placed within 4 m of the foundation wall shall consist of low water demanding trees with shallow roots systems that extend less than 1.5 m below ground surface. Trees placed greater than 4 m from the foundation wall may consist of typical street trees, which are typically moderate water demand species with roots extending to a maximum depth of 2 m below ground surface.

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.

Swimming Pools

The in-situ soils are considered to be acceptable for in-ground swimming pools. Above ground swimming pools must be placed at least 3 m away from the residence foundation and neighbouring foundations. Otherwise, pool construction is considered routine, and can be constructed in accordance with the manufacturer`s requirements.

7.0 RECOMMENDATIONS

It is recommended that the following be carried out once the site development details are determined:

☐ Review detailed grading plan(s) from a geotechnical perspective.

☐ Observation of all bearing surfaces prior to the placement of concrete.

☐ 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 ensure that the specified level of compaction has been 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 material 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 and our recommendations when the drawings and specifications are complete.

A geotechnical investigation of this nature is a limited sampling of a site. The recommendations are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around the test locations. The extent of the limited area depends on the soil, bedrock and groundwater conditions, as well the history of the site reflecting natural, construction, and other activities. Should any conditions at the site be encountered which differ from those at the test locations, we request notification 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 Campanale Homes or their agent(s) is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

LICENSED PROFESSIONAL ENGINEER
D. J. GILBERT
100116130
PROVINCE OF ONTARIO

Stephanie Boisvenue, B.Eng.

David J. Gilbert, P.Eng.

Report Distribution:

- ❏ Campanale Homes (3 copies)
- ❏ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE & TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TESTING RESULTS

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

REMARKS N 5014835; E 441573

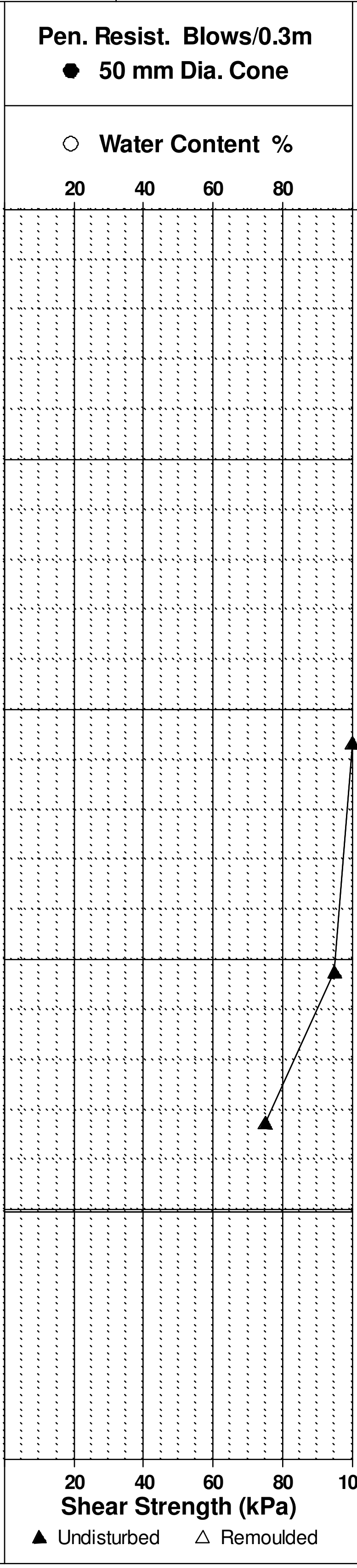
BORINGS BY Hydraulic Shovel

DATE February 15, 2013

FILE NO. PG2119

HOLE NO. TP 1-13

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Piezometer Construction
GROUND SURFACE						0	93.72	
FILL: Brown silty clay with gravel and cobbles, trace topsoil 1.83	▩	G G	1 2			1	92.72	
Very stiff to stiff, brown **SILTY CLAY** with sand seams - firm and grey by 3.5m depth 3.66	▨	G G G G	3 4 5 6			2 3	91.72 90.72	
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles, boulders 4.01	⁘	G	7			4	89.72	
End of Test Pit (TP dry upon completion)								



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

REMARKS N 5014843; E 441539

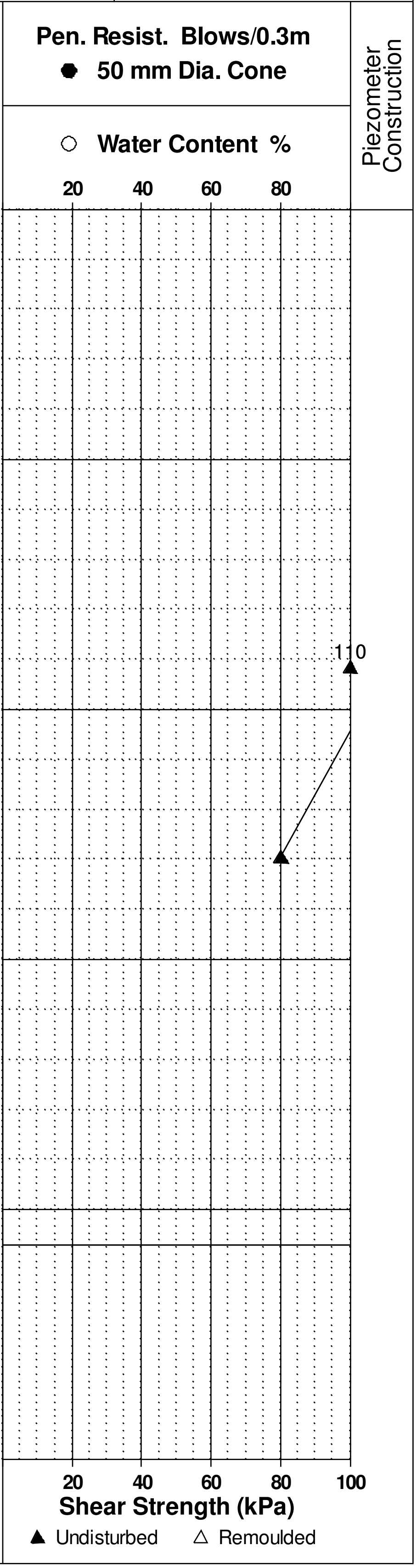
BORINGS BY Hydraulic Shovel

DATE February 15, 2013

FILE NO. PG2119

HOLE NO. TP 2-13

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.69
FILL: Brown silty clay with sand, gravel and cobbles							
0.40							
						1	92.69
Very stiff to stiff, brown **SILTY CLAY**		G	1				
						2	91.69
		G	2				
						3	90.69
3.20							
GLACIAL TILL: Compact to dense, brown silty sand with gravel and cobbles		G	3				
						4	89.69
4.14							
End of Test Pit (TP dry upon completion)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

REMARKS N 5014807; E 441520

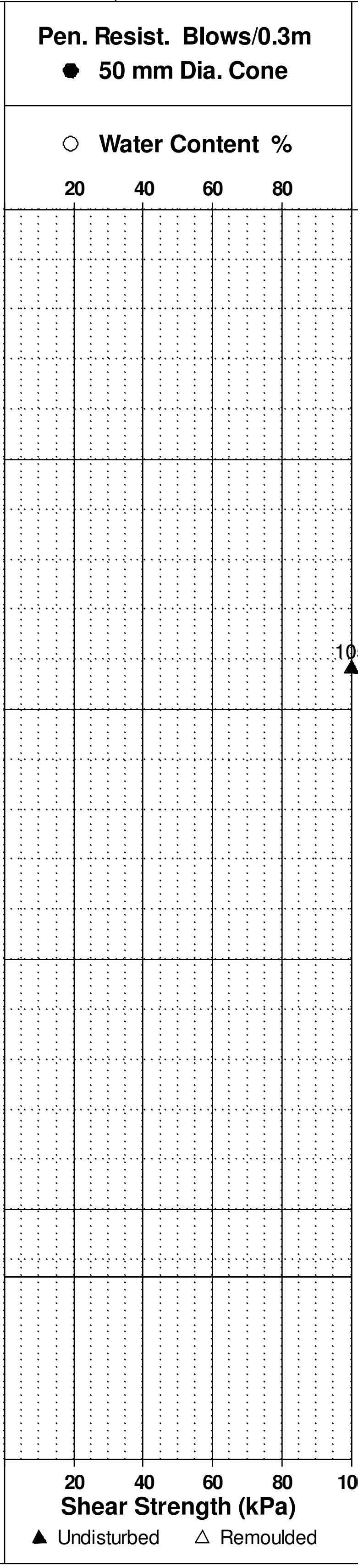
BORINGS BY Hydraulic Shovel

DATE February 15, 2013

FILE NO. PG2119

HOLE NO. TP 3-13

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.87
FILL: Brown silty clay with sand, gravel, cobbles, boulders		G	1				
						1	92.87
1.14							
Very stiff, brown **SILTY CLAY**		G	2				
						2	91.87
		G	3			3	90.87
		G	4				
3.86							
GLACIAL TILL: Dense, grey silty sand with clay, gravel, cobbles, boulders						4	89.87
		G	5				
4.27							
End of Test Pit (TP dry upon completion)							



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

REMARKS N 5014785; E 441553

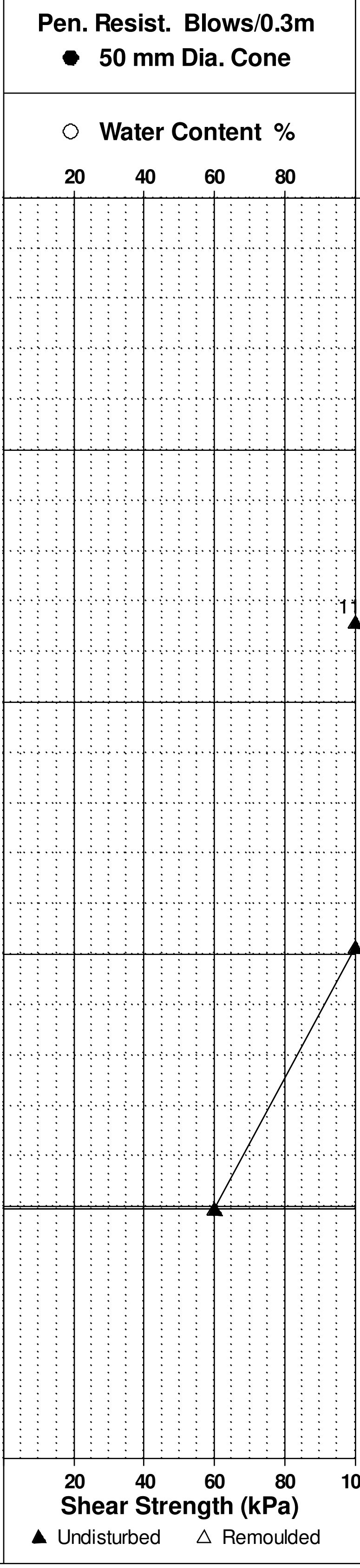
BORINGS BY Hydraulic Shovel

DATE February 15, 2013

FILE NO. PG2119

HOLE NO. TP 4-13

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Piezometer Construction
GROUND SURFACE						0	94.04	
FILL: Brown silty clay with sand, gravel, cobbles, boulders, trace organics		G	1					
1.09						1	93.04	
Very stiff to stiff, brown **SILTY CLAY**		G	2			2	92.04	
		G	3			3	91.04	
		G	4					
4.01						4	90.04	
End of Test Pit (TP dry upon completion)								



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

REMARKS N 5014765; E 441573

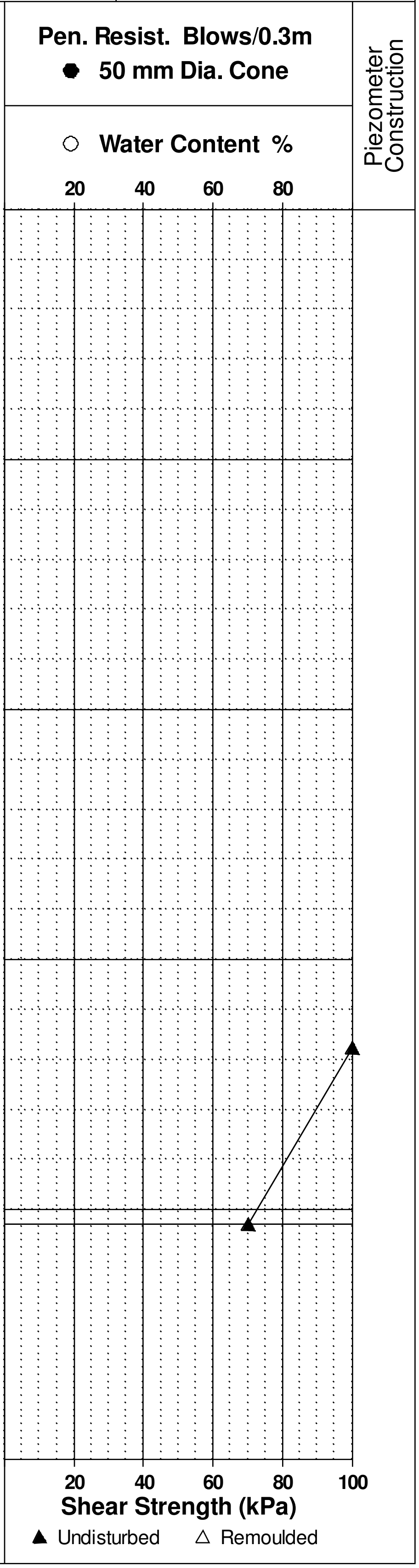
BORINGS BY Hydraulic Shovel

DATE February 15, 2013

FILE NO. PG2119

HOLE NO. TP 5-13

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.31
FILL: Brown silty sand with gravel 0.30							
FILL: Brown silty clay, trace gravel, cobbles and boulders 1.09		G	1			1	93.31
POSSIBLE FILL: Brown silty clay 2.29		G	2			2	92.31
Very stiff to stiff, brown **SILTY CLAY**		G	3			3	91.31
4.06		G	4			4	90.31
End of Test Pit (TP dry upon completion)							



SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

REMARKS N 5016186.844; E363985.613

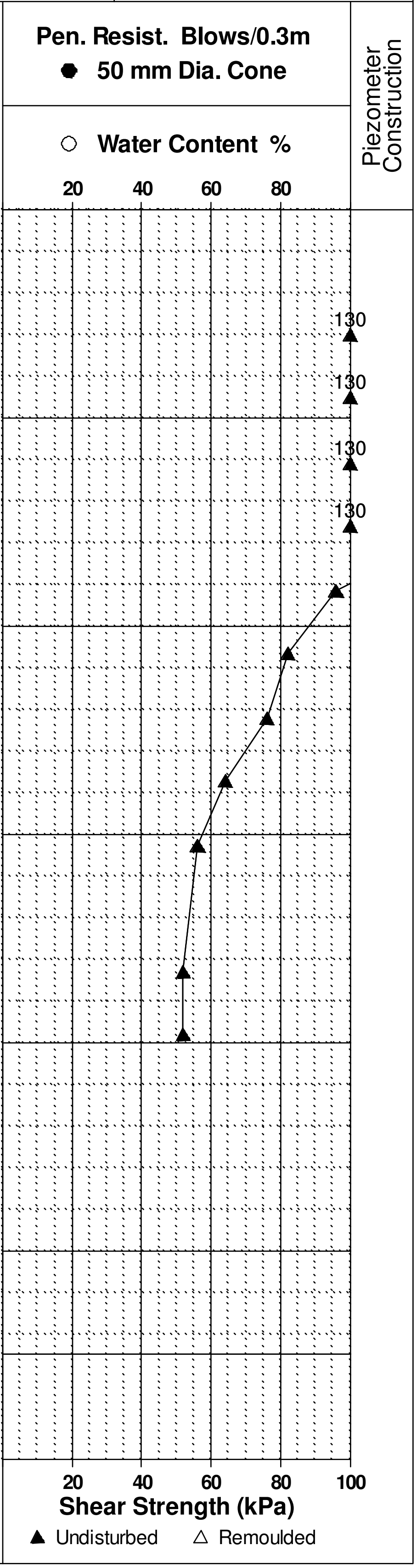
BORINGS BY Excavator

DATE May 20, 2010

FILE NO. PG2119

HOLE NO. TP 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.81
TOPSOIL 0.10							
Very stiff, brown **SILTY CLAY,** some sand 0.60		G	1				
						1	91.81
Very stiff to stiff, brown **SILTY CLAY**						2	90.81
- grey-brown with silt seams by 3.0m depth						3	89.81
3.96		G	2				
						4	88.81
GLACIAL TILL: Grey silty sand with gravel, cobbles and boulders, trace clay 5.49						5	87.81
End of Test Pit (TP dry upon completion)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

REMARKS N 5016027.540; E 364014.561

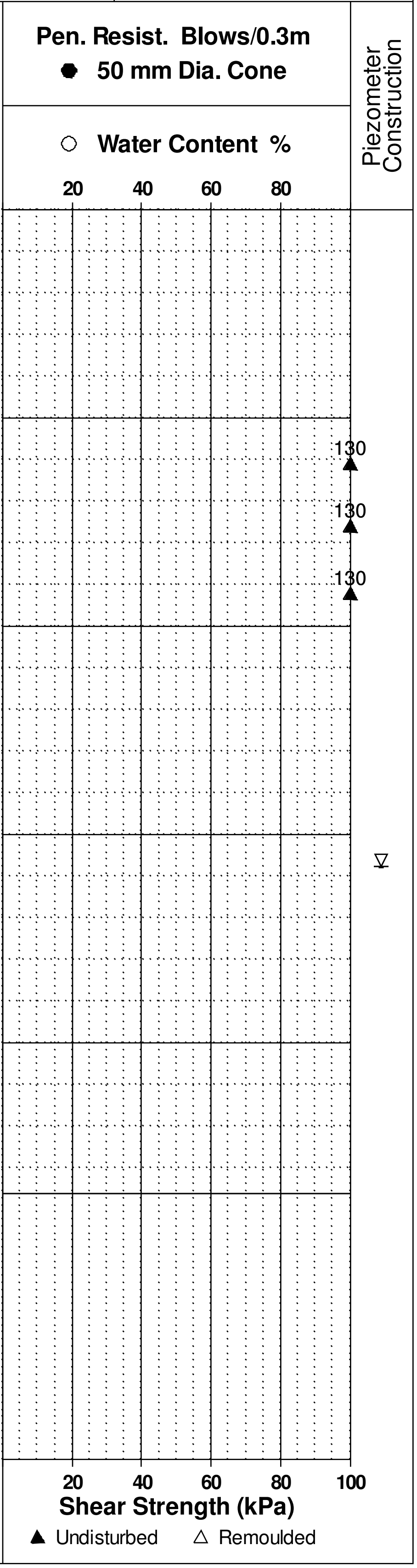
BORINGS BY Excavator

DATE May 20, 2010

FILE NO. PG2119

HOLE NO. TP 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.87
TOPSOIL 0.20							
Very stiff, brown **SILTY CLAY,** some sand		G	1			1	93.87
1.22							
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders, trace clay - grey by 3.15m depth		G	2			2	92.87
						3	91.87
		G	3			4	90.87
4.72							
End of Test Pit Practical refusal to excavation @ 4.72m depth (GWL @ 3.15m depth based on field observations)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

REMARKS N 5016017.629; E 363872.248

BORINGS BY Excavator

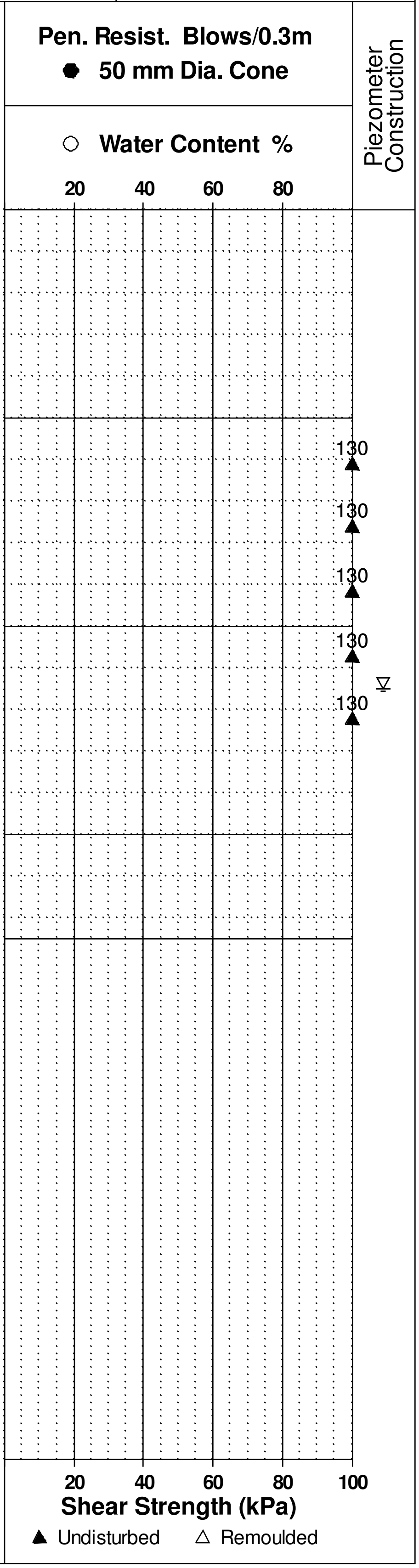
DATE May 20, 2010

FILE NO. PG2119

HOLE NO. TP 3

SOIL DESCRIPTION	Depth (m)	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.23				
Very stiff, brown **SILTY CLAY** with sand, trace gravel	0.91				
Very stiff, brown **SILTY CLAY**	2.13				
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders - grey by 2.7m depth	3.50	G G	1 2		
End of Test Pit Practical refusal to excavation on boulders @ 3.50m depth (GWL @ 2.3m depth based on field observations)					

DEPTH (m)	ELEV. (m)
0	94.21
1	93.21
2	92.21
3	91.21



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

REMARKS N 5015974.312; E 363744.604

BORINGS BY Excavator

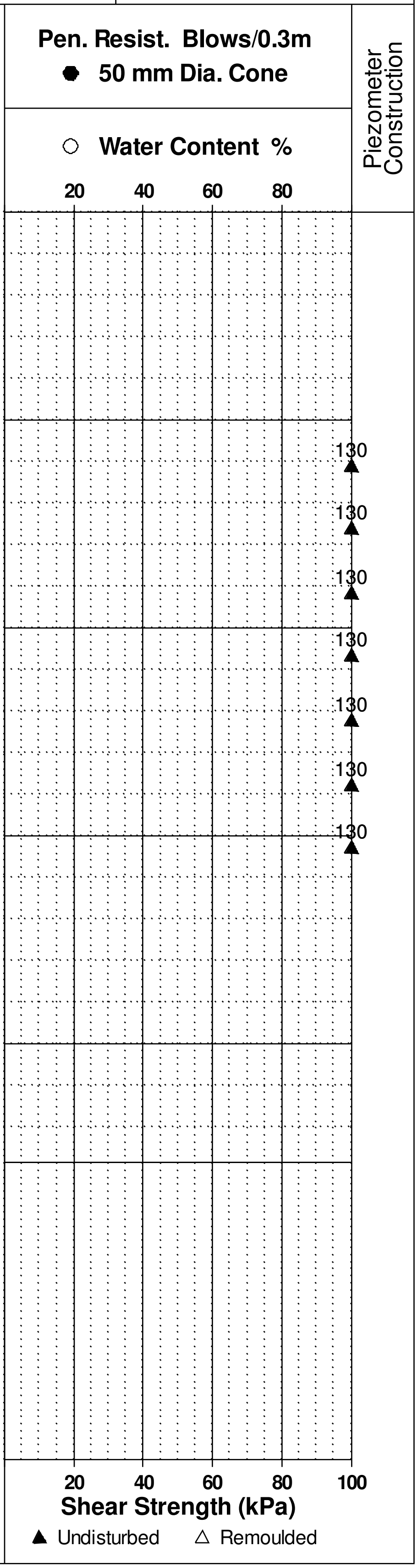
DATE May 20, 2010

FILE NO. PG2119

HOLE NO. TP 4

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL — 0.25	■				
Very stiff, brown **SILTY CLAY,** some sand — 0.91	▨				
Very stiff, brown **SILTY CLAY** with silt — 3.66	▨	G	1		
GLACIAL TILL: Grey silty sand with gravel, cobbles and boulders, trace clay — 4.57	^ ^ ^				
End of Test Pit Practical refusal to excavation @ 4.57m depth (TP dry upon completion)					

DEPTH (m)	ELEV. (m)
0	94.33
1	93.33
2	92.33
3	91.33
4	90.33



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

REMARKS N 5016117.160; E 363754.461

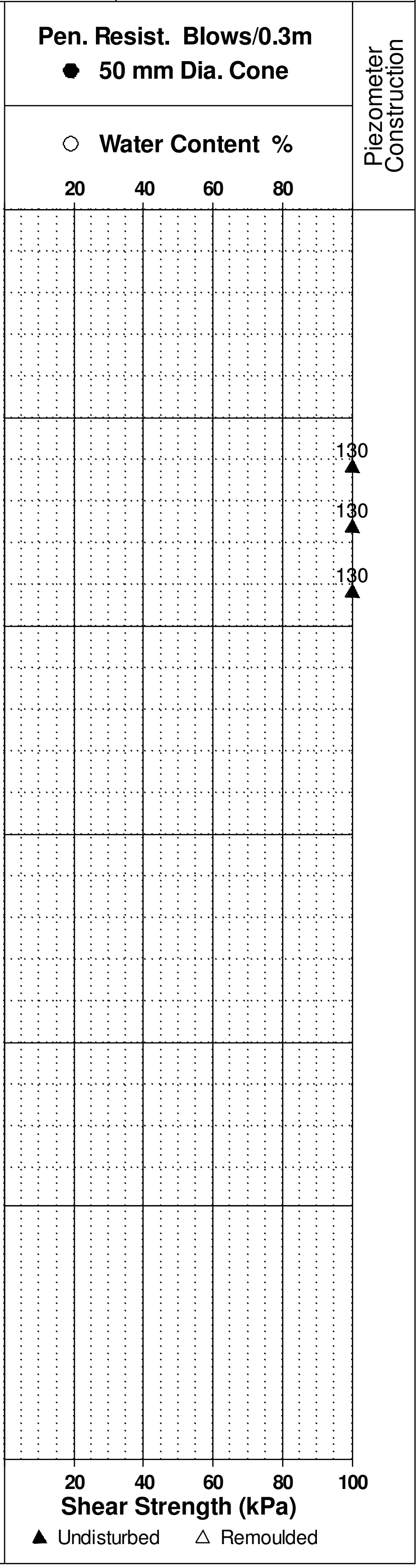
BORINGS BY Excavator

DATE May 20, 2010

FILE NO. PG2119

HOLE NO. TP 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.89
TOPSOIL 0.28	■						
Very stiff, brown **SILTY CLAY,** trace sand 0.91	▨						
	^					1	92.89
	^	G	1				
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders, trace clay - grey by 2.6m depth	^					2	91.89
	^					3	90.89
	^	G	2			4	89.89
4.78	^						
End of Test Pit Practical refusal to excavation on boulders @ 4.78m depth (TP dry upon completion)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

REMARKS N 5016134.355; E 363872.414

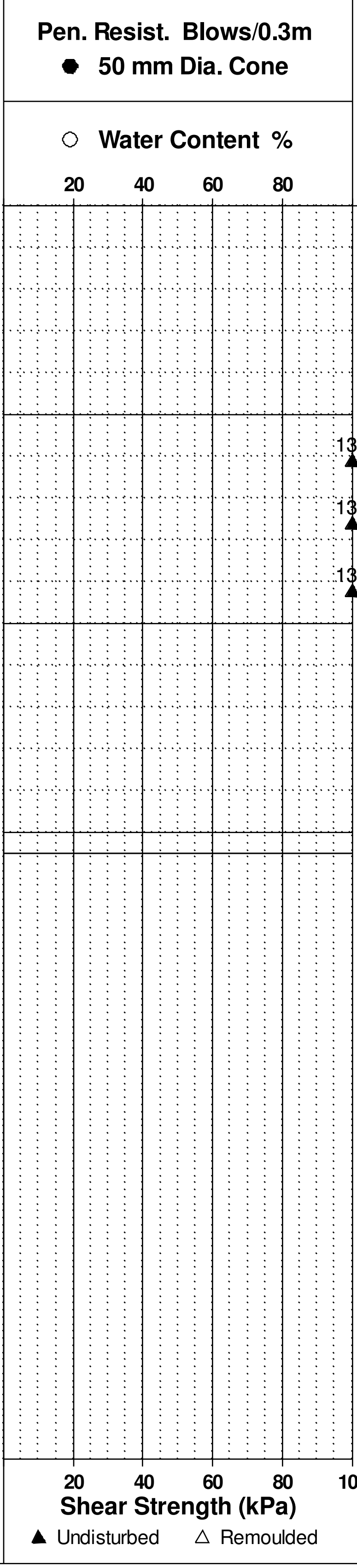
BORINGS BY Excavator

DATE May 20, 2010

FILE NO. PG2119

HOLE NO. TP 6

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.80
TOPSOIL							
0.36							
Very stiff, brown **SILTY CLAY,** with silt						1	92.80
1.73		G	1				
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders, trace clay - grey by 2.8m depth						2	91.80
3.10						3	90.80
End of Test Pit (TP dry upon completion)							



Piezometer Construction

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

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

REMARKS N 5016301.136; E 363935.813

BORINGS BY Excavator

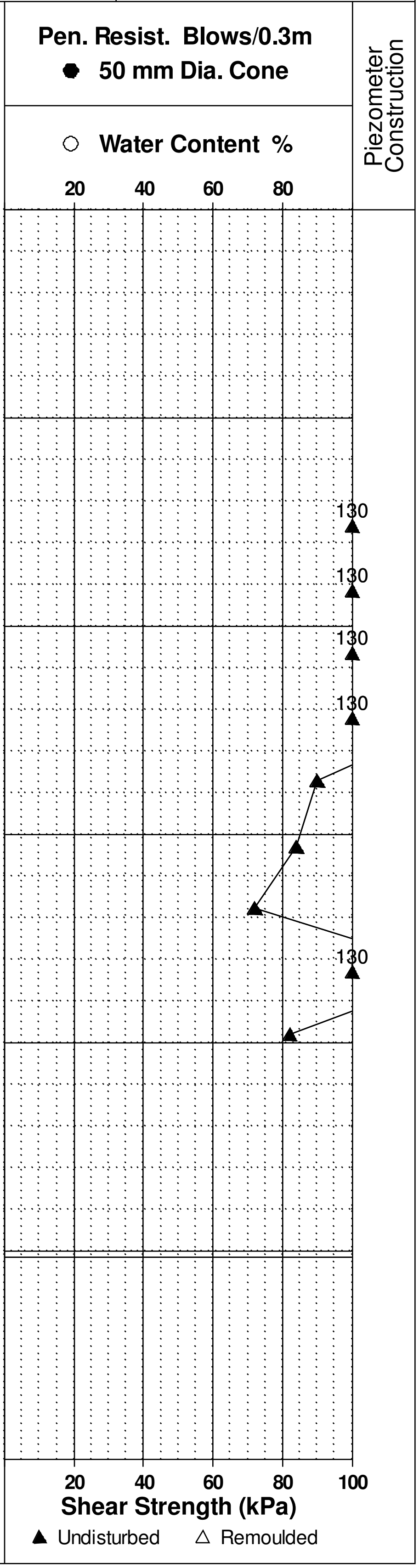
DATE May 20, 2010

FILE NO. PG2119

HOLE NO. TP 7

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD
GROUND SURFACE					
TOPSOIL 0.30					
Very stiff, brown **SILTY CLAY** with sand and gravel 1.22					
Very stiff to stiff, brown **SILTY CLAY** - grey with silt seams by 3.2m depth 4.27		G	1		
GLACIAL TILL: Grey silty sand with gravel, cobbles and boulders, trace clay 5.03					
End of Test Pit (TP dry upon completion)					

DEPTH (m)	ELEV. (m)
0	93.16
1	92.16
2	91.16
3	90.16
4	89.16
5	88.16



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

REMARKS N 5016531.674; E 364013.968

BORINGS BY Excavator

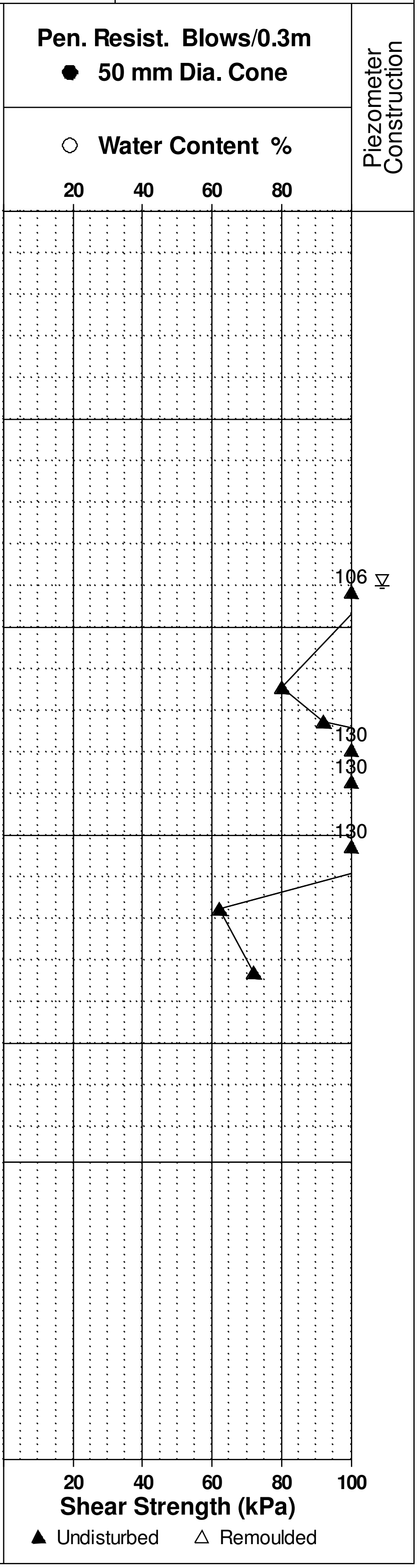
DATE May 20, 2010

FILE NO. PG2119

HOLE NO. TP 8

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD
GROUND SURFACE					
TOPSOIL 0.25	■				
Very stiff, brown **SILTY CLAY,** some sand 1.22	▨				
Very stiff to stiff, brown **SILTY CLAY** - grey by 2.4m depth 4.17	▨	G	1		
GLACIAL TILL: Grey silty sand with gravel, cobbles and boulders, trace clay 4.57	^^^				
End of Test Pit (GWL @ 1.8m depth based on field observations)					

DEPTH (m)	ELEV. (m)
0	92.64
1	91.64
2	90.64
3	89.64
4	88.64



SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

REMARKS N 5016426.508; E 363955.493

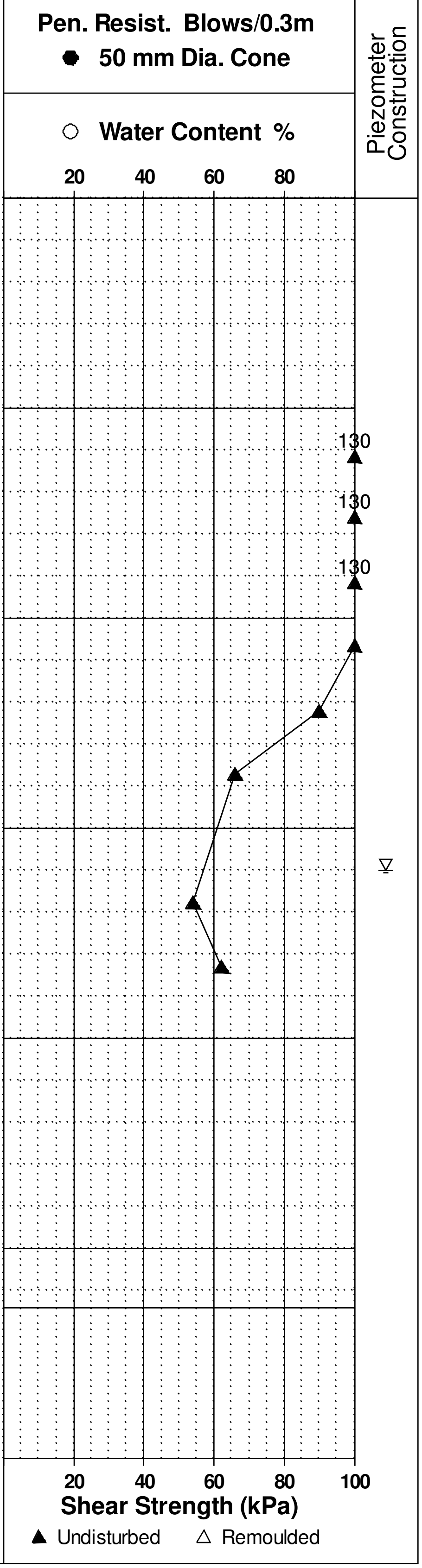
BORINGS BY Excavator

DATE May 20, 2010

FILE NO. PG2119

HOLE NO. TP 9

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.70
TOPSOIL (to 0.30)							
Very stiff, brown **SILTY CLAY** with sand (0.30 to 1.22)						1	91.70
Very stiff to stiff, brown **SILTY CLAY** - grey by 3.0m depth (1.22 to 4.88)		G	1				
						2	90.70
						3	89.70
						4	88.70
		G	2				
GLACIAL TILL: Grey silty sand with gravel, cobbles and boulders, trace clay (4.88 to 5.28)						5	87.70
End of Test Pit (GWL @ 3.2m depth based on field observations)							



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)

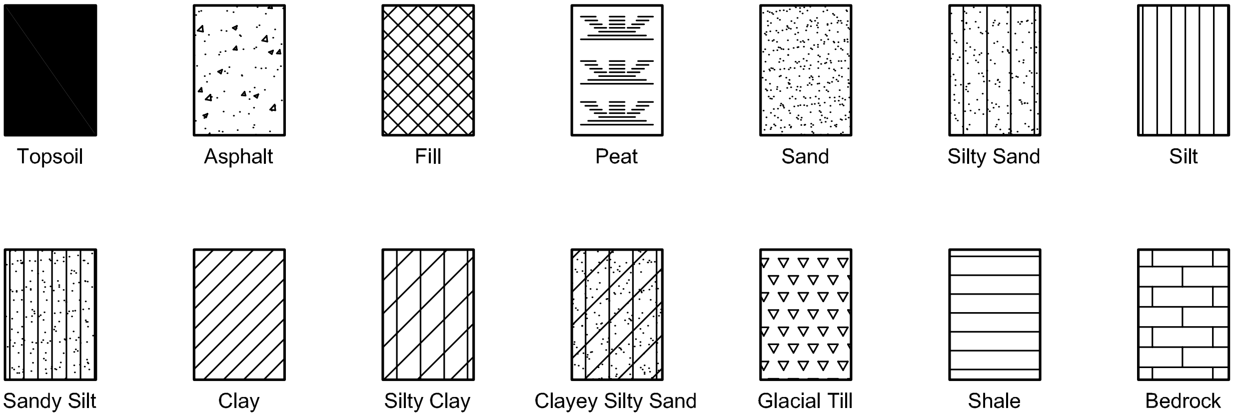
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

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.

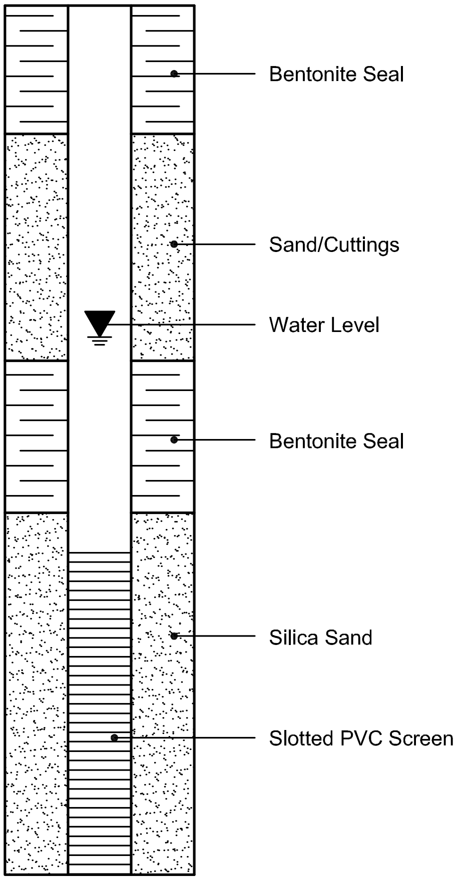
SYMBOLS AND TERMS (continued)

STRATA PLOT

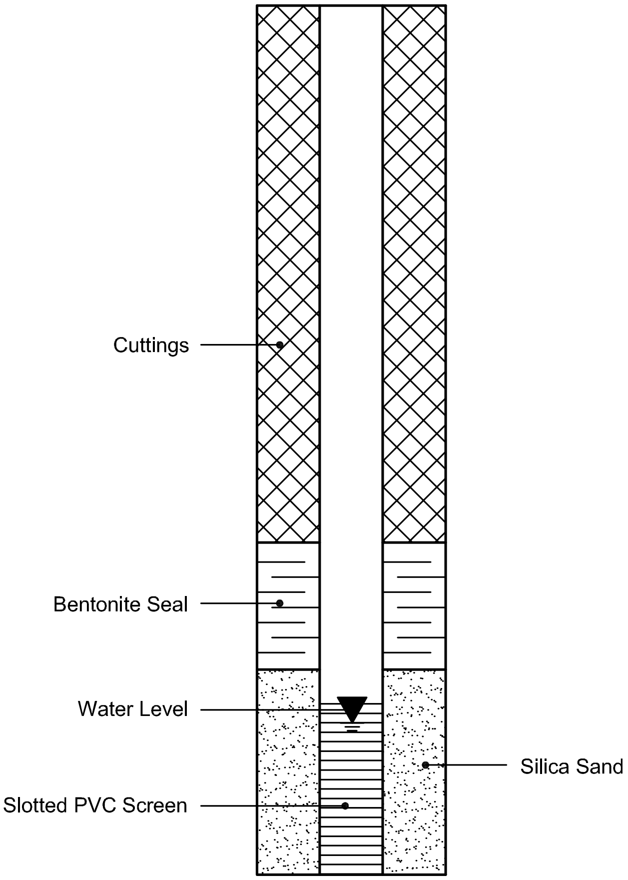


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Order #: 1022053

Certificate of Analysis

Report Date: 31-May-2010
Order Date:25-May-2010

Client: **Paterson Group Consulting Engineers**
Client PO: 9734
Project Description: PG2119

	Client ID:	TP9-G1	-	-	-
	Sample Date:	20-May-10	-	-	-
	Sample ID:	1022053-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	74.1	-	-	-
General Inorganics					
pH	0.05 pH Units	7.37	-	-	-
Resistivity	0.10 Ohm.m	222	-	-	-
Anions					
Chloride	5 ug/g dry	<5	-	-	-
Sulphate	5 ug/g dry	7	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG2119-2 - TEST HOLE LOCATION PLAN

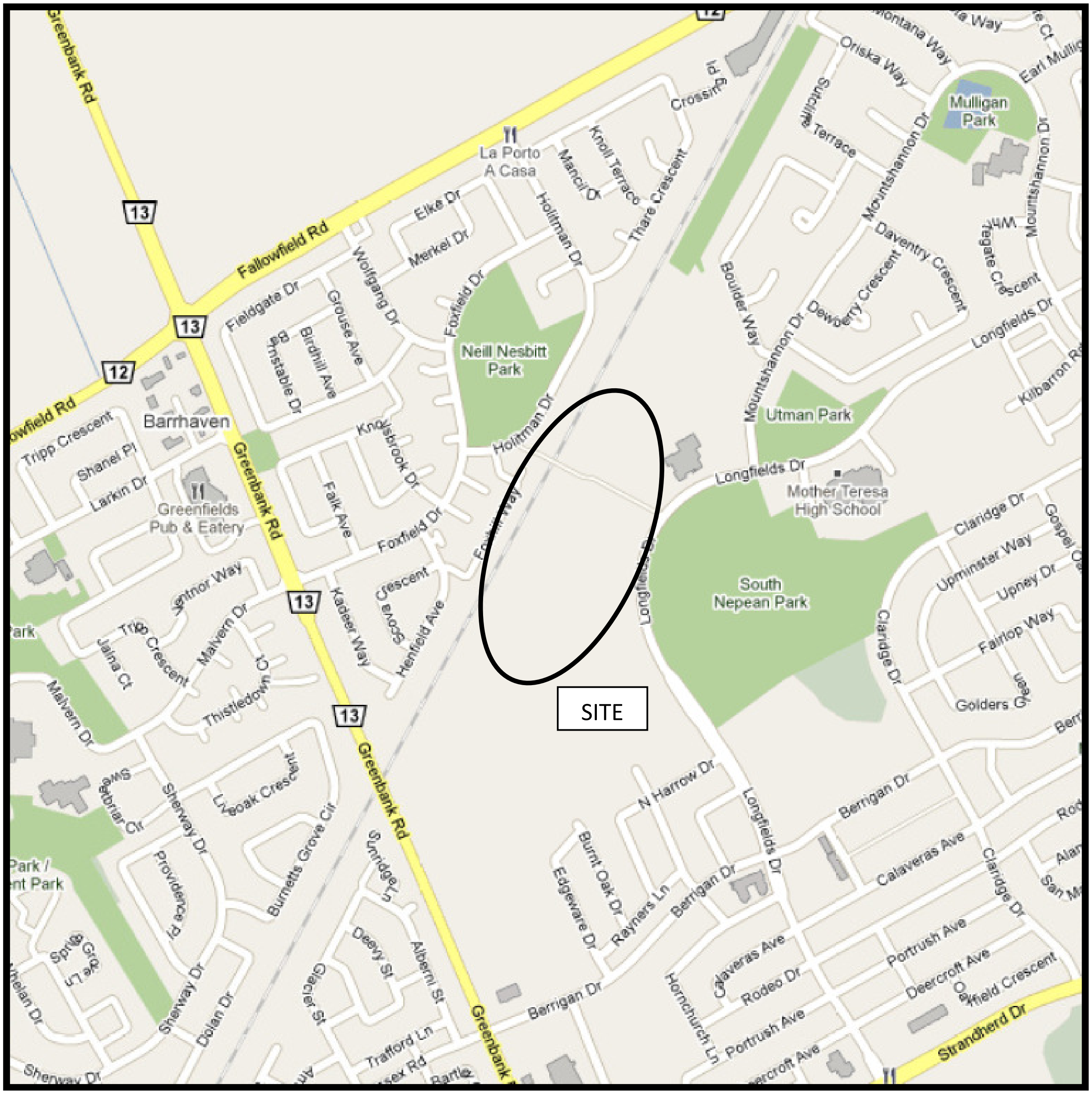
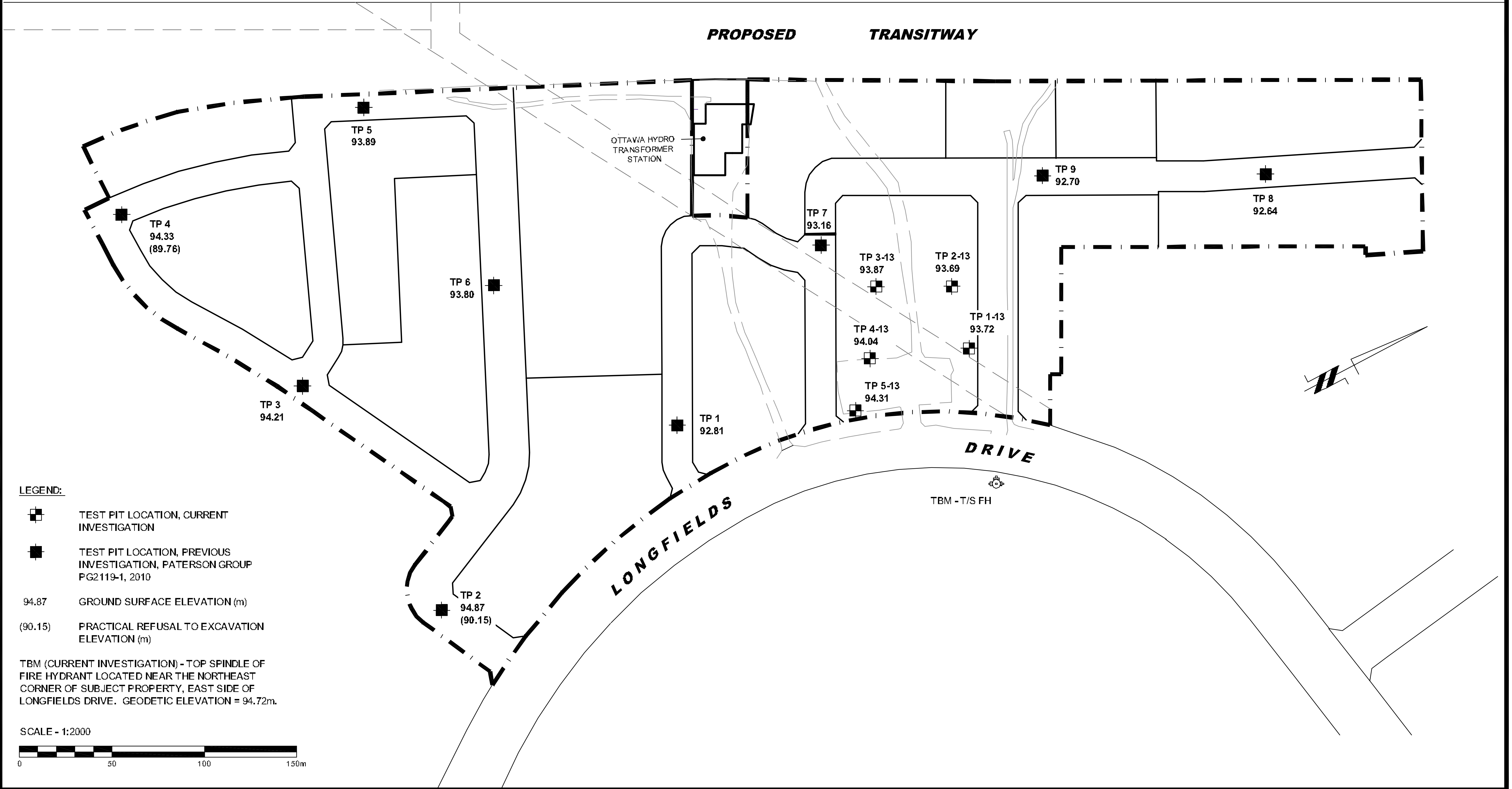


FIGURE 1

KEY PLAN



LEGEND:

◩	TEST PIT LOCATION, CURRENT INVESTIGATION
■	TEST PIT LOCATION, PREVIOUS INVESTIGATION, PATERSON GROUP PG2119-1, 2010
94.87	GROUND SURFACE ELEVATION (m)
(90.15)	PRACTICAL REFUSAL TO EXCAVATION ELEVATION (m)

TBM (CURRENT INVESTIGATION) - TOP SPINDLE OF FIRE HYDRANT LOCATED NEAR THE NORTHEAST CORNER OF SUBJECT PROPERTY, EAST SIDE OF LONGFIELDS DRIVE. GEODETIC ELEVATION = 94.72m.

SCALE - 1:2000

paterson group
consulting engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

Scale:	1:2000
Des.:	SB
Dwn:	MPG
Chkd:	DG

CAMPANALE HOMES

SUPPLEMENTAL GEOTECHNICAL INVESTIGATION
PROP. RESIDENTIAL DEVELOPMENT - LONGFIELDS DR.
OTTAWA, ONTARIO

TEST HOLE LOCATION PLAN

Dwg. No.	PG2119-2
Report No.:	PG2119-2
Date:	03/2013

11x17

Appendix E: DRAWINGS