APPENDICES

Appendix A : WATERMAIN CALCULATIONS AND EXCERPTS

879 River Road - Domestic Water Demand Estimates

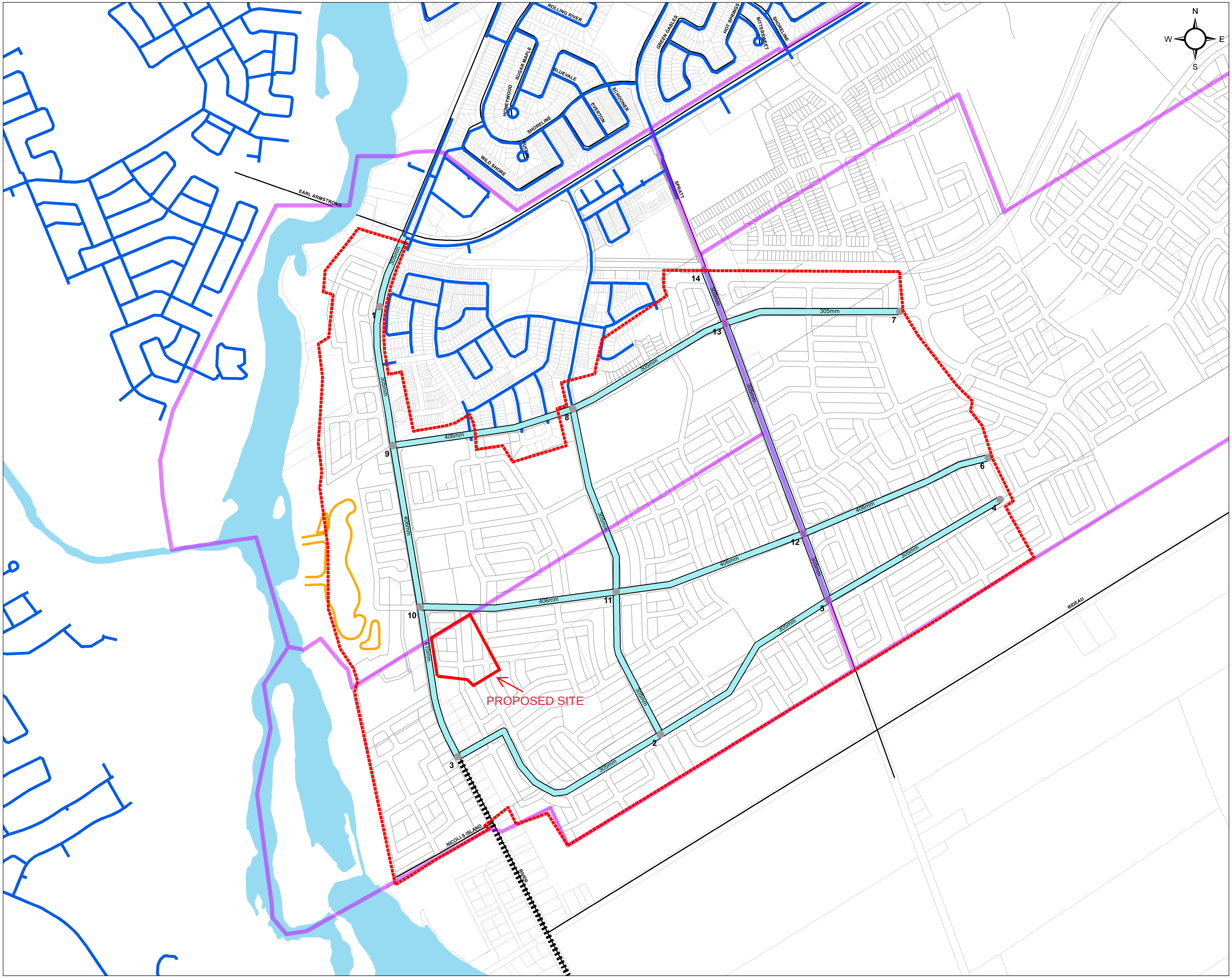
Densities as per City Guidelines:

B2B	2.3	ppu
Town	2.7	ppu

Building ID	Population	Daily Rate of Demand [1]	Avg Day Demand		Max Day Demand [2]		Peak Hour Demand [2]	
			(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Residential 1	299	350	72.7	1.21	181.7	3.03	399.8	6.66
Total Site :	**299**		**72.7**	**1.2**	**181.7**	**3.0**	**399.8**	**6.7**

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

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



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Legend

- Major Water
- Parcels
- Growth Polygons
- Rideau River Study Area
- Pond 5
- Streets
- Watermain Node
- Proposed Watermain
- Future Watermain to Manotick
- Existing Watermains

Client / Project:

CITY OF OTTAWA

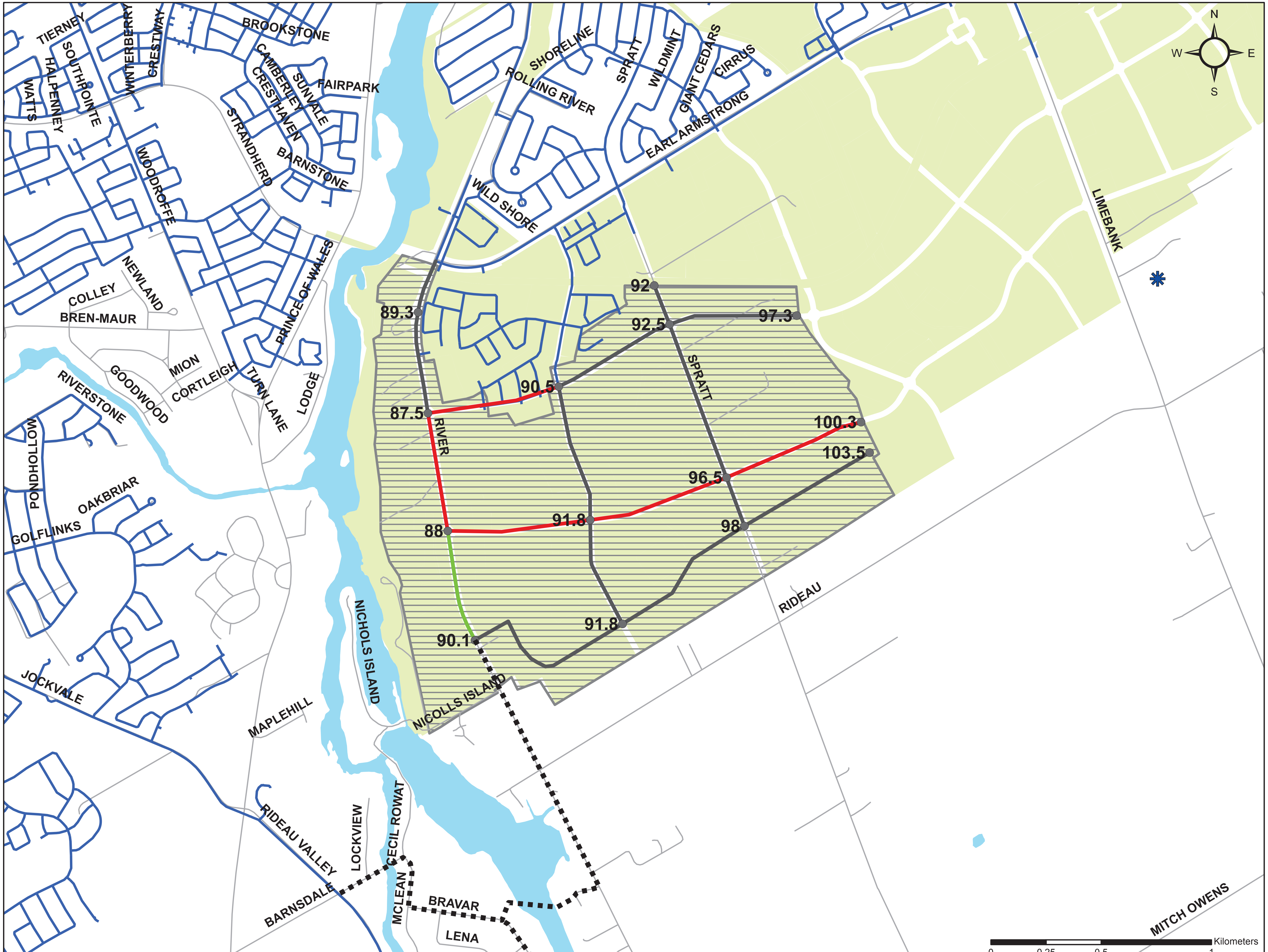
RIVERSIDE SOUTH ISSU UPDATE

OTTAWA, ON

Title:

POTABLE WATER SERVICING PLAN

Project No.:	Scale:	
163401101	0 125 250 Meters	
Drawing No.:	Sheet:	Revision:
WAT-1	7 of 7	0



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RIVERSIDE SOUTH ISSU UPDATE

OTTAWA, ON

Title:

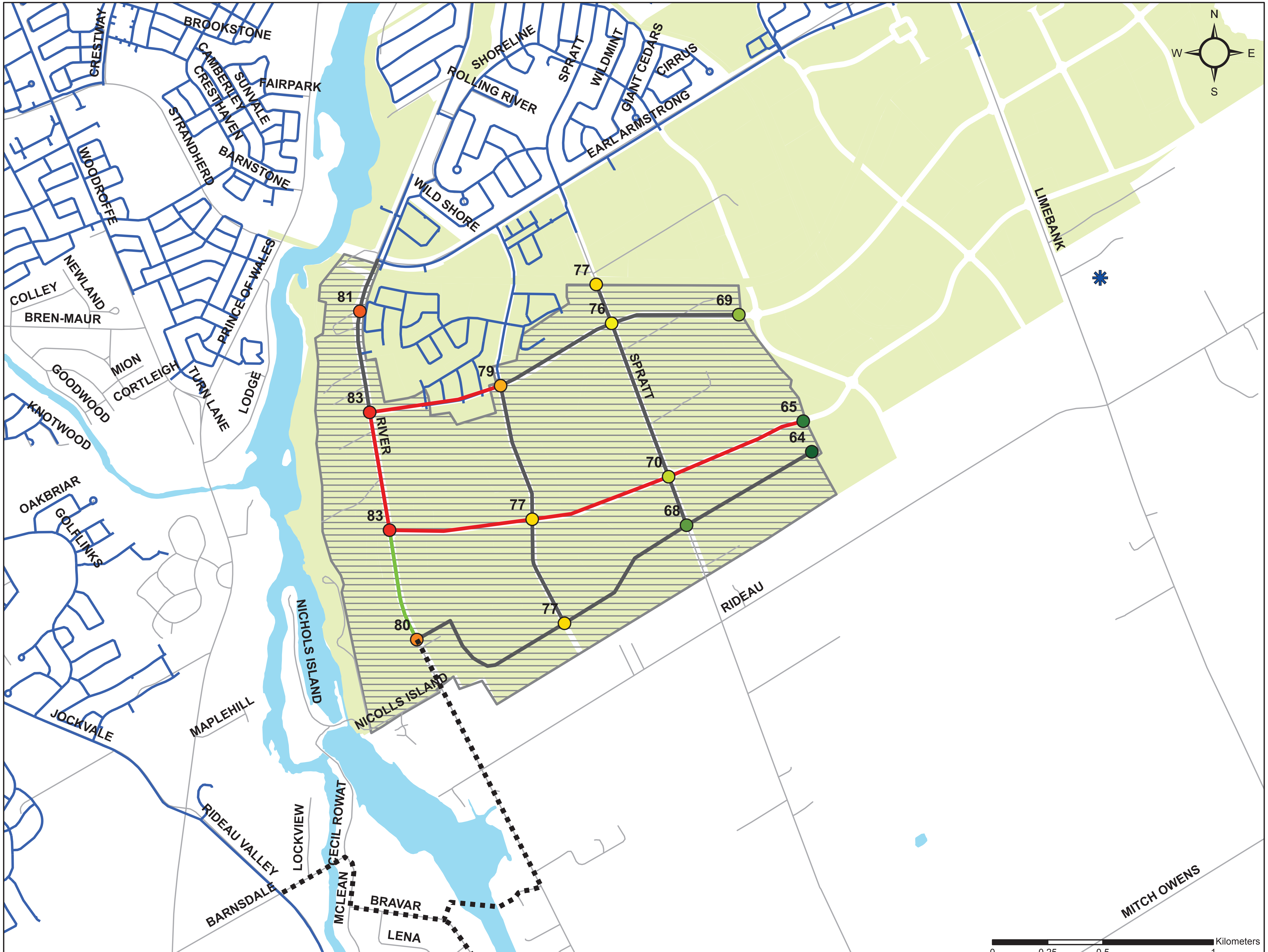
GROUND ELEVATION WITHIN THE RIDEAU RIVER STUDY AREA

Project No.:

163401101

Figure No.:

5-3



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Legend

- Rideau River Study Area
- Riveside South Area
- Future Elevated Tank Location
- Future Pipes to Manotick
- Existing Watermains

Proposed Pipes
Dia. (mm)

- 305
- 406
- 610

Model Nodes Maximum Pressure (psi)

- 64
- 65
- 68
- 69
- 70
- 76
- 77
- 79
- 80
- 81
- 83

Client / Project:

CITY OF OTTAWA

RIVERSIDE SOUTH ISSU UPDATE

OTTAWA, ON

Title:

Maximum Pressure During BSDY

Project No.:

163401101

Figure No.:

5-4

Appendix B : SANITARY SEWER

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Legend

- Major Water
- Parcels
- Streets
- Rideau River Study Area
- Pond 5

Catchments

- **Catchment Name Catchment Size (ha)**

Sanitary Manholes

- Sanitary Manholes
- Existing Sanitary Sewers
- Recommended Sanitary Sewers

Client / Project:

CITY OF OTTAWA

RIVERSIDE SOUTH ISSU UPDATE

OTTAWA, ON

Title:

SANITARY DRAINAGE PLAN

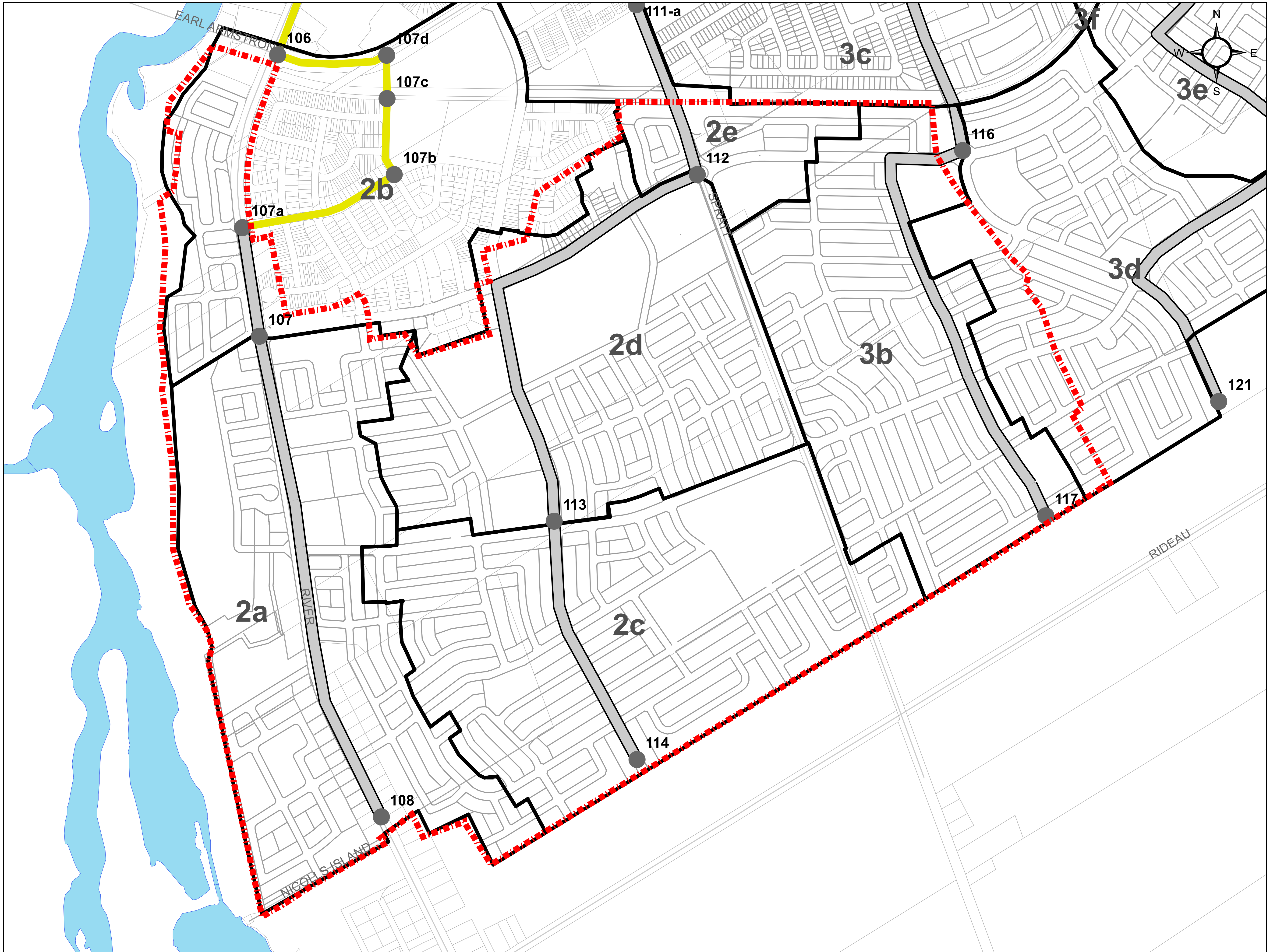
Project No.: 163401101

Scale: 0 125 250 500 Meters

Drawing No.: SAN-1

Sheet: 6 of 7

Revision: 0



Stantec

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Legend

- Rideau River Study Area
- Recomended Sanitary Catchments
- Sanitary Manholes
- Constructed Sanitary Sewers
- Recommended Sanitary Sewers

Client / Project:

CITY OF OTTAWA

RIVERSIDE SOUTH ISSU UPDATE

OTTAWA, ON

Title:

RECOMMENDED SANITARY SERVICING (2017 UPDATE)

Project No.: **163401101**

Scale: 0 62.5 125 250 Meters

Figure No.:

4-2

Riverside South Community
Infrastructure Servicing Study

Revision Date: June 5, 2017
Revison : 3
Designed by: Megan Young
Checked By: Amanda Lynch

File Number: 1634-01101

SANITARY SEWER DESIGN SHEET

CITY CRITERIA & DENSITIES
Approved area

DESIGN PARAMETERS

Average Daily Flow / Person:	350	l/p/day	Commercial:	0.579	l/s/ha	
Minimum Velocity:	0.60	m/s	Employment	0.579	l/s/ha	
n =	0.013		Institutional:	0.579	l/s/ha	
Max Peaking Factor:	4.0		Infiltration:	0.280	l/s/ha	
Min. Peaking Factor:	2.0					
Peaking Factor Industrial:	Based on Appendix 4-B		Low Density:	@	3.2	pers/unit
Peaking Factor Comm. / Inst.:	1.5		Medium Density:	@	2.4	pers/unit
			High Density:	@	1.9	pers/unit

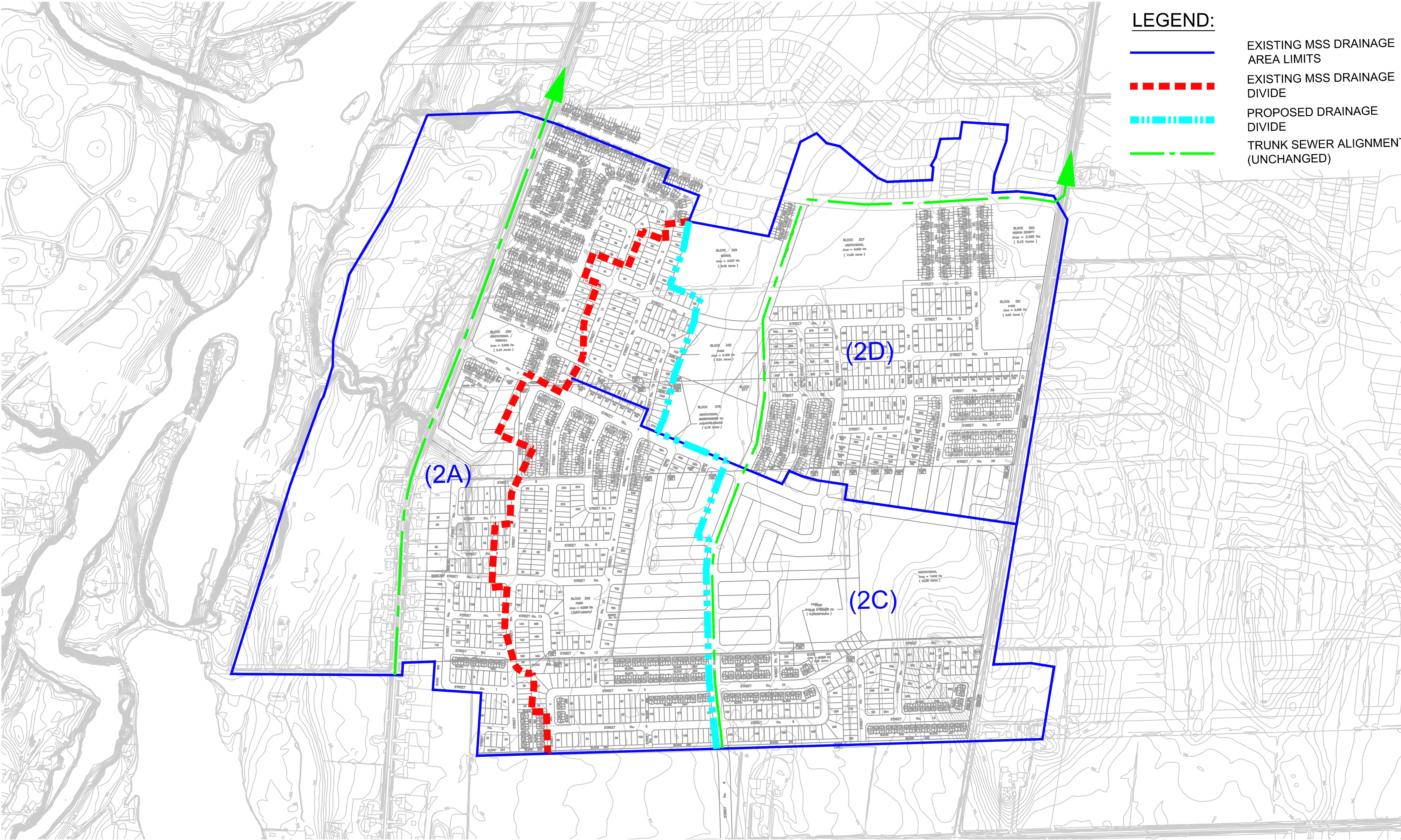
Existing Sanitary Sewer flows estimated by existing land use. Existing Phase 9 area contribution based on JLR 2011 report

STREET	ID Area	From MH	To MH	AREA (ha)	LOW Area (ha)	LOW Pop.	LOW Accum. Pop.	MED Area (ha)	MED Pop.	MED Accum. Pop.	HIGH Area (ha)	HIGH Pop.	HIGH Accum. Pop.	Units	Accum. Units	Total Accum. Pop.	Peak Factor	Peak Flow (l/s)
RIVER ROAD	2a	108	107	50.51	44.40	2189	2189	6.11	389	389	0.00	0	0	846	846	2578	3.5	36.5
RIVER ROAD	2b Future	107	107a	12.21	10.22	502	2691	1.99	127	516	0.00	0	0	210	1056	3207	3.4	44.4
RIVER ROAD	2b Existing (Phase 9)	107a	107b	43.20	43.20	2351	5042	0.00	0	516	0.00	0	0	N/A	1056	5558	3.2	72.1
RIVER ROAD		107b	107c	0.00	0.00	0	5042	0.00	0	516	0.00	0	0	0	1056	5558	3.2	72.1
RIVER ROAD		107c	107d	0.00	0.00	0	5042	0.00	0	516	0.00	0	0	0	1056	5558	3.2	72.1
		107d	106	0.00	0.00	0	5042	0.00	0	516	0.00	0	0	0	1056	5558	3.2	72.1
	Ex3	106	103	17.90	10.04	413	5455	7.86	564	1080	0.00	0	0	364	1420	6535	3.1	83.0
	Ex2	103	102	16.42	16.42	573	6028	0.00	0	1080	0.00	0	0	179	1599	7108	3.1	89.3
SPRATT SOUTH	2c	114	113	53.79	51.84	2554	2554	1.95	125	125	0.00	0	0	850	850	2679	3.5	37.8
SPRATT SOUTH	2d	113	112	39.28	28.89	1424	3978	10.40	665	790	0.00	0	0	722	1572	4768	3.3	63.0
SPRATT SOUTH	2e	112	111-a	17.48	0.00	0	3978	13.28	847	1637	4.19	479	479	605	2177	6094	3.2	78.1
SPRATT SOUTH		111-a	111	0.00	0.00	0	3978	0.00	0	1637	0.00	0	479	0	2177	6094	3.2	78.1
SPRATT SOUTH	Ex4	111	110	14.93	13.31	90	4068	1.62	468	2105	0.00	0	479	223	2400	6652	3.1	84.3
SHORELINE DRIVE	3b	117	116	48.13	43.40	2138	2138	4.73	302	302	0.00	0	0	794	794	2440	3.5	34.8
SHORELINE DRIVE	3c	116	115	47.51	27.40	1350	3488	15.47	989	1291	4.64	530	530	1113	1907	5309	3.2	69.3
SHORELINE DRIVE	Ex5	115	110	20.60	14.47	480	3968	6.13	302	1593	0.00	0	530	276	2183	6091	3.2	78.1
SPRATT SOUTH	Ex6	110	109	25.47	20.32	822	8858	5.15	288	3986	0.00	0	1009	377	4960	13853	2.8	157.9
CANYON WALK DRIVE	3d	121	120	46.05	35.39	1744	1744	10.66	679	679	0.00	0	0	828	828	2423	3.5	34.5
CANYON WALK DRIVE	3e	120	119	54.06	40.27	1984	3728	13.79	881	1560	0.00	0	0	987	1815	5288	3.2	69.0
CANYON WALK DRIVE	3f-4a	119	118	17.44	0.00	0	3728	3.06	194	1754	14.38	1007	1007	577	2392	6489	3.1	82.5
internal south	6a	123	122	49.84	31.53	1555	1555	18.31	1169	1169	0.00	0	0	973	973	2724	3.5	38.4
ARMSTRONG ROAD	4b	122	118	58.24	0.00	0	1555	0.00	0	1169	58.24	4070	4070	2005	2978	6794	3.1	85.8
CANYON WALK DRIVE	Ex1	118	124	45.64	22.12	896	6179	23.52	1687	4610	0.00	0	5077	983	6353	15866	2.8	177.0
SPRATT ROAD	5c	130	129	25.52	20.06	989	989	5.46	348	348	0.00	0	0	454	454	1337	3.7	20.1
SPRATT ROAD	1a	129	128	10.26	7.00	346	1335	3.26	209	557	0.00	0	0	195	649	1892	3.6	27.6
SPRATT ROAD	1b	128	127	18.80	4.11	202	1537	13.56	866	1423	1.13	129	129	492	1141	3089	3.4	42.9
internal north	5b	135	134	17.31	10.06	496	496	7.25	463	463	0.00	0	0	348	348	959	3.8	14.8
internal north	1d	134	127	21.95	12.43	611	1107	9.52	607	1070	0.00	0	0	444	792	2177	3.6	31.4
	BP-1	137	127	39.70	20.70	1173	1173	17.00	1019	1019	2.00	398	398	891	891	2590	3.5	36.7
SPRATT ROAD	1c	127	126	14.01	0.00	0	3817	8.98	574	4086	5.03	574	1101	541	3365	9004	3.0	109.4
internal north	5a	133	132	11.48	4.65	230	230	6.83	437	437	0.00	0	0	254	254	667	3.9	10.6
internal north	1e	132	126	34.06	22.08	1088	1318	11.98	766	1203	0.00	0	0	659	913	2521	3.5	35.8
	BP-2	138	126	0.11	0.00	0	0	0.11	7	7	0.00	0	0	3	3	7	4.0	0.1
SPRATT ROAD	1g	126	125	14.19	1.66	83	5218	9.47	605	5901	3.05	348	1449	461	4742	12568	2.9	145.4
SPRATT ROAD	1f	131	125	9.29	5.05	250	250	4.24	271	271	0.00	0	0	191	191	521	4.0	8.4
	BP3	136	125	0.00	0.00	0	0	0.00	0	0	0.00	0	0	0	0	0	0.0	0.0
SPRATT ROAD	1h	125	124	1.69	0.00	0	5468	1.69	108	6280	0.00	0	1449	45	4978	13197	2.8	151.5
SPRATT ROAD	Ex7	124	109	17.26	11.40	768	12415	3.00	250	11140	2.86	327	6853	516	11847	30408	2.5	304.4
CANYON WALK DRIVE	Ex8	109	102	56.40	54.40	2150	23423	2.00	134	15260	0.00	0	7862	728	17535	46545	2.3	432.5
SPRATT ROAD	BP-4	139	102	0.00	0.00	0	0	0.00	0	0	0.00	0	0	0	0	0	0.0	0.0
CROSSING		102	101	0			29451			16340			7862		19134	53653	2.2	486.0

STREET	ID Area	COMMERCIAL Area (ha)	COMMERCIAL Accum. Area (ha)	EMPLOYMENT Area (ha)	EMPLOYMENT Accum. Area (ha)	INSTITUTIONAL Area (ha)	INSTITUTIONAL Accum. Area (ha)	C+I+I Peak Flow (l/s)	ROAD Area (ha)	ROAD Accum. Area (ha)	INFILTRATION Total Area (ha)	INFILTRATION Accum. Area (ha)	Infilt. Flow (l/s)	Total Flow (l/s)	PIPE Distance (m)	Diameter (mm)	Slope (%)	Qa/Qc	Capacity (Full) (l/s)	Velocity (Full) (m/s)	Velocity (Actual) (m/s)
RIVER ROAD	2a	1.19	1.19	0.00	0.00	1.01	1.01	1.9	4.48	4.48	57.18	57.18	16.0	54.4	1255	450	0.12	0.53	103.0	0.63	0.63
RIVER ROAD	2b Future	0.00	1.19	0.00	0.00	0.00	1.01	1.9	2.64	7.12	14.85	72.03	20.2	66.5	254	525	0.12	0.43	155.4	0.70	0.66
RIVER ROAD	2b Existing (Phase 9)	0.00	1.19	0.00	0.00	2.46	3.47	4.0	0.00	7.12	45.66	117.69	33.0	109.1	405	525	0.10	0.76	144.5	0.65	0.71
RIVER ROAD		0.00	1.19	0.00	0.00	0.00	3.47	4.0	0.00	7.12	0.00	117.69	33.0	109.1	217	525	0.12	0.72	152.3	0.68	0.74
RIVER ROAD		0.00	1.19	0.00	0.00	0.00	3.47	4.0	4.70	11.82	4.70	122.39	34.3	110.4	107	525	0.10	0.77	143.9	0.64	0.71
		0.00	1.19	0.00	0.00	0.00	3.47	4.0	0.00	11.82	0.00	122.39	34.3	110.4	278	525	0.08	0.90	123.3	0.55	0.63
	Ex3	5.35	6.54	0.00	0.00	0.00	3.47	8.7	0.00	11.82	23.25	145.64	40.8	132.5	835	525	0.10	0.93	141.9	0.63	0.73
	Ex2	0.00	6.54	0.00	0.00	0.00	3.47	8.7	5.11	16.93	21.53	167.17	46.8	144.8	1100	525	0.10	1.02	141.9	0.63	0.74
SPRATT SOUTH	2c	0.00	0.00	0.00	0.00	7.68	7.68	6.7	5.93	5.93	67.41	67.41	18.9	63.4	695	450	0.11	0.64	98.6	0.60	0.64
SPRATT SOUTH	2d	0.00	0.00	0.00	0.00	14.95	22.63	19.7	5.45	11.38	59.69	127.09	35.6	118.3	1155	525	0.11	0.79	148.8	0.67	0.74
SPRATT SOUTH	2e	2.55	2.55	0.00	0.00	0.00	22.63	21.9	6.14	17.52	26.17	153.26	42.9	142.9	470	525	0.12	0.92	155.4	0.70	0.80
SPRATT SOUTH		0.00	2.55	0.00	0.00	0.00	22.63	21.9	0.00	17.52	0.00	153.26	42.9	142.9	215	525	0.11	0.96	148.8	0.67	0.77
SPRATT SOUTH	Ex4	0.91	3.46	0.00	0.00	0.00	22.63	22.7	0.00	17.52	15.84	169.10	47.3	154.3	600	525	0.12	0.99	155.4	0.70	0.81
SHORELINE DRIVE	3b	0.66	0.66	0.00	0.00	0.05	0.05	0.6	2.77	2.77	51.60	51.60	14.4	49.8	1270	450	0.11	0.51	98.6	0.60	0.60
SHORELINE DRIVE	3c	0.00	0.66	0.00	0.00	11.13	11.17	10.3	10.02	12.79	68.67	120.26	33.7	113.2	990	450	0.17	0.92	122.6	0.75	0.86
SHORELINE DRIVE	Ex5	0.80	1.46	0.00	0.00	3.16	14.33	13.7	0.00	12.79	24.56	144.82	40.6	132.3	480	450	0.20	0.99	133.0	0.81	0.94
SPRATT SOUTH	Ex6	0.00	4.92	0.00	0.00	2.39	39.36	38.5	0.00	30.31	27.86	341.78	95.7	292.0	675	675	0.12	0.96	303.8	0.82	0.95
CANYON WALK DRIVE	3d	0.60	0.60	0.00	0.00	3.72	3.72	3.8	5.41	5.41	55.78	55.78	15.6	53.9	820	450	0.15	0.47	115.2	0.70	0.69
CANYON WALK DRIVE	3e	0.00	0.60	0.00	0.00	3.91	7.63	7.2	9.21	14.62	67.19	122.97	34.4	110.6	925	525	0.18	0.58	190.3	0.85	0.89
CANYON WALK DRIVE	3f-4a	6.01	6.61	0.00	0.00	5.28	12.92	17.0	16.75	31.37	45.49	168.46	47.2	146.6	880	525	0.19	0.75	195.6	0.88	0.97
internal south	6a	1.18	1.18	0.00	0.00	5.33	5.33	5.7	6.44	6.44	62.80	62.80	17.6	61.6	600	525	0.14	0.37	167.9	0.75	0.68
ARMSTRONG ROAD	4b	24.34	25.53	0.00	0.00	0.00	5.33	26.8	24.91	31.35	107.49	170.29	47.7	160.3	1810	600	0.13	0.69	231.0	0.79	0.86
CANYON WALK DRIVE	Ex1	1.55	33.69	0.00	0.00	0.00	18.25	45.1	0.00	62.72	47.19	385.94	108.1	330.2	860	750	0.15	0.73	449.8	0.99	1.08
SPRATT ROAD	5c	0.00	0.00	0.00	0.00	2.38	2.38	2.1	4.86	4.86	32.77	32.77	9.2	31.4	420	600	0.15	0.13	248.1	0.85	0.56
SPRATT ROAD	1a	0.00	0.00	0.00	0.00	0.00	2.38	2.1	7.76	12.63	18.02	50.79	14.2	43.9	450	675	0.15	0.13	339.6	0.92	0.61
SPRATT ROAD	1b	0.00	0.00	0.00	0.00	2.82	5.20	4.5	5.34	17.97	26.97	77.76	21.8	69.2	490	675	0.15	0.20	339.6	0.92	0.70
internal north	5b	0.00	0.00	0.00	0.00	0.03	0.03	0.0	1.32	1.32	18.66	18.66	5.2	20.1	385	375	0.15	0.28	70.8	0.62	0.53
internal north	1d	2.66	2.66	0.00	0.00	0.01	0.04	2.3	4.33	5.66	28.95	47.61	13.3	47.0	550	375	0.15	0.66	70.8	0.62	0.67
	BP-1	0.00	0.00	16.18	16.18	0.00	0.00	9.4	6.81	6.81	62.69	62.69	17.6	63.6	725	375	0.15	0.90	70.8	0.62	0.71
SPRATT ROAD	1c	0.74	3.40	0.00	16.18	6.60	11.84	22.6	6.42	36.86	27.77	215.82	60.4	192.4	795	750	0.15	0.43	449.8	0.99	0.94
internal north	5a	1.02	1.02	0.00	0.00	1.15	1.15	1.9	4.02	4.02	17.68	17.68	5.0	17.4	410	375	0.15	0.25	70.8	0.62	0.50
internal north	1e	0.00	1.02	0.00	0.00	1.37	2.52	3.1	6.18	10.21	41.61	59.29	16.6	55.5	810	450	0.15	0.48	115.2	0.70	0.69
	BP-2	0.00	0.00	15.00	15.00	0.00	0.00	8.7	1.48	1.48	16.59	16.59	4.6	13.4	440	375	0.15	0.19	70.8	0.62	0.46
SPRATT ROAD	1g	0.98	5.40	0.00	31.18	10.12	24.48	44.0	3.45	52.00	28.74	320.44	89.7	279.1	710	750	0.17	0.58	478.9	1.05	1.09
SPRATT ROAD	1f	0.00	0.00	0.00	0.00	0.00	0.00	0.0	3.48	3.48	12.77	12.77	3.6	11.9	420	300	0.20	0.26	45.1	0.62	0.51
	BP3	0.00	0.00	38.46	38.46	0.00	0.00	22.3	5.69	5.69	44.15	44.15	12.4	34.6	986	375	0.14	0.51	68.4	0.60	0.60
SPRATT ROAD	1h	2.20	7.60	0.00	69.64	1.66	26.14	69.6	3.04	64.20	8.59	385.95	108.1	329.2	830	900	0.15	0.45	731.4	1.11	1.07
SPRATT ROAD	Ex7	0.64	41.93	0.00	69.64	0.00	44.39	115.3	0.00	126.93	17.90	789.79	221.1	640.9	515	1050	0.15	0.58	1103.3	1.23	1.28
CANYON WALK DRIVE	Ex8	0.00	46.85	0.00	69.64	0.00	83.75	153.7	5.45	162.68	61.85	1193.42	334.2	920.4	1100	1050	0.15	0.83	1103.3	1.23	1.39
SPRATT ROAD	BP-4	0.00	0.00	127.52	127.52	0.00	0.00	169.8	19.76	19.76	147.28	147.28	41.2	211.1	2790	675	0.15	0.62	339.6	0.92	0.97
CROSSING			53.39		197.16		87.21	384.7		199.37	0	1507.87	422.2	1292.9	145	1200	0.11	0.96	1349.0	1.16	1.33

CROSSING

Note:
Area BP-4 also accounts for additional 39ha area outside the CDP that was accounted for in calculation of Employment Area
PIPE Capacity (Full) calculated using ACTUAL PIPE SIZE
Limiting Capacity Calculated based on 1200 mm pipe @ 0.11% between Rideau Road and River
Additional sanitary flow of 29.21 L/s from Rideau Carleton Raceway (RCR) is not included in the above calculation, as it is proposed that flow from this area be pumped into the system at off-peak times



Scale	Project Title	Drawing Title	Sheet No.
N.T.S.	RIVERSIDE SOUTH RIDEAU RIVER POND 5 DRAINAGE AREA	ALTERNATIVE SANITARY DRAINAGE LIMIT	FIGURE S-1

Jim Moffatt

From: Sevigny, John <John.Sevigny@ottawa.ca>
Sent: Thursday, July 20, 2017 10:18 AM
To: Bob Wingate
Cc: Terry Brule; Jim Moffatt
Subject: RE: Riverside South , Rideau River Drainage Area

Hi Bob.
Yes, this is satisfactory.
Regards,

*****Absence alert: Please note that I will be out of the office as of July 31, 2017 and will be returning to the office on August 8, 2017*****

John Sevigny, C.E.T.
Project Manager, Infrastructure Approvals
Development Review, Suburban Services | *Examen des projets d'aménagement, Services suburbains*
Planning, Infrastructure and Economic Development Department | Services de la planification, de l'infrastructure et du développement économique
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West. Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste **14388**, fax/téléc:613-580-2576, john.sevigny@ottawa.ca

---

From: Bob Wingate [mailto:rwingate@IBIGroup.com]
Sent: Wednesday, July 19, 2017 10:18 AM
To: Sevigny, John <John.Sevigny@ottawa.ca>
Cc: Terry Brule <tbrule@IBIGroup.com>; Jim Moffatt <jmoffatt@IBIGroup.com>
Subject: Fw: Riverside South , Rideau River Drainage Area

Hi John
We assume this satisfies your requirement for acknowledgment from Cardel regarding concurrence with our proposed Revision to the sanitary drainage limit for the River Road trunk sewer.
Regards
Bob

Sent from my BlackBerry 10 smartphone on the Bell network.

From: Matt Wingate <MWingate@dsel.ca>
Sent: Tuesday, July 18, 2017 10:37 PM
To: John Sevigny
Cc: Bob Wingate; Terry Brule
Subject: Fwd: Riverside South , Rideau River Drainage Area

Hi John,
Please find Lisa Dalla Rosa's agreement below to IBI's proposed sanitary drainage plan described below.
Please feel free to call if you have any questions or need further input from our end.
Thanks

Matt Wingate, P.Eng.
DSEL
david schaeffer engineering ltd.

Begin forwarded message:

From: Lisa Dalla Rosa <lisa.dallarosa@cardelhomes.com>
Date: July 18, 2017 at 12:36:59 PM EDT
To: Matt Wingate <MWingate@dsel.ca>
Subject: RE: Riverside South , Rideau River Drainage Area

Agreed.
LDR

From: Matt Wingate [mailto:MWingate@dsel.ca]
Sent: Thursday, July 13, 2017 11:43 AM
To: Lisa Dalla Rosa <lisa.dallarosa@cardelhomes.com>
Cc: Laura Maxwell <LMaxwell@dsel.ca>; 'Bob Wingate P.Eng. (rwingate@ibigroup.com)' <rwingate@ibigroup.com>
Subject: RE: Riverside South , Rideau River Drainage Area

Hi Lisa,

IBI has requested that acceptance of their sanitary proposal come directly from Cardel. Can you respond to this email with your agreement?

Thanks

Matt

From: Matt Wingate
Sent: July 12, 2017 1:38 PM
To: 'Lisa Dalla Rosa (lisa.dallarosa@cardelhomes.com)' <lisa.dallarosa@cardelhomes.com>
Cc: Laura Maxwell <LMaxwell@dsel.ca>
Subject: FW: Riverside South , Rideau River Drainage Area

Hi Lisa,
Please see below related to the Urbandale/Claridge/Cardel coordinated sanitary servicing plan for Riverside south, as discussed two weeks ago.
Let me know if you have any questions.
We will forward the final draft of our functional servicing report to you shortly for your review.

Matt

From: Matt Wingate
Sent: July 12, 2017 1:35 PM
To: 'Bob Wingate' <rwingate@IBIGroup.com>
Cc: Steve Pichette <SPichette@dsel.ca>; Terry Brule <tbrule@IBIGroup.com>; Sevigny, John <John.Sevigny@ottawa.ca>
Subject: RE: Riverside South , Rideau River Drainage Area

Get Fig S.1

Hi Bob;
Thanks for including us in this circulation.
I can confirm that we are in agreement with your proposal to include Cardel's developable property area west of the Brian Good collector road within the River Road trunk sanitary sewer catchment, as illustrated in your Figure S-1.

We are currently finalizing our functional servicing report to be submitted in support of Cardel's application for plan of subdivision approval, and we will present a preferred alternative wastewater servicing plan for Cardel's subdvision that will match the drainage boundaries presented in IBI's proposal.
If there are any further questions or you require additional info related to our proposed servicing plan, please do not hesitate to call.

regards

Matt Wingate, P.Eng.
Manager of Design Administration

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext 522
direct: (613) 836-1522
cell: (613) 858-4975
e-mail: mwingate@DSEL.ca

From: Bob Wingate [mailto:rwingate@IBIGroup.com]
Sent: July 12, 2017 11:46 AM
To: Matt Wingate <MWingate@dsel.ca>
Cc: Steve Pichette <SPichette@dsel.ca>; Terry Brule <tbrule@IBIGroup.com>; Sevigny, John <John.Sevigny@ottawa.ca>
Subject: FW: Riverside South , Rideau River Drainage Area

Hi Matt
We have submitted our sanitary analysis for Riverside South to the City of Ottawa(John Sevigny) for their review and approval , as per our previous discussion. This morning John called to advise that he has circulated this request to expand the tributary area to the River Road trunk sanitary sewer and use the revised sanitary design parameters currently being considered by the City internally at the City . To support this submission he would appreciate it if we could get confirmation from Cardel / DSEL that you have seen this proposal and that you are in general agreement with the proposed drainage expansion through Cardel's lands as an initial servicing scenario. The e-mail below and supporting attachments included is a complete copy of the submission to reconfirm it is consistent with our discussions .
If you would provide us with the confirmation John is requesting that would be appreciated so we can ensure that this request maintains momentum at the City .

Bob Wingate

IBI GROUP
400-333 Preston Street
Ottawa ON K1S 5N4 Canada
tel +1 613 225 1311 fax +1 613 225 9868

<image007.png>

From: Bob Wingate
Sent: Thursday, June 29, 2017 2:20 PM
To: Sevigny, John <John.Sevigny@ottawa.ca>
Cc: Terry Brule (tbrule@ibigroup.com) <tbrule@ibigroup.com>; Marcel Denomme (mdenomme@urbandale.com) <mdenomme@urbandale.com>; Jim Burghout (jim.burghout@claridgehomes.com) <jim.burghout@claridgehomes.com>; Matt Wingate <mwingate@dsel.ca>
Subject: Riverside South , Rideau River Drainage Area

Got Plan + Spreadsheet

Hi John
Further to our previous discussions , attached is a figure which illustrates a proposed expansion of the River Road trunk sanitary sewer tributary area , easterly from the existing developed area to the north to the south limit of the urban boundary . This figure shows the drainage divide between the River Road sanitary collector sewer and the Spratt Road collector as currently proposed in the recently updated MSS , overlaid on the latest draft plans as proposed by the three major developers in the area (RSDC , Claridge , and Cardel) . also shown on this figure is a proposed expansion of the River Road collector drainage area easterly based on the use of monitored parameters from the current City design guidelines , as suggested by John Bougadis , and the use of revised design parameters currently being considered by the City for the undeveloped portion of the proposed tributary area to the River Road trunk sewer . To support the proposed expanded drainage area to the River Road trunk sewer we have recreated the sanitary spread sheet from the MSS and attached a copy of the unaltered version of this spread sheet for your use in confirming that the analysis prepared by IBI is based on exactly the same assumptions regarding land use , density , etc. as the final MSS document . The second spread sheet attached has only the design parameters for the areas tributary to the River Road trunk sewer adjusted to reflect the use of monitored parameters for the built out areas , and revised design parameters for the undeveloped areas tributary to the River Road trunk sewer . This last spread sheet demonstrates that the proposed expanded drainage area can be accommodated in the existing River Road collector sewer without surcharging the system . Given that this expanded drainage area significantly reduces the potential for grade raise issues , maximizes the use of parallel sewers in the local road network , and improves phasing potential for all three major developers involved , we request that the City confirm acceptance of this proposal as a minor adjustment to the MSS , so that all three developers can finalize their individual serviceability reports based on this revision to the drainage areas.
It should be noted that IBI represents both Claridge and RSDC for this development area and that we have met with DSEL who represents Cardel , the other major developer in the area , and all three developers are in agreement with the proposed new drainage limit , and support the implementation of this change .
If you have any questions regarding this submission please do not hesitate to contact me directly .

Regards

Bob Wingate

IBI GROUP
400-333 Preston Street
Ottawa ON K1S 5N4 Canada
tel +1 613 225 1311 fax +1 613 225 9868

<image008.jpg><image009.jpg><image010.jpg><image011.jpg><image012.jpg>

<image007.png>

IBI GROUP
400–333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Memorandum

To/Attention:	John Sevigny, City of Ottawa Marcel Denomme, Urbandale (RSDC) Jim Burghout, Claridge Homes	**Date:**	July 25, 2017
From:	Robert W. Wingate	**Project No:**	38269-5.3.1
cc:			
Subject:	**DEVIATION REPORT MEMORANDUM RIVERSIDE SOUTH, RIDEAU RIVER DRAINAGE AREA SANITARY SEWER DESIGN PARAMETERS**		

INTRODUCTION:

Urbandale Corporation (RSDC), Claridge Homes and Cardel Homes are in the process of advancing the development of their lands in Riverside South located in the area known as the Rideau River Drainage Area (Figure A-1 illustrates the ownership limits).

As part of the draft plan approval process, IBI Group has been retained to prepare "Adequacy of Services Reports" to support the proposed development of the RSDC lands and the Claridge lands. In reviewing the Final Master Servicing Study (MSS) IBI Group has determined that an alternative method of calculating the design flow for the trunk sanitary sewer in River Road will be beneficial to the design of the internal sanitary sewer system for the subject area, and will ultimately benefit development of the overall development area.

PURPOSE:

The purpose of this memorandum is to present the alternative method of design for the River Road Sanitary Collector Sewer, identify the benefits of implementing the proposed deviation, and request approval to proceed with the implementation of the proposed deviation in design procedure.

JUSTIFICATION:

In advancing the detailed local sanitary sewer system layout for the development lands in the Rideau River Drainage Area west of Spratt Road, it became apparent that the drainage divide between the River Road Sanitary Collector Sewer and the Spratt Road Collector Sewer was problematic as presented in the recent update to the MSS for this area. The combination of the Spratt Road Collector Sewer being significantly higher than the River Road Collector, and the fact that the existing ground surface drops off significantly between the Spratt Road Collector and the current drainage divide is problematic as proposed in the updated MSS. It is problematic because these facts combine to produce a high risk of grade raise issues along the corridor between the Spratt Road sewer and the drainage divide. This grade raise risk is further compounded by the fact that the MSS drainage proposal results in reverse flowing sewers between the sanitary sewer and storm sewer on most streets in that area.

The simple solution to resolve all these issues is to expand the drainage limit of the deeper River Road Collector sewer easterly. Figure A-2 illustrates the proposed expansion of the River Road Collector Sewer Drainage Area. This adjustment to the drainage area reduces the potential for grade raise issues, maximizes the use of parallel sewers in the local road network, and improves the phasing potential for all three developers.

The problem with implementing the proposed expansion of the River Road Collector Sewer drainage area is that the free flow design capacity of the existing River Road Collector Sewer is exceeded using the City of Ottawa's current design guideline design parameter for sanitary sewers. To alleviate this theoretical issue we have evaluated the River Road Sanitary Collector Sewer using monitored parameters for the existing development area tributary to the River Road Collector Sewer, and the City's proposed revised sanitary sewer design parameters, as presented in Table 1, for the remainder of the development area tributary to the River Road Collector Sewer. The attached spreadsheet was created to replicate the sanitary spreadsheet in the current MSS. The City's proposed revised design parameters were then applied to the un-built area tributary to the River Road Collector Sewer using the proposed expanded drainage area (see pink highlighted section of spreadsheet). The modified spreadsheet demonstrates that the River Road Collector Sewer's capacity under free flow conditions is not exceeded at build-out under this design scenario.

CONCLUSION:

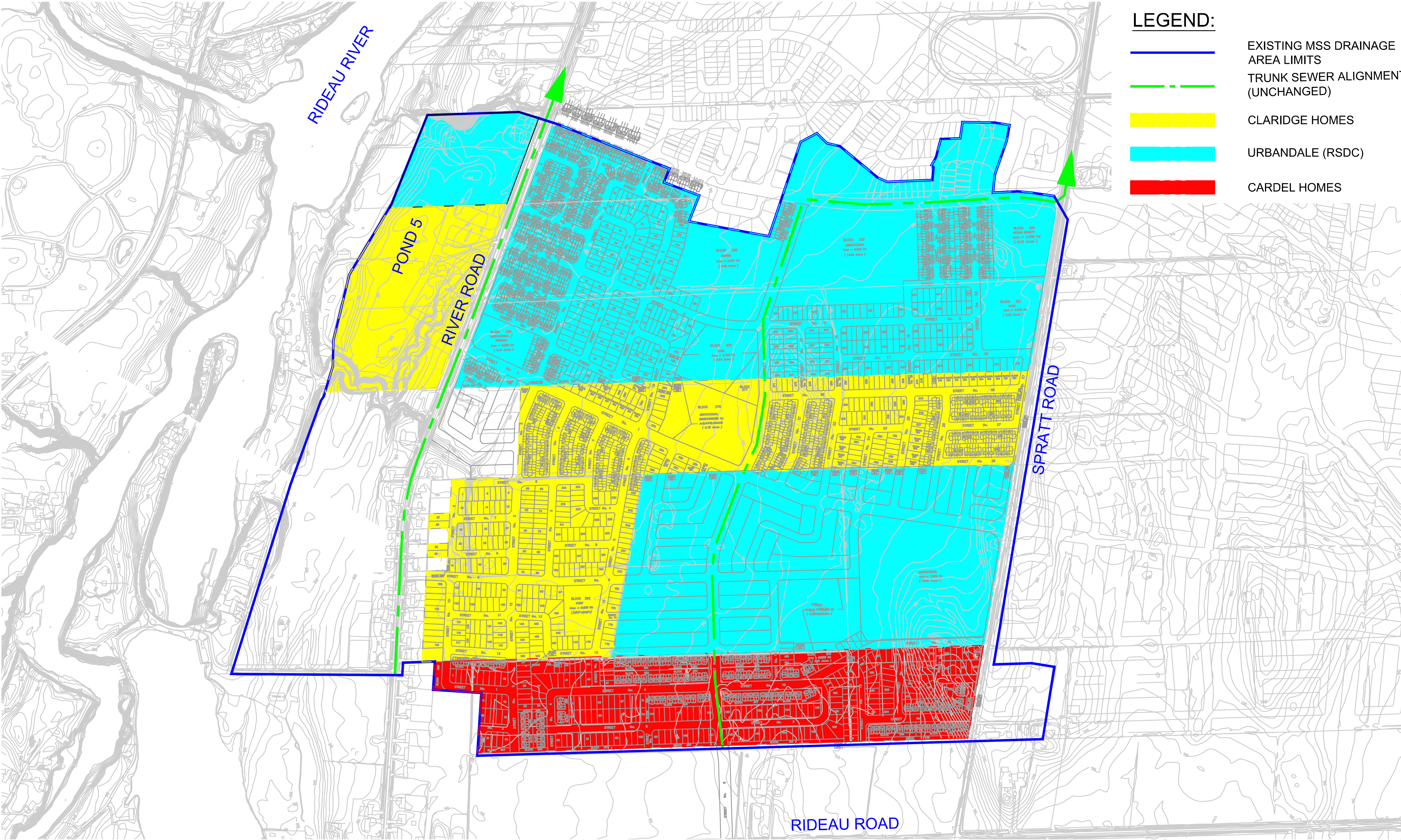
Given the significance of the benefits to expanding the River Road Sanitary Collector Sewers drainage area easterly, including reducing the risk of grade raise issues, maximizing the use of parallel sanitary and storm sewers, and enhancing construction phasing potential for all three developers involved, it is recommended that the City approve the use of the revised sanitary sewer design parameters for use in the Riverside South Rideau River Drainage Area in advance of formal approval of these revised parameters. In considering this recommendation, it should also be noted that shifting the drainage areas as proposed will provide additional residual capacity in the more easterly Spratt Road Sanitary Collector Sewer. This will help support more intensification beyond that currently proposed in the existing CDP for the eastern portion of the development area. This is consistent with the City's Building Better Smarter Suburbs (BBSS) initiative and the recent decision to extend the next phase of the LRT to Riverside South. Given these recent facts the City may want to approve the use of the proposed revised sanitary sewer design parameters for all of Riverside South at this time, to maximize the implementation of the BBSS initiative and further support the imminent extension of the LRT to Riverside South by facilitating additional intensification of development.

Yours truly,

IBI GROUP

Robert W. Wingate, P. Eng.
Associate

RWW/ks
Encl.



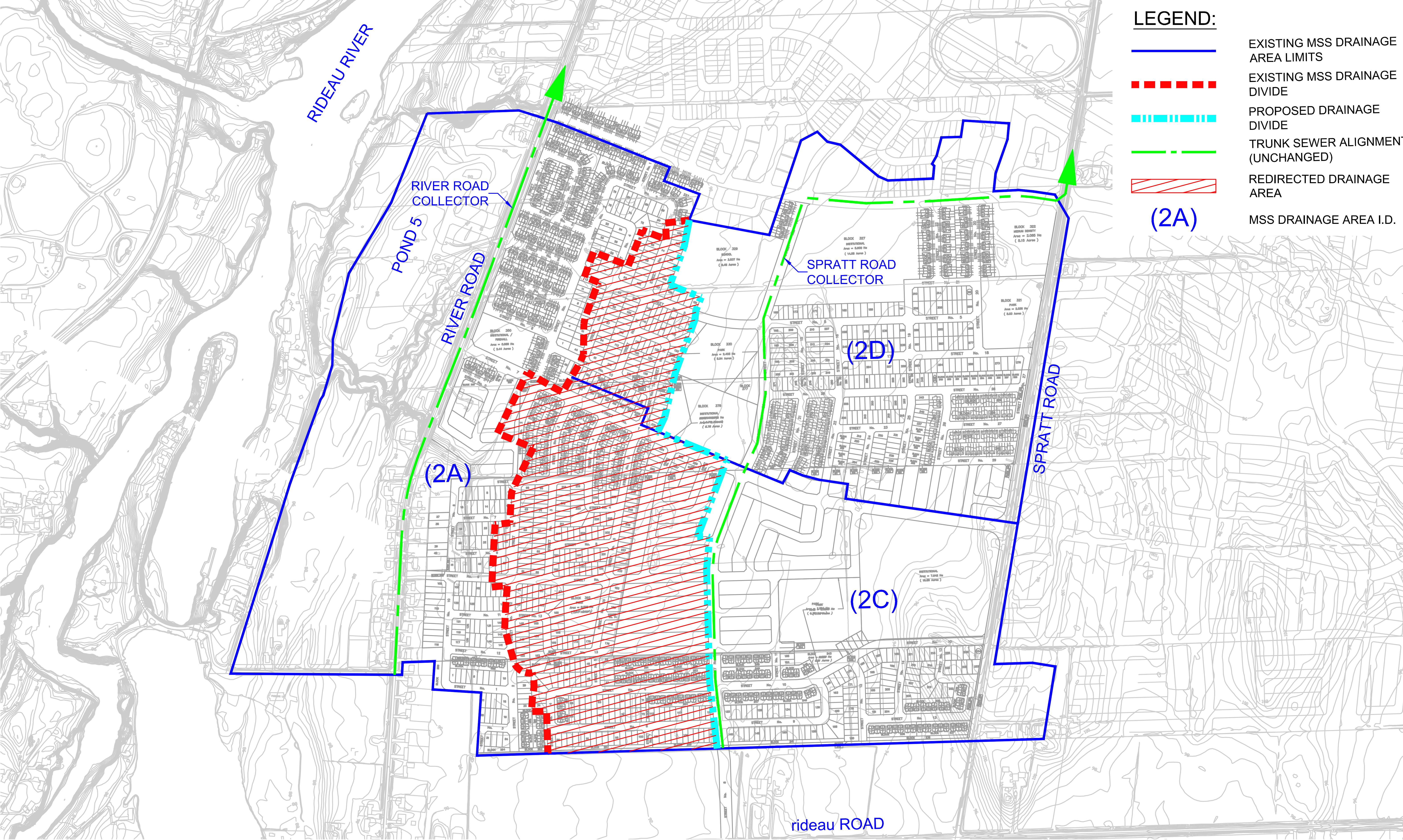
IBI

Scale: N.T.S.

Project Title: RIVERSIDE SOUTH RIDEAU RIVER POND 5 DRAINAGE AREA

Drawing Title: OWNERSHIP

Sheet No.: FIGURE A-1

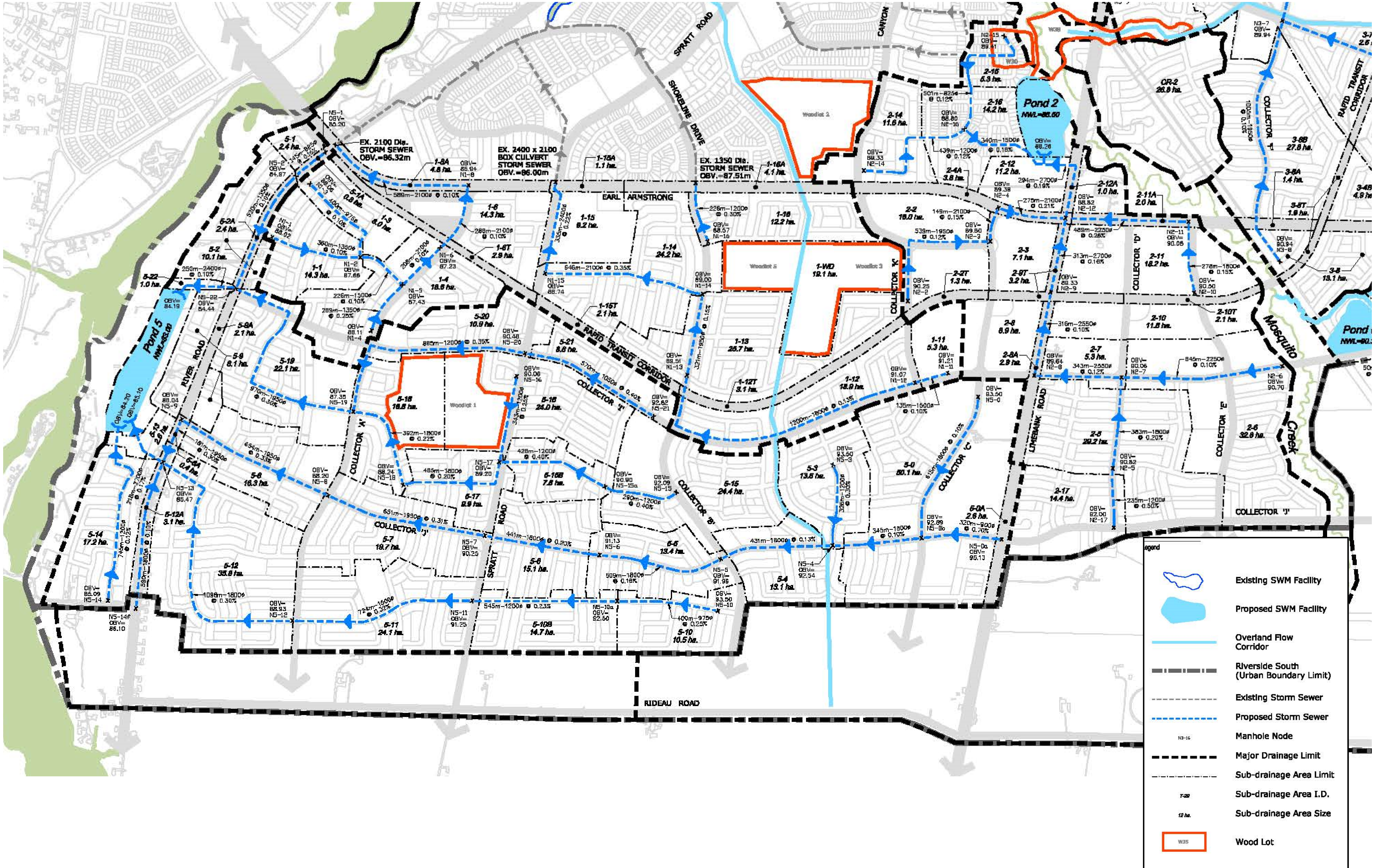


Scale	Project Title	Drawing Title	Sheet No.
N.T.S.	RIVERSIDE SOUTH RIDEAU RIVER POND 5 DRAINAGE AREA	ALTERNATIVE SANITARY DRAINAGE LIMIT	FIGURE A-2

J:\38269-RiversideSthPh15\5.9 Drawings\59civil\current\Deviation Report figures\FIGURE A-2.dwg Layout Name: FIGURE S-1 Plot Scale: 1:5.13 Plotted At: 7/25/2017 Last Saved By: chris.cormier Last Saved A

Appendix C : STORM SEWER

Figure 3-1: 2008 MDP Preferred Stormater Management Strategy



Stantec

STANTEC CONSULTING LTD.
400 1331 CLYDE AVENUE
OTTAWA, ON
TEL. 613.722.4420
WWW.STANTEC.COM

Legend

- Major Water
- Parcels
- Streets
- Rideau River Study Area
- Pond 5
- Catchments
- Minor System Nodes
- Culverts
- Storm Sewers

Note:
The presented imperviousness values represent directly connected imperviousness

Client / Project:

CITY OF OTTAWA

RIVERSIDE SOUTH ISSU UPDATE

OTTAWA, ON

Title:

STORM SEWERS

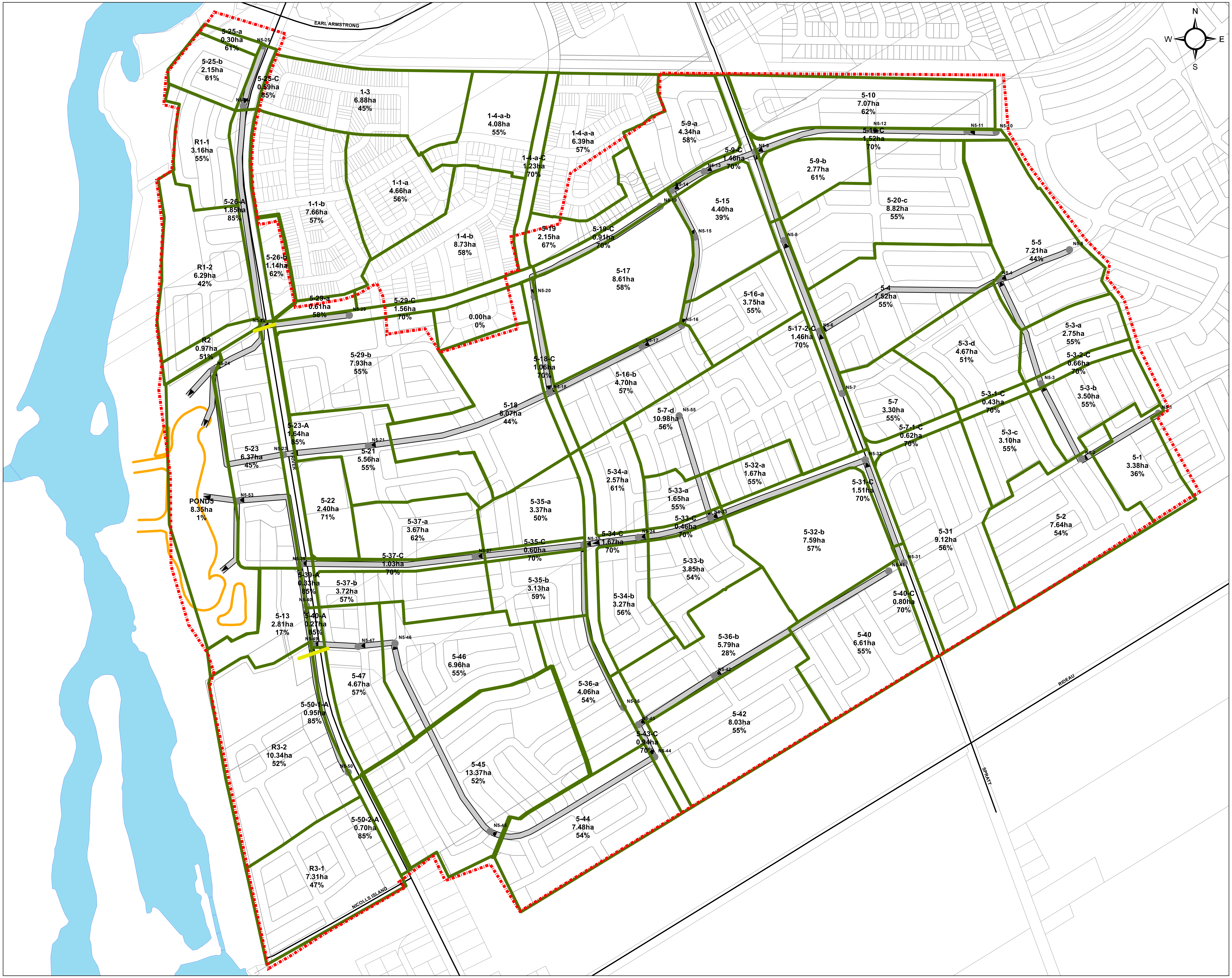
Project No.: 163401101

Scale: 0 50 100 200 Meters

Drawing No.: STM-1

Sheet: 3 of 7

Revision: 0



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OTTAWA, ON
TEL. 613.722.4420
WWW.STANTEC.COM

Legend

- Major Water
- Parcels
- Rideau River Study Area
- Pond 5
- Streets

Catchments

- Catchment ID / Area / % Imperviousness
- Minor System Nodes
- Culverts
- Storm Sewers

Note:
The presented imperviousness values represent directly connected imperviousness

Client / Project:

CITY OF OTTAWA

RIVERSIDE SOUTH ISSU UPDATE

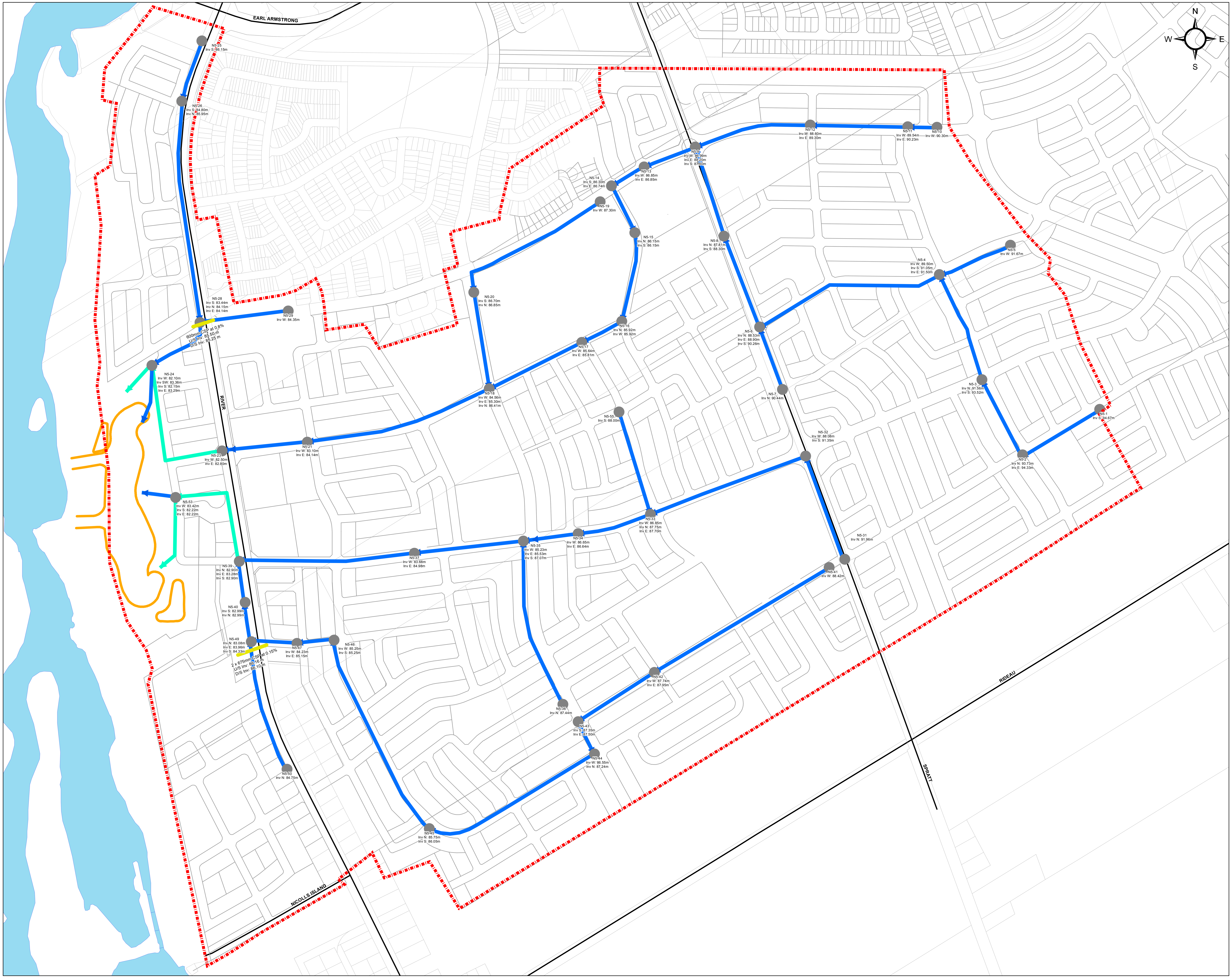
OTTAWA, ON

Title:

STORM CATCHMENTS

Project No.:	Scale:
163401101	0 50 100 200 Meters

Drawing No.:	Sheet:	Revision:
STM-2	4 of 7	0



Stantec

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OTTAWA, ON
TEL. 613.722.4420
WWW.STANTEC.COM

Legend

- Major Water
- Parcels
- Streets
- Rideau River Study Area
- Pond 5
- Minor System Nodes
- Culverts

Storm Sewers

- Not Submerged
- Partially Submerged

Note:
The presented imperviousness values represent directly connected imperviousness

Client / Project:

CITY OF OTTAWA

RIVERSIDE SOUTH ISSU UPDATE

OTTAWA, ON

Title:

STORM SEWER INVERTS AND FLOW CONDITION

Project No.: 163401101

Scale: 0 50 100 200 Meters

Drawing No.: STM-3

Sheet: 5 of 7

Revision: 0

Storm Sewer Design Sheet per PCSWMM HGL Analysis

STORM SEWER DESIGN SHEET

Stantec

Riverside South Community

FILE NUMBER: 1634-1101

DATE: 42885.000
REVISION: Sewers Sized for Capture per PCSWMM HGL Analysis
DESIGNED BY: Megan Young
CHECKED BY: Amanda Lynch

DESIGN PARAMETERS

I = a / (t+b)^c (As per City of Ottawa Guidelines, 2004)

	1:2 yr	1:5 yr	1:10 yr
a =	732.95	998.07	1174.184
b =	6.199	6.053	6.014
c =	0.810	0.814	0.816

MANNING'S n = 0.013
MINIMUM COVER: 2.500 m
MIN T_C 10.000 min
Assumed velocity in internal pipes: 0.017 m/min

LOCATION / DRAINAGE AREA

AREA ID / STREET						FROM M.H.	TO M.H.	2-year AREA (ha)	2-year IMPERV (%)	2-year C (-)	2-year ACCUM. AREA (ha)	2-year A x C (ha)	2-year ACCUM. AxC (ha)	5-year AREA (ha)	5-year IMPERV (%)	5-year C (-)	5-year ACCUM. AREA (ha)	5-year A x C (ha)	5-year ACCUM. AxC (ha)	10-year AREA (ha)	10-year IMPERV (%)	10-year C (-)	10-year ACCUM. AREA (ha)	10-year A x C (ha)	10-year ACCUM. AxC (ha)
POND 5 - Outlet 1																									
5-40-C	5-40	-	-	-	-	N5-41	N5-42	6.61	55	0.59	6.61	3.87	3.87	0.80	70	0.69	0.80	0.55	0.55	0.00		0.20	0.00	0.00	0.00
5-42	-	-	-	-	-	N5-42	N5-43	8.03	55	0.59	14.64	4.70	8.56	0.00		0.20	0.80	0.00	0.55	0.00		0.20	0.00	0.00	0.00
5-43-C	-	-	-	-	-	N5-43	N5-44	0.00		0.20	14.64	0.00	8.56	0.94	70	0.69	1.74	0.65	1.20	0.00		0.20	0.00	0.00	0.00
	5-44	-	-	-	-	N5-44	N5-45	7.48	54	0.58	22.12	4.32	12.89	0.00		0.20	0.80	0.00	0.55	0.00		0.20	0.00	0.00	0.00
5-45	-	-	-	-	-	N5-45	N5-46	13.37	52	0.56	35.49	7.54	20.43	0.00		0.20	0.80	0.00	0.55	0.00		0.20	0.00	0.00	0.00
5-46	-	-	-	-	-	N5-46	N5-47	6.96	55	0.59	42.45	4.07	24.50	0.00		0.20	0.80	0.00	0.55	0.00		0.20	0.00	0.00	0.00
5-47	-	-	-	-	-	N5-47	N5-49	4.67	57	0.60	47.12	2.80	27.30	0.00		0.20	0.80	0.00	0.55	0.00		0.20	0.00	0.00	0.00
5-50-1-A	5-50-2-A	R3-1	R3-2	-	-	N5-50	N5-49	17.65	50	0.55	17.65	9.70	9.70	0.00		0.20	0.00	0.00	0.00	1.65	85	0.80	1.65	1.31	1.31
5-40-A	-	-	-	-	-	N5-49	N5-40	0.00		0.20	64.77	0.00	37.00	0.00		0.20	0.80	0.00	0.55	0.27	85	0.80	1.92	0.21	1.53
-	-	-	-	-	-	N5-40	N5-39	0.00		0.20	64.77	0.00	37.00	0.00		0.20	0.80	0.00	0.55	0.00		0.20	1.92	0.00	1.53
5-31	5-31-C	-	-	-	-	N5-31	N5-32	9.12	56	0.59	9.12	5.40	5.40	1.51	70	0.69	1.51	1.04	1.04	0.00		0.20	0.00	0.00	0.00
5-31-C	5-34-C	5-32-b	-	-	-	N5-32	N5-33	7.59	57	0.60	16.71	4.55	9.95	3.18	70	0.69	4.69	2.19	3.23	0.00		0.20	0.00	0.00	0.00
5-7-d	-	-	-	-	-	N5-55	N5-33	10.98	56	0.59	10.98	6.50	6.50	0.00		0.20	0.00	0.00	0.00	0.00		0.20	0.00	0.00	0.00
5-33-C	5-33-a	5-33-b	-	-	-	N5-33	N5-34	5.50	54	0.58	33.19	3.19	19.64	0.46	70	0.69	5.15	0.32	3.55	0.00		0.20	0.00	0.00	0.00
5-34-C	5-34-a	5-34-b	-	-	-	N5-34	N5-35	5.84	58	0.61	39.03	3.55	23.18	1.67	70	0.69	6.81	1.15	4.70	0.00		0.20	0.00	0.00	0.00
5-36-b	5-36-a	-	-	-	-	N5-36	N5-35	9.85	39	0.47	9.85	4.64	4.64	0.00		0.20	0.00	0.00	0.00	0.00		0.20	0.00	0.00	0.00
5-35-C	5-35-a	5-35-b	-	-	-	N5-35	N5-37	6.50	54	0.58	55.38	3.77	31.60	0.60	70	0.69	7.41	0.41	5.11	0.00		0.20	0.00	0.00	0.00
5-37-C	5-37-a	5-37-b	-	-	-	N5-37	N5-39	7.39	59	0.62	62.77	4.56	36.15	1.03	70	0.69	8.44	0.71	5.82	0.00		0.20	0.00	0.00	0.00
5-39-A	-	-	-	-	-	N5-39	N5-53	0.00		0.20	127.54	0.00	73.15	0.00		0.20	9.24	0.00	6.38	0.33	85	0.80	1.92	0.26	1.79
			-	-	-	N5-53	Pond-5	0.00		0.20	127.54	0.00	73.15	0.00		0.20	9.24	0.00	6.38	0.00		0.20	1.92	0.00	1.79
POND 5 - Outlet 2																									
5-1	-	-	-	-	-	N5-1	N5-2	3.38	36	0.45	3.38	1.53	1.53	0.00		0.20	0.00	0.00	0.00	0.00		0.20	0.00	0.00	0.00
5-2	-	-	-	-	-	N5-2	N5-3	7.64	54	0.58	11.02	4.42	5.94	0.00		0.20	0.00	0.00	0.00	0.00		0.20	0.00	0.00	0.00
5-3-b	5-3-2-C	5-3-a	5-3-1-C	5-47	5-3-c	N5-3	N5-4	14.02	56	0.59	25.04	8.27	14.21	1.09	70	0.69	1.09	0.75	0.75	0.00		0.20	0.00	0.00	0.00
5-5	-	-	-	-	-	N5-5	N5-4	7.21	44	0.51	7.21	3.66	3.66	0.00		0.20	0.00	0.00	0.00	0.00		0.20	0.00	0.00	0.00
5-4	-	-	-	-	-	N5-4	N5-6	7.52	55	0.59	39.77	4.40	22.27	0.00		0.20	1.09	0.00	0.75	0.00		0.20	0.00	0.00	0.00
5-7	5-7-1-C	5-17-2-C	-	-	-	N5-7	N5-6	3.30	55	0.59	3.30	1.93	1.93	2.08	70	0.69	2.08	1.44	1.44	0.00		0.20	0.00	0.00	0.00
-	-	-	-	-	-	N5-6	N5-8	0.00		0.20	43.07	0.00	24.20	0.00		0.20	3.17	0.00	2.19	0.00		0.20	0.00	0.00	0.00
-	-	-	-	-	-	N5-8	N5-9	0.00		0.20	43.07	0.00	24.20	0.00		0.20	3.17	0.00	2.19	0.00		0.20	0.00	0.00	0.00
5-10	5-10-C	-	-	-	-	N5-10	N5-11	7.07	62	0.63	7.07	4.48	4.48	1.52	70	0.69	1.52	1.05	1.05	0.00		0.20	0.00	0.00	0.00
-	-	-	-	-	-	N5-11	N5-12	0.00		0.20	7.07	0.00	4.48	0.00		0.20	1.52	0.00	1.05	0.00		0.20	0.00	0.00	0.00
5-20-c	-	-	-	-	-	N5-12	N5-9	8.82	55	0.59	15.89	5.16	9.64	0.00		0.20	1.52	0.00	1.05	0.00		0.20	0.00	0.00	0.00
5-17-2-C	5-9-b	5-9-a	-	-	-	N5-9	N5-13	7.11	59	0.61	66.07	4.37	38.21	1.46	70	0.69	6.15	1.01	4.24	0.00		0.20	0.00	0.00	0.00
-	-	-	-	-	-	N5-13	N5-14	0.00		0.20	66.07	0.00	38.21	0.00		0.20	6.15	0.00	4.24	0.00		0.20	0.00	0.00	0.00
-	-	-	-	-	-	N5-14	N5-15	0.00		0.20	66.07	0.00	38.21	0.00		0.20	6.15	0.00	4.24	0.00		0.20	0.00	0.00	0.00
5-15	-	-	-	-	-	N5-15	N5-16	4.40	39	0.47	70.47	2.08	40.29	0.00		0.20	6.15	0.00	4.24	0.00		0.20	0.00	0.00	0.00
5-16-a	5-16-b	-	-	-	-	N5-16	N5-17	8.45	56	0.59	78.92	5.01	45.30	0.00		0.20	6.15	0.00	4.24	0.00		0.20	0.00	0.00	0.00
5-17	-	-	-	-	-	N5-17	N5-18	8.61	58	0.61	87.53	5.22	50.52	0.00		0.20	6.15	0.00	4.24	0.00		0.20	0.00	0.00	0.00
5-25-b	5-19-C	-	-	-	-	N5-19	N5-20	2.15	61	0.63	2.15	1.35	1.35	0.91	70	0.69	0.91	0.63	0.63	0.00		0.20	0.00	0.00	0.00
-	-	-	-	-	-	N5-20	N5-18	0.00		0.20	2.15	0.00	1.35	0.00		0.20	0.91	0.00	0.63	0.00		0.20	0.00	0.00	0.00
5-18-C	5-18	-	-	-	-	N5-18	N5-21	8.07	44	0.51	97.75	4.10	55.97	1.06	70	0.69	8.12	0.73	5.60	0.00		0.20	0.00	0.00	0.00
5-21	5-22	5-23-A	-	-	-	N5-21	N5-23	7.96	60	0.62	105.71	4.93	60.89	0.00		0.20	8.12	0.00	5.60	1.64	85	0.80	1.64	1.30	1.30
5-23	-	-	-	-	-	N5-23	N5-24	6.37	45	0.52	112.08	3.28	64.17	0.00		0.20	8.12	0.00	5.60	0.00		0.20	1.64	0.00	1.30
5-25-a	5-25-b	5-25-C	-	-	-	N5-25	N5-26	2.45	61	0.63	2.45	1.54	1.54	0.59	70	0.69	0.59	0.41	0.41	0.00		0.20	0.00	0.00	0.00
5-26-A	5-26-b	R1-1	-	-	-	N5-26	N5-28	4.30	57	0.60	6.75	2.57	4.11	0.00		0.20	0.59	0.00	0.41	1.85	85	0.80	1.85	1.47	1.47
5-29-a	5-29-C	5-29-b	-	-	-	N5-29	N5-28	8.54	55	0.59	8.54	5.01	5.01	1.56	70	0.69	1.56	1.08	1.08	0.00		0.20	0.00	0.00	0.00
-	-	-	-	-	-	N5-28	N5-24	0.00		0.20	15.29	0.00	9.12	0.00		0.20	2.15	0.00	1.48	0.00		0.20	1.85	0.00	1.47
-	-	-	-	-	-	N5-24	Pond-5	0.00		0.20	127.37	0.00	73.29	0.00		0.20	10.27	0.00	7.08	0.00		0.20	3.49	0.00	2.77

PIPE SELECTION

FROM M.H.	TO M.H.	T of C (min)	$I_{2\text{-}yr}$ (mm/h)	$I_{5\text{-}YEAR}$ (mm/h)	$I_{10\text{-}YEAR}$ (mm/h)	$Q_{2\text{-}YEAR}$ (CIA/360) (L/s)	$Q_{5\text{-}YEAR}$ (CIA/360) (L/s)	$Q_{10\text{-}YEAR}$ (CIA/360) (L/s)	Q_{TOTAL} (CIA/360) (L/s)	LENGTH (m)	Tech Bulletin PIPE SIZE (mm)	PCSWMM PIPE SIZE (mm)	PIPE SLOPE %	Q_{CAP} (FULL) (L/s)	Q_{ACT} / Q_{CAP} (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
POND 5 - Outlet 1																		
N5-41	N5-42	10.00	76.81	104.19	122.14	824.98	159.76	0.00	984.7	470	1200	1350	0.10	1760.9	0.56	1.19	1.22	6.44
N5-42	N5-43	16.44	58.56	79.16	92.69	1393.06	121.38	0.00	1514.4	288	1350	1500	0.12	2500.9	0.61	1.37	1.44	3.33
N5-43	N5-44	19.78	52.39	70.74	82.79	1246.36	235.92	0.00	1482.3	288	1350	1650	0.13	3428.5	0.43	1.55	1.48	3.25
N5-44	N5-45	19.78	52.39	70.74	82.79	1875.54	108.47	0.00	1984.0	424	1500	1650	0.12	3294.0	0.60	1.49	1.57	4.51
N5-45	N5-46	24.29	46.02	62.06	72.59	2611.61	95.16	0.00	2706.8	484	1800	1950	0.10	4694.6	0.58	1.52	1.57	5.14
N5-46	N5-47	29.42	40.57	54.64	63.88	2760.79	83.78	0.00	2844.6	83	1800	1950	0.12	5142.6	0.55	1.67	1.70	0.81
N5-47	N5-49	30.24	39.83	53.64	62.71	3020.29	82.25	0.00	3102.5	106	1950	2400	0.25	12913.3	0.24	2.77	2.21	0.80
N5-50	N5-49	10.00	76.81	104.19	122.14	2069.20	0.00	445.05	2514.3	337	1200	1800	0.14	4487.1	0.56	1.71	1.76	3.19
N5-49	N5-40	30.24	39.83	53.64	62.71	4093.40	82.25	265.88	4441.5	86	1950	3000	0.10	14807.4	0.30	2.03	1.72	0.83
N5-40	N5-39	31.07	39.11	52.66	61.56	4019.31	80.75	261.01	4361.1	97	1950	3000	0.10	14807.4	0.29	2.03	1.72	0.94
N5-31	N5-32	10.00	76.81	104.19	122.14	1151.87	301.55	0.00	1453.4	274	1200	1350	0.22	2611.8	0.56	1.77	1.80	2.53
N5-32	N5-33	12.53	68.28	92.48	108.35	1886.28	830.54	0.00	2716.8	338	1650	1800	0.11	3959.2	0.69	1.51	1.64	3.44
N5-55	N5-33	10.00	76.81	104.19	122.14	1386.79	0.00	0.00	1386.8	247	1200	1500	0.10	2332.1	0.59	1.28	1.33	3.10
N5-33	N5-34	12.53	68.28	92.48	108.35	3724.24	912.07	0.00	4636.3	182	1950	2400	0.12	8983.8	0.52	1.92	1.92	1.58
N5-34	N5-35	14.11	63.95	86.55	101.37	4118.39	1129.87	0.00	5248.3	146	2100	2400	0.12	8946.6	0.59	1.92	1.99	1.22
N5-36	N5-35	10.00	76.81	104.19	122.14	989.83	0.00	0.00	989.8	390	1200	1350	0.10	1760.9	0.56	1.19	1.23	5.30
N5-35	N5-37	14.11	63.95	86.55	101.37	5612.68	1229.40	0.00	6842.1	227	2400	2700	0.11	11726.2	0.58	1.98	2.06	1.83
N5-37	N5-39	15.94	59.63	80.63	94.41	5987.61	1304.49	0.00	7292.1	399	2400	2700	0.10	11180.5	0.65	1.89	2.02	3.29
N5-39	N5-53	50.30	27.92	37.49	43.78	5673.23	664.06	217.52	6554.8	270	2400	3000	0.25	23412.6	0.28	3.21	2.63	1.71
N5-53	Pond-5	52.01	27.26	36.59	42.72	5537.83	648.10	212.27	6398.2	160	2400	2700	0.25	17677.9	0.36	2.99	2.72	0.98
POND 5 - Outlet 2																		
N5-1	N5-2	10.00	76.81	104.19	122.14	325.94	0.00	0.00	325.9	205	675	900	0.17	778.7	0.42	1.19	1.11	3.07
N5-2	N5-3	13.07	66.75	90.38	105.88	1101.99	0.00	0.00	1102.0	195	1200	1500	0.11	2445.9	0.45	1.34	1.29	2.51
N5-3	N5-4	15.58	60.44	81.74	95.71	2385.76	170.76	0.00	2556.5	257	1500	1650	0.20	4252.5	0.60	1.93	2.02	2.12
N5-5	N5-4	10.00	76.81	104.19	122.14	781.42	0.00	0.00	781.4	174	1050	1200	0.10	1286.2	0.61	1.10	1.16	2.51
N5-4	N5-6	15.58	60.44	81.74	95.71	3739.22	170.76	0.00	3910.0	456	1950	2100	0.13	6522.2	0.60	1.82	1.90	4.01
N5-7	N5-6	10.00	76.81	104.19	122.14	411.87	415.38	0.00	827.2	139	1050	1050	0.13	1027.2	0.81	1.15	1.29	1.80
N5-6	N5-8	15.58	60.44	81.74	95.71	4063.32	496.63	0.00	4559.9	227	2100	2400	0.10	8167.1	0.56	1.75	1.78	2.12
N5-8	N5-9	17.70	56.06	75.75	88.67	3768.66	460.22	0.00	4228.9	210	2100	2400	0.10	8167.1	0.52	1.75	1.75	2.00
N5-10	N5-11	10.00	76.81	104.19	122.14	956.30	302.75	0.00	1259.1	66	1350	1500	0.11	2401.0	0.52	1.32	1.33	0.83
N5-11	N5-12	10.83	73.77	100.02	117.22	918.48	290.61	0.00	1209.1	220	1200	1500	0.11	2445.9	0.49	1.34	1.33	2.76
N5-12	N5-9	10.83	73.77	100.02	117.22	1975.75	290.61	0.00	2266.4	285	1500	1650	0.14	3557.9	0.64	1.61	1.71	2.78
N5-9	N5-13	17.70	56.06	75.75	88.67	5949.97	892.27	0.00	6842.2	107	2400	2700	0.13	12747.7	0.54	2.16	2.18	0.82
N5-13	N5-14	18.52	54.55	73.68	86.25	5789.84	867.99	0.00	6657.8	85	1200	2700	0.13	12747.7	0.52	2.16	2.18	0.65
N5-14	N5-15	19.17	53.41	72.13	84.42	5669.31	849.73	0.00	6519.0	125	1200	2700	0.12	12247.6	0.53	2.07	2.09	1.00
N5-15	N5-16	18.52	54.55	73.68	86.25	6105.18	867.99	0.00	6973.2	204	2400	2700	0.11	11726.2	0.59	1.98	2.06	1.65
N5-16	N5-17	20.16	51.77	69.89	81.79	6514.52	823.32	0.00	7337.8	102	2400	2700	0.11	11726.2	0.63	1.98	2.10	0.81
N5-17	N5-18	20.97	50.52	68.19	79.78	7089.26	803.22	0.00	7892.5	244	2400	2700	0.14	13228.9	0.60	2.24	2.33	1.75
N5-19	N5-20	10.00	76.81	104.19	122.14	287.60	181.73	0.00	469.3	378	900	1050	0.12	986.9	0.48	1.10	1.08	5.82
N5-20	N5-18	15.82	59.89	80.99	94.83	224.27	141.26	0.00	365.5	229	900	1200	0.13	1466.5	0.25	1.26	1.00	3.80
N5-18	N5-21	20.97	50.52	68.19	79.78	7853.70	1060.68	0.00	8914.4	422	2700	3000	0.10	14807.4	0.60	2.03	2.13	3.30
N5-21	N5-23	24.27	46.04	62.08	72.61	7787.08	965.71	262.99	9015.8	193	2700	3000	0.16	18730.1	0.48	2.57	2.54	1.27
N5-23	N5-24	25.54	44.54	60.05	70.23	7940.39	934.09	254.34	9128.8	350	2700	3000	0.10	14807.4	0.62	2.03	2.13	2.74
N5-25	N5-26	10.00	76.81	104.19	122.14	327.73	117.82	0.00	445.6	169	900	1050	0.12	986.9	0.45	1.10	1.07	2.64
N5-26	N5-28	12.64	67.95	92.03	107.82	775.33	104.07	440.51	1319.9	503	1350	1350	0.13	2007.7	0.66	1.36	1.45	5.77
N5-29	N5-28	10.00	76.81	104.19	122.14	1068.59	311.54	0.00	1380.1	201	1200	1350	0.10	1760.9	0.78	1.19	1.33	2.52
N5-28	N5-24	12.64	67.95	92.03	107.82	1720.77	379.25	440.51	2540.5	145	1800	1800	0.11	3922.7	0.65	1.49	1.60	1.51
N5-24	Pond-5	25.54	44.54	60.05	70.23	9068.36	1181.53	541.25	10791.2	50	3000	3000	0.10	14807.4	0.73	2.03	2.23	0.37

Theory

This sheet intended to provide the basis for design of the storm sewer system; other factors such as HGL or storage upsizing accounted for separately.
This sheet does not account for hydraulic grade line, inlet capacity or inlet control devices; separate calculations or models to be used to assess these measures and the dual drainage system
A dendritic sewer system outlet is assumed to be fully flowing when the entire tributary drainage area is contributing at the same time (longest time of concentration), presuming the storm duration is longer than this Tc.
Therefore, an accumulated weighted area x runoff coefficient is carried through the system based on the longest contributing travel time in the system.
Flow is calculated based on the Rational Method (Runoff Coefficient x Intensity (based on Tc) x Accumulated Area)
Areas & runoff C to be taken from Storm Sewer Design Drawing(s), with inlet locations based on High-point to High-point (vs MH to MH)
Pipes are sized using Manning's equation assuming Full Flow conditions (maximum gravity flow capacity), based on the diameter and slope
Sizing is considered adequate when the ratio of actual flow to full flow capacity is less than 1, and the actual velocity is between 0.8 & 6 m/s
Full flow velocity is calculated using Manning's equation (as above), and actual velocity is based on ratio of Qact/Qfull and standard circular pipe relationships (see Std. Data tab)

Appendix D : GEOTECHNICAL INVESTIGATION

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

patersongroup

Geotechnical Investigation

Proposed Residential Development
879 River Road
Ottawa, Ontario

Prepared For

Richcraft Group of Companies

March 2, 2018

Report PG4402-1

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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 Figures 2A - 3B - Slope Stability Sections Drawing PG4402-1 - Test Hole Location Plan

1.0 Introduction

Paterson Group (Paterson) was commissioned by Richcraft Group of Companies to conduct a geotechnical investigation for the subject site located at 879 River Road, in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objectives of the current investigation were to:

❏ determine the subsoil and groundwater conditions at this site by means of boreholes.

❏ to provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect the design.

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

2.0 Proposed Project

Based on available design plans, it is understood that the proposed development will consist of residential dwellings with associated roadways and landscaped areas. Installation of municipal services is also anticipated as part of the proposed project.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the geotechnical investigation was carried out on January 11, 2018. A total of six (6) boreholes were advanced to a maximum depth of 6.7 m. The borehole locations were distributed in a manner to provide general coverage of the subject site. The approximate locations of the boreholes are shown on Drawing PG4402-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were advanced using a track-mounted auger drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of our personnel under the direction of a senior engineer from our geotechnical department. The drilling procedure consisted of advancing each test hole to the required depths at the selected locations and sampling the overburden.

Sampling and In Situ Testing

Soil samples were collected from the boreholes using a 50 mm diameter split-spoon (SS) sampler or from the auger flights. The depths at which the auger and split spoon samples were recovered from the test holes are shown as AU and SS, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

A Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split spoon samples. The SPT results are recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm. This testing was done in general accordance with ASTM D1586-11 - Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.

Undrained shear strength testing was carried out at regular depth intervals in cohesive soils using a vane apparatus.

All soil samples were classified on site, placed in sealed plastic bags and were transported to our laboratory for visual inspection.

The thickness of the overburden was evaluated during the course of the investigation by a dynamic cone penetration test (DCPT) at BH 3. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at its tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment.

Subsurface conditions observed in the test holes were recorded in detail in the field. Reference should be made to the Soil Profile and Test Data sheets presented in Appendix 1 for specific details of the soil profile encountered at the test hole locations.

Groundwater

Flexible polyethylene standpipes were installed in all boreholes except BH 6 to permit monitoring of the groundwater levels subsequent to the completion of the sampling program.

Sample Storage

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

3.2 Field Survey

The borehole locations were selected in the field by Paterson personnel to provide general coverage of the subject site taking into consideration existing site features. The borehole locations are presented on Drawing PG4402-1 - Test Hole Location Plan in Appendix 2. The ground surface elevations at the borehole locations were interpolated based on a recently completed topographic survey by Annis, O'Sullivan, Vollebekk Ltd.

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. Two atterberg limit tests were completed on selected soil samples. The results are presented in Table 1 under Subsection 4.2.

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 6.6.

4.0 Observations

4.1 Surface Conditions

The majority of the subject site consists of agricultural fields. Two residential buildings occupy the northwest corner while a heavily treed area occupies the northeast portion of the subject site. The ground surface slopes gradually from east to west with an existing ravine with a maximum depth of 3 m running across the subject site. The site is bordered to the north by a forested area, to the east by agricultural properties, to the south by agricultural and residential properties and to the west by River Road.

It should be noted that the above mentioned ravine runs across the south portion of the subject site mainly from east to west. The ravine branches from the south central portion to the northeast corner. The ravine ranges in depth from 1 to 3 m based on available topographic survey completed for the subject site.

4.2 Subsurface Profile

Overburden

Generally, the soil profile at the borehole locations consists of topsoil/agricultural soils underlain by silty sand followed by a very stiff to stiff silty clay deposit. A grey, stiff to firm silty clay deposit was encountered below the silty clay crust. Practical refusal to DCPT was encountered at a depth of 14 m below existing grade at BH 3. Specific details of the soil profile at each test hole location are presented on the Soil Profile and Test Data sheets in Appendix 1.

The results of the atterberg limit testing on select silty clay samples are presented in Table 1 below:

Table 1 - Summary of Atterberg Limits Tests

Samples	Depth (m)	Initial Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index %
BH2 SS3	1.5 - 2.1	50.0	84	38	46
BH1 SS4	2.3 - 2.9	34.0	63	22	41

Bedrock

Based on available geological mapping, the subject site is located in an area where the bedrock consists of dolomite of the Oxford formation with an overburden thickness between 10 and 15 m.

4.3 Groundwater

Groundwater levels were measured in the standpipes installed in the boreholes on January 22, 2018. The observed groundwater levels are summarized in Table 2.

Table 2 - Summary of Groundwater Level Readings

Test Hole Number	Groundwater Depth (m)	Recording Date
BH 1	1.32	January 22, 2018
BH 2	0.40	January 22, 2018
BH 3	2.98	January 22, 2018
BH 4	0.96	January 22, 2018
BH 5	2.06	January 22, 2018

It should be noted that the groundwater levels could be influenced by surface water infiltrating the backfilled boreholes. It is important to note that groundwater readings at the piezometers can be influenced by water perched within the borehole backfill material. Long-term groundwater levels can also be estimated based on the observed colour and consistency of the recovered soil samples. Based on these observations, the long-term groundwater table can be expected at approximately 3.5 to 4.5 m below ground surface. The recorded groundwater levels are noted on the applicable Soil Profile and Test Data sheet presented in Appendix 1.

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

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered suitable for the proposed development. It is expected that the proposed buildings will be founded over conventional shallow footings placed on an undisturbed, very stiff to stiff silty clay bearing surface.

Due to the presence of a silty clay deposit, a permissible grade raise restriction is required for the subject site.

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

5.2 Site Preparation

Stripping Depth

Topsoil, and any deleterious fill, such as those containing organic materials, should be stripped from under any buildings and other settlement sensitive structures. Care should be taken not to disturb adequate bearing soils below the founding level during site preparation activities.

Existing fill, free of deleterious materials, should be reviewed by the geotechnical consultant at the time of construction to confirm if the existing fill can remain in place or be re-used as select subgrade fill or to in-fill existing ditches. For areas where the existing fill is to remain in place, it is recommended that the existing fill, free of deleterious materials, should be proof-rolled by a vibratory roller making several passes and any poor performing areas should be removed.

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. This material should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the 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.

In-filling the existing ditches should be completed in a stepped fashion within the lateral support of the proposed buildings. The fill should consist of clean imported granular fill, such as OPSS Granular A or Granular B Type II material. The steps should have a minimum horizontal length of 1.5 m and minimum vertical height of 0.5 m and should be compacted using suitable compaction equipment to a minimum 98% of the material's SPMDD.

5.3 Foundation Design

Shallow Foundation

Strip footings, up to 3 m wide, and pad footings, up to 6 m wide, placed on an undisturbed, stiff silty clay bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa**. A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance value at ULS.

Footings placed on engineered fill bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa.**

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

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

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to a stiff silty clay 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.

Permissible Grade Raise

A permissible grade raise restriction of **2 m** is recommended above existing grade for the proposed buildings where footings are to be placed over a stiff silty clay bearing surface. It should be noted that where existing ditches are to be in-filled, the permissible grade raise recommended for these areas is **1.5 m** above existing grade in adjacent table land. If greater permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class D** for the foundations considered at this site. A higher seismic site class, such as Class C, may be applicable for the subject site. However, the higher seismic site class would have to be confirmed by a site-specific seismic shear wave velocity test. The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code (OBC) 2012 for a full discussion of the earthquake design requirements.

5.5 Basement Slab/Slab on Grade Construction

With the removal of all topsoil and fill, containing deleterious or organic materials, the native soil or existing granular fill approved by the geotechnical consultant at the time of excavation will be considered to be an acceptable subgrade surface on which to commence backfilling for basement floor slab or slab on grade construction. Any soft areas should be removed and backfilled with appropriate backfill material. OPSS Granular A or 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 for basement slab construction consist of 19 mm clear crushed stone. It is also recommended that the upper 300 mm sub-floor fill below slab on grade construction consist of OPSS Granular A crushed stone. All backfill materials 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

For design purposes, the pavement structure presented in the following tables could be used for the design of car only parking areas and local roadways.

Table 3 - Recommended Pavement Structure - Car Only Parking Areas/Driveways

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 in situ soils or OPSS Granular B Type I or II material placed over in situ soil	

Table 4 - 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
400	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either in situ soils or OPSS Granular B Type I or II material placed over in situ soil	

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

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

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% 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.

Where silty clay is anticipated at subgrade level, consideration should be given to installing subdrains during the pavement construction. The subdrain inverts should be approximately 300 mm below subgrade level and run longitudinal along the curblines. The subgrade surface should be crowned to promote water flow to the drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

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

Backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a composite drainage system, such as Delta Drain 6000 or an approved equivalent. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise 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 effect of frost action. A minimum of 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, such as soil cover of 2.1 m or a combination of soil cover and foundation insulation.

6.3 Excavation Side Slopes

The side slopes of excavations in the overburden materials should either be 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 excavations to be undertaken by open-cut methods (i.e. unsupported excavations).

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsoil at this site is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

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

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

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

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications & Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

At least 150 mm of OPSS Granular A should be used for bedding for sewer and water pipes when placed on soil subgrade. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe should consist of OPSS Granular A (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to a minimum of 95% of the material’s SPMDD.

Generally, it should be possible to re-use the moist, not wet, silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. The wet silty clay should be given a sufficient drying period to decrease its moisture content to an acceptable level to make compaction possible prior to being re-used.

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. The seals should be at least 1.5 m long 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.

It is anticipated that pumping from open sumps will be sufficient to control the groundwater influx through the sides of the excavations.

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

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

6.6 Winter Construction

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

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

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. These results are indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The results of the chloride content, pH and resistivity indicate the presence of a non-aggressive to slightly aggressive environment for exposed ferrous metals at this site.

6.8 Landscaping Considerations

Tree Planting Restrictions

The proposed development is located in an area of medium sensitive silty clay deposits for tree planting. Based on the results of the atterberg tests completed under Subsection 4.2, the plasticity index was found to be between 41 and 46%. Therefore, it is recommended that trees placed within 7.5 m of the foundation wall consist of low water demanding trees with shallow roots systems that extend less than 1.5 m below ground surface. Trees placed greater than 7.5 m from the foundation wall may consist of typical street trees, which are typically moderate water demand species with roots extending to a maximum 2 m depth.

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 swimming pools. Above ground swimming pools must be placed at least 4 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.

6.9 Slope Stability Analysis

A slope stability analysis was completed for the slope along the south and southeast portion of the subject site. Two sections considered the worst case scenarios were analyzed as part of this study. The location of section A and B are presented on Drawing PG4402-1 - Test Hole Location Plan in Appendix 2.

Slope Stability Analysis

The analysis of the stability of the slope was carried out using SLIDE, a computer program which permits a two-dimensional slope stability analysis using several methods including the Bishop's method, which is a widely used and accepted analysis method. The program calculates a factor of safety, which represents the ratio of the forces resisting failure to those favoring failure. Theoretically, a factor of safety of 1.0 represents a condition where the slope is stable. However, due to intrinsic limitations of the calculation methods and the variability of the subsoil and groundwater conditions, a factor of safety greater than one is usually required to ascertain the risks of failure are acceptable. A minimum factor of safety of 1.5 is generally recommended for conditions where the failure of the slope would endanger permanent structures.

The cross-sections were analyzed taking into account a groundwater level at ground surface. Subsoil conditions at the cross-sections were inferred based on the findings at nearby borehole locations and general knowledge of the area's geology.

Static Analysis

The results for the existing slope conditions at Section A and B are shown in Figure 2A and 3A, respectively, in Appendix 2. The factor of safety was found to be greater than 1.5 for both sections when analyzed under static conditions.

Seismic Loading Analysis

An analysis considering seismic loading was also completed. A horizontal seismic acceleration, K_h, of 0.16G was considered for the analyzed sections. A factor of safety of 1.1 is considered to be satisfactory for stability analyses including seismic loading.

The results of the analyses including seismic loading are shown in Figure 2B and 3B for the slope sections. The results indicate that the factor of safety for Section A and B are greater than 1.1. Based on these results, the slopes are considered to be stable under seismic loading.

7.0 Recommendations

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

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

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

8.0 Statement of Limitations

The recommendations 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 Richcraft Group of Companies 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
Mar. 2, 2018
F. I. ABOU-SEIDO
100156744
PROVINCE OF ONTARIO

Faisal I. Abou-Seido, P.Eng.

David J. Gilbert, P.Eng.

Report Distribution:

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APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
879 River Road
Ottawa, Ontario

DATUM Ground surface elevations at test hole locations interpolated from recent completed topographic survey by Annis, O'Sullivan, Vollebekk Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE January 11, 2018

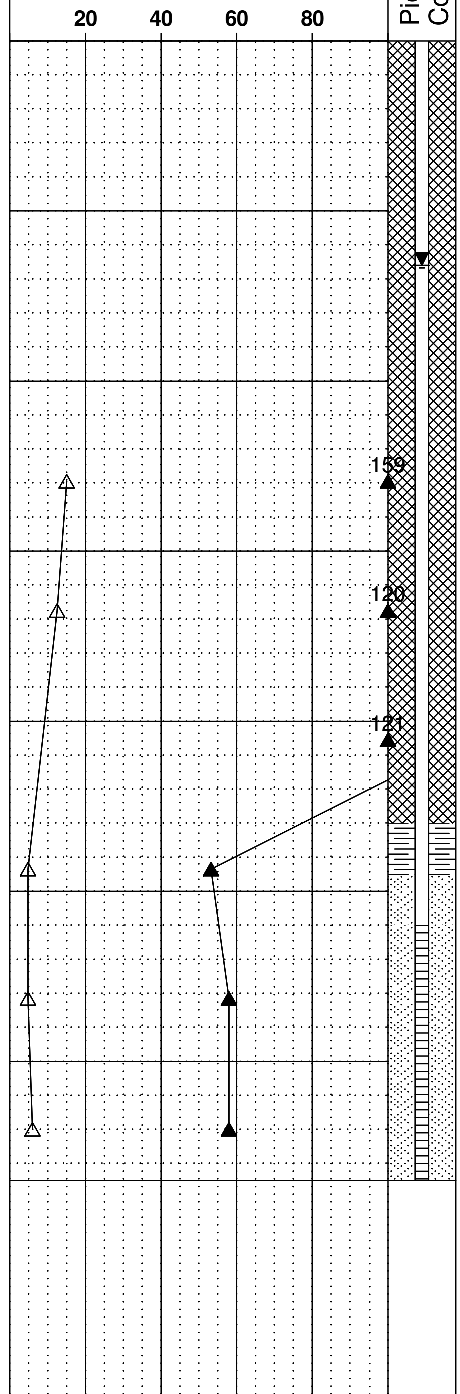
FILE NO. PG4402

HOLE NO. BH 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.00
FILL: Brown silty sand, some topsoil, trace gravel (0.28)		AU	1				
Loose, brown **SILTY SAND**		SS	2	50	7	1	89.00
(1.68)		SS	3	100	3	2	88.00
Very stiff to stiff, brown **SILTY CLAY,** some sand		SS	4	100	P		
		SS	5	100	P	3	87.00
- grey by 3.8m depth		SS	6	100	P	4	86.00
		SS	7	100	P	5	85.00
		SS	8	100	P	6	84.00
(6.70)		SS	9	100	P		
End of Borehole							
(GWL @ 1.32m - Jan. 22, 2018)							

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

○ Water Content %



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

Piezometer Construction

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REMARKS

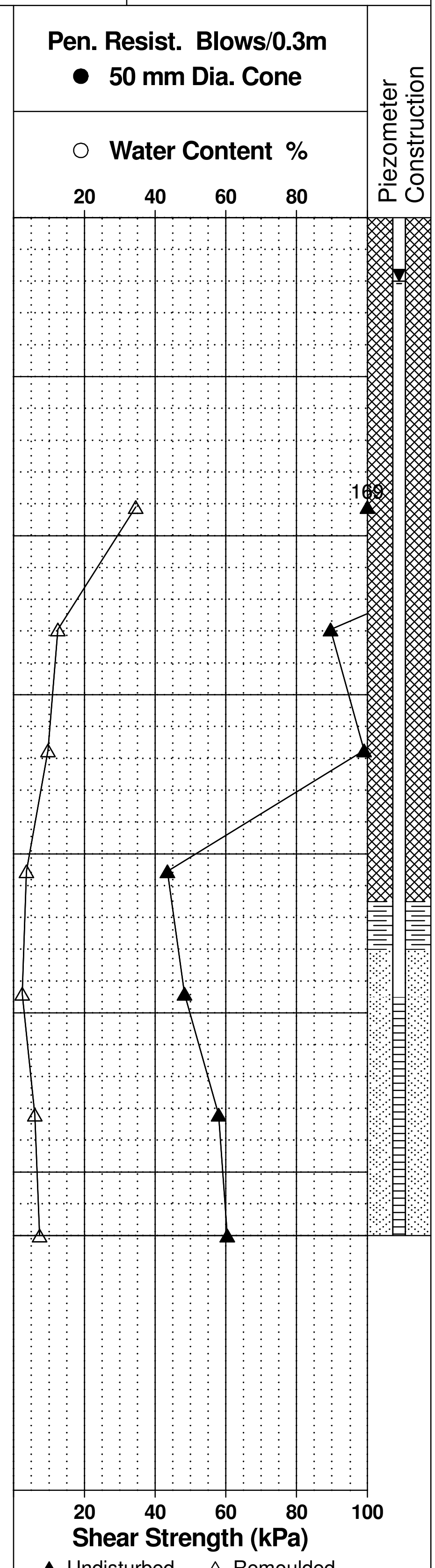
BORINGS BY CME 55 Power Auger

DATE January 11, 2018

FILE NO. PG4402

HOLE NO. BH 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.10
TOPSOIL (to 0.40)		AU	1				
Very stiff to stiff, brown **SILTY CLAY,** trace sand		SS	2	67	3	1	89.10
		SS	3	75	P	2	88.10
						3	87.10
- firm to stiff and grey by 3.8m depth						4	86.10
						5	85.10
						6	84.10
(to 6.40) End of Borehole							
(GWL @ 0.40m - Jan. 22, 2018)							



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879 River Road
Ottawa, Ontario

DATUM Ground surface elevations at test hole locations interpolated from recent completed topographic survey by Annis, O'Sullivan, Vollebekk Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE January 11, 2018

FILE NO. PG4402

HOLE NO. BH 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL — 0.33		AU	1		
Loose, brown **SILTY SAND** — 0.91					
Very stiff to stiff, brown **SILTY CLAY,** trace sand		SS	2	62	5
		SS	3	100	P
- firm to stiff and grey by 3.8m depth — 6.40					
Dynamic Cone Penetration Test commenced at 6.40m depth. Cone pushed to 12.5m depth.					

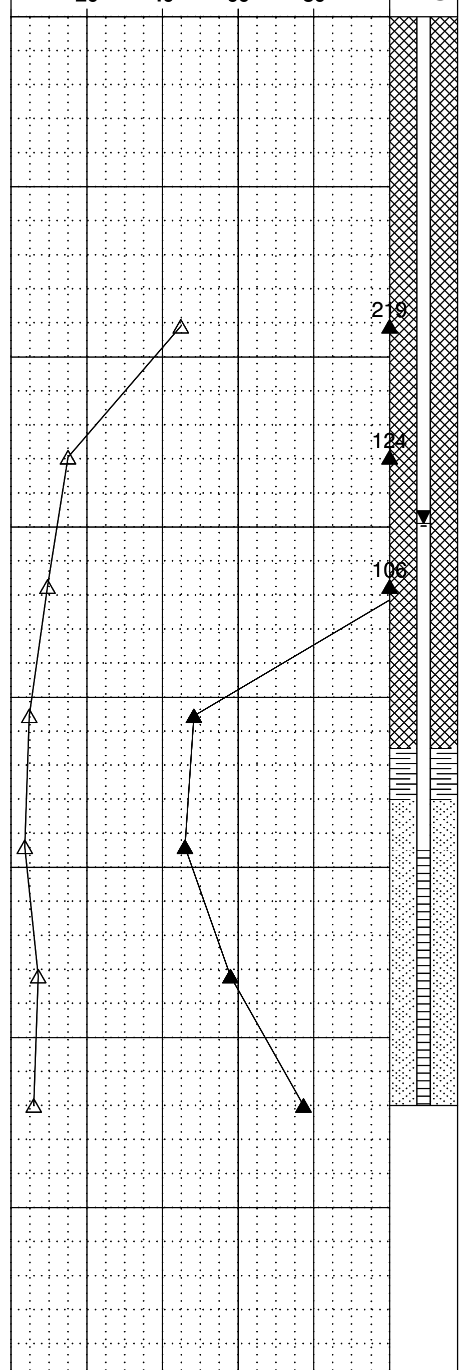
DEPTH (m)	ELEV. (m)
0	90.00
1	89.00
2	88.00
3	87.00
4	86.00
5	85.00
6	84.00
7	83.00
8	82.00

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

○ Water Content %

20 40 60 80

Piezometer Construction



20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

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Ottawa, Ontario

DATUM Ground surface elevations at test hole locations interpolated from recent completed topographic survey by Annis, O'Sullivan, Vollebekk Ltd.

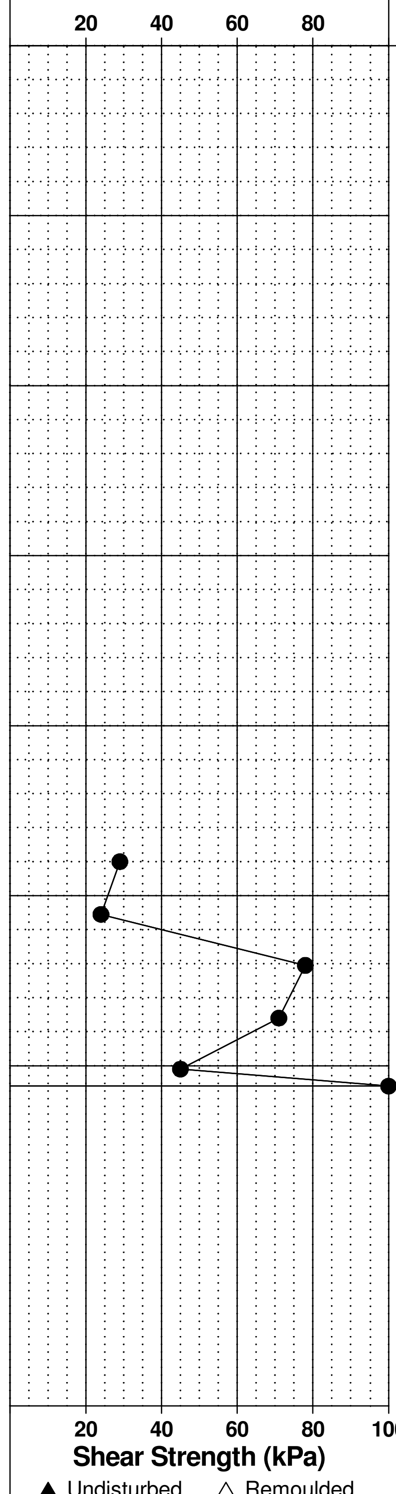
REMARKS

BORINGS BY CME 55 Power Auger **DATE** January 11, 2018

FILE NO. PG4402

HOLE NO. BH 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE: TYPE	SAMPLE: NUMBER	SAMPLE: % RECOVERY	SAMPLE: N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE									
						8	82.00		
						9	81.00		
						10	80.00		
						11	79.00		
						12	78.00		
						13	77.00		
14.12						14	76.00		
End of Borehole Practical DCPT refusal at 14.12m depth. (GWL @ 2.98m - Jan. 22, 2018)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
879 River Road
Ottawa, Ontario

DATUM Ground surface elevations at test hole locations interpolated from recent completed topographic survey by Annis, O'Sullivan, Vollebekk Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE January 11, 2018

FILE NO. PG4402

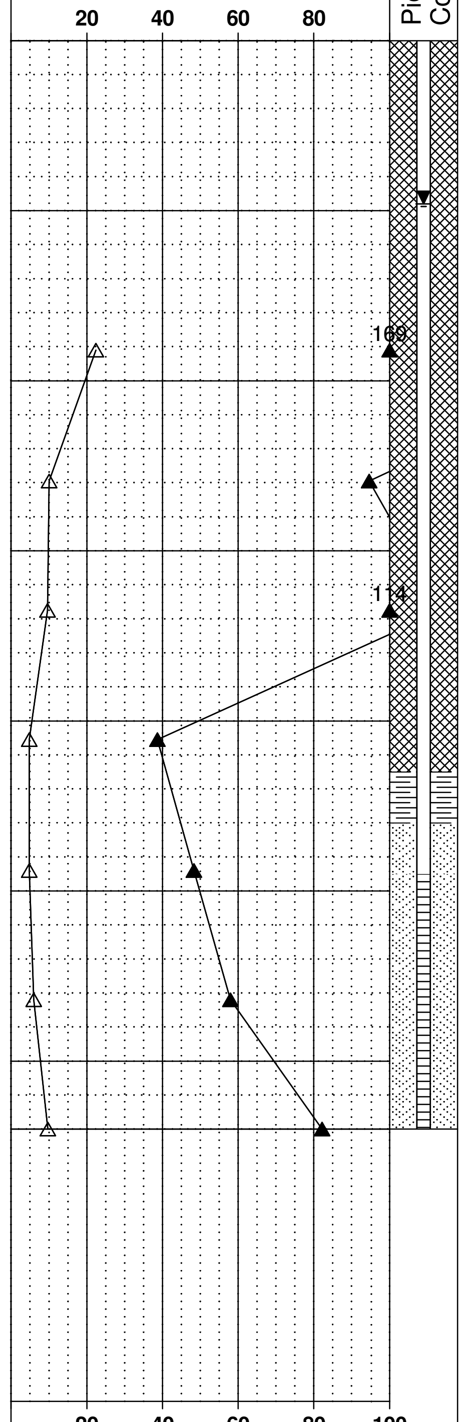
HOLE NO. BH 4

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	89.80
TOPSOIL (to 0.28)	AU	1				
Very stiff to stiff, brown **SILTY CLAY,** trace sand	SS	2	58	3	1	88.80
	SS	3	100	P	2	87.80
					3	86.80
- firm to stiff and grey by 3.8m depth					4	85.80
					5	84.80
(to 6.40)					6	83.80
End of Borehole						
(GWL @ 0.96m - Jan. 22, 2018)						

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

○ Water Content %

Piezometer Construction



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
879 River Road
Ottawa, Ontario

DATUM Ground surface elevations at test hole locations interpolated from recent completed topographic survey by Annis, O'Sullivan, Vollebekk Ltd.

REMARKS

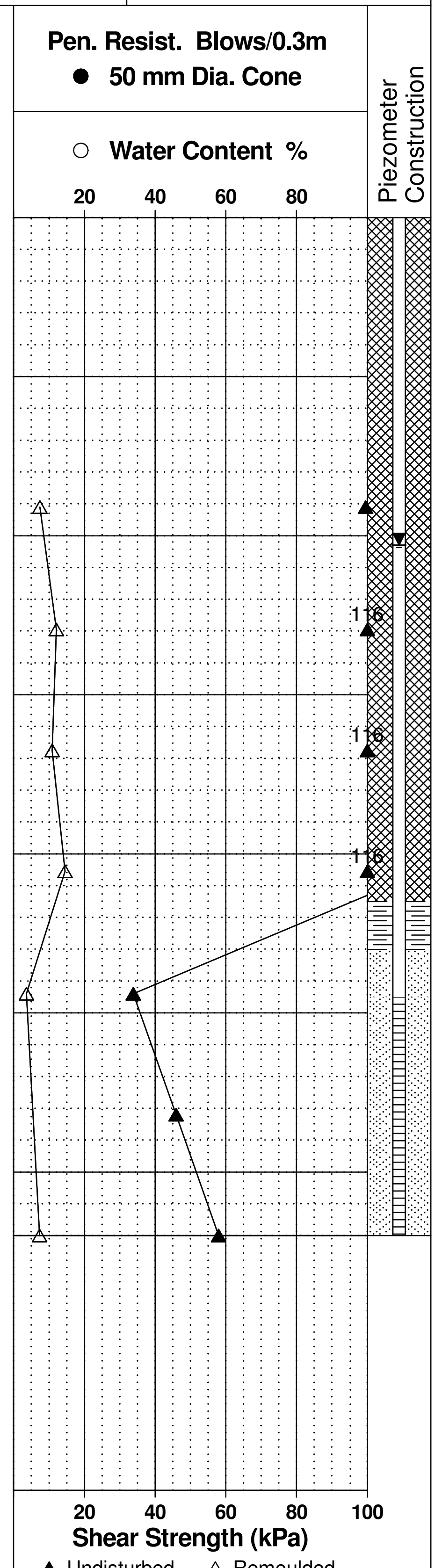
BORINGS BY CME 55 Power Auger

DATE January 11, 2018

FILE NO. PG4402

HOLE NO. BH 5

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	88.50
TOPSOIL (to 0.43)	AU	1				
	SS	2	58	5	1	87.50
	SS	3	67	P	2	86.50
Very stiff to stiff, brown **SILTY CLAY,** trace sand					3	85.50
					4	84.50
- firm to stiff and grey by 4.6m depth					5	83.50
					6	82.50
(to 6.40) End of Borehole						
(GWL @ 2.06m - Jan. 22, 2018)						



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
879 River Road
Ottawa, Ontario

DATUM Ground surface elevations at test hole locations interpolated from recent completed topographic survey by Annis, O'Sullivan, Vollebekk Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE January 11, 2018

FILE NO. PG4402

HOLE NO. BH 6

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0	90.10		
FILL: Brown silty sand, trace gravel, cobbles, topsoil and a piece of brick		AU	1						
0.69									
Loose, brown **SILTY SAND,** some clay		AU	2			1	89.10		
1.52									
End of Borehole									
(BH dry upon completion)									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

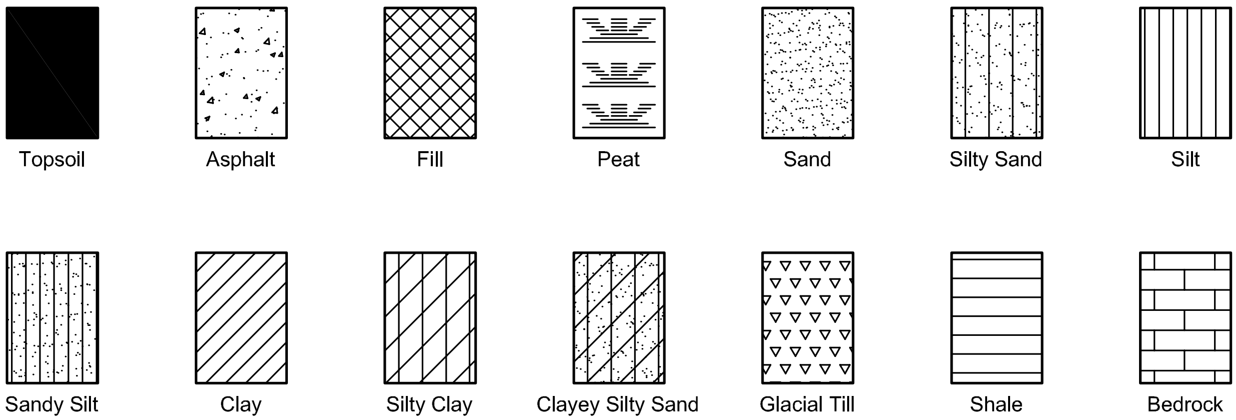
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

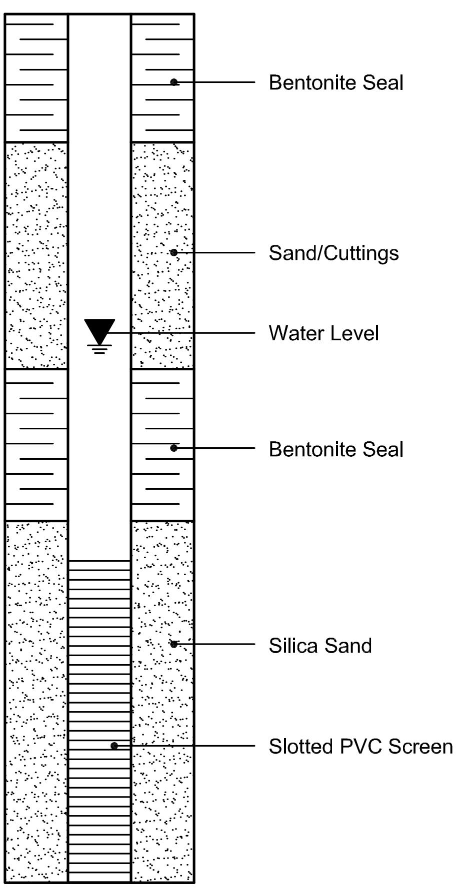
SYMBOLS AND TERMS (continued)

STRATA PLOT

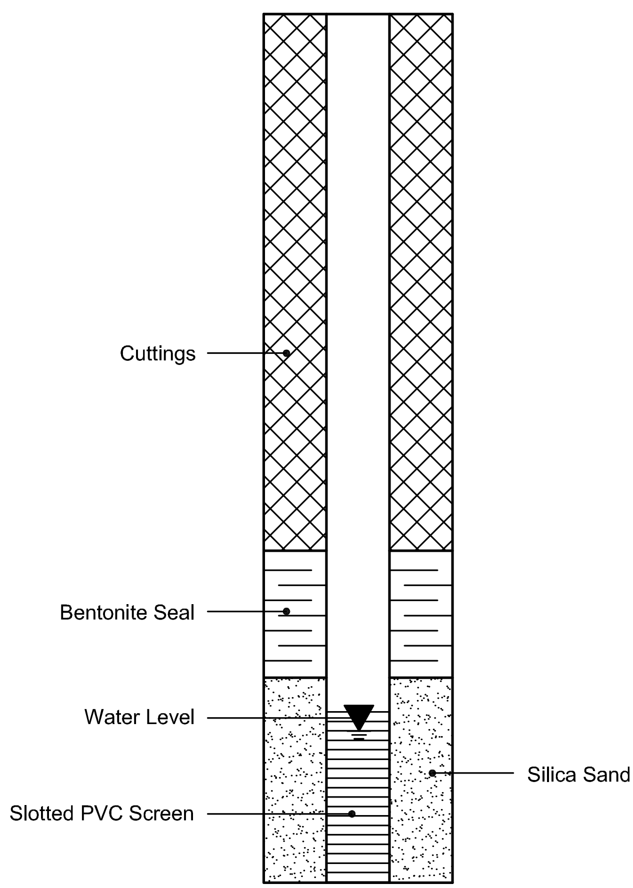


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 23197

Report Date: 17-Jan-2018

Order Date: 12-Jan-2018

Project Description: PE4402

	Client ID:	BH3-18 SS3	-	-	-
	Sample Date:	11-Jan-18	-	-	-
	Sample ID:	1802490-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	68.1	-	-	-
General Inorganics					
pH	0.05 pH Units	7.23	-	-	-
Resistivity	0.10 Ohm.m	175	-	-	-
Anions					
Chloride	5 ug/g dry	7	-	-	-
Sulphate	5 ug/g dry	8	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

FIGURE 2A - 3B - SLOPE STABILITY SECTIONS

DRAWING PG4402-1 - TEST HOLE LOCATION PLAN

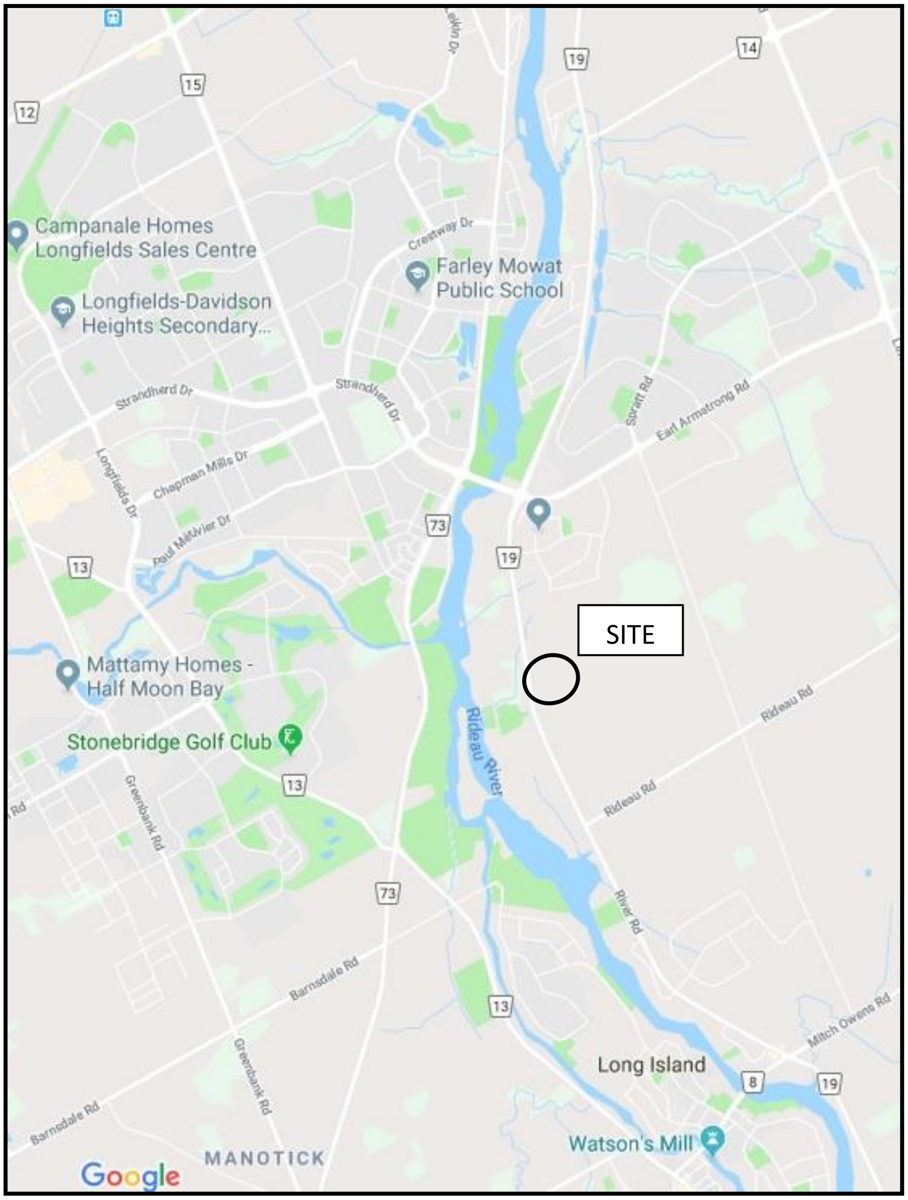
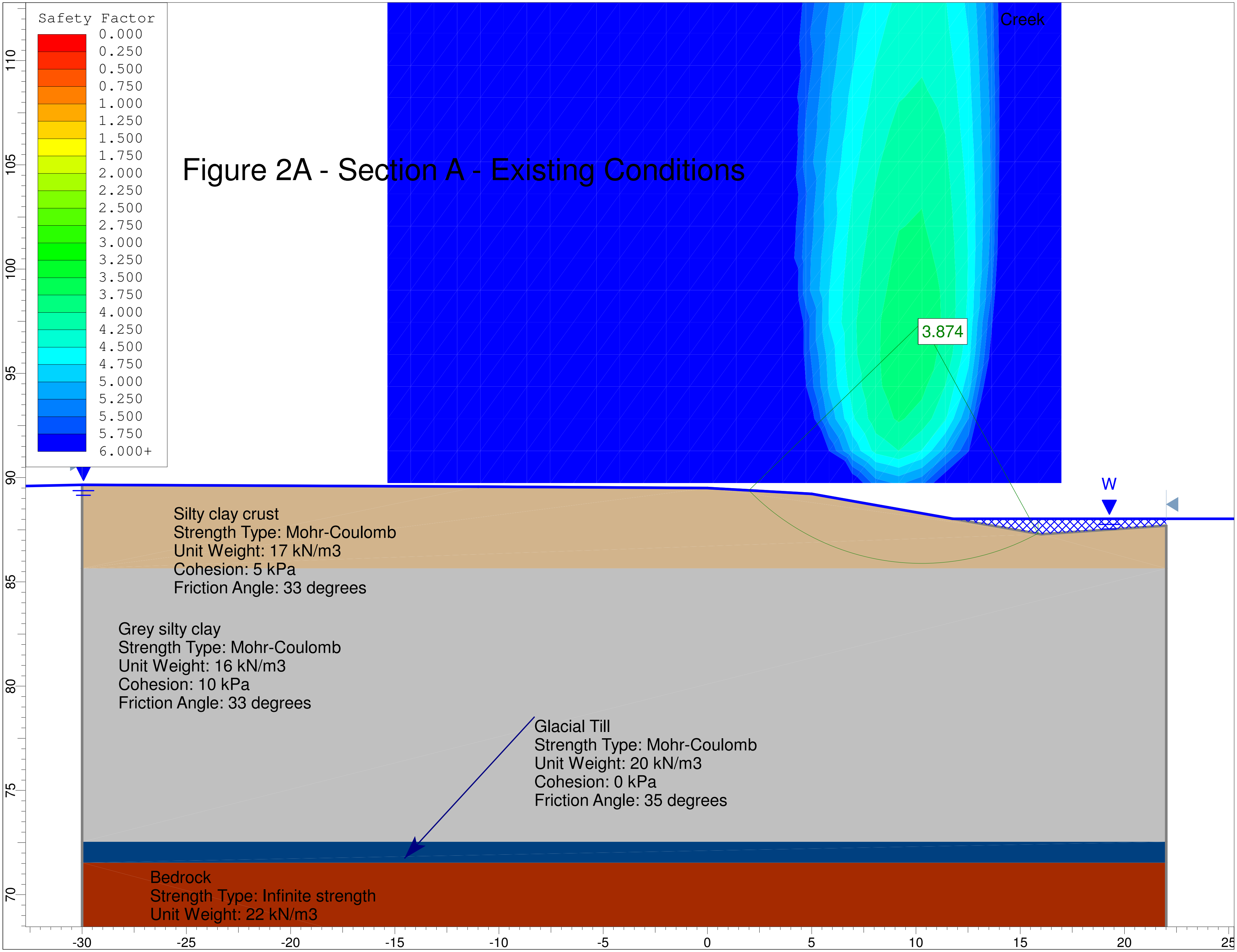


FIGURE 1

KEY PLAN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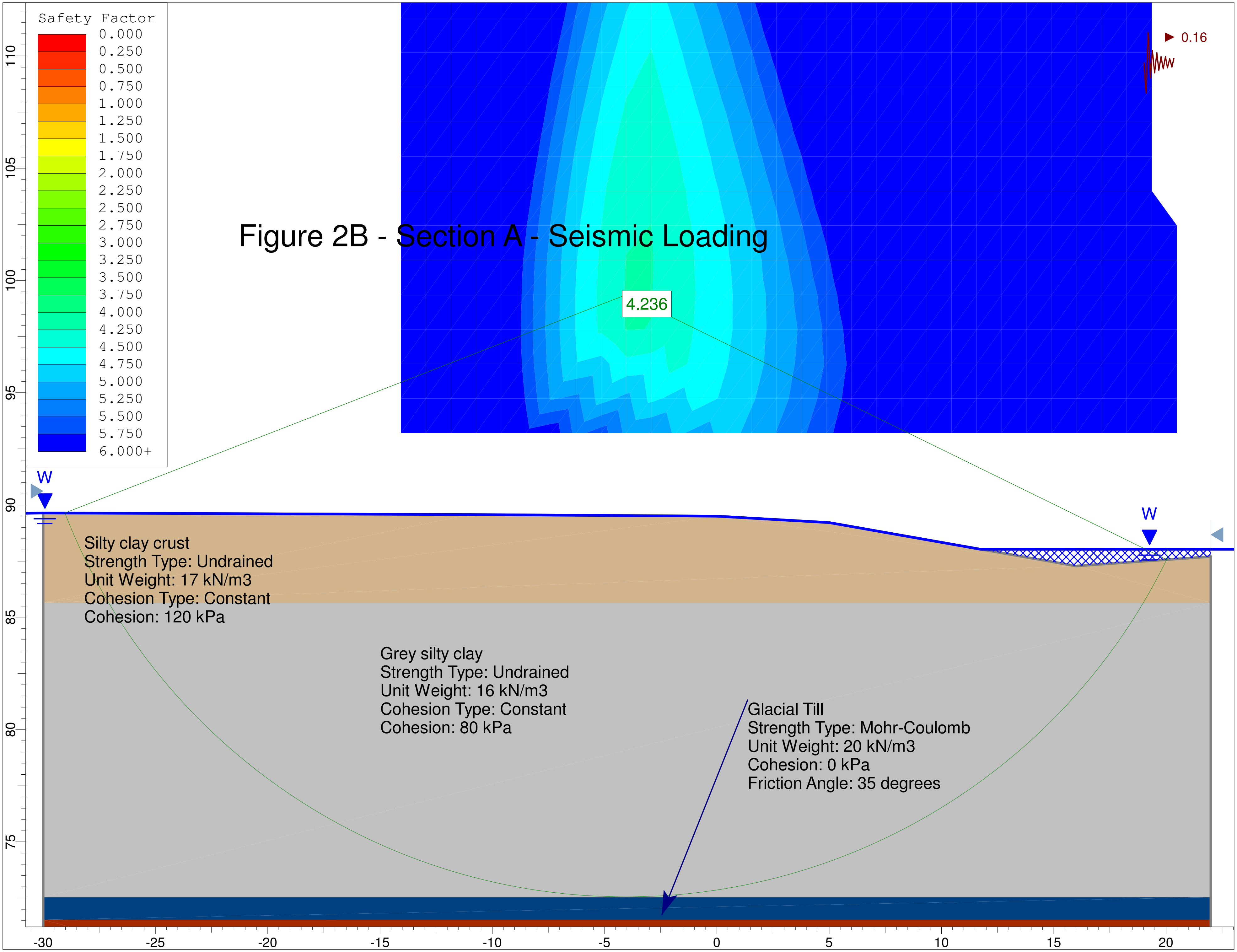
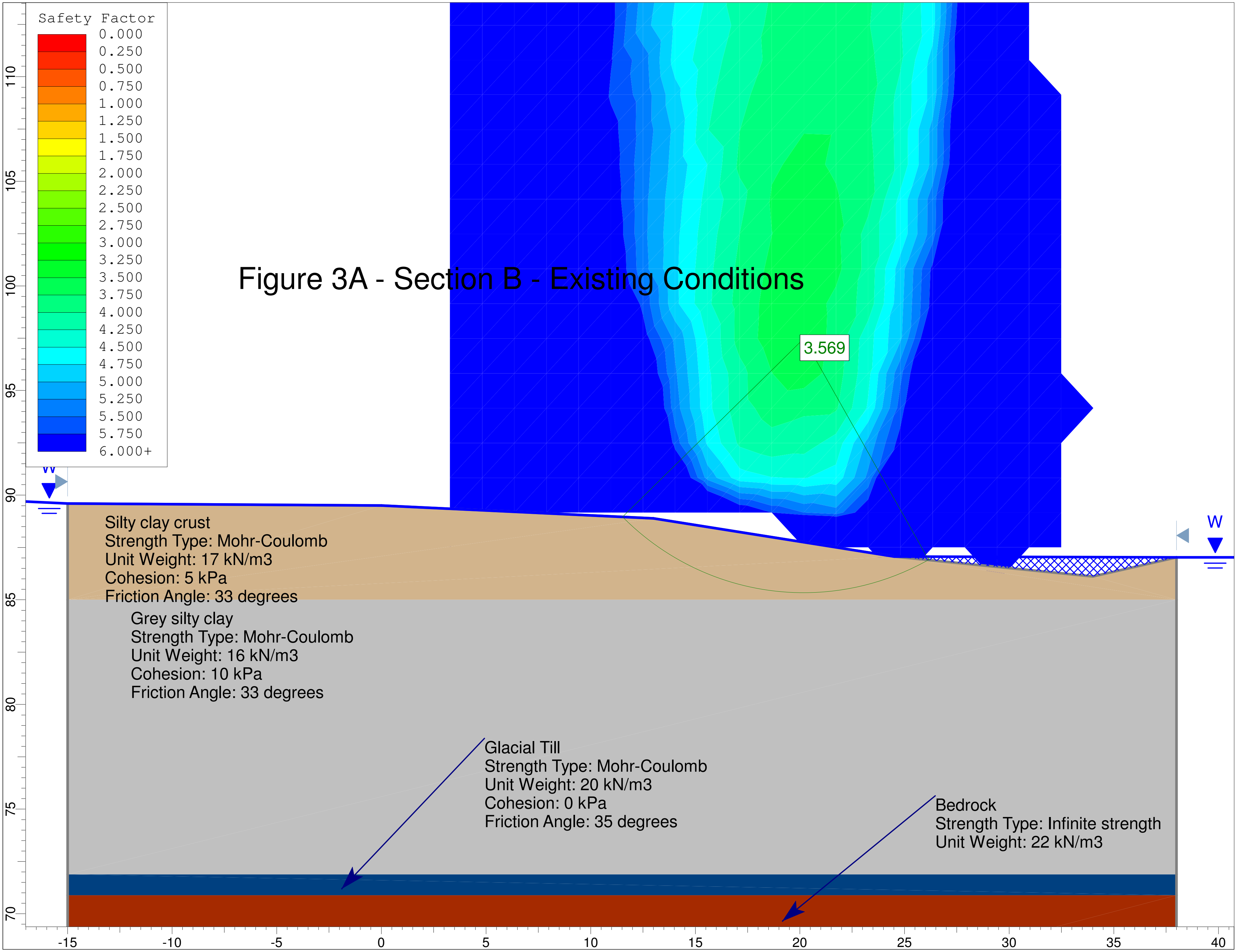
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Figure 2A - Section A - Existing Conditions
Creek
3.874
W
Silty clay crust
Strength Type: Mohr-Coulomb
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey silty clay
Strength Type: Mohr-Coulomb
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 33 degrees
Glacial Till
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m3
Cohesion: 0 kPa
Friction Angle: 35 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 22 kN/m3
110
105
100
95
90
85
80
75
70
-30
-25
-20
-15
-10
-5
0
5
10
15
20
25

Figure 2B - Section A - Seismic Loading





Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Figure 3A - Section B - Existing Conditions
3.569
W
W
Silty clay crust
Strength Type: Mohr-Coulomb
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey silty clay
Strength Type: Mohr-Coulomb
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 33 degrees
Glacial Till
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m3
Cohesion: 0 kPa
Friction Angle: 35 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 22 kN/m3
110
105
100
95
90
85
80
75
70
-15
-10
-5
0
5
10
15
20
25
30
35
40

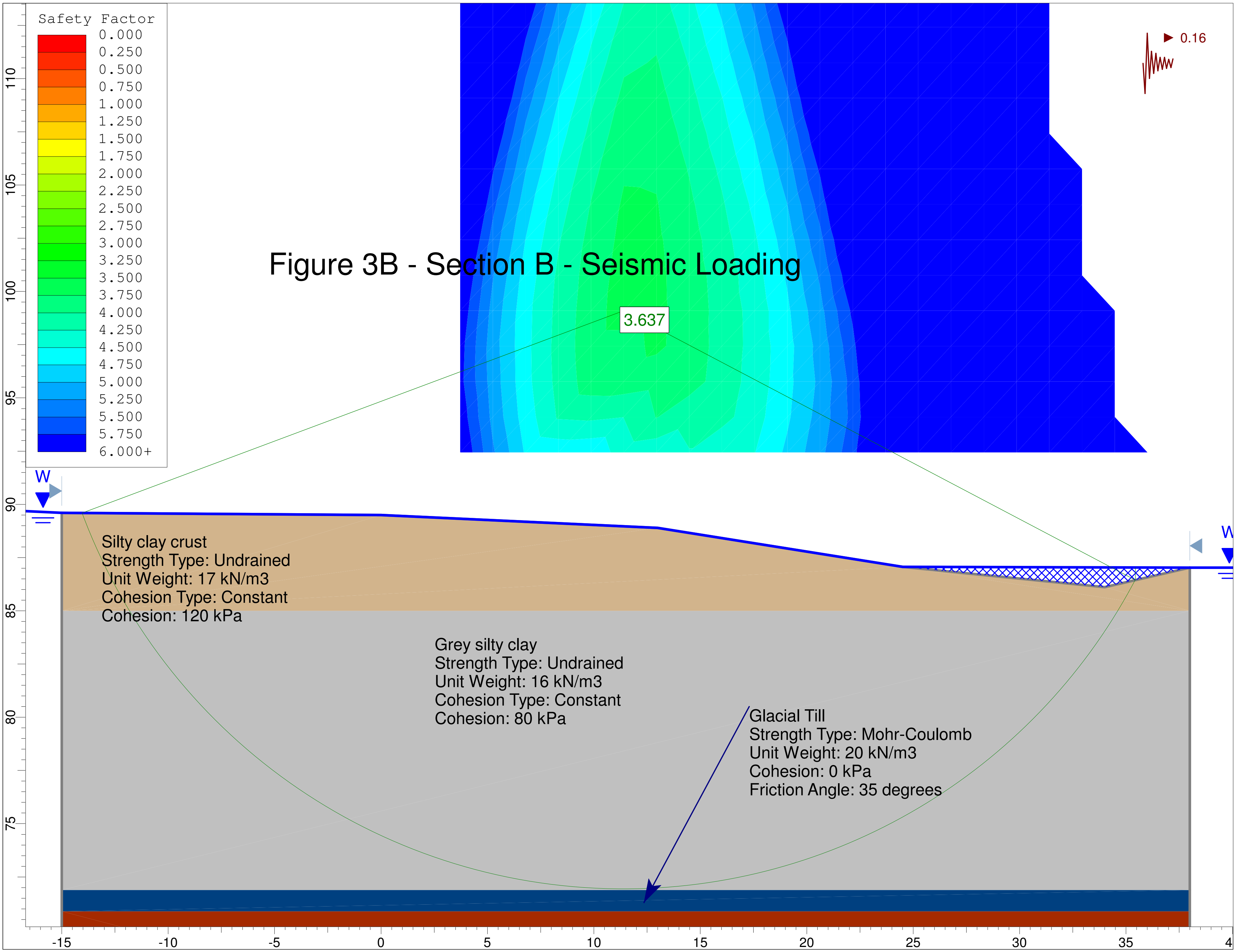
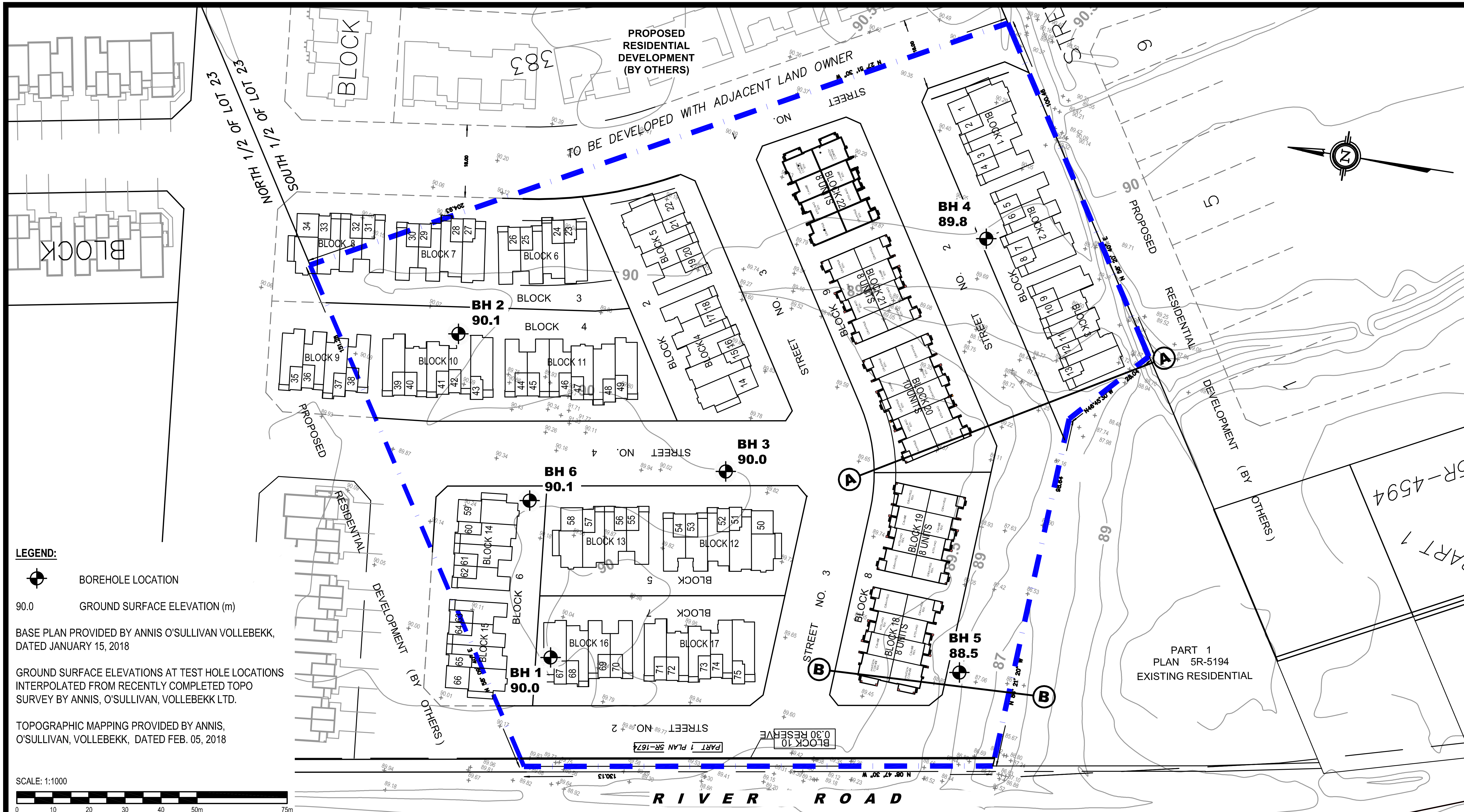


Figure 3B - Section B - Seismic Loading
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
3.637
0.16
W
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion Type: Constant
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion Type: Constant
Cohesion: 80 kPa
Glacial Till
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m3
Cohesion: 0 kPa
Friction Angle: 35 degrees
110
105
100
95
90
85
80
75
-15
-10
-5
0
5
10
15
20
25
30
35



LEGEND:

BOREHOLE LOCATION

90.0 GROUND SURFACE ELEVATION (m)

BASE PLAN PROVIDED BY ANNIS O'SULLIVAN VOLLEBEKK, DATED JANUARY 15, 2018

GROUND SURFACE ELEVATIONS AT TEST HOLE LOCATIONS INTERPOLATED FROM RECENTLY COMPLETED TOPO SURVEY BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD.

TOPOGRAPHIC MAPPING PROVIDED BY ANNIS, O'SULLIVAN, VOLLEBEKK, DATED FEB. 05, 2018

SCALE: 1:1000

0 10 20 30 40 50m 75m

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

RICHCRAFT GROUP OF COMPANIES

GEOTECHNICAL INVESTIGATION - PROPOSED RESIDENTIAL DEVELOPMENT
879 RIVER ROAD

OTTAWA, ONTARIO

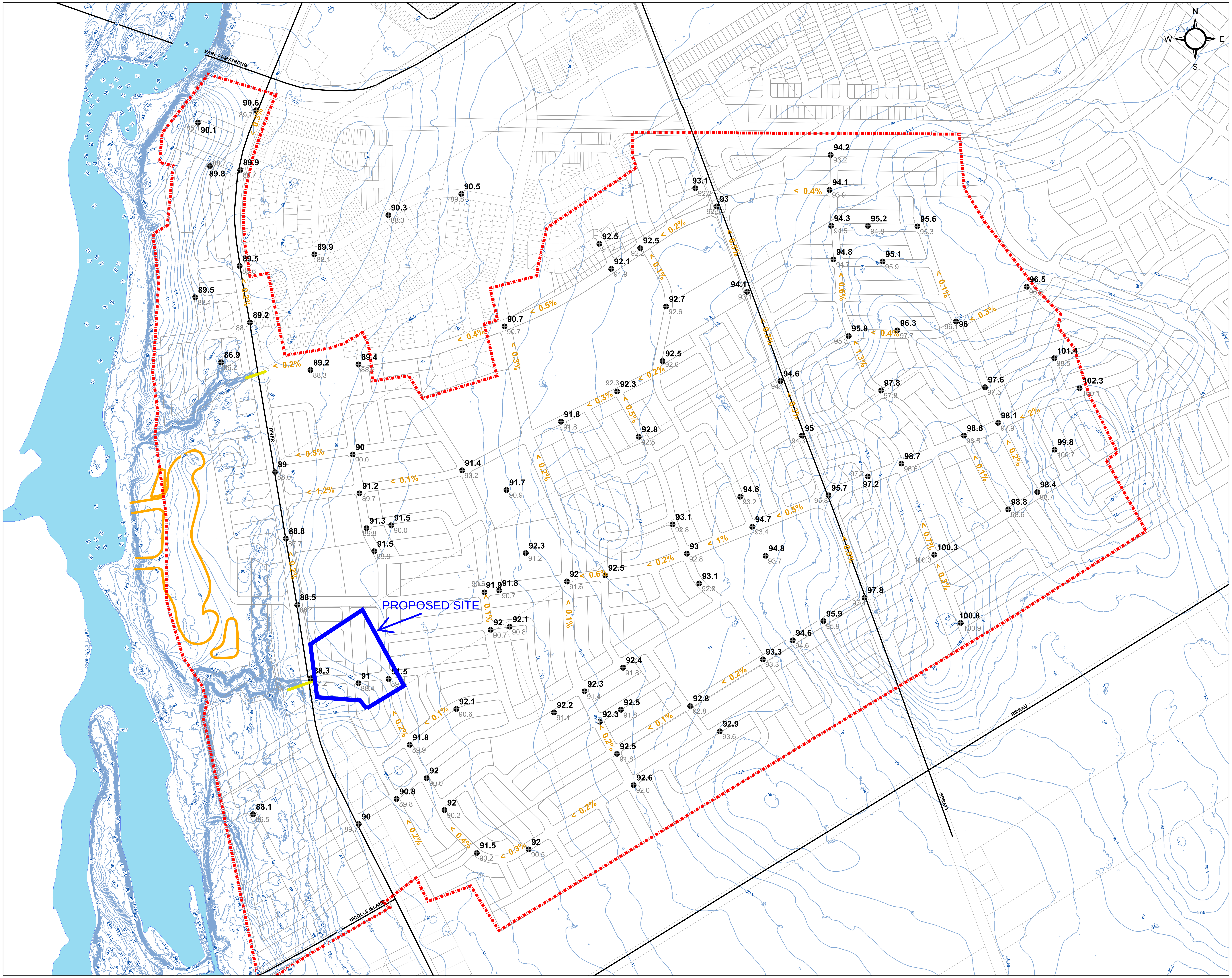
Title:

TEST HOLE LOCATION PLAN

Scale:	1:1000	Date:	01/2018
Drawn by:	RCG	Report No.:	PG4402-1
Checked by:	FA	Dwg. No.:	PG4402-1
Approved by:	FA	Revision No.:	0

p:\autocad drawings\geotechnical\pg44xx\pg4402\pg4402-1.dwg

Appendix E : ISSU MACRO GRADING PLAN



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W E
S

Stantec

STANTEC CONSULTING LTD.
400 1331 CLYDE AVENUE
OTTAWA, ON
TEL. 613.722.4420
WWW.STANTEC.COM

Legend

- Major Water
- Parcels
- Rideau River Study Area
- Pond 5
- Streets
- Proposed Elevation (m)
- Existing Elevation (m)
- Existing Contours (m)
- < Slope% Proposed Slope
- Culverts

Client / Project:

CITY OF OTTAWA

RIVERSIDE SOUTH ISSU UPDATE

OTTAWA, ON

Title:

MACRO-GRADING PLAN

Project No.:	Scale:
163401101	0 50 100 200 Meters

Drawing No.:	Sheet:	Revision:
GCP-1	1 of 7	0

Appendix F : DRAWINGS