FERNBANK
COMMUNITY DESIGN PLAN

MASTER SERVICING STUDY
Volume 2 of 2 (Appendix)

DRAFT

JUNE 2009

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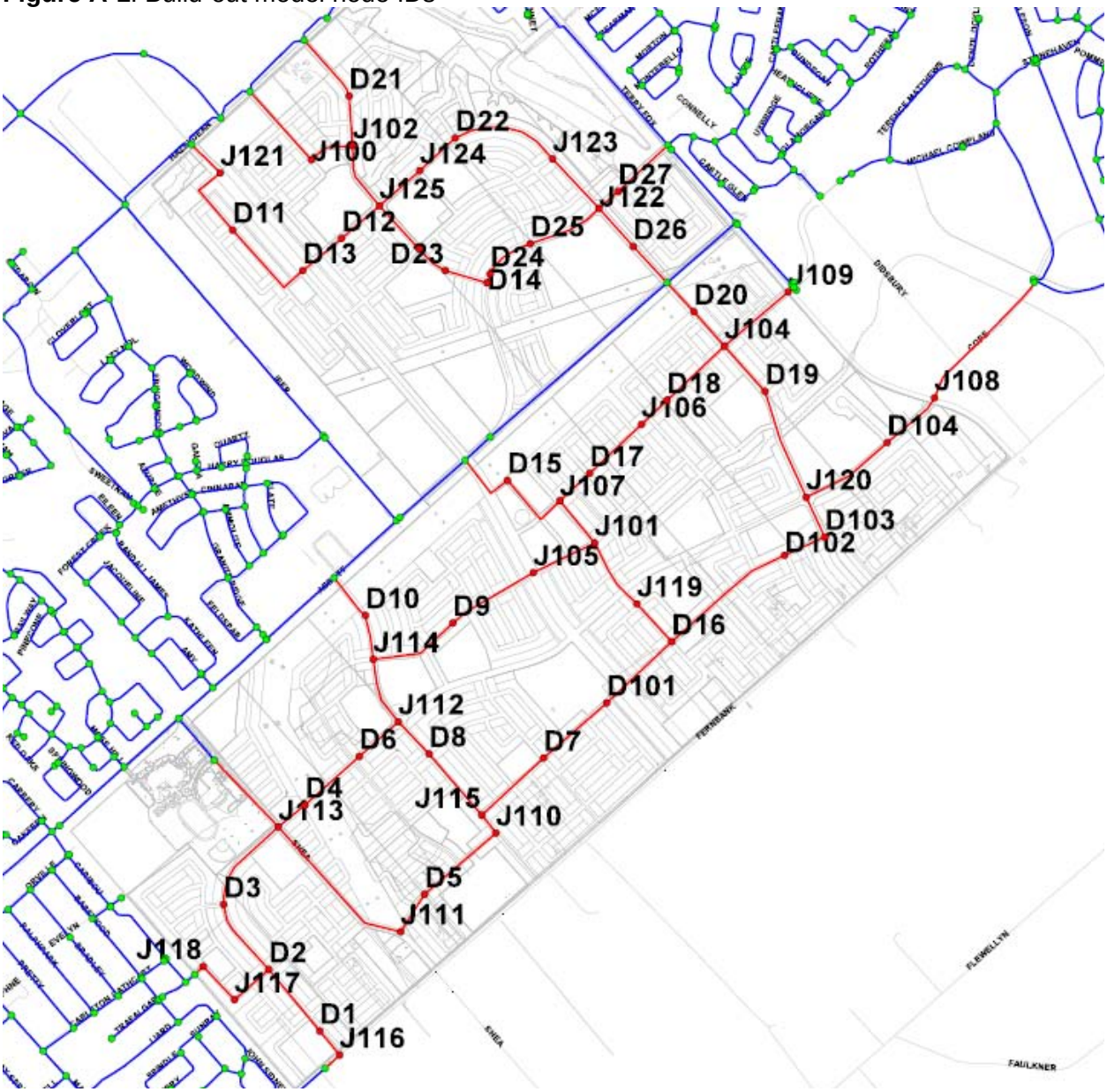

Figure A-2: Fernbank CDP area build-out model pipe IDs

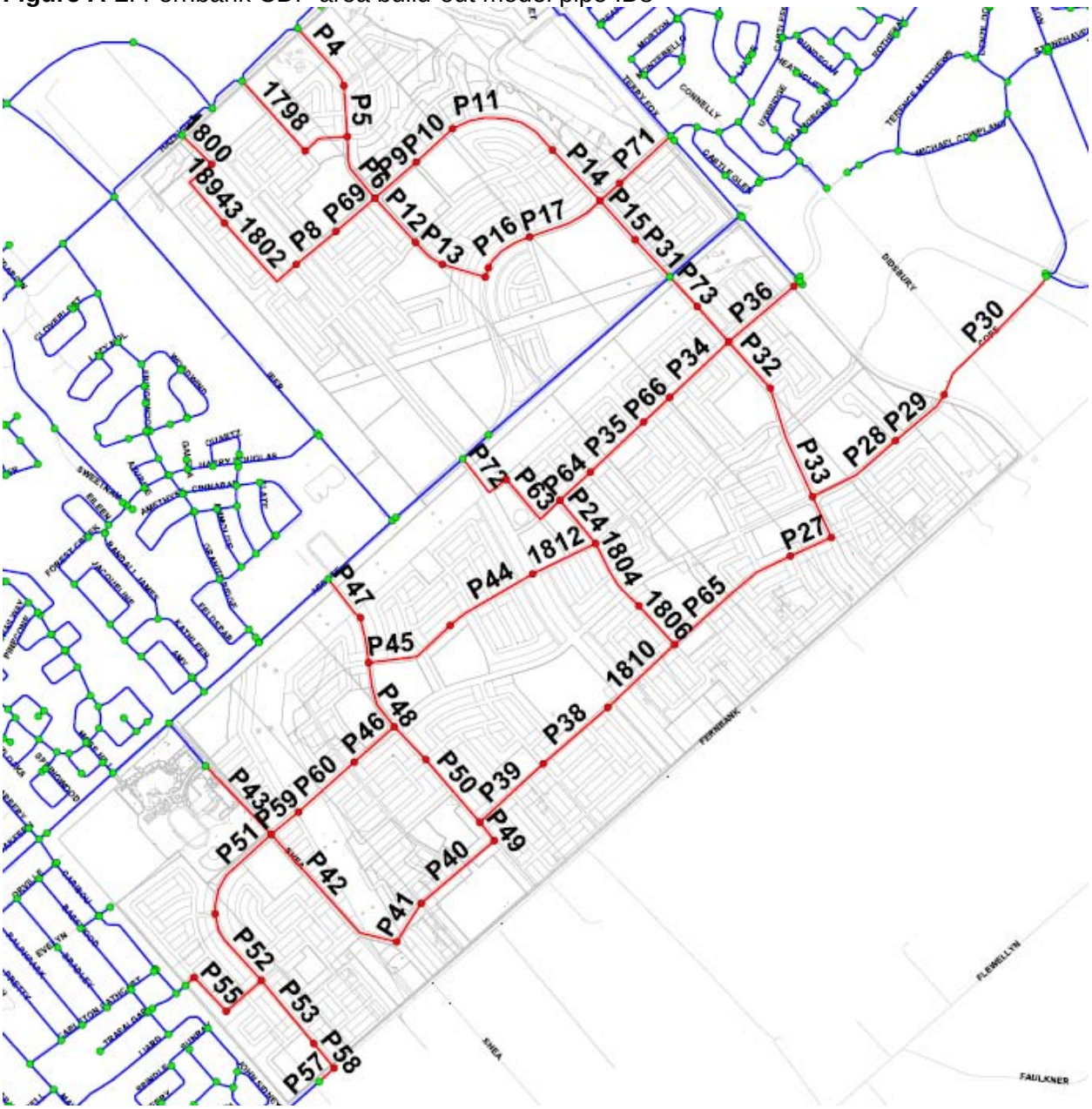

Figure A-3: Future Fernbank CDP area node elevations based on existing grades (shown in m)

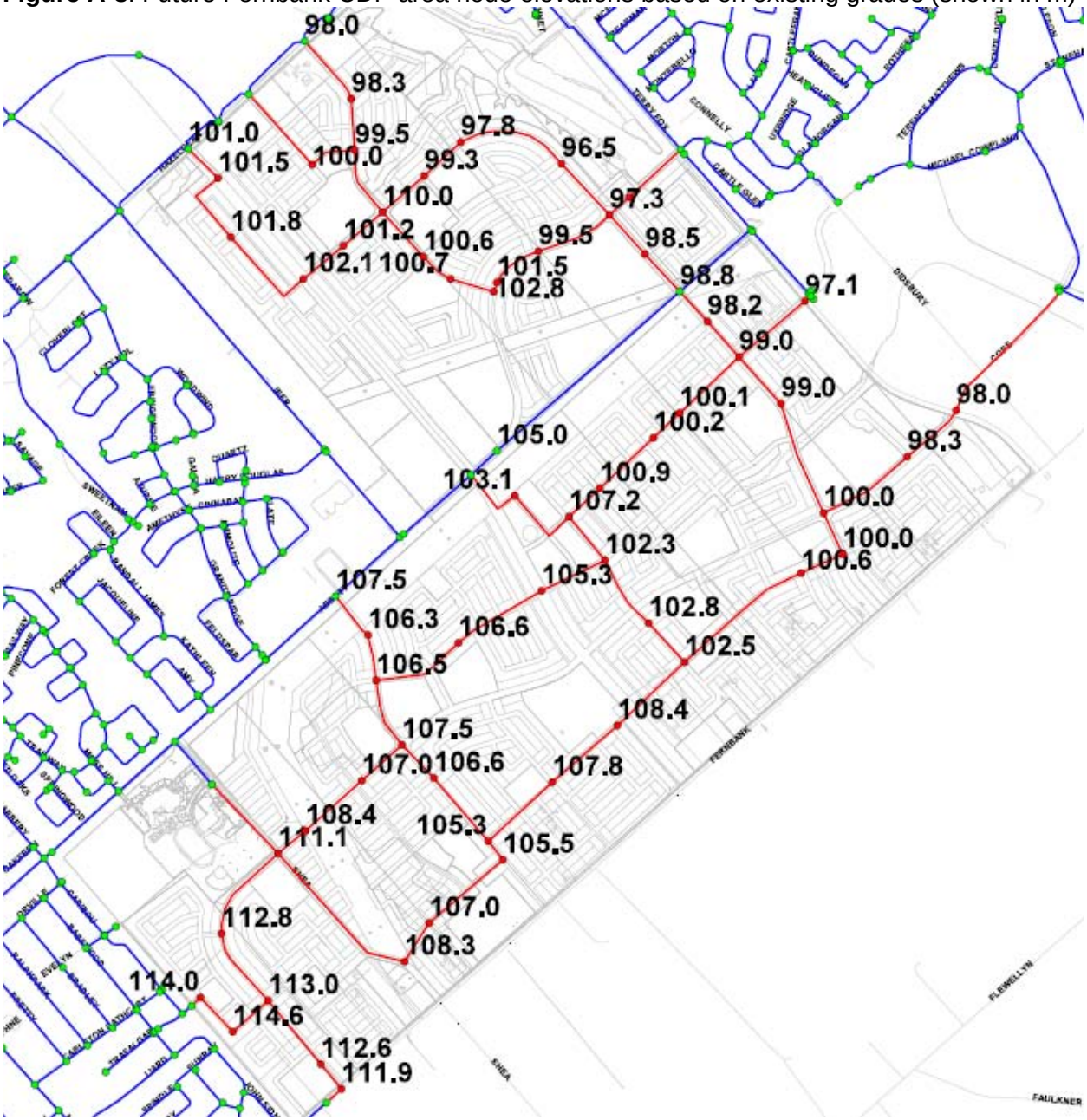

Figure A-4: Existing Zone 3W water distribution network – diameters shown in mm.

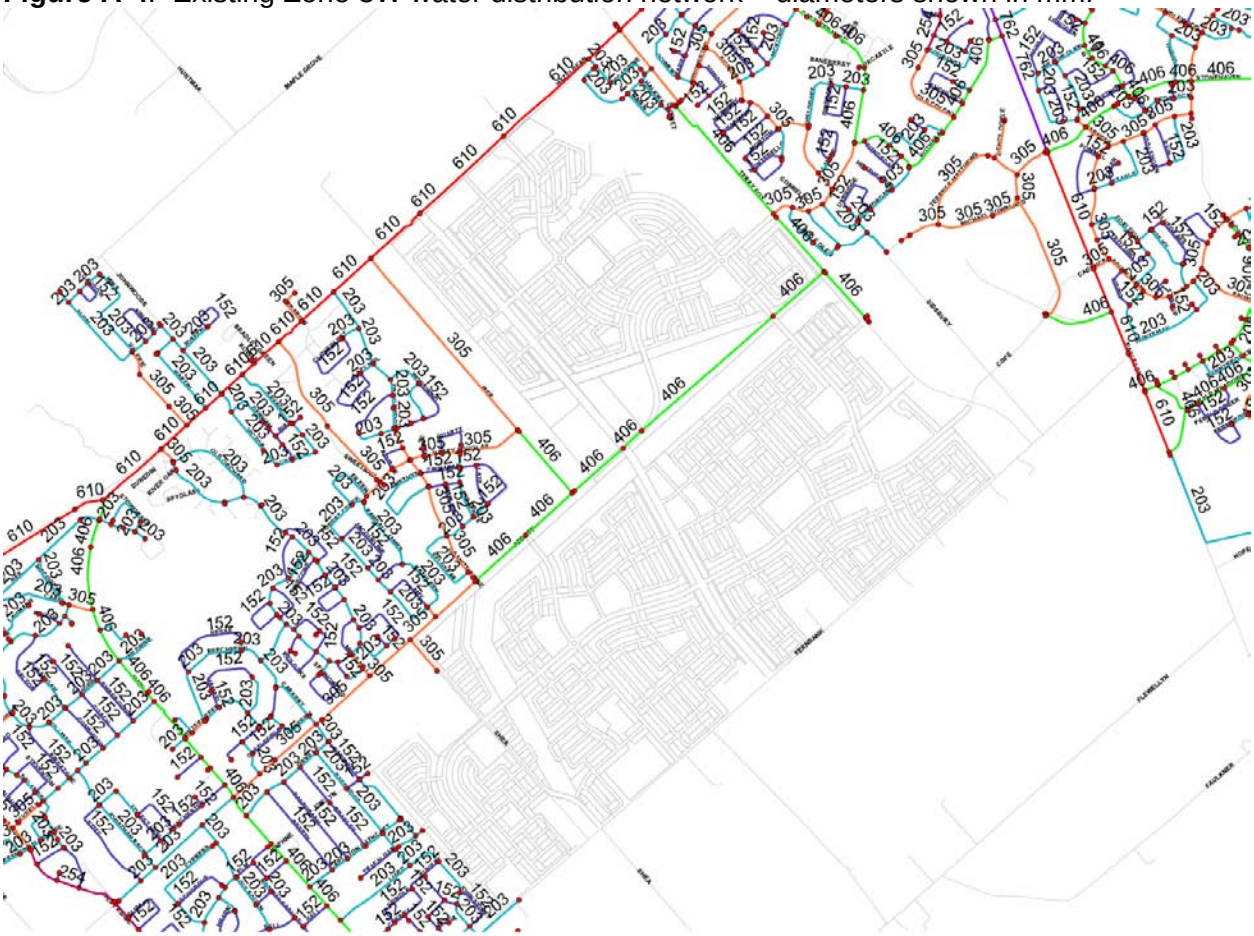

Figure A-5: Build-out watermain alignment and sizing (pipe diameters shown in mm)

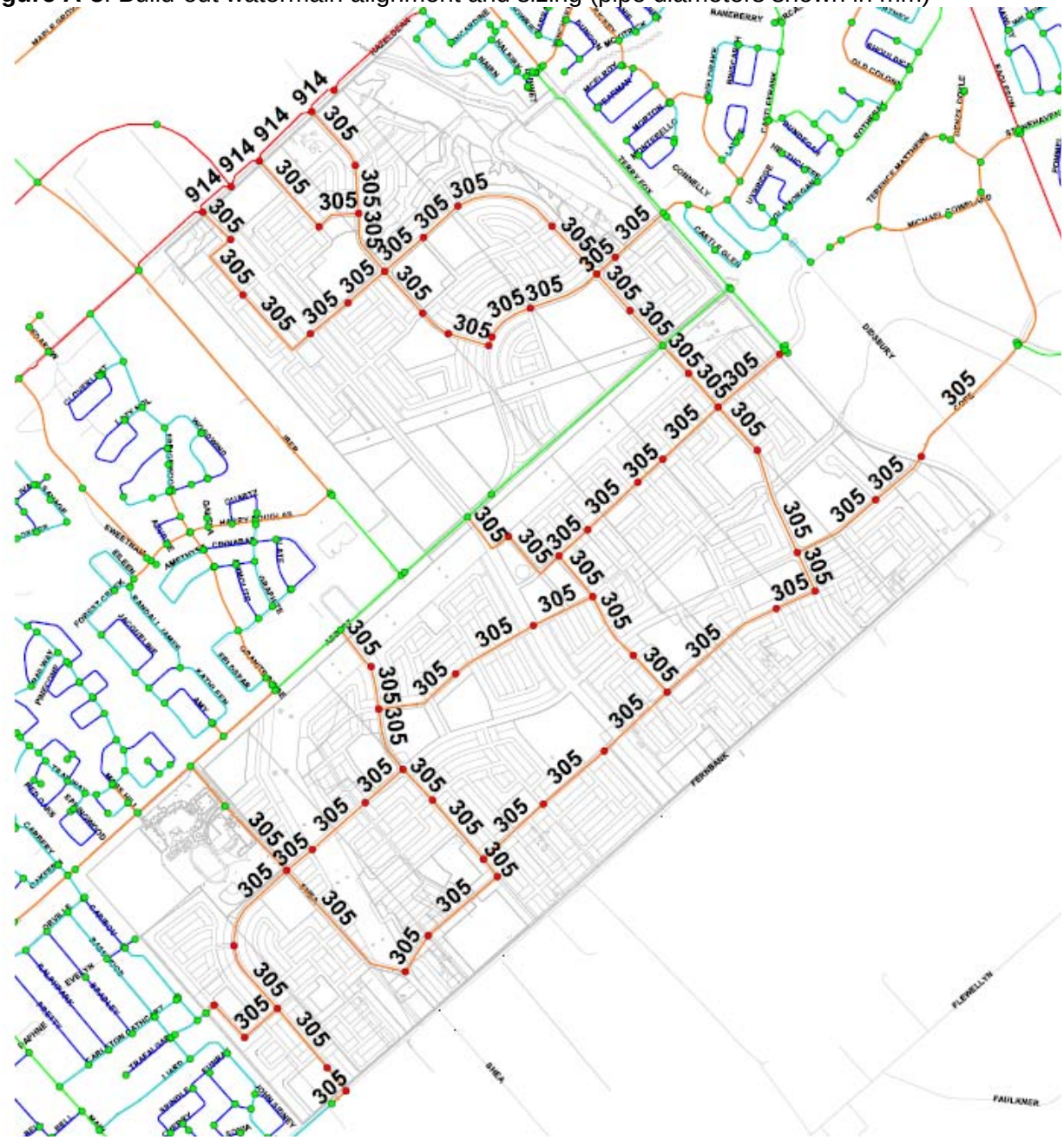

Figure A-6: Phase 1 watermain alignment and sizing (pipe diameters shown in mm)

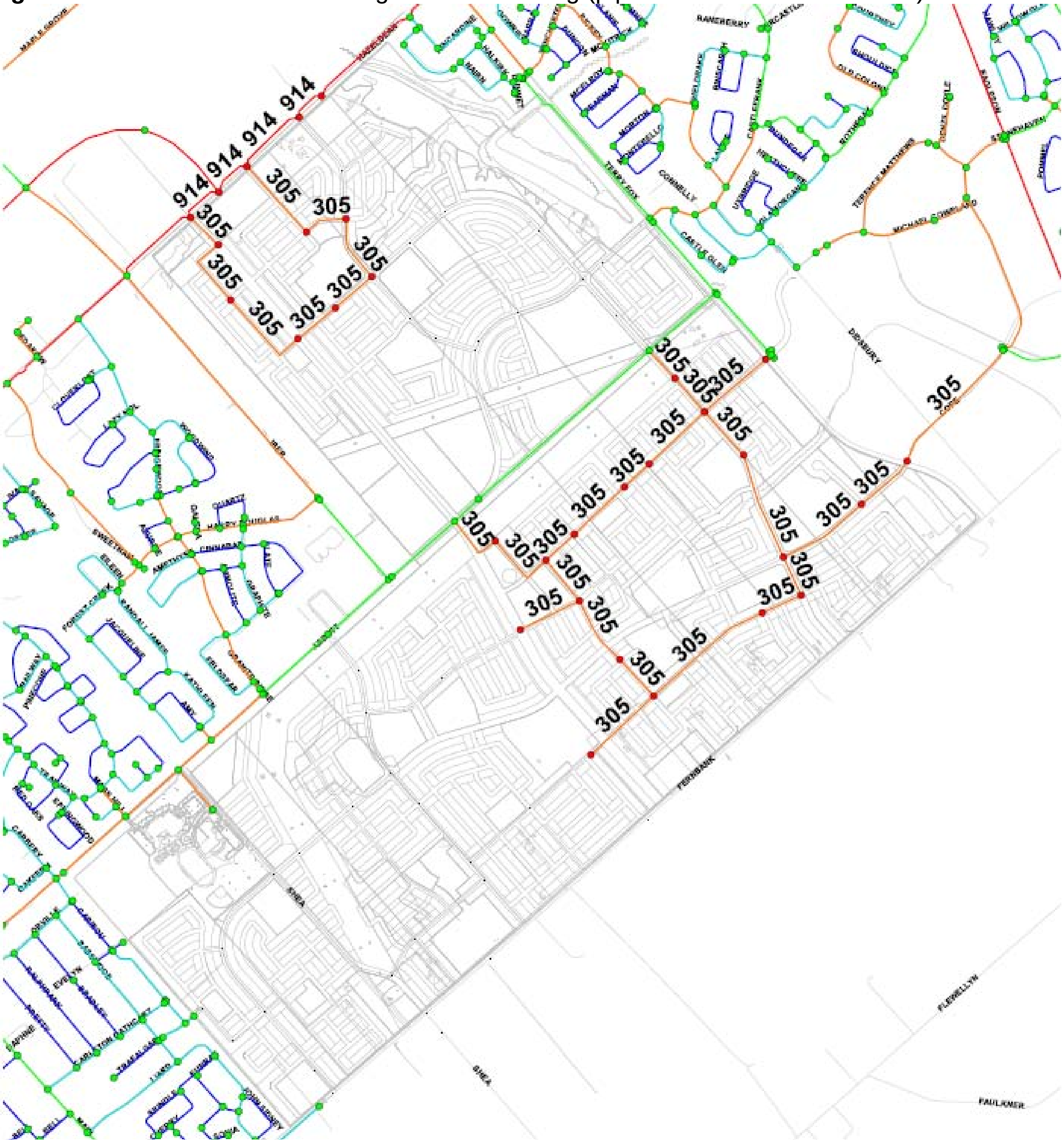

Figure A-7: Locations of pipe breaks

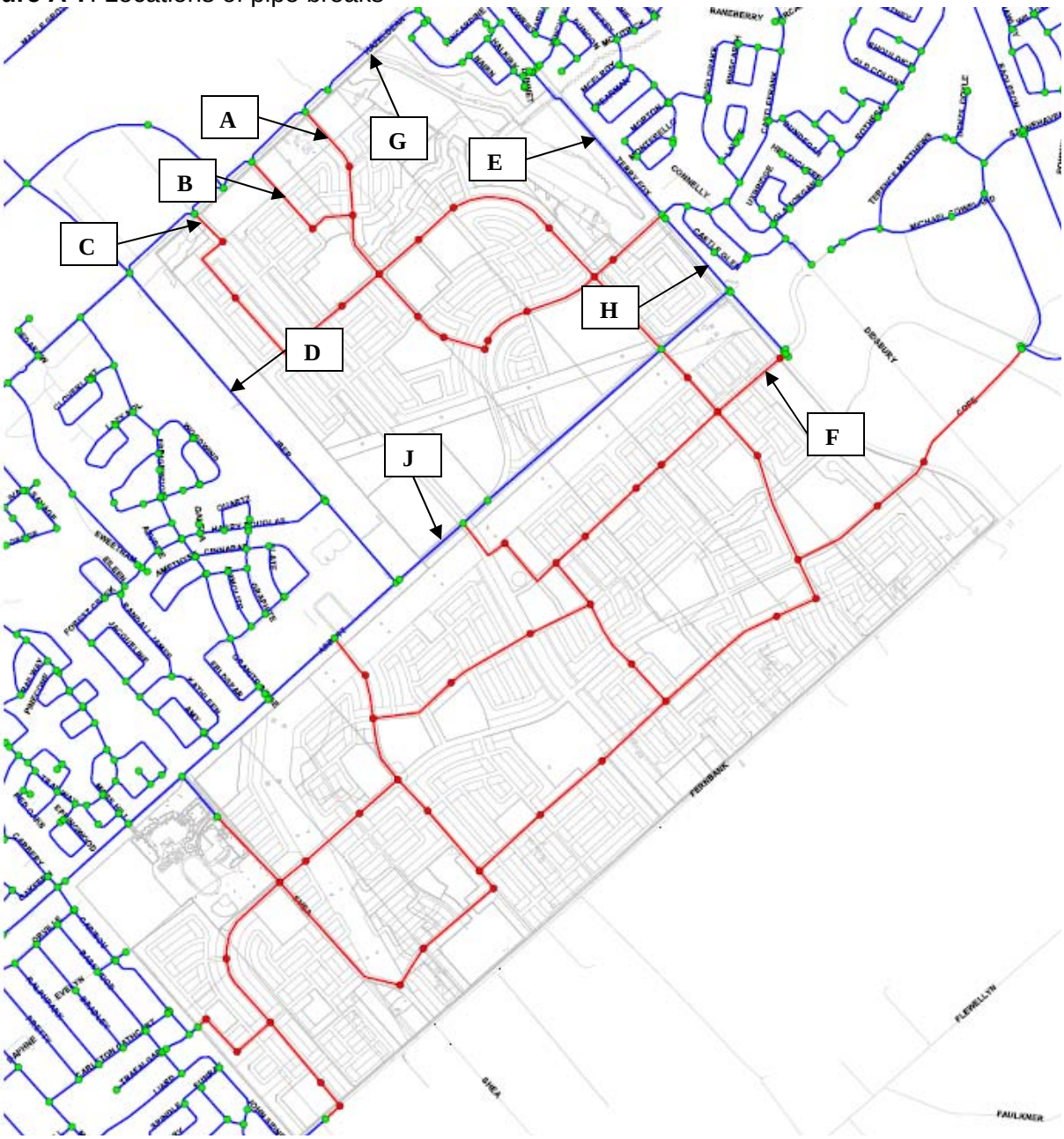

Figure A-8: Build-out model node IDs with new Fernbank Tank

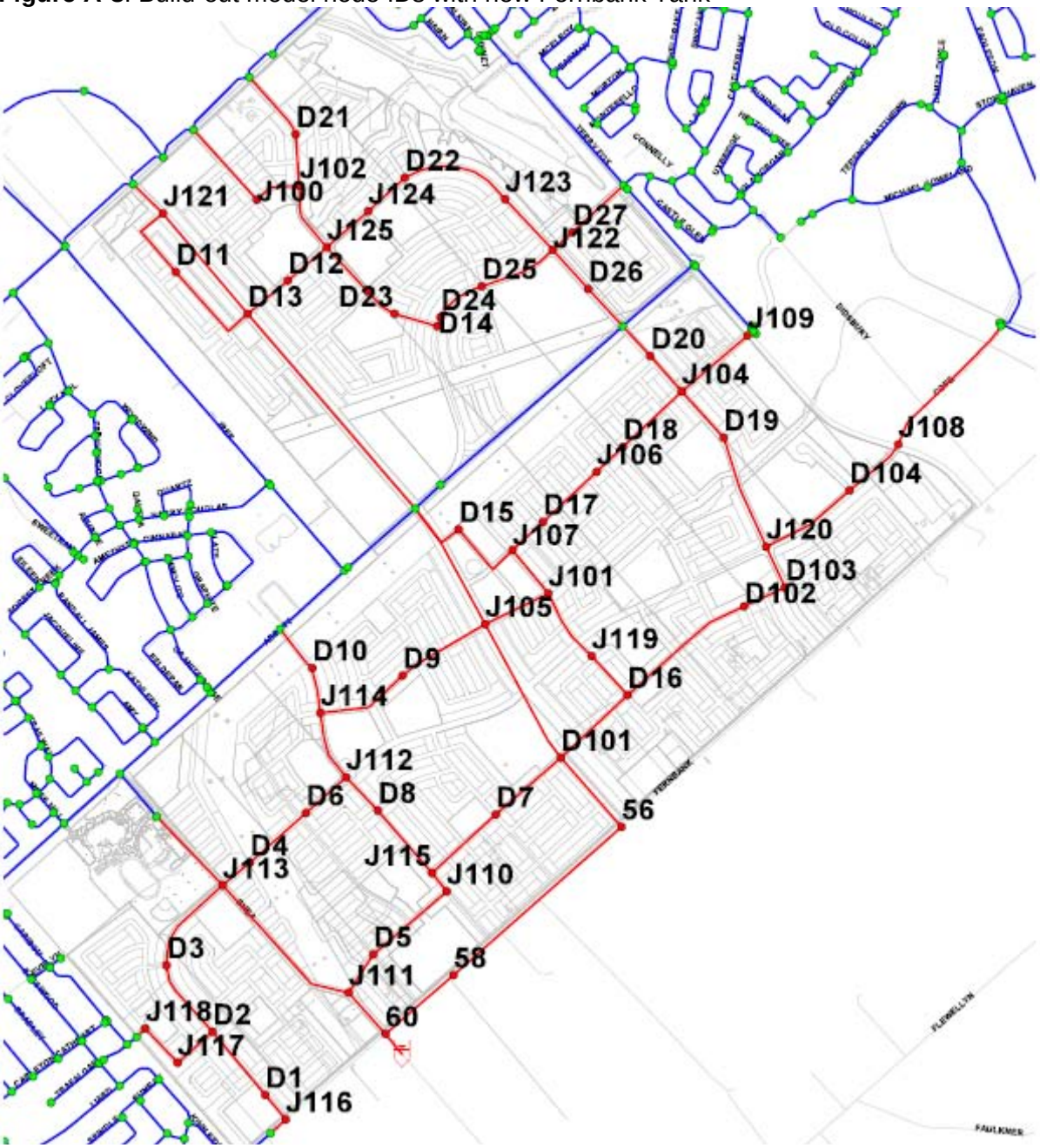

Figure A-9: Build-out model pipe IDs with new Fernbank Tank

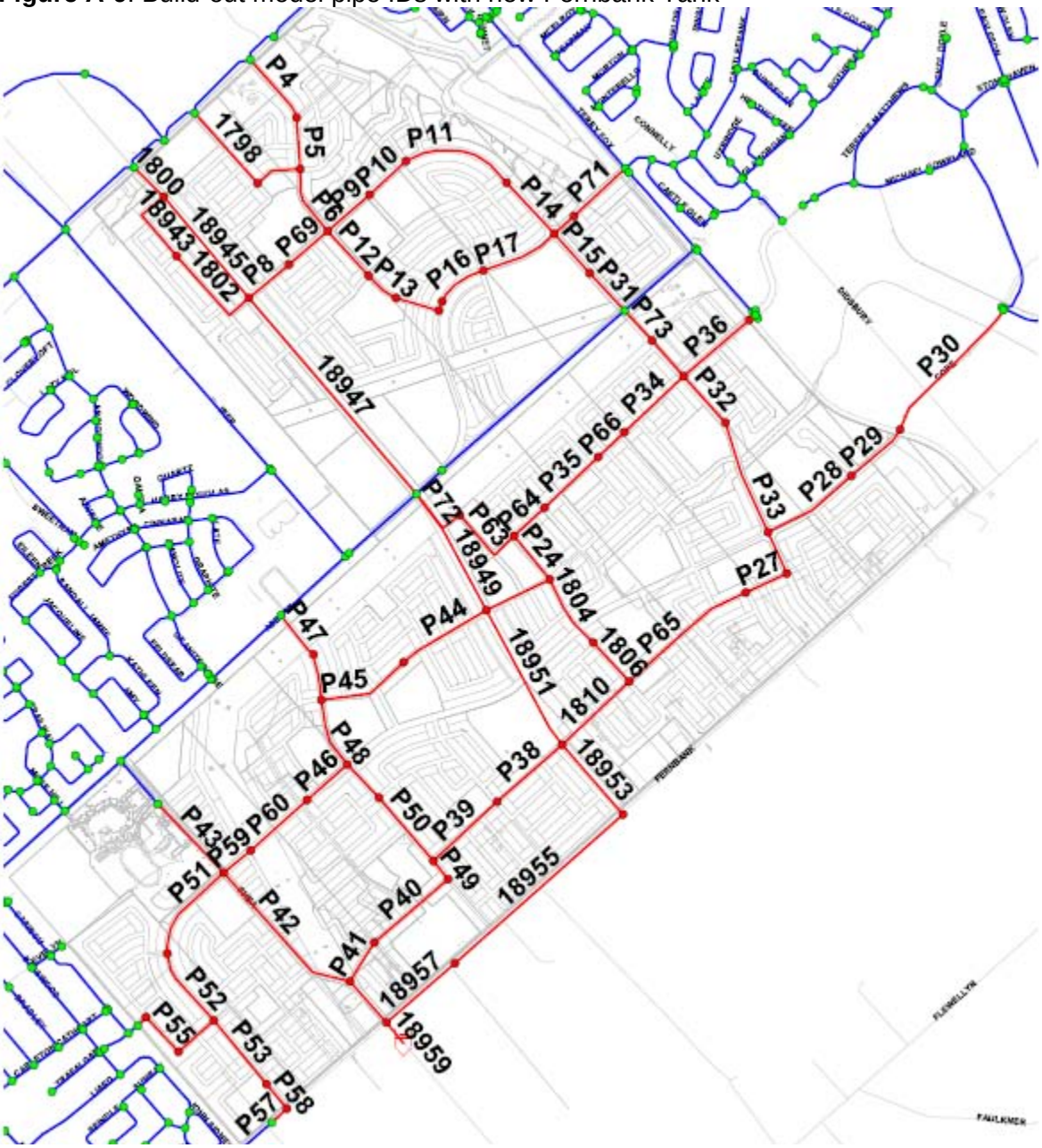

Figure A-10: Future Fernbank CDP area node elevations based on existing grades (shown in m) with new Fernbank Tank

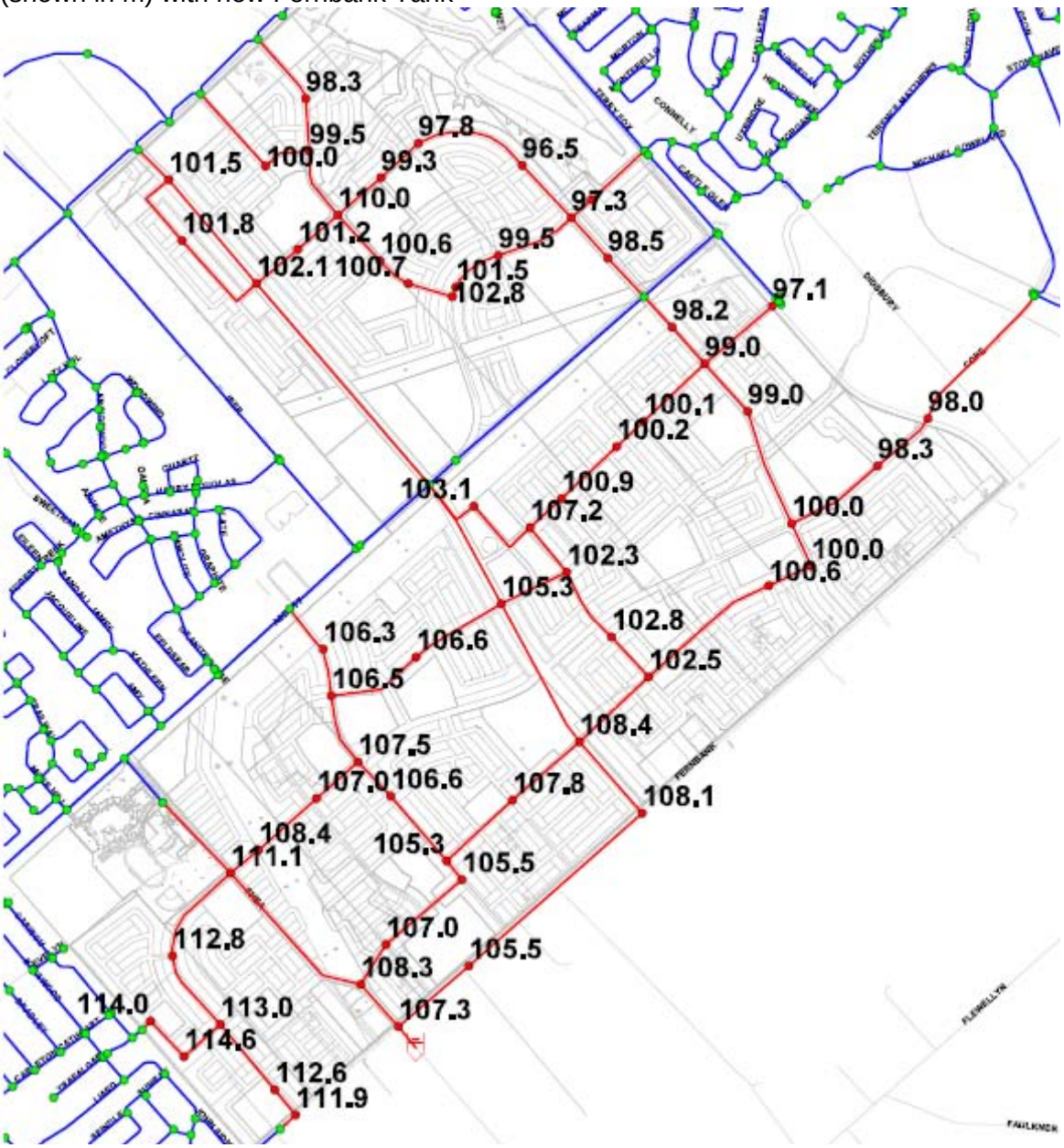

Figure A-11: Build-out watermain alignment and sizing (pipe diameters shown in mm) with new Fernbank Tank

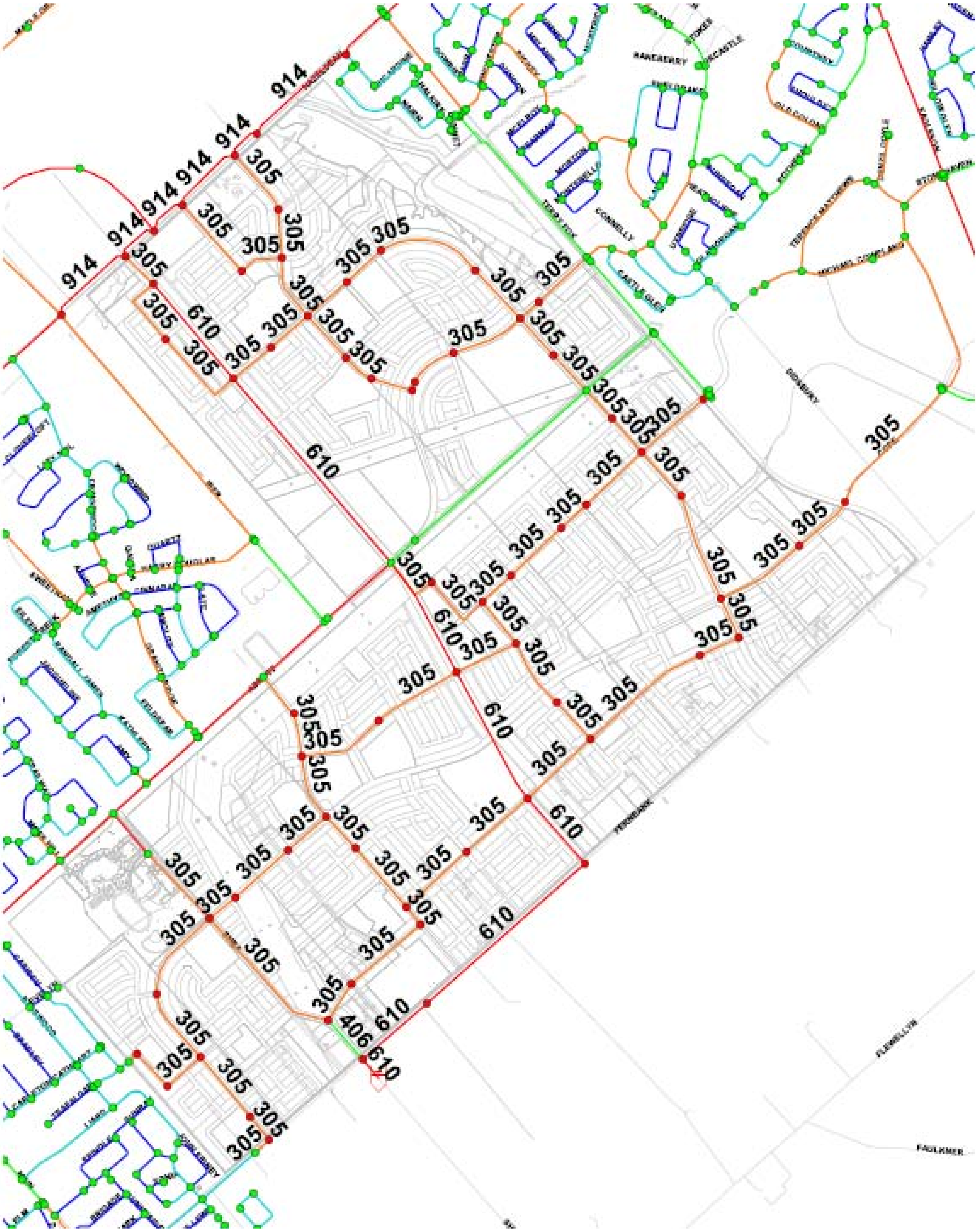

Figure A-12: Eagleson pipe break scenario

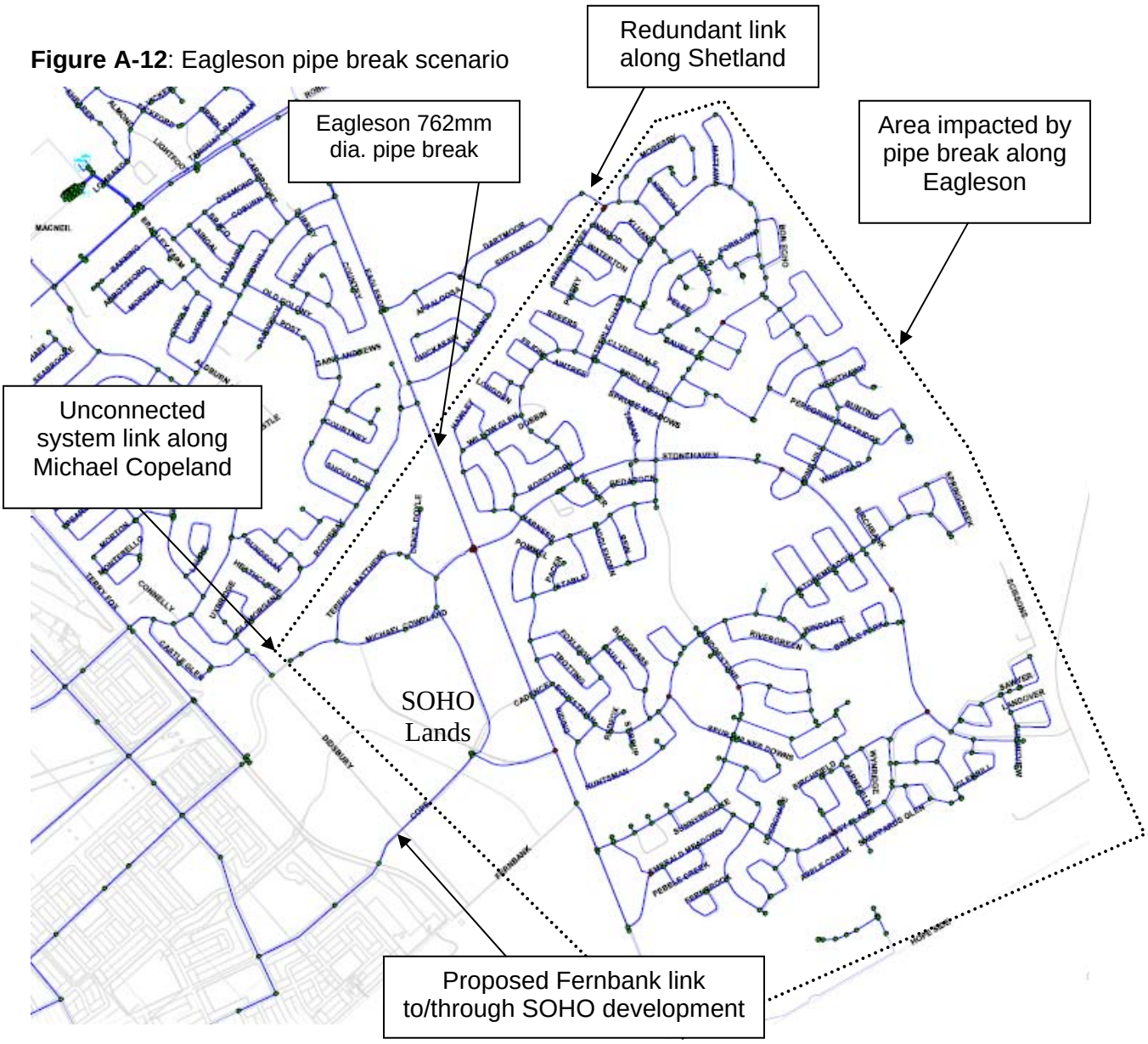

Table A-0.1: Distribution of areas, units, population and employment in Fernbank

	New Development Area							Residential Units				Residential Population				# of Employees		
Area ID	Low Density (ha)	Medium Density (ha)	High Density (ha)	Mixed Use Residential (ha)	Mixed Use Commercial (ha)	Commercial (ha)	Institutional (ha)	Low Density	Medium Density	High Density	Mixed Use	Low Density (persons)	Medium Density (persons)	High Density (persons)	Mixed Use (persons)	Mixed Use Commercial	Commercial	Institutional
1	8.08	0.35	0.00	0.00	0.00	0.00	3.19	210	18	0	0	694	44	0	0	0	0	319
2	11.12	3.90	0.00	0.00	0.00	0.00	0.64	289	195	0	0	954	488	0	0	0	0	64
3	7.72	0.00	0.00	0.00	0.00	0.00	2.65	201	0	0	0	662	0	0	0	0	0	265
4	3.34	2.75	0.00	0.00	0.00	0.63	0.00	87	138	0	0	287	345	0	0	0	63	0
5	9.45	0.00	0.00	0.00	0.00	0.00	0.81	246	0	0	0	811	0	0	0	0	0	81
6	11.30	0.00	0.00	0.00	0.00	0.00	3.20	294	0	0	0	970	0	0	0	0	0	320
7	15.31	2.08	0.00	0.00	0.00	0.00	0.93	398	104	0	0	1314	260	0	0	0	0	93
8	11.24	0.00	0.00	0.00	0.00	0.00	1.32	292	0	0	0	964	0	0	0	0	0	132
9	6.22	1.26	0.00	0.00	0.00	0.00	5.98	162	63	0	0	534	158	0	0	0	0	598
10	12.52	0.17	0.00	0.00	0.00	0.00	0.79	325	8	0	0	1074	21	0	0	0	0	79
11	5.07	8.28	0.00	1.82	1.73	0.24	0.82	132	414	0	136	435	1036	0	246	173	24	82
12	10.69	3.53	0.00	0.00	0.00	0.00	0.80	278	176	0	0	917	441	0	0	0	0	80
13	1.71	3.38	0.00	0.00	0.00	0.37	0.00	44	169	0	0	146	423	0	0	0	37	0
14	0.00	0.00	0.00	3.73	3.56	0.00	6.09	0	0	0	280	0	0	0	505	356	0	609
15	2.93	1.75	0.00	0.50	0.48	0.00	0.65	76	87	0	37	252	219	0	67	48	0	65
16	7.41	2.65	0.00	0.00	0.00	0.00	2.85	193	132	0	0	636	331	0	0	0	0	285
17	8.16	1.00	0.00	2.32	2.22	0.00	0.83	212	50	0	174	700	125	0	315	222	0	83
18	6.58	0.97	0.00	0.00	0.00	0.00	0.00	171	48	0	0	565	121	0	0	0	0	0
19	5.28	0.32	0.00	0.00	0.00	0.00	0.00	137	16	0	0	453	40	0	0	0	0	0
20	3.40	5.41	0.00	0.00	0.00	0.00	0.00	88	271	0	0	292	677	0	0	0	0	0
21	7.84	2.86	0.00	3.10	2.96	0.00	0.80	204	143	0	233	673	358	0	420	296	0	80
22	11.46	0.00	0.00	0.00	0.00	0.00	6.08	298	0	0	0	984	0	0	0	0	0	608
23	7.78	0.00	0.00	0.00	0.00	0.00	0.80	202	0	0	0	667	0	0	0	0	0	80
24	0.00	0.00	5.00	0.00	0.00	0.00	5.65	0	0	300	0	0	0	540	0	0	0	565
25	6.99	1.00	0.00	0.00	0.00	0.00	0.00	182	50	0	0	599	125	0	0	0	0	0
26	0.97	1.84	0.00	0.00	0.00	0.00	5.26	25	92	0	0	84	230	0	0	0	0	526
27	5.31	1.96	0.00	0.00	0.00	0.00	0.80	138	98	0	0	456	246	0	0	0	0	80
101	9.43	3.66	0.00	0.00	0.00	0.00	0.80	245	183	0	0	809	458	0	0	0	0	80
102	9.36	1.19	0.00	0.00	0.00	0.00	6.88	243	60	0	0	803	149	0	0	0	0	688
103	4.18	4.24	0.00	0.00	0.00	0.00	3.77	109	212	0	0	359	530	0	0	0	0	377
104	7.60	2.92	0.00	0.00	0.00	6.60	8.18	198	146	0	0	653	365	0	0	0	660	818
SUM	**218.46**	**57.46**	**5.00**	**11.47**	**10.94**	**7.84**	**70.57**	**5680**	**2873**	**300**	**860**	**18747**	**7188**	**540**	**1553**	**1094**	**784**	**7057**

Total Area: **381.7 ha** **Total Population:** **28028 persons** **Total Persons:** **8935 employees**

Table A-0.2: Distribution of Fernbank MXDY demands to model nodes

Area ID	Node ID	Single - Low Density Unit Demands (L/s)	Town Homes - Medium Density Unit Demands (L/s)	Apartments - High Density Unit Demands (L/s)	Mixed Use Residential Unit Demands (L/s)	Mixed Use Commercial Unit Demands (L/s)	Commercial Unit Demands (L/s)	Institutional Unit Demands (L/s)
		MXDY	MXDY	MXDY	MXDY	MXDY	MXDY	MXDY
1	D1	5.64	0.15	0.00	0.00	0.00	0.00	0.65
2	D2	7.76	1.62	0.00	0.00	0.00	0.00	0.13
3	D3	5.39	0.00	0.00	0.00	0.00	0.00	0.54
4	D4	2.33	1.15	0.00	0.00	0.00	0.13	0.00
5	D5	6.60	0.00	0.00	0.00	0.00	0.00	0.16
6	D6	7.89	0.00	0.00	0.00	0.00	0.00	0.65
7	D7	10.69	0.87	0.00	0.00	0.00	0.00	0.19
8	D8	7.85	0.00	0.00	0.00	0.00	0.00	0.27
9	D9	4.35	0.52	0.00	0.00	0.00	0.00	1.21
10	D10	8.74	0.07	0.00	0.00	0.00	0.00	0.16
11	D11	3.54	3.45	0.00	0.42	0.35	0.05	0.17
12	D12	7.46	1.47	0.00	0.00	0.00	0.00	0.16
13	D13	1.19	1.41	0.00	0.00	0.00	0.07	0.00
14	D14	0.00	0.00	0.00	0.86	0.72	0.00	1.23
15	D15	2.05	0.73	0.00	0.11	0.10	0.00	0.13
16	D16	5.17	1.10	0.00	0.00	0.00	0.00	0.58
17	D17	5.70	0.42	0.00	0.53	0.45	0.00	0.17
18	D18	4.59	0.40	0.00	0.00	0.00	0.00	0.00
19	D19	3.69	0.13	0.00	0.00	0.00	0.00	0.00
20	D20	2.37	2.25	0.00	0.00	0.00	0.00	0.00
21	D21	5.47	1.19	0.00	0.71	0.60	0.00	0.16
22	D22	8.00	0.00	0.00	0.00	0.00	0.00	1.23
23	D23	5.43	0.00	0.00	0.00	0.00	0.00	0.16
24	D24	0.00	0.00	0.92	0.00	0.00	0.00	1.14
25	D25	4.88	0.42	0.00	0.00	0.00	0.00	0.00
26	D26	0.68	0.77	0.00	0.00	0.00	0.00	1.07
27	D27	3.71	0.82	0.00	0.00	0.00	0.00	0.16
101	D101	6.58	1.53	0.00	0.00	0.00	0.00	0.16
102	D102	6.54	0.50	0.00	0.00	0.00	0.00	1.39
103	D103	2.92	1.77	0.00	0.00	0.00	0.00	0.76
104	D104	5.31	1.22	0.00	0.00	0.00	1.34	1.66
SUM:		**152.52**	**23.94**	**0.92**	**2.64**	**2.21**	**1.59**	**14.29**

TOTAL (all areas): **198.11**

Table A-0.3: Distribution of Fernbank BSDY demands to model nodes

Area ID	Node ID	Single - Low Density Unit Demands (L/s)	Town Homes - Medium Density Unit Demands (L/s)	Apartments - High Density Unit Demands (L/s)	Mixed Use Residential Unit Demands (L/s)	Mixed Use Commercial Unit Demands (L/s)	Commercial Unit Demands (L/s)	Institutional Unit Demands (L/s)
		BSDY	BSDY	BSDY	BSDY	BSDY	BSDY	BSDY
1	D1	2.03	0.15	0.00	0.00	0.00	0.00	0.65
2	D2	2.79	1.62	0.00	0.00	0.00	0.00	0.13
3	D3	1.94	0.00	0.00	0.00	0.00	0.00	0.54
4	D4	0.84	1.15	0.00	0.00	0.00	0.13	0.00
5	D5	2.38	0.00	0.00	0.00	0.00	0.00	0.16
6	D6	2.84	0.00	0.00	0.00	0.00	0.00	0.65
7	D7	3.85	0.87	0.00	0.00	0.00	0.00	0.19
8	D8	2.82	0.00	0.00	0.00	0.00	0.00	0.27
9	D9	1.56	0.52	0.00	0.00	0.00	0.00	1.21
10	D10	3.15	0.07	0.00	0.00	0.00	0.00	0.16
11	D11	1.27	3.45	0.00	0.42	0.35	0.05	0.17
12	D12	2.69	1.47	0.00	0.00	0.00	0.00	0.16
13	D13	0.43	1.41	0.00	0.00	0.00	0.07	0.00
14	D14	0.00	0.00	0.00	0.86	0.72	0.00	1.23
15	D15	0.74	0.73	0.00	0.11	0.10	0.00	0.13
16	D16	1.86	1.10	0.00	0.00	0.00	0.00	0.58
17	D17	2.05	0.42	0.00	0.53	0.45	0.00	0.17
18	D18	1.65	0.40	0.00	0.00	0.00	0.00	0.00
19	D19	1.33	0.13	0.00	0.00	0.00	0.00	0.00
20	D20	0.85	2.25	0.00	0.00	0.00	0.00	0.00
21	D21	1.97	1.19	0.00	0.71	0.60	0.00	0.16
22	D22	2.88	0.00	0.00	0.00	0.00	0.00	1.23
23	D23	1.95	0.00	0.00	0.00	0.00	0.00	0.16
24	D24	0.00	0.00	0.92	0.00	0.00	0.00	1.14
25	D25	1.76	0.42	0.00	0.00	0.00	0.00	0.00
26	D26	0.24	0.77	0.00	0.00	0.00	0.00	1.07
27	D27	1.33	0.82	0.00	0.00	0.00	0.00	0.16
101	D101	2.37	1.53	0.00	0.00	0.00	0.00	0.16
102	D102	2.35	0.50	0.00	0.00	0.00	0.00	1.39
103	D103	1.05	1.77	0.00	0.00	0.00	0.00	0.76
104	D104	1.91	1.22	0.00	0.00	0.00	1.34	1.66
SUM:		**54.89**	**23.94**	**0.92**	**2.64**	**2.21**	**1.59**	**14.29**

TOTAL (all areas): **100.49**

Table A-1: Build Out – MXDY/PKHR Demand (Extended Period Simulation) – Fernbank Junction Head Range

ID	Max.Value (m)	Max.Time (hrs)	Min.Value (m)	Min.Time (hrs)	Average (m)
D1	160.7	28:00:00	149.9	44:00:00	157.8
D10	160.8	27:00:00	151.1	44:00:00	158.3
D101	160.8	27:00:00	150.1	44:00:00	158.0
D102	160.9	27:00:00	150.9	44:00:00	158.3
D103	160.9	27:00:00	151.4	44:00:00	158.4
D104	160.9	27:00:00	152.1	44:00:00	158.7
D11	161.0	27:00:00	155.3	44:00:00	159.5
D12	161.0	27:00:00	154.9	44:00:00	159.4
D13	161.0	27:00:00	155.0	44:00:00	159.4
D14	161.0	27:00:00	154.2	44:00:00	159.2
D15	160.9	27:00:00	152.1	44:00:00	158.6
D16	160.8	27:00:00	150.6	44:00:00	158.2
D17	160.9	27:00:00	151.9	44:00:00	158.6
D18	160.9	27:00:00	152.2	44:00:00	158.7
D19	160.9	27:00:00	152.3	44:00:00	158.7
D2	160.7	28:00:00	149.9	44:00:00	157.8
D20	160.9	27:00:00	152.9	44:00:00	158.9
D21	161.0	28:00:00	156.7	44:00:00	159.9
D22	161.0	27:00:00	154.3	44:00:00	159.2
D23	161.0	27:00:00	154.4	44:00:00	159.2
D24	160.9	27:00:00	154.1	44:00:00	159.2
D25	160.9	27:00:00	154.0	44:00:00	159.1
D26	160.9	27:00:00	153.6	44:00:00	159.0
D27	160.9	27:00:00	154.0	44:00:00	159.1
D3	160.8	27:00:00	149.9	44:00:00	157.9
D4	160.8	27:00:00	150.1	44:00:00	158.0
D5	160.8	27:00:00	150.0	44:00:00	158.0
D6	160.8	27:00:00	150.1	44:00:00	158.0
D7	160.8	27:00:00	150.0	44:00:00	158.0
D8	160.8	27:00:00	150.0	44:00:00	158.0
D9	160.8	27:00:00	150.8	44:00:00	158.2
J100	161.0	28:00:00	156.6	44:00:00	159.8
J101	160.8	27:00:00	151.0	44:00:00	158.3
J102	161.0	27:00:00	156.4	44:00:00	159.8
J103	161.0	27:00:00	154.6	44:00:00	159.3
J104	160.9	27:00:00	152.7	44:00:00	158.8
J105	160.8	27:00:00	150.9	44:00:00	158.2
J106	160.9	27:00:00	152.1	44:00:00	158.6
J107	160.9	27:00:00	151.9	44:00:00	158.5
J108	160.9	27:00:00	152.5	44:00:00	158.8
J109	160.9	27:00:00	153.1	44:00:00	158.9
J110	160.8	27:00:00	150.0	44:00:00	158.0
J111	160.8	27:00:00	150.0	44:00:00	158.0
J112	160.8	27:00:00	150.2	44:00:00	158.0
J113	160.8	27:00:00	150.1	44:00:00	158.0
J114	160.8	27:00:00	150.8	44:00:00	158.2
J115	160.8	27:00:00	150.0	44:00:00	158.0
J116	160.7	28:00:00	149.9	44:00:00	157.8
J117	160.7	28:00:00	149.9	44:00:00	157.8
J118	160.7	28:00:00	150.0	44:00:00	157.9
J119	160.8	27:00:00	150.8	44:00:00	158.2
J120	160.9	27:00:00	151.9	44:00:00	158.6
J121	161.0	28:00:00	155.9	44:00:00	159.6
J122	160.9	27:00:00	153.9	44:00:00	159.1
J123	160.9	27:00:00	154.1	44:00:00	159.2
J124	161.0	27:00:00	154.6	44:00:00	159.3
J125	161.0	27:00:00	154.9	44:00:00	159.4

Table A-2: Build Out - MXDY/PKHR Demand (Extended Period Simulation) – Fernbank Junction Pressure Range

ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)
D1	68.4	28:00:00	52.9	44:00:00	64.3
D10	77.6	27:00:00	63.8	44:00:00	74.0
D101	74.6	27:00:00	59.4	44:00:00	70.6
D102	85.6	27:00:00	71.4	44:00:00	81.9
D103	86.6	27:00:00	73.2	44:00:00	83.1
D104	88.9	27:00:00	76.4	44:00:00	85.7
D11	84.2	27:00:00	76.2	44:00:00	82.0
D12	85.0	27:00:00	76.4	44:00:00	82.7
D13	83.8	27:00:00	75.3	44:00:00	81.5
D14	82.7	27:00:00	73.2	44:00:00	80.2
D15	82.1	27:00:00	69.6	44:00:00	78.8
D16	82.9	27:00:00	68.3	44:00:00	79.1
D17	85.3	27:00:00	72.6	44:00:00	82.0
D18	86.4	27:00:00	74.1	44:00:00	83.2
D19	88.0	27:00:00	75.8	44:00:00	84.9
D2	67.9	28:00:00	52.4	44:00:00	63.7
D20	89.1	27:00:00	77.8	44:00:00	86.2
D21	89.2	28:00:00	83.1	44:00:00	87.6
D22	89.8	27:00:00	80.3	44:00:00	87.3
D23	85.7	27:00:00	76.3	44:00:00	83.2
D24	84.5	27:00:00	74.8	44:00:00	82.0
D25	87.3	27:00:00	77.4	44:00:00	84.8
D26	88.7	27:00:00	78.2	44:00:00	86.0
D27	91.5	27:00:00	81.5	44:00:00	88.9
D3	68.2	27:00:00	52.7	44:00:00	64.1
D4	74.5	27:00:00	59.3	44:00:00	70.5
D5	76.5	27:00:00	61.1	44:00:00	72.4
D6	76.5	27:00:00	61.2	44:00:00	72.5
D7	75.4	27:00:00	60.0	44:00:00	71.4
D8	77.1	27:00:00	61.8	44:00:00	73.1
D9	77.1	27:00:00	62.8	44:00:00	73.3
J100	86.8	28:00:00	80.5	44:00:00	85.1
J101	83.3	27:00:00	69.3	44:00:00	79.6
J102	87.4	27:00:00	80.8	44:00:00	85.7
J103	85.9	27:00:00	76.8	44:00:00	83.5
J104	88.0	27:00:00	76.3	44:00:00	85.0
J105	79.0	27:00:00	64.9	44:00:00	75.3
J106	86.3	27:00:00	73.8	44:00:00	83.1
J107	76.3	27:00:00	63.5	44:00:00	73.0
J108	89.4	27:00:00	77.4	44:00:00	86.4
J109	90.7	27:00:00	79.6	44:00:00	87.8
J110	78.6	27:00:00	63.2	44:00:00	74.6
J111	74.7	27:00:00	59.3	44:00:00	70.6
J112	75.8	27:00:00	60.7	44:00:00	71.8
J113	70.7	27:00:00	55.5	44:00:00	66.7
J114	77.2	27:00:00	63.0	44:00:00	73.5
J115	79.0	27:00:00	63.6	44:00:00	74.9
J116	69.5	28:00:00	54.0	44:00:00	65.3
J117	65.6	28:00:00	50.2	44:00:00	61.4
J118	66.5	28:00:00	51.2	44:00:00	62.3
J119	82.6	27:00:00	68.3	44:00:00	78.8
J120	86.6	27:00:00	73.8	44:00:00	83.3
J121	84.6	28:00:00	77.3	44:00:00	82.6
J122	90.5	27:00:00	80.6	44:00:00	88.0
J123	91.7	27:00:00	81.9	44:00:00	89.1
J124	87.7	27:00:00	78.6	44:00:00	85.3
J125	72.5	27:00:00	63.9	44:00:00	70.2

Table A-3: Build Out - MXDY/PKHR Demand (Extended Period Simulation) – Fernbank Pipe Flow Range

ID	Max.Value (L/s)	Max.Time (hrs)	Min.Value (L/s)	Min.Time (hrs)	Average (L/s)
P4	58.55	44:00:00	7.47	27:00:00	27.60
P5	41.63	44:00:00	6.02	27:00:00	19.53
P6	81.81	44:00:00	11.17	27:00:00	37.75
P8	23.83	44:00:00	0.06	72:00:00	8.71
P9	43.15	44:00:00	4.82	3:00	18.50
P10	43.15	44:00:00	4.82	3:00	18.50
P11	21.98	44:00:00	3.20	1:00	9.34
P12	41.75	44:00:00	4.69	3:00	18.49
P13	41.75	44:00:00	4.69	3:00	18.49
P14	21.98	44:00:00	3.20	1:00	9.34
P15	45.81	44:00:00	7.43	27:00:00	21.64
P16	22.61	44:00:00	2.52	1:00	8.10
P17	9.88	44:00:00	0.05	30:00:00	2.93
P22	18.88	20:00	0.34	28:00:00	9.50
P24	46.70	44:00:00	6.46	27:00:00	22.12
P27	45.41	44:00:00	5.91	27:00:00	22.47
P28	28.12	20:00	2.10	27:00:00	13.65
P29	45.96	20:00	3.31	27:00:00	23.12
P30	45.96	20:00	3.31	27:00:00	23.12
P31	42.02	44:00:00	7.08	27:00:00	19.13
P32	41.54	44:00:00	4.17	3:00	18.02
P33	32.17	44:00:00	3.56	3:00	14.23
P34	39.39	44:00:00	5.28	27:00:00	19.08
P35	27.40	44:00:00	4.44	27:00:00	14.13
P36	39.83	44:00:00	5.26	27:00:00	18.39
P37	39.83	44:00:00	5.26	27:00:00	18.39
P38	22.58	44:00:00	3.67	31:00:00	11.97
P39	15.91	0:00	0.06	13:00	4.52
P40	16.45	0:00	0.41	8:00:00	4.95
P41	14.70	20:00	0.04	14:00	5.50
P42	14.70	20:00	0.04	14:00	5.50
P43	43.08	20:00	0.62	27:00:00	15.99
P44	17.67	44:00:00	2.98	28:00:00	9.23
P45	11.98	0:00	0.18	29:00:00	3.42

Table A-3 continued: Build Out - MXDY/PKHR Demand (Extended Period Simulation) – Fernbank Pipe Flow Range

P46	24.51	0:00:00	2.89	30:00:00	12.49
P47	68.63	44:00:00	7.27	27:00:00	30.78
P48	51.53	44:00:00	8.46	27:00:00	25.09
P49	16.45	0:00	0.41	8:00:00	4.95
P50	11.00	20:00	0.07	3:00:00	4.55
P51	31.69	0:00:00	2.94	6:00	14.38
P52	29.16	0:00	0.34	32:00:00	8.59
P53	11.66	0:00	0.17	30:00:00	3.84
P54	21.93	20:00	0.05	46:00:00	7.79
P55	21.93	20:00	0.05	46:00:00	7.79
P56	21.93	20:00	0.05	46:00:00	7.79
P57	13.19	20:00	0.16	22:00	4.60
P58	13.19	20:00	0.16	22:00	4.60
P59	19.25	0:00	0.07	4:00	5.35
P60	20.87	0:00	0.00	8:00	5.22
P61	30.83	20:00	1.14	3:00:00	12.60
P62	46.58	44:00:00	5.89	27:00:00	21.88
P63	35.40	44:00:00	1.55	3:00	15.21
P64	15.23	0:00:00	0.94	31:00:00	6.91
P65	27.08	44:00:00	4.58	28:00:00	14.11
P66	27.40	44:00:00	4.44	27:00:00	14.13
P67	41.10	44:00:00	5.47	27:00:00	18.71
P68	24.96	44:00:00	3.39	1:00	10.15
P69	9.98	0:00	0.01	39:00:00	1.59
P70	28.03	44:00:00	3.86	3:00	12.94
P71	29.36	20:00	0.48	27:00:00	14.12
P72	41.85	44:00:00	2.14	3:00	18.31
P73	50.01	44:00:00	6.55	27:00:00	23.31
1796	40.18	44:00:00	4.87	3:00	18.22
1798	40.18	44:00:00	4.87	3:00	18.22
1800	43.26	44:00:00	0.63	1:00:00	18.93
1802	28.74	44:00:00	0.53	2:00:00	11.25
1804	29.03	44:00:00	2.15	3:00	12.88
1806	29.03	44:00:00	2.15	3:00	12.88
1808	55.81	44:00:00	6.93	27:00:00	27.88
1810	41.18	44:00:00	6.64	27:00:00	20.19
1812	17.67	44:00:00	2.98	28:00:00	9.23
18943	43.26	44:00:00	0.63	1:00:00	18.93

Table A-4: Build Out - MXDY/PKHR Demand (Extended Period Simulation) – Fernbank Pipe Velocity Range

ID	Max.Value (m/s)	Max.Time (hrs)	Min.Value (m/s)	Min.Time (hrs)	Average (m/s)
P4	0.80	44:00:00	0.10	27:00:00	0.38
P5	0.57	44:00:00	0.08	27:00:00	0.27
P6	1.12	44:00:00	0.15	27:00:00	0.52
P8	0.33	44:00:00	0.00	72:00:00	0.12
P9	0.59	44:00:00	0.07	3:00	0.25
P10	0.59	44:00:00	0.07	3:00	0.25
P11	0.30	44:00:00	0.04	1:00	0.13
P12	0.57	44:00:00	0.06	3:00	0.25
P13	0.57	44:00:00	0.06	3:00	0.25
P14	0.30	44:00:00	0.04	1:00	0.13
P15	0.63	44:00:00	0.10	27:00:00	0.30
P16	0.31	44:00:00	0.03	1:00	0.11
P17	0.14	44:00:00	0.00	30:00:00	0.04
P22	0.26	20:00	0.00	28:00:00	0.13
P24	0.64	44:00:00	0.09	27:00:00	0.30
P27	0.62	44:00:00	0.08	27:00:00	0.31
P28	0.38	20:00	0.03	27:00:00	0.19
P29	0.63	20:00	0.05	27:00:00	0.32
P30	0.63	20:00	0.05	27:00:00	0.32
P31	0.58	44:00:00	0.10	27:00:00	0.26
P32	0.57	44:00:00	0.06	3:00	0.25
P33	0.44	44:00:00	0.05	3:00	0.19
P34	0.54	44:00:00	0.07	27:00:00	0.26
P35	0.38	44:00:00	0.06	27:00:00	0.19
P36	0.55	44:00:00	0.07	27:00:00	0.25
P37	0.55	44:00:00	0.07	27:00:00	0.25
P38	0.31	44:00:00	0.05	31:00:00	0.16
P39	0.22	0:00	0.00	13:00	0.06
P40	0.23	0:00	0.01	8:00:00	0.07
P41	0.20	20:00	0.00	14:00	0.08
P42	0.20	20:00	0.00	14:00	0.08
P43	0.59	20:00	0.01	27:00:00	0.22
P44	0.24	44:00:00	0.04	28:00:00	0.13
P45	0.16	0:00	0.00	29:00:00	0.05

Table A-4 continued: Build Out - MXDY/PKHR Demand (Extended Period Simulation) – Fernbank Pipe Velocity Range

P46	0.34	0:00:00	0.04	30:00:00	0.17
P47	0.94	44:00:00	0.10	27:00:00	0.42
P48	0.71	44:00:00	0.12	27:00:00	0.34
P49	0.23	0:00	0.01	8:00:00	0.07
P50	0.15	20:00	0.00	3:00:00	0.06
P51	0.43	0:00:00	0.04	6:00	0.20
P52	0.40	0:00	0.00	32:00:00	0.12
P53	0.16	0:00	0.00	30:00:00	0.05
P54	0.30	20:00	0.00	46:00:00	0.11
P55	0.30	20:00	0.00	46:00:00	0.11
P56	0.30	20:00	0.00	46:00:00	0.11
P57	0.18	20:00	0.00	22:00	0.06
P58	0.18	20:00	0.00	22:00	0.06
P59	0.26	0:00	0.00	4:00	0.07
P60	0.29	0:00	0.00	8:00	0.07
P61	0.42	20:00	0.02	3:00:00	0.17
P62	0.64	44:00:00	0.08	27:00:00	0.30
P63	0.48	44:00:00	0.02	3:00	0.21
P64	0.21	0:00:00	0.01	31:00:00	0.09
P65	0.37	44:00:00	0.06	28:00:00	0.19
P66	0.38	44:00:00	0.06	27:00:00	0.19
P67	0.56	44:00:00	0.07	27:00:00	0.26
P68	0.34	44:00:00	0.05	1:00	0.14
P69	0.14	0:00	0.00	39:00:00	0.02
P70	0.38	44:00:00	0.05	3:00	0.18
P71	0.40	20:00	0.01	27:00:00	0.19
P72	0.57	44:00:00	0.03	3:00	0.25
P73	0.68	44:00:00	0.09	27:00:00	0.32
1796	0.55	44:00:00	0.07	3:00	0.25
1798	0.55	44:00:00	0.07	3:00	0.25
1800	0.59	44:00:00	0.01	1:00:00	0.26
1802	0.39	44:00:00	0.01	2:00:00	0.15
1804	0.40	44:00:00	0.03	3:00	0.18
1806	0.40	44:00:00	0.03	3:00	0.18
1808	0.76	44:00:00	0.09	27:00:00	0.38
1810	0.56	44:00:00	0.09	27:00:00	0.28
1812	0.24	44:00:00	0.04	28:00:00	0.13
18943	0.59	44:00:00	0.01	1:00:00	0.26

Table A-5: Build Out - MXDY + Fire flow Fernbank output results (Stittsville Tank 40% full)

ID	Available Flow @Hydrant (L/s)	Available Flow @Hydrant (L/min)
D1	346	20,789
D10	745	44,727
D101	482	28,918
D102	553	33,192
D103	598	35,874
D104	578	34,666
D11	545	32,682
D12	668	40,103
D13	572	34,344
D14	540	32,405
D15	803	48,179
D16	627	37,649
D17	586	35,138
D18	627	37,643
D19	706	42,336
D2	438	26,276
D20	973	58,360
D21	978	58,686
D22	634	38,047
D23	588	35,258
D24	549	32,917
D25	622	37,307
D26	953	57,192
D27	996	59,762
D3	451	27,048
D4	585	35,128
D5	446	26,752
D6	571	34,244
D7	478	28,687
D8	571	34,250
D9	521	31,234
J100	913	54,759
J101	684	41,069
J102	1094	65,638
J103	638	38,287
J104	1046	62,767
J105	535	32,116
J106	588	35,260
J107	733	43,993
J108	575	34,493
J109	1013	60,799
J110	519	31,119
J111	430	25,771
J112	652	39,116
J113	655	39,314
J114	725	43,523
J115	566	33,945
J116	327	19,647
J117	387	23,232
J118	380	22,789
J119	586	35,169
J120	681	40,858
J121	594	35,638
J122	1093	65,558
J123	686	41,161
J124	680	40,829
J125	832	49,927

Table A-6: Build Out - BSDY + Fire flow + Pipe break output results (Stittsville Tank 40% full)

ID	No pipe break	Available Flow @Hydrant (L/s)								
		Pipe break at location A	Pipe break at location B	Pipe break at location C	Pipe break at location D	Pipe break at location E	Pipe break at location F	Pipe break at location G	Pipe break at location H	Pipe break at location J
D1	374	374	374	374	372	373	374	365	371	372
D10	797	796	796	796	765	782	795	775	753	753
D101	518	517	517	517	511	512	515	508	501	518
D102	583	582	582	582	577	576	575	575	564	581
D103	630	629	629	629	624	622	618	623	609	626
D104	601	601	601	600	598	597	595	597	592	598
D11	558	550	551	266	558	556	558	540	557	557
D12	687	651	656	469	687	683	687	663	687	686
D13	590	572	575	356	590	588	590	571	590	589
D14	560	544	546	532	559	552	560	548	559	556
D15	849	848	848	847	818	822	845	831	771	723
D16	671	670	670	670	660	660	663	659	640	670
D17	612	612	612	611	604	599	597	603	576	589
D18	656	655	655	655	647	640	618	647	610	632
D19	739	738	738	737	729	721	682	729	688	719
D2	477	477	477	477	473	475	477	464	471	473
D20	1019	1015	1016	1013	996	951	955	1001	839	935
D21	997	477	848	972	997	995	997	930	997	997
D22	652	629	632	611	650	641	651	637	651	647
D23	606	583	586	567	604	597	605	591	605	602
D24	568	555	557	544	567	559	568	557	568	564
D25	642	625	628	613	640	628	641	628	641	635
D26	992	980	982	970	981	919	988	974	931	943
D27	1034	1015	1018	1000	1025	957	1031	1014	1032	995
D3	491	491	491	491	487	488	491	478	484	487
D4	636	636	636	635	624	629	635	620	616	628
D5	477	476	476	476	471	473	476	467	466	474
D6	614	614	614	613	603	607	613	600	595	607
D7	512	512	512	511	505	507	510	502	497	511
D8	614	614	614	614	603	607	613	601	593	610
D9	553	553	553	553	544	546	551	543	534	552
J100	932	768	486	907	932	930	932	874	932	932
J101	730	729	729	728	713	715	723	715	687	724
J102	1123	740	768	1043	1123	1118	1123	1042	1122	1122
J103	661	628	633	605	660	652	661	643	660	657
J104	1107	1103	1103	1100	1075	1035	855	1085	914	1010
J105	570	569	569	569	560	562	567	559	547	569
J106	617	616	616	616	609	603	591	608	578	596
J107	782	781	781	780	758	758	772	765	713	716
J108	599	599	599	599	598	597	596	596	594	598
J109	1061	1056	1057	1053	1037	981	795	1042	853	967
J110	561	561	561	561	553	556	560	550	545	559
J111	463	463	463	463	458	460	463	454	453	461
J112	711	711	711	710	693	701	709	693	680	701
J113	723	722	722	722	706	714	721	700	696	709
J114	786	785	785	784	759	771	783	765	742	767
J115	615	614	614	614	604	607	612	602	593	612
J116	356	356	356	356	354	355	356	348	353	354
J117	425	425	425	425	423	424	425	414	421	423
J118	415	415	415	415	413	414	415	404	411	413
J119	625	625	625	624	615	616	619	614	598	624
J120	719	719	719	718	712	709	699	711	690	712
J121	609	603	604	224	609	608	609	586	608	608
J122	1140	1102	1108	1073	1130	1056	1137	1111	1136	1095
J123	709	689	692	674	707	693	709	694	708	701
J124	705	667	672	641	703	694	704	685	704	700
J125	870	757	770	691	869	856	870	825	869	865

Table A-7: Phase 1 - MXDY/PKHR Demand (Extended Period Simulation) – Fernbank Junction Head Range

ID	Max.Value (m)	Max.Time (hrs)	Min.Value (m)	Min.Time (hrs)	Average (m)
D101	160.9	27:00:00	153.4	44:00:00	159.0
D102	160.9	27:00:00	153.5	44:00:00	159.1
D103	160.9	27:00:00	153.6	44:00:00	159.1
D104	160.9	27:00:00	153.8	44:00:00	159.2
D11	161.1	28:00:00	157.3	44:00:00	160.0
D12	161.1	28:00:00	157.3	44:00:00	160.0
D13	161.1	28:00:00	157.3	44:00:00	160.0
D15	160.9	27:00:00	154.5	44:00:00	159.3
D16	160.9	27:00:00	153.5	44:00:00	159.1
D17	160.9	27:00:00	154.3	44:00:00	159.3
D18	160.9	27:00:00	154.4	44:00:00	159.3
D19	160.9	27:00:00	154.2	44:00:00	159.3
D20	160.9	27:00:00	154.7	44:00:00	159.4
J100	161.1	28:00:00	157.7	44:00:00	160.2
J101	160.9	27:00:00	153.9	44:00:00	159.2
J102	161.1	28:00:00	157.6	44:00:00	160.1
J104	160.9	27:00:00	154.5	44:00:00	159.3
J105	160.9	27:00:00	153.9	44:00:00	159.2
J106	160.9	27:00:00	154.3	44:00:00	159.3
J107	160.9	27:00:00	154.3	44:00:00	159.3
J108	160.9	27:00:00	153.9	44:00:00	159.2
J109	160.9	27:00:00	154.8	44:00:00	159.4
J119	160.9	27:00:00	153.7	44:00:00	159.1
J120	160.9	27:00:00	153.8	44:00:00	159.2
J121	161.1	28:00:00	157.4	44:00:00	160.1
J125	161.1	28:00:00	157.5	44:00:00	160.1

Table A-8: Phase 1 - MXDY/PKHR Demand (Extended Period Simulation) – Fernbank Junction Pressure Range

ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)
D101	74.7	27:00:00	64.0	44:00:00	72.0
D102	85.7	27:00:00	75.1	44:00:00	83.1
D103	86.7	27:00:00	76.3	44:00:00	84.1
D104	89.0	27:00:00	78.8	44:00:00	86.5
D11	84.3	28:00:00	79.0	44:00:00	82.9
D12	85.1	28:00:00	79.8	44:00:00	83.6
D13	83.9	28:00:00	78.6	44:00:00	82.4
D15	82.2	27:00:00	73.0	44:00:00	79.9
D16	83.1	27:00:00	72.4	44:00:00	80.4
D17	85.4	27:00:00	75.9	44:00:00	83.0
D18	86.5	27:00:00	77.1	44:00:00	84.1
D19	88.0	27:00:00	78.4	44:00:00	85.7
D20	89.2	27:00:00	80.3	44:00:00	87.0
J100	86.8	28:00:00	82.1	44:00:00	85.6
J101	83.4	27:00:00	73.4	44:00:00	80.9
J102	87.5	28:00:00	82.6	44:00:00	86.2
J104	88.1	27:00:00	78.9	44:00:00	85.8
J105	79.2	27:00:00	69.2	44:00:00	76.6
J106	86.3	27:00:00	77.0	44:00:00	84.0
J107	76.4	27:00:00	67.0	44:00:00	74.0
J108	89.5	27:00:00	79.5	44:00:00	87.0
J109	90.7	27:00:00	82.0	44:00:00	88.6
J119	82.7	27:00:00	72.4	44:00:00	80.1
J120	86.7	27:00:00	76.5	44:00:00	84.2
J121	84.7	28:00:00	79.5	44:00:00	83.2
J125	72.6	28:00:00	67.5	44:00:00	71.2

Table A-9: Build Out - MXDY/PKHR Demand (Extended Period Simulation) – Fernbank Pipe Flow Range

ID	Max.Value (L/s)	Max.Time (hrs)	Min.Value (L/s)	Min.Time (hrs)	Average (L/s)
P6	25.43	44:00:00	3.02	27:00:00	12.87
P8	9.23	0:00:00	0.17	5:00	3.83
P24	29.61	44:00:00	0.33	48:00:00	12.40
P27	24.61	20:00	0.63	27:00:00	11.34
P28	16.92	0:00	0.10	53:00:00	4.34
P29	27.88	20:00	0.97	52:00:00	13.51
P30	27.88	20:00	0.97	52:00:00	13.51
P32	40.09	44:00:00	0.44	3:00	16.54
P33	30.71	44:00:00	0.12	0:00	12.76
P34	23.98	44:00:00	2.49	27:00:00	12.14
P35	13.30	0:00:00	1.64	28:00:00	7.18
P36	31.98	44:00:00	3.70	3:00	14.48
P37	31.98	44:00:00	3.70	3:00	14.48
P63	34.09	68:00:00	0.08	51:00:00	13.80
P64	10.12	0:00	0.06	13:00	2.40
P65	10.86	0:00	0.18	52:00:00	3.00
P66	13.30	0:00:00	1.64	28:00:00	7.18
P67	32.09	44:00:00	3.68	3:00	14.20
P69	25.43	44:00:00	3.02	27:00:00	12.87
P72	40.54	68:00:00	0.51	51:00:00	16.56
P73	41.00	44:00:00	4.77	3:00	18.80
1796	25.43	44:00:00	3.02	27:00:00	12.87
1798	25.43	44:00:00	3.02	27:00:00	12.87
1800	17.07	20:00	0.06	51:00:00	7.15
1802	7.99	0:00	0.01	64:00:00	1.87
1804	29.61	44:00:00	0.33	48:00:00	12.40
1806	29.61	44:00:00	0.33	48:00:00	12.40
1808	35.00	20:00	1.65	27:00:00	16.76
1810	18.60	20:00	1.51	3:00	8.22
1812	0.00	0:00	0.00	2:00	0.00
18943	17.07	20:00	0.06	51:00:00	7.15

Table A-10: Build Out - MXDY/PKHR Demand (Extended Period Simulation) – Fernbank Pipe Velocity Range

ID	Max.Value (m/s)	Max.Time (hrs)	Min.Value (m/s)	Min.Time (hrs)	Average (m/s)
P6	0.35	44:00:00	0.04	27:00:00	0.18
P8	0.13	0:00:00	0.00	5:00	0.05
P24	0.41	44:00:00	0.00	48:00:00	0.17
P27	0.34	20:00	0.01	27:00:00	0.16
P28	0.23	0:00	0.00	53:00:00	0.06
P29	0.38	20:00	0.01	52:00:00	0.19
P30	0.38	20:00	0.01	52:00:00	0.19
P32	0.55	44:00:00	0.01	3:00	0.23
P33	0.42	44:00:00	0.00	0:00	0.17
P34	0.33	44:00:00	0.03	27:00:00	0.17
P35	0.18	0:00:00	0.02	28:00:00	0.10
P36	0.44	44:00:00	0.05	3:00	0.20
P37	0.44	44:00:00	0.05	3:00	0.20
P63	0.47	68:00:00	0.00	51:00:00	0.19
P64	0.14	0:00	0.00	13:00	0.03
P65	0.15	0:00	0.00	52:00:00	0.04
P66	0.18	0:00:00	0.02	28:00:00	0.10
P67	0.44	44:00:00	0.05	3:00	0.19
P69	0.35	44:00:00	0.04	27:00:00	0.18
P72	0.55	68:00:00	0.01	51:00:00	0.23
P73	0.56	44:00:00	0.07	3:00	0.26
1796	0.35	44:00:00	0.04	27:00:00	0.18
1798	0.35	44:00:00	0.04	27:00:00	0.18
1800	0.23	20:00	0.00	51:00:00	0.10
1802	0.11	0:00	0.00	64:00:00	0.03
1804	0.41	44:00:00	0.00	48:00:00	0.17
1806	0.41	44:00:00	0.00	48:00:00	0.17
1808	0.48	20:00	0.02	27:00:00	0.23
1810	0.25	20:00	0.02	3:00	0.11
1812	0.00	0:00	0.00	2:00	0.00
18943	0.23	20:00	0.00	51:00:00	0.10

Table A-11: Phase 1 - MXDY + Fire flow output results (Stittsville Tank 40% full)

ID	Available Flow @Hydrant (L/s)	Available Flow @Hydrant (L/min)
D101	282	16,923
D102	449	26,929
D103	519	31,140
D104	553	33,162
D11	479	28,733
D12	463	27,801
D13	448	26,863
D15	733	43,964
D16	412	24,749
D17	550	32,974
D18	594	35,636
D19	658	39,480
D20	892	53,544
J100	614	36,867
J101	452	27,095
J102	538	32,303
J104	936	56,131
J105	313	18,808
J106	557	33,395
J107	627	37,633
J108	559	33,512
J109	925	55,528
J119	414	24,860
J120	606	36,368
J121	547	32,842
J125	418	25,083

Table A-12: Phase 1 - BSDY + Fire flow + Pipe Break output results (Stittsville Tank 40% full)

ID	No pipe break	Available Flow @ Hydrant (L/s)							
		Pipe break at location B	Pipe break at location C	Pipe break at location D	Pipe break at location E	Pipe break at location F	Pipe break at location G	Pipe break at location H	Pipe break at location J
D101	294	294	294	292	290	290	292	275	280
D102	469	469	469	465	458	457	467	422	435
D103	545	545	545	539	530	527	542	482	501
D104	574	574	574	571	565	563	572	536	548
D11	488	288	196	488	488	488	470	488	488
D12	470	213	251	470	470	470	454	470	470
D13	458	226	223	458	458	458	442	458	458
D15	767	767	767	736	713	758	759	582	556
D16	433	433	433	429	423	423	430	390	399
D17	571	571	571	561	546	550	567	476	492
D18	617	617	617	606	587	574	613	497	531
D19	686	686	686	674	651	627	682	545	593
D20	929	929	929	898	819	873	922	589	719
J100	626	174	444	626	626	626	596	626	626
J101	474	474	474	468	460	464	471	416	424
J102	550	183	357	549	549	550	527	549	549
J104	982	982	982	944	868	773	974	623	741
J105	327	327	327	324	321	323	325	302	306
J106	581	581	581	571	555	549	577	478	504
J107	661	661	661	641	620	644	655	516	517
J108	582	582	582	580	576	575	580	556	563
J109	963	963	963	930	838	749	956	594	738
J119	436	436	436	432	425	427	434	390	399
J120	638	638	638	631	618	611	635	551	578
J121	559	376	174	559	559	559	536	559	559
J125	430	173	247	430	430	430	413	430	430

Table A-13: Build Out - MXDY/PKHR Demand (Extended Period Simulation) – Fernbank Junction Head Range (with new Fernbank Elevated Storage Tank)

ID	Max.Value (m)	Max.Time (hrs)	Min.Value (m)	Min.Time (hrs)	Average (m)
56	160.8	30:00:00	155.4	44:00:00	158.8
58	160.8	30:00:00	155.6	45:00:00	158.7
60	160.8	30:00:00	155.6	0:00:00	158.7
D1	160.7	29:00:00	151.5	44:00:00	158.2
D10	160.8	29:00:00	154.4	44:00:00	158.8
D101	160.8	30:00:00	155.2	44:00:00	158.8
D102	160.8	29:00:00	154.6	44:00:00	158.8
D103	160.8	29:00:00	154.6	44:00:00	158.9
D104	160.8	29:00:00	154.4	44:00:00	159.0
D11	160.8	29:00:00	155.1	44:00:00	159.0
D12	160.8	29:00:00	155.1	44:00:00	159.1
D13	160.8	29:00:00	155.1	44:00:00	159.0
D14	160.8	29:00:00	155.1	44:00:00	159.2
D15	160.8	29:00:00	155.0	44:00:00	158.9
D16	160.8	30:00:00	154.9	44:00:00	158.8
D17	160.8	29:00:00	154.9	44:00:00	158.9
D18	160.8	29:00:00	154.9	44:00:00	159.0
D19	160.8	29:00:00	154.7	44:00:00	159.0
D2	160.7	29:00:00	151.7	44:00:00	158.2
D20	160.8	29:00:00	155.0	44:00:00	159.1
D21	161.0	29:00:00	156.4	44:00:00	159.8
D22	160.8	29:00:00	155.1	44:00:00	159.2
D23	160.8	29:00:00	155.1	44:00:00	159.2
D24	160.8	29:00:00	155.1	44:00:00	159.2
D25	160.8	29:00:00	155.1	44:00:00	159.2
D26	160.8	29:00:00	155.1	44:00:00	159.1
D27	160.8	29:00:00	155.2	44:00:00	159.2
D3	160.7	29:00:00	152.3	44:00:00	158.3
D4	160.7	29:00:00	153.6	44:00:00	158.5
D5	160.7	30:00:00	155.3	44:00:00	158.6
D6	160.7	29:00:00	153.8	44:00:00	158.6
D7	160.7	30:00:00	154.8	44:00:00	158.7
D8	160.7	30:00:00	154.3	44:00:00	158.6
D9	160.8	29:00:00	154.6	44:00:00	158.8
J100	161.0	29:00:00	156.4	44:00:00	159.8
J101	160.8	29:00:00	155.0	44:00:00	158.9
J102	161.0	29:00:00	156.2	44:00:00	159.7
J103	160.8	29:00:00	155.2	44:00:00	159.2
J104	160.8	29:00:00	154.9	44:00:00	159.0
J105	160.8	29:00:00	155.1	44:00:00	158.9
J106	160.8	29:00:00	154.9	44:00:00	159.0
J107	160.8	29:00:00	155.0	44:00:00	158.9
J108	160.8	29:00:00	154.4	44:00:00	159.1
J109	160.8	29:00:00	155.1	44:00:00	159.1
J110	160.7	30:00:00	154.9	44:00:00	158.6
J111	160.8	30:00:00	155.5	45:00:00	158.6
J112	160.7	29:00:00	154.2	44:00:00	158.6
J113	160.7	30:00:00	153.6	44:00:00	158.5
J114	160.8	29:00:00	154.4	44:00:00	158.7
J115	160.7	30:00:00	154.8	44:00:00	158.6
J116	160.7	29:00:00	151.5	44:00:00	158.2
J117	160.7	29:00:00	151.7	44:00:00	158.3
J118	160.7	29:00:00	151.6	44:00:00	158.3
J119	160.8	29:00:00	154.9	44:00:00	158.8
J120	160.8	29:00:00	154.6	44:00:00	159.0
J121	160.8	29:00:00	155.1	44:00:00	159.0
J122	160.8	29:00:00	155.1	44:00:00	159.2
J123	160.8	29:00:00	155.1	44:00:00	159.2
J124	160.8	29:00:00	155.2	44:00:00	159.2
J125	160.8	29:00:00	155.2	44:00:00	159.2

Table A-14: Build Out - MXDY/PKHR Demand (Extended Period Simulation) – Fernbank Junction Pressure Range (with new Fernbank Elevated Storage Tank)

ID	Max.Value (psi)	Max.Time (hrs)	Min.Value (psi)	Min.Time (hrs)	Average (psi)
56	74.8	30:00:00	67.2	44:00:00	72.0
58	78.6	30:00:00	71.3	45:00:00	75.6
60	76.1	30:00:00	68.8	0:00:00	73.1
D1	68.4	29:00:00	55.3	44:00:00	64.8
D10	77.5	29:00:00	68.4	44:00:00	74.6
D101	74.5	30:00:00	66.5	44:00:00	71.7
D102	85.5	29:00:00	76.7	44:00:00	82.8
D103	86.5	29:00:00	77.6	44:00:00	83.8
D104	88.8	29:00:00	79.7	44:00:00	86.2
D11	84.0	29:00:00	75.8	44:00:00	81.4
D12	84.8	29:00:00	76.6	44:00:00	82.3
D13	83.5	29:00:00	75.4	44:00:00	80.9
D14	82.6	29:00:00	74.4	44:00:00	80.2
D15	82.0	29:00:00	73.7	44:00:00	79.3
D16	82.8	30:00:00	74.5	44:00:00	80.1
D17	85.1	29:00:00	76.7	44:00:00	82.5
D18	86.3	29:00:00	77.9	44:00:00	83.7
D19	87.8	29:00:00	79.2	44:00:00	85.3
D2	67.8	29:00:00	55.0	44:00:00	64.3
D20	89.0	29:00:00	80.8	44:00:00	86.5
D21	89.2	29:00:00	82.7	44:00:00	87.5
D22	89.6	29:00:00	81.5	44:00:00	87.2
D23	85.5	29:00:00	77.3	44:00:00	83.1
D24	84.3	29:00:00	76.2	44:00:00	82.0
D25	87.2	29:00:00	79.0	44:00:00	84.8
D26	88.5	29:00:00	80.4	44:00:00	86.1
D27	91.3	29:00:00	83.3	44:00:00	89.0
D3	68.1	29:00:00	56.1	44:00:00	64.7
D4	74.4	29:00:00	64.3	44:00:00	71.3
D5	76.4	30:00:00	68.7	44:00:00	73.4
D6	76.4	29:00:00	66.5	44:00:00	73.3
D7	75.3	30:00:00	66.9	44:00:00	72.4
D8	77.0	30:00:00	67.9	44:00:00	74.0
D9	77.0	29:00:00	68.2	44:00:00	74.1
J100	86.7	29:00:00	80.2	44:00:00	85.0
J101	83.2	29:00:00	75.0	44:00:00	80.5
J102	87.4	29:00:00	80.6	44:00:00	85.6
J103	85.7	29:00:00	77.6	44:00:00	83.3
J104	87.9	29:00:00	79.5	44:00:00	85.4
J105	78.9	29:00:00	70.8	44:00:00	76.2
J106	86.1	29:00:00	77.7	44:00:00	83.5
J107	76.2	29:00:00	67.9	44:00:00	73.5
J108	89.3	29:00:00	80.2	44:00:00	86.8
J109	90.5	29:00:00	82.4	44:00:00	88.1
J110	78.5	30:00:00	70.2	44:00:00	75.5
J111	74.6	30:00:00	67.1	45:00:00	71.6
J112	75.7	29:00:00	66.4	44:00:00	72.7
J113	70.6	30:00:00	60.4	44:00:00	67.5
J114	77.1	29:00:00	68.0	44:00:00	74.2
J115	78.9	30:00:00	70.4	44:00:00	75.9
J116	69.4	29:00:00	56.4	44:00:00	65.9
J117	65.5	29:00:00	52.6	44:00:00	62.0
J118	66.4	29:00:00	53.5	44:00:00	62.9
J119	82.5	29:00:00	74.2	44:00:00	79.7
J120	86.5	29:00:00	77.6	44:00:00	83.9
J121	84.3	29:00:00	76.2	44:00:00	81.7
J122	90.4	29:00:00	82.3	44:00:00	88.0
J123	91.5	29:00:00	83.4	44:00:00	89.2
J124	87.6	29:00:00	79.5	44:00:00	85.2
J125	72.3	29:00:00	64.3	44:00:00	69.9

Table A-15: Build Out - MXDY/PKHR Demand (Extended Period Simulation) – Fernbank Pipe Flow Range (with new Fernbank Elevated Storage Tank)

ID	Max.Value (L/s)	Max.Time (hrs)	Min.Value (L/s)	Min.Time (hrs)	Average (L/s)
P4	52.27	44:00:00	14.31	27:00:00	31.00
P5	36.35	45:00:00	10.54	30:00:00	22.93
P6	68.40	22:00	22.11	5:00	44.91
P8	44.47	0:00:00	2.32	31:00:00	17.29
P9	17.28	44:00:00	2.80	3:00:00	8.63
P10	17.28	20:00	2.80	3:00:00	8.63
P11	5.72	20:00	0.11	16:00	1.25
P12	19.91	20:00	2.82	3:00	9.96
P13	19.91	20:00	2.82	3:00	9.96
P14	5.72	20:00:00	0.11	16:00	1.25
P15	23.01	0:00:00	0.91	7:00	9.73
P16	2.07	31:00:00	0.01	6:00	0.97
P17	13.45	20:00	0.42	52:00:00	5.75
P22	26.93	46:00:00	6.56	29:00:00	15.96
P24	27.22	0:00	0.15	10:00:00	8.15
P27	36.44	0:00	0.21	35:00:00	11.70
P28	31.82	0:00	0.51	41:00:00	10.85
P29	36.16	0:00:00	0.34	33:00:00	16.28
P30	36.16	0:00:00	0.34	33:00:00	16.28
P31	21.80	0:00:00	0.08	20:00:00	7.52
P32	29.80	20:00	4.44	27:00:00	12.36
P33	20.42	20:00	3.22	30:00:00	8.56
P34	27.04	0:00	4.74	55:00:00	13.86
P35	24.92	0:00	0.02	68:00:00	8.91
P36	21.90	44:00:00	6.18	29:00:00	13.35
P37	21.90	20:00	6.18	29:00:00	13.35
P38	34.91	20:00	7.64	29:00:00	18.08
P39	16.03	0:00:00	0.29	30:00:00	6.42
P40	47.42	0:00	0.26	14:00:00	15.88
P41	52.28	20:00	0.78	61:00:00	20.10
P42	62.90	44:00:00	1.03	29:00:00	25.08
P43	39.05	0:00:00	0.65	17:00:00	11.65
P44	37.83	20:00	0.31	2:00:00	13.62
P45	25.11	20:00	0.04	48:00:00	7.83
P46	47.50	20:00	0.05	4:00:00	15.62
P47	38.48	0:00	9.74	5:00	19.56
P48	32.33	0:00	6.74	30:00:00	18.13
P49	47.42	0:00	0.26	14:00:00	15.88
P50	42.18	20:00	0.53	5:00	15.37
P51	62.14	44:00:00	0.27	4:00	21.78

Table A-15 continued: Build Out - MXDY/PKHR Demand (Extended Period Simulation) – Fernbank Pipe Flow Range (with new Fernbank Elevated Storage Tank)

P52	48.16	20:00	1.23	22:00:00	17.20
P53	19.24	20:00	0.62	28:00:00	6.94
P54	20.78	0:00:00	0.07	8:00:00	5.75
P55	20.78	0:00:00	0.07	8:00:00	5.75
P56	20.78	0:00	0.07	8:00:00	5.75
P57	12.75	0:00:00	0.03	8:00:00	3.52
P58	12.75	0:00	0.03	8:00:00	3.52
P59	19.71	20:00	0.10	53:00:00	5.74
P60	27.18	20:00	0.12	5:00	8.22
P61	34.81	0:00	0.11	15:00	10.70
P62	34.69	0:00	0.04	44:00:00	10.66
P63	10.64	20:00	2.04	27:00:00	5.17
P64	21.74	0:00	0.22	64:00:00	7.47
P65	32.75	0:00	0.10	64:00:00	11.93
P66	24.92	0:00:00	0.02	68:00:00	8.91
P67	20.71	22:00	5.61	30:00:00	12.86
P68	3.13	20:00	0.86	31:00:00	1.62
P69	48.42	0:00	11.12	31:00:00	26.33
P70	6.20	20:00	1.62	2:00:00	4.41
P71	33.36	20:00	8.19	27:00:00	20.61
P72	17.10	20:00	2.63	27:00:00	8.27
P73	29.43	20:00	8.01	29:00:00	17.46
1796	32.65	46:00:00	11.46	29:00:00	21.99
1798	32.65	22:00	11.46	29:00:00	21.99
1800	68.53	46:00:00	22.27	29:00:00	42.61
1802	5.37	68:00:00	0.08	29:00:00	2.61
1804	13.16	0:00:00	3.63	30:00:00	7.69
1806	13.16	0:00:00	3.63	30:00:00	7.69
1808	38.93	0:00	0.02	33:00:00	15.27
1810	42.90	0:00:00	0.44	12:00:00	14.84
1812	17.02	68:00:00	0.01	60:00:00	6.10
18943	10.20	22:00	3.34	29:00:00	6.81
18945	58.59	0:00	18.94	29:00:00	35.79
18947	106.59	0:00	14.92	31:00:00	49.31
18949	209.94	0:00	1.21	8:00:00	67.75
18951	223.67	0:00	0.76	17:00	68.48
18953	241.91	0:00	0.48	6:00	79.94
18955	241.91	0:00:00	0.48	54:00:00	79.94
18957	241.91	0:00:00	0.48	54:00:00	79.94
18959	341.88	0:00	2.40	16:00	116.20
18961	114.78	20:00	3.17	29:00:00	45.18

Table A-16: Build Out - MXDY/PKHR Demand (Extended Period Simulation) – Fernbank Pipe Velocity Range (with new Fernbank Elevated Storage Tank)

ID	Max.Value (m/s)	Max.Time (hrs)	Min.Value (m/s)	Min.Time (hrs)	Average (m/s)
P4	0.72	20:00	0.20	27:00:00	0.42
P5	0.50	21:00	0.14	30:00:00	0.31
P6	0.94	22:00	0.30	29:00:00	0.61
P8	0.61	0:00:00	0.03	31:00:00	0.24
P9	0.24	20:00	0.04	3:00	0.12
P10	0.24	44:00:00	0.04	3:00:00	0.12
P11	0.08	20:00:00	0.00	40:00:00	0.02
P12	0.27	20:00	0.04	3:00:00	0.14
P13	0.27	20:00	0.04	3:00:00	0.14
P14	0.08	20:00	0.00	40:00:00	0.02
P15	0.31	0:00	0.01	31:00:00	0.13
P16	0.03	31:00:00	0.00	6:00:00	0.01
P17	0.18	20:00	0.01	52:00:00	0.08
P22	0.37	22:00	0.09	29:00:00	0.22
P24	0.37	0:00:00	0.00	10:00:00	0.11
P27	0.50	0:00	0.00	35:00:00	0.16
P28	0.44	0:00	0.01	41:00:00	0.15
P29	0.49	0:00:00	0.00	33:00:00	0.22
P30	0.49	0:00:00	0.00	33:00:00	0.22
P31	0.30	0:00	0.00	20:00:00	0.10
P32	0.41	20:00	0.06	27:00:00	0.17
P33	0.28	20:00	0.04	30:00:00	0.12
P34	0.37	0:00	0.06	7:00	0.19
P35	0.34	0:00	0.00	68:00:00	0.12
P36	0.30	20:00	0.08	29:00:00	0.18
P37	0.30	20:00	0.08	5:00	0.18
P38	0.48	44:00:00	0.10	5:00	0.25
P39	0.22	0:00	0.00	30:00:00	0.09
P40	0.65	0:00:00	0.00	14:00:00	0.22
P41	0.72	68:00:00	0.01	61:00:00	0.28
P42	0.86	20:00	0.01	29:00:00	0.34
P43	0.53	0:00:00	0.01	17:00:00	0.16
P44	0.52	20:00	0.00	2:00:00	0.19
P45	0.34	20:00	0.00	48:00:00	0.11
P46	0.65	20:00	0.00	4:00	0.21
P47	0.53	0:00	0.13	5:00	0.27
P48	0.44	0:00	0.09	30:00:00	0.25
P49	0.65	0:00	0.00	14:00:00	0.22
P50	0.58	20:00	0.01	29:00:00	0.21
P51	0.85	44:00:00	0.00	28:00:00	0.30

Table A-16 continued: Build Out - MXDY/PKHR Demand (Extended Period Simulation) – Fernbank Pipe Velocity Range (with new Fernbank Elevated Storage Tank)

P52	0.66	20:00	0.02	22:00:00	0.24
P53	0.26	20:00	0.01	28:00:00	0.10
P54	0.28	0:00	0.00	8:00:00	0.08
P55	0.28	0:00	0.00	8:00:00	0.08
P56	0.28	0:00	0.00	8:00:00	0.08
P57	0.17	0:00	0.00	8:00:00	0.05
P58	0.17	0:00	0.00	8:00:00	0.05
P59	0.27	44:00:00	0.00	53:00:00	0.08
P60	0.37	44:00:00	0.00	29:00:00	0.11
P61	0.48	0:00:00	0.00	15:00:00	0.15
P62	0.47	0:00:00	0.00	44:00:00	0.15
P63	0.15	68:00:00	0.03	27:00:00	0.07
P64	0.30	0:00	0.00	64:00:00	0.10
P65	0.45	0:00:00	0.00	64:00:00	0.16
P66	0.34	0:00:00	0.00	68:00:00	0.12
P67	0.28	22:00	0.08	30:00:00	0.18
P68	0.04	20:00	0.01	31:00:00	0.02
P69	0.66	0:00	0.15	31:00:00	0.36
P70	0.08	20:00	0.02	2:00:00	0.06
P71	0.46	20:00	0.11	3:00	0.28
P72	0.23	20:00	0.04	3:00	0.11
P73	0.40	44:00:00	0.11	29:00:00	0.24
1796	0.45	46:00:00	0.16	29:00:00	0.30
1798	0.45	46:00:00	0.16	29:00:00	0.30
1800	0.94	46:00:00	0.30	29:00:00	0.58
1802	0.07	20:00	0.00	5:00	0.04
1804	0.18	0:00:00	0.05	30:00:00	0.11
1806	0.18	0:00:00	0.05	30:00:00	0.11
1808	0.53	0:00	0.00	33:00:00	0.21
1810	0.59	0:00	0.01	12:00	0.20
1812	0.23	20:00	0.00	12:00	0.08
18943	0.14	22:00	0.05	5:00	0.09
18945	0.20	0:00:00	0.06	5:00	0.12
18947	0.36	0:00:00	0.05	7:00	0.17
18949	0.72	0:00:00	0.00	8:00	0.23
18951	0.77	0:00	0.00	65:00:00	0.23
18953	0.83	0:00:00	0.00	54:00:00	0.27
18955	0.83	0:00	0.00	54:00:00	0.27
18957	0.83	0:00	0.00	54:00:00	0.27
18959	1.17	0:00	0.01	16:00:00	0.40
18961	0.89	44:00:00	0.02	29:00:00	0.35

Table A-17: Build Out - MXDY Steady State Fire flow output results (new Fernbank Tank at 40% full)

ID	Available Flow @Hydrant (L/s)	Available Flow @Hydrant (L/min)
D1	358	21,486
D10	890	53,418
D101	2553	153,181
D102	635	38,107
D103	658	39,453
D104	598	35,882
D11	792	47,507
D12	1010	60,605
D13	2015	120,876
D14	561	33,677
D15	956	57,366
D16	966	57,944
D17	632	37,946
D18	674	40,465
D19	755	45,321
D2	462	27,711
D20	1062	63,692
D21	989	59,359
D22	663	39,778
D23	615	36,919
D24	569	34,115
D25	644	38,665
D26	1002	60,145
D27	1044	62,613
D3	491	29,444
D4	737	44,226
D5	825	49,508
D6	709	42,569
D7	731	43,885
D8	745	44,695
D9	716	42,976
J100	924	55,459
J101	1051	63,066
J102	1141	68,482
J103	678	40,692
J104	1178	70,704
J105	2640	158,412
J106	631	37,868
J107	874	52,461
J108	589	35,353
J109	1105	66,271
J110	777	46,597
J111	1612	96,708
J112	872	52,335
J113	887	53,243
J114	944	56,628
J115	862	51,691
J116	337	20,239
J117	404	24,241
J118	393	23,589
J119	775	46,478
J120	739	44,336
J121	1780	106,809
J122	1161	69,641
J123	714	42,860
J124	727	43,598
J125	1012	60,699

APPENDIX B

Storm Drainage

Tables

TABLE B-1: POND 1 - STORM SEWER DESIGN SHEET (2031)
FERNBANK CDP LANDS

LOCATION			AREA										FLOW							PROPOSED SEWER							
Location	From Node	To Node	Mixed Use 0.80	Comm-ercial 0.80	Major Road 0.70	Schools 0.60	Medium Density 0.60	Low Density 0.50	Parks 0.40	Open Space 0.20	Total Area (ha)	Weighted Runoff Coefficient	Indiv 2.78 AR	Accum 2.78 AR	Time of Conc. (min)	Rain Intensity (mm/hr) 5yr	Rain Intensity (mm/hr) 10yr	Peak Flow (Q) (l/s)	Total Peak Flow (Q) (l/s)	Pipe Type	Size (mm)	Grade (%)	Length (m)	Capacity (l/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q/Qfull (%)
Outlet 1																											
P1-1	107	105	3.93								3.93	0.80	8.74	8.74	15.00	83.6		730.3	**730.3**	CONC	**975**	**0.15**	137	917.5	1.19	1.92	79.6%
P1-2	105	103					3.75	0.91			4.66	0.58	7.52	16.26	16.92	77.8		1265.6	**1265.6**	CONC	**1200**	**0.15**	154	1575.3	1.35	1.91	80.3%
															18.82												
P1-3	109	103					4.17	2.86	0.81		7.84	0.54	11.83	11.83	15.00	83.6		988.6	**1377.1**	CONC	**1200**	**0.20**	307	1819.0	1.56	3.28	75.7%
					2.04	**<-Arterial (10yr)**					2.04	0.70	3.97	3.97	15.00		97.9	388.5									
															18.28												
P1-4	103	101					1.55	3.15			4.70	0.53	6.96	35.06	18.82	72.9		2557.2	**2896.1**	CONC	**1650**	**0.30**	77	5208.0	2.36	0.54	55.6%
													0.00	3.97	18.82		85.4	338.9									
	101	POND									0.00		0.00	35.06	19.37	71.7		2512.6	**2845.6**	CONC	**1650**	**0.30**	48	5208.0	2.36	0.34	54.6%
													0.00	3.97	19.37		83.9	333.0									
											23.17				**19.70**				**122.8**	**L/s/ha**							
Outlet 2																											
*GR-SWMF	123	121																**2000.0**	**2000.0**	CONC	**1500**	**0.15**	311	2856.1	1.57	3.31	70.0%
P1-5	121	119	7.13		0.82	6.09				1.60	15.64	0.66	28.50	28.50	15.00	83.6		4381.4	**4739.4**	CONC	**1950**	**0.20**	394	6638.9	2.15	3.05	71.4%
					1.88	**<-Arterial (10yr)**					1.88	0.70	3.66	3.66	15.00		97.9	358.0									
P1-6	119	117					2.57	1.07	0.81	1.16	5.61	0.47	7.32	35.82	18.05	74.9		4681.3	**5235.4**	CONC	**1950**	**0.25**	236	7422.5	2.41	1.63	70.5%
					1.37	**<-Arterial (10yr)**					1.37	0.70	2.67	6.32	18.05		87.6	554.1									
P1-7	117	115		0.61			4.03	1.93			6.57	0.59	10.76	46.58	19.68	71.0		5305.5	**6052.1**	CONC	**2100**	**0.35**	107	10701.4	2.99	0.60	56.6%
					1.37	**<-Arterial (10yr)**					1.37	0.70	2.67	8.99	19.68		83.0	746.6									
P1-8	115	111			0.30		2.36	1.21			3.87	0.58	6.20	52.78	20.28	69.7		5676.4	**6409.2**	CONC	**2100**	**0.25**	196	9044.4	2.53	1.29	70.9%
													0.00	8.99	20.28		81.5	732.8									
															21.57												
P1-9	113	111				3.04	2.06	7.53	0.80		13.43	0.53	19.86	19.86	15.00	83.6		1659.7	**1659.7**	CONC	**1350**	**0.15**	236	2156.5	1.46	2.70	77.0%
															17.70												
P1-15	111	POND			0.52			3.70			4.22	0.52	6.15	78.80	21.57	67.0		7278.9	**7983.6**	CONC	**2100**	**0.40**	48	11440.3	3.20	0.25	69.8%
													0.00	8.99	21.57		78.4	704.7									
											53.96				**21.82**				**110.9**	**L/s/ha**							
POND TOTAL			**11.06**	**0.61**	**8.30**	**9.13**	**20.49**	**22.36**	**2.42**	**2.76**	**77.13**	**0.59**							**114.5**	**L/s/ha**		**NET FLOW (Less Open Space) =**		**118.72**	**L/s/ha**		

Q = 2.78 AIR WHERE : Q = PEAK FLOW IN LITRES PER SECOND (L/s)
A = AREA IN HECTARES (ha)
I = RAINFALL INTENSITY IN MILLIMETERS PER HOUR (mm/hr)
R =WEIGHTED RUNOFF COEFFICIENT
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)

$Q = (1/n)\ A\ R^{(2/3)}S_o^{(1/2)}$ WHERE : Q = CAPACITY (L/s)
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)
A = FLOW AREA (m^2)
R = HYDRAULIC RADIUS (m)
S_o = SLOPE OF HYDRAULIC GRADE LINE (m/m)

Project: Fernbank CDP (101108)
Designed: KJM
Checked: MAB
Dwg. Reference: 101108-STM1
Date: May 8, 2009

NOTES:

1) 2000 L/s (100yr storm) is to be conveyed from the Granite Ridge SWMF to Pond 1
2) Blue Text = Arterial Roadway (Minor system designed to convey a 1:10 year storm)
3) Red Text = Elliptical Pipe with Equivalent Flow Capacity

TABLE B-2: POND 1 - STORM SEWER HYDRAULIC GRADE LINE ANALYSIS (100-YR EVENT)
FERNBANK CDP LANDS

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The HGL slope is calculated and the minimum USF is established +0.30m above the HGL.

Bend Coefficients			
0	45	90	<----Bend (in degrees)
0.00	0.29	1.02	900 mm pipe or greater (benched)
0.00	0.40	1.32	825 mm pipe or smaller (sump)

MANHOLE		INVERT ELEV.		OBVERT ELEV.		GROUND ELEV.	COVER	PIPE PARAMETERS				TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			PIPE
U/S	D/S	U/S	D/S	U/S	D/S	U/S	U/S	Dia (N)	Dia (A)	Length	'n'				Pipe		Friction	Velocity		HL	U/S	U/S	D/S	Slope	Slope
		(m)	(m)	(m)	(m)	(m)	(m)	(mm)	(mm)	(m)		(m^3/s)	(m^3/s)		Area (m^2)	L/D	Factor (f)	V (m/s)	$V^2/2g$	(m)	(m)	(m)	(m)	(%)	(%)
Outlet 1																						**99.50**	<- 100yr POND LEVEL		
101	POND	97.80	97.66	99.14	99.00	101.20	2.06	1650	1340	48	0.013	2.805	5.208	0.54	2.300	29	0.01782	1.22	0.08	0.05	0.41	99.55	99.50	0.10%	0.30%
103	101	98.03	97.80	99.37	99.14	101.40	2.03	1650	1340	77	0.013	2.805	5.208	0.54	2.300	46	0.01782	1.22	0.08	0.17	0.35	99.72	99.55	0.22%	0.30%
109	103	98.78	98.17	99.98	99.37	102.50	2.52	1200	1219	307	0.013	1.200	1.814	0.66	1.167	252	0.01981	1.03	0.05	0.28	0.02	100.00	99.72	0.09%	0.20%
105	103	98.40	98.17	99.60	99.37	101.65	2.05	1200	1219	154	0.013	1.112	1.570	0.71	1.167	127	0.01981	0.95	0.05	0.13	0.25	99.85	99.72	0.09%	0.15%
107	105	98.83	98.63	99.81	99.61	101.85	2.05	975	991	137	0.013	0.590	0.894	0.66	0.771	138	0.02123	0.76	0.03	0.09	0.14	99.95	99.85	0.07%	0.15%
Outlet 2																									
111	POND	97.80	97.61	99.90	99.71	102.00	2.10	2100	2134	48	0.013	8.227	11.404	0.72	3.575	22	0.01644	2.30	0.27	0.22	0.03	99.93	99.71	0.46%	0.40%
113	111	98.90	98.55	100.25	99.90	102.60	2.35	1350	1372	236	0.013	1.396	2.143	0.65	1.478	172	0.01905	0.94	0.05	0.16	0.00	100.25	99.93	0.14%	0.15%
115	111	98.29	97.80	100.39	99.90	102.60	2.21	2100	2134	196	0.013	6.387	9.047	0.71	3.575	92	0.01644	1.79	0.16	0.27	0.00	100.39	99.93	0.24%	0.25%
117	115	98.66	98.29	100.76	100.39	102.80	2.04	2100	2134	107	0.013	5.951	10.632	0.56	3.575	50	0.01644	1.66	0.14	0.29	0.00	100.76	100.39	0.35%	0.35%
119	117	99.40	98.81	101.35	100.76	103.40	2.05	1950	1981	236	0.013	4.949	7.423	0.67	3.083	119	0.01685	1.61	0.13	0.29	0.00	101.35	100.76	0.25%	0.25%
121	119	100.19	99.40	102.14	101.35	104.15	2.01	1950	1981	394	0.013	4.237	6.651	0.64	3.083	199	0.01685	1.37	0.10	0.46	0.00	102.14	101.35	0.20%	0.20%
123	121	101.11	100.64	102.61	102.14	103.00	0.39	1500	1524	311	0.013	2.000	2.868	0.70	1.824	204	0.01839	1.10	0.06	0.30	0.00	102.61	102.14	0.15%	0.15%

MANHOLE LOSS								
Diameter (mm)			Bend					HL_{MH}
U/S MH	Pipe In	Pipe Out	Angle	K_O	C_D	K_b	K_{tot}	(m)
2400	1650	1650	0	0.15	1.00	0.00	**0.15**	0.01
2400	1200	1650	90	0.15	2.60	1.02	**1.40**	0.11
2400	1050	1200	0	0.20	1.49	0.00	**0.30**	0.02
2400	975	1200	0	0.20	1.86	0.00	**0.37**	0.02
1800	900	975	0	0.18	1.27	0.00	**0.23**	0.01
3000	1950	1950	45	0.15	1.00	0.29	**0.44**	0.12
2400	1200	1350	0	0.18	1.42	0.00	**0.25**	0.01
3000	1950	1950	0	0.15	1.00	0.00	**0.15**	0.03
3000	1800	1950	90	0.15	1.27	1.02	**1.22**	0.17
3000	1800	1800	0	0.17	1.00	0.00	**0.17**	0.02
3000	1350	1800	90	0.17	2.37	1.02	**1.42**	0.14
2400	1350	1350	90	0.18	1.00	1.02	**1.20**	0.07

DESIGN PARAMETERS

DOWNSTREAM WATER LEVEL in Pond '1' =99.25m
RETURN FREQUENCY = 5 YEARS
MINIMUM VELOCITY= 0.80 m/s
MANNING'S n= 0.013
MIN. HGL CLEARANCE to Underside of Footing (USF) = 0.30m

HGL=Major + Minor Losses
Major Loss= Pipe Friction (Darcy-Weisbach)
Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends
Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6
Elliptical Pipe Actual Diameter shown as Actual Rise

Designed: KJM	PROJECT: Fernbank CDP
Checked: MAB	CLIENT:
Dwg. Reference: 101108-STM1	Date: May 8, 2009

NOTES:

1) Red Text = Elliptical Pipes:
Dia (N) = Equivalent Pipe Size
Dia (A) = Elliptical Pipe Rise

TABLE B-3: POND 2 - STORM SEWER DESIGN SHEET (2031)
FERNBANK CDP LANDS

LOCATION			AREA								FLOW					PROPOSED SEWER							
Location	From Node	To Node	Mixed Use 0.80	Major Road 0.70	Schools 0.60	Medium Density 0.60	Low Density 0.50	Parks 0.40	Total Area (ha)	Weighted Runoff Coefficient	Indiv 2.78 AR	Accum 2.78 AR	Time of Conc. (min)	Rain Intensity (mm/hr)	Peak Flow (Q) (l/s)	Pipe Type	Size (mm)	Grade (%)	Length (m)	Capacity (l/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q/Qfull (%)
P2-1	207	205	3.71	0.31					4.02	0.79	8.85	8.85	15.00	83.6	739.8	CONC	**900**	**0.23**	193	905.7	1.38	2.33	81.7%
P2-2	205	203		0.58		3.63	1.23		5.44	0.59	8.89	17.75	17.33	76.7	1361.6	CONC	**1050**	**0.45**	154	1911.0	2.14	1.20	71.2%
P2-3	203	201		0.41			4.93	0.80	6.14	0.50	8.54	26.29	18.53	73.7	1936.4	CONC	**1200**	**0.80**	118	3637.9	3.12	0.63	53.2%
													19.15										
P2-4	209	201	3.31				4.23		7.54	0.63	13.24	13.24	15.00	83.6	1106.4	CONC	**1200**	**0.15**	282	1575.3	1.35	3.48	70.2%
													18.48										
	201	POND									0.00	39.53	19.15	72.2	2852.6	CONC	**1500**	**0.50**	80	5214.6	2.86	0.47	54.7%
													19.62										
POND TOTAL			**7.02**	**1.30**	**0.00**	**3.63**	**10.39**	**0.80**	**23.14**	**0.61**					**123.3**	**L/s/ha**			**NET FLOW (Less Open Space) =**			**123.28**	**L/s/ha**

Q = 2.78 AIR WHERE : Q = PEAK FLOW IN LITRES PER SECOND (L/s)
A = AREA IN HECTARES (ha)
I = RAINFALL INTENSITY IN MILLIMETERS PER HOUR (mm/hr)
R =WEIGHTED RUNOFF COEFFICIENT
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)

$Q = (1/n)\ A\ R^{(2/3)}S_o^{(1/2)}$ WHERE : Q = CAPACITY (L/s)
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)
A = FLOW AREA (m^2)
R = HYDRAULIC RADIUS (m)
S_o = SLOPE OF HYDRAULIC GRADE LINE (m/m)

Project: Fernbank CDP (101108)
Designed: KJM
Checked: MAB
Dwg. Reference: 101108-STM1
Date: May 8, 2009

NOTES:
1) Red Text = Elliptical Pipe with Equivalent Flow Capacity

TABLE B-4: POND 2 - STORM SEWER HYDRAULIC GRADE LINE ANALYSIS (100-YR EVENT)
FERNBANK CDP LANDS

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The HGL slope is calculated and the minimum USF is established +0.30m above the HGL.

Bend Coefficients			
0	45	90	<----Bend (in degrees)
0.00	0.29	1.02	900 mm pipe or greater (benched)
0.00	0.40	1.32	825 mm pipe or smaller (sump)

MANHOLE		INVERT ELEV.		OBVERT ELEV.		GROUND ELEV.	COVER	PIPE PARAMETERS				TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			PIPE
U/S	D/S	U/S (m)	D/S (m)	U/S (m)	D/S (m)	U/S (m)	U/S (m)	Dia (N) (mm)	Dia (A) (mm)	Length (m)	'n'	(m^3/s)	(m^3/s)		Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	U/S (m)	U/S (m)	D/S (m)	Slope (%)	Slope (%)
																						95.20	**<- 100yr POND LEVEL**		
201	POND	93.45	93.05	94.67	94.27	98.15	3.48	1500	1220	80	0.013	2.754	4.490	0.61	1.824	49	0.01839	1.51	0.12	0.27	0.80	95.47	95.20	0.33%	0.50%
209	201	93.89	93.47	95.09	94.67	97.50	2.41	1200	1219	282	0.013	0.920	1.569	0.59	1.167	231	0.01981	0.79	0.03	0.19	0.57	95.66	95.47	0.07%	0.15%
203	201	95.26	93.47	96.46	94.67	98.90	2.44	1200	1219	118	0.013	1.834	5.020	0.37	1.167	96	0.01981	1.57	0.13	0.42	0.00	96.46	95.47	0.84%	1.52%
205	203	96.10	95.41	97.15	96.46	99.35	2.20	1050	1067	154	0.013	1.226	1.910	0.64	0.894	144	0.02071	1.37	0.10	0.41	0.00	97.15	96.46	0.45%	0.45%
207	205	96.69	96.25	97.59	97.15	99.65	2.06	900	914	193	0.013	0.601	0.902	0.67	0.657	211	0.02181	0.92	0.04	0.21	0.00	97.59	97.15	0.23%	0.23%

MANHOLE LOSS								
Diameter (mm)			Bend					HL_{MH}
U/S MH	Pipe In	Pipe Out	Angle	K_O	C_D	K_b	K_{tot}	(m)
3000	1200	1500	90	0.20	1.95	1.02	**1.41**	0.16
3000	1050	1200	90	0.25	1.49	1.02	**1.39**	0.04
3000	1050	1200	90	0.25	1.49	1.02	**1.39**	0.18
2400	1050	1050	90	0.23	1.00	1.02	**1.25**	0.12
1800	900	1050	0	0.17	1.59	0.00	**0.27**	0.01

DESIGN PARAMETERS

DOWNSTREAM WATER LEVEL in Pond '2' = 95.60m
RETURN FREQUENCY = 5 YEARS
MINIMUM VELOCITY= 0.80 m/s
MANNING'S n= 0.013
MIN. HGL CLEARANCE to Underside of Footing (USF) = 0.30m

HGL=Major + Minor Losses
Major Loss= Pipe Friction (Darcy-Weisbach)
Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends
Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6
Elliptical Pipe Actual Diameter shown as Actual Rise

Designed: KJM
Checked: MAB
Dwg. Reference: 101108-STM1

PROJECT: Fernbank CDP
CLIENT:
Date: May 8, 2009

NOTES:

1) Red Text = Elliptical Pipes:
Dia (N) = Equivalent Pipe Size
Dia (A) = Elliptical Pipe Rise

TABLE B-5: POND 3 - STORM SEWER DESIGN SHEET (2031)
FERNBANK CDP LANDS

LOCATION			AREA									FLOW					PROPOSED SEWER							
Location	From Node	To Node	High Density 0.70	Major Road 0.70	Schools 0.60	Medium Density 0.60	Low Density 0.50	Parks 0.40	Open Space 0.20	Total Area (ha)	Weighted Runoff Coefficient	Indiv 2.78 AR	Accum 2.78 AR	Time of Conc. (min)	Rain Intensity (mm/hr)	Peak Flow (Q) (l/s)	Pipe Type	Size (mm)	Grade (%)	Length (m)	Capacity (l/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q/Qfull (%)
Outlet 2																								
P3-1	321	POND		0.60			6.77	1.00	1.41	9.78	0.46	12.47	12.47	15.00	83.6	1042.3	CONC	1200	**0.10**	375	1286.2	1.10	5.67	81.0%
										9.78				**20.67**		**106.6**	**L/s/ha**							
Outlet 1																								
P3-2	315	313		0.21		5.29			4.47	9.97	0.42	11.72	11.72	15.00	83.6	979.1	CONC	**975**	**0.30**	351	1280.5	1.66	3.52	76.5%
P3-3	131	303		2.52			5.78	8.90		17.20	0.48	22.83	34.55	18.52	73.7	2545.6	CONC	**1500**	**0.23**	259	3536.7	1.94	2.22	72.0%
														20.75										
P3-4	311	309	5.04	1.10		4.15			3.41	13.70	0.55	20.77	20.77	15.00	83.6	1735.2	CONC	**1200**	**0.30**	477	2227.8	1.91	4.17	77.9%
P3-5	309	307		1.14		2.31	3.82			7.27	0.56	11.38	32.15	19.17	72.1	2319.1	CONC	**1350**	**0.34**	102	3246.8	2.20	0.77	71.4%
P3-6	307	305		0.57			8.71			9.28	0.51	13.22	45.36	19.94	70.4	3192.9	CONC	**1350**	**0.50**	229	3937.3	2.66	1.43	81.1%
P3-7	305	303					6.77			6.77	0.50	9.41	54.77	21.37	67.4	3690.7	CONC	**1350**	**0.60**	164	4313.1	2.92	0.94	85.6%
														22.31										
P3-8	319	317		1.63	2.84		3.33	3.41		11.21	0.52	16.33	16.33	15.00	83.6	1364.5	CONC	**900**	**0.70**	142	1580.1	2.41	0.98	86.4%
P3-9	317	303		1.21			5.29			6.50	0.54	9.71	26.04	15.98	80.5	2096.5	CONC	**1500**	**0.15**	352	2856.1	1.57	3.74	73.4%
														19.72										
	303	301								0.00		0.00	115.36	22.31	65.6	7563.2	CONC	**2100**	**0.30**	41	9907.6	2.77	0.25	76.3%
	301	POND								0.00		0.00	115.36	22.56	65.1	7510.0	CONC	**2100**	**0.30**	39	9907.6	2.77	0.23	75.8%
										81.90		0.00		**22.79**		**91.7**	**L/s/ha**							
POND TOTAL			**5.04**	**8.98**	**2.84**	**11.75**	**40.47**	**13.31**	**9.29**	**91.68**	**0.50**					**93.3**	**L/s/ha**			**NET FLOW (Less Open Space) =**			**103.80**	**L/s/ha**

Q = 2.78 AIR WHERE : Q = PEAK FLOW IN LITRES PER SECOND (L/s)
A = AREA IN HECTARES (ha)
I = RAINFALL INTENSITY IN MILLIMETERS PER HOUR (mm/hr)
R =WEIGHTED RUNOFF COEFFICIENT
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)

$Q = (1/n)\ A\ R^{(2/3)}S_o^{(1/2)}$ WHERE : Q = CAPACITY (L/s)
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)
A = FLOW AREA (m^2)
R = HYDRAULIC RADIUS (m)
S_o = SLOPE OF HYDRAULIC GRADE LINE (m/m)

Project: Fernbank CDP (101108)
Designed: KJM
Checked: MAB
Dwg. Reference: 101108-STM1
Date: May 8, 2009

NOTES:
1) Red Text = Elliptical Pipe with Equivalent Flow Capacity

TABLE B-6: POND 3 - STORM SEWER HYDRAULIC GRADE LINE ANALYSIS (100-YR EVENT)
FERNBANK CDP LANDS

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The HGL slope is calculated and the minimum USF is established +0.30m above the HGL.

Bend Coefficients			
0	45	90	<----Bend (in degrees)
0.00	0.29	1.02	900 mm pipe or greater (benched)
0.00	0.40	1.32	825 mm pipe or smaller (sump)

MANHOLE		INVERT ELEV.		OBVERT ELEV.		GROUND ELEV.	COVER	PIPE PARAMETERS				TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			PIPE
U/S	D/S	U/S (m)	D/S (m)	U/S (m)	D/S (m)	U/S (m)	U/S (m)	Dia (N) (mm)	Dia (A) (mm)	Length (m)	'n'	(m^3/s)	(m^3/s)		Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	U/S (m)	U/S (m)	D/S (m)	Slope (%)	Slope (%)
Outlet 1																						**95.60**	<- 100yr POND LEVEL		
301	POND	93.90	93.78	95.61	95.49	97.80	2.19	2100	1705	39	0.013	7.780	9.908	0.79	4.870	18	0.01644	1.60	0.13	0.09	0.09	95.69	95.60	0.25%	0.30%
303	301	94.02	93.90	95.73	95.61	97.95	2.22	2100	1705	41	0.013	7.780	9.908	0.79	4.870	19	0.01644	1.60	0.13	0.22	0.19	95.92	95.69	0.55%	0.30%
317	303	94.76	94.28	96.26	95.78	98.45	2.19	1500	1524	352	0.013	1.839	2.750	0.67	1.824	231	0.01839	1.01	0.05	0.26	0.00	96.26	95.92	0.10%	0.14%
319	317	96.35	95.36	97.25	96.26	99.50	2.25	900	914	142	0.013	1.135	1.579	0.72	0.657	155	0.02181	1.73	0.15	0.55	0.00	97.25	96.26	0.70%	0.70%
305	303	95.36	94.38	96.71	95.73	99.10	2.39	1350	1372	164	0.013	3.736	4.300	0.87	1.478	120	0.01905	2.53	0.33	0.81	0.02	96.73	95.92	0.50%	0.60%
307	305	96.51	95.36	97.86	96.71	100.10	2.24	1350	1372	229	0.013	3.059	3.948	0.77	1.478	167	0.01905	2.07	0.22	0.96	0.00	97.86	96.73	0.49%	0.50%
309	307	96.85	96.51	98.20	97.86	100.40	2.20	1350	1372	102	0.013	2.105	3.232	0.65	1.478	74	0.01905	1.42	0.10	0.28	0.00	98.20	97.86	0.34%	0.34%
311	309	98.43	97.00	99.63	98.20	102.40	2.77	1200	1219	477	0.013	1.292	2.227	0.58	1.167	391	0.01981	1.11	0.06	0.50	0.00	99.63	98.20	0.30%	0.30%
313	303	94.82	94.23	96.32	95.73	98.35	2.03	1500	1524	259	0.013	2.205	3.522	0.63	1.824	170	0.01839	1.21	0.07	0.28	0.00	96.32	95.92	0.15%	0.23%
315	313	96.40	95.35	97.38	96.32	99.90	2.53	975	991	351	0.013	0.639	1.282	0.50	0.771	354	0.02123	0.83	0.04	0.27	0.00	97.38	96.32	0.30%	0.30%
Outlet 2																									
321	301	94.24	93.87	95.44	95.07	97.00	1.56	1200	975	375	0.013	0.834	1.286	0.65	1.131	312	0.01981	0.74	0.03	0.21	0.37	95.81	95.60	0.06%	0.10%

MANHOLE LOSS								
Diameter (mm)			Bend Angle	K_O	C_D	K_b	K_{tot}	HL_{MH} (m)
U/S MH	Pipe In	Pipe Out						
3000	2100	2100	45	0.14	1.00	0.29	**0.43**	0.06
3000	1500	2100	90	0.14	2.74	1.02	**1.41**	0.18
2400	900	1500	0	0.16	4.63	0.00	**0.74**	0.04
1800	825	900	0	0.20	1.30	0.00	**0.26**	0.04
2400	1350	1500	0	0.16	1.37	0.00	**0.22**	0.07
2400	1350	1350	90	0.18	1.00	1.02	**1.20**	0.26
2400	1200	1350	90	0.18	1.42	1.02	**1.27**	0.13
2400	1050	1200	0	0.20	1.49	0.00	**0.30**	0.02
2400	975	1500	0	0.16	3.64	0.00	**0.58**	0.04
1800	900	975	0	0.18	1.27	0.00	**0.23**	0.01
2400	1050	1200	90	0.20	1.49	1.02	**1.32**	0.04

DESIGN PARAMETERS

DOWNSTREAM WATER LEVEL in Pond '3' = 95.60m
RETURN FREQUENCY = 5 YEARS
MINIMUM VELOCITY= 0.80 m/s
MANNING'S n= 0.013
MIN. HGL CLEARANCE to Underside of Footing (USF) = 0.30m

HGL=Major + Minor Losses
Major Loss= Pipe Friction (Darcy-Weisbach)
Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends
Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6
Elliptical Pipe Actual Diameter shown as Actual Rise

Designed: KJM
Checked: MAB
Dwg. Reference: 101108-STM1

PROJECT: Fernbank CDP
CLIENT:
Date: May 8, 2009

NOTES:

1) Red Text = Elliptical Pipes:
Dia (N) = Equivalent Pipe Size
Dia (A) = Elliptical Pipe Rise

TABLE B-7: POND 4 - STORM SEWER DESIGN SHEET (2031)
FERNBANK CDP LANDS

LOCATION			AREA								FLOW					PROPOSED SEWER							
Location	From Node	To Node	Major Road 0.70	Schools 0.60	Medium Density 0.60	Low Density 0.50	Parks 0.40	Open Space 0.20	Total Area (ha)	Weighted Runoff Coefficient	Indiv 2.78 AR	Accum 2.78 AR	Time of Conc. (min)	Rain Intensity (mm/hr)	Peak Flow (Q) (l/s)	Pipe Type	Size (mm)	Grade (%)	Length (m)	Capacity (l/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q/Qfull (%)
Outlet 1																							
P4-1	407	405	0.74			7.60	0.36		8.70	0.51	12.40	12.40	15.00	83.6	1036.5	CONC	**750**	**1.00**	82	1161.4	2.55	0.53	89.2%
P4-2	405	403				5.06			5.06	0.50	7.03	19.44	15.53	81.9	1591.4	CONC	**825**	**1.50**	136	1834.1	3.32	0.68	86.8%
P4-3	403	401	0.28		1.57	0.87	1.04		3.76	0.53	5.53	24.97	16.22	79.8	1993.0	CONC	**1200**	**0.50**	241	2876.0	2.46	1.63	69.3%
													17.84										
P4-4	413	411				9.42	0.46	0.32	10.20	0.49	13.78	13.78	15.00	83.6	1151.7	CONC	**900**	**0.60**	378	1462.9	2.23	2.83	78.7%
P4-5	411	409	1.75	2.44		1.02		4.35	9.56	0.43	11.31	25.10	17.83	75.4	1892.3	CONC	**1200**	**0.40**	314	2572.4	2.20	2.38	73.6%
P4-6	409	401	0.58		4.55	0.20			5.33	0.61	9.00	34.09	20.21	69.8	2379.7	CONC	**1350**	**0.40**	154	3521.6	2.38	1.08	67.6%
													21.28										
	401	POND							0.00		0.00	59.06	21.28	67.6	3989.8	CONC	**1650**	**0.30**	71	5208.0	2.36	0.50	76.6%
									42.61		0.00		**21.78**		**93.6**	**L/s/ha**							
Outlet 2																							
P4-7	417	415	0.81	2.43		6.50			9.74	0.54	14.66	14.66	15.00	83.6	1225.3	CONC	**825**	**1.20**	190	1640.4	2.97	1.07	74.7%
													16.07										
P4-8	419	415				5.59			5.59	0.50	7.77	7.77	15.00	83.6	649.2	CONC	**975**	**0.15**	81	905.5	1.17	1.15	71.7%
													16.15										
	415	POND							0.00		0.00	22.43	16.15	80.0	1794.8	CONC	**1500**	**0.30**	63	4039.2	2.21	0.47	44.4%
									15.33				**16.63**		**117.1**	**L/s/ha**							
POND TOTAL			**4.16**	**4.87**	**6.12**	**36.26**	**1.86**	**4.67**	**57.94**	**0.51**					**99.8**	**L/s/ha**			**NET FLOW (Less Open Space) =**			**108.59**	**L/s/ha**

Q = 2.78 AIR WHERE : Q = PEAK FLOW IN LITRES PER SECOND (L/s)
A = AREA IN HECTARES (ha)
I = RAINFALL INTENSITY IN MILLIMETERS PER HOUR (mm/hr)
R =WEIGHTED RUNOFF COEFFICIENT
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)

$Q = (1/n)\ A\ R^{(2/3)}S_o^{(1/2)}$ WHERE : Q = CAPACITY (L/s)
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)
A = FLOW AREA (m^2)
R = HYDRAULIC RADIUS (m)
S_o = SLOPE OF HYDRAULIC GRADE LINE (m/m)

Project: Fernbank CDP (101108)
Designed: KJM
Checked: MAB
Dwg. Reference: 101108-STM1
Date: May 8, 2009

TABLE B-8: POND 4 - STORM SEWER HYDRAULIC GRADE LINE ANALYSIS (100-YR EVENT)
FERNBANK CDP LANDS

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The HGL slope is calculated and the minimum USF is established +0.30m above the HGL.

Bend Coefficients			
0	45	90	<----Bend (in degrees)
0.00	0.29	1.02	900 mm pipe or greater (benched)
0.00	0.40	1.32	825 mm pipe or smaller (sump)

MANHOLE		INVERT ELEV.		OBVERT ELEV.		GROUND ELEV.	COVER	PIPE PARAMETERS				TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			PIPE
U/S	D/S	U/S (m)	D/S (m)	U/S (m)	D/S (m)	U/S (m)	U/S (m)	Dia (N) (mm)	Dia (A) (mm)	Length (m)	'n'	(m^3/s)	(m^3/s)		Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	U/S (m)	U/S (m)	D/S (m)	Slope (%)	Slope (%)
Outlet 1																						**107.45**	<- 100yr POND LEVEL		
401	POND	105.80	105.59	107.45	107.24	109.60	2.15	1650	1676	71	0.013	4.017	5.168	0.78	2.207	42	0.01782	1.82	0.17	0.38	0.38	107.83	107.45	0.53%	0.30%
409	401	106.72	106.10	108.07	107.45	110.20	2.13	1350	1372	154	0.013	2.238	3.533	0.63	1.478	112	0.01905	1.51	0.12	0.27	0.03	108.10	107.83	0.18%	0.40%
411	409	108.12	106.87	109.32	108.07	111.70	2.38	1200	1219	314	0.013	1.611	2.566	0.63	1.167	258	0.01981	1.38	0.10	0.64	0.00	109.32	108.10	0.39%	0.40%
413	411	110.69	108.42	111.59	109.32	113.65	2.06	900	914	378	0.013	0.974	1.463	0.67	0.657	414	0.02181	1.48	0.11	1.04	0.00	111.59	109.32	0.60%	0.60%
403	401	107.45	106.25	108.65	107.45	110.80	2.15	1200	1219	241	0.013	1.779	2.873	0.62	1.167	197	0.01981	1.52	0.12	0.66	0.00	108.65	107.83	0.34%	0.50%
405	403	109.87	107.83	110.70	108.65	112.80	2.10	825	838	136	0.013	1.399	1.835	0.76	0.552	162	0.02245	2.53	0.33	1.27	0.00	110.70	108.65	1.50%	1.50%
407	405	110.76	109.95	111.51	110.70	113.95	2.44	750	762	82	0.013	0.893	1.161	0.77	0.456	107	0.02317	1.96	0.20	0.54	0.00	111.51	110.70	1.00%	1.00%
Outlet 2																						**107.45**	<- 100yr POND LEVEL		
415	POND	105.80	105.61	107.30	107.11	109.50	2.20	1500	1524	63	0.013	1.794	4.050	0.44	1.824	41	0.01839	0.98	0.05	0.12	0.27	107.57	107.45	0.18%	0.30%
419	415	106.45	106.32	107.42	107.30	109.60	2.18	975	991	81	0.013	0.649	0.916	0.71	0.771	82	0.02123	0.84	0.04	0.11	0.26	107.68	107.57	0.14%	0.15%
417	415	108.75	106.48	109.58	107.30	112.25	2.68	825	838	190	0.013	1.225	1.639	0.75	0.552	227	0.02245	2.22	0.25	1.65	0.00	109.58	107.57	1.06%	1.20%

DESIGN PARAMETERS

DOWNSTREAM WATER LEVEL in Pond '4' = 107.45m
RETURN FREQUENCY = 5 YEARS
MINIMUM VELOCITY= 0.80 m/s
MANNING'S n= 0.013
MIN. HGL CLEARANCE to Underside of Footing (USF) = 0.30m

HGL=Major + Minor Losses
Major Loss= Pipe Friction (Darcy-Weisbach)
Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends
Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6
Elliptical Pipe Actual Diameter shown as Actual Rise

Designed: KJM
Checked: MAB
Dwg. Reference: 101108-STM1

PROJECT: Fernbank CDP
CLIENT:
Date: May 8, 2009

MANHOLE LOSS									
Diameter (mm)			Bend						
U/S MH	Pipe In	Pipe Out	Angle	K_O	C_D	K_b	K_{tot}	HL_{MH} (m)
3000	1200	1650	90	0.18	2.60	1.02	**1.49**	0.25
2400	1200	1200	0	0.20	1.00	0.00	**0.20**	0.02
2400	900	1200	90	0.20	2.37	1.02	**1.49**	0.14
1800	825	900	0	0.20	1.30	0.00	**0.26**	0.03
2400	825	1200	90	0.20	3.08	1.02	**1.64**	0.19
1500	750	825	0	0.18	1.33	0.00	**0.24**	0.08
1500	675	750	0	0.20	1.37	0.00	**0.27**	0.05
2400	975	1500	90	0.16	3.64	1.02	**1.60**	0.08
1500	750	975	90	0.15	2.20	1.02	**1.36**	0.05
1800	900	825	90	0.22	0.77	1.32	**1.49**	0.37

TABLE B-9: POND 5 - STORM SEWER DESIGN SHEET (2031)
FERNBANK CDP LANDS

LOCATION			AREA									FLOW					PROPOSED SEWER							
Location	From Node	To Node	Commercial 0.80	Major Road 0.70	Schools 0.60	Medium Density 0.60	Low Density 0.50	Parks 0.40	Open Space 0.20	Total Area (ha)	Weighted Runoff Coefficient	Indiv 2.78 AR	Accum 2.78 AR	Time of Conc. (min)	Rain Intensity (mm/hr)	Peak Flow (Q) (l/s)	Pipe Type	Size (mm)	Grade (%)	Length (m)	Capacity (l/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q/Qfull (%)
Outlet 1																								
P5-1	513	511	0.63	0.58		2.37	3.85		6.68	14.11	0.40	15.55	15.55	15.00	83.6	1299.5	CONC	**825**	**1.00**	132	1497.5	2.71	0.81	86.8%
	511	509								0.00		0.00	15.55	15.81	81.0	1260.3	CONC	**975**	**0.40**	163	1478.7	1.92	1.41	85.2%
														17.22										
P5-2	515	509					5.08			5.08	0.50	7.06	7.06	15.00	83.6	590.0	CONC	**825**	**0.20**	75	669.7	1.21	1.03	88.1%
														16.03										
P5-3	509	507		0.61			2.96			3.57	0.53	5.30	27.92	17.22	77.0	2149.5	CONC	**1500**	**0.20**	169	3298.0	1.81	1.55	65.2%
P5-4	507	505					3.43			3.43	0.50	4.77	32.68	18.78	73.1	2387.7	CONC	**1500**	**0.15**	156	2856.1	1.57	1.66	83.6%
P5-5	505	503					4.87	0.62	2.76	8.25	0.39	8.99	41.68	20.43	69.3	2888.8	CONC	**1650**	**0.15**	149	3682.6	1.67	1.49	78.4%
P5-6	503	501					2.62	0.21		2.83	0.49	3.88	45.55	21.93	66.3	3019.6	CONC	**1650**	**0.15**	93	3682.6	1.67	0.93	82.0%
P5-7	501	POND		0.72			6.20		0.18	7.10	0.51	10.12	55.67	22.86	64.5	3593.4	CONC	**1650**	**0.30**	65	5208.0	2.36	0.46	69.0%
										44.37				**23.31**		**81.0**	**L/s/h**							
Outlet 2																								
P5-8	531	529					7.46	0.18	1.87	9.51	0.44	11.61	11.61	15.00	83.6	970.0	CONC	**975**	**0.20**	77	1045.6	1.36	0.95	92.8%
														15.95										
P5-9	533	529		0.71			1.27		5.31	7.29	0.30	6.10	6.10	15.00	83.6	509.6	CONC	**825**	**0.15**	50	580.0	1.05	0.78	87.9%
														15.78										
P5-10	535	529					8.94			8.94	0.50	12.43	12.43	15.00	83.6	1038.3	CONC	**975**	**0.20**	84	1045.6	1.36	1.04	99.3%
														16.04										
	529	523								0.00		0.00	30.14	16.04	80.4	2421.5	CONC	**1650**	**0.13**	293	3428.4	1.55	3.15	70.6%
														19.18										
P5-11	527	525		0.82		1.22	8.35			10.39	0.53	15.24	15.24	15.00	83.6	1273.2	CONC	**1200**	**0.15**	224	1575.3	1.35	2.77	80.8%
P5-12	525	523		1.05	2.88		1.74	3.28		8.95	0.52	12.91	28.15	17.77	75.6	2127.1	CONC	**1500**	**0.18**	198	3128.7	1.72	1.93	68.0%
														19.70										
P5-13	523	519		1.27	2.48		3.13			6.88	0.57	10.96	69.24	19.70	70.9	4911.0	CONC	**1950**	**0.17**	315	6120.8	1.99	2.64	80.2%
														22.34										
P5-14	521	519					11.94			11.94	0.50	16.60	16.60	15.00	83.6	1386.8	CONC	**1200**	**0.15**	81	1575.3	1.35	1.00	88.0%
														16.00										
P5-15	519	517		0.46			2.32			2.78	0.53	4.12	89.96	22.34	65.5	5892.4	CONC	**2400**	**0.15**	37	10002.3	2.14	0.29	58.9%
														22.63										
P5-16	543	541				1.46	6.51			7.97	0.52	11.48	11.48	15.00	83.6	959.6	CONC	**900**	**0.45**	221	1266.9	1.93	1.91	75.7%
P5-17	541	539					7.76			7.76	0.50	10.79	22.27	16.91	77.8	1733.7	CONC	**1200**	**0.25**	156	2033.7	1.74	1.49	85.3%
P5-18	539	537					6.43	1.30		7.73	0.48	10.38	32.65	18.41	74.0	2414.9	CONC	**1500**	**0.20**	160	3298.0	1.81	1.48	73.2%
P5-19	537	517		0.92			3.13			4.05	0.55	6.14	38.79	19.88	70.5	2735.4	CONC	**1650**	**0.20**	115	4252.3	1.93	1.00	64.3%
														21.81										
	517	POND								0.00		0.00	128.76	22.63	65.0	8364.7	CONC	**2400**	**0.40**	24	16333.6	3.50	0.11	51.2%
										94.19				**22.74**		**88.8**	L/s/h							
POND TOTAL			**0.63**	**7.14**	**5.36**	**5.05**	**97.99**	**5.59**	**16.80**	**138.56**	**0.48**					**86.3**	L/s/ha			**NET FLOW (Less Open Space) =**			**98.21**	**L/s/ha**	

Q = 2.78 AIR WHERE : Q = PEAK FLOW IN LITRES PER SECOND (L/s)
A = AREA IN HECTARES (ha)
I = RAINFALL INTENSITY IN MILLIMETERS PER HOUR (mm/hr)
R =WEIGHTED RUNOFF COEFFICIENT
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)

$Q = (1/n)\ A\ R^{(2/3)} S_o^{(1/2)}$ WHERE : Q = CAPACITY (L/s)
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)
A = FLOW AREA (m^2)
R = HYDRAULIC RADIUS (m)
S_o = SLOPE OF HYDRAULIC GRADE LINE (m/m)

Project: Fernbank CDP (101108)
Designed: KJM
Checked: MAB
Dwg. Reference: 101108-STM1
Date: May 8, 2009

NOTES:
1) Red Text = Elliptical Pipe with Equivalent Flow Capacity

TABLE B-10: POND 5 - STORM SEWER HYDRAULIC GRADE LINE ANALYSIS (100-YR EVENT)
FERNBANK CDP LANDS

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The HGL slope is calculated and the minimum USF is established +0.30m above the HGL.

Bend Coefficients			
0	45	90	<----Bend (in degrees)
0.00	0.29	1.02	900 mm pipe or greater (benched)
0.00	0.40	1.32	825 mm pipe or smaller (sump)

MANHOLE		INVERT ELEV.		OBVERT ELEV.		GROUND ELEV.	COVER	PIPE PARAMETERS				TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			PIPE
U/S	D/S	U/S (m)	D/S (m)	U/S (m)	D/S (m)	U/S (m)	U/S (m)	Dia (N) (mm)	Dia (A) (mm)	Length (m)	'n'	(m^3/s)	(m^3/s)		Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	U/S (m)	U/S (m)	D/S (m)	Slope (%)	Slope (%)
Outlet 1																						**104.40**	<- 100yr POND LEVEL		
501	POND	103.05	102.86	104.70	104.51	106.75	2.05	1650	1676	65	0.013	3.603	5.216	0.69	2.207	39	0.01782	1.63	0.14	0.12	0.00	104.70	104.51	0.30%	0.30%
503	501	103.19	103.05	104.84	104.70	106.90	2.06	1650	1676	93	0.013	2.879	3.685	0.78	2.207	56	0.01782	1.30	0.09	0.10	0.00	104.84	104.70	0.15%	0.15%
505	503	103.41	103.19	105.06	104.84	107.10	2.04	1650	1676	149	0.013	2.602	3.649	0.71	2.207	89	0.01782	1.18	0.07	0.13	0.00	105.06	104.84	0.15%	0.15%
507	505	103.80	103.56	105.30	105.06	107.45	2.15	1500	1524	156	0.013	2.072	2.896	0.72	1.824	102	0.01839	1.14	0.07	0.14	0.00	105.30	105.06	0.15%	0.15%
509	507	104.13	103.80	105.63	105.30	107.70	2.07	1500	1524	169	0.013	1.729	3.264	0.53	1.824	111	0.01839	0.95	0.05	0.17	0.00	105.63	105.30	0.20%	0.20%
511	509	105.31	104.66	106.29	105.64	108.50	2.22	975	991	163	0.013	0.836	1.477	0.57	0.771	164	0.02123	1.09	0.06	0.23	0.00	106.29	105.64	0.40%	0.40%
513	511	106.78	105.46	107.61	106.29	110.25	2.65	825	838	132	0.013	0.836	1.499	0.56	0.552	157	0.02245	1.52	0.12	0.44	0.00	107.61	106.29	1.00%	1.00%
515	509	104.96	104.81	105.79	105.64	107.90	2.12	825	838	75	0.013	0.508	0.671	0.76	0.552	89	0.02245	0.92	0.04	0.10	0.00	105.79	105.64	0.20%	0.20%
Outlet 2																									
517	POND	103.05	102.95	105.00	104.90	107.05	2.05	2400	1950	24	0.013	8.914	16.334	0.55	4.870	10	0.01573	1.83	0.17	0.22	0.12	105.12	104.90	0.92%	0.41%
537	517	103.58	103.35	105.23	105.00	107.25	2.02	1650	1676	115	0.013	2.775	4.250	0.65	2.207	69	0.01782	1.26	0.08	0.20	0.09	105.32	105.12	0.17%	0.20%
539	537	104.05	103.73	105.55	105.23	107.60	2.05	1500	1524	160	0.013	2.329	3.296	0.71	1.824	105	0.01839	1.28	0.08	0.18	0.00	105.55	105.32	0.15%	0.20%
541	539	104.74	104.35	105.94	105.55	108.00	2.06	1200	1219	156	0.013	1.595	2.033	0.78	1.167	128	0.01981	1.37	0.10	0.27	0.00	105.94	105.55	0.25%	0.25%
543	541	106.04	105.04	106.94	105.94	109.00	2.06	900	914	221	0.013	0.819	1.269	0.65	0.657	242	0.02181	1.25	0.08	0.43	0.00	106.94	105.94	0.45%	0.45%
519	517	103.11	103.05	105.06	105.00	107.10	2.04	2400	1950	37	0.013	6.139	10.002	0.61	4.870	78	0.01573	1.26	0.08	0.12	0.19	105.24	105.12	0.32%	0.15%
521	519	103.98	103.86	105.18	105.06	107.40	2.22	1200	1219	81	0.013	1.194	1.567	0.76	1.167	66	0.01981	1.02	0.05	0.09	0.15	105.33	105.24	0.11%	0.15%
523	519	103.64	103.11	105.59	105.06	107.60	2.01	1950	1981	315	0.013	4.646	6.090	0.76	3.083	159	0.01685	1.51	0.12	0.47	0.12	105.71	105.24	0.15%	0.17%
525	523	104.45	104.09	105.95	105.59	108.00	2.05	1500	1524	198	0.013	1.981	3.159	0.63	1.824	130	0.01839	1.09	0.06	0.16	0.00	105.95	105.71	0.12%	0.18%
527	525	105.08	104.75	106.28	105.95	108.30	2.02	1200	1219	224	0.013	1.094	1.560	0.70	1.167	184	0.01981	0.94	0.04	0.18	0.00	106.28	105.95	0.15%	0.15%
529	523	104.32	103.94	105.97	105.59	108.00	2.03	1650	1676	293	0.013	1.883	3.422	0.55	2.207	175	0.01782	0.85	0.04	0.18	0.00	105.97	105.71	0.09%	0.13%
535	529	105.16	105.00	106.14	105.97	108.15	2.01	975	991	84	0.013	0.894	1.047	0.85	0.771	85	0.02123	1.16	0.07	0.14	0.00	106.14	105.97	0.20%	0.20%
533	529	105.22	105.15	106.05	105.98	108.05	2.00	825	838	50	0.013	0.230	0.579	0.40	0.552	59	0.02245	0.42	0.01	0.01	0.00	106.05	105.98	0.15%	0.15%
531	529	105.15	105.00	106.13	105.98	108.15	2.02	975	991	77	0.013	0.759	1.045	0.73	0.771	78	0.02123	0.98	0.05	0.09	0.00	106.13	105.98	0.20%	0.20%

MANHOLE LOSS								
Diameter (mm)			Bend					HL_{MH}
U/S MH	Pipe In	Pipe Out	Angle	K_O	C_D	K_b	K_{tot}	(m)
3000	1650	1650	0	0.18	1.00	0.00	**0.18**	0.02
3000	1650	1650	0	0.18	1.00	0.00	**0.18**	0.02
3000	1500	1650	0	0.18	1.33	0.00	**0.24**	0.02
2400	1350	1500	0	0.16	1.37	0.00	**0.22**	0.01
2400	975	1500	90	0.16	3.64	1.02	**1.60**	0.07
1800	825	975	0	0.18	1.65	0.00	**0.30**	0.02
1500	750	825	0	0.18	1.33	0.00	**0.24**	0.03
1500	750	825	0	0.18	1.33	0.00	**0.24**	0.01
3000	2400	2400	90	0.13	1.00	1.02	**1.15**	0.20
3000	1650	1650	90	0.18	1.00	1.02	**1.20**	0.10
3000	1350	1500	0	0.20	1.37	0.00	**0.27**	0.02
2400	1050	1200	0	0.20	1.49	0.00	**0.30**	0.03
1800	975	900	0	0.20	0.79	0.00	**0.16**	0.01
3000	1950	2400	0	0.13	1.86	0.00	**0.23**	0.02
2400	1050	1200	0	0.20	1.49	0.00	**0.30**	0.02
3000	1500	1950	90	0.15	2.20	1.02	**1.36**	0.16
2400	1200	1500	0	0.16	1.95	0.00	**0.31**	0.02
2400	1050	1200	0	0.20	1.49	0.00	**0.30**	0.01
2400	975	1650	90	0.15	4.85	1.02	**1.72**	0.06
1800	900	975	0	0.18	1.27	0.00	**0.23**	0.02
1500	750	825	0	0.18	1.33	0.00	**0.24**	0.00
1800	900	975	0	0.18	1.27	0.00	**0.23**	0.01

DESIGN PARAMETERS

DOWNSTREAM WATER LEVEL in Pond '5' = 104.40m
RETURN FREQUENCY = 5 YEARS
MINIMUM VELOCITY= 0.80 m/s
MANNING'S n= 0.013
MIN. HGL CLEARANCE to Underside of Footing (USF) = 0.30m

HGL=Major + Minor Losses
Major Loss= Pipe Friction (Darcy-Weisbach)
Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends
Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6
Elliptical Pipe Actual Diameter shown as Actual Rise

Designed: KJM
Checked: MAB
Dwg. Reference: 101108-STM1

PROJECT: Fernbank CDP
CLIENT:
Date: May 8, 2009

NOTES:

1) Red Text = Elliptical Pipes:
Dia (N) = Equivalent Pipe Size
Dia (A) = Elliptical Pipe Rise

TABLE B-11: POND 6 - STORM SEWER DESIGN SHEET (2031)
FERNBANK CDP LANDS

LOCATION			AREA									FLOW							PROPOSED SEWER							
Location	From Node	To Node	Mixed Use 0.80	Major Road 0.70	Schools 0.60	Medium Density 0.60	Low Density 0.50	Parks 0.40	Open Space 0.20	Total Area (ha)	Weighted Runoff Coefficient	Indiv 2.78 AR	Accum 2.78 AR	Time of Conc. (min)	Rain Intensity (mm/hr) 5yr	Rain Intensity (mm/hr) 10yr	Peak Flow (Q) (l/s)	Total Peak Flow (Q) (l/s)	Pipe Type	Size (mm)	Grade (%)	Length (m)	Capacity (l/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q/Qfull (%)
Outlet 1																										
P6-1	611	609				1.40	3.67	0.84	5.42	11.33	0.36	11.38	11.38	15.00	83.6		951.2	**1221.6**	CONC	**1200**	**0.20**	207	1819.0	1.56	2.21	67.2%
				1.42	**<-Arterial (10yr)**					1.42	0.70	2.76	2.76	15.00		97.9	270.4									
P6-2	609	607	3.32				2.58		3.52	9.42	0.49	12.93	24.31	17.21	77.0		1872.7	**2121.9**	CONC	**1350**	**0.30**	328	3049.8	2.06	2.65	69.6%
												0.00	2.76	17.21		90.2	249.2									
P6-3	607	605	3.53				2.80			6.33	0.67	11.74	36.05	19.86	70.6		2543.8	**2772.0**	CONC	**1350**	**0.35**	80	3294.2	2.23	0.60	84.1%
													2.76	19.86		82.6	228.2									
P6-4	605	603			2.07	2.00	4.42			8.49	0.55	12.93	48.99	20.46	69.3		3393.0	**3616.9**	CONC	**1650**	**0.27**	242	4940.8	2.24	1.80	73.2%
													2.76	20.46		81.0	224.0									
P6-5	603	601				0.11	7.04	0.18		7.33	0.50	10.17	59.16	22.26	65.7		3883.8	**4096.0**	CONC	**1650**	**0.25**	158	4754.3	2.15	1.22	86.2%
													2.76	22.26		76.8	212.2									
P6-6	601	POND				2.74	8.18	0.75		11.67	0.52	16.77	75.93	23.48	63.4		4816.6	**5021.7**	CONC	**1650**	**0.40**	131	6013.7	2.72	0.80	83.5%
													2.76	23.48		74.2	205.1									
										55.99				**24.28**				**89.7**	**L/s/ha**							
Outlet 2																										
P6-7	617	615			6.61	1.64				8.25	0.60	13.76	13.76	15.00	83.6		1149.8	**1667.8**	CONC	**900**	**1.20**	246	2068.8	3.15	1.30	80.6%
				2.72	**<-Arterial (10yr)**					2.72	0.70	5.29	5.29	15.00		97.9	517.9									
P6-8	615	613		1.68	2.76	1.34	5.96			11.74	0.42	13.79	27.55	16.30	79.6		2192.2	**2685.4**	CONC	**1200**	**0.80**	257	3637.9	3.12	1.37	73.8%
												0.00	5.29	16.30		93.2	493.1									
														17.67												
P6-9	621	619		3.13		2.63	5.98	0.80		12.54	0.56	19.68	19.68	15.00	83.6		1644.4	**1907.2**	CONC	**1050**	**0.66**	151	2314.4	2.59	0.97	82.4%
				1.38	**<-Arterial (10yr)**					1.38	0.70	2.69	2.69	15.00		97.9	262.8									
P6-10	619	613		0.86			4.97	0.20		6.03	0.53	8.80	28.48	15.97	80.5		2294.2	**2547.5**	CONC	**1350**	**0.50**	218	3937.3	2.66	1.36	58.3%
												0.00	2.69	15.97		94.3	253.3									
														17.33												
	613	POND								0.00		0.00	56.03	17.67	75.8		4247.7	**4955.7**	CONC	**1650**	**0.50**	53	6723.5	3.05	0.29	63.2%
												0.00	7.98	17.67		88.7	708.0									
										42.66				**17.97**				**116.2**	**L/s/ha**							
POND TOTAL			**6.85**	**11.19**	**11.44**	**11.86**	**45.60**	**2.77**	**8.94**	**98.65**	**0.54**							**101.1**	**L/s/ha**		**NET FLOW (Less Open Space) = 111.22 L/s/ha**					

Q = 2.78 AIR WHERE : Q = PEAK FLOW IN LITRES PER SECOND (L/s)
A = AREA IN HECTARES (ha)
I = RAINFALL INTENSITY IN MILLIMETERS PER HOUR (mm/hr)
R =WEIGHTED RUNOFF COEFFICIENT
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)

$Q = (1/n)\ A\ R^{(2/3)}S_o^{(1/2)}$ WHERE : Q = CAPACITY (L/s)
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)
A = FLOW AREA (m^2)
R = HYDRAULIC RADIUS (m)
S_o = SLOPE OF HYDRAULIC GRADE LINE (m/m)

Project: Fernbank CDP (101108)
Designed: KJM
Checked: MAB
Dwg. Reference: 101108-STM1
Date: May 8, 2009

NOTES:
1) Blue Text = Arterial Roadway (Minor system designed to convey a 1:10 year storm)

TABLE B-12: POND 6 - STORM SEWER HYDRAULIC GRADE LINE ANALYSIS (100-YR EVENT)
FERNBANK CDP LANDS

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The HGL slope is calculated and the minimum USF is established +0.30m above the HGL.

Bend Coefficients			
0	45	90	<----Bend (in degrees)
0.00	0.29	1.02	900 mm pipe or greater (benched)
0.00	0.40	1.32	825 mm pipe or smaller (sump)

MANHOLE		INVERT ELEV.		OBVERT ELEV.		GROUND ELEV.	COVER	PIPE PARAMETERS				TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			PIPE
U/S	D/S	U/S (m)	D/S (m)	U/S (m)	D/S (m)	U/S (m)	U/S (m)	Dia (N) (mm)	Dia (A) (mm)	Length (m)	'n'	(m^3/s)	(m^3/s)		Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	U/S (m)	U/S (m)	D/S (m)	Slope (%)	Slope (%)
Outlet 1																						**98.70**	<- 100yr POND LEVEL		
601	POND	97.25	96.72	98.90	98.37	102.00	3.10	1650	1676	115	0.013	5.240	6.455	0.81	2.207	69	0.01782	2.37	0.29	0.70	0.50	99.40	98.70	0.61%	0.46%
603	601	97.64	97.25	99.29	98.90	102.50	3.21	1650	1676	158	0.013	4.054	4.727	0.86	2.207	94	0.01782	1.84	0.17	0.32	0.43	99.72	99.40	0.20%	0.25%
605	603	98.30	97.64	99.95	99.29	103.30	3.35	1650	1676	242	0.013	3.325	4.966	0.67	2.207	144	0.01782	1.51	0.12	0.45	0.22	100.17	99.72	0.19%	0.27%
607	605	98.88	98.60	100.23	99.95	103.10	2.87	1350	1372	80	0.013	2.415	3.300	0.73	1.478	58	0.01905	1.63	0.14	0.17	0.11	100.34	100.17	0.22%	0.35%
609	607	99.86	98.88	101.21	100.23	103.45	2.24	1350	1372	328	0.013	1.606	3.043	0.53	1.478	239	0.01905	1.09	0.06	0.35	0.00	101.21	100.34	0.26%	0.30%
611	609	100.42	100.01	101.62	101.21	103.65	2.03	1200	1219	207	0.013	0.850	1.811	0.47	1.167	170	0.01981	0.73	0.03	0.10	0.00	101.62	101.21	0.20%	0.20%
Outlet 2																						**98.70**	<- 100yr POND LEVEL		
613	POND	97.25	96.98	98.90	98.63	101.90	3.00	1650	1676	53	0.013	5.064	6.717	0.75	2.207	32	0.01782	2.29	0.27	0.36	0.16	99.06	98.70	0.67%	0.50%
619	613	98.64	97.55	99.99	98.90	102.10	2.11	1350	1372	218	0.013	2.301	3.942	0.58	1.478	159	0.01905	1.56	0.12	0.56	0.00	99.99	99.06	0.43%	0.50%
621	619	99.93	98.94	100.98	99.99	103.50	2.52	1050	1067	151	0.013	1.666	2.307	0.72	0.894	141	0.02071	1.86	0.18	0.57	0.00	100.98	99.99	0.66%	0.66%
615	613	99.90	97.85	101.10	99.05	103.30	2.20	1200	1219	257	0.013	2.763	3.635	0.76	1.167	211	0.01981	2.37	0.29	1.29	0.00	101.10	99.06	0.80%	0.80%
617	615	103.01	100.05	103.91	100.95	106.50	2.59	900	914	246	0.013	1.452	2.071	0.70	0.657	269	0.02181	2.21	0.25	1.53	0.00	103.91	101.10	1.14%	1.20%

MANHOLE LOSS									
Diameter (mm)			Bend						HL_{MH}
U/S MH	Pipe In	Pipe Out	Angle	K_O	C_D	K_b	K_{tot}		(m)
3000	1650	1650	90	0.18	1.00	1.02	**1.20**		0.35
3000	1650	1650	0	0.18	1.00	0.00	**0.18**		0.03
3000	1350	1650	90	0.18	1.83	1.02	**1.35**		0.16
2400	1350	1350	0	0.18	1.00	0.00	**0.18**		0.02
2400	1200	1350	90	0.18	1.42	1.02	**1.27**		0.08
1800	975	1200	0	0.15	1.86	0.00	**0.28**		0.01
3000	1200	1650	45	0.18	2.60	0.29	**0.76**		0.20
3000	1050	1350	90	0.22	2.13	1.02	**1.49**		0.18
1800	900	1050	0	0.17	1.59	0.00	**0.27**		0.05
1800	900	1200	0	0.15	2.37	0.00	**0.36**		0.10
1800	825	900	0	0.20	1.30	0.00	**0.26**		0.06

DESIGN PARAMETERS

DOWNSTREAM WATER LEVEL in Pond '6' = 98.70m
RETURN FREQUENCY = 5 YEARS
MINIMUM VELOCITY= 0.80 m/s
MANNING'S n= 0.013
MIN. HGL CLEARANCE to Underside of Footing (USF) = 0.30m

HGL=Major + Minor Losses
Major Loss= Pipe Friction (Darcy-Weisbach)
Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends
Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6
Elliptical Pipe Actual Diameter shown as Actual Rise

Designed: KJM
Checked: MAB
Dwg. Reference: 101108-STM1

PROJECT: Fernbank CDP
CLIENT:
Date: May 8, 2009

TABLE B-13: POND 7 - STORM SEWER DESIGN SHEET (2031)
FERNBANK CDP LANDS

LOCATION			AREA								FLOW					PROPOSED SEWER							
Location	From Node	To Node	Major Road 0.70	Schools 0.60	Medium Density 0.60	Low Density 0.50	Parks 0.40	Open Space 0.20	Total Area (ha)	Weighted Runoff Coefficient	Indiv 2.78 AR	Accum 2.78 AR	Time of Conc. (min)	Rain Intensity (mm/hr)	Peak Flow (Q) (l/s)	Pipe Type	Size (mm)	Grade (%)	Length (m)	Capacity (l/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q/Qfull (%)
P7-1	707	705			1.78	11.21			12.99	0.51	18.55	18.55	15.00	83.6	1550.1	CONC	**1050**	**0.35**	153	1685.4	1.89	1.35	92.0%
													16.35										
P7-2	709	705	0.87		1.29	0.12		7.21	9.49	0.30	8.02	8.02	15.00	83.6	670.2	CONC	**900**	**0.15**	189	731.4	1.11	2.83	91.6%
													17.83										
P7-3	711	705	0.83		0.26	1.47	3.24		5.80	0.48	7.70	7.70	15.00	83.6	643.0	CONC	**900**	**0.15**	224	731.4	1.11	3.35	87.9%
													18.35										
	705	703							0.00		0.00	34.27	18.35	74.1	2539.2	CONC	**1350**	**0.40**	124	3521.6	2.38	0.87	72.1%
P7-4	703	701	0.60		4.74	6.03		3.44	14.81	0.47	19.37	53.63	19.21	72.0	3863.0	CONC	**1500**	**0.50**	141	5214.6	2.86	0.82	74.1%
	701	POND							0.00		0.00	53.63	20.04	70.2	3763.6	CONC	**1500**	**0.30**	58	4039.2	2.21	0.43	93.2%
													20.47			L/s/ha							
POND TOTAL			**2.30**	**0.00**	**8.07**	**18.83**	**3.24**	**10.65**	**43.09**	**0.45**					**87.3**	L/s/ha			**NET FLOW (Less Open Space) =**			**116.02**	**L/s/ha**

Q = 2.78 AIR WHERE : Q = PEAK FLOW IN LITRES PER SECOND (L/s)
A = AREA IN HECTARES (ha)
I = RAINFALL INTENSITY IN MILLIMETERS PER HOUR (mm/hr)
R =WEIGHTED RUNOFF COEFFICIENT
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)

$Q = (1/n)\ A\ R^{(2/3)}S_o^{(1/2)}$ WHERE : Q = CAPACITY (L/s)
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)
A = FLOW AREA (m^2)
R = HYDRAULIC RADIUS (m)
S_o = SLOPE OF HYDRAULIC GRADE LINE (m/m)

Project: Fernbank CDP (101108)
Designed: KJM
Checked: MAB
Dwg. Reference: 101108-STM1
Date: May 8, 2009

TABLE B-14: POND 7 - STORM SEWER HYDRAULIC GRADE LINE ANALYSIS (100-YR EVENT)
FERNBANK CDP LANDS

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The HGL slope is calculated and the minimum USF is established +0.30m above the HGL.

Bend Coefficients			
0	45	90	<----Bend (in degrees)
0.00	0.29	1.02	900 mm pipe or greater (benched)
0.00	0.40	1.32	825 mm pipe or smaller (sump)

MANHOLE		INVERT ELEV.		OBVERT ELEV.		GROUND ELEV.	COVER	PIPE PARAMETERS				TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			PIPE
U/S	D/S	U/S (m)	D/S (m)	U/S (m)	D/S (m)	U/S (m)	U/S (m)	Dia (N) (mm)	Dia (A) (mm)	Length (m)	'n'	(m^3/s)	(m^3/s)		Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	U/S (m)	U/S (m)	D/S (m)	Slope (%)	Slope (%)
																						96.50	**<- 100yr POND LEVEL**		
701	POND	95.05	94.88	96.55	96.38	98.65	2.10	1500	1524	58	0.013	3.371	7.584	0.44	1.824	38	0.01839	1.85	0.17	0.21	0.16	96.71	96.50	0.36%	0.30%
703	701	95.76	95.05	97.26	96.55	99.26	2.00	1500	1524	141	0.013	3.371	7.094	0.48	1.824	93	0.01839	1.85	0.17	0.33	0.00	97.26	96.71	0.39%	0.50%
705	703	96.40	95.91	97.75	97.26	99.95	2.20	1350	1372	124	0.013	2.136	3.500	0.61	1.478	90	0.01905	1.45	0.11	0.34	0.00	97.75	97.26	0.40%	0.40%
711	705	97.19	96.85	98.09	97.75	100.30	2.21	900	914	224	0.013	0.524	0.736	0.71	0.657	245	0.02181	0.80	0.03	0.18	0.00	98.09	97.75	0.15%	0.15%
709	705	97.14	96.85	98.04	97.75	100.25	2.21	900	914	189	0.013	0.287	0.739	0.39	0.657	207	0.02181	0.44	0.01	0.05	0.00	98.04	97.75	0.15%	0.15%
707	705	97.24	96.70	98.29	97.75	100.50	2.21	1050	1067	153	0.013	1.326	1.691	0.78	0.894	144	0.02071	1.48	0.11	0.36	0.00	98.29	97.75	0.35%	0.35%

MANHOLE LOSS									
Diameter (mm)			Bend						HL_{MH}
U/S MH	Pipe In	Pipe Out	Angle	K_O	C_D	K_b	K_{tot}		(m)
3000	1500	1500	45	0.20	1.00	0.29	**0.49**		0.09
2400	1350	1500	0	0.16	1.37	0.00	**0.22**		0.04
3000	1050	1350	90	0.22	2.13	1.02	**1.49**		0.16
1800	825	900	0	0.20	1.30	0.00	**0.26**		0.01
1800	825	900	0	0.20	1.30	0.00	**0.26**		0.00
1800	900	1050	0	0.17	1.59	0.00	**0.27**		0.03

DESIGN PARAMETERS

DOWNSTREAM WATER LEVEL in Pond '7' = 96.50m
RETURN FREQUENCY = 5 YEARS
MINIMUM VELOCITY= 0.80 m/s
MANNING'S n= 0.013
MIN. HGL CLEARANCE to Underside of Footing (USF) = 0.30m

HGL=Major + Minor Losses
Major Loss= Pipe Friction (Darcy-Weisbach)
Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends
Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6
Elliptical Pipe Actual Diameter shown as Actual Rise

Designed: KJM
Checked: MAB
Dwg. Reference: 101108-STM1

PROJECT: Fernbank CDP
CLIENT:
Date: May 8, 2009

TABLE B-15: POND 8 - STORM SEWER DESIGN SHEET (2031)
FERNBANK CDP LANDS

LOCATION			AREA									FLOW					PROPOSED SEWER							
Location	From Node	To Node	Commercial 0.80	Major Road 0.70	Schools 0.60	Medium Density 0.60	Low Density 0.50	Parks 0.40	Open Space 0.20	Total Area (ha)	Weighted Runoff Coefficient	Indiv 2.78 AR	Accum 2.78 AR	Time of Conc. (min)	Rain Intensity (mm/hr)	Peak Flow (Q) (l/s)	Pipe Type	Size (mm)	Grade (%)	Length (m)	Capacity (l/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q/Qfull (%)
P8-1	809	807		0.63		1.19	6.33			8.15	0.53	12.01	12.01	15.00	83.6	1003.5	CONC	**975**	**0.20**	295	1045.6	1.36	3.62	96.0%
														18.62										
P8-2	811	807		0.66		3.59	10.40	0.93		15.58	0.53	22.76	22.76	15.00	83.6	1902.0	CONC	**1350**	**0.15**	164	2185.1	1.48	1.85	87.0%
														16.85										
P8-3	807	805		1.70	2.94	1.53	0.09			6.26	0.63	10.89	45.66	18.62	73.4	3353.2	CONC	**1500**	**0.25**	192	3687.3	2.02	1.58	90.9%
P8-4	805	803		0.86	7.29	1.31	6.96	0.25	0.11	16.78	0.56	26.03	71.69	20.20	69.8	5005.4	CONC	**1650**	**0.45**	248	6378.5	2.89	1.43	78.5%
P8-5	803	801		0.32		2.35	5.10	0.89	0.03	8.69	0.52	12.64	84.33	21.63	66.9	5638.8	CONC	**2100**	**0.17**	105	7458.2	2.09	0.84	75.6%
														22.47										
P8-6	813	801	6.60	0.51						7.11	0.79	15.67	15.67	15.00	83.6	1309.4	CONC	**1350**	**0.12**	58	1928.9	1.31	0.74	67.9%
														15.74										
	801	POND										0.00	100.00	22.47	65.3	6526.0	CONC	**2100**	**0.30**	37	9907.6	2.77	0.22	65.9%
														22.69										
POND TOTAL			**6.60**	**4.68**	**10.23**	**9.97**	**28.88**	**2.07**	**0.14**	**62.57**	**0.57**					**104.3**	**L/s/ha**			**NET FLOW (Less Open Space) =**			**104.53**	**L/s/ha**

Q = 2.78 AIR WHERE : Q = PEAK FLOW IN LITRES PER SECOND (L/s)
A = AREA IN HECTARES (ha)
I = RAINFALL INTENSITY IN MILLIMETERS PER HOUR (mm/hr)
R =WEIGHTED RUNOFF COEFFICIENT
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)

$Q = (1/n)\ A\ R^{(2/3)} S_o^{(1/2)}$ WHERE : Q = CAPACITY (L/s)
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)
A = FLOW AREA (m^2)
R = HYDRAULIC RADIUS (m)
S_o = SLOPE OF HYDRAULIC GRADE LINE (m/m)

Project: Fernbank CDP (101108)
Designed: KJM
Checked: MAB
Dwg. Reference: 101108-STM1
Date: May 8, 2009

NOTES:
1) Red Text = Elliptical Pipe with Equivalent Flow Capacity

TABLE B-16: POND 8 - STORM SEWER HYDRAULIC GRADE LINE ANALYSIS (100-YR EVENT)
FERNBANK CDP LANDS

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The HGL slope is calculated and the minimum USF is established +0.30m above the HGL.

Bend Coefficients			
0	45	90	<----Bend (in degrees)
0.00	0.29	1.02	900 mm pipe or greater (benched)
0.00	0.40	1.32	825 mm pipe or smaller (sump)

MANHOLE		INVERT ELEV.		OBVERT ELEV.		GROUND ELEV.	COVER	PIPE PARAMETERS				TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			PIPE
U/S	D/S	U/S (m)	D/S (m)	U/S (m)	D/S (m)	U/S (m)	U/S (m)	Dia (N) (mm)	Dia (A) (mm)	Length (m)	'n'	(m^3/s)	(m^3/s)		Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	U/S (m)	U/S (m)	D/S (m)	Slope (%)	Slope (%)
																						96.50	<- 100yr POND LEVEL		
801	POND	95.05	94.94	96.76	96.65	99.00	2.25	2100	1705	37	0.013	7.025	11.440	0.61	3.730	18	0.01644	1.88	0.18	0.13	0.02	96.78	96.65	0.35%	0.29%
813	801	95.12	95.05	96.47	96.40	97.50	1.03	1350	1372	58	0.013	1.064	1.929	0.55	1.478	43	0.01905	0.72	0.03	0.03	0.33	96.80	96.78	0.05%	0.12%
803	801	95.23	95.05	96.94	96.76	99.20	2.27	2100	1705	105	0.013	5.961	8.090	0.74	3.730	49	0.01644	1.60	0.13	0.14	0.00	96.94	96.78	0.15%	0.17%
805	803	96.28	95.29	97.93	96.94	100.15	2.22	1650	1676	248	0.013	5.072	6.006	0.84	2.207	148	0.01782	2.30	0.27	0.77	0.00	97.93	96.94	0.40%	0.40%
807	805	96.91	96.43	98.41	97.93	100.70	2.29	1500	1524	192	0.013	3.244	3.691	0.88	1.824	126	0.01839	1.78	0.16	0.45	0.00	98.41	97.93	0.25%	0.25%
811	807	97.31	97.06	98.66	98.41	100.90	2.24	1350	1372	164	0.013	1.614	2.173	0.74	1.478	120	0.01905	1.09	0.06	0.16	0.00	98.66	98.41	0.15%	0.15%
809	807	98.02	97.43	99.00	98.41	101.00	2.01	975	991	295	0.013	0.861	1.046	0.82	0.771	297	0.02123	1.12	0.06	0.42	0.00	99.00	98.41	0.20%	0.20%

MANHOLE LOSS									
Diameter (mm)			Bend						HL_{MH}
U/S MH	Pipe In	Pipe Out	Angle	K_O	C_D	K_b	K_{tot}		(m)
3000	2100	2100	45	0.14	1.00	0.29	**0.43**		0.08
2400	1050	1200	0	0.20	1.49	0.00	**0.30**		0.01
3000	1650	2100	0	0.14	2.06	0.00	**0.29**		0.04
3000	1500	1650	0	0.18	1.33	0.00	**0.24**		0.07
2400	1050	1500	0	0.16	2.92	0.00	**0.47**		0.08
2400	975	1050	0	0.23	1.25	0.00	**0.29**		0.02
2400	900	975	0	0.25	1.27	0.00	**0.31**		0.02

DESIGN PARAMETERS

DOWNSTREAM WATER LEVEL in Pond '8' = 96.50m
RETURN FREQUENCY = 5 YEARS
MINIMUM VELOCITY= 0.80 m/s
MANNING'S n= 0.013
MIN. HGL CLEARANCE to Underside of Footing (USF) = 0.30m

HGL=Major + Minor Losses
Major Loss= Pipe Friction (Darcy-Weisbach)
Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends
Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6
Elliptical Pipe Actual Diameter shown as Actual Rise

Designed: KJM
Checked: MAB
Dwg. Reference: 101108-STM1

PROJECT: Fernbank CDP
CLIENT:
Date: May 8, 2009

NOTES:

1) Red Text = Elliptical Pipes:
Dia (N) = Equivalent Pipe Size
Dia (A) = Elliptical Pipe Rise

```
2
*%=============================================================================|
*%
*%   ## MAJOR SYSTEM ANALYSIS - TYPICAL FLOWS FOR VARIOUS LAND USES  ##
*%   ### FERNBANK CDP: POST-DEVELOPMENT CONDITIONS - SEPTEMBER 2008 ###
*%
*%   3HR CHICAGO DISTRIBUTION (5, 10, 100YR EVENTS)
*%
*%=============================================================================|
START               TZERO=[0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
                    C5-3.stm
*
READ STORM          STORM_FILENAME=["storm.001"]
*
DEFAULT VALUES      ICASEdef=[1],  read and print values
                    DEFVAL_FILENAME=["ottawa.def"]
*%=============================================================================|
*  High Density Residential (5 hectares)
*  71% impervious (C=0.70)
*  150 m3/ha of storage
*  130 L/s capture rate
*%=============================================================================|
CALIB STANDHYD      ID=[1], NHYD=["HDR5"], DT=[5](min), AREA=[5.0](ha),
                    XIMP=[0.71], TIMP=[0.71], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80.5],
                    Pervious   surfaces: IAper=[4.67](mm), SLPP=[2.0](%),
                                         LGP=[40](m), MNP=[0.20], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.57](mm), SLPI=[1.0](%),
                                         LGI=[225](m), MNI=[0.013], SCI=[0](min)
                    END=-1
*
COMPUTE DUALHYD     IDin=[1], CINLET=[0.130](cms), NINLET=[5],
                    MAJID=[2], MajNHYD=["HDR5maj"],
                    MINID=[3], MinNHYD=["HDR5min"],
                    TMJSTO=[750](cu-m)
*%=============================================================================|
*  Low Density Residential
*  43% impervious (C=0.50)
*  50 m3/ha of storage
*  100 L/s capture rate
*%=============================================================================|
*  5 Hectares
* ============
CALIB STANDHYD      ID=[1], NHYD=["LDR5"], DT=[5](min), AREA=[5.0](ha),
                    XIMP=[0.34], TIMP=[0.43], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80.5],
                    Pervious   surfaces: IAper=[4.67](mm), SLPP=[2.0](%),
                                         LGP=[40](m), MNP=[0.20], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.57](mm), SLPI=[0.5](%),
                                         LGI=[250](m), MNI=[0.013], SCI=[0](min)
                    END=-1
*
COMPUTE DUALHYD     IDin=[1], CINLET=[0.100](cms), NINLET=[5],
                    MAJID=[2], MajNHYD=["LDR5maj"],
                    MINID=[3], MinNHYD=["LDR5min"],
                    TMJSTO=[250](cu-m)
* ============
*  10 Hectares
* ============
CALIB STANDHYD      ID=[1], NHYD=["LDR10"], DT=[5](min), AREA=[10.0](ha),
                    XIMP=[0.34], TIMP=[0.43], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80.5],
                    Pervious   surfaces: IAper=[4.67](mm), SLPP=[2.0](%),
                                         LGP=[40](m), MNP=[0.20], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.57](mm), SLPI=[0.5](%),
                                         LGI=[400](m), MNI=[0.013], SCI=[0](min)
                    END=-1
*
COMPUTE DUALHYD     IDin=[1], CINLET=[0.100](cms), NINLET=[10],
                    MAJID=[2], MajNHYD=["LDR10maj"],
                    MINID=[3], MinNHYD=["LDR10min"],
                    TMJSTO=[500](cu-m)
*%============
*  25 Hectares
* ============
CALIB STANDHYD      ID=[1], NHYD=["LDR25"], DT=[5](min), AREA=[25.0](ha),
                    XIMP=[0.34], TIMP=[0.43], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80.5],
                    Pervious   surfaces: IAper=[4.67](mm), SLPP=[2.0](%),
                                         LGP=[40](m), MNP=[0.20], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.57](mm), SLPI=[0.5](%),
                                         LGI=[900](m), MNI=[0.013], SCI=[0](min)
                    END=-1
*
COMPUTE DUALHYD     IDin=[1], CINLET=[0.100](cms), NINLET=[25],
                    MAJID=[2], MajNHYD=["LDR25maj"],
                    MINID=[3], MinNHYD=["LDR25min"],
                    TMJSTO=[1250](cu-m)
*%=============================================================================|
*  Medium Density Residential
*  57% impervious (C=0.60)
*  50 m3/ha of storage
*  115 L/s capture rate
*%=============================================================================|
*  5 Hectares
* ============
CALIB STANDHYD      ID=[1], NHYD=["MDR5"], DT=[5](min), AREA=[5.0](ha),
                    XIMP=[0.46], TIMP=[0.57], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80.5],
                    Pervious   surfaces: IAper=[4.67](mm), SLPP=[2.0](%),
                                         LGP=[40](m), MNP=[0.20], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.57](mm), SLPI=[0.5](%),
                                         LGI=[250](m), MNI=[0.013], SCI=[0](min)
                    END=-1
*
COMPUTE DUALHYD     IDin=[1], CINLET=[0.115](cms), NINLET=[5],
                    MAJID=[2], MajNHYD=["MDR5maj"],
                    MINID=[3], MinNHYD=["MDR5min"],
                    TMJSTO=[250](cu-m)
* ============
*  10 Hectares
* ============
CALIB STANDHYD      ID=[1], NHYD=["MDR10"], DT=[5](min), AREA=[10.0](ha),
                    XIMP=[0.46], TIMP=[0.57], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80.5],
                    Pervious   surfaces: IAper=[4.67](mm), SLPP=[2.0](%),
                                         LGP=[40](m), MNP=[0.20], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.57](mm), SLPI=[0.5](%),
                                         LGI=[400](m), MNI=[0.013], SCI=[0](min)
                    END=-1
*
COMPUTE DUALHYD     IDin=[1], CINLET=[0.115](cms), NINLET=[10],
                    MAJID=[2], MajNHYD=["MDR10maj"],
                    MINID=[3], MinNHYD=["MDR10min"],
                    TMJSTO=[500](cu-m)
*%============
*  25 Hectares
* ============
CALIB STANDHYD      ID=[1], NHYD=["MDR25"], DT=[5](min), AREA=[25.0](ha),
                    XIMP=[0.46], TIMP=[0.57], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80.5],
                    Pervious   surfaces: IAper=[4.67](mm), SLPP=[2.0](%),
                                         LGP=[40](m), MNP=[0.20], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.57](mm), SLPI=[0.5](%),
                                         LGI=[900](m), MNI=[0.013], SCI=[0](min)
                    END=-1
*
COMPUTE DUALHYD     IDin=[1], CINLET=[0.115](cms), NINLET=[25],
                    MAJID=[2], MajNHYD=["MDR25maj"],
                    MINID=[3], MinNHYD=["MDR25min"],
                    TMJSTO=[1250](cu-m)
*%=============================================================================|
*  Mixed Density Residential (50 ha) Including Parks, Schools, etc.
*  50% impervious (C=0.55)
*  50 m3/ha of storage
*  110 L/s capture rate
*%=============================================================================|
CALIB STANDHYD      ID=[1], NHYD=["R50"], DT=[5](min), AREA=[50.0](ha),
                    XIMP=[0.40], TIMP=[0.50], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80.5],
                    Pervious   surfaces: IAper=[4.67](mm), SLPP=[2.0](%),
                                         LGP=[40](m), MNP=[0.20], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.57](mm), SLPI=[0.5](%),
                                         LGI=[1200](m), MNI=[0.013], SCI=[0](min
                    END=-1
*
COMPUTE DUALHYD     IDin=[1], CINLET=[0.105](cms), NINLET=[50],
                    MAJID=[2], MajNHYD=["R50maj"],
                    MINID=[3], MinNHYD=["R50min"],
                    TMJSTO=[2500](cu-m)
*%=============================================================================|
*  Commercial Area (3 ha)
*  86% impervious (C=0.80)
*  150 m3/ha of storage
*  150 L/s/ha capture rate
*%=============================================================================|
CALIB STANDHYD      ID=[1], NHYD=["C3"], DT=[5](min), AREA=[3.0](ha),
                    XIMP=[0.86], TIMP=[0.86], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80.5],
                    Pervious   surfaces: IAper=[4.67](mm), SLPP=[1.0](%),
                                         LGP=[20](m), MNP=[0.20], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.57](mm), SLPI=[0.5](%),
                                         LGI=[175](m), MNI=[0.013], SCI=[0](min)
                    END=-1
*
COMPUTE DUALHYD     IDin=[1], CINLET=[0.700](cms), NINLET=[1],
                    MAJID=[2], MajNHYD=["C3maj"],
                    MINID=[3], MinNHYD=["C3min"],
                    TMJSTO=[360](cu-m)
*%=============================================================================|
*  Collector Road (2 ha)
*  71% impervious (C=0.70)
*  40 m3/ha major system storage
*  145 L/s/ha capture rate (5yr)
*%=============================================================================|
CALIB STANDHYD      ID=[1], NHYD=["CR"], DT=[5](min), AREA=[2.0](ha),
                    XIMP=[0.71], TIMP=[0.71], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80.5],
                    Pervious   surfaces: IAper=[4.67](mm), SLPP=[1.0](%),
                                         LGP=[10](m), MNP=[0.20], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.57](mm), SLPI=[0.30](%),
                                         LGI=[500](m), MNI=[0.013], SCI=[0](min)
                    END=-1
*
COMPUTE DUALHYD     IDin=[1], CINLET=[0.145](cms), NINLET=[2],
                    MAJID=[2], MajNHYD=["CR-maj"],
                    MINID=[3], MinNHYD=["CR-min"],
                    TMJSTO=[40](cu-m)
*%=============================================================================|
*  Arterial Road (2 ha)
*  71% impervious (C=0.70)
*  No major system storage
*  185 L/s/ha capture rate (10yr)
*%=============================================================================|
CALIB STANDHYD      ID=[1], NHYD=["AR"], DT=[5](min), AREA=[2.0](ha),
                    XIMP=[0.71], TIMP=[0.71], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80.5],
                    Pervious   surfaces: IAper=[4.67](mm), SLPP=[1.0](%),
                                         LGP=[10](m), MNP=[0.20], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.57](mm), SLPI=[0.30](%),
                                         LGI=[500](m), MNI=[0.013], SCI=[0](min)
                    END=-1
*
COMPUTE DUALHYD     IDin=[1], CINLET=[0.185](cms), NINLET=[2],
                    MAJID=[2], MajNHYD=["AR-maj"],
                    MINID=[3], MinNHYD=["AR-min"],
                    TMJSTO=[0](cu-m)
*%=============================================================================|
* Open Space Areas (2 ha)
*  0% impervious (C=0.20)
*  No major system storage
*  50 L/s/ha capture rate
*%=============================================================================|
CALIB NASHYD        ID=[1], NHYD=["OS"] DT=[5]min, AREA=[2.00](ha),
                    DWF= 0  CN= 80.5  IA= 9.8  N=2  TP=0.25, END=-1
*
COMPUTE DUALHYD     IDin=[1], CINLET=[0.050] cms), NINLET=[2],
                    MAJID=[2], MajNHYD=["OSmaj"],
                    MINID=[3], MinNHYD=["OSmin"],
                    TMJSTO=[0](cu-m)
*%=============================================================================|
* Parks (5 ha)
*  29% impervious (C=0.40)
*  50 m3/ha on-site storage
*  70 L/s/ha capture rate (approx 5yr)
*%=============================================================================|
```

```
CALIB STANDHYD      ID=[1], NHYD=["PK"], DT=[5](min), AREA=[5.0](ha),
                    XIMP=[0.01], TIMP=[0.29], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80.5],
                    Pervious   surfaces: IAper=[4.67](mm), SLPP=[0.5](%),
                                         LGP=[250](m), MNP=[0.20], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.57](mm), SLPI=[0.25](%),
                                         LGI=[100](m), MNI=[0.013], SCI=[0](min)
                    END=-1
*
COMPUTE DUALHYD     IDin=[1], CINLET=[0.070] cms), NINLET=[5],
                    MAJID=[2], MajNHYD=["PKmaj"],
                    MINID=[3], MinNHYD=["PKmin"],
                    TMJSTO=[250](cu-m)
*§=========================================================================|
START               TZERO=[0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
                    C10-3.stm
START               TZERO=[0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
                    C100-3.stm
FINISH
```

```
================================================================================

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO         999    888  =========
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O       9   9  8   8 =========
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##   9   9  8   8 Ver.  4.0
     S  W W W  M   M  H   H    Y    M   M  O   O        9999   888  Sept 1998
 SSSSS   W W   M   M  H   H    Y    M   M   OOO            9  8   8 =========
                                                       9   9  8   8 # 5320763
      StormWater Management HYdrologic Model            999    888  =========

 ********************************************************************************
 ************************** SWMHYMO-98  Ver/4.0 *********************************
 *******  A single event and continuous hydrologic simulation model  *******
 *******     based on the principles of HYMO and its successors      *******
 *******                OTTHYMO-83 and OTTHYMO-89.                   *******
 ********************************************************************************
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 *******                   Ottawa,  Ontario: (613) 727-5199         *******
 *******                   Gatineau, Quebec: (819) 243-6858         *******
 *******                   E-Mail: swmhymo@jfsa.com                 *******
 ********************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++ Licensed user: NOVATECH ENGINEERING CONSULTANTS LTD         +++++++
 +++++++                Nepean                 SERIAL#:5320763      +++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 *******          ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *******
 *******          Maximum value for ID numbers  :     10            *******
 *******          Max. number of rainfall points:  15000            *******
 *******          Max. number of flow points    :  15000            *******
 ********************************************************************************

 *** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) ***
 ***------------------------------------------------------------------------***
 ***    ID:  Hydrograph IDentification numbers, (1-10).                   ***
 ***  NHYD:  Hydrograph reference numbers, (6 digits or characters).      ***
 ***  AREA:  Drainage area associated with hydrograph, (ac.) or (ha.).    ***
 *** QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).      ***
 *** TpeakDate_hh:mm is the date and time of the peak flow.               ***
 ***  R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).         ***
 ***  R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).         ***
 ***     *:  see WARNING or NOTE message printed at end of run.           ***
 ***    **:  see  ERROR  message printed at end of run.                   ***
 ********************************************************************************
 ********************************************************************************

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 ********************************************************************************

 ********************   S U M M A R Y   O U T P U T   ***********************
 ********************************************************************************
 *       DATE: 2008-09-16     TIME: 17:23:01     RUN COUNTER: 001366       *
 ********************************************************************************
 * Input   filename: M:\2001\101108\DATA\CALCUL~1\SWM\SWMHYMO\Major\MAJ.dat*
 * Output  filename: M:\2001\101108\DATA\CALCUL~1\SWM\SWMHYMO\Major\MAJ.out*
 * Summary filename: M:\2001\101108\DATA\CALCUL~1\SWM\SWMHYMO\Major\MAJ.sum*
 * User comments:                                                          *
 * 1:_____________________________________________________________________*
 * 2:_____________________________________________________________________*
 * 3:_____________________________________________________________________*
 ********************************************************************************


 RUN:COMMAND#
 001:0001--------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   1 ]
 001:0002--------------------------------------------------------------------------
     READ STORM
      Filename = storm.001
      Comment  = City of Ottawa:  5yr-3hr Chicago (10 minute time step)
      [SDT=10.00:SDUR=   3.00:PTOT=  42.51]
 001:0003--------------------------------------------------------------------------
     DEFAULT VALUES
      Filename = M:\2001\101108\DATA\CALCUL~1\SWM\SWMHYMO\Major\ottawa.def
      ICASEdv  = 1 (read and print data)
      FileTitle= ------ ENTER YOUR COMMENTS ON THIS LINE AND THE NEXT ONE ---
                 ------ PARAMETER VALUES MUST BE ENTERD AFTER COLUMN 60 ----
      Horton's infiltration equation parameters:
      [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 1.66 /hr] [F=  .00 mm]
      Parameters for PERVIOUS surfaces in STANDHYD:
      [IAper=   4.67 mm] [LGP=40.00 m] [MNP= .250]
      Parameters for IMPERVIOUS surfaces in STANDHYD:
      [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .013]
      Parameters used in NASHYD:
      [Ia=   4.67 mm] [N= 2.00]
 001:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  CALIB STANDHYD     01:HDR5       5.00     .984 No_date    1:00   33.25 .782
      [XIMP=.71:TIMP=.71]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI=1.00:LGI= 225.:MNI=.013:SCI=   .0]
 001:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD    01:HDR5       5.00     .984 No_date    1:00   33.25  n/a
        Major System /  02:HDR5ma      .00     .000 No_date    0:00     .00  n/a
        Minor System \  03:HDR5mi     5.00     .650 No_date    0:55   32.78  n/a
       {MjSysSto=.1173E+03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 001:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     CALIB STANDHYD     01:LDR5       5.00     .503 No_date    1:00   24.58 .578
      [XIMP=.34:TIMP=.43]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 250.:MNI=.013:SCI=   .0]
 001:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD    01:LDR5       5.00     .503 No_date    1:00   24.58  n/a
        Major System /  02:LDR5ma      .00     .000 No_date    0:00     .00  n/a
        Minor System \  03:LDR5mi     5.00     .500 No_date    1:00   24.57  n/a
       {MjSysSto=.2398E-01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 001:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     CALIB STANDHYD     01:LDR10     10.00     .923 No_date    1:00   24.58 .578
      [XIMP=.34:TIMP=.43]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 400.:MNI=.013:SCI=   .0]
 001:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD    01:LDR10     10.00     .923 No_date    1:00   24.58  n/a
        Major System /  02:LDR10m      .00     .000 No_date    0:00     .00  n/a
        Minor System \  03:LDR10m    10.00     .923 No_date    1:00   24.58  n/a
       {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 001:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     CALIB STANDHYD     01:LDR25     25.00    1.821 No_date    1:05   24.59 .578
      [XIMP=.34:TIMP=.43]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 900.:MNI=.013:SCI=   .0]
 001:0011--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD    01:LDR25     25.00    1.821 No_date    1:05   24.59  n/a
        Major System /  02:LDR25m      .00     .000 No_date    0:00     .00  n/a
        Minor System \  03:LDR25m    25.00    1.821 No_date    1:05   24.59  n/a
       {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 001:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     CALIB STANDHYD     01:MDR5       5.00     .650 No_date    1:00   28.09 .661
      [XIMP=.46:TIMP=.57]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 250.:MNI=.013:SCI=   .0]
 001:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD    01:MDR5       5.00     .650 No_date    1:00   28.09  n/a
        Major System /  02:MDR5ma      .00     .000 No_date    0:00     .00  n/a
        Minor System \  03:MDR5mi     5.00     .575 No_date    1:00   27.74  n/a
       {MjSysSto=.9628E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 001:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     CALIB STANDHYD     01:MDR10     10.00    1.191 No_date    1:00   28.09 .661
      [XIMP=.46:TIMP=.57]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 400.:MNI=.013:SCI=   .0]
 001:0015--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD    01:MDR10     10.00    1.191 No_date    1:00   28.09  n/a
        Major System /  02:MDR10m      .00     .000 No_date    0:00     .00  n/a
        Minor System \  03:MDR10m    10.00    1.150 No_date    1:00   27.98  n/a
       {MjSysSto=.1742E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 001:0016--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     CALIB STANDHYD     01:MDR25     25.00    2.306 No_date    1:05   28.09 .661
      [XIMP=.46:TIMP=.57]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 900.:MNI=.013:SCI=   .0]
 001:0017--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD    01:MDR25     25.00    2.306 No_date    1:05   28.09  n/a
        Major System /  02:MDR25m      .00     .000 No_date    0:00     .00  n/a
        Minor System \  03:MDR25m    25.00    2.306 No_date    1:05   28.09  n/a
       {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 001:0018--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     CALIB STANDHYD     01:R50       50.00    3.580 No_date    1:10   26.33 .619
      [XIMP=.40:TIMP=.50]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=1200.:MNI=.013:SCI=   .0]
 001:0019--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD    01:R50       50.00    3.580 No_date    1:10   26.33  n/a
        Major System /  02:R50maj      .00     .000 No_date    0:00     .00  n/a
        Minor System \  03:R50min    50.00    3.580 No_date    1:10   26.33  n/a
       {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 001:0020--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  CALIB STANDHYD     01:C3         3.00     .697 No_date    1:00   37.23 .876
      [XIMP=.86:TIMP=.86]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=1.00:LGP=  20.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 175.:MNI=.013:SCI=   .0]
 001:0021--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD    01:C3         3.00     .697 No_date    1:00   37.23  n/a
        Major System /  02:C3maj       .00     .000 No_date    0:00     .00  n/a
        Minor System \  03:C3min      3.00     .697 No_date    1:00   37.23  n/a
       {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 001:0022--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     CALIB STANDHYD     01:CR         2.00     .284 No_date    1:05   33.25 .782
      [XIMP=.71:TIMP=.71]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=1.00:LGP=  10.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .30:LGI= 500.:MNI=.013:SCI=   .0]
 001:0023--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD    01:CR         2.00     .284 No_date    1:05   33.25  n/a
        Major System /  02:CR-maj      .00     .000 No_date    0:00     .00  n/a
        Minor System \  03:CR-min     2.00     .284 No_date    1:05   33.25  n/a
       {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 001:0024--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     CALIB STANDHYD     01:AR         2.00     .284 No_date    1:05   33.25 .782
      [XIMP=.71:TIMP=.71]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=1.00:LGP=  10.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .30:LGI= 500.:MNI=.013:SCI=   .0]
 001:0025--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD    01:AR         2.00     .284 No_date    1:05   33.25  n/a
        Major System /  02:AR-maj      .00     .000 No_date    0:00     .00  n/a
        Minor System \  03:AR-min     2.00     .284 No_date    1:05   33.25  n/a
 001:0026--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     CALIB NASHYD       01:OS         2.00     .047 No_date    1:20   11.35 .267
      [CN= 80.5: N= 2.00]
      [Tp=  .25:DT= 5.00]
 001:0027--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD    01:OS         2.00     .047 No_date    1:20   11.35  n/a
        Major System /  02:OSmaj       .00     .000 No_date    0:00     .00  n/a
        Minor System \  03:OSmin      2.00     .047 No_date    1:20   11.35  n/a
 001:0028--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  CALIB STANDHYD     01:PK         5.00     .120 No_date    1:55   18.64 .438
      [XIMP=.01:TIMP=.29]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP= .50:LGP= 250.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .25:LGI= 100.:MNI=.013:SCI=   .0]
 001:0029--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD    01:PK         5.00     .120 No_date    1:55   18.64  n/a
        Major System /  02:PKmaj       .00     .000 No_date    0:00     .00  n/a
        Minor System \  03:PKmin      5.00     .120 No_date    1:55   18.64  n/a
       {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
  ** END OF RUN :   1

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

```
RUN:COMMAND#
002:0001------------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =   2 ]
002:0002------------------------------------------------------------------------
    READ STORM
     Filename = storm.001
     Comment  = City of Ottawa:  10yr-3hr Chicago (10 minute time step)
     [SDT=10.00:SDUR=   3.00:PTOT=  49.49]
002:0003------------------------------------------------------------------------
    DEFAULT VALUES
     Filename = M:\2001\101108\DATA\CALCUL~1\SWM\SWMHYMO\Major\ottawa.def
     ICASEdv  = 1 (read and print data)
     FileTitle= ------ ENTER YOUR COMMENTS ON THIS LINE AND THE NEXT ONE ---
                ------ PARAMETER VALUES MUST BE ENTERD AFTER COLUMN 60 ----□
     Horton's infiltration equation parameters:
     [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 1.66 /hr] [F=  .00 mm]
     Parameters for PERVIOUS surfaces in STANDHYD:
     [IAper=   4.67 mm] [LGP=40.00 m] [MNP= .250]
     Parameters for IMPERVIOUS surfaces in STANDHYD:
     [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .013]
     Parameters used in NASHYD:
     [Ia=   4.67 mm] [N= 2.00]
002:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  CALIB STANDHYD     01:HDR5        5.00     1.184 No_date    1:10   39.50 .798
     [XIMP=.71:TIMP=.71]
     [LOSS= 2 :CN= 80.5]
     [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
     [Impervious   area: IAimp= 1.57:SLPI=1.00:LGI= 225.:MNI=.013:SCI=   .0]
002:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:HDR5        5.00     1.184 No_date    1:10   39.50  n/a
      Major System /  02:HDR5ma       .00      .000 No_date    0:00     .00  n/a
      Minor System \  03:HDR5mi      5.00      .650 No_date    1:05   39.78  n/a
     {MjSysSto=.2310E+03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
002:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    CALIB STANDHYD     01:LDR5        5.00      .639 No_date    1:10   30.13 .609
     [XIMP=.34:TIMP=.43]
     [LOSS= 2 :CN= 80.5]
     [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
     [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 250.:MNI=.013:SCI=   .0]
002:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:LDR5        5.00      .639 No_date    1:10   30.13  n/a
      Major System /  02:LDR5ma       .00      .000 No_date    0:00     .00  n/a
      Minor System \  03:LDR5mi      5.00      .500 No_date    1:10   30.38  n/a
     {MjSysSto=.3773E+02, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
002:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    CALIB STANDHYD     01:LDR10      10.00     1.180 No_date    1:10   30.13 .609
     [XIMP=.34:TIMP=.43]
     [LOSS= 2 :CN= 80.5]
     [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
     [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 400.:MNI=.013:SCI=   .0]
002:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:LDR10      10.00     1.180 No_date    1:10   30.13  n/a
      Major System /  02:LDR10m       .00      .000 No_date    0:00     .00  n/a
      Minor System \  03:LDR10m     10.00     1.000 No_date    1:10   29.88  n/a
     {MjSysSto=.4290E+02, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
002:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    CALIB STANDHYD     01:LDR25      25.00     2.360 No_date    1:15   30.13 .609
     [XIMP=.34:TIMP=.43]
     [LOSS= 2 :CN= 80.5]
     [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
     [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 900.:MNI=.013:SCI=   .0]
002:0011--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:LDR25      25.00     2.360 No_date    1:15   30.13  n/a
      Major System /  02:LDR25m       .00      .000 No_date    0:00     .00  n/a
      Minor System \  03:LDR25m     25.00     2.360 No_date    1:15   30.13  n/a
     {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
002:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    CALIB STANDHYD     01:MDR5        5.00      .809 No_date    1:10   33.98 .687
     [XIMP=.46:TIMP=.57]
     [LOSS= 2 :CN= 80.5]
     [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
     [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 250.:MNI=.013:SCI=   .0]
002:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:MDR5        5.00      .809 No_date    1:10   33.98  n/a
      Major System /  02:MDR5ma       .00      .000 No_date    0:00     .00  n/a
      Minor System \  03:MDR5mi      5.00      .575 No_date    1:05   34.18  n/a
     {MjSysSto=.7668E+02, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
002:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    CALIB STANDHYD     01:MDR10      10.00     1.494 No_date    1:10   33.98 .687
     [XIMP=.46:TIMP=.57]
     [LOSS= 2 :CN= 80.5]
     [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
     [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 400.:MNI=.013:SCI=   .0]
002:0015--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:MDR10      10.00     1.494 No_date    1:10   33.98  n/a
      Major System /  02:MDR10m       .00      .000 No_date    0:00     .00  n/a
      Minor System \  03:MDR10m     10.00     1.150 No_date    1:10   34.24  n/a
     {MjSysSto=.1017E+03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
002:0016--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    CALIB STANDHYD     01:MDR25      25.00     2.925 No_date    1:15   33.98 .687
     [XIMP=.46:TIMP=.57]
     [LOSS= 2 :CN= 80.5]
     [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
     [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 900.:MNI=.013:SCI=   .0]
002:0017--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:MDR25      25.00     2.925 No_date    1:15   33.98  n/a
      Major System /  02:MDR25m       .00      .000 No_date    0:00     .00  n/a
      Minor System \  03:MDR25m     25.00     2.875 No_date    1:15   33.93  n/a
     {MjSysSto=.2559E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
002:0018--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    CALIB STANDHYD     01:R50        50.00     4.604 No_date    1:20   32.05 .648
     [XIMP=.40:TIMP=.50]
     [LOSS= 2 :CN= 80.5]
     [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
     [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=1200.:MNI=.013:SCI=   .0]
002:0019--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:R50        50.00     4.604 No_date    1:20   32.05  n/a
      Major System /  02:R50maj       .00      .000 No_date    0:00     .00  n/a
      Minor System \  03:R50min     50.00     4.604 No_date    1:20   32.05  n/a
     {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
002:0020--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  CALIB STANDHYD     01:C3          3.00      .843 No_date    1:10   43.86 .886
     [XIMP=.86:TIMP=.86]
     [LOSS= 2 :CN= 80.5]
     [Pervious     area: IAper= 4.67:SLPP=1.00:LGP=  20.:MNP=.200:SCP=   .0]
     [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 175.:MNI=.013:SCI=   .0]
002:0021--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:C3          3.00      .843 No_date    1:10   43.86  n/a
      Major System /  02:C3maj        .00      .000 No_date    0:00     .00  n/a
      Minor System \  03:C3min       3.00      .700 No_date    1:10   42.89  n/a
     {MjSysSto=.2771E+02, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
002:0022--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    CALIB STANDHYD     01:CR          2.00      .349 No_date    1:15   39.50 .798
     [XIMP=.71:TIMP=.71]
     [LOSS= 2 :CN= 80.5]
     [Pervious     area: IAper= 4.67:SLPP=1.00:LGP=  10.:MNP=.200:SCP=   .0]
     [Impervious   area: IAimp= 1.57:SLPI= .30:LGI= 500.:MNI=.013:SCI=   .0]
002:0023--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:CR          2.00      .349 No_date    1:15   39.50  n/a
      Major System /  02:CR-maj       .00      .000 No_date    0:00     .00  n/a
      Minor System \  03:CR-min      2.00      .290 No_date    1:10   39.57  n/a
     {MjSysSto=.2177E+02, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
002:0024--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    CALIB STANDHYD     01:AR          2.00      .349 No_date    1:15   39.50 .798
     [XIMP=.71:TIMP=.71]
     [LOSS= 2 :CN= 80.5]
     [Pervious     area: IAper= 4.67:SLPP=1.00:LGP=  10.:MNP=.200:SCP=   .0]
     [Impervious   area: IAimp= 1.57:SLPI= .30:LGI= 500.:MNI=.013:SCI=   .0]
002:0025--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:AR          2.00      .349 No_date    1:15   39.50  n/a
      Major System /  02:AR-maj       .00      .000 No_date    0:00     .00  n/a
      Minor System \  03:AR-min      2.00      .349 No_date    1:15   39.50  n/a
002:0026--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    CALIB NASHYD       01:OS          2.00      .072 No_date    1:30   15.57 .314
     [CN= 80.5: N= 2.00]
     [Tp=  .25:DT= 5.00]
002:0027--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:OS          2.00      .072 No_date    1:30   15.57  n/a
      Major System /  02:OSmaj        .00      .000 No_date    0:00     .00  n/a
      Minor System \  03:OSmin       2.00      .072 No_date    1:30   15.57  n/a
002:0028--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  CALIB STANDHYD     01:PK          5.00      .179 No_date    1:55   23.83 .482
     [XIMP=.01:TIMP=.29]
     [LOSS= 2 :CN= 80.5]
     [Pervious     area: IAper= 4.67:SLPP= .50:LGP= 250.:MNP=.200:SCP=   .0]
     [Impervious   area: IAimp= 1.57:SLPI= .25:LGI= 100.:MNI=.013:SCI=   .0]
002:0029--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:PK          5.00      .179 No_date    1:55   23.83  n/a
      Major System /  02:PKmaj        .00      .000 No_date    0:00     .00  n/a
      Minor System \  03:PKmin       5.00      .179 No_date    1:55   23.83  n/a
     {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 ** END OF RUN :   2
********************************************************************************




RUN:COMMAND#
003:0001------------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =   3 ]
003:0002------------------------------------------------------------------------
    READ STORM
     Filename = storm.001
     Comment  = City of Ottawa:  100yr-3hr Chicago (10 minute time step)
     [SDT=10.00:SDUR=   3.00:PTOT=  71.65]
003:0003------------------------------------------------------------------------
    DEFAULT VALUES
     Filename = M:\2001\101108\DATA\CALCUL~1\SWM\SWMHYMO\Major\ottawa.def
     ICASEdv  = 1 (read and print data)
     FileTitle= ------ ENTER YOUR COMMENTS ON THIS LINE AND THE NEXT ONE ---
                ------ PARAMETER VALUES MUST BE ENTERD AFTER COLUMN 60 ----□
     Horton's infiltration equation parameters:
     [Fo= 76.20 mm/hr] [Fc=13.20 mm/hr] [DCAY= 1.66 /hr] [F=  .00 mm]
     Parameters for PERVIOUS surfaces in STANDHYD:
     [IAper=   4.67 mm] [LGP=40.00 m] [MNP= .250]
     Parameters for IMPERVIOUS surfaces in STANDHYD:
     [IAimp=   1.57 mm] [CLI= 1.50]   [MNI= .013]
     Parameters used in NASHYD:
     [Ia=   4.67 mm] [N= 2.00]
003:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  CALIB STANDHYD     01:HDR5        5.00     1.877 No_date    1:10   59.88 .836
     [XIMP=.71:TIMP=.71]
     [LOSS= 2 :CN= 80.5]
     [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
     [Impervious   area: IAimp= 1.57:SLPI=1.00:LGI= 225.:MNI=.013:SCI=   .0]
003:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:HDR5        5.00     1.877 No_date    1:10   59.88  n/a
      Major System /  02:HDR5ma       .00      .000 No_date    0:00     .00  n/a
      Minor System \  03:HDR5mi      5.00      .650 No_date    1:05   60.37  n/a
     {MjSysSto=.7389E+03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
003:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  CALIB STANDHYD     01:LDR5        5.00     1.226 No_date    1:10   48.82 .681
     [XIMP=.34:TIMP=.43]
     [LOSS= 2 :CN= 80.5]
     [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
     [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 250.:MNI=.013:SCI=   .0]
003:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:LDR5        5.00     1.226 No_date    1:10   48.82  n/a
      Major System /  02:LDR5ma       .58      .380 No_date    1:15   48.82  n/a
      Minor System \  03:LDR5mi      4.42      .500 No_date    1:05   48.23  n/a
     {MjSysSto=.2500E+03, TotOvfVol=.2840E+03, N-Ovf=    1, TotDurOvf=    0.hrs
003:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    CALIB STANDHYD     01:LDR10      10.00     2.284 No_date    1:10   48.82 .681
     [XIMP=.34:TIMP=.43]
     [LOSS= 2 :CN= 80.5]
     [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
     [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 400.:MNI=.013:SCI=   .0]
003:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:LDR10      10.00     2.284 No_date    1:10   48.82  n/a
      Major System /  02:LDR10m      1.03      .763 No_date    1:20   48.82  n/a
      Minor System \  03:LDR10m      8.97     1.000 No_date    1:05   49.04  n/a
     {MjSysSto=.5000E+03, TotOvfVol=.5021E+03, N-Ovf=    1, TotDurOvf=    0.hrs
003:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
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    CALIB STANDHYD     01:LDR25     25.00    4.547 No_date    1:15   48.82 .681
      [XIMP=.34:TIMP=.43]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 900.:MNI=.013:SCI=   .0]
003:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:LDR25     25.00    4.547 No_date    1:15   48.82  n/a
       Major System /  02:LDR25m     1.33    1.179 No_date    1:25   48.82  n/a
       Minor System \  03:LDR25m    23.67    2.500 No_date    1:10   48.77  n/a
      {MjSysSto=.1250E+04, TotOvfVol=.6517E+03, N-Ovf=    1, TotDurOvf=    0.hrs
003:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  CALIB STANDHYD     01:MDR5       5.00    1.447 No_date    1:10   53.55 .747
      [XIMP=.46:TIMP=.57]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 250.:MNI=.013:SCI=   .0]
003:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:MDR5       5.00    1.447 No_date    1:10   53.55  n/a
       Major System /  02:MDR5ma      .63     .645 No_date    1:15   53.55  n/a
       Minor System \  03:MDR5mi     4.37     .575 No_date    1:05   52.89  n/a
      {MjSysSto=.2500E+03, TotOvfVol=.3349E+03, N-Ovf=    1, TotDurOvf=    0.hrs
003:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    CALIB STANDHYD     01:MDR10     10.00    2.698 No_date    1:10   53.55 .747
      [XIMP=.46:TIMP=.57]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 400.:MNI=.013:SCI=   .0]
003:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:MDR10     10.00    2.698 No_date    1:10   53.55  n/a
       Major System /  02:MDR10m     1.11     .903 No_date    1:15   53.55  n/a
       Minor System \  03:MDR10m     8.89    1.150 No_date    1:05   53.75  n/a
      {MjSysSto=.5000E+03, TotOvfVol=.5940E+03, N-Ovf=    1, TotDurOvf=    0.hrs
003:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    CALIB STANDHYD     01:MDR25     25.00    5.286 No_date    1:15   53.55 .747
      [XIMP=.46:TIMP=.57]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 900.:MNI=.013:SCI=   .0]
003:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:MDR25     25.00    5.286 No_date    1:15   53.55  n/a
       Major System /  02:MDR25m     1.51    1.445 No_date    1:25   53.55  n/a
       Minor System \  03:MDR25m    23.49    2.875 No_date    1:10   53.49  n/a
      {MjSysSto=.1250E+04, TotOvfVol=.8100E+03, N-Ovf=    1, TotDurOvf=    0.hrs
003:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    CALIB STANDHYD     01:R50       50.00    8.335 No_date    1:15   51.18 .714
      [XIMP=.40:TIMP=.50]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=2.00:LGP=  40.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI=1200.:MNI=.013:SCI=   .0]
003:0019---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:R50       50.00    8.335 No_date    1:15   51.18  n/a
       Major System /  02:R50maj     1.42    1.723 No_date    1:30   51.18  n/a
       Minor System \  03:R50min    48.58    5.250 No_date    1:10   50.86  n/a
      {MjSysSto=.2500E+04, TotOvfVol=.7277E+03, N-Ovf=    1, TotDurOvf=    0.hrs
003:0020---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  CALIB STANDHYD     01:C3         3.00    1.280 No_date    1:10   65.16 .909
      [XIMP=.86:TIMP=.86]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=1.00:LGP=  20.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .50:LGI= 175.:MNI=.013:SCI=   .0]
003:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:C3         3.00    1.280 No_date    1:10   65.16  n/a
       Major System /  02:C3maj       .00     .000 No_date    0:00     .00  n/a
       Minor System \  03:C3min      3.00     .700 No_date    1:05   64.31  n/a
      {MjSysSto=.2490E+03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
003:0022---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    CALIB STANDHYD     01:CR         2.00     .572 No_date    1:15   59.88 .836
      [XIMP=.71:TIMP=.71]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=1.00:LGP=  10.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .30:LGI= 500.:MNI=.013:SCI=   .0]
003:0023---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:CR         2.00     .572 No_date    1:15   59.88  n/a
       Major System /  02:CR-maj      .28     .249 No_date    1:15   59.88  n/a
       Minor System \  03:CR-min     1.72     .290 No_date    1:10   60.39  n/a
      {MjSysSto=.4000E+02, TotOvfVol=.1652E+03, N-Ovf=    1, TotDurOvf=    0.hrs
003:0024---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    CALIB STANDHYD     01:AR         2.00     .572 No_date    1:15   59.88 .836
      [XIMP=.71:TIMP=.71]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP=1.00:LGP=  10.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .30:LGI= 500.:MNI=.013:SCI=   .0]
003:0025---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:AR         2.00     .572 No_date    1:15   59.88  n/a
       Major System /  02:AR-maj      .21     .202 No_date    1:15   59.88  n/a
       Minor System \  03:AR-min     1.79     .370 No_date    1:10   59.88  n/a
003:0026---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    CALIB NASHYD       01:OS         2.00     .151 No_date    1:25   31.01 .433
      [CN= 80.5: N= 2.00]
      [Tp=  .25:DT= 5.00]
003:0027---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:OS         2.00     .151 No_date    1:25   31.01  n/a
       Major System /  02:OSmaj       .27     .051 No_date    1:25   31.01  n/a
       Minor System \  03:OSmin      1.73     .100 No_date    1:15   31.01  n/a
003:0028---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  CALIB STANDHYD     01:PK         5.00     .411 No_date    1:40   41.78 .583
      [XIMP=.01:TIMP=.29]
      [LOSS= 2 :CN= 80.5]
      [Pervious     area: IAper= 4.67:SLPP= .50:LGP= 250.:MNP=.200:SCP=   .0]
      [Impervious   area: IAimp= 1.57:SLPI= .25:LGI= 100.:MNI=.013:SCI=   .0]
003:0029---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:PK         5.00     .411 No_date    1:40   41.78  n/a
       Major System /  02:PKmaj       .00     .000 No_date    0:00     .00  n/a
       Minor System \  03:PKmin      5.00     .350 No_date    1:35   41.92  n/a
      {MjSysSto=.5293E+02, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
003:0002---------------------------------------------------------------------------
      FINISH
-------------------------------------------------------------------------------
*******************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0004 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0020 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0028 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0004 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0020 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0028 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 003:0004 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 003:0006 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 003:0012 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 003:0020 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 003:0028 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
   Simulation ended on 2008-09-16     at 17:23:02
===============================================================================
```

B-19: Major System to Pond 1

ID	Land Use	Individual			Cumulative				Dry Pond		
		Drainage Area (ha)	Unit Flow Rate (L/s/ha)	Major System Flow (m^3/s)	IDs	Area (ha)	Unit Flow Rate (L/s/ha)	Major System Flow (m^3/s)	Drainage Area (ha)	Storage Required (m^3/ha)	Storage Required m^3
M1.1	LDR	5.1	76	0.39				0.00			
	MDR	9.43	90	0.85	M1.1	14.53	85	1.24	14.53	50	727
M1.2	Arterial	2.02	101	0.20	M1.2	2.02	101	0.20			
M1.3	Commercial	3.78	0	0.00	M1.3	3.78	0	0.00			
M1.4	LDR	7.7	76	0.59				0.00			
	MDR	3.5	130	0.46	M1.2,1.4	13.22	94	1.24			
M1.5	School	6.09	77	0.47							
	Commercial	3.55	0	0.00	M1.5	9.64	49	0.47			
M1.6	MDR	2.63	130	0.34							
	LDR	1.65	76	0.13							
	OS	1.55	26	0.04	M1.6	5.83	87	0.51	15.47	50	774
M1.7	Arterial	4.44	101	0.45	M1.6	4.44	101	0.45			
M1.8	MDR	11.18	89	1.00	M1.6-1.7	15.62	76	1.19			
M1.9	LDR	13.41	70	0.94	M1.6-1.8	29.03	48	**1.63**			
Total:		76.03									

Average Overland Slope: 0.23%
Maximum Overland Length: 1200 m

B-20: Major System to Pond 2

ID	Land Use	Individual			Cumulative				Dry Pond		
		Drainage Area (ha)	Unit Flow Rate (L/s/ha)	Major System Flow (m^3/s)	IDs	Area (ha)	Unit Flow Rate (L/s/ha)	Major System Flow (m^3/s)	Drainage Area (ha)	Storage Required (m^3/ha)	Storage Required m^3
M2.1	Commercial	6.22	0	0.00	M2.1	6.22	0	0.00			
M2.2	LDR	4.4	76	0.33				0.00			
	MDR	4	130	0.52	M2.2	8.4	102	0.85			
M2.3	LDR	5.48	76	0.42	M2.2-2.3	13.88	68	**0.94**			
Total:		20.1									

Average Overland Slope: 0.40%
Maximum Overland Length: 800 m

B-21: Major System to Pond 3

ID	Land Use	Individual			Cumulative				Dry Pond		
		Drainage Area (ha)	Unit Flow Rate (L/s/ha)	Major System Flow (m^3/s)	IDs	Area (ha)	Unit Flow Rate (L/s/ha)	Major System Flow (m^3/s)	Drainage Area (ha)	Storage Required (m^3/ha)	Storage Required m^3
M3.1	LDR / Mixed Use	7.14	76	0.54							
	Mixed Use	6.00	0	0.00	M3.1	13.14	41	0.54			
M3.2	LDR	4.00	76	0.30							
	MDR	3.26	130		M3.1-2	20.40	65	0.30			
M3.3	MDR	6.07	125	0.76	M3.3	6.07	125	0.76			
M3.4	LDR	11.78	75	0.88	M3.4	11.78	75	0.88			
M3.5	Park / OS	12.85	0	0.00							
	Collector	2.5	125	0.31	M3.1-3.5	53.60	35	1.88			
M3.6	LDR	16.91	64	1.08	M3.6	16.91	64	1.08			
M3.7	LDR	3.58	76	0.27	M3.1-3.7	74.09	29	**2.15**			
M3.8	Collector	1.53	125	0.19							
	LDR	6.00	76	0.46							
	School / Park	7.49	35	0.26	M3.8	15.02	61	0.91			
Total:		89.11									

Average Overland Slope: 0.40%
Maximum Overland Length: 1400 m

B-22: Major System to Pond 4

ID	Land Use	Individual			Cumulative				Dry Pond Storage (m^3)
		Drainage Area (ha)	Unit Flow Rate (L/s/ha)	Major System Flow (m^3/s)	IDs	Area (ha)	Unit Flow Rate (L/s/ha)	Major System Flow (m^3/s)	
M4.1	LDR / School	29.83	44	1.31					
	MDR	3.17	130	0.41	M4.1	33.00	52.26	1.72	
M4.2	LDR	2.50	76	0.19					
	MDR	5.37	130	0.70	M4.1-4.2	40.87	44.00	**1.80**	
M4.3	LDR	17.73	58	1.03	M4.3	17.73	58.00	1.03	
Total:		58.60							

Average Overland Slope: 0.40%
Maximum Overland Length: 1350 m

B-23: Major System to Pond 5

ID	Land Use	Individual			Cumulative				Dry Pond		
		Drainage Area (ha)	Unit Flow Rate (L/s/ha)	Major System Flow (m^3/s)	IDs	Area (ha)	Unit Flow Rate (L/s/ha)	Major System Flow (m^3/s)	Drainage Area (ha)	Storage Required (m^3/ha)	Storage Required m^3
M5.1	LDR	4.85	76	0.37					4.85	58	281
	MDR	2.48	130	0.32					2.48	70	174
	OS	4.44	26	0.12	M5.1	11.77	59	0.69	4.44	42	186
											641
M5.2	LDR	1.51	76	0.11					1.51	60	91
	OS	6.50	26	0.17	M5.2	8.01	14	0.11	6.50	42	273
											364
M5.3	LDR	9.08	76	0.69							
	OS	7.12	26	0.19	M5.3	16.20	54	0.88			
M5.4	LDR	7.63	76	0.58	M5.4	7.63	76	0.58			
M5.5	LDR	18.63	54	1.01							
	School	2.89	65	0.19	M5.3-5.5	29.15	46	1.34			
M5.6	LDR	14.24	64	0.91							
	School	2.50	65	0.16	M5.3-5.6	45.89	32	1.47			
M5.7	LDR	13.71	71	0.97							
	School	6.61	65	0.43	M5.7	20.32	69	1.40			
M5.8	LDR	15.37	62	0.95	M5.7-5.8	35.69	40	**1.43**			
M5.9	LDR	14.12	62	0.88	M5.9	14.12	62	0.88			
M5.10	LDR	12.44	69	0.86	M5.9-5.10	26.56	44	1.17			
Total:		144.12									

Average Overland Slope: 0.21%
Maximum Overland Length: 1100 m

B-24: Major System to Pond 6

ID	Land Use	Individual			Cumulative				Dry Pond		
		Drainage Area (ha)	Unit Flow Rate (L/s/ha)	Major System Flow (m^3/s)	IDs	Area (ha)	Unit Flow Rate (L/s/ha)	Major System Flow (m^3/s)	Drainage Area (ha)	Storage Required (m^3/ha)	Storage Required m^3
M6.1	Arterial	1.47	101	0.15	M6.1	1.47	101	0.15	1.47	63	93
M6.2	MDR	2.31	155	0.36	M6.2	2.31	155	0.36	2.31	68	157
M6.3	LDR	3.71	76	0.28					3.71	58	215
	MDR	2.00	130	0.26					2.00	68	136
	OS	5.50	26	0.14	M6.2-6.3	13.52	67	0.90	5.50	42	231
											832
M6.4	Arterial	3.59	101	0.36	M6.4	3.59	101	0.36			
M6.5	LDR	10.24	76	0.78							
	MDR	2.30	130	0.30	M6.5	12.54	86	1.08			
M6.6	LDR	8.80	76	0.67							
	Transit	3.12	120	0.37	M6.6	11.92	88	1.04			
M6.7	LDR	3.28	76	0.25							
	School	2.76	77	0.21							
	Collector	1.78	125	0.22	M6.4-6.7	35.87	42	1.51			
M6.8	LDR	14.76	63	0.93							
	Commercial	6.58	0	0.00							
	OS	3.97	26	0.10		25.31	41	1.03			
M6.9	LDR	11.31	70	0.79							
	MDR	1.20	140	0.17							
	School	1.65	65	0.11	M6.8-6.9	39.47	43	**1.70**			
Total:		90.33									

Average Overland Slope: 0.21%
Maximum Overland Length: 1100 m

B-25: Major System to Pond 7

ID	Land Use	Individual			Cumulative				Dry Pond Storage (m^3)
		Drainage Area (ha)	Unit Flow Rate (L/s/ha)	Major System Flow (m^3/s)	IDs	Area (ha)	Unit Flow Rate (L/s/ha)	Major System Flow (m^3/s)	
M7.1	OS	12.21	26	0.32	M7.1	12.21	26	0.32	
M7.2	LDR	6.97	76	0.53					
	Park	3.24	0	0.00	M7.2	10.21	52	0.53	
M7.3	LDR	2.60	76	0.20					
	MDR	11.43	88	1.01	M7.2-7.3	24.24	55	1.33	
M7.4	LDR	6.87	76	0.52					
	MDR	4.35	130	0.57	M7.2-7.3	35.46	44	**1.56**	
Total:		47.67							

Average Overland Slope: 0.30%
Maximum Overland Length: 950 m

B-26: Major System to Pond 8

ID	Land Use	Individual			Cumulative				Dry Pond Storage (m^3)
		Drainage Area (ha)	Unit Flow Rate (L/s/ha)	Major System Flow (m^3/s)	IDs	Area (ha)	Unit Flow Rate (L/s/ha)	Major System Flow (m^3/s)	
M8.1	LDR	22.23	50	1.11					
	MDR	3.30	130	0.43					
	School	2.95	76	0.22	M8.1	28.48	54	1.54	
M8.2	LDR	13.50	67	0.90					
	MDR	2.29	130	0.30	M8.1-8.2	44.27	37	1.64	
M8.3	School	7.28	65	0.47		7.28	65	0.47	
M8.4	LDR	0.90	78	0.07					
	MDR	1.10	130	0.14					
	Commercial	6.60	0	0.00					
	Collector	0.79	125	0.10	M8.1-8.3	60.94	32	**1.95**	
Total:		60.94							

Average Overland Slope: 0.22%
Maximum Overland Length: 1300 m

B-27: Overland Flow to Pond 1

Location : **M1.9**

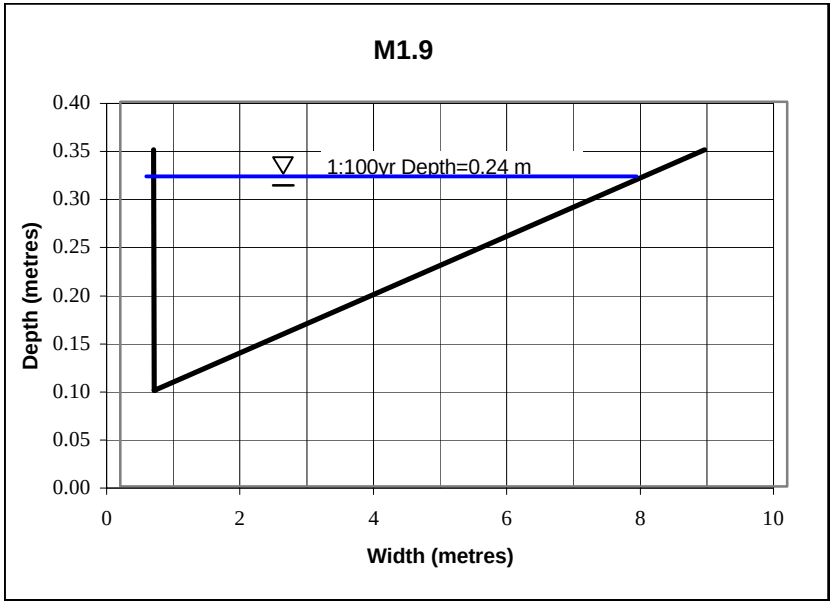
Description: **Collector Road**

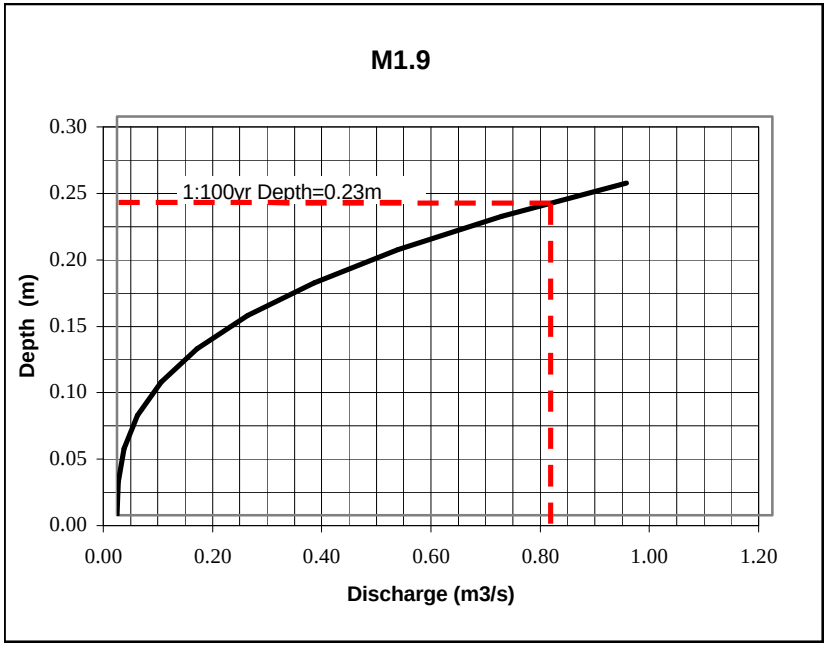
Dimensions:

Bottom width =	0.00	m
Crossfall =	33	:1
	3%	
Road Slope =	0.23%	
Mannings n =	0.013	
Maximum depth =	0.25	m

Depth (m)	Area (m2)	Hydraulic Radius (m)	Velocity (m/s)	Flow (m3/s)
0.00	0.00	0.00	0.00	0.00
0.03	0.01	0.01	0.20	0.00
0.05	0.04	0.02	0.31	0.01
0.08	0.09	0.04	0.41	0.04
0.10	0.17	0.05	0.49	0.08
0.13	0.26	0.06	0.57	0.15
0.15	0.37	0.07	0.64	0.24
0.18	0.51	0.08	0.71	0.36
0.20	0.66	0.10	0.78	0.51
0.23	0.84	0.11	0.84	0.70
0.25	1.03	0.12	0.91	0.93

100yr Peak Flow:	**1.63 m^3/s**	
Peak Flow (per side):	0.82 m^3/s	
Flow Depth:	0.24 m	OK
Velocity:	0.88 m/s	
Depth x Velocity:	0.21 m^2/s	OK





B-28: Overland Flow to Pond 2

Location : **M2.3**

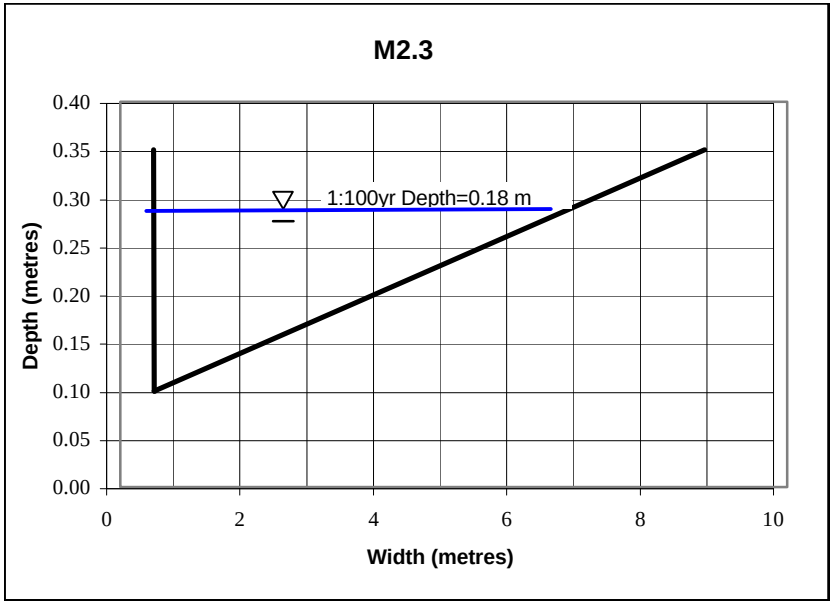
Description: Local Road

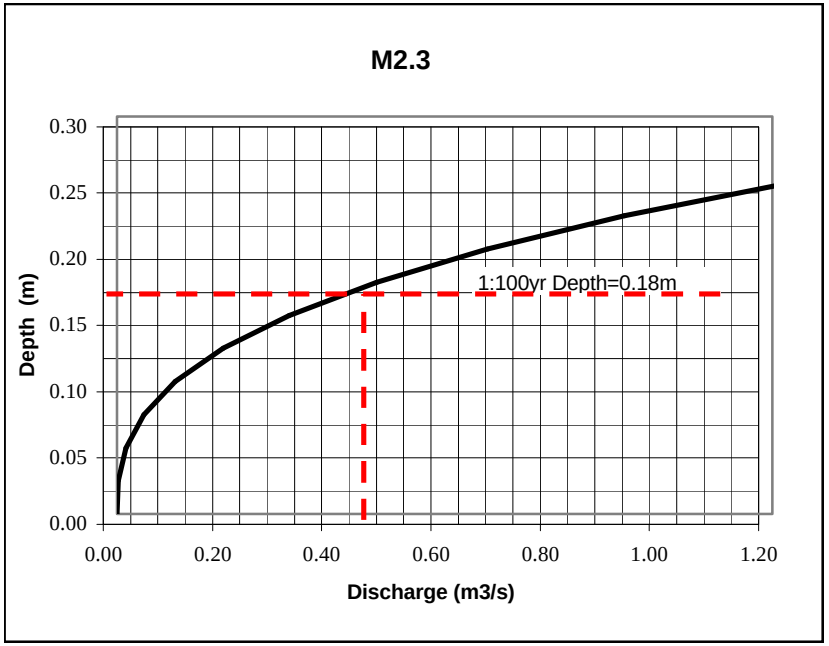
Dimensions:

Bottom width =	0.00	m
Crossfall =	33	:1
	3%	
Road Slope =	0.40%	
Mannings n =	0.013	
Maximum depth =	0.25	m

Depth (m)	Area (m2)	Hydraulic Radius (m)	Velocity (m/s)	Flow (m3/s)
0.00	0.00	0.00	0.00	0.00
0.03	0.01	0.01	0.26	0.00
0.05	0.04	0.02	0.41	0.02
0.08	0.09	0.04	0.54	0.05
0.10	0.17	0.05	0.65	0.11
0.13	0.26	0.06	0.75	0.19
0.15	0.37	0.07	0.85	0.32
0.18	0.51	0.08	0.94	0.48
0.20	0.66	0.10	1.03	0.68
0.23	0.84	0.11	1.11	0.93
0.25	1.03	0.12	1.19	1.23

100yr Peak Flow:	**0.94 m^3/s**	
Peak Flow (per side):	0.47 m^3/s	
Flow Depth:	0.18 m	OK
Velocity:	0.94 m/s	
Depth x Velocity:	0.17 m^2/s	OK





B-29: Overland Flow to Pond 3

Location : **M3.7**

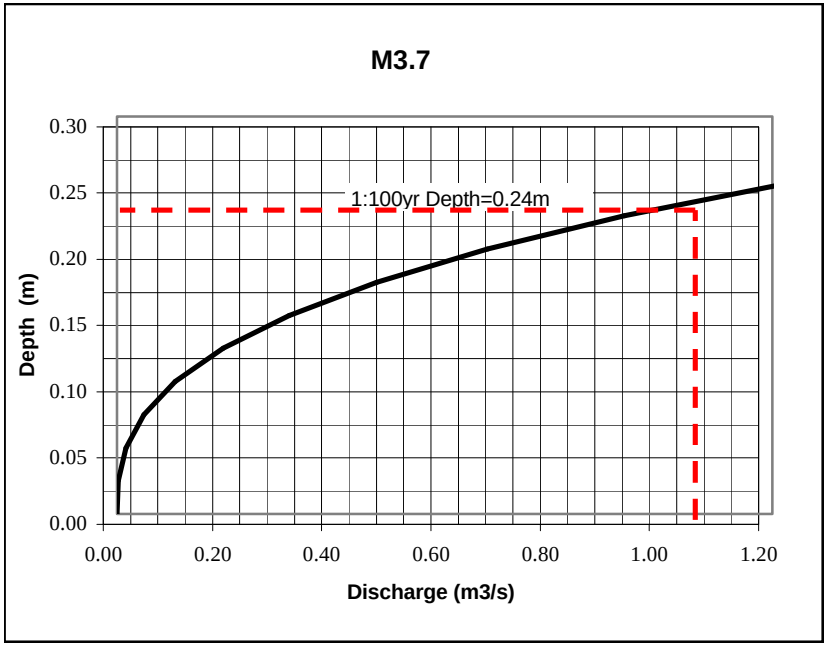
Description: Collector

Dimensions:

Bottom width =	0.00	m
Crossfall =	33	:1
	3%	
Road Slope =	0.40%	
Mannings n =	0.013	
Maximum depth =	0.25	m

Depth (m)	Area (m2)	Hydraulic Radius (m)	Velocity (m/s)	Flow (m3/s)
0.00	0.00	0.00	0.00	0.00
0.03	0.01	0.01	0.26	0.00
0.05	0.04	0.02	0.41	0.02
0.08	0.09	0.04	0.54	0.05
0.10	0.17	0.05	0.65	0.11
0.13	0.26	0.06	0.75	0.19
0.15	0.37	0.07	0.85	0.32
0.18	0.51	0.08	0.94	0.48
0.20	0.66	0.10	1.03	0.68
0.23	0.84	0.11	1.11	0.93
0.25	1.03	0.12	1.19	1.23

100yr Peak Flow:	**2.15 m^3/s**	
Peak Flow (per side):	1.08 m^3/s	
Flow Depth:	0.24 m	OK
Velocity:	1.15 m/s	
Depth x Velocity:	0.28 m^2/s	OK



B-30: Overland Flow to Pond 4

Location : **M4.2**

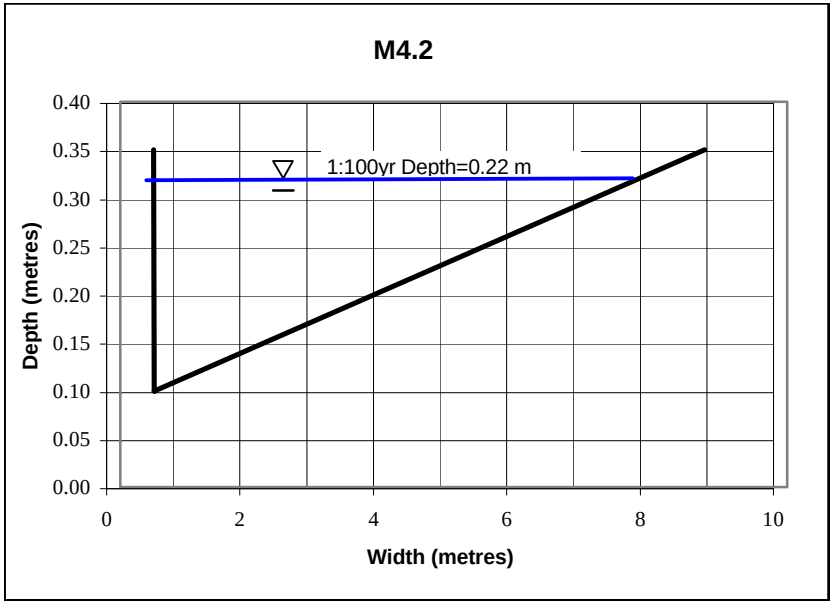
Description: Collector

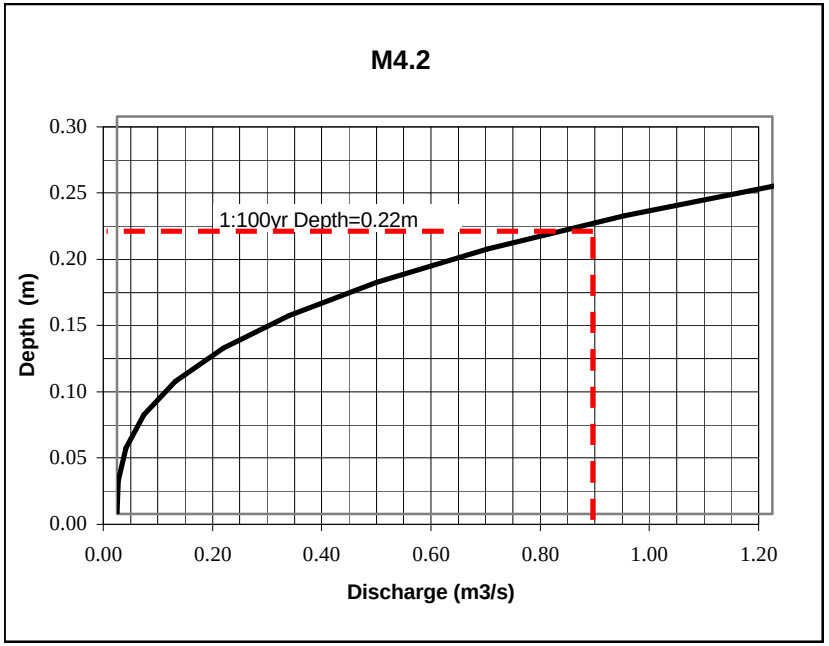
Dimensions:

Bottom width =	0.00	m
Crossfall =	33	:1
	3%	
Road Slope =	0.40%	
Mannings n =	0.013	
Maximum depth =	0.25	m

Depth (m)	Area (m2)	Hydraulic Radius (m)	Velocity (m/s)	Flow (m3/s)
0.00	0.00	0.00	0.00	0.00
0.03	0.01	0.01	0.26	0.00
0.05	0.04	0.02	0.41	0.02
0.08	0.09	0.04	0.54	0.05
0.10	0.17	0.05	0.65	0.11
0.13	0.26	0.06	0.75	0.19
0.15	0.37	0.07	0.85	0.32
0.18	0.51	0.08	0.94	0.48
0.20	0.66	0.10	1.03	0.68
0.23	0.84	0.11	1.11	0.93
0.25	1.03	0.12	1.19	1.23

100yr Peak Flow:	**1.80 m^3/s**	
Peak Flow (per side):	0.90 m^3/s	
Flow Depth:	0.22 m	OK
Velocity:	1.09 m/s	
Depth x Velocity:	0.24 m^2/s	OK





B-31: Overland Flow to Pond 5

Location : **M5.8**

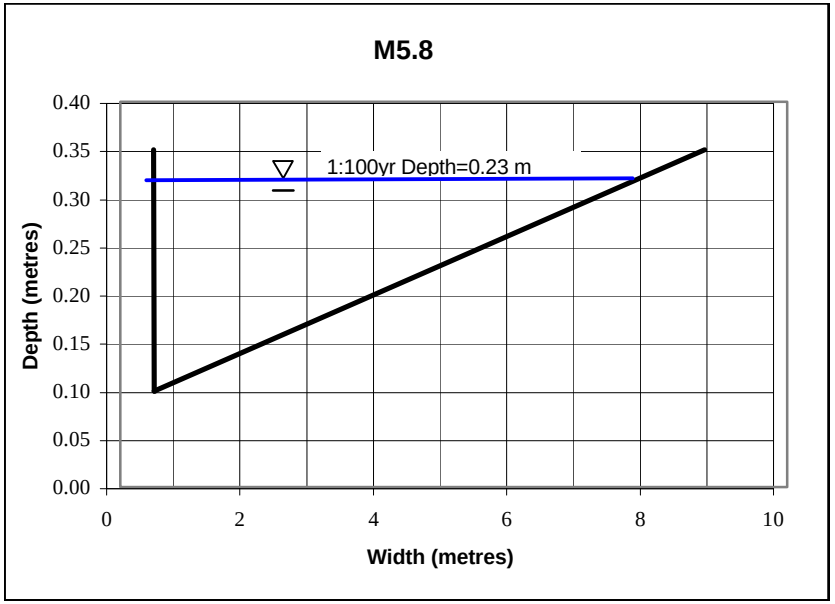
Description: Collector

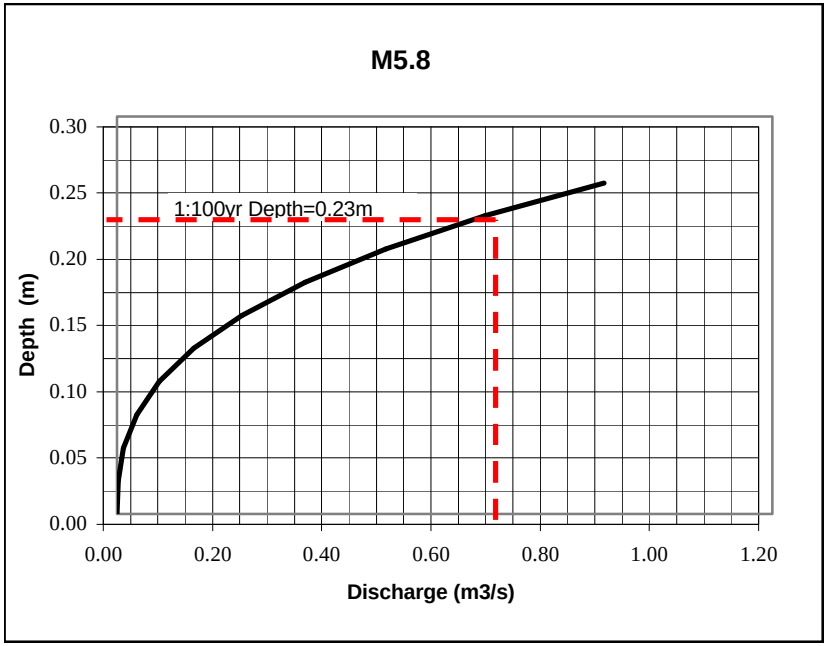
Dimensions:

Bottom width =	0.00	m
Crossfall =	33	:1
	3%	
Road Slope =	0.21%	
Mannings n =	0.013	
Maximum depth =	0.25	m

Depth (m)	Area (m2)	Hydraulic Radius (m)	Velocity (m/s)	Flow (m3/s)
0.00	0.00	0.00	0.00	0.00
0.03	0.01	0.01	0.19	0.00
0.05	0.04	0.02	0.30	0.01
0.08	0.09	0.04	0.39	0.04
0.10	0.17	0.05	0.47	0.08
0.13	0.26	0.06	0.55	0.14
0.15	0.37	0.07	0.62	0.23
0.18	0.51	0.08	0.68	0.34
0.20	0.66	0.10	0.75	0.49
0.23	0.84	0.11	0.81	0.67
0.25	1.03	0.12	0.86	0.89

100yr Peak Flow:	**1.43 m^3/s**	
Peak Flow (per side):	0.72 m^3/s	
Flow Depth:	0.23 m	OK
Velocity:	0.81 m/s	
Depth x Velocity:	0.19 m^2/s	OK





B-32: Overland Flow to Pond 6

Location : **M6.9**

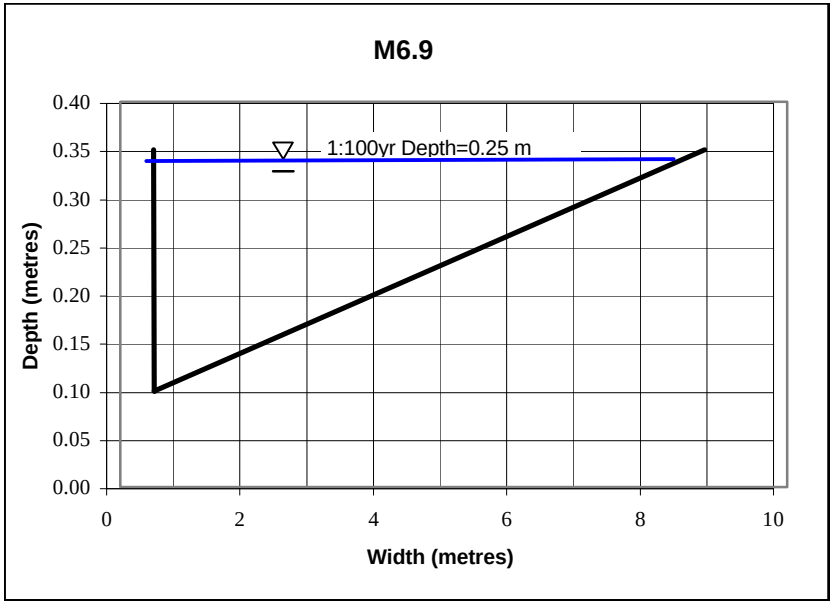
Description: Local

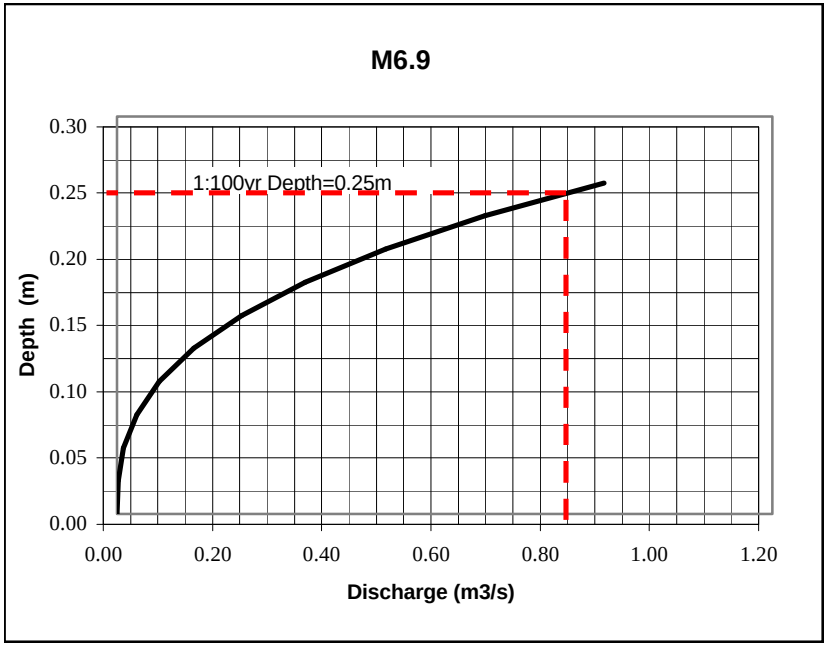
Dimensions:

Bottom width =	0.00	m
Crossfall =	33	:1
	3%	
Road Slope =	0.21%	
Mannings n =	0.013	
Maximum depth =	0.25	m

Depth (m)	Area (m2)	Hydraulic Radius (m)	Velocity (m/s)	Flow (m3/s)
0.00	0.00	0.00	0.00	0.00
0.03	0.01	0.01	0.19	0.00
0.05	0.04	0.02	0.30	0.01
0.08	0.09	0.04	0.39	0.04
0.10	0.17	0.05	0.47	0.08
0.13	0.26	0.06	0.55	0.14
0.15	0.37	0.07	0.62	0.23
0.18	0.51	0.08	0.68	0.34
0.20	0.66	0.10	0.75	0.49
0.23	0.84	0.11	0.81	0.67
0.25	1.03	0.12	0.86	0.89

100yr Peak Flow:	**1.70 m^3/s**	
Peak Flow (per side):	0.85 m^3/s	
Flow Depth:	0.25 m	
Velocity:	0.86 m/s	
Depth x Velocity:	0.22 m^2/s	OK





B-33: Overland Flow to Pond 7

Location : **M7.4**

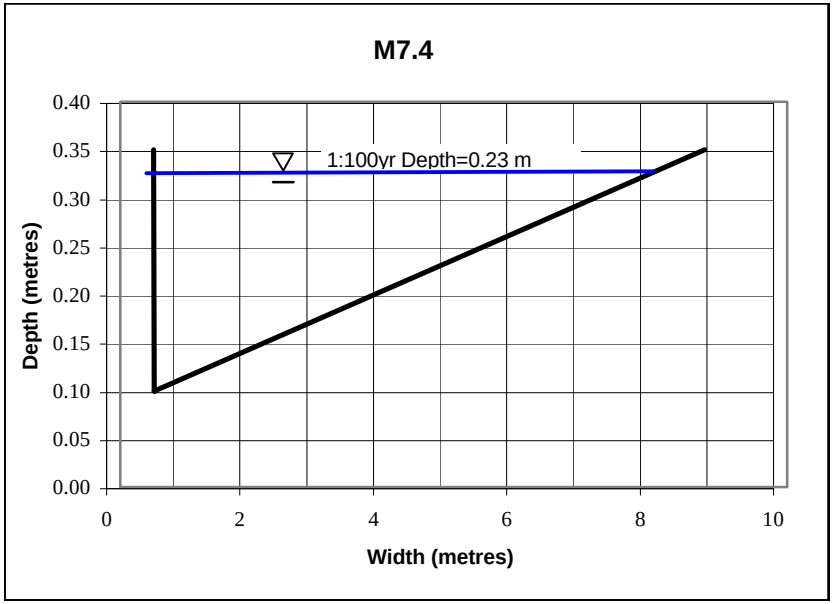
Description: Local

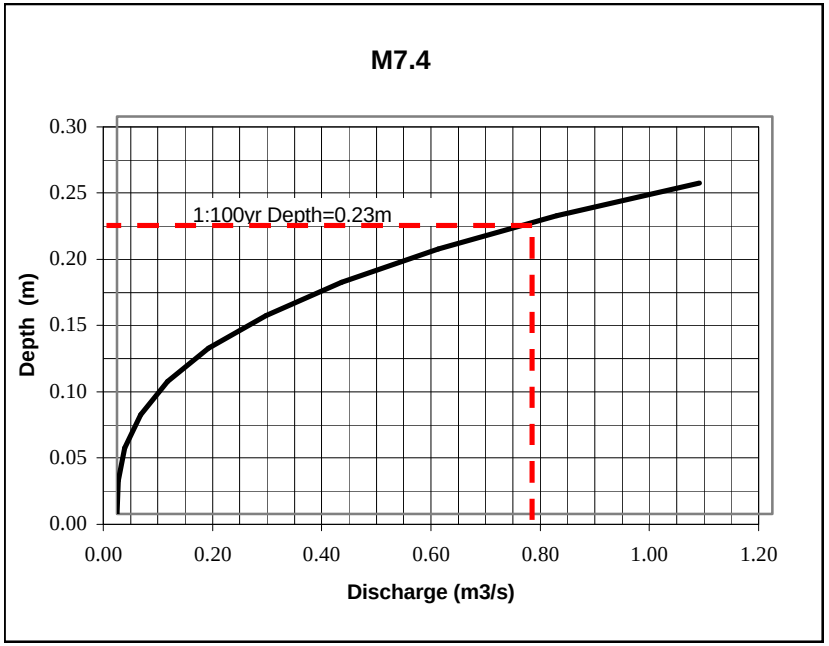
Dimensions:

Bottom width =	0.00	m
Crossfall =	33	:1
	3%	
Road Slope =	0.30%	
Mannings n =	0.013	
Maximum depth =	0.25	m

Depth (m)	Area (m2)	Hydraulic Radius (m)	Velocity (m/s)	Flow (m3/s)
0.00	0.00	0.00	0.00	0.00
0.03	0.01	0.01	0.22	0.00
0.05	0.04	0.02	0.35	0.01
0.08	0.09	0.04	0.46	0.04
0.10	0.17	0.05	0.56	0.09
0.13	0.26	0.06	0.65	0.17
0.15	0.37	0.07	0.74	0.27
0.18	0.51	0.08	0.82	0.41
0.20	0.66	0.10	0.89	0.59
0.23	0.84	0.11	0.96	0.80
0.25	1.03	0.12	1.03	1.07

100yr Peak Flow:	**1.56 m^3/s**	
Peak Flow (per side):	0.78 m^3/s	
Flow Depth:	0.23 m	OK
Velocity:	0.96 m/s	
Depth x Velocity:	0.22 m^2/s	OK





B-34: Overland Flow to Pond 8

Location : **M8.4**

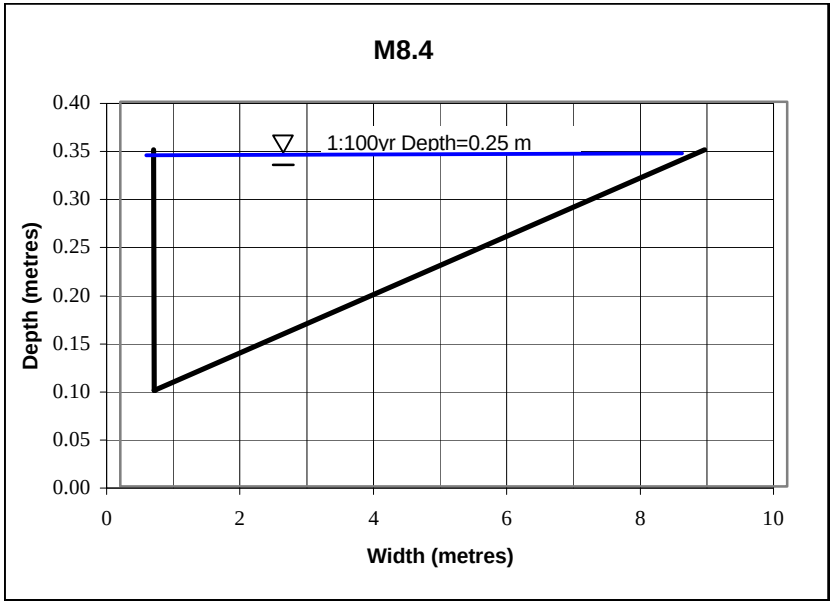
Description: Collector

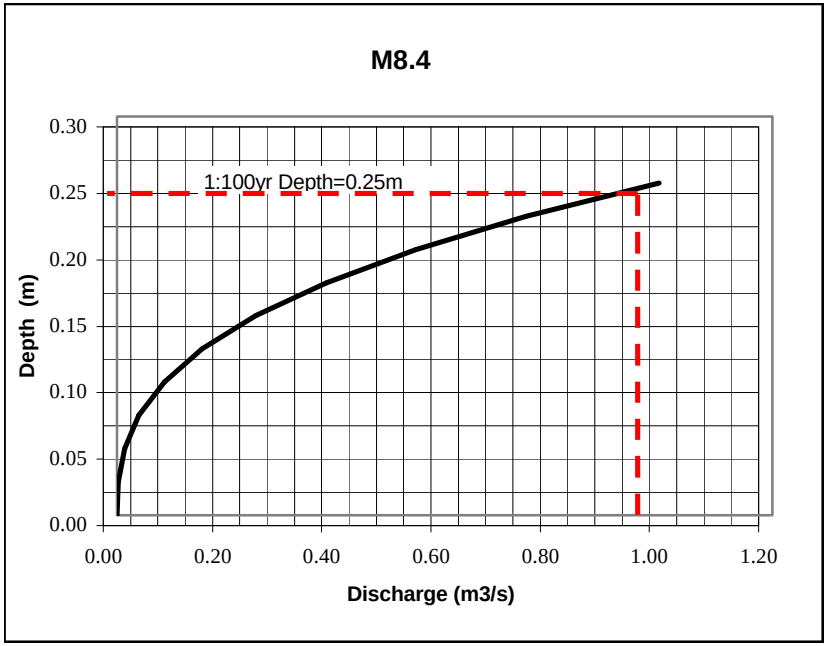
Dimensions:

Bottom width =	0.00	m
Crossfall =	33	:1
	3%	
Road Slope =	0.26%	
Mannings n =	0.013	
Maximum depth =	0.25	m

Depth (m)	Area (m2)	Hydraulic Radius (m)	Velocity (m/s)	Flow (m3/s)
0.00	0.00	0.00	0.00	0.00
0.03	0.01	0.01	0.21	0.00
0.05	0.04	0.02	0.33	0.01
0.08	0.09	0.04	0.43	0.04
0.10	0.17	0.05	0.52	0.09
0.13	0.26	0.06	0.61	0.16
0.15	0.37	0.07	0.68	0.25
0.18	0.51	0.08	0.76	0.38
0.20	0.66	0.10	0.83	0.55
0.23	0.84	0.11	0.90	0.75
0.25	1.03	0.12	0.96	0.99

100yr Peak Flow:	**1.95 m^3/s**	
Peak Flow (per side):	0.98 m^3/s	
Flow Depth:	0.25 m	
Velocity:	0.96 m/s	
Depth x Velocity:	0.24 m^2/s	OK





APPENDIX C

Population, Employment & Land Use

Figures

Tables

Miscellaneous

Dec. 2005 Vacant Residential Land in Kanata/Stittsville

DEVELOPMENT STATUS / STATUT DE DEVÉLOPPEMENT

- Registered / enregistré
- Draft Approved / ébauche approuvée
- Pending / en instance d'approbation
- No Plan / aucun plan

0 600 1,200 2,400 3,600 4,800 Meters

Kanata

Stittsville

Watt's Creek

Shirley's Brook

Ottawa

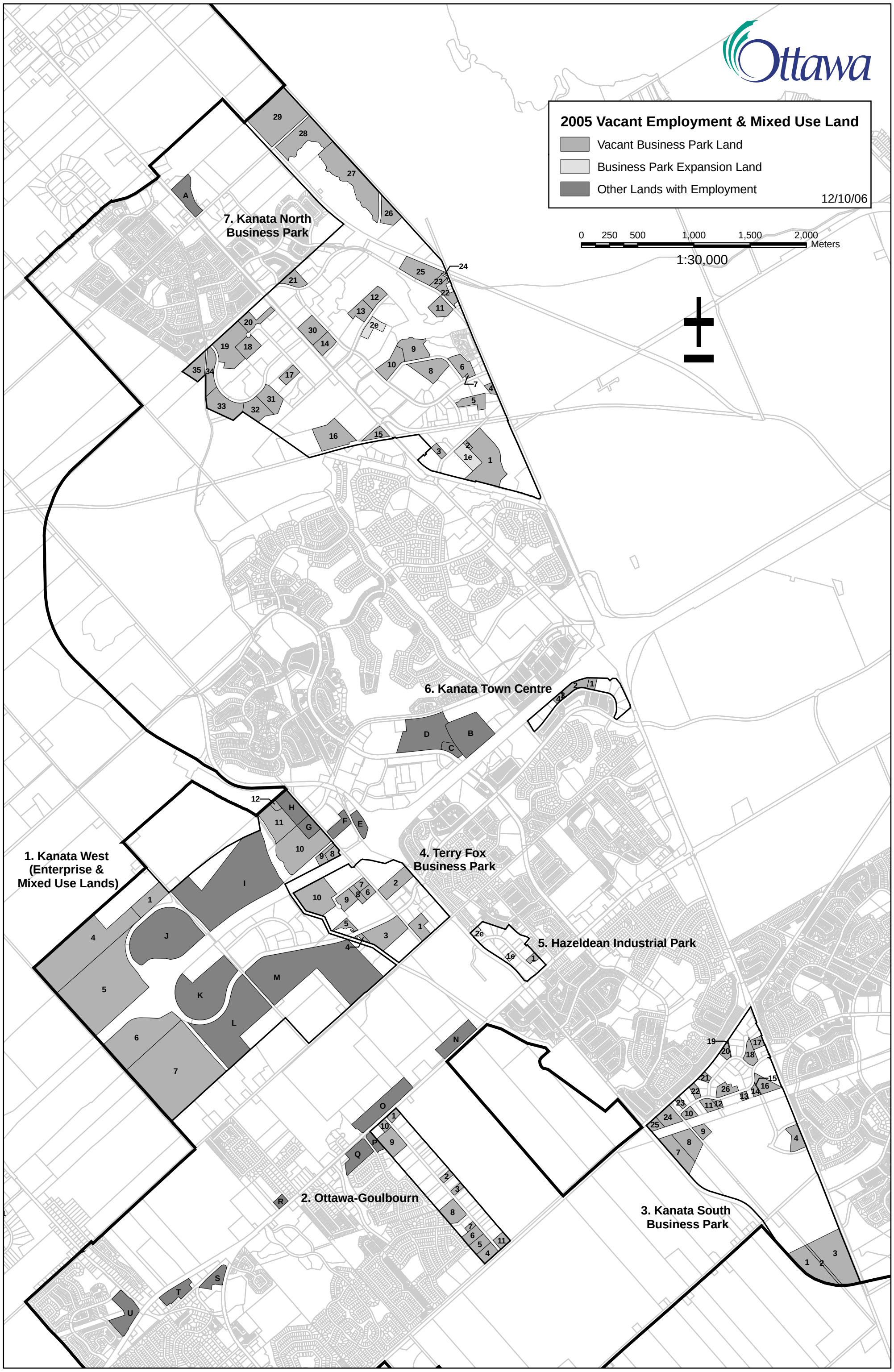

2005 Vacant Employment & Mixed Use Land
Vacant Business Park Land
Business Park Expansion Land
Other Lands with Employment
12/10/06
0 250 500 1,000 1,500 2,000 Meters
1:30,000
7. Kanata North Business Park
1. Kanata West (Enterprise & Mixed Use Lands)
2. Ottawa-Goulbourn
3. Kanata South Business Park
4. Terry Fox Business Park
5. Hazeldean Industrial Park
6. Kanata Town Centre

TABLE C-1: POPULATION AND LAND USE
RAW CITY DATA FROM 2001 WWMP UPDATE (2006 PROJECTIONS)

		Land Use (Ha)														Population							
		Existing							Future								Existing		Future				
Catch_ID	Vacant	Frm	Res	Com	Ind	Ins	Spc	Gov	WWWL	VURL	VUIL	VRIL	Total (Existing)	Total (Future)	Total	Vacant	Frm	Res	WWWL	VURL	Total (Existing)	Total (Future)	Total
1	53.9	42.1	82.1	2.2	1.4	3.9	48.7	0.7	0	0	0	0	181.1	0	181.1	0	0	1,466	0	0	1466	0	1,466
2	0	0	3	0.5	0	0	0	0	0	0	0	0	3.5	0	3.5	0	0	34	0	0	34	0	34
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	83.6	0	76.1	0	0	2.9	0.1	0	0.8	28.3	0	0	79.1	29.1	108.2	0	0	5,467	50	945	5467	995	6,462
5	0	0	0	0	0	0	0	0	0	18.1	0	0	0	18.1	18.1	0	0	0	0	1,181	0	1181	1,181
6	55	68.2	32.4	9.7	0.1	0	1.5	0	0.3	81.4	38	0	111.9	119.7	231.6	0	3	1,224	17	3,384	1227	3401	4,628
7	6.1	0	14.3	13.1	11.6	1	0	0	0	0	2.1	0	40	2.1	42.1	0	0	1,267	0	0	1267	0	1,267
8	28.9	0	3.6	58.4	1	0	0	0	0	0.7	25.7	0	63	26.4	89.4	0	0	166	0	96	166	96	262
9	1.3	0	0	9.3	10.3	0	0	0	0	0	2.2	0	19.6	2.2	21.8	0	0	0	0	0	0	0	0
10	14.8	0	0	7.4	10.1	0	0	0	0	0	3.3	0	17.5	3.3	20.8	0	0	0	0	0	0	0	0
11	42.8	0	0	34.8	28.3	0	0.6	0	0	7.4	14	0	63.7	21.4	85.1	0	0	0	0	558	0	558	558
27	10.9	0	0	12.3	25.4	0	0	0	3.7	0	8.4	0	37.7	12.1	49.8	0	0	0	337	0	0	337	337
28	11.6	0	0.2	5.2	16.1	0	0	0	0	0	11.6	0	21.5	11.6	33.1	0	0	0	0	0	0	0	0
29	2.4	0	0.6	2.6	14.5	0	0	0	0	0	2.2	0	17.7	2.2	19.9	0	0	14	0	0	14	0	14
30	9.4	0	52.4	0.5	0	5.1	0	0	0.4	0	0	0	58	0.4	58.4	0	0	1,386	143	0	1386	143	1,529
31	5.9	0	2.4	0	0	0	0	0	0	0	0	0	2.4	0	2.4	0	0	116	0	0	116	0	116
32	2.3	0	12.2	0	0	0	0	0.6	0	0	0	0	12.8	0	12.8	0	0	366	0	0	366	0	366
33	10.8	0	30.9	1.4	0	13.2	11.5	1.7	2.4	1.9	0	0	58.7	4.3	63	0	0	1,460	151	79	1460	230	1,690
34	12.9	0	31.3	2.6	0.4	3.2	1.4	0	2.2	0	0	0	38.9	2.2	41.1	0	0	1,088	727	0	1088	727	1,815
35	2.4	0	41.2	0	0	1	0	0	0	0.1	0	0	42.2	0.1	42.3	0	0	2,393	0	3	2393	3	2,396
36	22.6	0	27.8	0	0	0.7	0	0	0	11.4	0	0	28.5	11.4	39.9	0	0	1,194	0	176	1194	176	1,370
42	21.7	62.5	53.4	14.4	4.4	0	0	0	0.7	2.8	0	0	134.7	3.5	138.2	0	0	3,483	30	79	3483	109	3,592
45	8.1	0	33	0	0	0	0	0	0	0	0	0	33	0	33	0	0	2,482	0	0	2482	0	2,482
46	1.7	0	12.6	0.3	0	0	1.2	0	0	0	0	0	14.1	0	14.1	0	0	847	0	0	847	0	847
47	28.7	0	2.4	25.8	0	0	3.9	0	0	18.7	0	0	32.1	18.7	50.8	0	0	10	0	3,526	10	3526	3,536
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	11.9	0	8.7	10.9	0	0	1.8	0	0.6	2.3	3	0	21.4	5.9	27.3	0	0	886	62	313	886	375	1,261
51	3.4	0	14	0.4	0	6	0	0	1.5	0	0	0	20.4	1.5	21.9	0	0	1,140	264	0	1140	264	1,404
52	12.9	0	0	7.7	0.8	0	0.6	0	0	0	6.2	0	9.1	6.2	15.3	0	0	0	0	0	0	0	0
53	17.4	0	63.4	1.3	0	7.4	1.5	0	0.5	0	0	0	73.6	0.5	74.1	0	0	3,501	178	0	3501	178	3,679
54	11.1	0	52.7	1.3	12.2	2.7	0	0	0.8	0.1	0	0	68.9	0.9	69.8	0	0	3,065	99	3	3065	102	3,167
55	61.6	1.3	181.6	30.8	12.3	16.4	48.4	1.1	10.9	0.1	0.6	0	291.9	11.6	303.5	0	0	12,804	620	3	12804	623	13,427
56	97.8	30.6	17.8	67.8	18.4	0	29.3	0	3	109.3	100.3	0	163.9	212.6	376.5	0	3	10	0	7,766	13	7766	7,779
57	75.5	150.9	7.3	0	0	0	2.6	0	0	108.1	95	0	160.8	203.1	363.9	0	3	7	0	7,946	10	7946	7,956
58	136.3	39	22.2	0	0.4	0	2	0	0	116.7	18.2	0	63.6	134.9	198.5	0	0	34	0	8,900	34	8900	8,934
59	65.4	0	59.2	26.2	0	0	0	0	0.5	19.3	0	0	85.4	19.8	105.2	0	0	2,287	47	1,437	2287	1484	3,771
60	12.9	0	24.5	6.6	3.7	0	0	0	1.1	2.8	0	0	34.8	3.9	38.7	0	0	1,129	108	357	1129	465	1,594
61	15.9	0	0.4	3.7	19.8	0	0	0	0	1.2	14.9	0	23.9	16.1	40	0	0	17	0	3	17	3	20
62	8.1	0	0	0	2.4	0	0	0	0	0	0	0	2.4	0	2.4	0	0	0	0	0	0	0	0
63	6.7	0	16.7	0	0	0	0	0	0	0	0	0	16.7	0	16.7	0	0	987	0	0	987	0	987
64	9.3	0	23.6	0	0	2.7	0	0	0	19	0	0	26.3	19	45.3	0	0	1,215	0	338	1215	338	1,553
65	19.6	0	39.5	0.5	0	4.4	0.1	0	0.1	0	0	0	44.5	0.1	44.6	0	0	1,994	10	0	1994	10	2,004
66	56.1	0	49.3	6.3	0	0.3	1.2	1.1	1.4	26.6	0	0	58.2	28	86.2	0	0	1,859	226	1,501	1859	1727	3,586
67	95.2	0	129.1	12	4	4	2.5	0	1.3	35.5	0	0	151.6	36.8	188.4	0	0	6,679	124	2,050	6679	2174	8,853
68	58.5	33.4	17.8	4.4	9.7	0	0	0	0	71.5	29.5	0	65.3	101	166.3	0	0	7	0	4,483	7	4483	4,490
69	35.4	0	139.1	3	5.4	8.2	2.8	0	1	41.1	0	0	158.5	42.1	200.6	0	0	10,871	54	665	10871	719	11,590
70	62.9	50.4	120.1	0.4	10.9	3	10.2	0	0.2	108	0	0	195	108.2	303.2	0	3	8,967	5	5,261	8970	5266	14,236
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	29.6	0	44.4	2.1	0	0	0.6	0	0	0	0	0	47.1	0	47.1	0	0	1,133	0	0	1133	0	1,133
73	2.1	2	22.8	3.6	0.1	0.8	15.6	0	0	0	0	0	44.9	0	44.9	0	0	463	0	0	463	0	463
74	27.9	6	46.1	3	0	2.5	5.2	0.4	0	0	0	0	63.2	0	63.2	0	0	1,144	0	0	1144	0	1,144

TABLE C-1: POPULATION AND LAND USE
RAW CITY DATA FROM 2001 WWMP UPDATE (2006 PROJECTIONS)

		Land Use (Ha)														Population							
		Existing							Future								Existing			Future			
Catch_ID	Vacant	Frm	Res	Com	Ind	Ins	Spc	Gov	WWWL	VURL	VUIL	VRIL	Total (Existing)	Total (Future)	Total	Vacant	Frm	Res	WWWL	VURL	Total (Existing)	Total (Future)	Total
75	1.1	0	5.7	0.2	0	0	0	0	0	0	0	0	5.9	0	5.9	0	0	162	0	0	162	0	162
76	8.1	0.8	40.6	0	0.4	7.9	0	0	0	0	0	0	49.7	0	49.7	0	0	1,200	0	0	1200	0	1,200
77	2.3	0	6.9	0	0	0	0	0	0	4.8	0	0	6.9	4.8	11.7	0	0	785	0	42	785	42	827
112	73.8	158.3	0	0	0	0	0	0	0	155.4	0	0	158.3	155.4	313.7	0	0	0	0	11,624	0	11624	11,624
113	0	118.5	0	0	0	0	0	0	0	76.4	0	0	118.5	76.4	194.9	0	0	0	0	5,830	0	5830	5,830
200	0	95.3	0.2	0	0	0	0	0	0	61.5	0	0	95.5	61.5	157	0	0	0	0	4,736	0	4736	4,736
201	0	128.2	0	0	0	0	0	0	0	56.3	0	0	128.2	56.3	184.5	0	0	0	0	4,268	0	4268	4,268
202	17.6	0	0	0	0	0	0	0	0	11.1	0	0	0	11.1	11.1	0	0	0	0	748	0	748	748
203	0	62.2	0	0	0	0	0	0	0	119.4	0	0	62.2	119.4	181.6	0	0	0	0	2,298	0	2298	2,298
204	131.7	0	0	0	3.5	0	0	0	0	119.4	0	0	3.5	119.4	122.9	0	0	0	0	1,699	0	1699	1,699
205	46	0	0	0	0	0	0	0	0	119.4	0	0	0	119.4	119.4	0	0	0	0	2,027	0	2027	2,027
206	24.9	0	0	0	0	0	0	0	0	16.5	0	0	0	16.5	16.5	0	0	0	0	1,277	0	1277	1,277
207	0	0	0	0	0	0	0	0	0	119.4	0	0	0	119.4	119.4	0	0	0	0	1,607	0	1607	1,607
209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
211	0	100.8	0	9.8	0	0	0	0	0	110.4	0	0	110.6	110.4	221	0	0	0	0	4,940	0	4940	4,940
st_w_ps_cedarow	4.1	0	0	0.9	0	0	0	0	0.4	0	0	0	0.9	0.4	1.3	0	0	0	34	0	0	34	34
st_w_ps_cwm_carp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
st_w_ps_eco_woods	3.4	0	7.8	1.5	0	0	0	0	0.1	22.4	0	0	9.3	22.5	31.8	0	0	306	3	95	306	98	404
st_w_ps_friendly_creS	27.8	48.4	12.8	0	0.1	0	0	0	0	100.9	0	0	61.3	100.9	162.2	0	0	687	0	627	687	627	1,314
st_w_ps_fringewood	5.5	1.3	20.3	0.3	0	0	0	0	0	0	0	0	21.9	0	21.9	0	0	806	0	0	806	0	806
st_w_ps_hazeldean	19	3.6	0	13.8	7.5	0.7	0.8	0	0	0	16.6	0	26.4	16.6	43	0	0	0	0	0	0	0	0
st_w_ps_john	0.7	0	11.4	0	0.1	0	0	0	0	0	0	0	11.5	0	11.5	0	0	898	0	0	898	0	898
st_w_ps_joseph_cir	0	0	1.8	0	0	0	0	0	0	0	0	0	1.8	0	1.8	0	0	68	0	0	68	0	68
st_w_ps_stittsvill	11.9	0.2	63.1	0	0.1	0	1	0	0.1	17.3	0	0	64.4	17.4	81.8	0	3	2,026	5	944	2029	949	2,978
Total	**1,748.40**	**1,203.70**	**1,782.70**	**419.1**	**235.2**	**97.9**	**345**	**5.7**	**33.8**	**1,942.60**	**391.8**	**251.3**	**4089.3**	**2619.5**	**6708.8**	**0**	**17**	**91,602**	**3,295**	**93,812**	91619	97107	188,726

TABLE C-2: POPULATION AND LAND USE
NOVATECH ADJUSTED DATA (2006 EXISTING CONDITIONS)

		Land Use (Ha)														Population									
			Existing						Future								Existing		Future		Totals				
Catch_ID	Description	Vacant	Frm	Res	Com	Ind	Ins	Spc	WWWL	VURL	VUIL	VRIL	Total (Existing)	Total (Future)	Total	Vacant	Frm	Res	WWWL	VURL	Existing (Sewer)	Future (Sewer)	Future (I.Cross)	Build-Out (Sewer)	Build-Out (I.Cross)
HAZELDEAN PUMP STATION																									
Stittsville																									
59		65.4	0.0	59.2	26.2	0.0	0.0	0.0	0.5	19.3	0.0	0.0	85.4	19.8	105.2	0	0	2,287	47	1,437	2,287	1,484	1,752	3,771	4,039
60		12.9	0.0	24.5	6.6	3.7	0.0	0.0	1.1	2.8	0.0	0.0	34.8	3.9	38.7	0	0	1,129	108	357	1,129	465	435	1,594	1,564
61		15.9	0.0	0.4	3.7	19.8	0.0	0.0	0.0	1.2	14.9	0.0	23.9	16.1	40.0	0	0	17	0	3	17	3	0	20	17
62	Stittsville Trunk	8.1	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	2.4	0	0	0	0	0	0	0	0	0	0
63		6.7	0.0	16.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.7	0.0	16.7	0	0	987	0	0	987	0	0	987	987
64		9.3	0.0	23.6	0.0	0.0	2.7	0.0	0.0	19.0	0.0	0.0	26.3	19.0	45.3	0	0	1,215	0	338	1,215	338	352	1,553	1,567
65		19.6	0.0	39.5	0.5	0.0	4.4	0.1	0.1	0.0	0.0	0.0	44.5	0.1	44.6	0	0	1,994	10	0	1,994	10	0	2,004	1,994
66		56.1	0.0	49.3	6.3	0.0	0.3	1.2	1.4	26.6	0.0	0.0	58.2	28.0	86.2	0	0	1,859	226	1,501	1,859	1,727	1,538	3,586	3,397
67		95.2	0.0	129.1	12.0	4.0	4.0	2.5	1.3	35.5	0.0	0.0	151.6	36.8	188.4	0	0	6,679	124	2,050	6,679	2,174	2,458	8,853	9,137
st_w_ps_friendly_cres	Friendly Cres PS	27.8	48.4	12.8	0.0	0.1	0.0	0.0	0.0	100.9	0.0	0.0	61.3	100.9	162.2	0	0	687	0	627	687	627	2,058	1,314	2,745
st_w_ps_stittsvill	Stittsville PS	11.9	0.2	63.1	0.0	0.1	0.0	1.0	0.1	17.3	0.0	0.0	64.4	17.4	81.8	0	3	2,026	5	944	2,029	949	46	2,978	2,075
st_w_ps_cwm_carp	Carp PS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0
st_w_ps_eco_woods	Eco Woods PS	3.4	0.0	7.8	1.5	0.0	0.0	0.0	0.1	22.4	0.0	0.0	9.3	22.5	31.8	0	0	306	3	95	306	98	92	404	398
st_w_ps_john	John Street PS	0.7	0.0	11.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	11.5	0.0	11.5	0	0	898	0	0	898	0	0	898	898
st_w_ps_joseph_cir	Joseph Circle PS	0	0	1.8	0	0	0	0	0	0	0	0	1.8	0	1.8	0	0	68	0	0	68	0	0	68	68
st_w_ps_cedarow	Cedarow Ct PS	4.1	0	0	0.9	0	0	0	0.4	0	0	0	0.9	0.4	1.3	0	0	0	34	0	0	34	0	34	0
st_w_ps_fringewood	Fringewood PS	5.5	1.3	20.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.9	0.0	21.9	0	0	806	0	0	806	0	0	806	806
Missing	Tartan/Cav																			3,933	0	3,933	3,933	3,933	3,933
112	Brookfield	73.8	158.3	0.0	0.0	0.0	0.0	0.0	0.0	155.4	0.0	0.0	158.3	155.4	313.7	0	0	0	0	13,203	0	13,203	13,203	13,203	13,203
113	Westpark	0.0	118.5	0.0	0.0	0.0	0.0	0.0	0.0	76.4	0.0	0.0	118.5	76.4	194.9	0	0	0	0	7,016	0	7,016	7,016	7,016	7,016
	Stittsville Trunk	416.4	326.7	459.5	58.0	30.2	11.4	4.8	5.0	476.8	14.9	0.0	891.7	496.7	1,388.4	0	3	20,958	557	31,504	20,961	32,061	32,883	53,022	53,844
Glen Cairn Community																									
55	Glamorgan Trunk	61.6	1.3	181.6	30.8	12.3	16.4	48.4	10.9	0.1	0.6	0.0	291.9	11.6	303.5	0	0	12,804	620	3	12,804	623	6	13,427	12,810
Bridlewood & KSBP																									
68	KSBP	58.5	33.4	17.8	4.4	9.7	0.0	0.0	0.0	71.5	29.5	0.0	65.3	101.0	166.3	0	0	7	0	4,483	7	4,483	7,749	4,490	7,756
69	Bridlewood	35.4	0.0	139.1	3.0	5.4	8.2	2.8	1.0	41.1	0.0	0.0	158.5	42.1	200.6	0	0	10,871	54	665	10,871	719	751	11,590	11,622
70	Bridlewood	62.9	50.4	120.1	0.4	10.9	3.0	10.2	0.2	108.0	0.0	0.0	195.0	108.2	303.2	0	3	8,967	5	5,261	8,970	5,266	6,203	14,236	15,173
	South Glen Cairn Trunk	156.8	83.8	277.0	7.8	26.0	11.2	13.0	1.2	220.6	29.5	0.0	418.8	251.3	670.1	0	3	19,845	59	10,409	19,848	10,468	14,703	30,316	34,551
st_w_ps_hazeldean	Hazeldean PS	19.0	3.6	0.0	13.8	7.5	0.7	0.8	0.0	0.0	16.6	0.0	26.4	16.6	43.0	0	0	0	0	0	0	0	0	0	0
	Hazeldean PS Sewershed	653.8	415.4	918.1	110.4	76.0	39.7	67.0	17.1	697.5	61.6	0.0	1,628.8	776.2	2,405.0	0.0	6	53,607	1,236	41,916	53,613	43,152	47,592	96,765	101,205
RICHMOND PUMP STATION																									
Richmond																									
71	Richmond FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0
72		29.6	0.0	44.4	2.1	0.0	0.0	0.6	0.0	0.0	0.0	0.0	47.1	0.0	47.1	0	0	1,133	0	0	1,133	0	0	1,133	1,133
73		2.1	2.0	22.8	3.6	0.1	0.8	15.6	0.0	0.0	0.0	0.0	44.9	0.0	44.9	0	0	463	0	0	463	0	0	463	463
74		27.9	6.0	46.1	3.0	0.0	2.5	5.2	0.0	0.0	0.0	0.0	63.2	0.0	63.2	0	0	1,144	0	0	1,144	0	0	1,144	1,144
75		1.1	0.0	5.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.0	5.9	0	0	162	0	0	162	0	0	162	162
76		8.1	0.8	40.6	0.0	0.4	7.9	0.0	0.0	0.0	0.0	0.0	49.7	0.0	49.7	0	0	1,200	0	0	1,200	0	0	1,200	1,200
	Richmond PS Sewershed	68.8	8.8	159.6	8.9	0.5	11.2	21.4	0.0	0.0	0.0	0.0	210.8	0.0	210.8	0	0	4,102	0	0	4,102	0	0	4,102	4,102

TABLE C-2: POPULATION AND LAND USE
NOVATECH ADJUSTED DATA (2006 EXISTING CONDITIONS)

		Land Use (Ha)													Population									
			Existing						Future							Existing		Future		Totals				
Catch_ID	Description	Vacant	Frm	Res	Com	Ind	Ins	Spc	WWWL	VURL	VUIL	VRIL	Total (Existing)	Total (Future)	Total	Vacant	Frm	Res	WWWL	VURL	Existing (Sewer)	Future (Sewer)	Future (I.Cross)	Build-Out (Sewer)	Build-Out (I.Cross)
KANATA WEST PUMP STATION																									
Kanata West - South of 417																									
52		12.9	0.0	0.0	7.7	0.8	0.0	0.6	0.0	0.0	6.2	0.0	9.1	6.2	15.3	0	0	0	0	0	0	0	0	0	0
56		97.8	30.6	17.8	67.8	18.4	0.0	29.3	3.0	109.3	100.3	0.0	163.9	212.6	376.5	0	3	10	0	7,766	13	7,766	6,316	7,779	6,329
58		136.3	39.0	22.2	0.0	0.4	0.0	2.0	0.0	116.7	18.2	0.0	63.6	134.9	198.5	0	0	34	0	8,900	34	8,900	10,881	8,934	10,915
200	Del	0.0	95.3	0.2	0.0	0.0	0.0	0.0	0.0	61.5	0.0	0.0	95.5	61.5	157.0	0	0	0	0	5,535	0	5,535	5,536	5,535	5,536
211	Craig/Dawson	0.0	100.8	0.0	9.8	0.0	0.0	0.0	0.0	110.4	0.0	0.0	110.6	110.4	221.0	0	0	0	0	6,300	0	6,300	6,300	6,300	6,300
Kanata West PS Sewershed		247.0	265.7	40.2	85.3	19.6	0.0	31.9	3.0	397.9	124.7	0.0	442.7	525.6	968.3	0	3	44	0	28,501	47	28,501	29,033	28,548	29,080
GLEN CAIRN COLLECTOR SEWERSHED																									
HPS	Hazeldean PS	653.8	415.4	918.1	110.4	76.0	39.7	67.0	17.1	697.5	61.6	0.0	1,628.8	776.2	2,405.0	0	6	53,607	1,236	41,916	53,613	43,152	47,592	96,765	101,205
RPS	Richmond PS	68.8	8.8	159.6	8.9	0.5	11.2	21.4	0.0	0.0	0.0	0.0	210.8	0.0	210.8	0	0	4,102	0	0	4,102	0	0	4,102	4,102
KWPS	Kanata West PS	247.0	265.7	40.2	85.3	19.6	0.0	31.9	3.0	397.9	124.7	0.0	442.7	525.6	968.3	0	3	44	0	28,501	47	28,501	29,033	28,548	29,080
49		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0
54	Kakulu	11.1	0.0	52.7	1.3	12.2	2.7	0.0	0.8	0.1	0.0	0.0	68.9	0.9	69.8	0	0	3,065	99	3	3,065	102	3	3,167	3,068
Glen Cairn Trunk Sewershed		980.7	689.9	1,170.6	205.9	108.3	53.6	120.3	20.9	1,095.5	186.3	0.0	2,351.2	1,302.7	3,653.9	0	9	60,818	1,335	70,420	60,827	71,755	76,628	132,582	137,455
SIGNATURE RIDGE PUMP STATION																									
42	SRPS	21.7	62.5	53.4	14.4	4.4	0.0	0.0	0.7	2.8	0.0	0.0	134.7	3.5	138.2	0	0	3,483	30	79	3,483	109	86	3,592	3,569
57	KW-North of 417	75.5	150.9	7.3	0.0	0.0	0.0	2.6	0.0	108.1	95.0	0.0	160.8	203.1	363.9	0	3	7	0	7,946	10	7,946	6,170	7,956	6,180
201	Richardson	0.0	128.2	0.0	0.0	0.0	0.0	0.0	0.0	56.3	0.0	0.0	128.2	56.3	184.5	0	0	0	0	4,268	0	4,268	5,205	4,268	5,205
202	Broughton	17.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.1	0.0	0.0	0.0	11.1	11.1	0	0	0	0	748	0	748	912	748	912
Signature Ridge PS Sewershed		114.8	341.6	60.7	14.4	4.4	0.0	2.6	0.7	178.3	95.0	0.0	423.7	274.0	697.7	0	3	3,490	30	13,041	3,493	13,071	12,373	16,564	15,866
MAIN STREET SEWER																									
SRPS	Signature Ridge PS	114.8	341.6	60.7	14.4	4.4	0.0	2.6	0.7	178.3	95.0	0.0	423.7	274.0	697.7	0	3	3,490	30	13,041	3,493	13,071	12,373	16,564	15,866
33		10.8	0.0	30.9	1.4	0.0	13.2	11.5	2.4	1.9	0.0	0.0	58.7	4.3	63.0	0	0	1,460	151	79	1,460	230	80	1,690	1,540
47		28.7	0.0	2.4	25.8	0.0	0.0	3.9	0.0	18.7	0.0	0.0	32.1	18.7	50.8	0	0	10	0	3,526	10	3,526	4,134	3,536	4,144
50		11.9	0.0	8.7	10.9	0.0	0.0	1.8	0.6	2.3	3.0	0.0	21.4	5.9	27.3	0	0	886	62	313	886	375	314	1,261	1,200
51		3.4	0.0	14.0	0.4	0.0	6.0	0.0	1.5	0.0	0.0	0.0	20.4	1.5	21.9	0	0	1,140	264	0	1,140	264	0	1,404	1,140
53		17.4	0.0	63.4	1.3	0.0	7.4	1.5	0.5	0.0	0.0	0.0	73.6	0.5	74.1	0	0	3,501	178	0	3,501	178	0	3,679	3,501
77		2.3	0.0	6.9	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	6.9	4.8	11.7	0	0	785	0	42	785	42	54	827	839
Main Street Sewershed		189.3	341.6	187.0	54.2	4.4	26.6	21.3	5.7	206.0	98.0	0.0	636.8	309.7	946.5	0	3	11,272	685	17,001	11,275	17,686	16,955	28,961	28,230
PENFIELD DRIVE SEWER																									
28		11.6	0.0	0.2	5.2	16.1	0.0	0.0	0.0	0.0	11.6	0.0	21.5	11.6	33.1	0	0	0	0	0	0	0	0	0	0
30		9.4	0.0	52.4	0.5	0.0	5.1	0.0	0.4	0.0	0.0	0.0	58.0	0.4	58.4	0	0	1,386	143	0	1,386	143	0	1,529	1,386
32		2.3	0.0	12.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.8	0.0	12.8	0	0	366	0	0	366	0	0	366	366
34		12.9	0.0	31.3	2.6	0.4	3.2	1.4	2.2	0.0	0.0	0.0	38.9	2.2	41.1	0	0	1,088	727	0	1,088	727	0	1,815	1,088
Penfield Drive Sewershed		36.2	0.0	96.1	8.3	16.5	8.3	1.4	2.6	0.0	11.6	0.0	131.2	14.2	145.4	0	0	2,840	870	0	2,840	870	0	3,710	2,840
CARP PUMP STATION																									
1	Carp Village	53.9	42.1	82.1	2.2	1.4	3.9	48.7	0.0	0.0	0.0	0.0	181.1	0.0	181.1	0	0	1,466	0	0	1,466	0	0	1,466	1,466
2	Carp PS	0.0	0.0	3.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	3.5	0	0	34	0	0	34	0	0	34	34
209	Carp Airport	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0
3	Carp FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0
Carp PS Sewershed		53.9	42.1	85.1	2.7	1.4	3.9	48.7	0.0	0.0	0.0	0.0	184.6	0.0	184.6	0	0	1,500	0	0	1,500	0	0	1,500	1,500

TABLE C-2: POPULATION AND LAND USE
NOVATECH ADJUSTED DATA (2006 EXISTING CONDITIONS)

		Land Use (Ha)														Population									
			Existing						Future								Existing		Future		Totals				
Catch_ID	Description	Vacant	Frm	Res	Com	Ind	Ins	Spc	WWWL	VURL	VUIL	VRIL	Total (Existing)	Total (Future)	Total	Vacant	Frm	Res	WWWL	VURL	Existing (Sewer)	Future (Sewer)	Future (I.Cross)	Build-Out (Sewer)	Build-Out (I.Cross)
MARCH PUMP STATION																									
	Carp PS	53.9	42.1	85.1	2.7	1.4	3.9	48.7	0.0	0.0	0.0	0.0	184.6	0.0	184.6	0	0	1,500	0	0	1,500	0	0	1,500	1,500
4		83.6	0.0	76.1	0.0	0.0	2.9	0.1	0.8	28.3	0.0	0.0	79.1	29.1	108.2	0	0	5,467	50	945	5,467	995	773	6,462	6,240
5		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.1	0.0	0.0	0.0	18.1	18.1	0	0	0	0	1,181	0	1,181	1,737	1,181	1,737
9		1.3	0.0	0.0	9.3	10.3	0.0	0.0	0.0	0.0	2.2	0.0	19.6	2.2	21.8	0	0	0	0	0	0	0	0	0	0
10		14.8	0.0	0.0	7.4	10.1	0.0	0.0	0.0	0.0	3.3	0.0	17.5	3.3	20.8	0	0	0	0	0	0	0	0	0	0
11		42.8	0.0	0.0	34.8	28.3	0.0	0.6	0.0	7.4	14.0	0.0	63.7	21.4	85.1	0	0	0	0	558	0	558	0	558	0
	Marchwood Trunk	196.4	42.1	161.2	54.2	50.1	6.8	49.4	0.8	53.8	19.5	0.0	364.5	74.1	438.6	0	0	6,967	50	2,684	6,967	2,734	2,510	9,701	9,477
North Kanata																									
6	Briar Ridge PS	55.0	68.2	32.4	9.7	0.1	0.0	1.5	0.3	81.4	38.0	0.0	111.9	119.7	231.6	0	3	1,224	17	3,384	1,227	3,401	4,281	4,628	5,508
7		6.1	0.0	14.3	13.1	11.6	1.0	0.0	0.0	0.0	2.1	0.0	40.0	2.1	42.1	0	0	1,267	0	0	1,267	0	547	1,267	1,814
8		28.9	0.0	3.6	58.4	1.0	0.0	0.0	0.0	0.7	25.7	0.0	63.0	26.4	89.4	0	0	166	0	96	166	96	98	262	264
	East March Trunk	90.0	68.2	50.3	81.2	12.7	1.0	1.5	0.3	82.1	65.8	0.0	214.9	148.2	363.1	0	3	2,657	17	3,480	2,660	3,497	4,926	6,157	7,586
Kanata Lakes																									
27		10.9	0.0	0.0	12.3	25.4	0.0	0.0	3.7	0.0	8.4	0.0	37.7	12.1	49.8	0	0	0	337	0	0	337	0	337	0
29		2.4	0.0	0.6	2.6	14.5	0.0	0.0	0.0	0.0	2.2	0.0	17.7	2.2	19.9	0	0	14	0	0	14	0	0	14	14
31		5.9	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	2.4	0	0	116	0	0	116	0	0	116	116
35		2.4	0.0	41.2	0.0	0.0	1.0	0.0	0.0	0.1	0.0	0.0	42.2	0.1	42.3	0	0	2,393	0	3	2,393	3	3	2,396	2,396
36		22.6	0.0	27.8	0.0	0.0	0.7	0.0	0.0	11.4	0.0	0.0	28.5	11.4	39.9	0	0	1,194	0	176	1,194	176	182	1,370	1,376
45		8.1	0.0	33.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.0	0.0	33.0	0	0	2,482	0	0	2,482	0	0	2,482	2,482
46		1.7	0.0	12.6	0.3	0.0	0.0	1.2	0.0	0.0	0.0	0.0	14.1	0.0	14.1	0	0	847	0	0	847	0	0	847	847
203		0.0	62.2	0.0	0.0	0.0	0.0	0.0	0.0	119.4	0.0	0.0	62.2	119.4	181.6	0	0	0	0	2,298	0	2,298	2,802	2,298	2,802
204		131.7	0.0	0.0	0.0	3.5	0.0	0.0	0.0	119.4	0.0	0.0	3.5	119.4	122.9	0	0	0	0	1,699	0	1,699	2,072	1,699	2,072
205		46.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	119.4	0.0	0.0	0.0	119.4	119.4	0	0	0	0	2,027	0	2,027	2,472	2,027	2,472
206		24.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.5	0.0	0.0	0.0	16.5	16.5	0	0	0	0	1,277	0	1,277	1,557	1,277	1,557
207		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	119.4	0.0	0.0	0.0	119.4	119.4	0	0	0	0	1,607	0	1,607	1,960	1,607	1,960
	Kanata Lakes Trunk	256.6	62.2	117.6	15.2	43.4	1.7	1.2	3.7	505.6	10.6	0.0	241.3	519.9	761.2	0	0	7,046	337	9,087	7,046	9,424	11,048	16,470	18,094
	March PS Sewershed	543.0	172.5	329.1	150.6	106.2	9.5	52.1	4.8	641.5	95.9	0.0	820.7	742.2	1,562.9	0	3	16,670	404	15,251	16,673	15,655	18,484	32,328	35,157
MARCH RIDGE TRUNK																									
Main Street Sewershed		189.3	341.6	187.0	54.2	4.4	26.6	21.3	5.7	206.0	98.0	0.0	636.8	309.7	946.5	0	3	11,272	685	17,001	11,275	17,686	16,955	28,961	28,230
Penfield Drive Sewershed		36.2	0.0	96.1	8.3	16.5	8.3	1.4	2.6	0.0	11.6	0.0	131.2	14.2	145.4	0	0	2,840	870	0	2,840	870	0	3,710	2,840
March Pump Station		543.0	172.5	329.1	150.6	106.2	9.5	52.1	4.8	641.5	95.9	0.0	820.7	742.2	1562.9	0	3	16,670	404	15,251	16,673	15,655	18,484	32,328	35,157
March Ridge Trunk Sewershed		768.5	514.1	612.2	213.1	127.1	44.4	74.8	13.1	847.5	205.5	0.0	1588.7	1066.1	2654.8	0	6	30,782	1,959	32,252	30,788	34,211	35,439	64,999	66,227
TRI-TOWNSHIP COLLECTOR																									
Glen Cairn Collector		980.7	689.9	1,170.6	205.9	108.3	53.6	120.3	20.9	1,095.5	186.3	0.0	2,351.2	1,302.7	3,653.9	0	9	60,818	1,335	70,420	60,827	71,755	76,628	132,582	137,455
March Ridge Trunk		768.5	514.1	612.2	213.1	127.1	44.4	74.8	13.1	847.5	205.5	0.0	1,588.7	1,066.1	2,654.8	0	6	30,782	1,959	32,252	30,788	34,211	35,439	64,999	66,227
	TTC Sewershed	1,749.2	1,204.0	1,782.8	419.0	235.4	98.0	195.1	34.0	1,943.0	391.8	0.0	3,939.9	2,368.8	6,308.7	0	15	91,600	3,294	102,672	91,615	105,966	112,067	197,581	203,682
NORTH KANATA TRUNK (LOWER REACH)																									
Tri-Township Collector		1,749.2	1,204.0	1,782.8	419.0	235.4	98.0	195.1	34.0	1,943.0	391.8	0.0	3,939.9	2,368.8	6,308.7	0	15	91,600	3,294	102,672	91,615	105,966	112,067	197,581	203,682
March PS (future diversion)																									
	North Kanata Sewershed	1,749.2	1,204.0	1,782.8	419.0	235.4	98.0	195.1	34.0	1,943.0	391.8	0.0	3,939.9	2,368.8	6,308.7	0	15	91,600	3,294	102,672	91,615	105,966	112,067	197,581	203,682
								345.0				251.3													

Notes:
1) No data on the Nepean Collector sewershed (Bell's Corners)
2) Tartan & Cavanagh lands appear to have been ommitted in this data sheet (Ian Cross has accounted for them)
3) Discrepancies Land Use, Existing, Special (ha) & Land Use, Future, VRIL (ha)

TABLE C-3: RESIDENTIAL GROWTH
RAW CITY ISSUED DATA (2006-2031)

Fernbank CDP Infrastructure Analysis Assumptions

V2, 18-Dec-06

Detailed Development Assumptions, Residential Potential 2006 onward

AREA	PARCEL NUMBER	UNIT POTENTIAL	PARCEL SIZE (net ha)	DENSITY (units/net ha)	UNIT TYPE	EST. POP	OWNER	REG. PLAN NO.	DEV. STATUS
KANATA	100	7	0.39	17.9	SF	23	MINTO	4M-1246	RG
KANATA	101	90	4.60	19.6	SF	297	MINTO		DA
KANATA	102	94	4.79	19.6	SF	310	MINTO	4M-1154	RG
KANATA	103	1	0.04	25.0	SF	3	MINTO	4M-1121	RG
KANATA	104	50	2.09	23.9	MX	150	MCMURTRY		PG
KANATA	109	167	5.81	28.7	MX	501	TENTH LINE DEVELOPMENTS	4M-1274	RG
KANATA	110	14	0.85	16.5	SF	46	TENTH LINE DEVELOPMENTS	4M-778	RG
KANATA	113	430	16.00	26.9	MX	1290	MINTO		PG
KANATA	118	39	0.70	55.7	MS	98	KANATA RESEARCH PARK	SITE PLAN	RG
KANATA	122	17	2.70	6.3	SF	56	TERON, CHRIS	645	RG
KANATA	123	49	0.86	57.0	MS	123	KNL DEVELOPMENTS	4M-1170	RG
KANATA	126	1	0.08	12.5	SF	3	KNL DEVELOPMENTS	4M-1135	RG
KANATA	128	519	16.47	31.5	MX	1557	RICHCRAFT		DA
KANATA	130	2	0.10	20.0	SF	7	SIGNATURE RIDGE	4M-1155	RG
KANATA	131	3	0.18	16.7	SF	10	DCR PHOENIX	4M-1102	RG
KANATA	133	6	0.40	15.0	MS	15	DCR PHOENIX	SITE PLAN	RG
KANATA	135	1	0.09	11.1	SF	3	MACLEOD, JAMES	4M-510	RG
KANATA	138	431	9.50	45.4	AP	759	CITY OF OTTAWA/ URBANDALE		DA
KANATA	140	1,125	9.22	122.0	MX	3375	CITY OF OTTAWA/ URBANDALE		PG
KANATA	143	18	0.60	30.0	MX	54	URBANDALE	4M-1164	RG
KANATA	144	32	0.96	33.3	MS	80	URBANDALE	4M-1039	RG
KANATA	146	18	0.36	50.0	AP	32	977664 ONTARIO	4M-873	RG
KANATA	147	160	1.89	84.7	AP	282	871530 ONTARIO	SITE PLAN	RG
KANATA	148	1	0.07	14.3	SF	3	MULTIPLE OWNERS		RG
KANATA	149	2	0.05	40.0	SD	6	PEGASUS DEVELOPMENTS	4M-1068	RG
KANATA	152	2	0.07	28.6	SF	7	URBANDALE	4M-797	RG
KANATA	153	18	1.05	17.1	SF	59	URBANDALE	4M-1196	RG
KANATA	154	44	1.54	28.6	SF	145	URBANDALE	4M-1219	RG
KANATA	158	68	2.22	30.8	MX	204	URBANDALE		NP
KANATA	159	15	0.62	24.2	SF	50	URBANDALE	4M-776	RG
KANATA	161	18	0.71	25.4	SF	59	URBANDALE	4M-880	RG
KANATA	163	268	5.69	47.1	MX	804	URBANDALE	4M-1248	RG
KANATA	164	30	0.70	42.9	MS	75	URBANDALE	SITE PLAN	RG
KANATA	165	130	4.45	29.2	MS	325	URBANDALE	4M-1251	RG
KANATA	166	3	0.13	23.1	SF	10	URBANDALE	4M-1132	RG
KANATA	168	223	16.72	13.3	SF	736	URBANDALE		PG
KANATA	169	1,068	34.68	30.8	MX	3204	HOPE, LLOYD		NP
KANATA	170	82	2.59	30.8	MS	205	MINTO		DA
KANATA	171	21	0.76	27.6	MS	53	MINTO	4M-1225	RG
KANATA	172	2	0.17	11.8	SF	7	MINTO	4M-1007	RG
KANATA	173	2	0.07	28.6	SF	7	MINTO	4M-1220	RG
KANATA	174	800	25.10	31.9	MX	2400	KLONDIKE (ASHCROFT)		DA
KANATA	175	3,102	119.43	26.0	MX	9306	KNL DEVELOPMENTS		DA

TABLE C-3: RESIDENTIAL GROWTH
RAW CITY ISSUED DATA (2006-2031)

KANATA	180	180	3.30	30.8	MX	540	URBANDALE		PG
KANATA	181	18	0.57	30.8	MX	54	CITY OF OTTAWA		NP
KANATA	182	166	5.95	27.9	MS	415	URBANDALE	SITE PLAN	PG
KANATA	183	50	2.29	21.8	SD	145	URBANDALE	4M-1269	RG
KANATA WEST	184	850	41.18	20.6	MX	2550	MATTAMY DEV. CO.		PG
KANATA WEST	185	1,246	26.95	46.2	MX	3738	RICHCRAFT		PG
KANATA	188	7	0.48	14.6	SF	23	MINTO	4M-1280	RG
KANATA	189	35	1.60	21.9	SF	116	6180655 CANADA LTD.	4M-1287	RG
KANATA	190	57	2.71	21.0	MS	143	CITY OF OTTAWA	4M-1274	RG
KANATA	191	282	9.17	30.8	MX	846	MULTIPLE OWNERS		NP
KANATA WEST	192	180	5.00	36.0	MX	540	NORTH AMERICAN		PG
KANATA	193	1,288	28.70	44.9	MX	3864	WESTPARK		PG
KANATA	194	392	5.50	71.3	MX	1176	SHILLINGTON		DA
KANATA	195	80	3.55	22.5	SF	264	MINTO		DA
KANATA	196	1,735	56.32	30.8	MX	5205	RICHARDSON RIDGE INC.; MAXWELL, JAMES		NP
KANATA	197	304	11.13	27.3	MX	912	KANATA ROAD INC. C/O REGIONAL GROUP		PG
KANATA WEST	198	1,065	34.57	30.8	MX	3195	MINTO		NP
KANATA WEST	201	1,351	43.58	31.0	MX	4052.94	MULTIPLE OWNERS		NP
FERNBANK CDP	202	1,845	59.52	31.0	MX	5535.73	DEL		NP
FERNBANK CDP	203	4,260	137.42	31.0	MX	12780.2	BROOKFIELD		NP
FERNBANK CDP	204	2,232	71.99	31.0	MX	6695.35	WESTPARK		NP
KANATA	205	345	11.83	29.2	MX	1035	TENTH LINE DEVELOPMENTS		NP
FERNBANK CDP	206	1,311	42.28	31.0	MX	3933	MULTIPLE OWNERS		NP
FERNBANK CDP	207	59	1.91	31.0	MX	177.491	DOROTHY JONES		NP
FERNBANK CDP	208	82	2.64	31.0	MX	246	NORMAN STONE		NP
FERNBANK CDP	209	107	3.45	31.0	MX	321	PETRUS VAN GAAL		NP
KANATA	210	230	3.29	70.0	MX	690.9	MULTIPLE OWNERS		NP
KANATA	211	604	13.43	45.0	MX	1813.05	ARTHUR VAN GAAL		NP
FERNBANK CDP	212	2,100	67.75	31.0	MX	6300.52	MULTIPLE OWNERS		NP
KANATA WEST	213	1,602	17.80	90.0	MX	4806	MATTAMY (MAPLE GROVE)		NP
KANATA WEST	214	503	8.39	60.0	MX	1510.2	HUNTMAR DEVELOPMENT		NP
KANATA WEST	215	767	12.78	60.0	MX	2300.4	2049824 ONTARIO INC.		NP
KANATA WEST	216	225	3.75	60.0	MX	675	WEST KANATA DEVELOPMENT		NP
STITTSVILLE	250	11	0.75	14.7	MX	33	TIMBERWOOD DEVELOPMENTS	4M-1159	RG
STITTSVILLE	251	7	0.50	14.0	MX	21	TIMBERWOOD DEVELOPMENTS	4M-1159	RG
STITTSVILLE	252	28	1.72	16.3	SF	92	LEMAY HOMES	4M-1192	RG
STITTSVILLE	253	41	1.33	30.8	MX	123	MARTIN, EDWARD		NP
STITTSVILLE	255	15	0.50	30.8	MX	45	743104 ONTARIO		NP
STITTSVILLE	256	11	0.77	14.3	SF	36	GRANITE RIDGE	4M-1085	RG
STITTSVILLE	257	23	1.21	19.0	SF	76	GRANITE RIDGE	4M-1084	RG
STITTSVILLE	259	107	3.69	29.0	SF	353	RAY BELL	4M-1163	RG
STITTSVILLE	261	60	2.36	25.4	SF	198	CAVANAUGH CONSTRUCTION	4M-1228	RG
STITTSVILLE	263	113	5.21	21.7	MX	339	ASHCROFT HOMES	4M-1266	RG
STITTSVILLE	264	229	11.66	19.6	MX	687	DCR PHOENIX		PG
STITTSVILLE	265	136	4.41	30.8	MX	408	CHENIER, J. CO. LTD.		NP
STITTSVILLE	266	128	6.87	18.6	SF	422	FRANK ARGUE	4M-1259	RG
STITTSVILLE	267	15	0.77	19.5	SF	50	PHOENIX HOMES	4M-1107	RG

TABLE C-3: RESIDENTIAL GROWTH
RAW CITY ISSUED DATA (2006-2031)

STITTSVILLE	269	43	3.00	14.3	SF	142	ARGUE/REGIONAL GROUP	4M-1256	RG
STITTSVILLE	270	584	19.29	30.3	MX	1752	TAGGART RESIDENTIAL		DA
STITTSVILLE	271	29	0.61	47.5	MS	73	AVERY, BARBARA		DA
STITTSVILLE	272	96	3.00	32.0	MS	240	CDS RENTALS	SITE PLAN	RG
STITTSVILLE	273	255	8.27	30.8	MX	765	JOHNSON, GLENDA		NP
STITTSVILLE	274	159	5.15	30.8	MX	477	KAVANAUGH INVESTMENTS		NP
STITTSVILLE	275	160	5.20	30.8	MX	480	KAVANAUGH REALTY		NP
STITTSVILLE	276	139	4.52	30.8	MX	417	KAVANAUGH REALTY		NP
STITTSVILLE	277	130	2.28	57.0	MX	390	1590675 ONTARIO INC.		PG
STITTSVILLE	278	14	1.18	11.9	SF	46	6448593 CANADA INC.		PG
STITTSVILLE	279	168	9.08	18.5	SF	554	FRANK ARGUE		DA
STITTSVILLE	280	155	6.83	22.7	SF	512	FRANK ARGUE		DA
						112065			

Total future units	37,588
Existing & started units, end 2005	31,048
Total units*	68,636

* includes no allowance for intensification
Note: Fernbank CDP parcels adjusted to remove Hydro right-of-way

Sub-totals:

Kanata West	7,789
Fernbank CDP Lands	11,996

Unit Type abbreviations:
SF - Single-detached
SD - Semi-detached
MS - Multiples (generally townhouses)
AP - Apartment
MX - Mix of dwelling types

Development Status abbreviations:
RG - Registered
DA - Draft Approved
PG - Pending (application filed)
NP - No Plan

TABLE C-4: RESIDENTIAL GROWTH
NOVATECH ADJUSTED DATA BY SEWERSHED (2006-2031)

Fernbank CDP Infrastructure Analysis Assumptions

Detailed Development Assumptions, Residential Potential, Jan. 2006 onward

AREA	PARCEL NUMBER	SEWER ID NUMBER	SEWER CATCHMENT	PUMP STATION CATCHMENT	UNIT POTENTIAL	PARCEL SIZE (net ha)	UNIT DENSITY (units/net ha)	UNIT TYPE	POPULATION DENSITY (GUIDELINES)	POPULATION GROWTH (SIMPLE)	POPULATION GROWTH (GUIDELINES)	POPULATION GROWTH (I.CROSS)	OWNER	REG. PLAN NO.	DEV. STATUS
KANATA	100	4	Hines Road	March PS	7	0.39	17.9	SF	3.4	21	24	23	MINTO	4M-1246	RG
KANATA	101	5	Hines Road	March PS	90	4.60	19.6	SF	3.4	270	306	297	MINTO		DA
KANATA	102	4	Hines Road	March PS	94	4.79	19.6	SF	3.4	282	320	310	MINTO	4M-1154	RG
KANATA	103	4	Hines Road	March PS	1	0.04	25.0	SF	3.4	3	3	3	MINTO	4M-1121	RG
KANATA	104	5	Hines Road	March PS	50	2.09	23.9	MX	3.0	150	150	150	MCMURTRY		PG
KANATA	109	7	East March	March PS	167	5.81	28.7	MX	3.0	501	501	501	TENTH LINE DEVELOPMENTS	4M-1274	RG
KANATA	110	7	East March	March PS	14	0.85	16.5	SF	3.4	42	48	46	TENTH LINE DEVELOPMENTS	4M-778	RG
KANATA	113	5	Hines Road	March PS	430	16.00	26.9	MX	3.0	1,290	1,290	1,290	MINTO		PG
KANATA	118	8	East March	March PS	39	0.70	55.7	TH	2.7	117	105	98	KANATA RESEARCH PARK	SITE PLAN	RG
KANATA	122	36	Kanata Lakes	March PS	17	2.70	6.3	SF	3.4	51	58	56	TERON, CHRIS	645	RG
KANATA	123	36	Kanata Lakes	March PS	49	0.86	57.0	MS	2.7	147	132	123	KNL DEVELOPMENTS	4M-1170	RG
KANATA	126	36	Kanata Lakes	March PS	1	0.08	12.5	SF	3.4	3	3	3	KNL DEVELOPMENTS	4M-1135	RG
KANATA	128	206	Kanata Lakes	March PS	519	16.47	31.5	MX	3.0	1,557	1,557	1,557	RICHCRAFT		DA
KANATA	130	42	Main Street	Signature Ridge	2	0.10	20.0	SF	3.4	6	7	7	SIGNATURE RIDGE	4M-1155	RG
KANATA	131	42	Main Street	Signature Ridge	3	0.18	16.7	SF	3.4	9	10	10	DCR PHOENIX	4M-1102	RG
KANATA	133	42	Main Street	Signature Ridge	6	0.40	15.0	TH	2.7	18	16	15	DCR PHOENIX	SITE PLAN	RG
KANATA	135	35	Kanata Lakes	March PS	1	0.09	11.1	SF	3.4	3	3	3	MACLEOD, JAMES	4M-510	RG
KANATA	138	47	Main Street	Acres Road PS	431	9.50	45.4	AP	1.8	1,293	776	759	CITY of OTTAWA/ URBANDALE		DA
KANATA	140	47	Main Street	Acres Road PS	1,125	9.22	122.0	MX	3.0	3,375	3,375	3,375	CITY of OTTAWA/ URBANDALE		PG
KANATA	143	77	Main Street	Acres Road PS	18	0.60	30.0	MX	3.0	54	54	54	URBANDALE	4M-1164	RG
KANATA	144	33	Main Street	Acres Road PS	32	0.96	33.3	TH	2.7	96	86	80	URBANDALE	4M-1039	RG
KANATA	146	50	Main Street	Acres Road PS	18	0.36	50.0	AP	1.8	54	32	32	977664 ONTARIO	4M-873	RG
KANATA	147	50	Main Street	Acres Road PS	160	1.89	84.7	AP	1.8	480	288	282	871530 ONTARIO	SITE PLAN	RG
KANATA	148	54	Glen Cairn	Acres Road PS	1	0.07	14.3	SF	3.4	3	3	3	MULTIPLE OWNERS		RG
KANATA	149	55	Glamorgan	Hazeldean PS	2	0.05	40.0	SD	2.7	6	5	6	PEGASUS DEVELOPMENTS (Olympi	4M-1068	RG
KANATA	152	69	South Glen Cairn	Hazeldean PS	2	0.07	28.6	SF	3.4	6	7	7	URBANDALE	4M-797	RG
KANATA	153	69	South Glen Cairn	Hazeldean PS	18	1.05	17.1	SF	3.4	54	61	59	URBANDALE	4M-1196	RG
KANATA	154	69	South Glen Cairn	Hazeldean PS	44	1.54	28.6	SF	3.4	132	150	145	URBANDALE	4M-1219	RG
KANATA	158	70	South Glen Cairn	Hazeldean PS	68	2.22	30.8	MX	3.0	204	204	204	URBANDALE		NP
KANATA	159	70	South Glen Cairn	Hazeldean PS	15	0.62	24.2	SF	3.4	45	51	50	URBANDALE	4M-776	RG
KANATA	161	70	South Glen Cairn	Hazeldean PS	18	0.71	25.4	SF	3.4	54	61	59	URBANDALE	4M-880	RG
KANATA	163	70	South Glen Cairn	Hazeldean PS	268	5.69	47.1	MX	3.0	804	804	804	URBANDALE	4M-1248	RG
KANATA	164	70	South Glen Cairn	Hazeldean PS	30	0.70	42.9	TH	2.7	90	81	75	URBANDALE	SITE PLAN	RG
KANATA	165	70	South Glen Cairn	Hazeldean PS	130	4.45	29.2	TH	2.7	390	351	325	URBANDALE	4M-1251	RG
KANATA	166	70	South Glen Cairn	Hazeldean PS	3	0.13	23.1	SF	3.4	9	10	10	URBANDALE	4M-1132	RG
KANATA	168	70	South Glen Cairn	Hazeldean PS	223	16.72	13.3	SF	3.4	669	758	736	URBANDALE		PG
KANATA	169	70	South Glen Cairn	Hazeldean PS	1,068	34.68	30.8	MX	3.0	3,204	3,204	3,204	HOPE, LLOYD		NP
KANATA	170	68	South Glen Cairn	Hazeldean PS	82	2.59	30.8	TH	2.7	246	221	205	MINTO		DA
KANATA	171	70	South Glen Cairn	Hazeldean PS	21	0.76	27.6	TH	2.7	63	57	53	MINTO	4M-1225	RG
KANATA	172	70	South Glen Cairn	Hazeldean PS	2	0.17	11.8	SF	3.4	6	7	7	MINTO	4M-1007	RG
KANATA	173	4	Hines Road	March PS	2	0.07	28.6	SF	3.4	6	7	7	MINTO	4M-1220	RG
KANATA	174	6	East March	March PS	800	25.10	31.9	MX	3.0	2,400	2,400	2,400	KLONDIKE (ASHCROFT)		DA
KANATA	175	MPS-Part	Kanata Lakes	March PS	3,102	119.43	26.0	MX	3.0	9,306	9,306	9,306	KNL DEVELOPMENTS		DA
KANATA	180	69	South Glen Cairn	Hazeldean PS	180	3.30	30.8	MX	3.0	540	540	540	URBANDALE		PG
KANATA	181	42	Main Street	Signature Ridge	18	0.57	30.8	MX	3.0	54	54	54	CITY OF OTTAWA		NP
KANATA	182	70	South Glen Cairn	Hazeldean PS	166	5.95	27.9	TH	2.7	498	448	415	URBANDALE	SITE PLAN	PG
KANATA	183	70	South Glen Cairn	Hazeldean PS	50	2.29	21.8	SD	2.7	150	135	145	URBANDALE	4M-1269	RG
KANATA WEST	184	58	Kanata West	Kanata West PS	850	41.18	20.6	MX	3.0	2,550	2,550	2,550	MATTAMY DEV.		PG
KANATA WEST	185	58	Kanata West	Kanata West PS	1,246	26.95	46.2	MX	3.0	3,738	3,738	3,738	RICHCRAFT		PG
KANATA	188	4	Hines Road	March PS	7	0.48	14.6	SF	3.4	21	24	23	MINTO	4M-1280	RG
KANATA	189	70	South Glen Cairn	Hazeldean PS	35	1.60	21.9	SF	3.4	105	119	116	6180655 CANADA	4M-1287	RG
KANATA	190	4	Hines Road	March PS	57	2.71	21.0	TH	2.7	171	154	143	CITY OF OTTAWA	4M-1274	RG
KANATA	191	6	East March	March PS	282	9.17	30.8	MX	3.0	846	846	846	MULTIPLE OWNERS		NP
KANATA WEST	192	58	Kanata West	Kanata West PS	180	5.00	36.0	MX	3.0	540	540	540	NORTH AMERICAN		PG
KANATA	193	68	South Glen Cairn	Hazeldean PS	1,288	28.70	44.9	MX	3.0	3,864	3,864	3,864	WESTPARK		PG

TABLE C-4: RESIDENTIAL GROWTH
NOVATECH ADJUSTED DATA BY SEWERSHED (2006-2031)

Fernbank CDP Infrastructure Analysis Assumptions

Detailed Development Assumptions, Residential Potential, Jan. 2006 onward

AREA	PARCEL NUMBER	SEWER ID NUMBER	SEWER CATCHMENT	PUMP STATION CATCHMENT	UNIT POTENTIAL	PARCEL SIZE (net ha)	UNIT DENSITY (units/net ha)	UNIT TYPE	POPULATION DENSITY (GUIDELINES)	POPULATION GROWTH (SIMPLE)	POPULATION GROWTH (GUIDELINES)	POPULATION GROWTH (I.CROSS)	OWNER	REG. PLAN NO.	DEV. STATUS
KANATA	194	68	South Glen Cairn	Hazeldean PS	392	5.50	71.3	MX	3.0	1,176	1,176	1,176	SHILLINGTON		DA
KANATA	195	4	Hines Road	March PS	80	3.55	22.5	SF	3.4	240	272	264	MINTO		DA
KANATA	196	201	Main Street	Signature Ridge	1,735	56.32	30.8	MX	3.0	5,205	5,205	5,205	MAXWELL, JAMES		NP
KANATA	197	202	Main Street	Signature Ridge	304	11.13	27.3	MX	3.0	912	912	912	REGIONAL GROUP		PG
KANATA WEST	198	57	Main Street	Signature Ridge	1,065	34.57	30.8	MX	3.0	3,195	3,195	3,195	MINTO		NP
KANATA WEST	201	58	Kanata West	Kanata West PS	1,351	43.58	31.0	MX	3.0	4,053	4,053	4,053	MULTIPLE OWNERS		NP
FERNBANK CDP	202	200	Kanata West	Kanata West PS	1,845	59.52	31.0	MX	3.0	5,535	5,535	5,536	DEL		NP
FERNBANK CDP	203	112	Stittsville	Hazeldean PS	4,260	137.42	31.0	MX	3.0	12,780	12,780	12,780	BROOKFIELD		NP
FERNBANK CDP	204	113	Stittsville	Hazeldean PS	2,232	71.99	31.0	MX	3.0	6,696	6,696	6,695	WESTPARK		NP
KANATA	205	6	East March	March PS	345	11.83	29.2	MX	3.0	1,035	1,035	1,035	TENTH LINE DEVELOPMENTS		NP
FERNBANK CDP	206	X	Stittsville	Hazeldean PS	1,311	42.28	31.0	MX	3.0	3,933	3,933	3,933	MULTIPLE OWNERS		NP
FERNBANK CDP	207	112	Stittsville	Hazeldean PS	59	1.91	31.0	MX	3.0	177	177	177	DOROTHY JONES		NP
FERNBANK CDP	208	112	Stittsville	Hazeldean PS	82	2.64	31.0	MX	3.0	246	246	246	NORMAN STONE		NP
FERNBANK CDP	209	113	Stittsville	Hazeldean PS	107	3.45	31.0	MX	3.0	321	321	321	PETRUS VAN GAAL		NP
KANATA	210	68	South Glen Cairn	Hazeldean PS	230	3.29	70.0	MX	3.0	691	691	691	MULTIPLE OWNERS		NP
KANATA	211	68	South Glen Cairn	Hazeldean PS	604	13.43	45.0	MX	3.0	1,813	1,813	1,813	ARTHUR VAN GAAL		NP
FERNBANK CDP	212	211	Kanata West	Kanata West PS	2,100	67.75	31.0	MX	3.0	6,300	6,300	6,300	MULTIPLE OWNERS		NP
KANATA WEST	213	56	Kanata West	Kanata West PS	1,602	17.80	90.0	MX	3.0	4,806	4,806	4,806	MATTAMY (MAPLE GROVE)		NP
KANATA WEST	214	56	Kanata West	Kanata West PS	503	8.39	60.0	MX	3.0	1,510	1,510	1,510	HUNTMAR DEVELOPMENT		NP
KANATA WEST	215	57	Main Street	Signature Ridge	767	12.78	60.0	MX	3.0	2,300	2,300	2,300	2049824 ONTARIO INC.		NP
KANATA WEST	216	57	Main Street	Signature Ridge	225	3.75	60.0	MX	3.0	675	675	675	WEST KANATA DEVELOPMENT		NP
STITTSVILLE	250	67	Stittsville	Hazeldean PS	11	0.75	14.7	MX	3.0	33	33	33	TIMBERWOOD DEVELOPMENTS	4M-1159	RG
STITTSVILLE	251	67	Stittsville	Hazeldean PS	7	0.50	14.0	MX	3.0	21	21	21	TIMBERWOOD DEVELOPMENTS	4M-1159	RG
STITTSVILLE	252	PS-Eco	Stittsville	Hazeldean PS	28	1.72	16.3	SF	3.4	84	95	92	LEMAY HOMES	4M-1192	RG
STITTSVILLE	253	67	Stittsville	Hazeldean PS	41	1.33	30.8	MX	3.0	123	123	123	MARTIN, EDWARD		NP
STITTSVILLE	255	60	Stittsville	Hazeldean PS	15	0.50	30.8	MX	3.0	45	45	45	743104 ONTARIO		NP
STITTSVILLE	256	64	Stittsville	Hazeldean PS	11	0.77	14.3	SF	3.4	33	37	36	GRANITE RIDGE	4M-1085	RG
STITTSVILLE	257	64	Stittsville	Hazeldean PS	23	1.21	19.0	SF	3.4	69	78	76	GRANITE RIDGE	4M-1084	RG
STITTSVILLE	259	PS-FC	Stittsville	Hazeldean PS	107	3.69	29.0	SF	3.4	321	364	353	RAY BELL	4M-1163	RG
STITTSVILLE	261	PS-FC	Stittsville	Hazeldean PS	60	2.36	25.4	SF	3.4	180	204	198	CAVANAUGH CONSTRUCTION	4M-1228	RG
STITTSVILLE	263	PS-FC	Stittsville	Hazeldean PS	113	5.21	21.7	MX	3.0	339	339	339	ASHCROFT HOMES	4M-1266	RG
STITTSVILLE	264	PS-FC	Stittsville	Hazeldean PS	229	11.66	19.6	MX	3.0	687	687	687	DCR PHOENIX		PG
STITTSVILLE	265	PS-FC	Stittsville	Hazeldean PS	136	4.41	30.8	MX	3.0	408	408	408	CHENIER, J. CO. LTD.		NP
STITTSVILLE	266	66	Stittsville	Hazeldean PS	128	6.87	18.6	SF	3.4	384	435	422	FRANK ARGUE	4M-1259	RG
STITTSVILLE	267	66	Stittsville	Hazeldean PS	15	0.77	19.5	SF	3.4	45	51	50	PHOENIX HOMES	4M-1107	RG
STITTSVILLE	269	67	Stittsville	Hazeldean PS	43	3.00	14.3	SF	3.4	129	146	142	ARGUE/REGIONAL GROUP	4M-1256	RG
STITTSVILLE	270	59	Stittsville	Hazeldean PS	584	19.29	30.3	MX	3.0	1,752	1,752	1,752	TAGGART RESIDENTIAL		DA
STITTSVILLE	271	PS-FC	Stittsville	Hazeldean PS	29	0.61	47.5	TH	2.7	87	78	73	AVERY, BARBARA		DA
STITTSVILLE	272	64	Stittsville	Hazeldean PS	96	3.00	32.0	TH	2.7	288	259	240	CDS RENTALS	SITE PLAN	RG
STITTSVILLE	273	67	Stittsville	Hazeldean PS	255	8.27	30.8	MX	3.0	765	765	765	JOHNSON, GLENDA		NP
STITTSVILLE	274	67	Stittsville	Hazeldean PS	159	5.15	30.8	MX	3.0	477	477	477	KAVANAUGH INVESTMENTS		NP
STITTSVILLE	275	67	Stittsville	Hazeldean PS	160	5.20	30.8	MX	3.0	480	480	480	KAVANAUGH REALTY		NP
STITTSVILLE	276	67	Stittsville	Hazeldean PS	139	4.52	30.8	MX	3.0	417	417	417	KAVANAUGH REALTY		NP
STITTSVILLE	277	60	Stittsville	Hazeldean PS	130	2.28	57.0	MX	3.0	390	390	390	1590675 ONTARIO		PG
STITTSVILLE	278	PS-Stitts	Stittsville	Hazeldean PS	14	1.18	11.9	SF	3.4	42	48	46	6448593 CANADA		PG
STITTSVILLE	279	66	Stittsville	Hazeldean PS	168	9.08	18.5	SF	3.4	504	571	554	FRANK ARGUE		DA
STITTSVILLE	280	66	Stittsville	Hazeldean PS	155	6.83	22.7	SF	3.4	465	527	512	FRANK ARGUE		DA
						1146.44				112,763	112,369	112,067			

TABLE C-4: RESIDENTIAL GROWTH
NOVATECH ADJUSTED DATA BY SEWERSHED (2006-2031)

Population Growth by Sewer ID Number

SEWER ID NUMBER	UNIT POTENTIAL	AREA (ha)	ESTIMATED POPULATION (SIMPLE)	ESTIMATED POPULATION (GUIDELINES)	ESTIMATED POPULATION (I.CROSS)
4	248	12.03	744	803	773
5	570	22.69	1,710	1,746	1,737
6	1,427	46.10	4,281	4,281	4,281
7	181	6.66	543	549	547
8	39	0.70	117	105	98
33	32	0.96	96	86	80
35	1	0.09	3	3	3
36	67	3.64	201	194	182
42	29	1.25	87	87	86
47	1,556	18.72	4,668	4,151	4,134
50	178	2.25	534	320	314
54	1	0.07	3	3	3
55	2	0.05	6	5	6
56	2,105	26.19	6,316	6,316	6,316
57	2,057	51.10	6,170	6,170	6,170
58	3,627	116.71	10,881	10,881	10,881
59	584	19.29	1,752	1,752	1,752
60	145	2.78	435	435	435
64	130	4.98	390	375	352
66	466	23.55	1,398	1,584	1,538
67	815	28.72	2,445	2,462	2,458
68	2,597	53.51	7,790	7,765	7,749
69	244	5.96	732	758	751
70	2,097	76.69	6,291	6,290	6,203
77	18	0.60	54	54	54
112	4,401	141.97	13,203	13,203	13,203
113	2,339	75.44	7,017	7,017	7,016
200	1,845	59.52	5,535	5,535	5,536
201	1,735	56.32	5,205	5,205	5,205
202	304	11.13	912	912	912
206	519	16.47	1,557	1,557	1,557
211	2,100	67.75	6,300	6,300	6,300
PS-Eco	28	1.72	84	95	92
PS-FC	674	27.94	2,022	2,080	2,058
PS-Stitts	14	1.18	42	48	46
MPS-Part	3,102	119.43	9,306	9,306	9,306
X	1,311	42.28	3,933	3,933	3,933
	37,588	1,146.44	112,763	112,369	112,067

Population Growth by Sewershed

SEWERSHED	AREA (ha)	ESTIMATED POPULATION (I.CROSS)
East March	53.46	4,926
Hines Road	34.72	2,510
Kanata Lakes	139.63	11,048
Main Street	142.33	16,955
Penfield Drive	0	0
Stittsville	369.85	32,883
Glamorgan	0.05	6
South Glen Cairn	136.16	14,703
Kanata West	270.17	29,033
Glen Cairn	0.07	3
	1,146.44	**112,067**

TABLE C-5: EMPLOYMENT GROWTH
RAW CITY ISSUED DATA (2006-2031)

Fernbank CDP Infrastructure Analysis Assumptions

Detailed Development Assumptions, Employment Potential on Enterprise Area, Employment Area and Mixed Use Centre Lands, Jan. 2006 onward

Employment Area & Parcel Number	Vacant Net Ha	Expandable Lots*	Total Vacant Ha	Assumed Density (jobs/net ha)	Employment Potential
*expandable lots are not completely occupied by the current use & therefore allow possible future buildings or additions					
1. Kanata West Enterprise Area Designations					
1	3.7		3.7	100	371
4	21.7		21.7	100	2,170
5	30.0		30.0	100	3,003
6	13.8		13.8	100	1,377
7	34.3		34.3	100	3,434
8	0.9		0.9	50	45
9	1.0		1.0	50	49
10	9.8		9.8	80	783
11	5.1		5.1	100	514
12	0.5		0.5	100	47
Total	**120.8**		120.8		11,793
2. Ottawa-Goulbourn Business Park (Iber Rd.)					
1	0.7		0.7	50	37
2	0.6		0.6	70	43
3	0.6		0.6	70	40
4	1.8		1.8	70	126
5	1.7		1.7	70	121
6	1.7		1.7	70	116
7	0.4		0.4	70	28
8	3.0		3.0	45	136
9	3.7		3.7	70	256
10	0.7		0.7	50	34
11	1.2		1.2	70	84
Total	**16.1**		16.1		1,021
3. Kanata South Business Park					
1	5.4		5.4	80	432
2	0.9		0.9	80	72
3	9.7		9.7	70	679
4	2.4		2.4	50	120
7	3.6		3.6	80	286
8	3.4		3.4	80	269
9	1.3		1.3	80	104
10	1.0		1.0	80	80
11	1.2		1.2	80	97
12	0.5		0.5	80	38
13	0.4		0.4	80	34
14	0.5		0.5	80	42
15	0.1		0.1	80	6
16	2.1		2.1	50	107
17	1.0		1.0	50	48
18	1.7		1.7	80	133
19	0.1		0.1	80	7
20	0.9		0.9	80	70
21	0.6		0.6	80	49
22	0.8		0.8	80	65
23	0.5		0.5	80	41

TABLE C-5: EMPLOYMENT GROWTH
RAW CITY ISSUED DATA (2006-2031)

24	2.1		2.1	80	168
25	0.9		0.9	80	74
26	1.6		1.6	80	129
Total	**42.7**		42.7		3,151
4. Terry Fox Business Park					
1	2.4		2.4	125	306
2	3.8		3.8	100	378
3	6.2		6.2	70	435
4	0.4		0.4	50	18
5	1.0		1.0	50	52
6	1.0		1.0	50	50
7	0.9		0.9	50	44
8	0.9		0.9	50	47
9	2.1		2.1	50	105
10	7.9		7.9	50	393
Total	**26.7**		26.7		1,830
5. Hazeldean Industrial Park					
1	0.6		0.6	50	29
1e		0.5	0.5	50	23
2e		0.4	0.4	50	20
Total	**0.6**	**0.8**	1.4		72
6. Kanata Town Centre Industrial Area					
1	0.7		0.7	60	43
2	1.8		1.8	60	106
3	0.0		0.0	60	2
4	0.5		0.5	60	28
Total	**3.0**		3.0		179
7. Kanata North Business Park					
1	9.1		9.1	125	1,136
2	0.3		0.3	125	34
3	0.8		0.8	125	104
4	0.6		0.6	125	76
5	2.2		2.2	125	279
6	2.7		2.7	125	336
7	0.1		0.1	125	12
8	4.4		4.4	125	551
9	4.2		4.2	125	519
10	3.3		3.3	125	418
11	2.4		2.4	125	300
12	2.1		2.1	125	267
13	2.3		2.3	125	284
14	2.2		2.2	125	276
15	1.4		1.4	125	173
16	6.2		6.2	125	777
17	1.5		1.5	125	188
18	2.6		2.6	125	328
19	6.3		6.3	125	782
20	2.6		2.6	125	320
21	2.0		2.0	125	256
22	1.7		1.7	125	216
23	0.8		0.8	125	101
24	0.1		0.1	125	11
25	5.0		5.0	125	627
26	2.9		2.9	100	286
27	10.6		10.6	100	1,062

TABLE C-5: EMPLOYMENT GROWTH
RAW CITY ISSUED DATA (2006-2031)

28	7.0		7.0	100	701
29	9.1		9.1	100	914
30	3.6		3.6	125	450
31	2.0		2.0	125	255
32	2.0		2.0	125	255
33	5.2		5.2	125	650
34	3.0		3.0	50	150
35	2.9		2.9	50	145
1e		2.7	2.7	125	343
2e		2.0	2.0	125	246
Total	**121.1**	**4.7**	125.9		13,827

Other Employment and Mixed Use Lands:

Kanata North					
A	4.1		4.1	50	205
Town Centre Mixed Use					
B	8.5		8.5	325	2,763
C	1.2		1.2	100	119
D	10.1		10.1	325	3,287
E	1.9		1.9	50	95
F	2.3		2.3	50	115
Total	**24.0**		24.0		6,379
Kanata West Mixed Use Centre Designation					
G	2.3		2.3	50	115
H	4.2		4.2	125	525
I	33.3		33.3	125	4,163
J	19.0		19.0	90	1,706
K	15.6		15.6	50	782
L	20.5		20.5	150	3,073
M	32.6		32.6	150	4,890
Total	**127.5**		127.5		15,253
Stittsville, Hazeldean Road Commercial Lands					
J	6.5		6.5	50	327
K	3.8		3.8	50	191
L	1.3		1.3	50	65
M	4.0		4.0	50	200
N	0.9		0.9	50	45
O	4.5		4.5	50	225
P	3.1		3.1	50	155
Q	2.4		2.4	50	120
Total	**26.6**		26.6		1,329
Del, Brookfield, Westpark Lands					
Del	7.6			50	380
Brookfield	5.8			50	290
Westpark	4			50	200
Total	17.4				870

Total Employment Lands (Employment Areas, Enterprise Areas excluding Kanata West)	20,079
Total Other Lands (Town Centre and scattered sites, mostly retail)	8,782
Total Kanata West	27,046
Total All	55,908

TABLE C-6: EMPLOYMENT GROWTH
NOVATECH ADJUSTED DATA BY SEWERSHED (2006-2031)

Fernbank CDP Infrastructure Analysis Assumptions

Detailed Development Assumptions, Employment Potential on Enterprise Area, Employment Area and Mixed Use Centre Lands, Jan. 2006 onward

Employment Area & Parcel Number	Vacant Net (ha)	Expandable Lots* (ha)	Total Vacant (ha)	LAND USE	Assumed Density (jobs/net ha)	Employment Potential	SEWER ID NUMBER	SEWER CATCHMENT	PUMP STATION CATCHMENT
*expandable lots are not completely occupied by the current use & therefore allow possible future buildings or additions									
1. Kanata West Enterprise Area Designations									
1	3.7		3.7	Industrial	100	371	57	Main Street	Signature Ridge
4	21.7		21.7	Industrial	100	2,170	57	Main Street	Signature Ridge
5	30.0		30.0	Industrial	100	3,003	57	Main Street	Signature Ridge
6	13.8		13.8	Industrial	100	1,377	56	Glen Cairn	Kanata West PS
7	34.3		34.3	Industrial	100	3,434	56	Glen Cairn	Kanata West PS
8	0.9		0.9	Industrial	50	45	57	Main Street	Signature Ridge
9	1.0		1.0	Industrial	50	49	57	Main Street	Signature Ridge
10	9.8		9.8	Industrial	80	783	57	Main Street	Signature Ridge
11	5.1		5.1	Industrial	100	514	57	Main Street	Signature Ridge
12	0.5		0.5	Industrial	100	47	57	Main Street	Signature Ridge
Total	**120.8**					11,793			
2. Ottawa-Goulbourn Business Park (Iber Rd.)									
1	0.7		0.7	Industrial	50	37	58	Glen Cairn	Kanata West PS
2	0.6		0.6	Industrial	70	43	58	Glen Cairn	Kanata West PS
3	0.6		0.6	Industrial	70	40	61	Stittsville	Hazeldean PS
4	1.8		1.8	Industrial	70	126	61	Stittsville	Hazeldean PS
5	1.7		1.7	Industrial	70	121	61	Stittsville	Hazeldean PS
6	1.7		1.7	Industrial	70	116	61	Stittsville	Hazeldean PS
7	0.4		0.4	Industrial	70	28	61	Stittsville	Hazeldean PS
8	3.0		3.0	Industrial	45	136	61	Stittsville	Hazeldean PS
9	3.7		3.7	Industrial	70	256	58	Glen Cairn	Kanata West PS
10	0.7		0.7	Industrial	50	34	58	Glen Cairn	Kanata West PS
11	1.2		1.2	Industrial	70	84	61	Stittsville	Hazeldean PS
Total	**16.1**					1,021			
3. Kanata South Business Park									
1	5.4		5.4	Mixed I-C	80	432	68	South Glen Cairn	Hazeldean PS
2	0.9		0.9	Mixed I-C	80	72	68	South Glen Cairn	Hazeldean PS
3	9.7		9.7	Mixed I-C	70	679	68	South Glen Cairn	Hazeldean PS
4	2.4		2.4	Industrial	50	120	68	South Glen Cairn	Hazeldean PS
7	3.6		3.6	Industrial	80	286	68	South Glen Cairn	Hazeldean PS
8	3.4		3.4	Industrial	80	269	68	South Glen Cairn	Hazeldean PS
9	1.3		1.3	Industrial	80	104	68	South Glen Cairn	Hazeldean PS
10	1.0		1.0	Industrial	80	80	68	South Glen Cairn	Hazeldean PS
11	1.2		1.2	Industrial	80	97	68	South Glen Cairn	Hazeldean PS
12	0.5		0.5	Industrial	80	38	68	South Glen Cairn	Hazeldean PS
13	0.4		0.4	Industrial	80	34	68	South Glen Cairn	Hazeldean PS
14	0.5		0.5	Industrial	80	42	68	South Glen Cairn	Hazeldean PS
15	0.1		0.1	Commercial	80	6	68	South Glen Cairn	Hazeldean PS
16	2.1		2.1	Commercial	50	107	68	South Glen Cairn	Hazeldean PS
17	1.0		1.0	Industrial	50	48	68	South Glen Cairn	Hazeldean PS
18	1.7		1.7	Industrial	80	133	68	South Glen Cairn	Hazeldean PS
19	0.1		0.1	Industrial	80	7	68	South Glen Cairn	Hazeldean PS
20	0.9		0.9	Industrial	80	70	68	South Glen Cairn	Hazeldean PS
21	0.6		0.6	Industrial	80	49	68	South Glen Cairn	Hazeldean PS
22	0.8		0.8	Industrial	80	65	68	South Glen Cairn	Hazeldean PS
23	0.5		0.5	Industrial	80	41	68	South Glen Cairn	Hazeldean PS
24	2.1		2.1	Industrial	80	168	68	South Glen Cairn	Hazeldean PS
25	0.9		0.9	Industrial	80	74	68	South Glen Cairn	Hazeldean PS
26	1.6		1.6	Industrial	80	129	68	South Glen Cairn	Hazeldean PS
Total	**42.7**					3,151			

TABLE C-6: EMPLOYMENT GROWTH
NOVATECH ADJUSTED DATA BY SEWERSHED (2006-2031)

4. Terry Fox Business Park									
1	2.4		2.4	Industrial	125	306	52	Glen Cairn	Kanata West PS
2	3.8		3.8	Commercial	100	378	52	Glen Cairn	Kanata West PS
3	6.2		6.2	Industrial	70	435	52	Glen Cairn	Kanata West PS
4	0.4		0.4	Industrial	50	18	52	Glen Cairn	Kanata West PS
5	1.0		1.0	Industrial	50	52	52	Glen Cairn	Kanata West PS
6	1.0		1.0	Commercial	50	50	52	Glen Cairn	Kanata West PS
7	0.9		0.9	Commercial	50	44	52	Glen Cairn	Kanata West PS
8	0.9		0.9	Commercial	50	47	52	Glen Cairn	Kanata West PS
9	2.1		2.1	Commercial	50	105	52	Glen Cairn	Kanata West PS
10	7.9		7.9	Commercial	50	393	52	Glen Cairn	Kanata West PS
Total	**26.7**					1,830			
5. Hazeldean Industrial Park									
1	0.6		0.6	Industrial	50	29	55	Glamorgan	Hazeldean PS
1e		0.5	0.5	Industrial	50	23	55	Glamorgan	Hazeldean PS
2e		0.4	0.4	Industrial	50	20	55	Glamorgan	Hazeldean PS
Total	**0.6**	**0.8**				72			
6. Kanata Town Centre Industrial Area									
1	0.7		0.7	Industrial	60	43	50	Main Street	Acres Road PS
2	1.8		1.8	Industrial	60	106	50	Main Street	Acres Road PS
3	0.0		0.0	Industrial	60	2	50	Main Street	Acres Road PS
4	0.5		0.5	Industrial	60	28	50	Main Street	Acres Road PS
Total	**3.0**					179			
7. Kanata North Business Park									
1	9.1		9.1	Industrial	125	1,136	8	East March	March PS
2	0.3		0.3	Industrial	125	34	8	East March	March PS
3	0.8		0.8	Industrial	125	104	8	East March	March PS
4	0.6		0.6	Industrial	125	76	8	East March	March PS
5	2.2		2.2	Industrial	125	279	8	East March	March PS
6	2.7		2.7	Industrial	125	336	8	East March	March PS
7	0.1		0.1	Industrial	125	12	8	East March	March PS
8	4.4		4.4	Industrial	125	551	8	East March	March PS
9	4.2		4.2	Industrial	125	519	8	East March	March PS
10	3.3		3.3	Industrial	125	418	8	East March	March PS
11	2.4		2.4	Industrial	125	300	8	East March	March PS
12	2.1		2.1	Industrial	125	267	8	East March	March PS
13	2.3		2.3	Industrial	125	284	8	East March	March PS
14	2.2		2.2	Industrial	125	276	11	Hines Road	March PS
15	1.4		1.4	Industrial	125	173	11	Hines Road	March PS
16	6.2		6.2	Industrial	125	777	11	Hines Road	March PS
17	1.5		1.5	Industrial	125	188	11	Hines Road	March PS
18	2.6		2.6	Industrial	125	328	11	Hines Road	March PS
19	6.3		6.3	Industrial	125	782	11	Hines Road	March PS
20	2.6		2.6	Industrial	125	320	11	Hines Road	March PS
21	2.0		2.0	Industrial	125	256	8	East March	March PS
22	1.7		1.7	Industrial	125	216	8	East March	March PS
23	0.8		0.8	Industrial	125	101	8	East March	March PS
24	0.1		0.1	Industrial	125	11	8	East March	March PS
25	5.0		5.0	Industrial	125	627	8	East March	March PS
26	2.9		2.9	Industrial	100	286	6	East March	Briar Ridge PS
27	10.6		10.6	Industrial	100	1,062	6	East March	Briar Ridge PS
28	7.0		7.0	Industrial	100	701	6	East March	Briar Ridge PS
29	9.1		9.1	Industrial	100	914	6	East March	Briar Ridge PS
30	3.6		3.6	Industrial	125	450	11	Hines Road	March PS
31	2.0		2.0	Industrial	125	255	11	Hines Road	March PS
32	2.0		2.0	Industrial	125	255	11	Hines Road	March PS
33	5.2		5.2	Industrial	125	650	11	Hines Road	March PS
34	3.0		3.0	Industrial	50	150	11	Hines Road	March PS
35	2.9		2.9	Industrial	50	145	11	Hines Road	March PS
1e		2.7	2.7	Industrial	125	343	8	East March	March PS
2e		2.0	2.0	Industrial	125	246	8	East March	March PS
Total	**121.1**	**4.7**				13,827			

TABLE C-6: EMPLOYMENT GROWTH
NOVATECH ADJUSTED DATA BY SEWERSHED (2006-2031)

Other Employment and Mixed Use Lands:

Kanata North								
A	4.1	4.1	Commercial	50	205	6	East March	Briar Ridge PS
Town Centre Mixed Use								
B	8.5	8.5	Mixed R-C	325	2,763	47	Main Street	Acres Road PS
C	1.2	1.2	Mixed R-C	100	119	47	Main Street	Acres Road PS
D	10.1	10.1	Mixed R-C	325	3,287	47	Main Street	Acres Road PS
E	1.9	1.9	Mixed R-C	50	95	42	Main Street	Signature Ridge
F	2.3	2.3	Mixed R-C	50	115	42	Main Street	Signature Ridge
Total	**24.0**				6,379			
Kanata West Mixed Use Centre Designation								
G	2.3	2.3	Commercial	50	115	57	Main Street	Signature Ridge
H	4.2	4.2	Commercial	125	525	57	Main Street	Signature Ridge
I	33.3	33.3	Industrial	125	4,163	57	Main Street	Signature Ridge
J	19.0	19.0	Commercial	90	1,706	57	Main Street	Signature Ridge
K	15.6	15.6	Commercial	50	782	56	Glen Cairn	Kanata West PS
L	20.5	20.5	Industrial	150	3,073	56	Glen Cairn	Kanata West PS
M	32.6	32.6	Mixed R-C	150	4,890	56	Glen Cairn	Kanata West PS
Total	**127.5**				15,253			
Stittsville, Hazeldean Road Commercial Lands								
J → O	6.5	6.5	Commercial	50	327	56	Glen Cairn	Kanata West PS
K → N	3.8	3.8	Commercial	50	191	56	Glen Cairn	Kanata West PS
L → P	1.3	1.3	Commercial	50	65	56	Glen Cairn	Kanata West PS
M → Q	4.0	4.0	Commercial	50	200	56	Glen Cairn	Kanata West PS
N → R	0.9	0.9	Commercial	50	45	56	Glen Cairn	Kanata West PS
O → U	4.5	4.5	Commercial	50	225	67	Stittsville	Hazeldean PS
P → T	3.1	3.1	Commercial	50	155	56	Glen Cairn	Kanata West PS
Q → S	2.4	2.4	Commercial	50	120	56	Glen Cairn	Kanata West PS
Total	**26.6**				1,329			
Del, Brookfield, Westpark Lands								
Del	7.6	7.6	Misc	50	380	200	New Trunk	Hazeldean PS
Brookfield	5.8	5.8	Misc	50	290	112	New Trunk	Hazeldean PS
Westpark	4.0	4.0	Misc	50	200	113	New Trunk	Hazeldean PS
Total	17.4				870			
GRAND TOTAL	**513.1**	**5.6**	**530.3**					

Total Employment Lands (Employment Areas, Enterprise Areas excluding Kanata West)	20,079
Total Other Lands (Town Centre and scattered sites, mostly retail)	8,782
Total Kanata West	27,046
Total All	55,908

TABLE C-6: EMPLOYMENT GROWTH
NOVATECH ADJUSTED DATA BY SEWERSHED (2006-2031)

Employment Growth by Sewer ID Number

SEWER ID NUMBER	SEWERSHED	TOTAL AREA (ha)	INDUSTRIAL LAND (ha)	COMMERCIAL LAND (ha)	RESIDENTIAL LAND (ha)	VARIOUS I-C-I (ha)		MIXED USE I-C (ha)	MIXED USE R-C (ha)
6	East March	33.7	29.6	4.1					
8	East March	48.9	48.9						
11	Hines Road	41.5	41.5						
42	Main Street	4.2		2.1	2.1				4.2
47	Main Street	19.8		9.9	9.9				19.8
50	Main Street	3.0	3.0						
52	Glen Cairn	26.7	10.0	16.6					
55	Glamorgan	1.4	1.4						
56	Glen Cairn	138.9	68.6	54.0	16.3				32.6
57	Main Street	131.5	106.0	25.5					
58	Glen Cairn	5.7	5.7						
61	Stittsville	10.4	10.4						
67	Stittsville	4.5		4.5					
68	South Glen Cairn	42.7	24.5	10.2	8.0			16.0	
112	New Trunk	5.8				5.8			
113	New Trunk	4.0				4.0			
200	New Trunk	7.6				7.6			
		530.3	349.6	126.9	36.3	17.4	530.2	16	56.6

Employment Growth by Sewershed

SEWERSHED	AREA (ha)	INDUSTRIAL LAND (ha)	COMMERCIAL LAND (ha)	RESIDENTIAL LAND (ha)	
East March	82.66	78.5	4.1	0.0	82.6
Hines Road	41.52	41.5	0.0	0.0	41.5
Kanata Lakes	0.00	0.0	0.0	0.0	0.0
Main Street	158.47	109.0	37.5	12.0	158.5
Penfield Drive	0.00	0.0	0.0	0.0	0.0
Stittsville	14.86	10.4	4.5	0.0	14.9
Glamorgan	1.43	1.4	0.0	0.0	1.4
South Glen Cairn	42.67	24.5	10.2	8.0	42.7
Kanata West	0.00	0.0	0.0	0.0	0.0
Glen Cairn	171.26	84.3	70.6	16.3	171.2
New Trunk	17.40	0.0	0.0	0.0	0.0
	530.28				

MISC C-1: CORRESPONDENCE

Mark Bissett

From: Diduch, Roman [Roman.Diduch@ottawa.ca]
Sent: Thursday, March 15, 2007 7:35 AM
To: Mark Bissett (E-mail)
Subject: FW: Fernbank CDP_Population Numbers

Call if you need further clarifications.
-----Original Message-----
From: Cooper, Ted
Sent: March 14,2007 11:20 AM
To: Diduch, Roman
Subject: RE: Fernbank CDP_Population Numbers

My comments are inserted below

> -----Original Message-----
> **From:** Diduch, Roman
> **Sent:** 2007/03/14 10:18
> **To:** Cooper, Ted
> **Subject:** FW: Fernbank CDP_Population Numbers
>
> -----Original Message-----
> **From:** Mark Bissett [mailto:m.bissett@novatech-eng.com]
> **Sent:** March 14,2007 9:30 AM
> **To:** Diduch, Roman
> **Cc:** John Riddell
> **Subject:** Fernbank CDP_Population Numbers
>
> Hi Roman,
>
> I've been working away on the population and land use data that was provided by Mr. Ian Cross on Dec. 19/06 (demographics) and by your office on Oct. 11/06 (sewershed). Many of the queries relate to population demographics provided by Mr. Ian Cross and may best be answered by his office. Can you review and comment on the following:
>
> **1) Bell's Corners:**
> I do not appear to have data for the Bell's Corners sewershed which flows from the Nepean Collector into the Watt's Creek Relief sewer. These lands fall within the Acres Road Pump Station Sewershed that defines the limit of our sanitary analysis, pursuant to the Fernbank CDP Terms of Reference. While I don't think this data will significantly alter our results, for the sake of completeness, could your department issue said information for incorporation into the analysis.
>
> The original dataset assembled for the Kanata / West End area was to provide background for the Tri-Township / North Kanata Sewer. The Watt's Creek Relief Sewer is downstream of this, and wasn't accounted for in the dataset that was passed onto Novatech. The Bells Corners / Watts Creek Relief Sewer will be included in the Wastewater MP update. Nevertheless, the Acres Road PS Monitoring data includes flows from Bells Corners, and there is lots of available capacity at that point in the system.
>
> **2) Tartan/Cavanagh Lands:**
> The sewer data sheet does not appear to have a land or population allocation for the Tartan/Cavanagh Lands (west of Brookfield Lands). These lands are identified as Parcel 206 by Mr. I. Cross' office. Please confirm I am to use the data provided by Mr. I. Cross.

The 'Official' VURLs database that I was working from was the VURLs 2005 dataset that was released in Sept 2006. The VURLs 2006 dataset was released shortly thereafter (October 2006), but I was not informed. The additional areas that Mr. Bissett refers is included in the VURLs 2006 database. This data was recently sent to Hunter GIS for updating, and will be included in the Wastewater MP update.

3) Land Use & Population, Sewer Spreadsheet Totals (Oct. 11/06):
There appears to be an error in the summation of the Existing Land Use, Special (345.0 ha vs. 195.1 ha) and Future Land Use, VRIL (0.0 ha vs. 251.3 ha) columns of the sewer data spreadsheet (attached). All other columns essentially add to within a couple of hectares and discrepancies are likely due to rounding. May I update the spreadsheet to reflect the corrected column summations?

I will have to look into the discrepancies. I suspect that in the case of the 'Special' there has been some double accounting (for whatever reason). In regard to the VRIL, I believe this has to do with the Carp Airport that falls within the serviced area, but the catchment has yet to be connected to the Carp PS. This problem will be fixed with the Wastewater MP update.

4) Residential Potential, Demographics Spreadsheet (Dec. 19/06):
a) The Unit Potential of Parcel 180 appears to be in error (102 units vs. 180 units). Please advise if I may update.
b) I believe the owner of Parcel 209 is an M. Watters, rather than Petrus Van Gaal, unless the land database registry is not up-to-date; does your office concur?
c) Novatech agrees with the Residential Potential adjustments made to the Del, Brookfield and Westpark Lands as reflected in the Dec. 19/06 version of this spreadsheet. We believe similar adjustments are required to...

i) Parcel 206 to reflect the 8.80 ha of protected Natural Environment Area lands.
ii) Parcel 212 to reflect the 4.99 ha of Hydro Easement and Carp River floodplain land that cannot be developed upon. The precise limit of the floodplain is under review as part of the Kanata West EA process; the land area allocation can be issued upon resolution of that external process.

These issues are best dealt with by taking direction from Ian.

5) Population Discrepancies - Demographics vs. Sewersheds:

The demographics information spreadsheet provides a region-by-region allocation of anticipated population growth in the Kanata-Stittsville area categorized by *land ownership*. By contrast, the sanitary sewer information spreadsheet provides a region-by-region allocation of existing and anticipated population growth of the same area categorized by *sewershed*. In order to make an apples-to-apples population comparison, Novatech has cross-referenced the Sewer Catchment ID Number that correlates with the Parcel ID Number (i.e. to compare the sewer and demographic data sets). The purpose of this exercise was to identify where discrepancies may exist, and ultimately to generate consensus amongst the parties on the area-by-area population allocations that will be used in future analytical works for this project.

a) Future Population Growth: Using several prediction techniques, Novatech found a strong correlation with the projected high-level population growth (some deviation noted with the Sewer spreadsheet). We generally agree with and propose to use the future population data set provided by Mr. I. Cross. Please advise if your office concurs with this approach.

b) Existing Population: Novatech proposes to use the existing population allocations provided by Mr. R. Diduch in the Sewer Spreadsheet. Existing total population of Kanata-Stittsville is 91,615 people housed in 31,048 units, which computes to 2.95 people per dwelling. This seems reasonable and is inline with the planning-level population expectations. Please advise if your office concurs with this approach.

At some point in 2007, the Census Block data will be available from the 2006 Census. This will provide additional information for consideration in defining the catchment "Existing Population". Because the population estimate in the spreadsheet is derived by assigning average densities to the Land Use code from the parcel database, it is not surprising that some 'sway' one way or the other could exist in the Existing population estimates for the catchments. As demographics change, we may have to give some consideration to this issue in terms of calibration of models etc.

On the whole, the discrepancies are for the most-part, inconsequential at a Master Planning Scale.

Notes:
a) I am reasonably confident in the area allocations, but due to the scale of the sewershed and demographic mapping, I cannot guarantee a planning parcel wasn't inadvertently assigned to an adjacent sewer catchment. In most cases, this has no net effect on the total population within a given sewershed.

b) The sewer spreadsheet now has two tabs. Tab1 is the original data issued by Mr. R. Diduch. Tab2 has been reorganized by sewer catchment and some data by Mr. I. Cross has been added for comparison.

c) The Residential Potential spreadsheet now has two tabs. Tab1 is the original data set issued by Mr. I. Cross. Tab2 has some additional columns to cross-reference the sewer and demographic data sets, all of which are identified by a blue heading title to differentiate Novatech additions to the spreadsheet. Some comment notes have been added within select cells of the spreadsheet to facilitate review.

Thank you for your time and effort assisting with this project. Please call if you have any questions, comments, or require additional information.

Sincerely,

I am not sure about time schedules for Fernbank, but there may be some value in holding-off (if possible) for a month, while Stantec comes up with their model for the Wastewater MP update. In the interim, if necessary, Novatech could proceed with their changes, recognizing that the City's 'Official' numbers are likely to change as the Wastewater MP is updated. We plan on using compatible catchment no. references that would facilitate rolling the new numbers into Novatech's analysis.

Mark Bissett, P. Eng.
Project Engineer

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240 Michael Cowpland Drive, Suite 200
Ottawa, Ontario, K2M 1P6
Tel: (613) 254-9643 x-237
Fax: (613) 254-5867

APPENDIX D

Wastewater Collection

Tables

TABLE D-1: FERNBANK CDP LANDS - NEW TRUNK SEWER
SANITARY SEWER DESIGN SHEET (2031)

AREA			RESIDENTIAL																COMMERCIAL		INSTITUTIONAL		C+I	INFILTRATION			Total Flow (l/s)	PIPE					
			LOW DENSITY			MEDIUM DENSITY			HIGH DENSITY			MIXED USE			TOTAL																	
ID	From	To	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Pop.	Accum. Pop.	Peak Factor	Peak Flow (l/s)	Area (ha)	Accum. Area (ha)	Area (ha)	Accum. Area (ha)	Peak Flow (l/s)	Total Area (ha)	Accum. Area (ha)	Infilt. Flow (l/s)		Size (mm)	Slope (%)	Length (m)	Capacity (l/s)	Full Flow Vel. (m/s)	Q/Q_{full} (%)
1	902	904	9.85	910	910	0.36	54	54	0.00	0	0	0.00	0	0	964	964	3.8	14.9	0.00	0.00	0.78	0.78	0.7	16.07	16.07	4.5	20.1	250	0.24	154	30.4	0.60	66.0%
2	904	908	11.65	1076	1986	3.10	465	519	0.00	0	0	0.00	0	0	1541	2505	3.5	35.6	0.00	0.00	0.91	1.69	1.5	22.29	38.36	10.7	47.8	300	0.24	306	49.4	0.68	96.7%
3	906	908	7.45	688	688	0.00	0	0	0.00	0	0	0.00	0	0	688	688	3.9	10.9	0.00	0.00	2.63	2.63	2.3	14.51	14.51	4.1	17.2	250	1.50	373	76.0	1.50	22.7%
4	908	912	4.45	411	3085	1.67	251	770	0.00	0	0	0.00	0	0	662	3855	3.3	52.3	0.63	0.63	0.00	4.32	4.3	16.43	69.30	19.4	76.0	300	0.61	396	78.8	1.08	96.4%
5	910	912	10.35	956	956	0.00	0	0	0.00	0	0	0.00	0	0	956	956	3.8	14.8	0.00	0.00	0.83	0.83	0.7	19.34	19.34	5.4	20.9	250	0.24	320	30.4	0.60	68.8%
6	912	920	11.15	1030	5071	0.00	0	770	0.00	0	0	0.00	0	0	1030	5841	3.2	75.3	0.00	0.63	2.50	7.65	7.2	18.11	106.75	29.9	112.4	450	0.15	207	115.2	0.70	97.5%
7	914	916	16.35	1511	1511	0.90	135	135	0.00	0	0	0.00	0	0	1646	1646	3.7	24.3	0.00	0.00	0.45	0.45	0.4	25.23	25.23	7.1	31.8	300	0.25	152	50.4	0.69	63.0%
8	916	920	10.45	966	2477	0.00	0	135	0.00	0	0	0.00	0	0	966	2612	3.5	37.0	0.00	0.00	0.85	1.30	1.1	15.69	40.92	11.5	49.5	375	0.20	314	81.8	0.72	60.6%
9	918	920	5.55	513	513	0.49	74	74	0.00	0	0	0.00	0	0	587	587	3.9	9.4	0.00	0.00	6.14	6.14	5.3	16.04	16.04	4.5	19.2	250	0.85	363	57.2	1.13	33.5%
	920	922	0.00	0	8061	0.00	0	979	0.00	0	0	0.00	0	0	0	9040	3.0	109.8	0.00	0.63	0.00	15.09	13.6	0.00	163.71	45.8	169.3	525	0.18	265	190.3	0.85	88.9%
10	922	924	12.20	1127	9188	0.09	14	993	0.00	0	0	0.00	0	0	1141	10181	2.9	121.5	0.00	0.63	1.52	16.61	15.0	27.31	191.02	53.5	190.0	525	0.23	290	215.2	0.96	88.3%
	924	934	0.00	0	9188	0.00	0	993	0.00	0	0	0.00	0	0	0	10181	2.9	121.5	0.00	0.63	0.00	16.61	15.0	0.00	191.02	53.5	190.0	525	0.79	669	398.8	1.78	47.6%
11	926	930	4.95	457	457	8.40	1260	1260	0.00	0	0	3.45	279	279	1996	1996	3.6	29.0	1.99	1.99	0.82	0.82	2.4	26.79	26.79	7.5	38.9	375	0.14	530	68.4	0.60	56.9%
12	928	930	9.35	864	864	3.55	533	533	0.00	0	0	0.00	0	0	1397	1397	3.7	20.9	0.00	0.00	3.85	3.85	3.3	22.72	22.72	6.4	30.7	200	7.00	55	90.5	2.79	33.9%
13	930	932	1.65	152	1473	2.95	443	2236	0.00	0	0	0.00	0	279	595	3988	3.3	53.9	0.34	2.33	0.80	5.47	6.8	10.54	60.05	16.8	77.4	450	0.11	308	99.1	0.60	78.2%
14	932	934	0.00	0	1473	0.00	0	2236	0.00	0	0	7.12	577	856	577	4565	3.3	60.7	3.56	5.89	6.10	11.57	15.2	17.52	77.57	21.7	97.6	525	0.10	455	141.9	0.63	68.8%
15	934	972	2.90	268	10929	1.80	270	3499	0.00	0	0	1.21	98	954	636	15382	2.8	172.4	0.61	7.12	0.40	28.58	31.0	15.08	283.67	79.4	282.8	600	0.26	1007	326.6	1.12	86.6%
16	936	938	7.58	700	700	0.70	105	105	0.00	0	0	0.00	0	0	805	805	3.9	12.6	0.00	0.00	2.17	2.17	1.9	14.42	14.42	4.0	18.5	250	1.00	108	62.0	1.22	29.8%
17	938	940	8.05	744	1444	1.00	150	255	0.00	0	0	4.41	357	357	1251	2056	3.6	29.8	2.21	2.21	0.83	3.00	4.5	25.14	39.56	11.1	45.4	300	0.35	156	59.7	0.82	76.0%
18	940	952	6.35	587	2031	0.99	149	404	0.00	0	0	0.00	0	357	736	2792	3.5	39.2	0.00	2.21	0.00	3.00	4.5	10.51	50.07	14.0	57.8	300	0.75	310	87.4	1.20	66.1%
19	942	944	7.25	670	670	4.70	705	705	0.00	0	0	0.00	0	0	1375	1375	3.7	20.6	0.00	0.00	12.67	12.67	11.0	34.19	34.19	9.6	41.2	250	0.90	516	58.9	1.16	70.0%
20	944	946	12.20	1127	1797	1.00	150	855	0.00	0	0	0.00	0	0	1277	2652	3.5	37.5	0.00	0.00	0.82	13.49	11.7	20.35	54.54	15.3	64.4	375	0.20	511	81.8	0.72	78.8%
21	946	948	4.15	383	2180	4.22	633	1488	0.00	0	0	0.00	0	0	1016	3668	3.4	50.0	0.00	0.00	3.87	17.36	15.1	17.22	71.76	20.1	85.2	375	0.50	243	129.3	1.13	65.9%
	948	950	0.00	0	2180	0.00	0	1488	0.00	0	0	0.00	0	0	0	3668	3.4	50.0	0.00	0.00	0.00	17.36	15.1	0.00	71.76	20.1	85.2	450	0.15	195	115.2	0.70	74.0%
22	950	952	5.05	467	2647	0.30	45	1533	0.00	0	0	0.00	0	0	512	4180	3.3	56.2	0.00	0.00	3.24	20.6	17.9	11.43	83.19	23.3	97.3	450	0.15	221	115.2	0.70	84.5%
23	952	972	4.15	383	5061	5.50	825	2762	0.00	0	0	0.00	0	357	1208	8180	3.0	100.8	0.00	2.21	0.00	23.60	22.4	22.72	155.98	43.7	166.8	450	0.54	282	218.6	1.33	76.3%
24	954	956	7.70	711	711	2.90	435	435	0.00	0	0	6.70	543	543	1689	1689	3.6	24.9	3.35	3.35	0.79	0.79	3.6	22.81	22.81	6.4	34.9	375	0.15	330	70.8	0.62	49.3%
25	956	958	10.70	989	1700	0.00	0	435	0.00	0	0	0.00	0	543	989	2678	3.5	37.8	0.00	3.35	6.27	7.06	9.0	23.45	46.26	13.0	59.8	450	0.20	411	133.0	0.81	44.9%
	958	960	0.00	0	1700	0.00	0	435	0.00	0	0	0.00	0	543	0	2678	3.5	37.8	0.00	3.35	0.00	7.06	9.0	0.00	46.26	13.0	59.8	450	0.15	177	115.2	0.70	51.9%
26	960	966	7.75	716	2416	0.00	0	435	0.00	0	0	0.00	0	543	716	3394	3.4	46.7	0.00	3.35	0.00	7.06	9.0	11.51	57.77	16.2	71.9	450	0.15	82	115.2	0.70	62.4%
27	962	964	2.55	236	236	4.70	705	705	5.04	680	680	0.00	0	0	1621	1621	3.7	24.0	0.00	0.00	0.00	0.00	0.0	20.97	20.97	5.9	29.9	250	0.35	479	36.7	0.72	81.4%
	964	966	0.00	0	236	0.00	0	705	0.00	0	680	0.00	0	0	0	1621	3.7	24.0	0.00	0.00	0.00	0.00	0.0	0.00	20.97	5.9	29.9	250	1.00	298	62.0	1.22	48.2%
28	966	970	1.80	166	2818	5.25	788	1928	0.00	0	680	0.00	0	543	954	5969	3.2	76.7	0.00	3.35	8.89	15.95	16.8	22.38	101.12	28.3	121.8	525	0.15	249	173.8	0.78	70.1%
29	968	970	6.90	638	638	0.00	0	0	0.00	0	0	0.00	0	0	638	638	3.9	10.1	0.00	0.00	0.99	0.99	0.9	11.03	11.03	3.1	14.1	200	0.32	82	19.4	0.60	72.7%
	970	972	0.00	0	3456	0.00	0	1928	0.00	0	680	0.00	0	543	0	6607	3.1	83.8	0.00	3.35	0.00	16.94	17.6	0.00	112.15	31.4	132.8	600	0.15	178	248.1	0.85	53.5%
	972	974	0.00	0	19446	0.00	0	8189	0.00	0	680	0.00	0	1854	0	30169	2.5	302.5	0.00	12.68	0.00	69.12	71.0	0.00	551.8	154.5	528.0	825	0.20	586	669.7	1.21	78.8%
	974	Ex	0.00	0	19446	0.00	0	8189	0.00	0	680	0.00	0	1854	0	30169	2.5	302.5	0.00	12.68	0.00	69.12	71.0	0.00	551.80	154.5	528.0	825	0.20	66	669.7	1.21	78.8%
			210.48			**54.57**			**5.04**			**22.89**																					

Design Parameters:

					Units/Net ha	Pop/Unit	
Avg Flow/Person =	350	l/day	Pipe Friction n = 0.013	Low Density Residential =	28	3.30	
Comm./Inst. Flow =	50,000	l/ha/day	Residential Peaking Factor = Harmon Equation (max 4, min 2)	Medium Density Residential =	60	2.50	(Multi Family Residential)
Infiltration =	0.28	l/s/ha	Peaking Factor Comm./Inst. = 1.5	High Density Residential =	75	1.80	
				Mixed Use =	90	1.80	(50% of mixed use area is residential)

Project: Fernbank CDP (101108)
Designed: KJM
Checked: MAB
Dwg. Reference: 101108-SAN
Date: May 8, 2009

TABLE D-2: FERNBANK CDP LANDS - NEW TRUNK SEWER
SANITARY SEWER HYDRAULIC GRADE LINE ANALYSIS (2031)

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The HGL slope is calculated and the minimum USF is established +0.30m above the HGL.

Bend Coefficients

0	45	90	<----Bend (in degrees)
0.00	0.29	1.02	900 mm pipe or greater (benched)
0.00	0.40	1.32	825 mm pipe or smaller (sump)

MANHOLE		INVERT ELEV.		OBVERT ELEV.		GROUND ELEV.	COVER	PIPE PARAMETERS				TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			PIPE
U/S	D/S	U/S (m)	D/S (m)	U/S (m)	D/S (m)	U/S (m)	U/S (m)	Dia (N) (mm)	Dia (A) (m)	Length (m)	'n'	(m^3/s)	(m^3/s)		Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	U/S (m)	U/S (m)	D/S (m)	Slope (%)	Slope (%)
Hazeldean Pump Station																						**95.00**	**<- 100yr Starting HGL**		
974	HPS	90.88	90.74	91.70	91.57	99.50	7.80	825	838	66	0.013	0.528	0.677	0.78	0.552	79	0.02245	0.96	0.05	0.09	3.39	95.09	95.00	0.14%	0.20%
972	974	92.04	90.88	92.87	91.70	100.25	7.38	825	838	586	0.013	0.528	0.668	0.79	0.552	699	0.02245	0.96	0.05	0.82	3.04	95.91	95.09	0.14%	0.20%
970	972	92.54	92.27	93.14	92.87	99.65	6.51	600	610	178	0.013	0.133	0.249	0.53	0.292	292	0.02496	0.46	0.01	0.09	2.86	96.00	95.91	0.05%	0.15%
968	970	93.20	92.94	93.40	93.14	98.20	4.80	200	203	82	0.013	0.014	0.019	0.73	0.032	406	0.03600	0.43	0.01	0.15	2.75	96.15	96.00	0.18%	0.32%
966	970	92.98	92.61	93.51	93.14	98.35	4.84	525	533	249	0.013	0.122	0.173	0.70	0.223	466	0.02610	0.55	0.02	0.21	2.71	96.21	96.00	0.08%	0.15%
964	966	96.24	93.26	96.49	93.51	100.45	3.96	250	254	298	0.013	0.030	0.062	0.48	0.051	1171	0.03342	0.59	0.02	0.73	0.45	96.94	96.21	0.24%	1.00%
962	964	97.90	96.24	98.15	96.49	102.40	4.25	250	254	479	0.013	0.030	0.037	0.82	0.051	1884	0.03342	0.59	0.02	1.12	0.00	98.15	96.94	0.25%	0.35%
960	966	93.18	93.06	93.63	93.51	98.25	4.62	450	457	82	0.013	0.072	0.114	0.63	0.164	179	0.02747	0.44	0.01	0.05	2.63	96.26	96.21	0.06%	0.15%
958	960	93.45	93.18	93.90	93.63	97.95	4.05	450	457	177	0.013	0.060	0.116	0.51	0.164	387	0.02747	0.36	0.01	0.07	2.43	96.33	96.26	0.04%	0.15%
956	958	94.27	93.45	94.72	93.90	99.00	4.28	450	457	411	0.013	0.060	0.133	0.45	0.164	899	0.02747	0.36	0.01	0.18	1.79	96.51	96.33	0.04%	0.20%
954	956	94.83	94.34	95.21	94.72	98.15	2.95	375	381	330	0.013	0.035	0.070	0.50	0.114	866	0.02920	0.31	0.00	0.12	1.43	96.64	96.51	0.04%	0.15%
952	972	93.95	92.42	94.40	92.87	99.95	5.55	450	457	282	0.013	0.167	0.219	0.76	0.164	617	0.02747	1.02	0.05	0.98	2.48	96.88	95.91	0.35%	0.54%
950	952	94.28	93.95	94.73	94.40	100.30	5.57	450	457	221	0.013	0.097	0.115	0.85	0.164	483	0.02747	0.59	0.02	0.24	2.39	97.12	96.88	0.11%	0.15%
948	950	94.57	94.28	95.02	94.73	101.00	5.98	450	457	195	0.013	0.085	0.115	0.74	0.164	427	0.02747	0.52	0.01	0.17	2.27	97.29	97.12	0.09%	0.15%
946	948	95.86	94.64	96.24	95.02	100.60	4.36	375	381	243	0.013	0.085	0.130	0.66	0.114	638	0.02920	0.75	0.03	0.58	1.63	97.87	97.29	0.24%	0.50%
944	946	96.88	95.86	97.26	96.24	101.40	4.15	375	381	511	0.013	0.064	0.082	0.79	0.114	1340	0.02920	0.57	0.02	0.65	1.27	98.52	97.87	0.13%	0.20%
942	944	101.65	97.01	101.90	97.26	106.00	4.11	250	254	516	0.013	0.041	0.059	0.70	0.051	2033	0.03342	0.81	0.03	2.31	0.00	101.90	98.52	0.65%	0.90%
940	952	96.42	94.10	96.72	94.40	101.40	4.68	300	305	310	0.013	0.058	0.087	0.66	0.073	1017	0.03145	0.79	0.03	1.03	1.20	97.92	96.88	0.33%	0.75%
938	940	96.97	96.42	97.27	96.72	101.95	4.68	300	305	156	0.013	0.045	0.060	0.76	0.073	512	0.03145	0.62	0.02	0.36	1.00	98.27	97.92	0.23%	0.35%
936	938	98.10	97.02	98.35	97.27	102.20	3.85	250	254	108	0.013	0.019	0.062	0.30	0.051	425	0.03342	0.37	0.01	0.10	0.02	98.37	98.27	0.09%	1.00%
934	972	94.86	92.27	95.46	92.87	103.00	7.54	600	610	1007	0.013	0.283	0.325	0.87	0.292	1652	0.02496	0.97	0.05	2.05	2.50	97.96	95.91	0.20%	0.26%
932	934	95.39	94.93	95.92	95.46	103.80	7.88	525	533	455	0.013	0.098	0.143	0.68	0.223	853	0.02610	0.44	0.01	0.22	2.26	98.18	97.96	0.05%	0.10%
930	932	95.81	95.47	96.26	95.92	103.40	7.14	450	457	308	0.013	0.077	0.099	0.78	0.164	673	0.02747	0.47	0.01	0.21	2.13	98.39	98.18	0.07%	0.11%
928	930	99.91	96.06	100.11	96.26	103.20	3.09	200	203	55	0.013	0.031	0.091	0.34	0.032	271	0.03600	0.95	0.05	0.47	0.00	100.11	98.39	3.12%	7.00%
926	930	96.62	95.88	97.00	96.26	102.50	5.51	375	381	530	0.013	0.039	0.068	0.57	0.114	1391	0.02920	0.34	0.01	0.25	1.64	98.64	98.39	0.05%	0.14%
924	934	100.22	94.93	100.75	95.46	108.20	7.46	525	533	669	0.013	0.190	0.399	0.48	0.223	1254	0.02610	0.85	0.04	1.26	0.00	100.75	97.96	0.42%	0.79%
922	924	100.89	100.22	101.42	100.75	107.95	6.54	525	533	290	0.013	0.190	0.216	0.88	0.223	544	0.02610	0.85	0.04	0.53	0.00	101.42	100.75	0.23%	0.23%
920	922	101.37	100.89	101.90	101.42	107.60	5.70	525	533	265	0.013	0.169	0.191	0.89	0.223	497	0.02610	0.76	0.03	0.43	0.00	101.90	101.42	0.18%	0.18%
918	920	104.73	101.65	104.98	101.90	108.30	3.32	250	254	363	0.013	0.019	0.057	0.34	0.051	1430	0.03342	0.38	0.01	0.35	0.00	104.98	101.90	0.85%	0.85%
916	920	102.15	101.52	102.53	101.90	107.30	4.77	375	381	314	0.013	0.050	0.082	0.60	0.114	824	0.02920	0.43	0.01	0.24	0.00	102.53	101.90	0.20%	0.20%
914	916	102.61	102.23	102.91	102.53	107.25	4.34	300	305	152	0.013	0.032	0.050	0.63	0.073	498	0.03145	0.44	0.01	0.16	0.00	102.91	102.53	0.25%	0.25%
912	920	101.76	101.45	102.21	101.90	107.70	5.49	450	457	207	0.013	0.112	0.115	0.98	0.164	453	0.02747	0.68	0.02	0.35	0.04	102.25	101.90	0.17%	0.15%
910	912	102.73	101.96	102.98	102.21	107.10	4.12	250	254	320	0.013	0.021	0.030	0.69	0.051	1258	0.03342	0.41	0.01	0.37	0.00	102.98	102.25	0.23%	0.24%
908	912	104.32	101.91	104.62	102.21	111.70	7.08	300	305	396	0.013	0.076	0.079	0.97	0.073	1299	0.03145	1.04	0.06	2.35	0.00	104.62	102.25	0.60%	0.61%
906	908	109.97	104.37	110.22	104.62	113.65	3.43	250	254	373	0.013	0.017	0.076	0.23	0.051	1470	0.03342	0.34	0.01	0.30	0.00	110.22	104.62	1.50%	1.50%
904	908	105.05	104.32	105.35	104.62	110.20	4.85	300	305	306	0.013	0.048	0.049	0.97	0.073	1002	0.03145	0.66	0.02	0.70	0.00	105.35	104.62	0.24%	0.24%
902	904	105.47	105.10	105.72	105.35	109.60	3.88	250	254	154	0.013	0.020	0.030	0.66	0.051	605	0.03342	0.40	0.01	0.18	0.00	105.72	105.35	0.24%	0.24%

MANHOLE LOSS									
Diameter (mm)			Bend						HL_{MH}
U/S MH	Pipe In	Pipe Out	Angle	K_O	C_D	K_b	K_{tot}		(m)
1500	825	825	0	0.18	1.00	0.00	**0.18**		0.01
1500	600	825	90	0.18	2.60	1.32	**1.79**		0.08
1200	525	600	90	0.20	1.49	1.32	**1.62**		0.02
1200	200	200	0	0.60	1.00	0.00	**0.60**		0.01
1200	450	525	90	0.23	1.59	1.32	**1.68**		0.03
1200	250	250	90	0.48	1.00	1.32	**1.80**		0.03
1200	250	250	0	0.48	1.00	0.00	**0.48**		0.01
1200	450	450	0	0.27	1.00	0.00	**0.27**		0.00
1200	450	450	0	0.27	1.00	0.00	**0.27**		0.00
1200	375	450	90	0.27	1.73	1.32	**1.78**		0.01
1200	300	375	0	0.32	1.95	0.00	**0.63**		0.00
1200	450	450	90	0.27	1.00	1.32	**1.59**		0.08
1200	450	450	0	0.27	1.00	0.00	**0.27**		0.00
1200	375	450	0	0.27	1.73	0.00	**0.46**		0.01
1200	375	375	90	0.32	1.00	1.32	**1.64**		0.05
1200	250	375	0	0.32	3.38	0.00	**1.08**		0.02
1200	250	250	0	0.48	1.00	0.00	**0.48**		0.02
1200	300	300	0	0.40	1.00	0.00	**0.40**		0.01
1200	250	300	90	0.40	1.73	1.32	**2.01**		0.04
1200	250	250	0	0.48	1.00	0.00	**0.48**		0.00
1200	525	600	90	0.20	1.49	1.32	**1.62**		0.08
1200	450	525	0	0.23	1.59	0.00	**0.36**		0.00
1200	375	450	0	0.27	1.73	0.00	**0.46**		0.01
1200	200	200	0	0.60	1.00	0.00	**0.60**		0.03
1200	300	375	0	0.32	1.95	0.00	**0.63**		0.00
1200	525	525	90	0.23	1.00	1.32	**1.55**		0.06
1200	525	525	0	0.23	1.00	0.00	**0.23**		0.01
1200	450	525	90	0.23	1.59	1.32	**1.68**		0.05
1200	250	250	0	0.48	1.00	0.00	**0.48**		0.00
1200	300	375	0	0.32	1.95	0.00	**0.63**		0.01
1200	300	300	0	0.40	1.00	0.00	**0.40**		0.00
1200	300	450	90	0.27	3.38	1.32	**2.22**		0.05
1200	250	250	0	0.48	1.00	0.00	**0.48**		0.00
1200	300	300	90	0.40	1.00	1.32	**1.72**		0.10
1200	250	250	90	0.48	1.00	1.32	**1.80**		0.01
1200	250	300	0	0.40	1.73	0.00	**0.69**		0.02
1200	250	250	90	0.48	1.00	1.32	**1.80**		0.01

Average Daily Flow=	350 L/cap/day	Industrial Peak Factor= per MOE graph	HGL=Major + Minor Losses
Comm/Inst Flow=	50000 L/ha/day	Extraneous Flow= 0.28	Major Loss= Pipe Friction (Darcy-Weisbach)
Industrial Flow=	35000 L/ha/day	Minimum Velocity= 0.60	Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends
Max Res Peak Factor=	4.00	Manning's n= 0.013	Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6
Comm Peak Factor=	1.50		
Indst Peak Factor=	1.50		

Designed: KJM	PROJECT: Fernbank CDP
Checked: MAB	CLIENT:
Dwg. Reference: 101108-SAN	Date: May 8, 2009

TABLE D-3: FERNBANK CDP LANDS - COPE DRIVE OUTLET TO SOUTH GLEN CAIRN TRUNK
SANITARY SEWER DESIGN SHEET (2031)

AREA			RESIDENTIAL															COMMERCIAL		INSTITUTIONAL		C+I	INFILTRATION			Total Flow (l/s)	PIPE					
			LOW DENSITY			MEDIUM DENSITY			HIGH DENSITY			MIXED USE			TOTAL																	
ID	From	To	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Pop.	Accum. Pop.	Peak Factor	Peak Flow (l/s)	Area (ha)	Accum. Area (ha)	Area (ha)	Accum. Area (ha)	Peak Flow (l/s)	Total Area (ha)	Accum. Area (ha)	Infilt. Flow (l/s)		Size (mm)	Slope (%)	Length (m)	Capacity (l/s)	Full Flow Vel. (m/s)	Q/Q_{full} (%)
FERNBANK CDP LANDS																																
101	02	04	7.95	735	735	2.98	447	447	0.00	0	0	0.00	0	0	1182	1182	3.8	18.0	6.60	6.60	8.41	8.41	13.0	32.09	32.09	9.0	40.0	300	0.45	360	67.7	0.93	59.1%
	04	STUB	0.00	0	735	0.00	0	447	0.00	0	0	0.00	0	0	0	1182	3.8	18.0	0.00	6.60	0.00	8.41	13.0	0.00	32.09	9.0	40.0	300	1.00	116	100.9	1.38	39.6%
EXISTING SANITARY - COPE DRIVE (SOHO LANDS)																																
	STUB	145B	0.14	0	735	0.00	0	0	0.00	0	0	0.00	0	0	0	1182	3.8	18.0	0.00	6.60	0.00	8.41	13.0	0.14	32.23	9.0	40.0	525	0.90	262	425.6	1.90	9.4%
	145B	145A	0.09	0	735	0.00	0	0	0.00	0	0	0.00	0	0	0	1182	3.8	18.0	0.00	6.60	0.00	8.41	13.0	0.09	32.32	9.0	40.0	525	0.24	531	219.8	0.98	18.2%
	145A	145	0.12	0	735	0.00	0	0	0.00	0	0	0.00	0	0	0	1182	3.8	18.0	0.00	6.60	0.00	8.41	13.0	0.12	32.44	9.1	40.1	525	0.20	191	200.6	0.90	20.0%
	145	146	23.14	2811	3546	0.00	0	0	0.00	0	0	0.00	0	0	2811	3993	3.3	53.9	0.00	6.60	0.00	8.41	13.0	23.14	55.58	15.6	82.5	525	0.45	360	301.0	1.35	27.4%
	133A	146	2.70	272	272	0.00	0	0	0.00	0	0	0.00	0	0	272	272	4.0	4.4	0.00	0.00	0.00	0.00	0.0	2.70	2.70	0.8	5.2	200	1.00	116	34.2	1.06	15.1%
	146	147	0.21	0	3818	0.00	0	0	0.00	0	0	0.00	0	0	0	4265	3.3	57.2	0.00	6.60	0.00	8.41	13.0	0.21	58.49	16.4	86.6	525	0.90	262	425.6	1.90	20.3%
	110	147	4.98	410	410	0.00	0	0	0.00	0	0	0.00	0	0	410	410	4.0	6.6	0.00	0.00	0.00	0.00	0.0	4.98	4.98	1.4	8.0	200	0.24	531	16.8	0.52	48.0%
	147	148	0.17	0	4228	0.00	0	0	0.00	0	0	0.00	0	0	0	4675	3.3	62.0	0.00	6.6	0.00	8.41	13.0	0.17	63.64	17.8	92.8	525	0.20	191	200.6	0.90	46.3%
	148	149	0.13	0	4228	0.00	0	0	0.00	0	0	0.00	0	0	0	4675	3.3	62.0	0.00	6.60	0.00	8.41	13.0	0.13	63.77	17.9	92.8	525	0.45	360	301.0	1.35	30.9%
	144	149	5.40	345	345	0.00	0	0	0.00	0	0	0.00	0	0	345	345	4.0	5.6	0.00	0.00	0.00	0.00	0.0	12.25	12.25	3.4	9.0	200	1.00	116	34.2	1.06	26.4%
	125A	149	7.29	692	692	0.00	0	0	0.00	0	0	0.00	0	0	692	692	3.9	10.9	0.00	0.00	0.00	0.00	0.0	7.29	7.29	2.0	13.0	200	1.00	116	34.2	1.06	37.9%
	149	150	0.48	32	5297	0.00	0	0	0.00	0	0	0.00	0	0	32	5744	3.2	74.2	0.00	6.60	0.00	8.41	13.0	0.48	83.79	23.5	110.7	525	0.90	262	425.6	1.90	26.0%
	150	151	0.13	0	5297	0.00	0	0	0.00	0	0	0.00	0	0	0	5744	3.2	74.2	0.00	6.60	0.00	8.41	13.0	0.13	83.92	23.5	110.7	525	0.24	531	219.8	0.98	50.4%
	151A	151	6.40	476	476	0.00	0	0	0.00	0	0	0.00	0	0	476	476	4.0	62.7	0.00	0.00	0.00	0.00	0.0	6.40	6.40	1.8	64.5	450	0.20	191	133.0	0.81	48.5%
	151	SG01000	0.01	0	5773	0.00	0	0	0.00	0	0	0.00	0	0	0	6220	3.2	79.5	0.00	6.6	0.00	8.41	30.5	0.01	90.33	25.3	190.3	600	0.45	360	429.7	1.47	44.3%
			7.95			**2.98**			**0.00**			**0.00**																				

Design Parameters:

Avg Flow/Person =	350	l/day	Pipe Friction n = 0.013		**Units/Net ha**	**Pop/Unit**	
Comm./Inst. Flow =	50000	l/ha/day	Residential Peaking Factor = Harmon Equation (max 4, min 2)	Low Density Residential =	28	3.3	
Infiltration =	0.28	l/s/ha	Peaking Factor Comm./Inst. = 1.5	Medium Density Residential =	60	2.5	(Multi Family Residential)
				High Density Residential =	75	1.8	
				Mixed Use =	90	1.8	(50% of mixed use area is residential)

Project: Fernbank CDP (101108)
Designed: KJM
Checked: MAB
Dwg. Reference: 101108-SAN
Date: May 8, 2009

TABLE D-4: SOUTH GLEN CAIRN TRUNK
SANITARY SEWER HYDRAULIC GRADE LINE ANALYSIS (2031)

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The HGL slope is calculated and the minimum USF is established +0.30m above the HGL.

Bend Coefficients

0	45	90	<----Bend (in degrees)
0.00	0.29	1.02	900 mm pipe or greater (benched)
0.00	0.40	1.32	825 mm pipe or smaller (sump)

MANHOLE		INVERT ELEV.		OBVERT ELEV.		GROUND ELEV.	COVER	PIPE PARAMETERS				TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SUR-CHARGE	HGL			PIPE
U/S	D/S	U/S (m)	D/S (m)	U/S (m)	D/S (m)	U/S (m)	U/S (m)	Dia (N) (mm)	Dia (A) (m)	Length (m)	'n'	(m^3/s)	(m^3/s)		Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	U/S (m)	U/S (m)	D/S (m)	Slope (%)	Slope (%)
Hazeldean Pump Station																						**95.00**	<- 100yr Starting HGL		
sg00100	st00100	89.44	88.99	90.20	89.75	95.55	5.35	750	762	103.63	0.013	0.827	0.765	1.08	0.456	136	0.02317	1.81	0.17	0.77	5.35	95.55	95.00	0.53%	0.43%
sg00200	sg00100	89.62	89.44	90.53	90.35	95.71	5.18	900	914	137.46	0.013	0.827	0.683	1.21	0.657	150	0.02181	1.26	0.08	0.28	5.18	95.71	95.55	0.12%	0.13%
sg00300	sg00200	89.71	89.62	90.62	90.53	95.86	5.24	900	914	121.31	0.013	0.827	0.514	1.61	0.657	133	0.02181	1.26	0.08	0.27	5.24	95.86	95.71	0.12%	0.07%
sg00400	sg00300	89.86	89.71	90.77	90.62	96.01	5.24	900	914	76.20	0.013	0.827	0.838	0.99	0.657	83	0.02181	1.26	0.08	0.16	5.24	96.01	95.86	0.20%	0.20%
sg00500	sg00400	89.99	89.86	90.90	90.77	95.55	4.65	900	914	106.68	0.013	0.642	0.659	0.97	0.657	117	0.02181	0.98	0.05	0.13	4.65	95.55	96.01	-0.43%	0.12%
sg00600	st00600	90.18	89.99	91.09	90.90	96.85	5.76	900	914	121.92	0.013	0.642	0.746	0.86	0.657	133	0.02181	0.98	0.05	0.15	4.61	95.70	95.55	0.12%	0.16%
sg00700	sg00600	90.33	90.18	91.24	91.09	96.75	5.51	900	914	121.92	0.013	0.642	0.662	0.97	0.657	133	0.02181	0.98	0.05	0.17	4.62	95.87	95.70	0.14%	0.12%
sg00800	sg00700	90.45	90.33	91.36	91.24	96.60	5.24	900	914	121.92	0.013	0.642	0.593	1.08	0.657	133	0.02181	0.98	0.05	0.15	4.65	96.02	95.87	0.12%	0.10%
sg00900	sg00800	90.62	90.45	91.53	91.36	96.60	5.07	900	914	121.92	0.013	0.642	0.705	0.91	0.657	133	0.02181	0.98	0.05	0.15	4.63	96.16	96.02	0.12%	0.14%
sg01000	sg00900	90.75	90.62	91.66	91.53	97.00	5.34	900	914	121.92	0.013	0.642	0.617	1.04	0.657	133	0.02181	0.98	0.05	0.22	4.72	96.38	96.16	0.18%	0.11%
S151	sg01000	91.05	91.05	91.66	91.66	96.40	4.74	600	610	3.40	0.013	0.190	0.320	0.59	0.292	6	0.02496	0.65	0.02	0.04	4.74	96.40	96.38	0.49%	0.25%
S151A	S151	91.99	91.91	92.45	92.37	96.40	3.95	450	457	50.20	0.013	0.064	0.119	0.54	0.164	110	0.02747	0.39	0.01	0.03	3.95	96.40	96.40	0.00%	0.16%
S150	S151	91.27	91.13	91.80	91.66	96.30	4.50	525	533	57.40	0.013	0.111	0.222	0.50	0.223	108	0.02610	0.50	0.01	0.04	4.50	96.30	96.40	-0.17%	0.24%
S149	S150	91.60	91.32	92.13	91.85	96.50	4.37	525	533	111.90	0.013	0.111	0.224	0.49	0.223	210	0.02610	0.50	0.01	0.09	4.25	96.39	96.30	0.08%	0.25%
S144	S149	92.63	92.18	92.83	92.38	96.50	3.67	200	203	64.50	0.013	0.013	0.028	0.46	0.032	317	0.03600	0.40	0.01	0.10	3.66	96.49	96.39	0.15%	0.69%
S125A	S149	92.37	92.18	92.57	92.38	96.50	3.93	200	203	47.90	0.013	0.009	0.022	0.42	0.032	236	0.03600	0.28	0.00	0.04	3.85	96.42	96.39	0.07%	0.40%
S148	S149	91.80	91.65	92.33	92.18	96.80	4.47	525	533	58.30	0.013	0.093	0.228	0.41	0.223	109	0.02610	0.42	0.01	0.03	4.08	96.41	96.39	0.05%	0.26%
S147	S148	92.20	91.85	92.73	92.38	96.75	4.02	525	533	70.90	0.013	0.093	0.315	0.29	0.223	133	0.02610	0.42	0.01	0.04	3.73	96.46	96.41	0.06%	0.49%
S110	S147	93.15	92.60	93.35	92.80	96.70	3.35	200	203	46.50	0.013	0.008	0.037	0.22	0.032	229	0.03600	0.25	0.00	0.03	3.13	96.49	96.46	0.06%	1.18%
S146	S147	92.29	92.07	92.82	92.60	96.80	3.98	525	533	87.50	0.013	0.087	0.225	0.38	0.223	164	0.02610	0.39	0.01	0.04	3.68	96.50	96.46	0.05%	0.25%
S133A	S146	93.35	92.88	93.55	93.08	96.90	3.35	200	203	43.20	0.013	0.005	0.036	0.14	0.032	213	0.03600	0.16	0.00	0.01	2.96	96.51	96.50	0.02%	1.09%
S145	S146	92.54	92.34	93.07	92.87	96.94	3.87	525	533	78.00	0.013	0.083	0.227	0.36	0.223	146	0.02610	0.37	0.01	0.03	3.46	96.53	96.50	0.04%	0.26%
S145A	S145	92.65	92.54	93.18	93.07	97.23	4.05	525	533	46.40	0.013	0.040	0.218	0.18	0.223	87	0.02610	0.18	0.00	0.00	3.35	96.54	96.53	0.01%	0.24%
S145B	S145A	92.74	92.65	93.27	93.18	97.17	3.90	525	533	34.40	0.013	0.040	0.229	0.17	0.223	64	0.02610	0.18	0.00	0.00	3.27	96.54	96.54	0.01%	0.26%
Stub	S145B	92.79	92.74	93.32	93.27	97.37	4.05	525	533	20.40	0.013	0.040	0.222	0.18	0.223	38	0.02610	0.18	0.00	0.00	3.22	96.54	96.54	0.02%	0.25%
FERNBANK CDP LANDS																									
SAN 04	Stub	94.03	92.87	94.33	93.17	98.60	4.27	300	305	116.00	0.013	0.040	0.101	0.40	0.073	381	0.03145	0.55	0.02	0.19	2.40	96.73	96.54	0.16%	1.00%
SAN 02	SAN 04	95.65	94.03	95.95	94.33	100.10	4.15	300	305	359.60	0.013	0.040	0.068	0.59	0.073	1180	0.03145	0.55	0.02	0.57	1.36	97.31	96.73	0.16%	0.45%

MANHOLE LOSS								
Diameter (mm)			Bend					HL_{MH}
U/S MH	Pipe In	Pipe Out	Angle	K_O	C_D	K_b	K_{tot}	(m)
1800	914	762	90	0.24	0.58	1.32	**1.46**	0.24
1500	914	914	0	0.16	1.00	0.00	**0.16**	0.01
1800	914	914	45	0.20	1.00	0.29	**0.49**	0.04
1500	914	914	0	0.16	1.00	0.00	**0.16**	0.01
1500	914	914	0	0.16	1.00	0.00	**0.16**	0.01
1500	914	914	0	0.16	1.00	0.00	**0.16**	0.01
1800	914	914	45	0.20	1.00	0.29	**0.49**	0.02
1500	914	914	0	0.16	1.00	0.00	**0.16**	0.01
1500	914	914	0	0.16	1.00	0.00	**0.16**	0.01
1500	610	914	90	0.16	3.38	1.02	**1.57**	0.08
1200	533	610	90	0.20	1.49	1.32	**1.61**	0.03
1200	457	457	0	0.26	1.00	0.00	**0.26**	0.00
1200	533	533	45	0.22	1.00	0.40	**0.62**	0.01
1200	533	533	90	0.22	1.00	1.32	**1.54**	0.02
1200	203	203	0	0.59	1.00	0.00	**0.59**	0.00
1200	203	203	0	0.59	1.00	0.00	**0.59**	0.00
1200	533	533	0	0.22	1.00	0.00	**0.22**	0.00
1200	533	533	90	0.22	1.00	1.32	**1.54**	0.01
1200	203	203	0	0.59	1.00	0.00	**0.59**	0.00
1200	533	533	90	0.22	1.00	1.32	**1.54**	0.01
1200	203	203	0	0.59	1.00	0.00	**0.59**	0.00
1200	533	533	0	0.22	1.00	0.00	**0.22**	0.00
1200	533	533	45	0.22	1.00	0.40	**0.62**	0.00
1200	533	533	0	0.22	1.00	0.00	**0.22**	0.00
1200	305	533	45	0.22	5.36	0.40	**1.61**	0.00
1200	305	305	0	0.39	1.00	0.00	**0.39**	0.01
1200	305	305	0	0.39	1.00	0.00	**0.39**	0.01

Average Daily Flow=	350	L/cap/day	Industrial Peak Factor=	per MOE graph
Comm/Inst Flow=	50000	L/ha/day	Extraneous Flow=	0.28
Industrial Flow=	35000	L/ha/day	Minimum Velocity=	0.60
Max Res Peak Factor=	4.00		Manning's n=	0.013
Comm Peak Factor=	1.50			
Indst Peak Factor=	1.50			

HGL=Major + Minor Losses
Major Loss= Pipe Friction (Darcy-Weisbach)
Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends
Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6

Designed: KJM
Checked: MAB
Dwg. Reference: 101108-SAN

PROJECT:
Fernbank CDP
CLIENT:
Date:May 8, 2009

TABLE D-5: SOUTH GLEN CAIRN TRUNK (WITH ADDITIONAL BYPASS)
SANITARY SEWER HYDRAULIC GRADE LINE ANALYSIS (2031)

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The HGL slope is calculated and the minimum USF is established +0.30m above the HGL.

Bend Coefficients

0	45	90	<----Bend (in degrees)
0.00	0.29	1.02	900 mm pipe or greater (benched)
0.00	0.40	1.32	825 mm pipe or smaller (sump)

MANHOLE		INVERT ELEV.		OBVERT ELEV.		GROUND ELEV.	COVER	PIPE PARAMETERS				TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SUR-CHARGE	HGL			PIPE
U/S	D/S	U/S (m)	D/S (m)	U/S (m)	D/S (m)	U/S (m)	U/S (m)	Dia (N) (mm)	Dia (A) (m)	Length (m)	'n'	(m^3/s)	(m^3/s)		Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	U/S (m)	U/S (m)	D/S (m)	Slope (%)	Slope (%)
Hazeldean Pump Station																						**95.00**	**<- 100yr Starting HGL**		
sg00100	st00100	89.44	88.99	90.20	89.75	95.55	5.35	750	762	103.63	0.013	0.827	0.765	1.08	0.456	136	0.02317	1.81	0.17	0.77	5.35	95.55	95.00	0.53%	0.43%
sg00200	sg00100	89.62	89.44	90.53	90.35	95.71	5.18	900	914	137.46	0.013	0.827	0.683	1.21	0.657	150	0.02181	1.26	0.08	0.28	5.18	95.71	95.55	0.12%	0.13%
sg00300	sg00200	89.71	89.62	90.62	90.53	95.86	5.24	900	914	121.31	0.013	0.827	0.514	1.61	0.657	133	0.02181	1.26	0.08	0.27	5.24	95.86	95.71	0.12%	0.07%
sg00400	sg00300	89.86	89.71	90.77	90.62	96.01	5.24	900	914	76.20	0.013	0.827	0.838	0.99	0.657	83	0.02181	1.26	0.08	0.16	5.24	96.01	95.86	0.20%	0.20%
sg00500	sg00400	89.99	89.86	90.90	90.77	95.55	4.65	900	914	106.68	0.013	0.642	0.659	0.97	0.657	117	0.02181	0.98	0.05	0.13	4.65	95.55	96.01	-0.43%	0.12%
sg00600	st00600	90.18	89.99	91.09	90.90	96.85	5.76	900	914	121.92	0.013	0.642	0.746	0.86	0.657	133	0.02181	0.98	0.05	0.15	4.61	95.70	95.55	0.12%	0.16%
sg00700	sg00600	90.33	90.18	91.24	91.09	96.75	5.51	900	914	121.92	0.013	0.642	0.662	0.97	0.657	133	0.02181	0.98	0.05	0.17	4.62	95.87	95.70	0.14%	0.12%
sg00800	sg00700	90.45	90.33	91.36	91.24	96.60	5.24	900	914	121.92	0.013	0.642	0.593	1.08	0.657	133	0.02181	0.98	0.05	0.15	4.65	96.02	95.87	0.12%	0.10%
sg00900	sg00800	90.62	90.45	91.53	91.36	96.60	5.07	900	914	121.92	0.013	0.642	0.705	0.91	0.657	133	0.02181	0.98	0.05	0.15	4.63	96.16	96.02	0.12%	0.14%
sg01000	sg00900	90.75	90.62	91.66	91.53	97.00	5.34	900	914	121.92	0.013	0.642	0.617	1.04	0.657	133	0.02181	0.98	0.05	0.22	3.34	**95.00**	96.16	-0.96%	0.11%
S151	sg01000	91.05	91.05	91.66	91.66	96.40	4.74	600	610	3.40	0.013	0.190	0.320	0.59	0.292	6	0.02496	0.65	0.02	0.04	3.37	95.04	95.00	1.12%	0.25%
S151A	S151	91.99	91.91	92.45	92.37	96.40	3.95	450	457	50.20	0.013	0.064	0.119	0.54	0.164	110	0.02747	0.39	0.01	0.03	2.62	95.06	95.04	0.05%	0.16%
S150	S151	91.27	91.13	91.80	91.66	96.30	4.50	525	533	57.40	0.013	0.111	0.222	0.50	0.223	108	0.02610	0.50	0.01	0.04	3.28	95.08	95.04	0.07%	0.24%
S149	S150	91.60	91.32	92.13	91.85	96.50	4.37	525	533	111.90	0.013	0.111	0.224	0.49	0.223	210	0.02610	0.50	0.01	0.09	3.04	95.17	95.08	0.08%	0.25%
S144	S149	92.63	92.18	92.83	92.38	96.50	3.67	200	203	64.50	0.013	0.013	0.028	0.46	0.032	317	0.03600	0.40	0.01	0.10	2.44	95.27	95.17	0.15%	0.69%
S125A	S149	92.37	92.18	92.57	92.38	96.50	3.93	200	203	47.90	0.013	0.009	0.022	0.42	0.032	236	0.03600	0.28	0.00	0.04	2.63	95.20	95.17	0.07%	0.40%
S148	S149	91.80	91.65	92.33	92.18	96.80	4.47	525	533	58.30	0.013	0.093	0.228	0.41	0.223	109	0.02610	0.42	0.01	0.03	2.86	95.20	95.17	0.05%	0.26%
S147	S148	92.20	91.85	92.73	92.38	96.75	4.02	525	533	70.90	0.013	0.093	0.315	0.29	0.223	133	0.02610	0.42	0.01	0.04	2.51	95.24	95.20	0.06%	0.49%
S110	S147	93.15	92.60	93.35	92.80	96.70	3.35	200	203	46.50	0.013	0.008	0.037	0.22	0.032	229	0.03600	0.25	0.00	0.03	1.91	95.27	95.24	0.06%	1.18%
S146	S147	92.29	92.07	92.82	92.60	96.80	3.98	525	533	87.50	0.013	0.087	0.225	0.38	0.223	164	0.02610	0.39	0.01	0.04	2.46	95.28	95.24	0.05%	0.25%
S133A	S146	93.35	92.88	93.55	93.08	96.90	3.35	200	203	43.20	0.013	0.005	0.036	0.14	0.032	213	0.03600	0.16	0.00	0.01	1.74	95.30	95.28	0.02%	1.09%
S145	S146	92.54	92.34	93.07	92.87	96.94	3.87	525	533	78.00	0.013	0.083	0.227	0.36	0.223	146	0.02610	0.37	0.01	0.03	2.24	95.31	95.28	0.04%	0.26%
S145A	S145	92.65	92.54	93.18	93.07	97.23	4.05	525	533	46.40	0.013	0.040	0.218	0.18	0.223	87	0.02610	0.18	0.00	0.00	2.13	95.32	95.31	0.01%	0.24%
S145B	S145A	92.74	92.65	93.27	93.18	97.17	3.90	525	533	34.40	0.013	0.040	0.229	0.17	0.223	64	0.02610	0.18	0.00	0.00	2.05	95.32	95.32	0.01%	0.26%
Stub	S145B	92.79	92.74	93.32	93.27	97.37	4.05	525	533	20.40	0.013	0.040	0.222	0.18	0.223	38	0.02610	0.18	0.00	0.00	2.00	95.32	95.32	0.02%	0.25%
FERNBANK CDP LANDS																									
SAN 04	Stub	94.03	92.87	94.33	93.17	98.60	4.27	300	305	116.00	0.013	0.040	0.101	0.40	0.073	381	0.03145	0.55	0.02	0.19	1.18	95.51	95.32	0.16%	1.00%
SAN 02	SAN 04	95.65	94.03	95.95	94.33	100.10	4.15	300	305	359.60	0.013	0.040	0.068	0.59	0.073	1180	0.03145	0.55	0.02	0.57	0.14	96.09	95.51	0.16%	0.45%

MANHOLE LOSS								
Diameter (mm)			Bend					HL_{MH}
U/S MH	Pipe In	Pipe Out	Angle	K_O	C_D	K_b	K_{tot}	(m)
1800	914	762	90	0.24	0.58	1.32	**1.46**	0.24
1500	914	914	0	0.16	1.00	0.00	**0.16**	0.01
1800	914	914	45	0.20	1.00	0.29	**0.49**	0.04
1500	914	914	0	0.16	1.00	0.00	**0.16**	0.01
1500	914	914	0	0.16	1.00	0.00	**0.16**	0.01
1500	914	914	0	0.16	1.00	0.00	**0.16**	0.01
1800	914	914	45	0.20	1.00	0.29	**0.49**	0.02
1500	914	914	0	0.16	1.00	0.00	**0.16**	0.01
1500	914	914	0	0.16	1.00	0.00	**0.16**	0.01
1500	610	914	90	0.16	3.38	1.02	**1.57**	0.08
1200	533	610	90	0.20	1.49	1.32	**1.61**	0.03
1200	457	457	0	0.26	1.00	0.00	**0.26**	0.00
1200	533	533	45	0.22	1.00	0.40	**0.62**	0.01
1200	533	533	90	0.22	1.00	1.32	**1.54**	0.02
1200	203	203	0	0.59	1.00	0.00	**0.59**	0.00
1200	203	203	0	0.59	1.00	0.00	**0.59**	0.00
1200	533	533	0	0.22	1.00	0.00	**0.22**	0.00
1200	533	533	90	0.22	1.00	1.32	**1.54**	0.01
1200	203	203	0	0.59	1.00	0.00	**0.59**	0.00
1200	533	533	90	0.22	1.00	1.32	**1.54**	0.01
1200	203	203	0	0.59	1.00	0.00	**0.59**	0.00
1200	533	533	0	0.22	1.00	0.00	**0.22**	0.00
1200	533	533	45	0.22	1.00	0.40	**0.62**	0.00
1200	533	533	0	0.22	1.00	0.00	**0.22**	0.00
1200	305	533	45	0.22	5.36	0.40	**1.61**	0.00
1200	305	305	0	0.39	1.00	0.00	**0.39**	0.01
1200	305	305	0	0.39	1.00	0.00	**0.39**	0.01

Average Daily Flow=	350	L/cap/day	Industrial Peak Factor=	per MOE graph
Comm/Inst Flow=	50000	L/ha/day	Extraneous Flow=	0.28
Industrial Flow=	35000	L/ha/day	Minimum Velocity=	0.60
Max Res Peak Factor=	4.00		Manning's n=	0.013
Comm Peak Factor=	1.50			
Indst Peak Factor=	1.50			

HGL=Major + Minor Losses
Major Loss= Pipe Friction (Darcy-Weisbach)
Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends
Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6

Designed: KJM	PROJECT: Fernbank CDP
Checked: MAB	CLIENT:
Dwg. Reference: 101108-SAN	Date:May 8, 2009

TABLE D-6: FERNBANK CDP LANDS - NEW TRUNK SEWER
SANITARY SEWER SENSITIVITY ANALYSIS (AVERAGE FLOW PER PERSON) (2031)

AREA			RESIDENTIAL																COMMERCIAL		INSTITUTIONAL		C+I	INFILTRATION				PIPE					
			LOW DENSITY			MEDIUM DENSITY			HIGH DENSITY			MIXED USE			TOTAL																	
ID	From	To	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Pop.	Accum. Pop.	Peak Factor	Peak Flow (l/s)	Area (ha)	Accum. Area (ha)	Area (ha)	Accum. Area (ha)	Peak Flow (l/s)	Total Area (ha)	Accum. Area (ha)	Infilt. Flow (l/s)	Total Flow (l/s)	Size (mm)	Slope (%)	Length (m)	Capacity (l/s)	Full Flow Vel. (m/s)	Q/Q_{full} (%)
1	902	904	9.87	912	912	0.36	54	54	0.00	0	0	0.00	0	0	966	966	3.8	19.2	0.00	0.00	0.78	0.78	0.7	16.07	16.07	4.5	24.3	250	0.24	154	30.4	0.60	80.1%
2	904	908	11.70	1081	1993	3.10	465	519	0.00	0	0	0.00	0	0	1546	2512	3.5	45.9	0.00	0.00	0.91	1.69	1.5	22.29	38.36	10.7	58.1	300	0.24	306	49.4	0.68	117.5%
3	906	908	7.45	688	688	0.00	0	0	0.00	0	0	0.00	0	0	688	688	3.9	14.0	0.00	0.00	2.63	2.63	2.3	14.51	14.51	4.1	20.3	250	1.50	373	76.0	1.50	26.7%
4	908	912	4.45	411	3092	1.67	251	770	0.00	0	0	0.00	0	0	662	3862	3.3	67.3	0.63	0.63	0.00	4.32	4.3	16.43	69.30	19.4	91.0	300	0.61	396	78.8	1.08	115.5%
5	910	912	10.36	957	957	0.00	0	0	0.00	0	0	0.00	0	0	957	957	3.8	19.0	0.00	0.00	0.83	0.83	0.7	19.34	19.34	5.4	25.1	250	0.24	320	30.4	0.60	82.7%
6	912	920	11.15	1030	5079	0.00	0	770	0.00	0	0	0.00	0	0	1030	5849	3.2	96.9	0.00	0.63	2.50	7.65	7.2	18.11	106.75	29.9	134.0	450	0.15	207	115.2	0.70	116.3%
7	914	916	16.33	1509	1509	0.90	135	135	0.00	0	0	0.00	0	0	1644	1644	3.7	31.3	0.00	0.00	0.45	0.45	0.4	25.23	25.23	7.1	38.7	300	0.25	152	50.4	0.69	76.7%
8	916	920	10.46	967	2476	0.00	0	135	0.00	0	0	0.00	0	0	967	2611	3.5	47.5	0.00	0.00	0.85	1.30	1.1	15.69	40.92	11.5	60.1	375	0.20	314	81.8	0.72	73.5%
9	918	920	5.57	515	515	0.49	74	74	0.00	0	0	0.00	0	0	589	589	3.9	12.1	0.00	0.00	6.14	6.14	5.3	16.04	16.04	4.5	21.9	250	0.85	363	57.2	1.13	38.3%
	920	922	0.00	0	8070	0.00	0	979	0.00	0	0	0.00	0	0	0	9049	3.0	141.3	0.00	0.63	0.00	15.09	13.6	0.00	163.71	45.8	200.8	525	0.18	265	190.3	0.85	105.5%
10	922	924	12.25	1132	9202	0.09	14	993	0.00	0	0	0.00	0	0	1146	10195	2.9	156.4	0.00	0.63	1.52	16.61	15.0	27.31	191.02	53.5	224.9	525	0.23	290	215.2	0.96	104.5%
	924	934	0.00	0	9202	0.00	0	993	0.00	0	0	0.00	0	0	0	10195	2.9	156.4	0.00	0.63	0.00	16.61	15.0	0.00	191.02	53.5	224.9	525	0.79	669	398.8	1.78	56.4%
11	926	930	4.98	460	460	8.47	1270	1270	0.00	0	0	3.45	279	279	2009	2009	3.6	37.5	1.99	1.99	0.82	0.82	2.4	26.79	26.79	7.5	47.4	375	0.14	530	68.4	0.60	69.3%
12	928	930	9.39	868	868	3.57	536	536	0.00	0	0	0.00	0	0	1404	1404	3.7	27.1	0.00	0.00	3.85	3.85	3.3	22.72	22.72	6.4	36.8	200	7.00	55	90.5	2.79	40.6%
13	930	932	1.67	154	1482	2.96	444	2250	0.00	0	0	0.00	0	279	598	4011	3.3	69.6	0.34	2.33	0.80	5.47	6.8	10.54	60.05	16.8	93.2	450	0.11	308	99.1	0.60	94.0%
14	932	934	0.00	0	1482	0.00	0	2250	0.00	0	0	7.12	577	856	577	4588	3.3	78.4	3.56	5.89	6.10	11.57	15.2	17.52	77.57	21.7	115.2	525	0.10	455	141.9	0.63	81.2%
15	934	972	2.90	268	10952	1.80	270	3513	0.00	0	0	1.21	98	954	636	15419	2.8	222.1	0.61	7.12	0.40	28.58	31.0	15.08	283.67	79.4	332.6	600	0.26	1007	326.6	1.12	101.8%
16	936	938	7.58	700	700	0.70	105	105	0.00	0	0	0.00	0	0	805	805	3.9	16.2	0.00	0.00	2.17	2.17	1.9	14.42	14.42	4.0	22.1	250	1.00	108	62.0	1.22	35.6%
17	938	940	8.06	745	1445	1.03	155	260	0.00	0	0	4.41	357	357	1257	2062	3.6	38.4	2.21	2.21	0.83	3.00	4.5	25.14	39.56	11.1	54.0	300	0.35	156	59.7	0.82	90.5%
18	940	952	6.36	588	2033	0.99	149	409	0.00	0	0	0.00	0	357	737	2799	3.5	50.6	0.00	2.21	0.00	3.00	4.5	10.51	50.07	14.0	69.1	300	0.75	310	87.4	1.20	79.1%
19	942	944	7.25	670	670	4.71	707	707	0.00	0	0	0.00	0	0	1377	1377	3.7	26.6	0.00	0.00	12.67	12.67	11.0	34.19	34.19	9.6	47.2	250	0.90	516	58.9	1.16	80.1%
20	944	946	12.27	1134	1804	1.00	150	857	0.00	0	0	0.00	0	0	1284	2661	3.5	48.3	0.00	0.00	0.82	13.49	11.7	20.35	54.54	15.3	75.3	375	0.20	511	81.8	0.72	92.0%
21	946	948	4.14	383	2187	4.22	633	1490	0.00	0	0	0.00	0	0	1016	3677	3.4	64.5	0.00	0.00	3.87	17.36	15.1	17.22	71.76	20.1	99.6	375	0.50	243	129.3	1.13	77.0%
	948	950	0.00	0	2187	0.00	0	1490	0.00	0	0	0.00	0	0	0	3677	3.4	64.5	0.00	0.00	0.00	17.36	15.1	0.00	71.76	20.1	99.6	450	0.15	195	115.2	0.70	86.5%
22	950	952	5.20	480	2667	0.30	45	1535	0.00	0	0	0.00	0	0	525	4202	3.3	72.5	0.00	0.00	3.24	20.6	17.9	11.43	83.19	23.3	113.7	450	0.15	221	115.2	0.70	98.7%
23	952	972	3.35	310	5010	5.50	825	2769	0.00	0	0	0.00	0	357	1135	8136	3.0	129.0	0.00	2.21	0.00	23.60	22.4	21.67	154.93	43.4	194.7	450	0.54	282	218.6	1.33	89.1%
24	954	956	7.74	715	715	2.90	435	435	0.00	0	0	6.70	543	543	1693	1693	3.6	32.1	3.35	3.35	0.79	0.79	3.6	22.81	22.81	6.4	42.1	375	0.15	330	70.8	0.62	59.4%
25	956	958	10.70	989	1704	0.00	0	435	0.00	0	0	0.00	0	543	989	2682	3.5	48.7	0.00	3.35	6.27	7.06	9.0	23.45	46.26	13.0	70.6	450	0.20	411	133.0	0.81	53.1%
	958	960	0.00	0	1704	0.00	0	435	0.00	0	0	0.00	0	543	0	2682	3.5	48.7	0.00	3.35	0.00	7.06	9.0	0.00	46.26	13.0	70.6	450	0.15	177	115.2	0.70	61.3%
26	960	966	7.75	716	2420	0.00	0	435	0.00	0	0	0.00	0	543	716	3398	3.4	60.1	0.00	3.35	0.00	7.06	9.0	11.51	57.77	16.2	85.3	450	0.15	82	115.2	0.70	74.1%
27	962	964	2.54	235	235	4.70	705	705	5.04	680	680	0.00	0	0	1620	1620	3.7	30.8	0.00	0.00	0.00	0.00	0.0	20.97	20.97	5.9	36.7	250	0.35	479	36.7	0.72	100.0%
	964	966	0.00	0	235	0.00	0	705	0.00	0	680	0.00	0	0	0	1620	3.7	30.8	0.00	0.00	0.00	0.00	0.0	0.00	20.97	5.9	36.7	250	1.00	298	62.0	1.22	59.2%
28	966	970	1.80	166	2821	5.30	795	1935	0.00	0	680	0.00	0	543	961	5979	3.2	98.8	0.00	3.35	8.89	15.95	16.8	22.38	101.12	28.3	143.9	525	0.15	249	173.8	0.78	82.8%
29	968	970	6.92	639	639	0.00	0	0	0.00	0	0	0.00	0	0	639	639	3.9	13.0	0.00	0.00	0.99	0.99	0.9	12.89	12.89	3.6	17.5	200	0.32	82	19.4	0.60	90.4%
	970	972	0.00	0	3460	0.00	0	1935	0.00	0	680	0.00	0	543	0	6618	3.1	107.9	0.00	3.35	0.00	16.94	17.6	0.00	114.01	31.9	157.4	600	0.15	178	248.1	0.85	63.5%
	972	974	0.00	0	19422	0.00	0	8217	0.00	0	680	0.00	0	1854	0	30173	2.5	388.9	0.00	12.68	0.00	69.12	71.0	0.00	552.61	154.7	614.6	825	0.20	586	669.7	1.21	91.8%
	974	Ex	0.00	0	19422	0.00	0	8217	0.00	0	680	0.00	0	1854	0	30173	2.5	388.9	0.00	12.68	0.00	69.12	71.0	0.00	552.61	154.7	614.6	825	0.20	66	669.7	1.21	91.8%
			210.19			**54.76**			**5.04**			**22.89**																					

Design Parameters:

				Units/Net ha	Pop/Unit	
Avg Flow/Person =	450	l/day	Pipe Friction n = 0.013	Low Density Residential =	28	3.30	
Comm./Inst. Flow =	50,000	l/ha/day	Residential Peaking Factor = Harmon Equation (max 4, min 2)	Medium Density Residential =	60	2.50	(Multi Family Residential)
Infiltration =	0.28	l/s/ha	Peaking Factor Comm./Inst. = 1.5	High Density Residential =	75	1.80	
				Mixed Use =	90	1.80	(50% of mixed use area is residential)

Project: Fernbank CDP (101108)
Designed: KJM
Checked: MAB
Dwg. Reference: 101108-SAN
Date: May 8, 2009

TABLE D-7: FERNBANK CDP LANDS - NEW TRUNK SEWER
SANITARY SEWER SENSITIVITY ANALYSIS (INFILTRATION) (2031)

AREA			RESIDENTIAL																COMMERCIAL		INSTITUTIONAL		C+I	INFILTRATION			Total Flow (l/s)	PIPE					
			LOW DENSITY			MEDIUM DENSITY			HIGH DENSITY			MIXED USE			TOTAL																	
ID	From	To	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Area (ha)	Pop.	Accum. Pop.	Pop.	Accum. Pop.	Peak Factor	Peak Flow (l/s)	Area (ha)	Accum. Area (ha)	Area (ha)	Accum. Area (ha)	Peak Flow (l/s)	Total Area (ha)	Accum. Area (ha)	Infilt. Flow (l/s)		Size (mm)	Slope (%)	Length (m)	Capacity (l/s)	Full Flow Vel. (m/s)	Q/Q_{full} (%)
1	902	904	9.87	912	912	0.36	54	54	0.00	0	0	0.00	0	0	966	966	3.8	14.9	0.00	0.00	0.78	0.78	0.7	16.07	16.07	8.0	23.6	250	0.24	154	30.4	0.60	77.7%
2	904	908	11.70	1081	1993	3.10	465	519	0.00	0	0	0.00	0	0	1546	2512	3.5	35.7	0.00	0.00	0.91	1.69	1.5	22.29	38.36	19.2	56.3	300	0.24	306	49.4	0.68	114.0%
3	906	908	7.45	688	688	0.00	0	0	0.00	0	0	0.00	0	0	688	688	3.9	10.9	0.00	0.00	2.63	2.63	2.3	14.51	14.51	7.3	20.4	250	1.50	373	76.0	1.50	26.9%
4	908	912	4.45	411	3092	1.67	251	770	0.00	0	0	0.00	0	0	662	3862	3.3	52.4	0.63	0.63	0.00	4.32	4.3	16.43	69.30	34.7	91.3	300	0.61	396	78.8	1.08	115.9%
5	910	912	10.36	957	957	0.00	0	0	0.00	0	0	0.00	0	0	957	957	3.8	14.8	0.00	0.00	0.83	0.83	0.7	19.34	19.34	9.7	25.2	250	0.24	320	30.4	0.60	82.8%
6	912	920	11.15	1030	5079	0.00	0	770	0.00	0	0	0.00	0	0	1030	5849	3.2	75.4	0.00	0.63	2.50	7.65	7.2	18.11	106.75	53.4	135.9	450	0.15	207	115.2	0.70	118.0%
7	914	916	16.33	1509	1509	0.90	135	135	0.00	0	0	0.00	0	0	1644	1644	3.7	24.3	0.00	0.00	0.45	0.45	0.4	25.23	25.23	12.6	37.3	300	0.25	152	50.4	0.69	74.0%
8	916	920	10.46	967	2476	0.00	0	135	0.00	0	0	0.00	0	0	967	2611	3.5	36.9	0.00	0.00	0.85	1.30	1.1	15.69	40.92	20.5	58.5	375	0.20	314	81.8	0.72	71.6%
9	918	920	5.57	515	515	0.49	74	74	0.00	0	0	0.00	0	0	589	589	3.9	9.4	0.00	0.00	6.14	6.14	5.3	16.04	16.04	8.0	22.7	250	0.85	363	57.2	1.13	39.8%
	920	922	0.00	0	8070	0.00	0	979	0.00	0	0	0.00	0	0	0	9049	3.0	109.9	0.00	0.63	0.00	15.09	13.6	0.00	163.71	81.9	205.4	525	0.18	265	190.3	0.85	107.9%
10	922	924	12.25	1132	9202	0.09	14	993	0.00	0	0	0.00	0	0	1146	10195	2.9	121.7	0.00	0.63	1.52	16.61	15.0	27.31	191.02	95.5	232.2	525	0.23	290	215.2	0.96	107.9%
	924	934	0.00	0	9202	0.00	0	993	0.00	0	0	0.00	0	0	0	10195	2.9	121.7	0.00	0.63	0.00	16.61	15.0	0.00	191.02	95.5	232.2	525	0.79	669	398.8	1.78	58.2%
11	926	930	4.98	460	460	8.47	1270	1270	0.00	0	0	3.45	279	279	2009	2009	3.6	29.2	1.99	1.99	0.82	0.82	2.4	26.79	26.79	13.4	45.0	375	0.14	530	68.4	0.60	65.8%
12	928	930	9.39	868	868	3.57	536	536	0.00	0	0	0.00	0	0	1404	1404	3.7	21.0	0.00	0.00	3.85	3.85	3.3	22.72	22.72	11.4	35.7	200	7.00	55	90.5	2.79	39.5%
13	930	932	1.67	154	1482	2.96	444	2250	0.00	0	0	0.00	0	279	598	4011	3.3	54.1	0.34	2.33	0.80	5.47	6.8	10.54	60.05	30.0	90.9	450	0.11	308	99.1	0.60	91.8%
14	932	934	0.00	0	1482	0.00	0	2250	0.00	0	0	7.12	577	856	577	4588	3.3	60.9	3.56	5.89	6.10	11.57	15.2	17.52	77.57	38.8	114.9	525	0.10	455	141.9	0.63	81.0%
15	934	972	2.90	268	10952	1.80	270	3513	0.00	0	0	1.21	98	954	636	15419	2.8	172.8	0.61	7.12	0.40	28.58	31.0	15.08	283.67	141.8	345.6	600	0.26	1007	326.6	1.12	105.8%
16	936	938	7.58	700	700	0.70	105	105	0.00	0	0	0.00	0	0	805	805	3.9	12.6	0.00	0.00	2.17	2.17	1.9	14.42	14.42	7.2	21.7	250	1.00	108	62.0	1.22	34.9%
17	938	940	8.06	745	1445	1.03	155	260	0.00	0	0	4.41	357	357	1257	2062	3.6	29.9	2.21	2.21	0.83	3.00	4.5	25.14	39.56	19.8	54.2	300	0.35	156	59.7	0.82	90.8%
18	940	952	6.36	588	2033	0.99	149	409	0.00	0	0	0.00	0	357	737	2799	3.5	39.3	0.00	2.21	0.00	3.00	4.5	10.51	50.07	25.0	68.9	300	0.75	310	87.4	1.20	78.8%
19	942	944	7.25	670	670	4.71	707	707	0.00	0	0	0.00	0	0	1377	1377	3.7	20.7	0.00	0.00	12.67	12.67	11.0	34.19	34.19	17.1	48.8	250	0.90	516	58.9	1.16	82.9%
20	944	946	12.27	1134	1804	1.00	150	857	0.00	0	0	0.00	0	0	1284	2661	3.5	37.6	0.00	0.00	0.82	13.49	11.7	20.35	54.54	27.3	76.6	375	0.20	511	81.8	0.72	93.6%
21	946	948	4.14	383	2187	4.22	633	1490	0.00	0	0	0.00	0	0	1016	3677	3.4	50.1	0.00	0.00	3.87	17.36	15.1	17.22	71.76	35.9	101.1	375	0.50	243	129.3	1.13	78.2%
	948	950	0.00	0	2187	0.00	0	1490	0.00	0	0	0.00	0	0	0	3677	3.4	50.1	0.00	0.00	0.00	17.36	15.1	0.00	71.76	35.9	101.1	450	0.15	195	115.2	0.70	87.8%
22	950	952	5.20	480	2667	0.30	45	1535	0.00	0	0	0.00	0	0	525	4202	3.3	56.4	0.00	0.00	3.24	20.6	17.9	11.43	83.19	41.6	115.9	450	0.15	221	115.2	0.70	100.6%
23	952	972	3.35	310	5010	5.50	825	2769	0.00	0	0	0.00	0	357	1135	8136	3.0	100.3	0.00	2.21	0.00	23.60	22.4	21.67	154.93	77.5	200.2	450	0.54	282	218.6	1.33	91.6%
24	954	956	7.74	715	715	2.90	435	435	0.00	0	0	6.70	543	543	1693	1693	3.6	25.0	3.35	3.35	0.79	0.79	3.6	22.81	22.81	11.4	40.0	375	0.15	330	70.8	0.62	56.4%
25	956	958	10.70	989	1704	0.00	0	435	0.00	0	0	0.00	0	543	989	2682	3.5	37.8	0.00	3.35	6.27	7.06	9.0	23.45	46.26	23.1	70.0	450	0.20	411	133.0	0.81	52.6%
	958	960	0.00	0	1704	0.00	0	435	0.00	0	0	0.00	0	543	0	2682	3.5	37.8	0.00	3.35	0.00	7.06	9.0	0.00	46.26	23.1	70.0	450	0.15	177	115.2	0.70	60.8%
26	960	966	7.75	716	2420	0.00	0	435	0.00	0	0	0.00	0	543	716	3398	3.4	46.7	0.00	3.35	0.00	7.06	9.0	11.51	57.77	28.9	84.7	450	0.15	82	115.2	0.70	73.5%
27	962	964	2.54	235	235	4.70	705	705	5.04	680	680	0.00	0	0	1620	1620	3.7	24.0	0.00	0.00	0.00	0.00	0.0	20.97	20.97	10.5	34.5	250	0.35	479	36.7	0.72	93.9%
	964	966	0.00	0	235	0.00	0	705	0.00	0	680	0.00	0	0	0	1620	3.7	24.0	0.00	0.00	0.00	0.00	0.0	0.00	20.97	10.5	34.5	250	1.00	298	62.0	1.22	55.6%
28	966	970	1.80	166	2821	5.30	795	1935	0.00	0	680	0.00	0	543	961	5979	3.2	76.8	0.00	3.35	8.89	15.95	16.8	22.38	101.12	50.6	144.1	525	0.15	249	173.8	0.78	83.0%
29	968	970	6.92	639	639	0.00	0	0	0.00	0	0	0.00	0	0	639	639	3.9	10.1	0.00	0.00	0.99	0.99	0.9	12.89	12.89	6.4	17.4	200	0.32	82	19.4	0.60	90.1%
	970	972	0.00	0	3460	0.00	0	1935	0.00	0	680	0.00	0	543	0	6618	3.1	83.9	0.00	3.35	0.00	16.94	17.6	0.00	114.01	57.0	158.5	600	0.15	178	248.1	0.85	63.9%
	972	974	0.00	0	19422	0.00	0	8217	0.00	0	680	0.00	0	1854	0	30173	2.5	302.5	0.00	12.68	0.00	69.12	71.0	0.00	552.61	276.3	649.8	825	0.20	586	669.7	1.21	97.0%
	974	Ex	0.00	0	19422	0.00	0	8217	0.00	0	680	0.00	0	1854	0	30173	2.5	302.5	0.00	12.68	0.00	69.12	71.0	0.00	552.61	276.3	649.8	825	0.20	66	669.7	1.21	97.0%
			210.19			**54.76**			**5.04**			**22.89**																					

Design Parameters:

					Units/Net ha	Pop/Unit	
Avg Flow/Person =	350	l/day	Pipe Friction n = 0.013	Low Density Residential =	28	3.30	
Comm./Inst. Flow =	50,000	l/ha/day	Residential Peaking Factor = Harmon Equation (max 4, min 2)	Medium Density Residential =	60	2.50	(Multi Family Residential)
Infiltration =	0.5	l/s/ha	Peaking Factor Comm./Inst. = 1.5	High Density Residential =	75	1.80	
				Mixed Use =	90	1.80	(50% of mixed use area is residential)

Project: Fernbank CDP (101108)
Designed: KJM
Checked: MAB
Dwg. Reference: 101108-SAN
Date: May 8, 2009

TABLE D-8: OFFSITE - SANITARY DESIGN SHEETS (2006-2031)
NORTH KANATA TRUNK

YEAR	RESIDENTIAL AREA AND POPULATION				COMM	INDUSTRIAL		INST	ICI	EXTRAN.	INFILTRATION		FLOW
	Cumulative		Peak	Peak	Accu.	Accu.	Peak	Accu.	Peak	Accu.	Accu.	Infiltration	Total
	Area	Pop.	Factor	Flow	Area	Area	Factor	Area	Flow	Extran	Area	Flow	Flow
	(ha)			(l/s)	(ha)	(ha)	(MOE)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(l/s)
Stittsville Trunk (st00200-st00100)													
2006	467.0	21,471	2.62	228.0	58.0	30.2	3.3	16.2	105.4	0.0	571.4	160.0	493.4
2031	526.6	28,031	2.51	284.6	59.8	40.5	3.2	16.2	117.8	0.0	643.1	180.1	582.5
South Glen Cairn Trunk (sg00100-st00100)													
2006	277.0	19,848	2.66	213.5	7.8	26.0	3.5	24.2	64.1	0.0	335.0	93.8	371.5
2031	432.8	33,113	2.44	326.7	24.6	50.5	3.0	32.6	111.5	6.3	546.8	153.1	591.3
Glamorgan Trunk (gs0100-st00100)													
2006	182.0	12,804	2.85	147.7	30.8	12.3	4.0	64.8	102.9	0.0	289.9	81.2	331.8
2031	182.1	12,810	2.85	147.7	30.8	13.7	3.9	64.8	104.7	0.0	291.4	81.6	334.1
Fernbank Community Design Trunk (NEW FCDP 902-st00100)													
2006	0.0	0	4.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2031	281.5	30,111	2.48	302.0	12.7	0.0	0.0	69.1	72.0	188.8	551.8	154.7	528.0
Hazeldean Pump Station (Stittsville, Glamorgan, South Glen Cairn, and Fernbank CDP) (hf00900-gt03100)													
2006	926.0	54,123	2.23	489.5	96.6	68.5	2.8	105.2	254.1	0.0	1196.3	335.0	1,078.6
2031	1422.4	104,123	2.00	843.6	127.9	104.7	2.6	183.8	381.5	195.1	2033.9	569.5	1,794.6
Richmond Forcemain (rf00800-gt03100)													
2006	159.6	4,102	3.32	55.2	8.9	0.5	7.6	32.6	37.6	0.0	201.6	56.4	149.2
2031	261.0	8,260	3.04	101.6	87.9	0.5	7.6	32.6	106.1	29.0	411.0	115.1	322.8
Kakulu Sewer Catchment (Local MH - gt02100)													
2006-2031	52.7	3,065	3.43	42.6	1.3	12.2	4.0	2.7	23.3	0.0	68.9	19.3	85.2
Energy Mines & Resources (Local MH - gt02100)													
2006-2031	0.0	0	4.00	0.0	14.6	0.0	0.0	0	12.7	0.0	14.6	4.1	16.8
KWCP (South of Hwy 417) (Local MH - gt02100)													
2006	0.0	0	4.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2031	239.3	23,653	2.58	247.2	244.1	217.4	2.3	0.0	411.0	59.9	760.7	213.0	871.2
Glen Cairn Trunk (gt00100 - tr02200)													
2006	1,138.3	61,290	2.18	542.1	121.4	81.2	2.8	140.5	317.8	0.0	1,481.4	414.8	1,274.7
2031	1,975.4	139,101	2.00	1127.0	475.8	334.8	2.1	219.1	884.5	284.0	3,289.1	921.0	2,932.5
March Ridge Trunk (ma00100-tr02200)													
2006	630.0	30,801	2.47	307.7	288.6	146.3	2.4	119.2	499.0	59.9	1244.0	348.3	1,155.0
2031	437.4	32,690	2.44	323.2	102.5	201.9	2.3	57.6	326.6	0.0	799.4	223.8	873.6
Tri-Township Collector, Upper Reach (tr01000 - MH7)													
2006	1768.3	92,091	2.03	757.2	410.0	227.5	2.2	259.7	787.8	59.9	2725.4	763.1	2,308.1
2026	2412.8	171,791	2.00	1391.8	578.3	536.7	1.9	276.7	1152.7	284.0	4088.5	1144.8	3,689.3
March Pump Station (mw00100nk - MH7)													
2006	0.0	0	4.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2031	556.9	35,157	2.41	343.2	154.7	226.2	2.2	61.6	393.3	0.0	999.4	279.8	1016.3
Connaught Rifle Range (Upstream - MH7)													
2006-2031	0.0	0	4.00	0.0	35.0	0.0	0.0	0.0	30.4	0.0	35.0	9.8	40.2
National Defence Lands (Upstream - MH7)													
2006-2031	0.0	0	4.00	0.0	27.4	0.0	0.0	0.0	23.8	0.0	27.4	7.7	31.5
North Kanata, Lower Reach (MH7-MH6)													
2006	1,768.3	92,091	2.03	757.2	472.4	227.5	2.2	259.7	842.0	59.9	2,787.8	780.6	2,379.7
2026	2,969.7	206,948	2.00	1676.7	795.4	762.9	1.8	338.3	1528.1	284.0	5,150.3	1442.1	4,646.9

TABLE D-9: FERNBANK CDP - TRI TOWNSHIP COLLECTOR AND GLEN CAIRN TRUNK
SANITARY SEWER: HYDRAULIC GRADE LINE ANALYSIS (2006-2031)

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The HGL slope is calculated and the minimum USF is established +0.30m above the HGL.

Bend Coefficients			
0	45	90	<----Bend (in degrees)
0.00	0.29	1.02	900 mm pipe or greater (benching)
0.00	0.40	1.32	825 mm pipe or smaller (300 mm sump)

YEAR	LOCATION	MANHOLE Upstream	MANHOLE Downstream	INVERT ELEVATION U/S (m)	INVERT ELEVATION D/S (m)	GROUND ELEVATION Upstream (m)	COVER Upstream (m)	PIPE PARAMETERS Dia (mm)	PIPE PARAMETERS Length (m)	'n'	TOTAL FLOW (m^3/s)	Q_{cap} (m^3/s)	Q_{in}/Q_{cap}	Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HEAD LOSS HL (m)	SURCHARGE Upstream (m)	HGL Upstream (m)	HGL Downstream (m)	SLOPE (%)	Manhole Loss Diameters (mm) U/S MH	Pipe In	Pipe Out	Bend Angle	K_O	C_D	K_b	K_{tot}	HL_{MH} (m)
North Kanata Trunk																					68.80	<- OUTLET										
2006	TTC	tr01100	tr01000	72.89	72.13	75.550	1.610	1050	53.46	0.013	2.308	3.397	0.68	0.8938	51	0.02071	2.58	0.34	0.87	0.00	73.94	73.18	1.42	1800	1050	1050	90	0.171	1.00	1.32	**1.491**	0.507
		tr01200	tr01100	73.17	72.89	75.670	1.450	1050	107.68	0.013	2.308	1.453	1.59	0.8938	103	0.02071	2.58	0.34	0.78	0.50	74.72	73.94	0.26	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.058
		tr01300	tr01200	73.62	73.17	76.660	1.990	1050	102.72	0.013	2.308	1.886	1.22	0.8938	98	0.02071	2.58	0.34	0.75	0.80	75.47	74.72	0.44	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.058
		tr01400	tr01300	75.37	73.62	78.490	2.070	1050	119.36	0.013	2.308	3.449	0.67	0.8938	114	0.02071	2.58	0.34	0.86	0.00	76.42	75.47	1.47	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.058
		tr01500	tr01400	77.37	75.37	80.640	2.220	1050	120.36	0.013	2.308	3.672	0.63	0.8938	115	0.02071	2.58	0.34	1.31	0.00	78.42	76.42	1.66	1800	1050	1050	90	0.171	1.00	1.32	**1.491**	0.507
		tr01600	tr01500	77.69	77.37	80.570	1.830	1050	117.33	0.013	2.308	1.488	1.55	0.8938	112	0.02071	2.58	0.34	0.84	0.52	79.26	78.42	0.27	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.058
		tr01700	tr01600	78.01	77.69	80.890	1.830	1050	116.71	0.013	2.308	1.492	1.55	0.8938	111	0.02071	2.58	0.34	0.84	1.05	80.11	79.26	0.27	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.058
		tr01800	tr01700	78.37	78.01	80.720	1.300	1050	117.99	0.013	2.308	1.574	1.47	0.8938	112	0.02071	2.58	0.34	0.85	1.30	80.72	80.11	0.31	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.058
		tr01900	tr01800	78.96	78.37	81.800	1.790	1050	112.04	0.013	2.308	2.067	1.12	0.8938	107	0.02071	2.58	0.34	0.81	1.52	81.53	80.72	0.53	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.058
		tr02000	tr01900	79.47	78.96	82.310	1.790	1050	114.05	0.013	2.308	1.905	1.21	0.8938	109	0.02071	2.58	0.34	0.82	1.79	82.31	81.53	0.45	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.058
		tr02100	tr02000	80.15	79.47	83.460	2.260	1050	111.74	0.013	2.308	2.222	1.04	0.8938	106	0.02071	2.58	0.34	0.81	1.92	83.12	82.31	0.61	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.058
		tr02200	tr02100	80.37	80.15	83.770	2.350	1050	95.92	0.013	2.308	1.364	1.69	0.8938	91	0.02071	2.58	0.34	0.70	2.35	83.77	83.12	0.23	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.058
																					83.77											
	Glen Cairn	gt00100	tr02200	81.21	80.49	83.590	1.180	1200	134.70	0.013	1.275	2.974	0.43	1.1675	112	0.01981	1.092	0.061	0.143	1.18	83.59	83.77	0.535	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.008
		gt00200	gt00100	82.61	81.78	84.980	1.170	1200	149.36	0.013	1.275	3.032	0.42	1.1675	124	0.01981	1.092	0.061	0.157	0.00	83.81	83.59	0.556	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.008
		gt00300	gt00200	83.40	82.60	86.290	1.690	1200	151.94	0.013	1.275	2.951	0.43	1.1675	127	0.01981	1.092	0.061	0.160	0.00	84.60	83.81	0.527	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.008
		gt00400	gt00300	84.92	84.12	87.780	1.660	1200	148.72	0.013	1.275	2.983	0.43	1.1675	124	0.01981	1.092	0.061	0.157	0.00	86.12	85.32	0.538	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.008
		gt00500	gt00400	86.40	85.62	89.990	2.390	1200	149.36	0.013	1.275	2.939	0.43	1.1675	124	0.01981	1.092	0.061	0.157	0.00	87.60	86.82	0.522	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.008
North Kanata Trunk																					68.91	<- OUTLET										
2031	TTC	tr01100	tr01000	72.89	72.13	75.550	1.610	1050	53.46	0.013	3.689	3.397	1.09	0.8938	51	0.02071	4.13	0.87	2.21	1.45	75.39	73.18	1.42	1800	1050	1050	90	0.171	1.00	1.32	**1.491**	1.295
		tr01200	tr01100	73.17	72.89	75.670	1.450	1050	107.68	0.013	3.689	1.453	2.54	0.8938	103	0.02071	4.13	0.87	1.99	1.45	75.67	75.39	0.26	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.149
		tr01300	tr01200	73.62	73.17	76.660	1.990	1050	102.72	0.013	3.689	1.886	1.96	0.8938	98	0.02071	4.13	0.87	1.91	1.99	76.66	75.67	0.44	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.149
		tr01400	tr01300	75.37	73.62	78.490	2.070	1050	119.36	0.013	3.689	3.449	1.07	0.8938	114	0.02071	4.13	0.87	2.19	2.07	78.49	76.66	1.47	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.149
		tr01500	tr01400	77.37	75.37	80.640	2.220	1050	120.36	0.013	3.689	3.672	1.00	0.8938	115	0.02071	4.13	0.87	3.36	2.22	80.64	78.49	1.66	1800	1050	1050	90	0.171	1.00	1.32	**1.491**	1.295
		tr01600	tr01500	77.69	77.37	80.570	1.830	1050	117.33	0.013	3.689	1.488	2.48	0.8938	112	0.02071	4.13	0.87	2.16	1.83	80.57	80.64	0.27	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.149
		tr01700	tr01600	78.01	77.69	80.890	1.830	1050	116.71	0.013	3.689	1.492	2.47	0.8938	111	0.02071	4.13	0.87	2.15	1.83	80.89	80.57	0.27	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.149
		tr01800	tr01700	78.37	78.01	80.720	1.300	1050	117.99	0.013	3.689	1.574	2.34	0.8938	112	0.02071	4.13	0.87	2.17	1.30	80.72	80.89	0.31	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.149
		tr01900	tr01800	78.96	78.37	81.800	1.790	1050	112.04	0.013	3.689	2.067	1.78	0.8938	107	0.02071	4.13	0.87	2.07	1.79	81.80	80.72	0.53	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.149
		tr02000	tr01900	79.47	78.96	82.310	1.790	1050	114.05	0.013	3.689	1.905	1.94	0.8938	109	0.02071	4.13	0.87	2.10	1.79	82.31	81.80	0.45	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.149
		tr02100	tr02000	80.15	79.47	83.460	2.260	1050	111.74	0.013	3.689	2.222	1.66	0.8938	106	0.02071	4.13	0.87	2.06	2.26	83.46	82.31	0.61	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.149
		tr02200	tr02100	80.37	80.15	83.770	2.350	1050	95.92	0.013	3.689	1.364	2.70	0.8938	91	0.02071	4.13	0.87	1.79	2.35	83.77	83.46	0.23	1800	1050	1050	0	0.171	1.00	0	**0.171**	0.149
																					83.77											
	Glen Cairn	gt00100	tr02200	81.21	80.49	83.590	1.180	1200	134.70	0.013	2.932	2.974	0.99	1.1675	112	0.01981	2.512	0.322	0.755	1.18	83.59	83.77	0.535	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.040
		gt00200	gt00100	82.61	81.78	84.980	1.170	1200	149.36	0.013	2.932	3.032	0.97	1.1675	124	0.01981	2.512	0.322	0.833	0.00	83.81	83.59	0.556	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.040
		gt00300	gt00200	83.40	82.60	86.290	1.690	1200	151.94	0.013	2.932	2.951	0.99	1.1675	127	0.01981	2.512	0.322	0.847	0.00	84.60	83.81	0.527	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.040
		gt00400	gt00300	84.92	84.12	87.780	1.660	1200	148.72	0.013	2.932	2.983	0.98	1.1675	124	0.01981	2.512	0.322	0.830	0.00	86.12	85.32	0.538	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.040
		gt00500	gt00400	86.40	85.62	89.990	2.390	1200	149.36	0.013	2.932	2.939	1.00	1.1675	124	0.01981	2.512	0.322	0.833	0.00	87.60	86.82	0.522	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.040

DESIGN PARAMETERS

Average Daily Flow=	350 L/cap/day	Industrial Peak Factor= per MOE graph		HGL=Major + Minor Losses	
Comm/Inst Flow=	50000 L/ha/day	Extraneous Flow=	0.28 L/s/ha	Major Loss= Pipe Friction (Darcy-Weisbach)	
Industrial Flow=	35000 L/ha/day	Minimum Velocity=	0.60 m/s	Minor Loss= Head loss correction for flow through MH,	
Max Res Peak Factor=	4.00	Manning's n=	0.013	changes in pipe size, and pipe bends	
Comm Peak Factor=	1.50			Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6	
Indst Peak Factor=	1.50				

Designed: KJM	PROJECT: 101108 - Fernbank CDP
Checked: MAB	CLIENT:
Dwg. Reference:	Date: May 8, 2009

TABLE D-10: FERNBANK CDP - NEW (1350mm) TRI TOWNSHIP COLLECTOR AND GLEN CAIRN TRUNK SANITARY SEWER: HYDRAULIC GRADE LINE ANALYSIS (2006-2031)

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.

The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The HGL slope is calculated and the minimum USF is established +0.30m above the HGL.

Bend Coefficients			
0	45	90	<----Bend (in degrees)
0.00	0.29	1.02	900 mm pipe or greater (benching)
0.00	0.40	1.32	825 mm pipe or smaller (300 mm sump)

YEAR	LOCATION	MANHOLE Upstream	MANHOLE Downstream	INVERT ELEVATION U/S (m)	INVERT ELEVATION D/S (m)	GROUND ELEVATION Upstream (m)	COVER Upstream (m)	PIPE PARAMETERS Dia (mm)	Length (m)	'n'	TOTAL FLOW (m^3/s)	Q_{cap} (m^3/s)	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HEAD LOSS HL (m)	SURCHARGE Upstream (m)	HGL Upstream (m)	HGL Downstream (m)	SLOPE (%)
North Kanata Trunk																					68.80	<- OUTLET	
2006	TTC	tr01100	tr01000	72.89	72.13	75.550	1.310	1350	53.46	0.013	2.308	6.639	0.35	1.4776	40	0.01905	1.56	0.12	0.28	0.00	74.24	73.48	1.42
		tr01200	tr01100	73.17	72.89	75.670	1.150	1350	107.68	0.013	2.308	2.839	0.81	1.4776	80	0.01905	1.56	0.12	0.21	0.00	74.52	74.24	0.26
		tr01300	tr01200	73.62	73.17	76.660	1.690	1350	102.72	0.013	2.308	3.685	0.63	1.4776	76	0.01905	1.56	0.12	0.20	0.00	74.97	74.52	0.44
		tr01400	tr01300	75.37	73.62	78.490	1.770	1350	119.36	0.013	2.308	6.742	0.34	1.4776	88	0.01905	1.56	0.12	0.23	0.00	76.72	74.97	1.47
		tr01500	tr01400	77.37	75.37	80.640	1.920	1350	120.36	0.013	2.308	7.178	0.32	1.4776	89	0.01905	1.56	0.12	0.40	0.00	78.72	76.72	1.66
		tr01600	tr01500	77.69	77.37	80.570	1.530	1350	117.33	0.013	2.308	2.908	0.79	1.4776	87	0.01905	1.56	0.12	0.23	0.00	79.04	78.72	0.27
		tr01700	tr01600	78.01	77.69	80.890	1.530	1350	116.71	0.013	2.308	2.916	0.79	1.4776	86	0.01905	1.56	0.12	0.23	0.00	79.36	79.04	0.27
		tr01800	tr01700	78.37	78.01	80.720	1.000	1350	117.99	0.013	2.308	3.076	0.75	1.4776	87	0.01905	1.56	0.12	0.23	0.00	79.72	79.36	0.31
		tr01900	tr01800	78.96	78.37	81.800	1.490	1350	112.04	0.013	2.308	4.041	0.57	1.4776	83	0.01905	1.56	0.12	0.22	0.00	80.31	79.72	0.53
		tr02000	tr01900	79.47	78.96	82.310	1.490	1350	114.05	0.013	2.308	3.723	0.62	1.4776	84	0.01905	1.56	0.12	0.22	0.00	80.82	80.31	0.45
		tr02100	tr02000	80.15	79.47	83.460	1.960	1350	111.74	0.013	2.308	4.344	0.53	1.4776	83	0.01905	1.56	0.12	0.22	0.00	81.50	80.82	0.61
		tr02200	tr02100	80.37	80.15	83.770	2.050	1350	95.92	0.013	2.308	2.667	0.87	1.4776	71	0.01905	1.56	0.12	0.19	0.00	81.72	81.50	0.23
																					81.72		
	Glen Cairn	gt00100	tr02200	81.21	80.49	83.590	1.180	1200	134.70	0.013	1.275	2.974	0.43	1.1675	112	0.01981	1.092	0.061	0.143	0.00	82.41	81.72	0.53
		gt00200	gt00100	82.61	81.78	84.980	1.170	1200	149.36	0.013	1.275	3.032	0.42	1.1675	124	0.01981	1.092	0.061	0.157	0.00	83.81	82.98	0.56
		gt00300	gt00200	83.40	82.60	86.290	1.690	1200	151.94	0.013	1.275	2.951	0.43	1.1675	127	0.01981	1.092	0.061	0.160	0.00	84.60	83.81	0.53
		gt00400	gt00300	84.92	84.12	87.780	1.660	1200	148.72	0.013	1.275	2.983	0.43	1.1675	124	0.01981	1.092	0.061	0.157	0.00	86.12	85.32	0.54
		gt00500	gt00400	86.40	85.62	89.990	2.390	1200	149.36	0.013	1.275	2.939	0.43	1.1675	124	0.01981	1.092	0.061	0.157	0.00	87.60	86.82	0.52
North Kanata Trunk																					68.91	<- OUTLET	
2031	TTC	tr01100	tr01000	72.89	72.13	75.550	1.310	1350	53.46	0.013	3.689	6.639	0.56	1.4776	40	0.01905	2.50	0.32	0.72	0.00	74.24	73.48	1.42
		tr01200	tr01100	73.17	72.89	75.670	1.150	1350	107.68	0.013	3.689	2.839	1.30	1.4776	80	0.01905	2.50	0.32	0.54	0.26	74.78	74.24	0.26
		tr01300	tr01200	73.62	73.17	76.660	1.690	1350	102.72	0.013	3.689	3.685	1.00	1.4776	76	0.01905	2.50	0.32	0.52	0.33	75.30	74.78	0.44
		tr01400	tr01300	75.37	73.62	78.490	1.770	1350	119.36	0.013	3.689	6.742	0.55	1.4776	88	0.01905	2.50	0.32	0.59	0.00	76.72	75.30	1.47
		tr01500	tr01400	77.37	75.37	80.640	1.920	1350	120.36	0.013	3.689	7.178	0.51	1.4776	89	0.01905	2.50	0.32	1.02	0.00	78.72	76.72	1.66
		tr01600	tr01500	77.69	77.37	80.570	1.530	1350	117.33	0.013	3.689	2.908	1.27	1.4776	87	0.01905	2.50	0.32	0.58	0.26	79.30	78.72	0.27
		tr01700	tr01600	78.01	77.69	80.890	1.530	1350	116.71	0.013	3.689	2.916	1.27	1.4776	86	0.01905	2.50	0.32	0.58	0.52	79.88	79.30	0.27
		tr01800	tr01700	78.37	78.01	80.720	1.000	1350	117.99	0.013	3.689	3.076	1.20	1.4776	87	0.01905	2.50	0.32	0.59	0.75	80.47	79.88	0.31
		tr01900	tr01800	78.96	78.37	81.800	1.490	1350	112.04	0.013	3.689	4.041	0.91	1.4776	83	0.01905	2.50	0.32	0.56	0.72	81.03	80.47	0.53
		tr02000	tr01900	79.47	78.96	82.310	1.490	1350	114.05	0.013	3.689	3.723	0.99	1.4776	84	0.01905	2.50	0.32	0.57	0.77	81.59	81.03	0.45
		tr02100	tr02000	80.15	79.47	83.460	1.960	1350	111.74	0.013	3.689	4.344	0.85	1.4776	83	0.01905	2.50	0.32	0.56	0.65	82.15	81.59	0.61
		tr02200	tr02100	80.37	80.15	83.770	2.050	1350	95.92	0.013	3.689	2.667	1.38	1.4776	71	0.01905	2.50	0.32	0.49	0.92	82.64	82.15	0.23
																					82.64		
	Glen Cairn	gt00100	tr02200	81.21	80.49	83.590	1.180	1200	134.70	0.013	2.932	2.974	0.99	1.1675	112	0.01981	2.512	0.322	0.755	0.98	83.39	82.64	0.53
		gt00200	gt00100	82.61	81.78	84.980	1.170	1200	149.36	0.013	2.932	3.032	0.97	1.1675	124	0.01981	2.512	0.322	0.833	0.00	83.81	83.39	0.56
		gt00300	gt00200	83.40	82.60	86.290	1.690	1200	151.94	0.013	2.932	2.951	0.99	1.1675	127	0.01981	2.512	0.322	0.847	0.00	84.60	83.81	0.53
		gt00400	gt00300	84.92	84.12	87.780	1.660	1200	148.72	0.013	2.932	2.983	0.98	1.1675	124	0.01981	2.512	0.322	0.830	0.00	86.12	85.32	0.54
		gt00500	gt00400	86.40	85.62	89.990	2.390	1200	149.36	0.013	2.932	2.939	1.00	1.1675	124	0.01981	2.512	0.322	0.833	0.00	87.60	86.82	0.52

Manhole (Upstream)	Manhole Loss Diameters (mm) U/S MH	Pipe In	Pipe Out	Bend Angle	K_O	C_D	K_b	K_{tot}	HL_{MH} (m)
tr01100 (2006)	2400	1350	1350	90	0.178	1.00	1.32	**1.498**	0.186
tr01200	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.022
tr01300	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.022
tr01400	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.022
tr01500	2400	1350	1350	90	0.178	1.00	1.32	**1.498**	0.186
tr01600	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.022
tr01700	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.022
tr01800	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.022
tr01900	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.022
tr02000	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.022
tr02100	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.022
tr02200	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.022
gt00100	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.008
gt00200	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.008
gt00300	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.008
gt00400	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.008
gt00500	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.008
tr01100 (2031)	2400	1350	1350	90	0.178	1.00	1.32	**1.498**	0.476
tr01200	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.056
tr01300	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.056
tr01400	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.056
tr01500	2400	1350	1350	90	0.178	1.00	1.32	**1.498**	0.476
tr01600	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.056
tr01700	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.056
tr01800	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.056
tr01900	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.056
tr02000	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.056
tr02100	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.056
tr02200	2400	1350	1350	0	0.178	1.00	0	**0.178**	0.056
gt00100	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.040
gt00200	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.040
gt00300	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.040
gt00400	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.040
gt00500	1500	1200	1200	0	0.125	1.00	0	**0.125**	0.040

DESIGN PARAMETERS

Average Daily Flow= 350 L/cap/day	Industrial Peak Factor= per MOE graph	HGL=Major + Minor Losses	Designed: KJM	PROJECT: 101108 - Fernbank CDP
Comm/Inst Flow= 50000 L/ha/day	Extraneous Flow= 0.28 L/s/ha	Major Loss= Pipe Friction (Darcy-Weisbach)		
Industrial Flow= 35000 L/ha/day	Minimum Velocity= 0.60 m/s	Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends	Checked: MAB	CLIENT:
Max Res Peak Factor= 4.00	Manning's n= 0.013	Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6		
Comm Peak Factor= 1.50				
Indst Peak Factor= 1.50			Dwg. Reference:	Date: May 8, 2009

TABLE D-11: FERNBANK CDP - NORTH KANATA TRUNK
SANITARY SEWER: HYDRAULIC GRADE LINE ANALYSIS (2006-2031)

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.

The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The HGL slope is calculated and the minimum USF is established +0.30m above the HGL.

Bend Coefficients			
0	45	90	<----Bend (in degrees)
0.00	0.29	1.02	900 mm pipe or greater (benching)
0.00	0.40	1.32	825 mm pipe or smaller (300 mm sump)

YEAR	LOCATION	MANHOLE		INVERT ELEVATION		GROUND ELEVATION	COVER	PIPE PARAMETERS			TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL		SLOPE
		Upstream	Downstream	U/S (m)	D/S (m)	Upstream (m)	Upstream (m)	Dia (mm)	Length (m)	'n'	(m^3/s)	(m^3/s)		Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	Upstream (m)	Upstream (m)	Downstream (m)	(%)
Watts Creek Collector																					**67.50**	**<- OUTLET**	
2006	**North Kanata**	MH1	wa02700	65.72	65.67	73.54	6.020	1800	16.54	0.013	2.380	6.593	0.36	2.6268	9.2	0.01731	0.91	0.04	0.03	0.00	67.52	67.50	0.30
		MH2	MH1	65.96	65.73	73.11	5.350	1800	151.99	0.013	2.380	4.665	0.51	2.6268	84.4	0.01731	0.91	0.04	0.07	0.00	67.76	67.53	0.15
		MH3	MH2	66.17	65.97	73.44	5.470	1800	152.00	0.013	2.380	4.350	0.55	2.6268	84.4	0.01731	0.91	0.04	0.07	0.00	67.97	67.77	0.13
		MH4	MH3	66.38	66.20	73.10	4.920	1800	163.81	0.013	2.380	3.975	0.60	2.6268	91.0	0.01731	0.91	0.04	0.07	0.00	68.18	68.00	0.11
		MH5	MH4	66.48	66.38	73.00	4.720	1800	87.36	0.013	2.380	4.057	0.59	2.6268	48.5	0.01731	0.91	0.04	0.04	0.00	68.28	68.18	0.11
		MH6	MH5	66.76	66.48	75.35	6.790	1800	118.98	0.013	2.380	5.817	0.41	2.6268	66.1	0.01731	0.91	0.04	0.07	0.00	68.56	68.28	0.24
		MH7	MH6	67.00	66.78	74.57	5.770	1800	165.13	0.013	2.380	4.377	0.54	2.6268	91.7	0.01731	0.91	0.04	0.09	0.00	68.80	68.58	0.13
Watts Creek Collector																					**67.50**	**<- OUTLET**	
2031	**North Kanata**	MH1	wa02700	65.72	65.67	73.54	6.020	1800	16.54	0.013	4.647	6.593	0.70	2.6268	9.2	0.01731	1.77	0.16	0.10	0.00	67.52	67.50	0.30
		MH2	MH1	65.96	65.73	73.11	5.350	1800	151.99	0.013	4.647	4.665	1.00	2.6268	84.4	0.01731	1.77	0.16	0.26	0.00	67.76	67.53	0.15
		MH3	MH2	66.17	65.97	73.44	5.470	1800	152.00	0.013	4.647	4.350	1.07	2.6268	84.4	0.01731	1.77	0.16	0.26	0.06	68.03	67.77	0.13
		MH4	MH3	66.38	66.20	73.10	4.920	1800	163.81	0.013	4.647	3.975	1.17	2.6268	91.0	0.01731	1.77	0.16	0.28	0.13	68.31	68.03	0.11
		MH5	MH4	66.48	66.38	73.00	4.720	1800	87.36	0.013	4.647	4.057	1.15	2.6268	48.5	0.01731	1.77	0.16	0.16	0.19	68.47	68.31	0.11
		MH6	MH5	66.76	66.48	75.35	6.790	1800	118.98	0.013	4.647	5.817	0.80	2.6268	66.1	0.01731	1.77	0.16	0.26	0.00	68.56	68.47	0.24
		MH7	MH6	67.00	66.78	74.57	5.770	1800	165.13	0.013	4.647	4.377	1.06	2.6268	91.7	0.01731	1.77	0.16	0.33	0.11	68.91	68.58	0.13

MANHOLE LOSS								
Diameters (mm)			Bend Angle	K_O	C_D	K_b	K_{tot}	HL_{MH} (m)
U/S MH	Pipe In	Pipe Out						
3000	1800	1800	45	0.167	1.00	0.29	**0.457**	0.019
3000	1800	1800	0	0.167	1.00	0	**0.167**	0.007
3000	1800	1800	0	0.167	1.00	0	**0.167**	0.007
3000	1800	1800	0	0.167	1.00	0	**0.167**	0.007
3000	1800	1800	0	0.167	1.00	0	**0.167**	0.007
3000	1800	1800	45	0.167	1.00	0.29	**0.457**	0.019
3000	1800	1800	45	0.167	1.00	0.29	**0.457**	0.019
3000	1800	1800	45	0.167	1.00	0.29	**0.457**	0.073
3000	1800	1800	0	0.167	1.00	0	**0.167**	0.027
3000	1800	1800	0	0.167	1.00	0	**0.167**	0.027
3000	1800	1800	0	0.167	1.00	0	**0.167**	0.027
3000	1800	1800	0	0.167	1.00	0	**0.167**	0.027
3000	1800	1800	45	0.167	1.00	0.29	**0.457**	0.073
3000	1800	1800	45	0.167	1.00	0.29	**0.457**	0.073

DESIGN PARAMETERS

Average Daily Flow=	350	L/cap/day	Industrial Peak Factor=	per MOE graph	
Comm/Inst Flow=	50000	L/ha/day	Extraneous Flow=	0.28	L/s/ha
Industrial Flow=	35000	L/ha/day	Minimum Velocity=	0.60	m/s
Max Res Peak Factor=	4.00		Manning's n=	0.013	
Comm Peak Factor=	1.50				
Indst Peak Factor=	1.50				

HGL=Major + Minor Losses

Major Loss= Pipe Friction (Darcy-Weisbach)

Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends

Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6

Designed: KJM

Checked: MAB

Dwg. Reference:

PROJECT:
101108 - Fernbank CDP

CLIENT:

Date: May 8, 2009

TABLE D-12: ALTERNATIVE EVALUATION
CAPITAL COST ESTIMATES

Pipe Diameter (mm)	Cost/m	57.5% Capital Allowance	Length of Pipe (m)		
			Alternative 1	Alternative 2	Alternative 3
525	$ 273.41	$ 430.62	1926	3204	1295
600	$ 329.66	$ 519.21	1185		740
675	$ 411.43	$ 648.00		652	518
750	$ 502.39	$ 791.26			972
825	$ 616.00	$ 970.20	652		
Increased KW Pipe Diameter					
600->750	$ 172.73	$ 272.05		760	
600->825	$ 286.34	$ 450.99			760
Total Capital Cost			**$ 2,077,215.15**	**$ 2,008,964.16**	**$ 2,389,395.60**

TABLE D-13: PRESENT WORTH ANALYSIS
STITTSVILLE TRUNK (MAINTAIN OR ABANDON)

Existing Stittsville Trunk & New Fernbank Trunk

Present Worth Analysis

Description		Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Capital Costs																																						
Fernbank Trunk Construction																																						
Fernbank Trunk Capital Allowance	**57.50%**		$131,748	$395,245																																		
(Engineering/Contingency/PM/Construction Supervision)																																						
	Length (m)	**Cost/m**																																				
825mmØ SAN	652	$616.00		$401,632																																		
600mmØ SAN	1007	$329.66		$331,968																																		
525mm Ø SAN	669	$273.41		$182,911																																		
Total Capital Costs			$131,748	$1,311,756	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operating and Maintenance Costs																																						
	Length (m)	**Cost/m**																																				
Fernbank Trunk O & M	2328	$5.851			**$13,621**	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621
Stittsville Trunk O & M	2328	$5.851	**$13,621**	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621
Total O&M Costs			$13,621	$13,621	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242
TOTAL CAPITAL AND O&M COSTS			$145,370	$1,325,377	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242
PRESENT VALUE FACTOR	**5%**		1.0000	0.9524	0.9070	0.8638	0.8227	0.7835	0.7462	0.7107	0.6768	0.6446	0.6139	0.5847	0.5568	0.5303	0.5051	0.4810	0.4581	0.4363	0.4155	0.3957	0.3769	0.3589	0.3418	0.3256	0.3101	0.2953	0.2812	0.2678	0.2551	0.2429	0.2314	0.2204	0.2099	0.1999	0.1904	0.1813
PRESENT VALUE (2010)	**$1,908,627**		$145,370	$1,262,264	$24,710	$23,533	$22,412	$21,345	$20,329	$19,361	$18,439	$17,561	$16,724	$15,928	$15,170	$14,447	$13,759	$13,104	$12,480	$11,886	$11,320	$10,781	$10,267	$9,778	$9,313	$8,869	$8,447	$8,045	$7,662	$7,297	$6,949	$6,618	$6,303	$6,003	$5,717	$5,445	$5,186	$4,939
			$145,370	$1,407,634	$1,432,343	$1,455,876	$1,478,288	$1,499,633	$1,519,962	$1,539,323	$1,557,761	$1,575,322	$1,592,046	$1,607,974	$1,623,144	$1,637,591	$1,651,350	$1,664,454	$1,676,934	$1,688,820	$1,700,139	$1,710,920	$1,721,187	$1,730,966	$1,740,279	$1,749,148	$1,757,595	$1,765,640	$1,773,301	$1,780,598	$1,787,547	$1,794,166	$1,800,469	$1,806,472	$1,812,189	$1,817,634	$1,822,820	$1,827,759

$1,908,627

Year	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621
	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621
	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242
	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242	$27,242
	0.1727	0.1644	0.1566	0.1491	0.1420	0.1353	0.1288	0.1227	0.1169	0.1113	0.1060	0.1009	0.0961	0.0916	0.0872	0.0831	0.0791	0.0753	0.0717	0.0683	0.0651	0.0620	0.0590	0.0562	0.0535	0.0510	0.0486	0.0462	0.0440	0.0419	0.0399	0.0380	0.0362	0.0345	0.0329
	$4,704	$4,480	$4,266	$4,063	$3,870	$3,685	$3,510	$3,343	$3,184	$3,032	$2,888	$2,750	$2,619	$2,494	$2,376	$2,263	$2,155	$2,052	$1,954	$1,861	$1,773	$1,688	$1,608	$1,531	$1,458	$1,389	$1,323	$1,260	$1,200	$1,143	$1,088	$1,036	$987	$940	$895
	$2,914,721	$2,919,201	$2,923,467	$2,927,530	$2,931,400	$2,935,085	$2,938,595	$2,941,938	$2,945,121	$2,948,153	$2,951,041	$2,953,791	$2,956,410	$2,958,905	$2,961,280	$2,963,543	$2,965,697	$2,967,750	$2,969,704	$2,971,565	$2,973,338	$2,975,026	$2,976,634	$2,978,166	$2,979,624	$2,981,013	$2,982,336	$2,983,596	$2,984,796	$2,985,938	$2,987,027	$2,988,063	$2,989,050	$2,989,990	$2,990,886

Abandoned Stittsville Trunk + Oversized Fernbank Trunk

Present Worth Analysis

Description		Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Capital Costs																																						
Fernbank Trunk Construction																																						
Fernbank Trunk Capital Allowance	**57.50%**		$184,789	$554,367																																		
(Engineering/Contingency/PM/Construction Supervision)																																						
	Length (m)	**Cost/m**																																				
900mmØ SAN	652	$680.19		$443,484																																		
750mmØ SAN	1007	$502.39		$505,907																																		
750mmØ SAN	669	$502.39		$336,099																																		
Total Capital Costs			$184,789	$1,839,857	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operating and Maintenance Costs																																						
	Length (m)	**Cost/m**																																				
Fernbank Trunk O & M	2328	$5.851			**$13,621**	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621
Stittsville Trunk O & M	2328	$5.851	**$13,621**	$13,621	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Costs			$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621
TOTAL CAPITAL AND O&M COSTS			$198,410	$1,853,478	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621
PRESENT VALUE FACTOR	**5%**		1.0000	0.9524	0.9070	0.8638	0.8227	0.7835	0.7462	0.7107	0.6768	0.6446	0.6139	0.5847	0.5568	0.5303	0.5051	0.4810	0.4581	0.4363	0.4155	0.3957	0.3769	0.3589	0.3418	0.3256	0.3101	0.2953	0.2812	0.2678	0.2551	0.2429	0.2314	0.2204	0.2099	0.1999	0.1904	0.1813
PRESENT VALUE (2010)	**$2,214,124**		$198,410	$1,765,217	$12,355	$11,766	$11,206	$10,673	$10,164	$9,680	$9,219	$8,780	$8,362	$7,964	$7,585	$7,224	$6,880	$6,552	$6,240	$5,943	$5,660	$5,390	$5,134	$4,889	$4,656	$4,435	$4,223	$4,022	$3,831	$3,648	$3,475	$3,309	$3,152	$3,002	$2,859	$2,722	$2,593	$2,469
			$198,410	$1,963,627	$1,975,982	$1,987,749	$1,998,955	$2,009,627	$2,019,792	$2,029,472	$2,038,691	$2,047,471	$2,055,834	$2,063,798	$2,071,382	$2,078,606	$2,085,486	$2,092,038	$2,098,278	$2,104,220	$2,109,880	$2,115,271	$2,120,404	$2,125,293	$2,129,950	$2,134,384	$2,138,608	$2,142,630	$2,146,461	$2,150,110	$2,153,584	$2,156,893	$2,160,045	$2,163,047	$2,165,905	$2,168,628	$2,171,221	$2,173,690

$2,214,124

Year	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621
	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621
	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621	$13,621
	0.1727	0.1644	0.1566	0.1491	0.1420	0.1353	0.1288	0.1227	0.1169	0.1113	0.1060	0.1009	0.0961	0.0916	0.0872	0.0831	0.0791	0.0753	0.0717	0.0683	0.0651	0.0620	0.0590	0.0562	0.0535	0.0510	0.0486	0.0462	0.0440	0.0419	0.0399	0.0380	0.0362	0.0345	0.0329
	$2,352	$2,240	$2,133	$2,032	$1,935	$1,843	$1,755	$1,671	$1,592	$1,516	$1,444	$1,375	$1,310	$1,247	$1,188	$1,131	$1,077	$1,026	$977	$931	$886	$844	$804	$766	$729	$694	$661	$630	$600	$571	$544	$518	$494	$470	$448
	$3,694,003	$3,696,242	$3,698,375	$3,700,407	$3,702,342	$3,704,185	$3,705,940	$3,707,611	$3,709,203	$3,710,719	$3,712,162	$3,713,537	$3,714,847	$3,716,094	$3,717,282	$3,718,413	$3,719,491	$3,720,517	$3,721,494	$3,722,425	$3,723,311	$3,724,155	$3,724,959	$3,725,725	$3,726,454	$3,727,149	$3,727,810	$3,728,440	$3,729,040	$3,729,611	$3,730,155	$3,730,674	$3,731,167	$3,731,637	$3,732,085

APPENDIX E

Hazeldean Pump Station

Tables

Figures

TABLE E-1: Hazeldean Pump Station Sewershed, Growth Projections

RESIDENTIAL AREA GROWTH

AREA	PARCEL NUMBER	UNIT POTENTIAL	PARCEL SIZE (net ha)	UNIT DENSITY (units/net ha)	POPULATION GROWTH (I.CROSS)
	149	2	0.05	40.0	6
	152	2	0.07	28.6	7
	153	18	1.05	17.1	59
	154	44	1.54	28.6	145
	158	68	2.22	30.8	204
	159	15	0.62	24.2	50
	161	18	0.71	25.4	59
	163	268	5.69	47.1	804
	164	30	0.70	42.9	75
	165	130	4.45	29.2	325
	166	3	0.13	23.1	10
	168	223	16.72	13.3	736
	169	1,068	34.68	30.8	3,204
	170	82	2.59	30.8	205
	171	21	0.76	27.6	53
	172	2	0.17	11.8	7
	180	180	3.30	30.8	540
	182	166	5.95	27.9	415
	183	50	2.29	21.8	145
Kanata West	184	850	41.18	20.6	2,550
Kanata West	185	1,246	26.95	46.2	3,738
	189	35	1.60	21.9	116
Kanata West	192	180	5.00	36.0	540
SOHO	193	1,288	28.70	44.9	3,864
Bridlewood Trails	194	392	5.50	71.3	1,176
Kanata West	201	1,351	43.58	31.0	4,053
Fernbank	202-204/206-209/212	10,977	444.50	29.0	31,351
	210	230	3.29	70.0	691
	211	604	13.43	45.0	1,813
Kanata West	213	1,602	17.80	90.0	4,806
Kanata West	214	503	8.39	60.0	1,510
	250	11	0.75	14.7	33
	251	7	0.50	14.0	21
	252	28	1.72	16.3	92
	253	41	1.33	30.8	123
	255	15	0.50	30.8	45
	256	11	0.77	14.3	36
	257	23	1.21	19.0	76
	259	107	3.69	29.0	353
	261	60	2.36	25.4	198
	263	113	5.21	21.7	339
Harris Lands	264	229	11.66	19.6	687
	265	136	4.41	30.8	408
Westwood Phase 1,2,3	266	128	6.87	18.6	422
	267	15	0.77	19.5	50
	269	43	3.00	14.3	142
Jackson Trails	270	584	19.29	30.3	1,752
	271	29	0.61	47.5	73
	272	96	3.00	32.0	240
Longwood Cardel	273	255	8.27	30.8	765
Longwood Cardel	274	159	5.15	30.8	477
Longwood Cardel	275	160	5.20	30.8	480
Longwood Cardel	276	139	4.52	30.8	417
Hartin Street Subdivision	277	130	2.28	57.0	390
	278	14	1.18	11.9	46
Westwood Phase 1,2,3	279	168	9.08	18.5	554
Westwood Phase 1,2,3	280	155	6.83	22.7	512
			833.77		**71,988**
			646.16	**<--KW Online**	**50,510**

<--KW Online

EMPLOYMENT AREA GROWTH

Employment Area	Parcel Number	Parcel Size (net ha)
Kanata South Business Park	1	5.4
	2	0.9
	3	9.7
	4	2.4
	7	3.6
	8	3.4
	9	1.3
	10	1.0
	11	1.2
	12	0.5
	13	0.4
	14	0.5
	15	0.1
	16	2.1
	17	1.0
	18	1.7
	19	0.1
	20	0.9
	21	0.6
	22	0.8
	23	0.5
	24	2.1
	25	0.9
	26	1.6
Ottawa-Goulbourn Business Park (Iber Rd.)	1	0.7
	2	0.6
	3	0.6
	4	1.8
	5	1.7
	6	1.7
	7	0.4
	8	3.0
	9	3.7
	10	0.7
	11	1.2
Stittsville, Hazeldean Road Commercial Lands	O	6.5
	N	3.8
	P	1.3
	Q	4.0
	R	0.9
	U	4.5
	T	3.1
	S	2.4
Kanata West Mixed Use Centre	L	20.5
	M	32.6
Kanata West Enterprise Area	6	13.8
	7	34.3
Fernbank ICI Area	-	99.5
		286.0
	KW Online-->	**162.7**

--> Area Tributary to KWPS when it comes online

TABLE E-2: Hazeldean Pump Station,Future Design Flow

350	Res Flow (L/c/d)
0.28	Infiltration
1.5	ICI Peaking Factor
50000	ICI Flow (L/s/ha)

Future Design Flows at Hazeldean Pump Station

WITH Kanata West

Year	Residential Flow					ICI Flow			Total Increase (L/s)	Total Flow (L/s)
	Population	Residential Peak Factor	Pop. Flow Increase (L/s)	Infiltration (L/s)	Total Residential Flow Increase	ICI Flow Increase (L/s)	Infiltration (L/s)	Total ICI Flow Increase (L/s)		
2006	56201	2.2	0.00	0.00	0.00	0.0	0.00	0.00	0.00	**760.14**
2007	58901	2.2	24.05	8.76	32.81	9.3	3.00	12.31	45.12	**805.26**
2008	61601	2.2	23.67	8.76	32.42	9.3	3.00	12.31	44.74	**850.00**
2009	64301	2.2	23.31	8.76	32.07	9.3	3.00	12.31	44.38	**894.38**
2010	67001	2.1	22.98	8.76	31.74	9.3	3.00	12.31	44.05	**938.43**
2011	69701	2.1	22.67	8.76	31.43	9.3	3.00	12.31	43.74	**982.18**
2012	72401	2.1	22.38	8.76	31.14	9.3	3.00	12.31	43.46	**1025.63**
2013	75101	2.1	22.12	8.76	30.87	9.3	3.00	12.31	43.19	**1068.82**
2014	77801	2.1	21.86	8.76	30.62	9.3	3.00	12.31	42.93	**1111.75**
2015	80501	2.1	21.62	8.76	30.38	9.3	3.00	12.31	42.69	**1154.45**
2016	83201	2.1	21.40	8.76	30.16	9.3	3.00	12.31	42.47	**1196.92**
2017	85901	2.1	21.19	8.76	29.94	9.3	3.00	12.31	42.26	**1239.17**
2018	88601	2.0	20.99	8.76	29.74	9.3	3.00	12.31	42.06	**1281.23**
2019	91301	2.0	20.80	8.76	29.55	9.3	3.00	12.31	41.87	**1323.10**
2020	94001	2.0	20.61	8.76	29.37	9.3	3.00	12.31	41.69	**1364.78**
2021	96701	2.0	20.44	8.76	29.20	9.3	3.00	12.31	41.51	**1406.29**
2022	99401	2.0	20.28	8.76	29.03	9.3	3.00	12.31	41.35	**1447.64**
2023	102101	2.0	21.50	8.76	30.26	9.3	3.00	12.31	42.57	**1490.21**
2024	104801	2.0	21.88	8.76	30.63	9.3	3.00	12.31	42.95	**1533.16**
2025	107501	2.0	21.88	8.76	30.63	9.3	3.00	12.31	42.95	**1576.11**
2026	110201	2.0	21.88	8.76	30.63	9.3	3.00	12.31	42.95	**1619.05**
2027	112901	2.0	21.88	8.76	30.63	9.3	3.00	12.31	42.95	**1662.00**
2028	115601	2.0	21.88	8.76	30.63	9.3	3.00	12.31	42.95	**1704.94**
2029	118301	2.0	21.88	8.76	30.63	9.3	3.00	12.31	42.95	**1747.89**
2030	121001	2.0	21.88	8.76	30.63	9.3	3.00	12.31	42.95	**1790.83**
2031	123701	2.0	21.88	8.76	30.63	9.3	3.00	12.31	42.95	**1833.78**
2032	126401	2.0	21.88	8.76	30.63	9.3	3.00	12.31	42.95	**1876.73**
2032.66	128189	2.0	14.49	5.80	20.28	6.2	1.99	8.16	28.44	**1905.16**
2033	128189	2.0	0.00	0.00	0.00	0.0	0	0.00	0.00	**1905.16**
2034	128189	2.0	0.00	0.00	0.00	0.0	0	0.00	0.00	**1905.16**

900	units/year
2700	people/year
26.66	years to buildout
31.27	ha/year Res
10.73	ha/year ICI

WITHOUT Kanata West

Year	Residential Flow					ICI Flow			Total Increase (L/s)	Total Flow (L/s)
	Population	Residential Peak Factor	Pop. Flow Increase (L/s)	Infiltration (L/s)	Total Residential Flow Increase	ICI Flow Increase (L/s)	Infiltration (L/s)	Total ICI Flow Increase (L/s)		
2006	53613	2.237	0.00	0.00	0.00	0.0	0.00	0.00	0.00	**721.19**
2007	55507	2.223	17.06	6.79	23.84	5.3	1.71	7.01	30.85	**752.04**
2008	57402	2.209	16.85	6.79	23.64	5.3	1.71	7.01	30.65	**782.68**
2009	59296	2.197	16.66	6.79	23.45	5.3	1.71	7.01	30.45	**813.14**
2010	61191	2.184	16.48	6.79	23.26	5.3	1.71	7.01	30.27	**843.41**
2011	63085	2.172	16.30	6.79	23.09	5.3	1.71	7.01	30.10	**873.50**
2012	64980	2.161	16.14	6.79	22.93	5.3	1.71	7.01	29.93	**903.44**
2013	66874	2.150	15.98	6.79	22.77	5.3	1.71	7.01	29.78	**933.22**
2014	68769	2.139	15.84	6.79	22.62	5.3	1.71	7.01	29.63	**962.85**
2015	70663	2.128	15.70	6.79	22.48	5.3	1.71	7.01	29.49	**992.33**
2016	72557	2.118	15.56	6.79	22.35	5.3	1.71	7.01	29.35	**1021.69**
2017	74452	2.109	15.43	6.79	22.22	5.3	1.71	7.01	29.22	**1050.91**
2018	76346	2.099	15.31	6.79	22.09	5.3	1.71	7.01	29.10	**1080.01**
2019	78241	2.090	15.19	6.79	21.98	5.3	1.71	7.01	28.98	**1108.99**
2020	80135	2.081	15.08	6.79	21.86	5.3	1.71	7.01	28.87	**1137.86**
2021	82030	2.072	14.97	6.79	21.75	5.3	1.71	7.01	28.76	**1166.62**
2022	83924	2.064	14.86	6.79	21.65	5.3	1.71	7.01	28.66	**1195.28**
2023	85818	2.056	14.76	6.79	21.55	5.3	1.71	7.01	28.55	**1223.83**
2024	87713	2.047	14.67	6.79	21.45	5.3	1.71	7.01	28.46	**1252.29**
2025	89607	2.040	14.57	6.79	21.36	5.3	1.71	7.01	28.36	**1280.66**
2026	91502	2.032	14.48	6.79	21.27	5.3	1.71	7.01	28.27	**1308.93**
2027	93396	2.025	14.40	6.79	21.18	5.3	1.71	7.01	28.19	**1337.12**
2028	95291	2.017	14.31	6.79	21.10	5.3	1.71	7.01	28.10	**1365.22**
2029	97185	2.010	14.23	6.79	21.02	5.3	1.71	7.01	28.02	**1393.25**
2030	99080	2.003	14.15	6.79	20.94	5.3	1.71	7.01	27.94	**1421.19**
2031	100974	2.000	14.74	6.79	21.53	5.3	1.71	7.01	28.53	**1449.72**
2032	102868	2.000	15.35	6.79	22.13	5.3	1.71	7.01	29.14	**1478.87**
2032.66	104123	2.000	10.16	4.49	14.66	3.5	1.13	4.64	19.30	**1498.16**
2033	104123	2.000	0.00	0.00	0.00	0.0	0	0.00	0.00	**1498.16**
2034	104123	2.000	0.00	0.00	0.00	0.0	0	0.00	0.00	**1498.16**

631	units/year
1894	people/year
26.66	years to buildout
24.24	ha/year Res
6.10	ha/year ICI

TABLE E-3: Hazeldean Pump Station, Projection of Monitored Flow

270	Res Flow (L/c/d)
0.28	Infiltration
1	ICI Peaking Factor
17000	ICI Flow (L/s/ha)

Future 'Monitored' Flows at Hazeldean Pump Station

WITH Kanata West

Year	Residential Flow					ICI Flow			Total Increase (L/s)	Total Flow (L/s)
	Population	Residential Peak Factor	Pop. Flow Increase (L/s)	Infiltration (L/s)	Total Residential Flow Increase	ICI Flow Increase (L/s)	Infiltration (L/s)	Total ICI Flow Increase (L/s)		
2006	56201	2.2	0.00	0.00	0.00	0.0	0.00	0.00	0.00	**785.45**
2007	58901	2.2	18.56	8.76	27.31	2.1	3.00	5.11	32.43	**817.87**
2008	61601	2.2	18.26	8.76	27.01	2.1	3.00	5.11	32.13	**850.00**
2009	64301	2.2	17.98	8.76	26.74	2.1	3.00	5.11	31.85	**881.85**
2010	67001	2.1	17.73	8.76	26.48	2.1	3.00	5.11	31.60	**913.45**
2011	69701	2.1	17.49	8.76	26.25	2.1	3.00	5.11	31.36	**944.81**
2012	72401	2.1	17.27	8.76	26.02	2.1	3.00	5.11	31.14	**975.95**
2013	75101	2.1	17.06	8.76	25.82	2.1	3.00	5.11	30.93	**1006.88**
2014	77801	2.1	16.87	8.76	25.62	2.1	3.00	5.11	30.74	**1037.62**
2015	80501	2.1	16.68	8.76	25.44	2.1	3.00	5.11	30.55	**1068.17**
2016	83201	2.1	16.51	8.76	25.26	2.1	3.00	5.11	30.38	**1098.55**
2017	85901	2.1	16.34	8.76	25.10	2.1	3.00	5.11	30.21	**1128.76**
2018	88601	2.0	16.19	8.76	24.95	2.1	3.00	5.11	30.06	**1158.82**
2019	91301	2.0	16.04	8.76	24.80	2.1	3.00	5.11	29.91	**1188.73**
2020	94001	2.0	15.90	8.76	24.66	2.1	3.00	5.11	29.77	**1218.50**
2021	96701	2.0	15.77	8.76	24.53	2.1	3.00	5.11	29.64	**1248.14**
2022	99401	2.0	15.64	8.76	24.40	2.1	3.00	5.11	29.51	**1277.66**
2023	102101	2.0	16.59	8.76	25.34	2.1	3.00	5.11	30.46	**1308.11**
2024	104801	2.0	16.88	8.76	25.63	2.1	3.00	5.11	30.75	**1338.86**
2025	107501	2.0	16.88	8.76	25.63	2.1	3.00	5.11	30.75	**1369.60**
2026	110201	2.0	16.88	8.76	25.63	2.1	3.00	5.11	30.75	**1400.35**
2027	112901	2.0	16.88	8.76	25.63	2.1	3.00	5.11	30.75	**1431.09**
2028	115601	2.0	16.88	8.76	25.63	2.1	3.00	5.11	30.75	**1461.84**
2029	118301	2.0	16.88	8.76	25.63	2.1	3.00	5.11	30.75	**1492.58**
2030	121001	2.0	16.88	8.76	25.63	2.1	3.00	5.11	30.75	**1523.33**
2031	123701	2.0	16.88	8.76	25.63	2.1	3.00	5.11	30.75	**1554.07**
2032	126401	2.0	16.88	8.76	25.63	2.1	3.00	5.11	30.75	**1584.82**
2032.66	128189	2.0	11.18	5.80	16.97	1.4	1.99	3.39	20.36	**1605.18**
2033	128189	2.0	0.00	0.00	0.00	0.0	0	0.00	0.00	**1605.18**
2034	128189	2.0	0.00	0.00	0.00	0.0	0	0.00	0.00	**1605.18**

900	units/year	
2700	people/year	
26.66	years to buildout	
31.27	ha/year	Res
10.73	ha/year	ICI

WITHOUT Kanata West

Year	Residential Flow					ICI Flow			Total Increase (L/s)	Total Flow (L/s)
	Population	Residential Peak Factor	Pop. Flow Increase (L/s)	Infiltration (L/s)	Total Residential Flow Increase	ICI Flow Increase (L/s)	Infiltration (L/s)	Total ICI Flow Increase (L/s)		
2006	53613	2.2	0.00	0.00	0.00	0.0	0.00	0.00	0.00	**746.50**
2007	55507	2.2	13.16	6.79	19.94	1.2	1.71	2.91	22.85	**769.35**
2008	57402	2.2	13.00	6.79	19.79	1.2	1.71	2.91	22.70	**792.05**
2009	59296	2.2	12.85	6.79	19.64	1.2	1.71	2.91	22.55	**814.59**
2010	61191	2.2	12.71	6.79	19.50	1.2	1.71	2.91	22.41	**837.00**
2011	63085	2.2	12.58	6.79	19.36	1.2	1.71	2.91	22.27	**859.28**
2012	64980	2.2	12.45	6.79	19.24	1.2	1.71	2.91	22.15	**881.42**
2013	66874	2.1	12.33	6.79	19.12	1.2	1.71	2.91	22.03	**903.45**
2014	68769	2.1	12.22	6.79	19.00	1.2	1.71	2.91	21.91	**925.36**
2015	70663	2.1	12.11	6.79	18.89	1.2	1.71	2.91	21.80	**947.17**
2016	72557	2.1	12.00	6.79	18.79	1.2	1.71	2.91	21.70	**968.86**
2017	74452	2.1	11.90	6.79	18.69	1.2	1.71	2.91	21.60	**990.46**
2018	76346	2.1	11.81	6.79	18.59	1.2	1.71	2.91	21.50	**1011.97**
2019	78241	2.1	11.72	6.79	18.50	1.2	1.71	2.91	21.41	**1033.38**
2020	80135	2.1	11.63	6.79	18.42	1.2	1.71	2.91	21.33	**1054.71**
2021	82030	2.1	11.55	6.79	18.33	1.2	1.71	2.91	21.24	**1075.95**
2022	83924	2.1	11.47	6.79	18.25	1.2	1.71	2.91	21.16	**1097.11**
2023	85818	2.1	11.39	6.79	18.17	1.2	1.71	2.91	21.08	**1118.19**
2024	87713	2.0	11.31	6.79	18.10	1.2	1.71	2.91	21.01	**1139.20**
2025	89607	2.0	11.24	6.79	18.03	1.2	1.71	2.91	20.94	**1160.14**
2026	91502	2.0	11.17	6.79	17.96	1.2	1.71	2.91	20.87	**1181.01**
2027	93396	2.0	11.10	6.79	17.89	1.2	1.71	2.91	20.80	**1201.81**
2028	95291	2.0	11.04	6.79	17.83	1.2	1.71	2.91	20.74	**1222.54**
2029	97185	2.0	10.98	6.79	17.76	1.2	1.71	2.91	20.67	**1243.22**
2030	99080	2.0	10.92	6.79	17.70	1.2	1.71	2.91	20.61	**1263.83**
2031	100974	2.0	11.37	6.79	18.16	1.2	1.71	2.91	21.07	**1284.90**
2032	102868	2.0	11.84	6.79	18.63	1.2	1.71	2.91	21.54	**1306.43**
2032.66	104123	2.0	7.84	4.49	12.33	0.8	1.13	1.93	14.26	**1320.69**
2033	104123	2.0	0.00	0.00	0.00	0.0	0	0.00	0.00	**1320.69**
2034	104123	2.0	0.00	0.00	0.00	0.0	0	0.00	0.00	**1320.69**

631	units/year	
1894	people/year	
26.66	years to buildout	
24.24	ha/year	Res
6.10	ha/year	ICI

FIGURE E-1: SCADA FLOW MONITORING (2004)

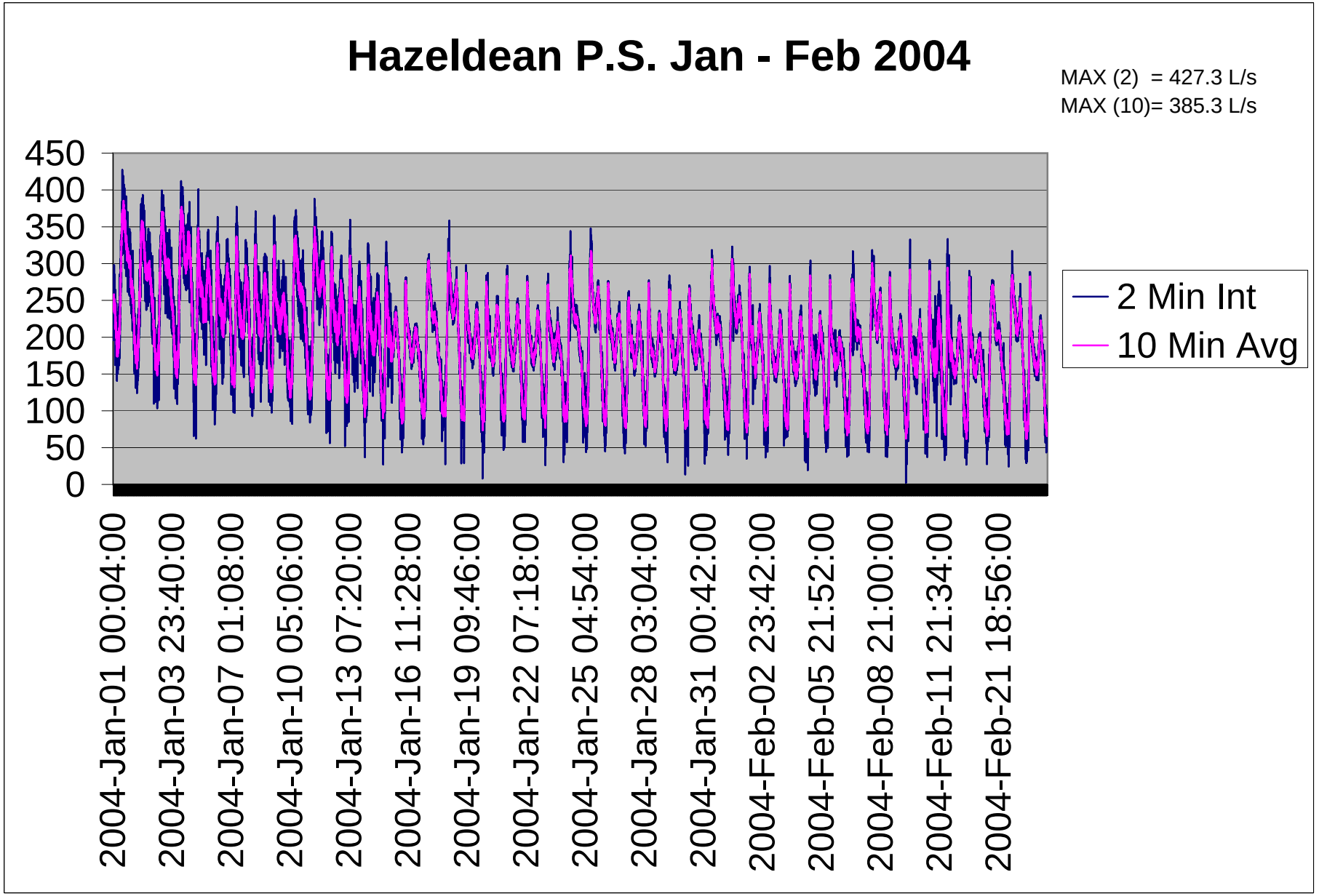


FIGURE E-1: SCADA FLOW MONITORING (2004)

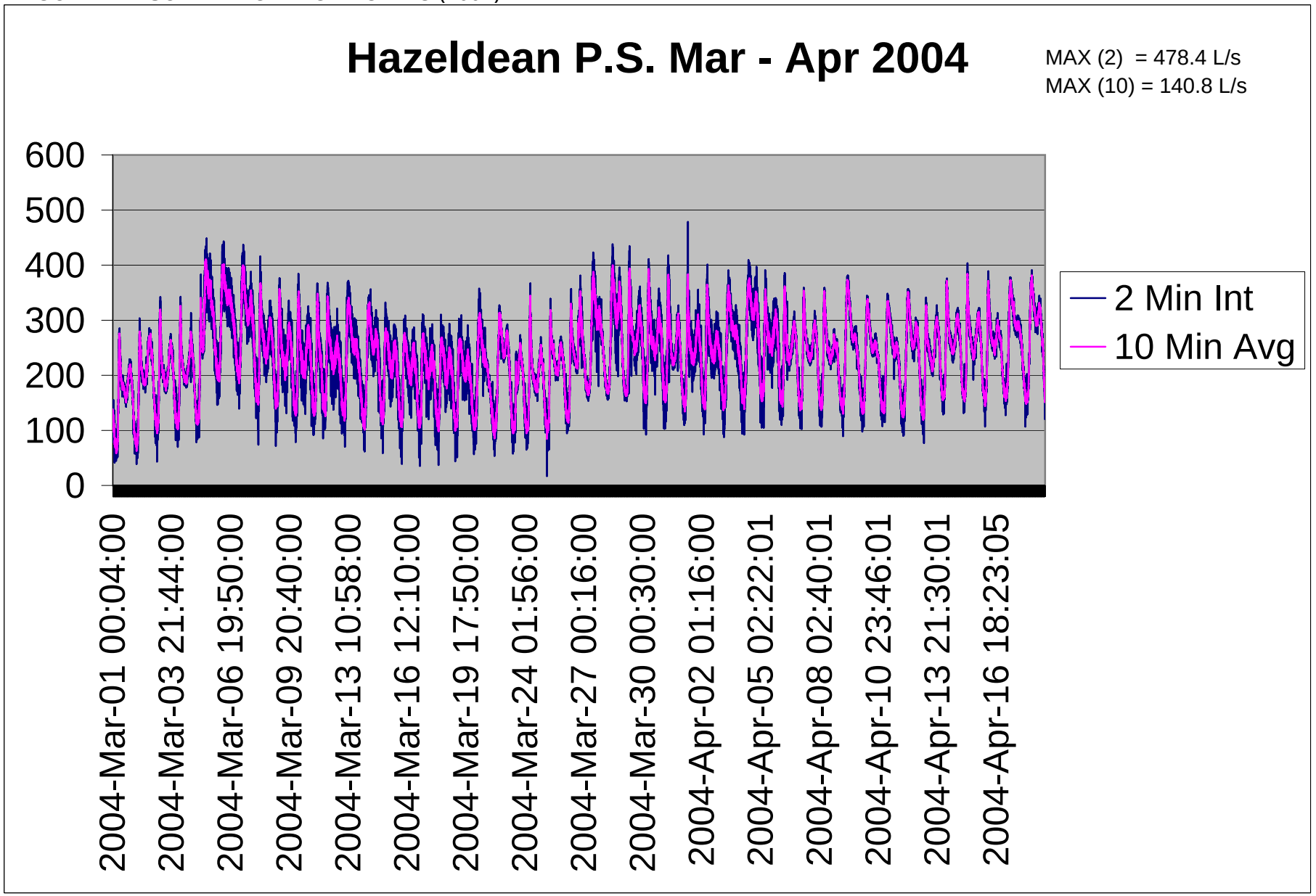


FIGURE E-1: SCADA FLOW MONITORING (2004)

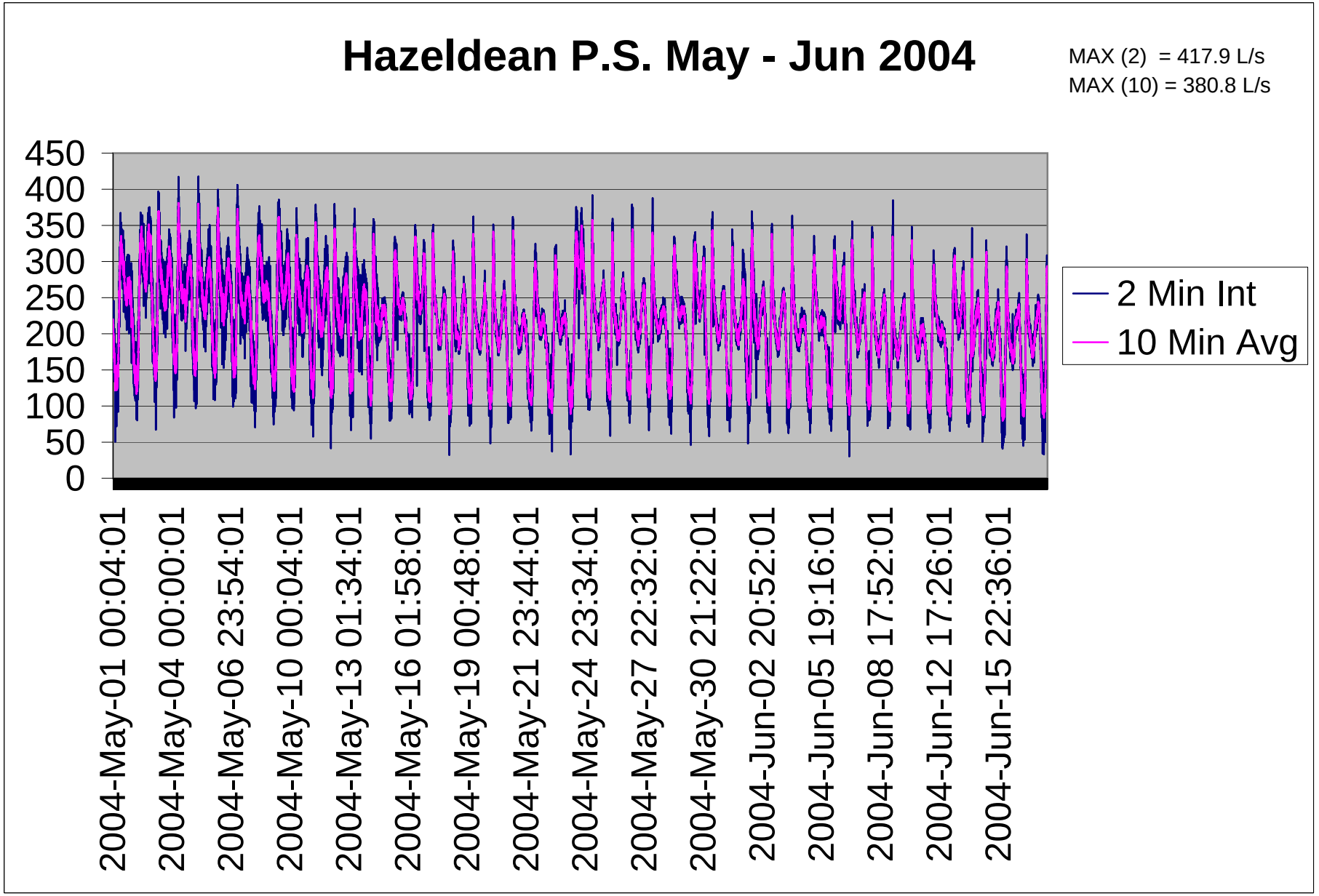


FIGURE E-1: SCADA FLOW MONITORING DATA (2004)

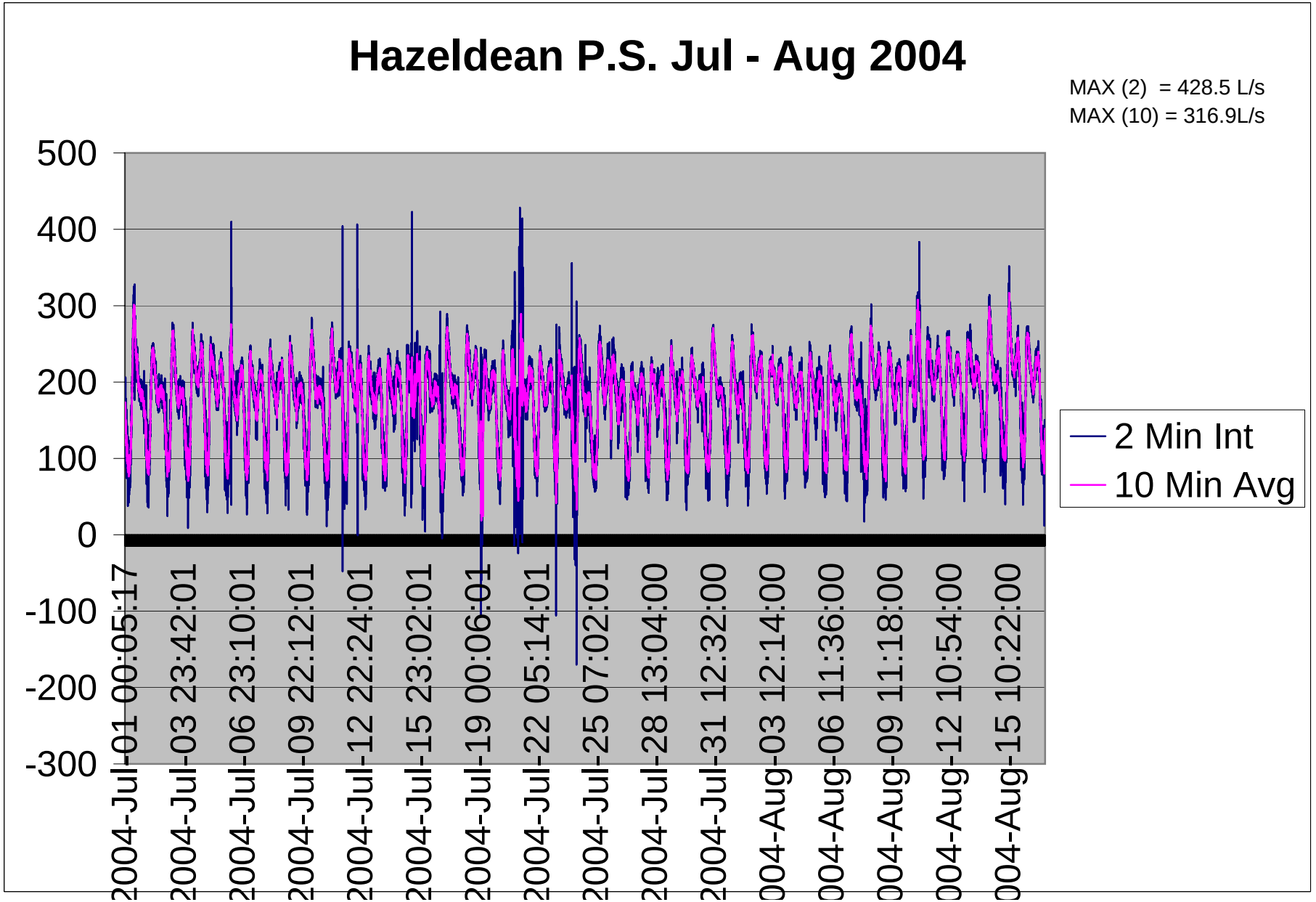


FIGURE E-1: SCADA FLOW MONITORING (2004)

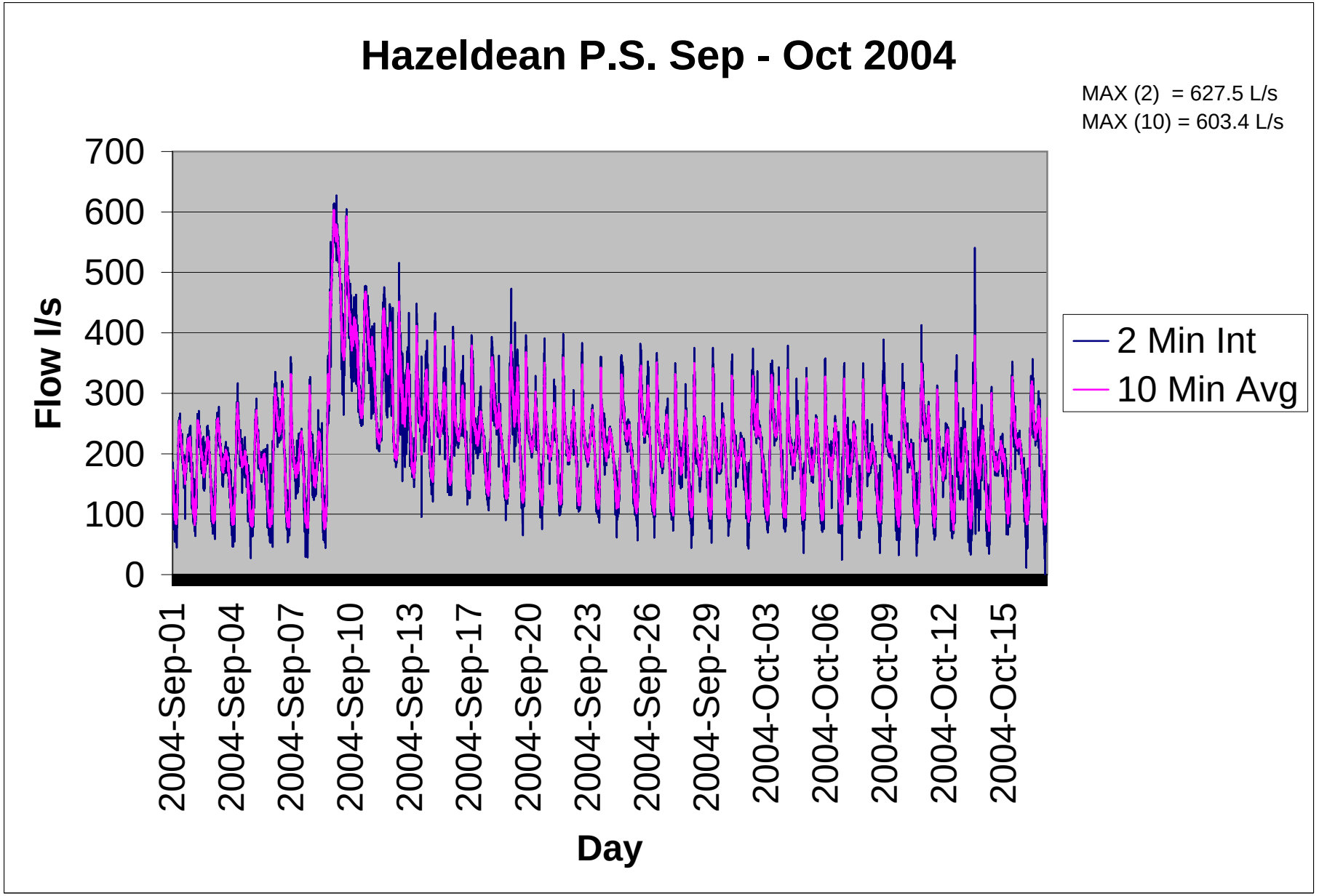
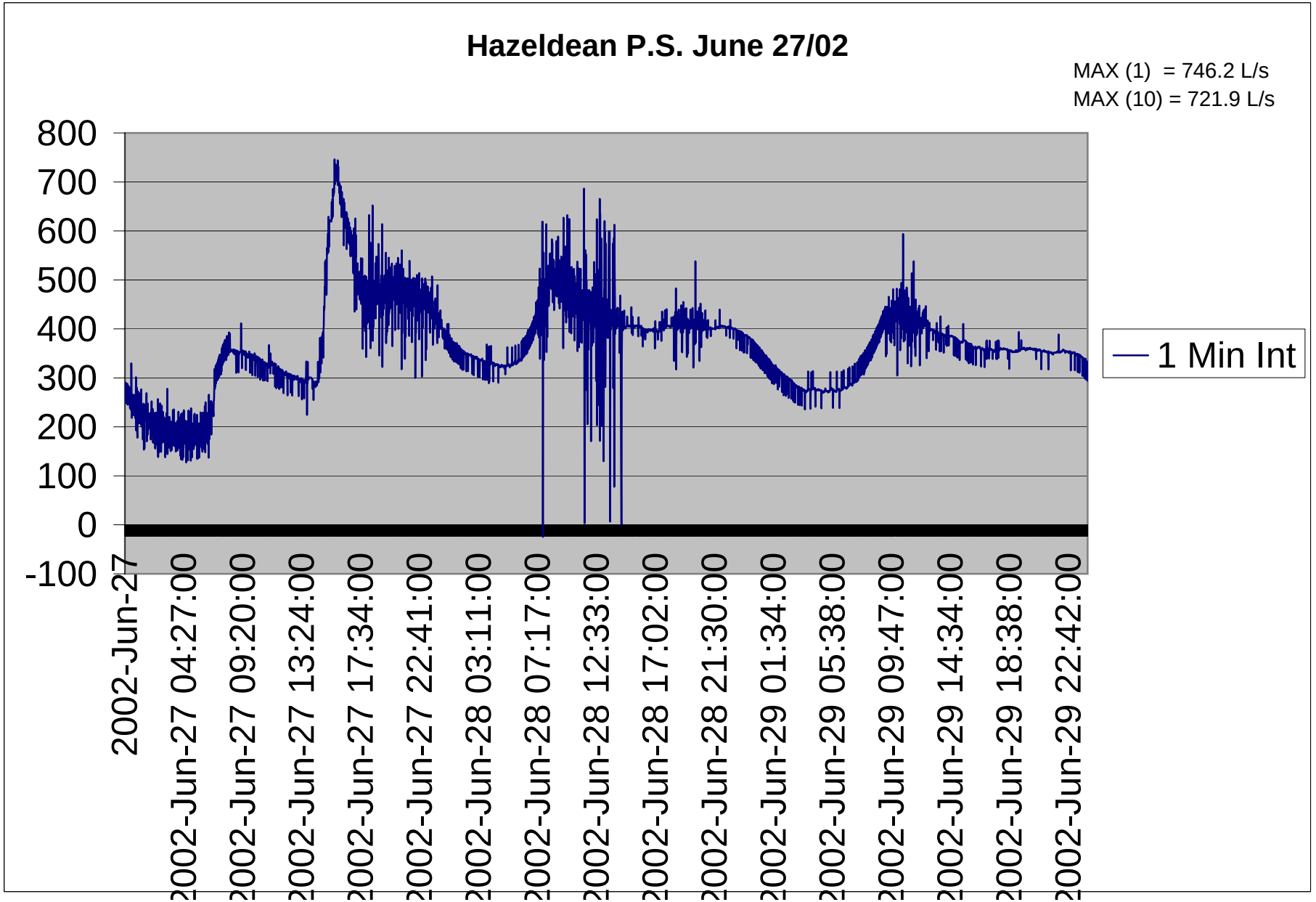
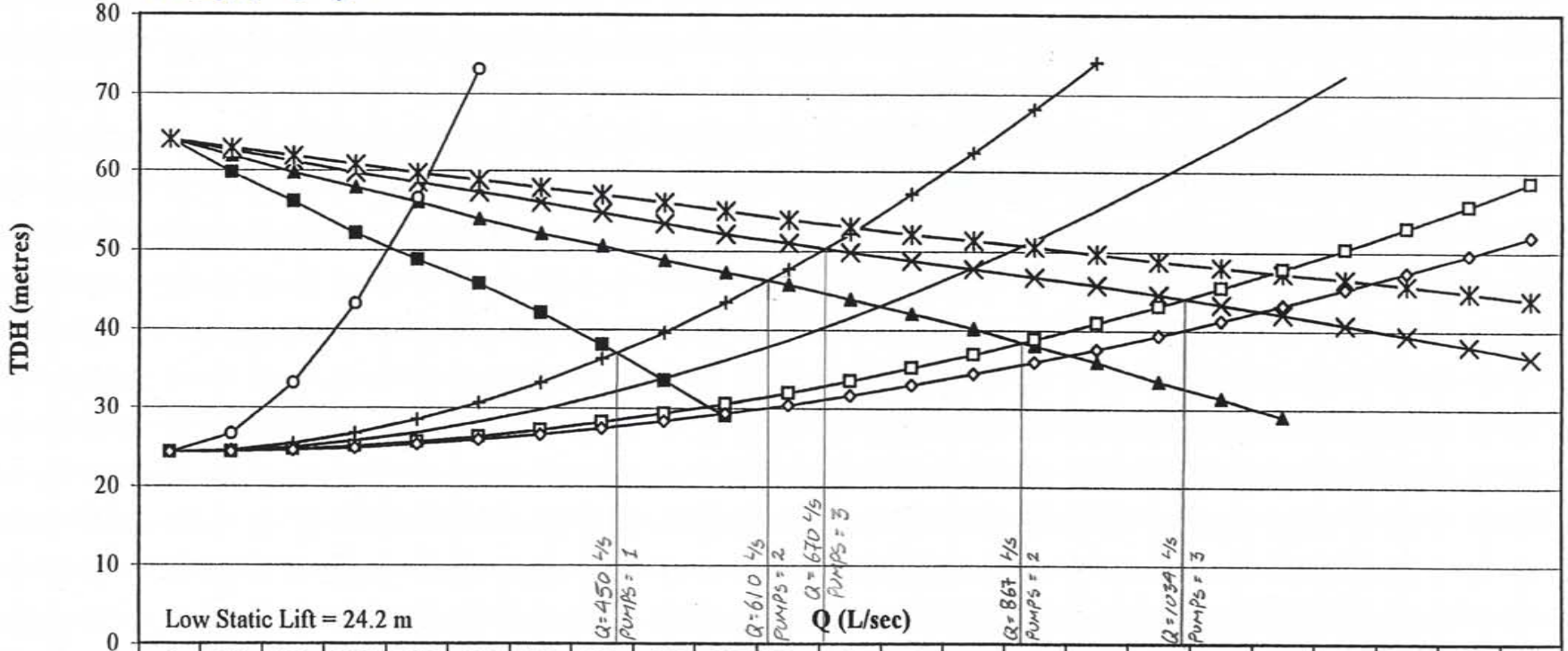


FIGURE E-2: SCADA FLOW MONITORING (JUNE 27,2002)



Hazeldean Pumping Station
System Curves for Submersible Pumps 1-4 with 504 mm Impeller

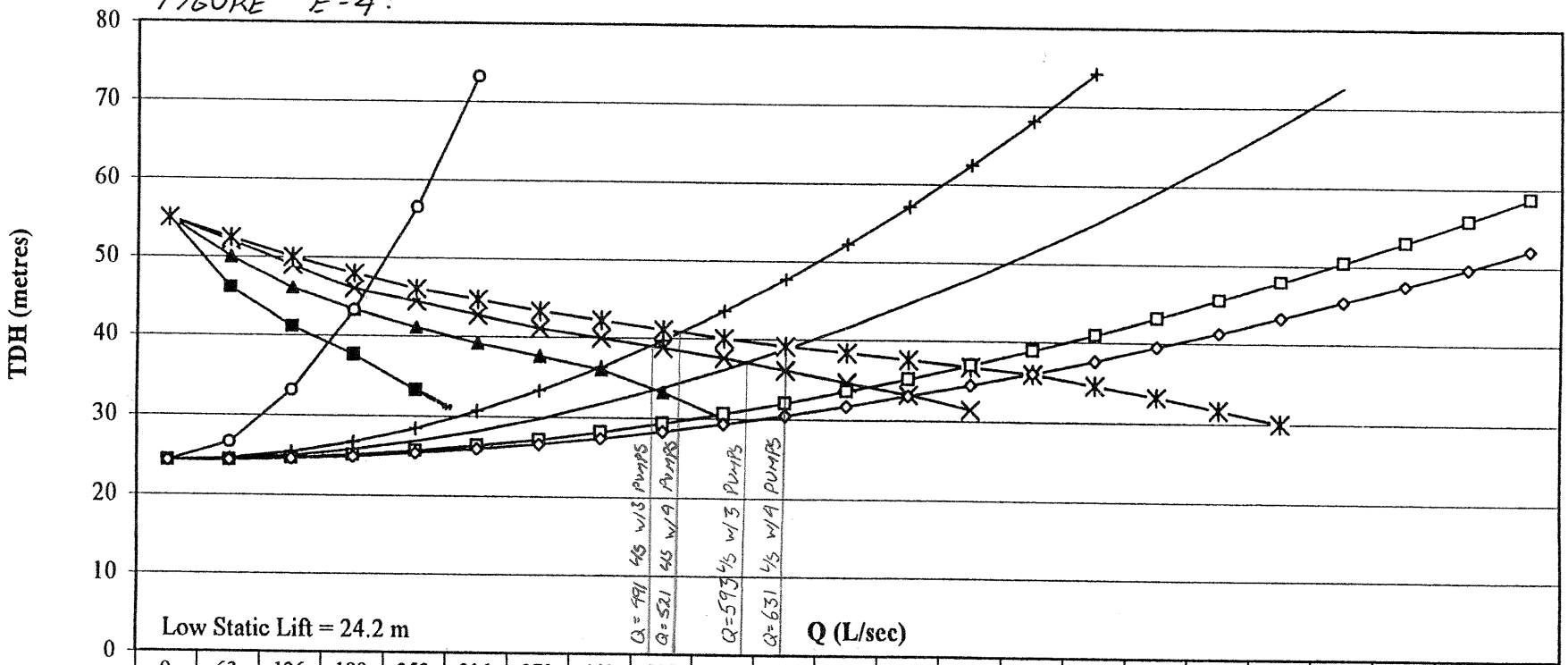
FIGURE E-3:



	0	63	126	189	253	316	379	442	505	568	631	695	758	821	884	947	1010	1073	1136	1200	1263	1326	1389
1 Pump	64.0	59.7	56.1	52.1	48.8	45.7	42.1	38.1	33.5	29.0													
2 Pumps	64.0	61.9	59.7	57.9	56.1	53.9	52.1	50.6	48.8	47.2	45.7	43.9	42.1	40.2	38.1	36.0	33.5	31.4	29.0				
3 Pumps	64.0	62.6	61.2	59.7	58.5	57.3	56.1	54.8	53.4	52.1	51.0	49.9	48.8	47.8	46.7	45.7	44.5	43.3	42.1	40.7	39.4	38.1	36.6
4 Pumps	64.0	62.9	61.9	60.8	59.7	58.8	57.9	57.0	56.1	55.0	53.9	53.0	52.1	51.4	50.6	49.7	48.8	48.0	47.2	46.5	45.7	44.8	43.9
A 400 mm	24.2	26.7	33.1	43.2	56.6	73.2																	
B 600 mm	24.2	24.5	25.4	26.7	28.4	30.6	33.2	36.3	39.7	43.5	47.6	52.2	57.1	62.4	68.1	74.1							
C 400+600	24.2	24.4	24.9	25.7	26.8	28.2	29.8	31.7	33.8	36.1	38.7	41.6	44.6	47.9	51.5	55.2	59.2	63.4	67.8	72.5			
D 2-600	24.2	24.3	24.6	25.0	25.6	26.3	27.2	28.2	29.3	30.6	32.0	33.5	35.2	37.0	38.9	40.9	43.1	45.4	47.8	50.3	53.0	55.8	58.7
E 400+2-600	24.2	24.3	24.5	24.8	25.3	25.9	26.6	27.4	28.3	29.3	30.4	31.7	33.0	34.5	36.0	37.6	39.4	41.2	43.2	45.2	47.4	49.6	52.0

Hazeldean Pumping Station
System Curves for Pumps 1-4 with Model B5416 489 mm Impeller

FIGURE E-4:



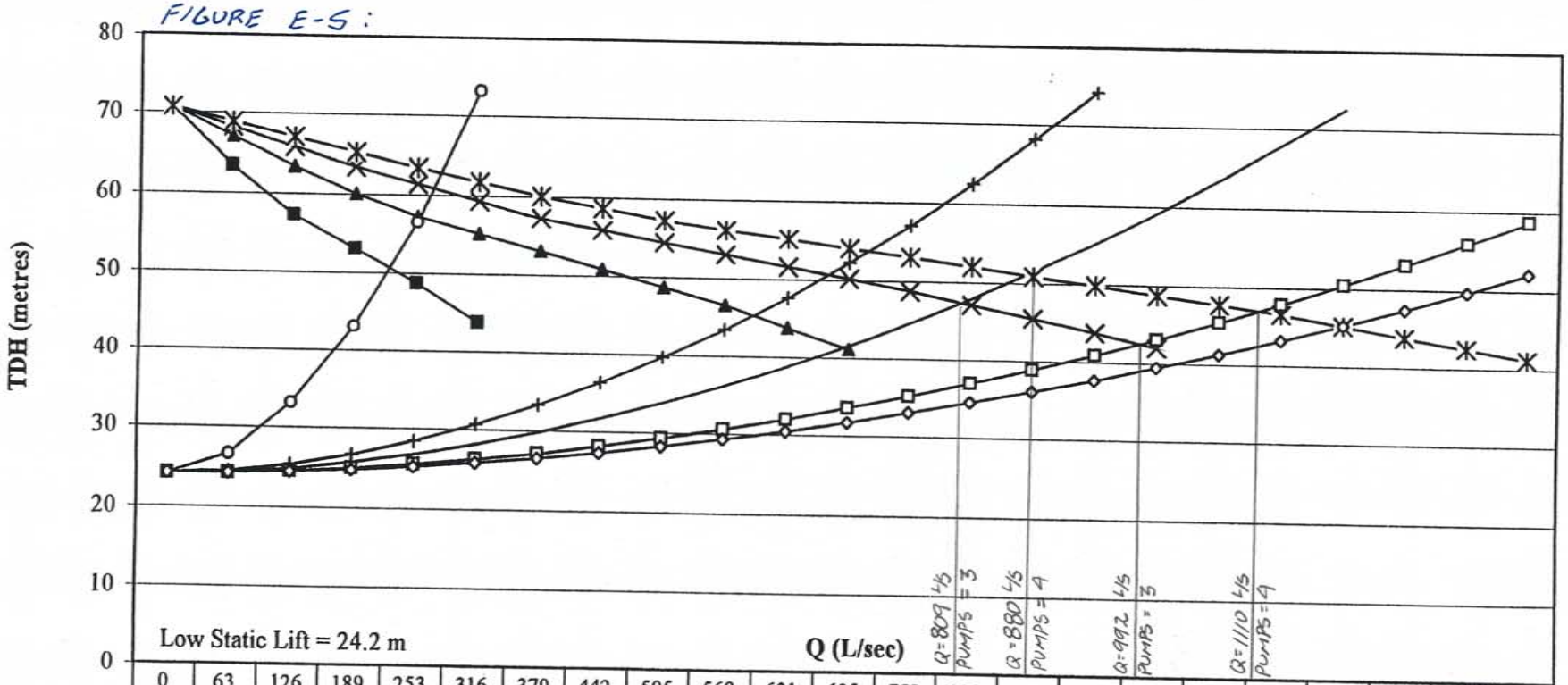
	0	63	126	189	253	316	379	442	505	568	631	695	758	821	884	947	1010	1073	1136	1200	1263	1326	1389
1 Pump	55.0	46.0	41.1	37.6	33.2																		
2 Pumps	55.0	50.0	46.0	43.3	41.1	39.1	37.6	36.0	33.2	30.0													
3 Pumps	55.0	52.0	49.0	46.0	44.4	42.7	41.1	39.9	38.8	37.6	36.1	34.7	33.2	31.4									
4 Pumps	55.0	52.5	50.0	48.0	46.0	44.7	43.3	42.2	41.1	40.1	39.1	38.4	37.6	36.8	36.0	34.6	33.2	31.6	30.0				
A 400 mm	24.2	26.7	33.2	43.2	56.6	73.2																	
B 600 mm	24.2	24.5	25.4	26.7	28.5	30.6	33.3	36.3	39.7	43.5	47.7	52.2	57.2	62.5	68.2	74.2							
C 400+600	24.2	24.4	24.9	25.7	26.8	28.2	29.8	31.7	33.8	36.2	38.8	41.6	44.7	48.0	51.5	55.3	59.3	63.5	67.9	72.6			
D 2-600	24.2	24.3	24.6	25.0	25.6	26.3	27.2	28.2	29.3	30.6	32.0	33.5	35.2	37.0	38.9	41.0	43.2	45.5	47.9	50.4	53.1	55.9	58.8
E 400+2-600	24.2	24.3	24.5	24.8	25.3	25.9	26.6	27.4	28.3	29.3	30.5	31.7	33.0	34.5	36.0	37.7	39.5	41.3	43.3	45.3	47.5	49.7	52.1

ΔQ = 63.14 L/s

AREA (m²)
1257
2827
4084
5655
6912

Hazeldean Pumping Station
System Curves for Pumps 1-4 with Model B5416 533 mm Impeller

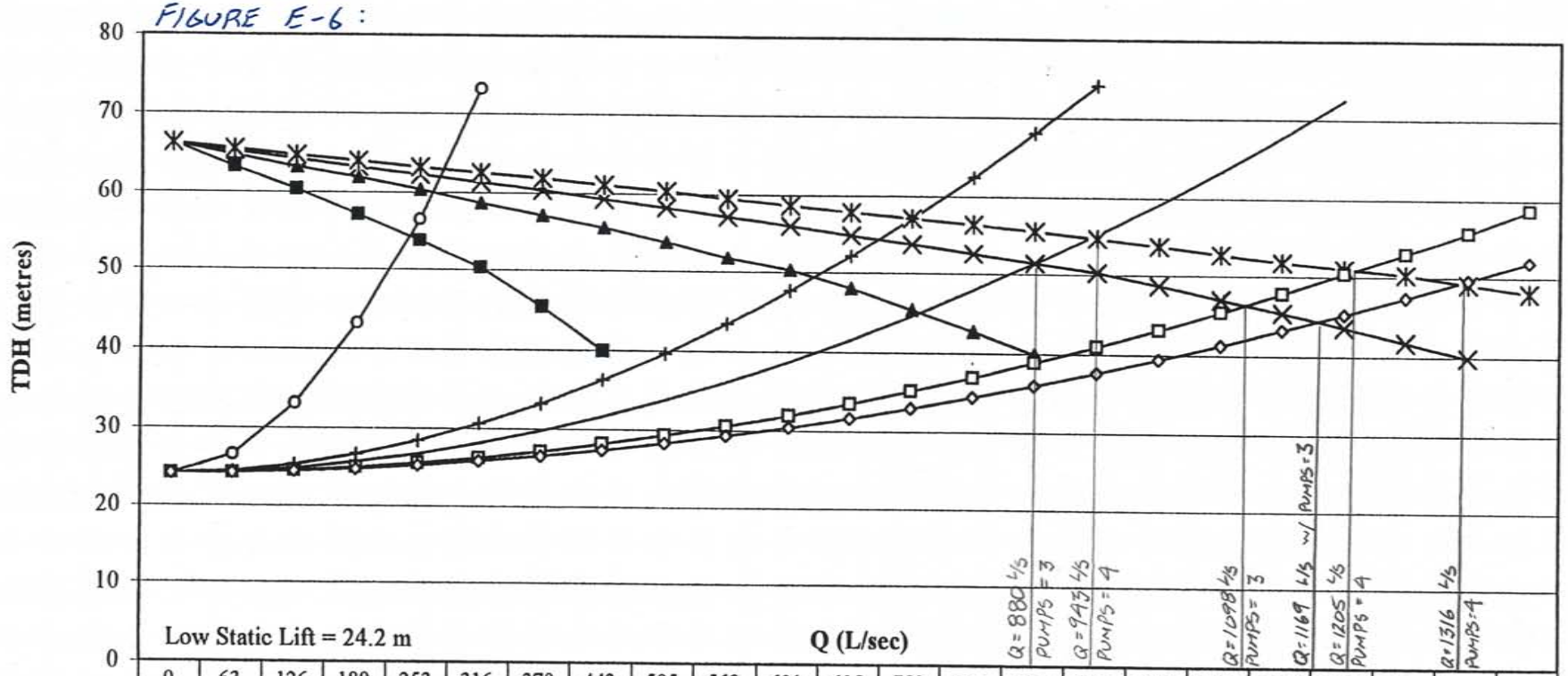
FIGURE E-5:



	0	63	126	189	253	316	379	442	505	568	631	695	758	821	884	947	1010	1073	1136	1200	1263	1326	1389
1 Pump	70.7	63.4	57.3	53.0	48.8	43.9																	
2 Pumps	70.7	67.1	63.4	60.0	57.3	55.2	53.0	50.9	48.8	46.6	43.9	41.1											
3 Pumps	70.7	68.3	65.8	63.4	61.4	59.3	57.3	55.9	54.5	53.0	51.6	50.2	48.8	47.1	45.5	43.9	42.1						
4 Pumps	70.7	68.9	67.1	65.2	63.4	61.7	60.0	58.7	57.3	56.2	55.2	54.1	53.0	52.0	50.9	49.8	48.8	47.7	46.6	45.3	43.9	42.5	41.1
A 400 mm	24.2	26.7	33.2	43.2	56.6	73.2																	
B 600 mm	24.2	24.5	25.4	26.7	28.5	30.6	33.3	36.3	39.7	43.5	47.7	52.2	57.2	62.5	68.2	74.2							
C 400+600	24.2	24.4	24.9	25.7	26.8	28.2	29.8	31.7	33.8	36.2	38.8	41.6	44.7	48.0	51.5	55.3	59.3	63.5	67.9	72.6			
D 2-600	24.2	24.3	24.6	25.0	25.6	26.3	27.2	28.2	29.3	30.6	32.0	33.5	35.2	37.0	38.9	41.0	43.2	45.5	47.9	50.4	53.1	55.9	58.8
E 400+2-600	24.2	24.3	24.5	24.8	25.3	25.9	26.6	27.4	28.3	29.3	30.5	31.7	33.0	34.5	36.0	37.7	39.5	41.3	43.3	45.3	47.5	49.7	52.1

Hazeldean Pumping Station
System Curves for New Pumps 1-4 with Model B5415 533 mm Impeller

FIGURE E-6 :



	0	63	126	189	253	316	379	442	505	568	631	695	758	821	884	947	1010	1073	1136	1200	1263	1326	1389
1 Pump	66.3	63.2	60.4	57.2	53.8	50.3	45.4	39.9															
2 Pumps	66.3	64.8	63.2	61.9	60.4	58.7	57.2	55.6	53.8	51.8	50.3	48.0	45.4	42.7	39.9								
3 Pumps	66.3	65.3	64.3	63.2	62.3	61.3	60.4	59.3	58.2	57.2	56.0	54.9	53.8	52.6	51.5	50.3	48.7	47.0	45.4	43.6	41.8	39.9	
4 Pumps	66.3	65.5	64.8	64.0	63.2	62.6	61.9	61.1	60.4	59.5	58.7	57.9	57.2	56.4	55.6	54.7	53.8	52.8	51.8	51.1	50.3	49.1	48.0
A 400 mm	24.2	26.7	33.1	43.2	56.6	73.2																	
B 600 mm	24.2	24.5	25.4	26.7	28.4	30.6	33.2	36.3	39.7	43.5	47.6	52.2	57.1	62.4	68.1	74.1							
C 400+600	24.2	24.4	24.9	25.7	26.8	28.2	29.8	31.7	33.8	36.1	38.7	41.6	44.6	47.9	51.5	55.2	59.2	63.4	67.8	72.5			
D 2-600	24.2	24.3	24.6	25.0	25.6	26.3	27.2	28.2	29.3	30.6	32.0	33.5	35.2	37.0	38.9	40.9	43.1	45.4	47.8	50.3	53.0	55.8	58.7
E 400+2-600	24.2	24.3	24.5	24.8	25.3	25.9	26.6	27.4	28.3	29.3	30.4	31.7	33.0	34.5	36.0	37.6	39.4	41.2	43.2	45.2	47.4	49.6	52.0

FIGURE E-7: FLYGT PUMP C3231 PERFORMANCE FIELD

FLYGT

PERFORMANCE FIELD

at Constant nominal speed

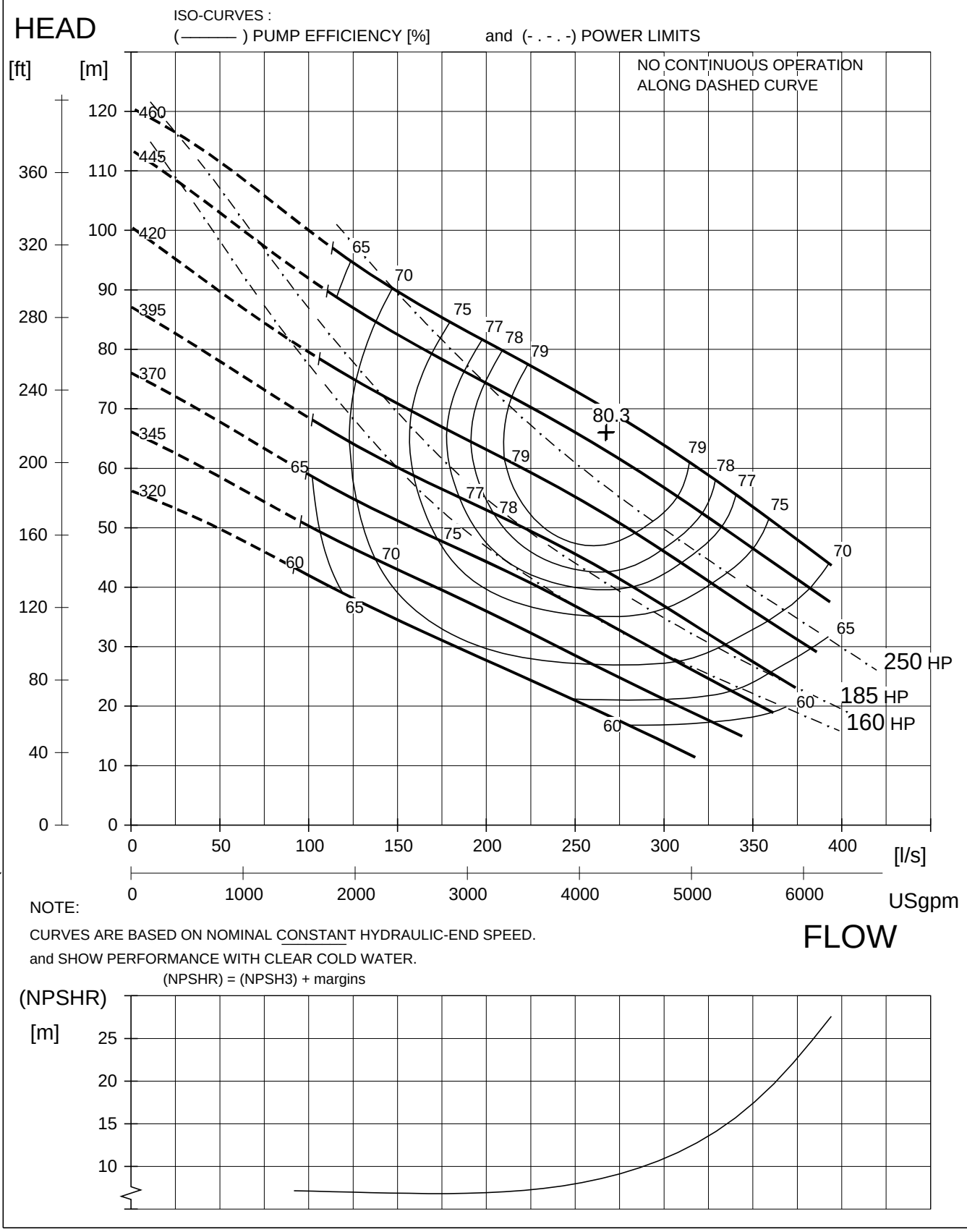
PROD
C 3231

CURVE NO
63- 430

DATE	ISSUE	FREQ.	NOMINAL HYDRAULIC-END SPEED
2006-01-12	8	60 HZ	1785 RPM

IMPELLER PART	PUMPHOUSING PART	INLET/OUTLET	IMP.THROUGHLET	NO. OF BLADES	AVAILABLE IMPELLER DIAMETERS
		250/200	BALL 88 mm	2	EVERY 5 mm FROM 320 TO 460

DRIVE UNIT	MOTOR	POLES	RATED POWER	RATED SPEED RPM
665	35-45-4AA	4	160 HP /119 kW	
705	43-30-4AA	4	185 HP /138 kW	
735	43-44-4AA	4	250 HP /186 kW	
765	43-56-4AA	4	335 HP /250 kW	



NOTE:

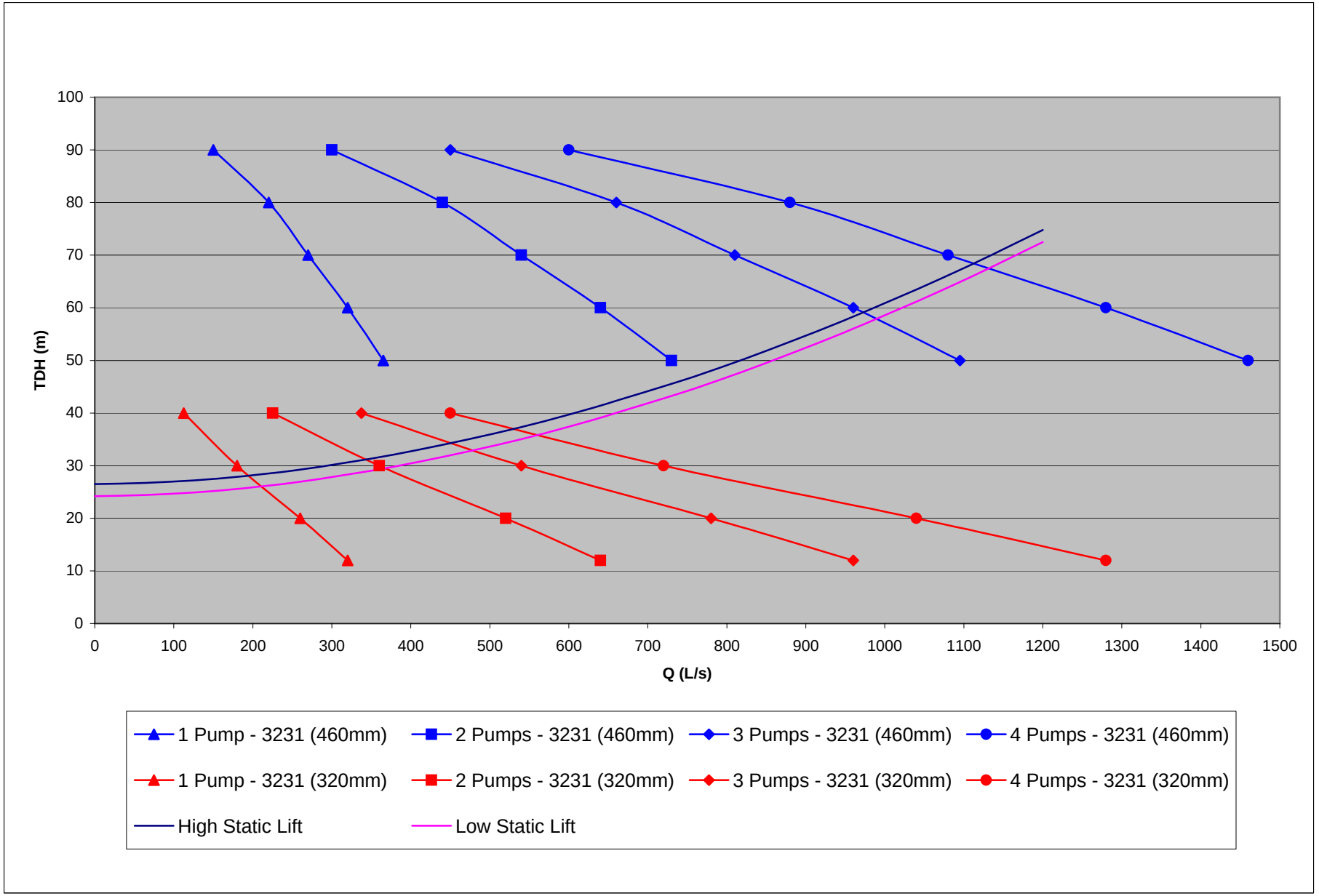
CURVES ARE BASED ON NOMINAL CONSTANT HYDRAULIC-END SPEED.

and SHOW PERFORMANCE WITH CLEAR COLD WATER.

(NPSHR) = (NPSH3) + margins

unix AUTHOR: GPWEB1 CUPF (rev:7.36

FIGURE E-8: Flygt Pump C3231 Curve Approximations, System Curve 400+600 Forcemain

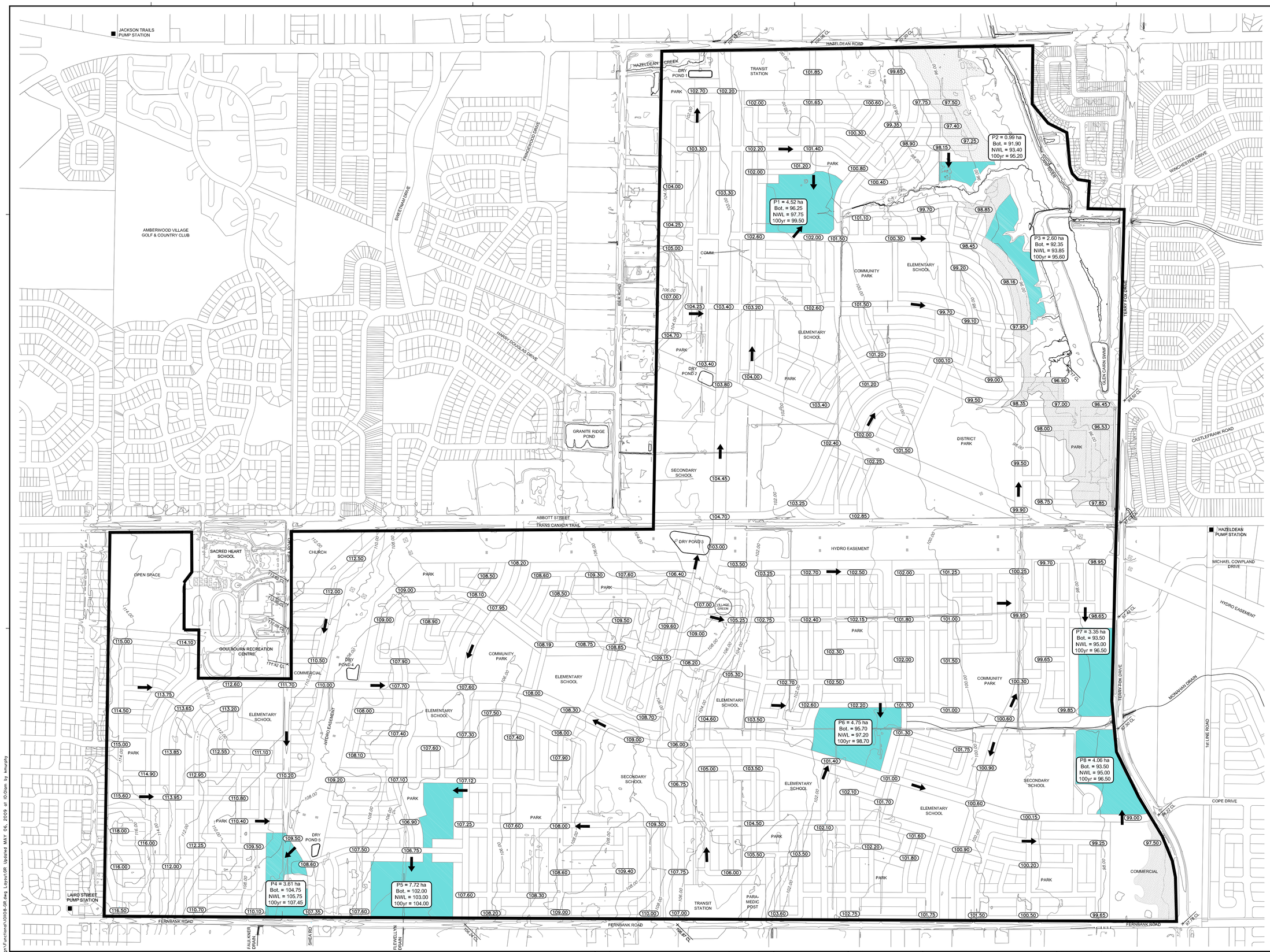


APPENDIX F

Drawings

Drawing List

Drawing 101108-GR	Grading Plan
Drawing 101108-STM1	Storm Drainage Area Plan, Minor System Drainage
Drawing 101108-STM2	Storm Drainage Area Plan, Major System Drainage
Drawing 101108-SAN	Sanitary Drainage Area Plan
Drawing 101108-WM	Water Distribution System
Drawing 101108-KP	Profile Drawings, Key Plan
Drawing 101108-PR1	Profile Drawings, Sanitary Trunk Alignments
Drawing 101108-PR2	Profile Drawings, Storm Sewer Alignments
Drawing 101108-PR3	Profile Drawings, Storm Sewer Alignments



LEGEND

- (101.20) PROPOSED GRADE
- —101— EXISTING GRADE (1.0m CONTOUR)
- 100.97 CL EXISTING GRADE (CENTRE LINE OF ROAD)
- DIRECTION OF OVERLAND FLOW
- GRADE RAISE CONSTRAINT AREA (NO BASEMENT SUBJECT TO DETAIL DESIGN)
- STUDY AREA BOUNDARY

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
3	ISSUED WITH MASTER SERVICING STUDY	MAY 25/09	MAB
2	UPDATED WITH DRAFT MASTER SERVICING STUDY	SEP 12/08	MAB
1	ISSUED WITH DRAFT MASTER SERVICING STUDY	MAY 02/08	MAB

LICENSED PROFESSIONAL ENGINEER — M.A. BISSETT — PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER — J.G. RIDDELL — PROVINCE OF ONTARIO

NOVATECH ENGINEERING CONSULTANTS LTD.
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Suite 200, 240 Michael Cowpland Drive
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K2M 1P6
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Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

DESIGN	KJM
CHECKED	MAB
DRAWN	GMH
CHECKED	MAB
APPROVED	JGR

SCALE: 1 : 5000

CITY OF OTTAWA

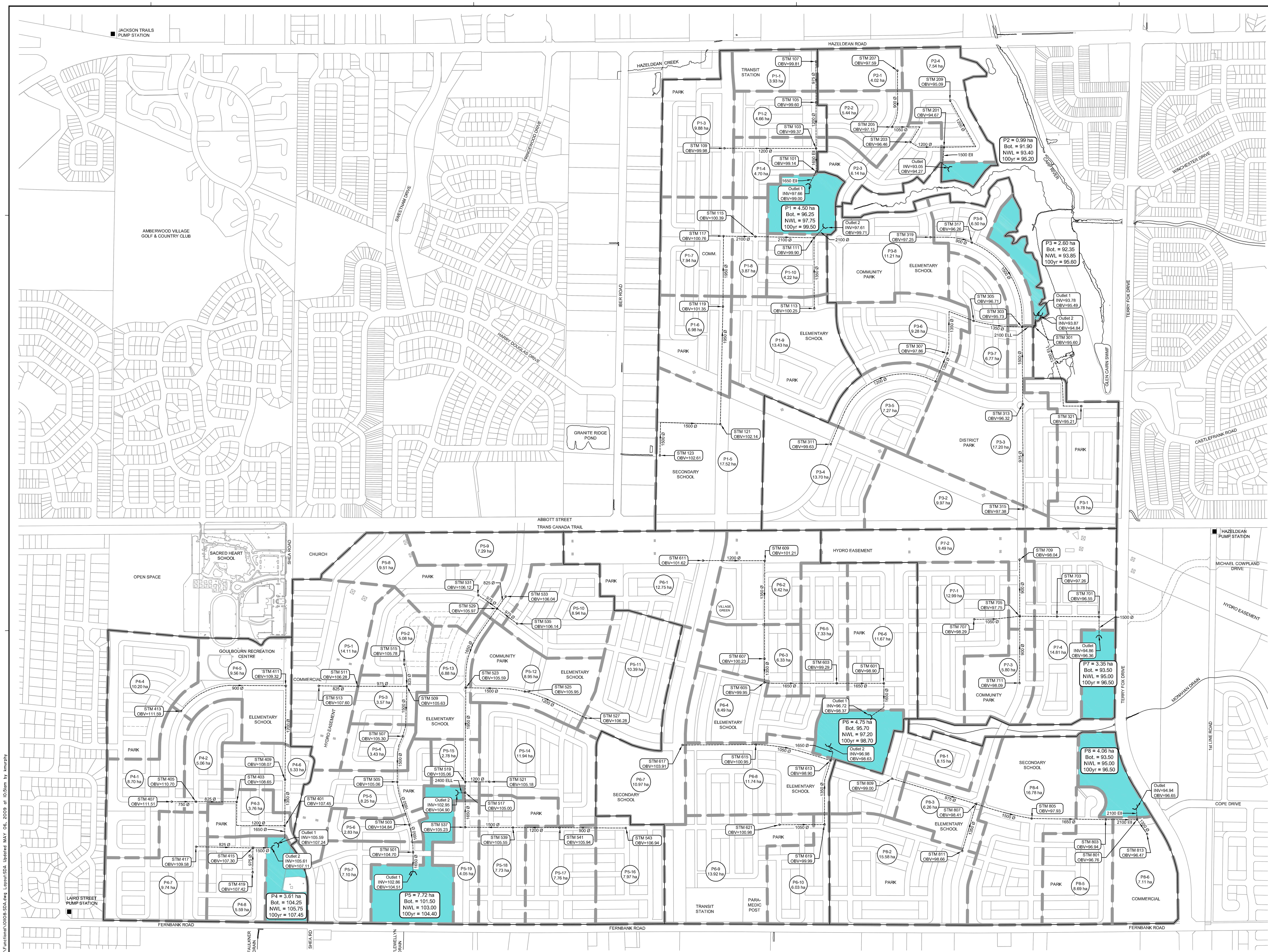
FERNBANK CDP

GRADING PLAN

PROJECT No. 101108-0

DATE: AUGUST 2007

DRAWING No. 101108-GR



NOTE:
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2	UPDATED WITH DRAFT MASTER SERVICING STUDY	SEP 12/08	MAB
1	ISSUED WITH DRAFT MASTER SERVICING STUDY	MAY 02/08	MAB

LICENSED PROFESSIONAL ENGINEER M.A. BISSETT PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER J.G. RIDDELL PROVINCE OF ONTARIO

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DESIGN	KJM	SCALE	
CHECKED	MAB	1 : 5000	
DRAWN	KJM		
CHECKED	MAB		
APPROVED	JGR		

CITY OF OTTAWA

FERNBANK CDP

STORM DRAINAGE AREA PLAN
MINOR SYSTEM DRAINAGE

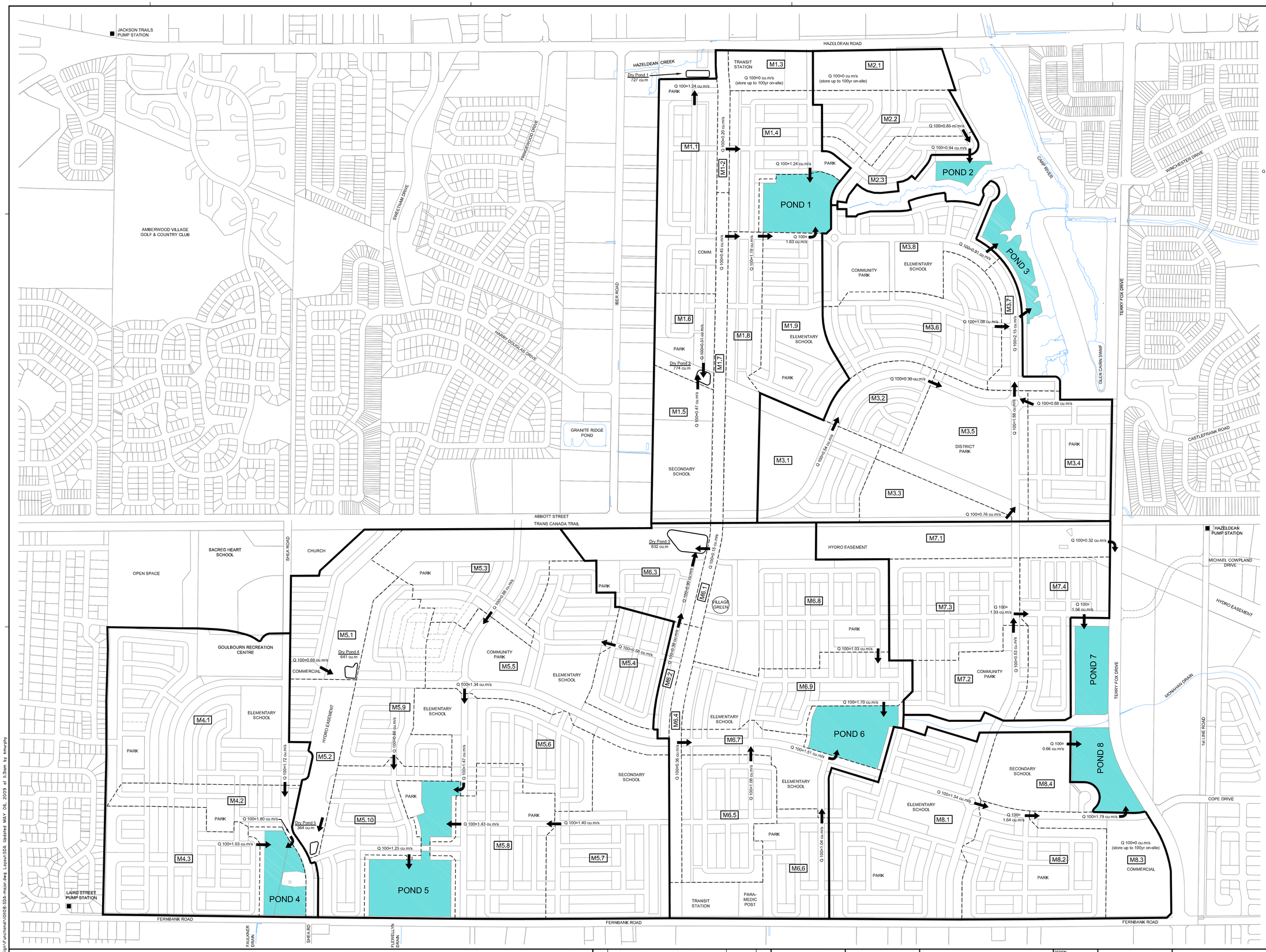
PROJECT No. 101108-0

DATE AUGUST 2007

DRAWING No. 101108-STM1

PLANBLDWG - 1000mmX707mm

Drawing:M:\2001\0108\CAD\design\Functional\10108-SDA.dwg Layout:SDA Updated MAY 06, 2009 at 10:51am by kmurphy



LEGEND

- M3-5 — MAJOR SYSTEM SUBCATCHMENT ID
- MAJOR SYSTEM DRAINAGE AREA BOUNDARY
- MAJOR SYSTEM SUBCATCHMENT BOUNDARY
- Q 100=1.86 cu.m/s — 1:100yr PEAK OVERLAND FLOW RATE
- DIRECTION OF OVERLAND FLOW

NOTE:
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No.	REVISION	DATE	BY
3	ISSUED WITH MASTER SERVICING STUDY	MAY 25/09	MJP
2	UPDATED WITH DRAFT MASTER SERVICING STUDY	SEPT 12/08	MJP
1	ISSUED WITH DRAFT MASTER SERVICING STUDY	MAY 02/08	MJP

LICENSED PROFESSIONAL ENGINEER — M.J. PETEPIECE — 100079354 — PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER — J.G. RIDDELL — PROVINCE OF ONTARIO

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Email: novatech@novatech-eng.com

DESIGN	MJP
CHECKED	MAB
DRAWN	MJP
CHECKED	MAB
APPROVED	JGR

SCALE: 1 : 5000

CITY OF OTTAWA

FERNBANK CDP

STORM DRAINAGE AREA PLAN
MAJOR SYSTEM DRAINAGE

PROJECT No. 101108-0

DATE: APRIL 2008

DRAWING No. 101108-STM2

PLANBLDWG - 300mmX750mm

Drawing:M:\2008\101108\CAD\design\Functional\101108-50A-major.dwg Layout:50A Updated MAY 06, 2009 at 8:35am by kmurphy

NOTE:
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1	ISSUED WITH DRAFT MASTER SERVICING STUDY	MAY 02/08	MAB

LICENSED PROFESSIONAL ENGINEER — M.A. BISSETT — PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER — J.G. RIDDELL — PROVINCE OF ONTARIO

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DESIGN	KJM
CHECKED	MAB
DRAWN	KJM
CHECKED	MAB
APPROVED	JGR

SCALE 1 : 5000

CITY OF OTTAWA

FERNBANK CDP

SANITARY DRAINAGE AREA PLAN

PROJECT No. 101108-0

DATE AUGUST 2007

DRAWING No. 101108-SAN

NOTE:
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LICENSED PROFESSIONAL ENGINEER M.A. BISSETT PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER J.G. RIDDELL PROVINCE OF ONTARIO

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DESIGN	KJM
CHECKED	MAB
DRAWN	KJM
CHECKED	MAB
APPROVED	JGR

SCALE 1 : 5000

CITY OF OTTAWA

FERNBANK CDP

WATERMAIN LAYOUT

PROJECT No. 101108-00

DATE OCTOBER 2007

DRAWING No. 101108-WM

PLANBI.DWG - 1000mmX707mm

Drawing:M:\2001\101108\CAD\design\Functional\WATER.dwg Layout:WM Updated MAY 06, 2009 at 12:02pm by kmurphy

Drawing M:\2001\101108\CAD\design\Functional\101108-KP.dwg Layout101108-KP Updated MAY 13, 2009 at 9:26am by kmurphy

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

STORM PROFILES

SANITARY PROFILES

No.	REVISION	DATE	BY
2	ISSUED WITH MASTER SERVICING STUDY	MAY 25/09	MAB
1	ISSUED WITH DRAFT MASTER SERVICING STUDY	SEPT 12/08	MAB

LICENSED PROFESSIONAL ENGINEER M.A. BISSETT PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER J.G. RIDDELL PROVINCE OF ONTARIO

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DESIGN	KJM	SCALE	CITY OF OTTAWA
CHECKED	MAB	1 : 5000	FERNBANK CDP
DRAWN	CV		
CHECKED	MAB		PROFILE DRAWINGS
APPROVED	JGR		KEY PLAN

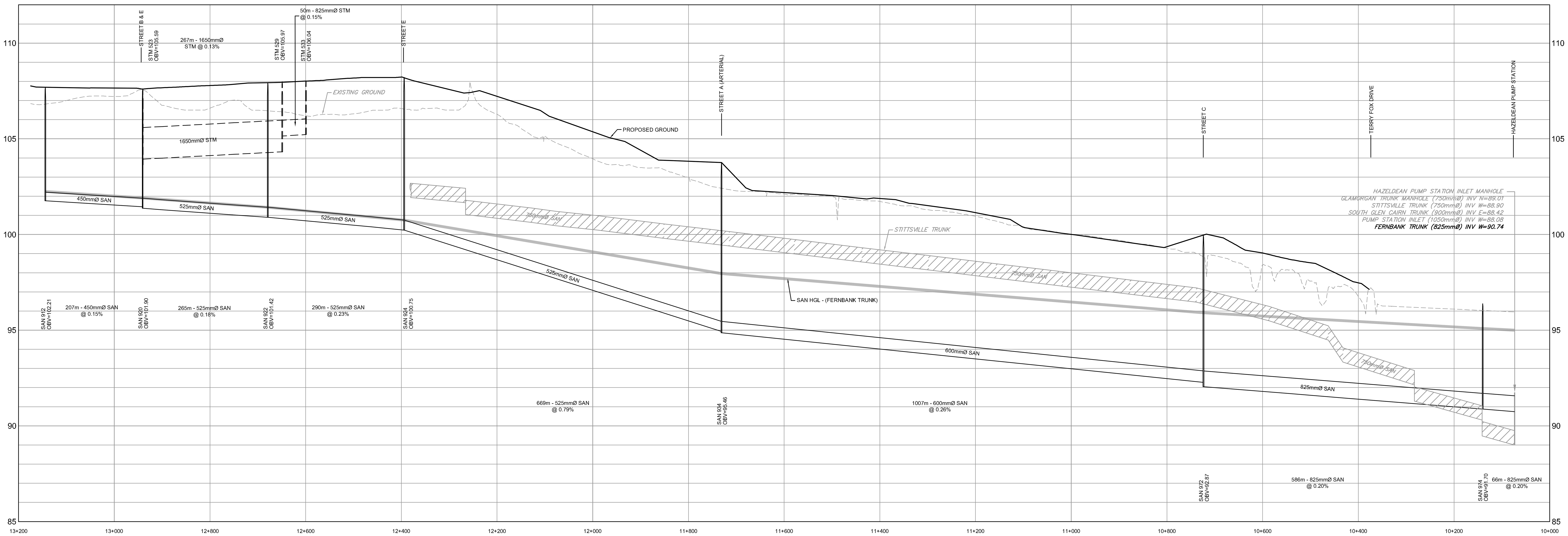
PROJECT No. 101108-0

DATE SEPTEMBER 2008

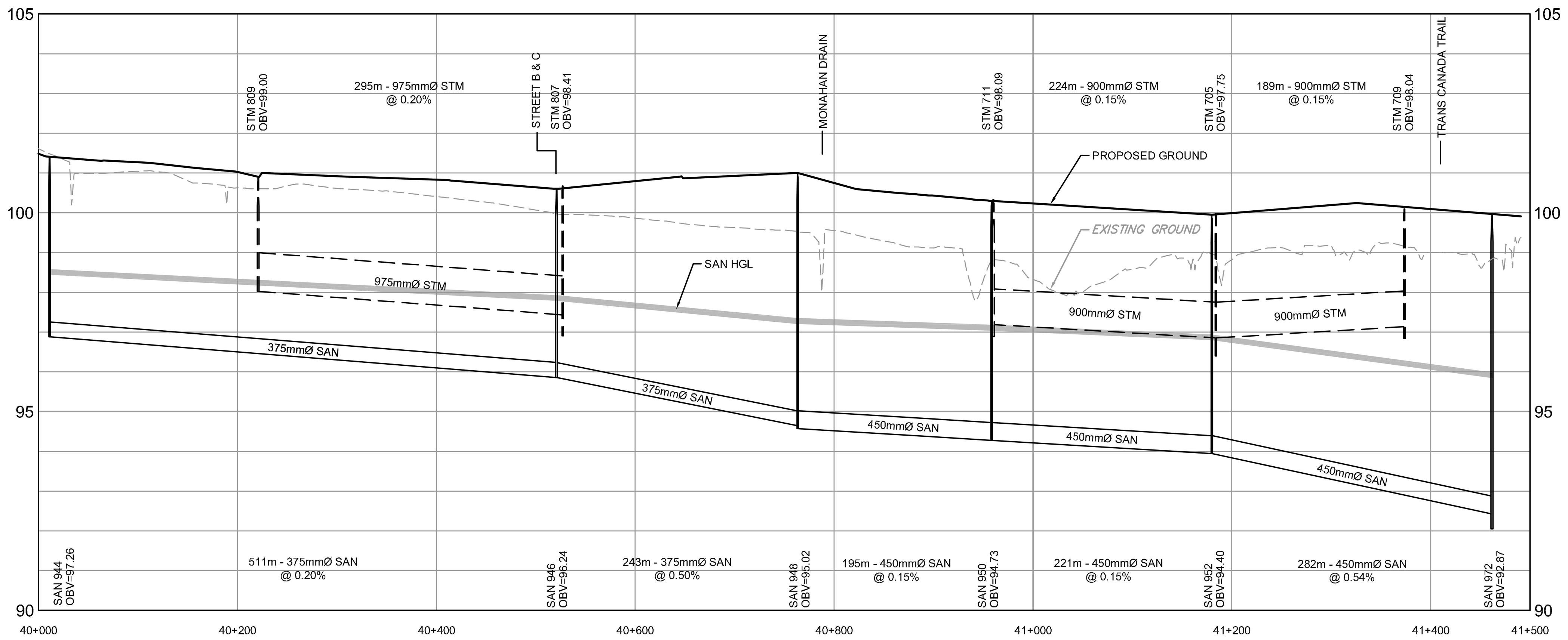
DRAWING No. 101108-KP

PLANBLDWG - 1000mmX707mm

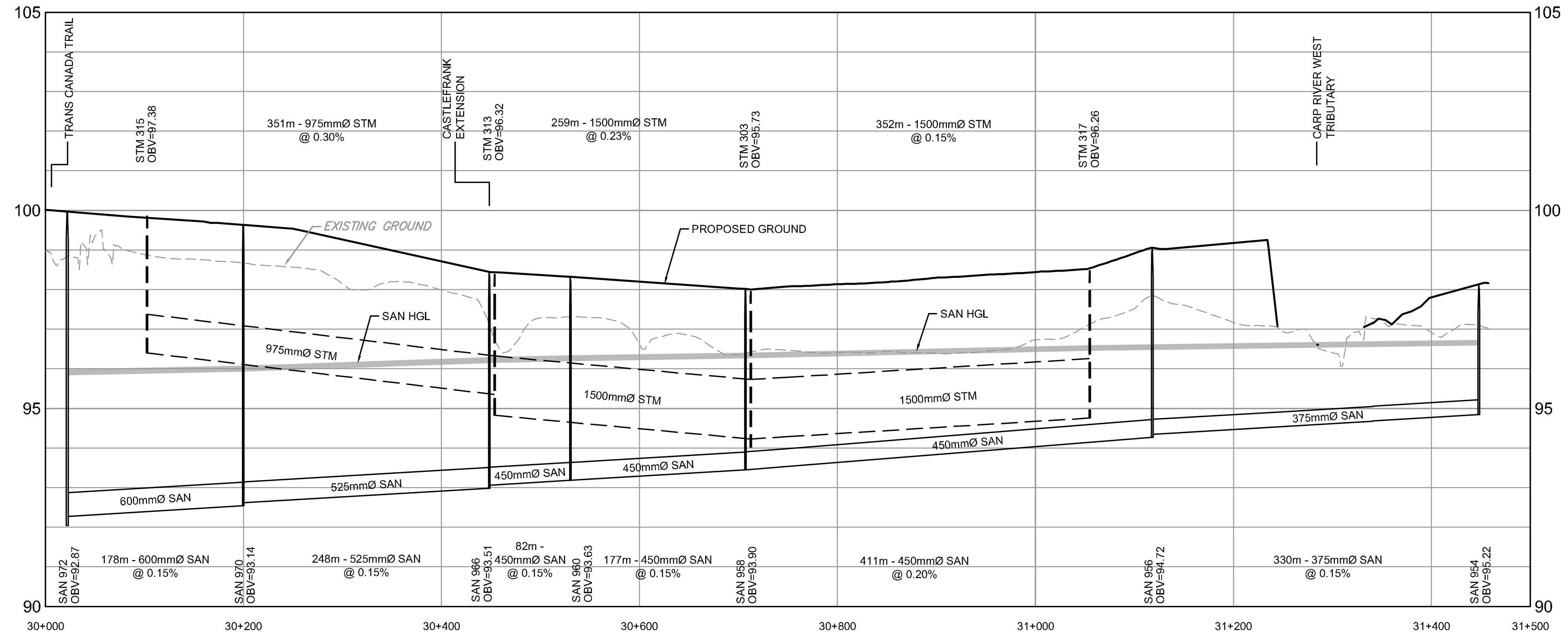
PR1 - FERNBANK TRUNK SEWER (TRANS CANADA TRAIL)



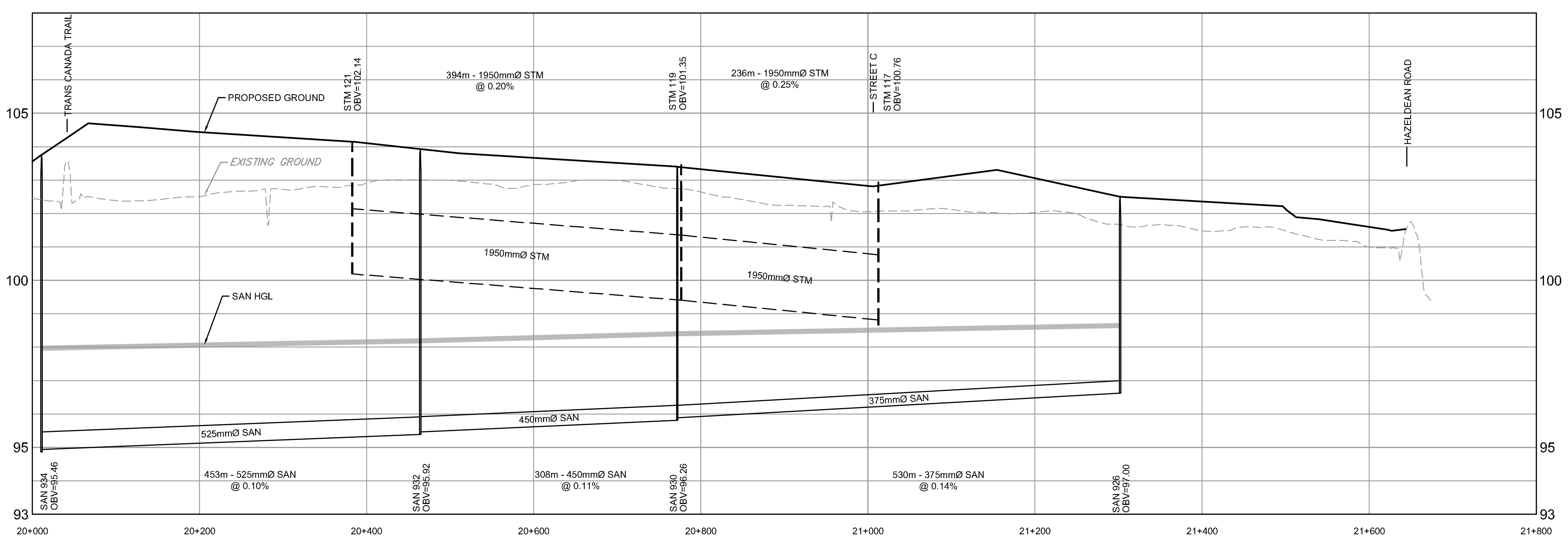
PR2 - STREET C TRUNK SEWER (MONAHAN DRAIN CROSSING)



PR3 - STREET C TRUNK SEWER (ADJACENT TO CARP RIVER)



PR4 - STREET A TRUNK SEWER (ARTERIAL ROAD)



LEGEND

- FINISHED GROUND
- EXISTING GROUND
- 35m - 375mmØ SAN @ 0.15% — SANITARY SEWER (LENGTH, SIZE & SLOPE)
- 35m - 1500mmØ STM @ 0.30% — STORM SEWER (LENGTH, SIZE & SLOPE)
- POND — 100 YR.=96.50m — 100 YEAR WATER LEVEL; NWL=95.00m — NORMAL WATER LEVEL
- STITTSVILLE TRUNK 750mmØ SAN — EXISTING SANITARY SEWER
- HYDRAULIC GRADE LINE (SAN)

NOTES

1. SANITARY HYDRAULIC GRADE LINE ANALYZED UNDER CATSTROPHIC FAILURE CONDITIONS AT THE HAZELDEAN PUMP STATION WITH THE PROPOSED OVERFLOW (ELEV 95.00)
2. FOR STORM HGL, SEE DRAWINGS 101108-PR2 & 101108-PR3

NOTE:
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LICENSED PROFESSIONAL ENGINEER — M.A. BISSETT — PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER — J.G. RIDDELL — PROVINCE OF ONTARIO

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DESIGN	KJM
CHECKED	MAB
DRAWN	CV
CHECKED	MAB
APPROVED	JGR

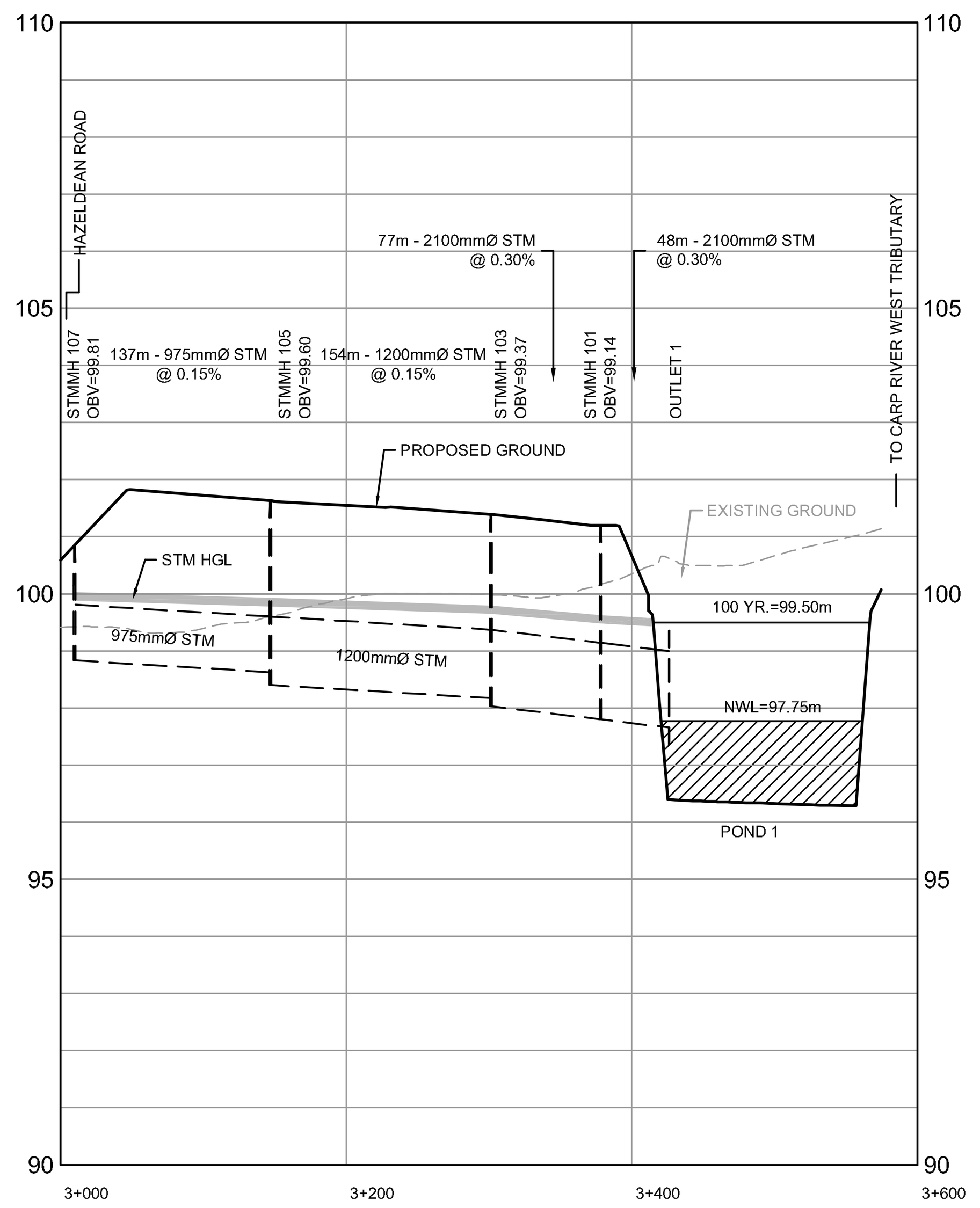
SCALE: 1 : 4000 HORIZONTAL; 1 : 100 VERTICAL

CITY OF OTTAWA
FERNBANK CDP

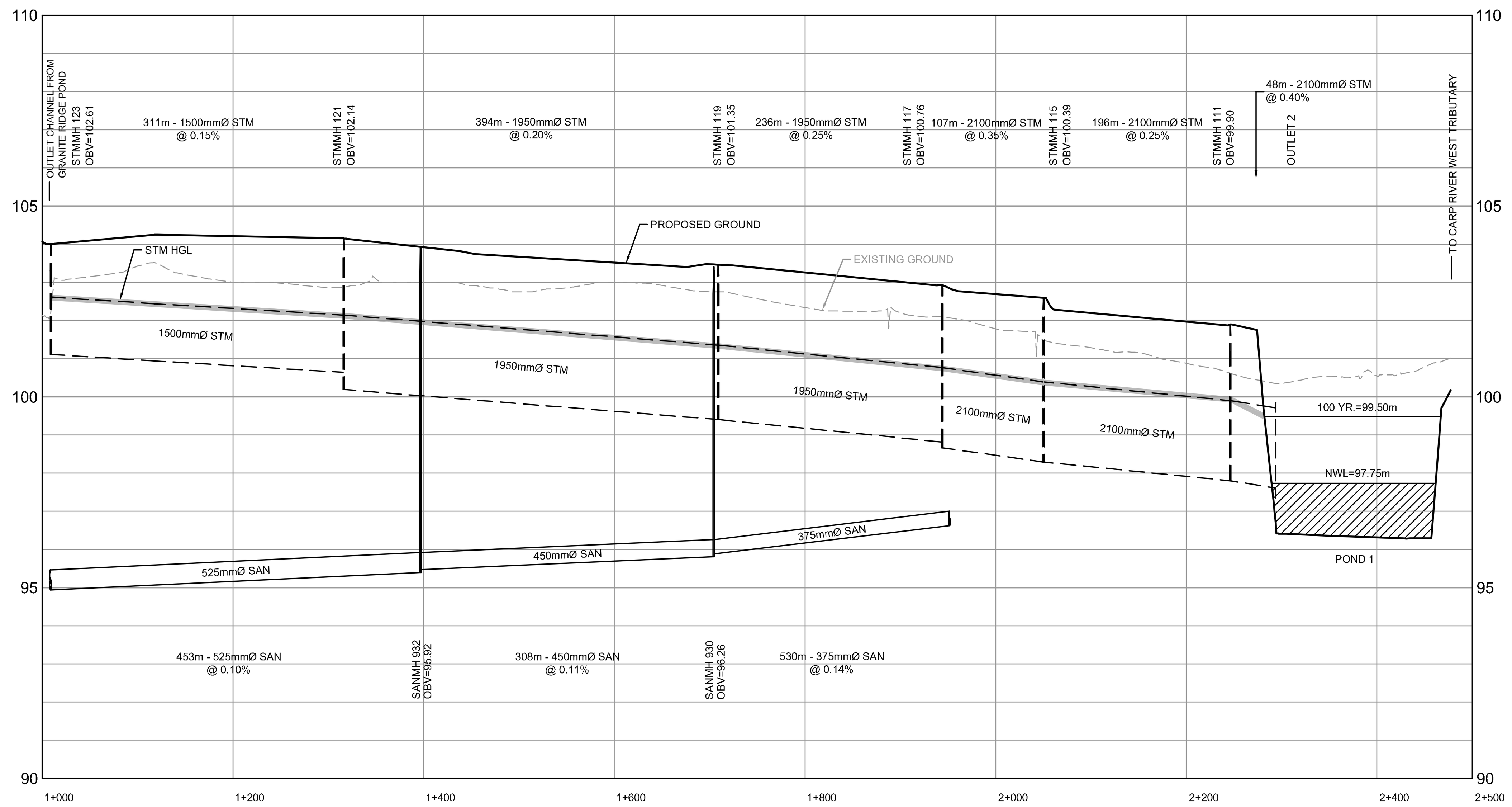
PROFILE DRAWINGS
SANITARY TRUNK ALIGNMENTS

PROJECT No. 101108-0
DATE SEPTEMBER 2008
DRAWING No. 101108-PR1

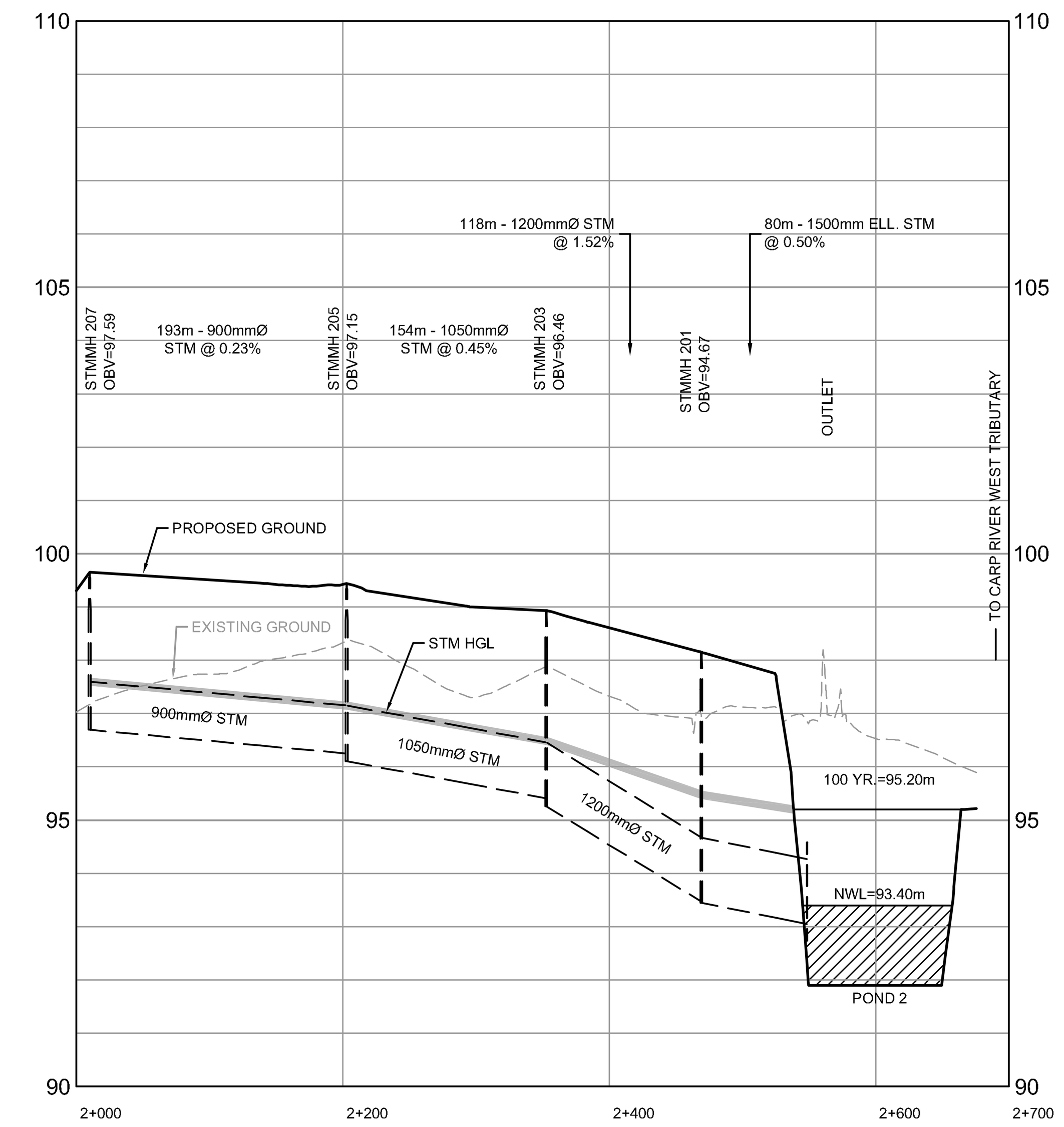
PR5 - POND 1 - MH107 TO STORM OUTLET (NORTH TRUNK)



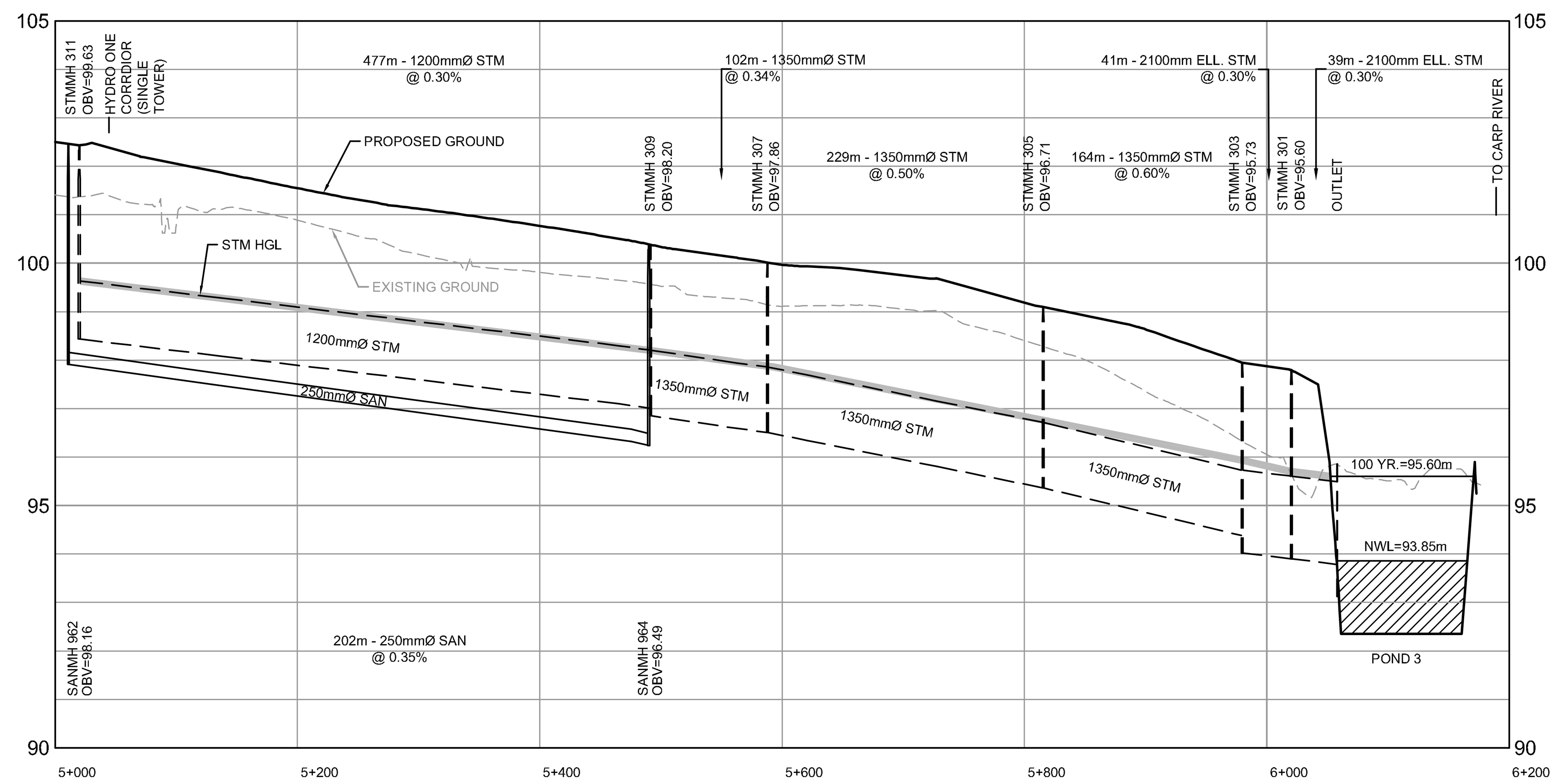
PR6 - POND 1 - MH123 TO STORM OUTLET 2 (SOUTH TRUNK)



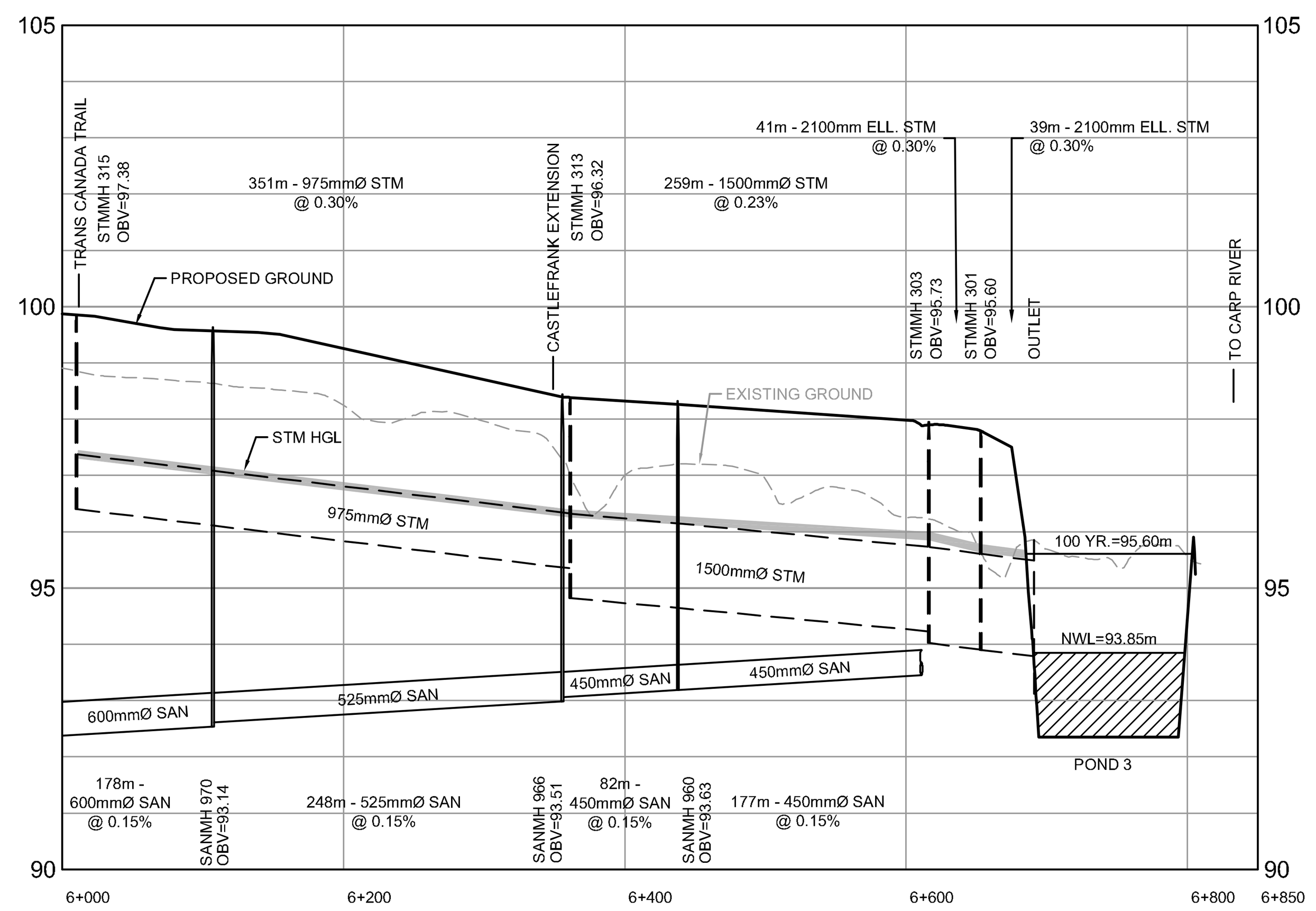
PR7 - POND 2 - MH207 TO STORM OUTLET



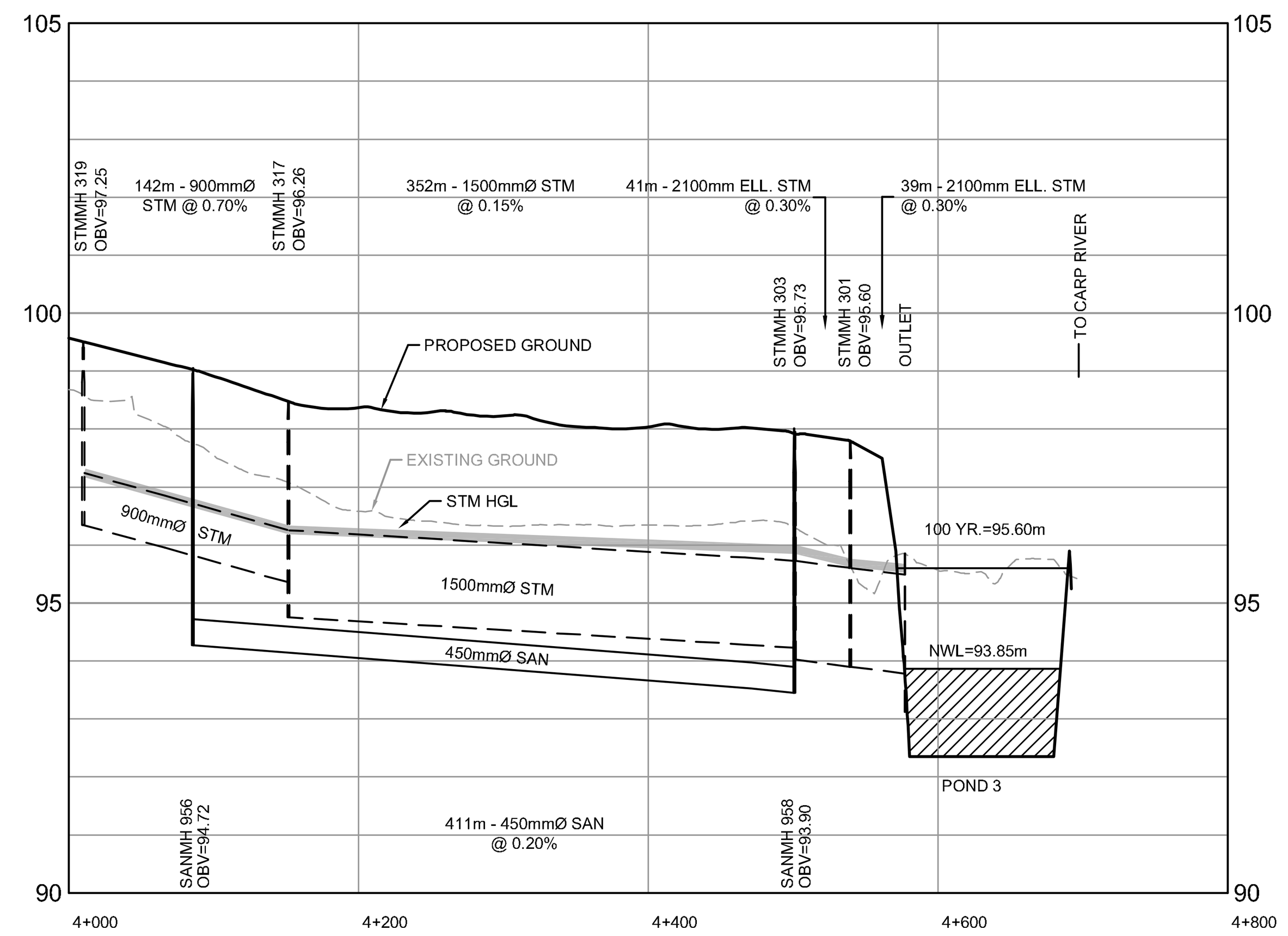
PR8 - POND 3 - MH311 TO STORM OUTLET (WEST TRUNK)



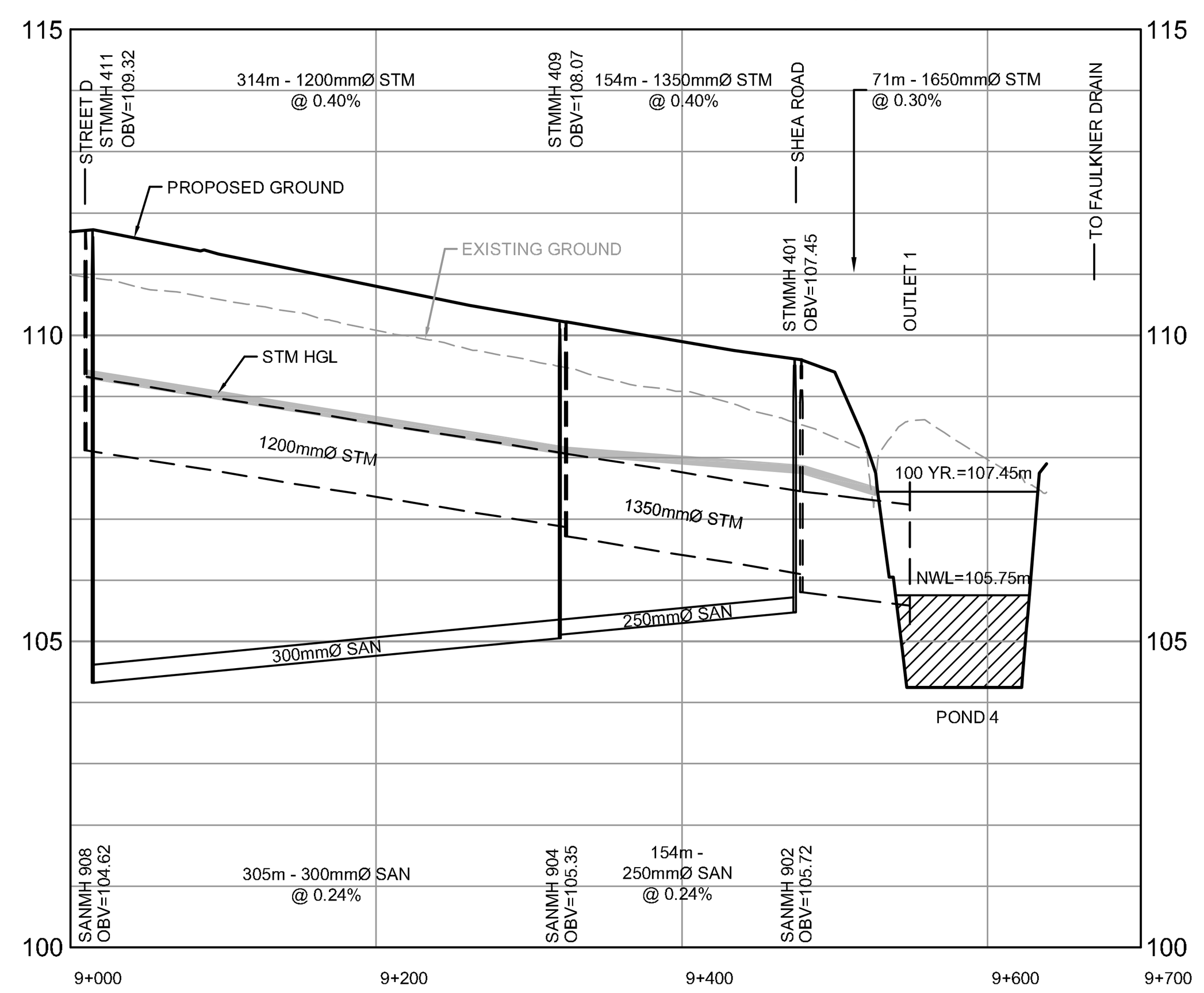
PR9 - POND 3 - MH315 TO STORM OUTLET (SOUTH TRUNK)



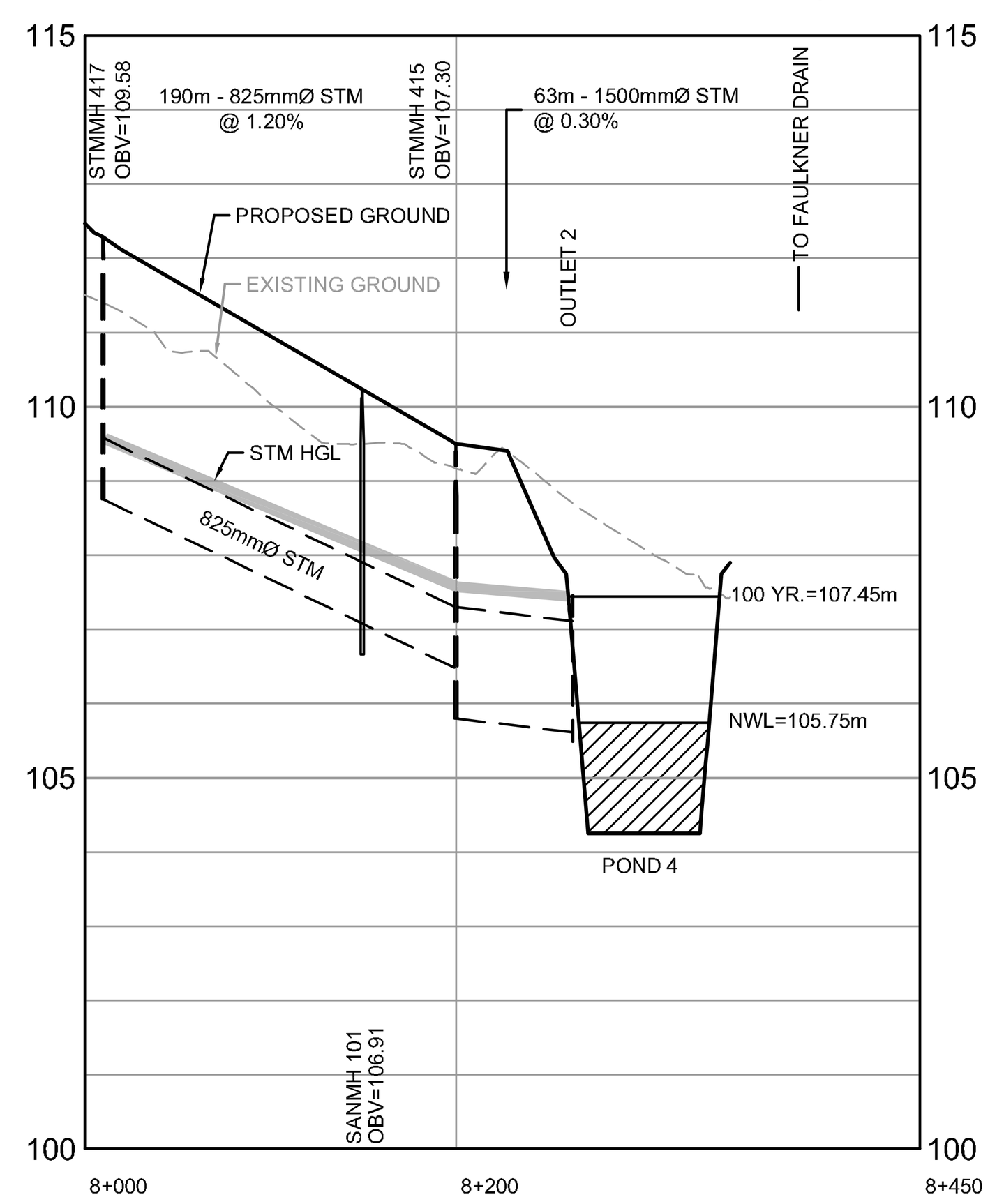
PR10 - POND 3 - MH319 TO STORM OUTLET (NORTH TRUNK)



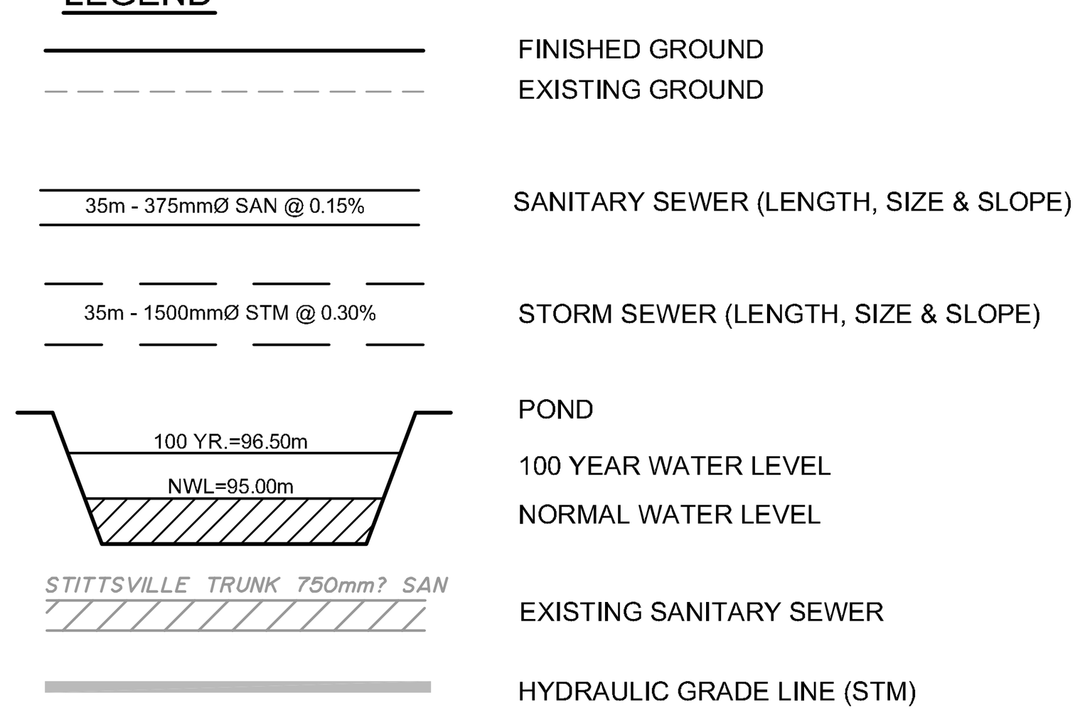
PR11 - POND 4 - MH411 TO STORM OUTLET 1 (NORTH TRUNK)



PR12 - POND 4 - MH417 TO STORM OUTLET 2 (WEST TRUNK)



LEGEND



NOTES

1. STORM HYDRAULIC GRADE LINE ANALYZED UNDER 100 YEAR STORM CONDITION.
2. FOR SANITARY HGL, SEE DRAWING 101108-PR1.

Drawing:M:\2001\101108\CAD\design\Functional\STORM.dwg Layout:101108-PR2 Updated MAY 14, 2009 at 9:41am by kmurphy

NOTE:
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2	ISSUED WITH MASTER SERVICING STUDY	MAY 25/09	MAB
1	ISSUED WITH DRAFT MASTER SERVICING STUDY	SEPT 12/08	MAB

LICENSED PROFESSIONAL ENGINEER M.A. BISSETT PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER J.G. RIDDELL PROVINCE OF ONTARIO

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DESIGN	KJM
CHECKED	MAB
DRAWN	CV
CHECKED	MAB
APPROVED	JGR

SCALE
1 : 4000 HORIZONTAL
1 : 100 VERTICAL

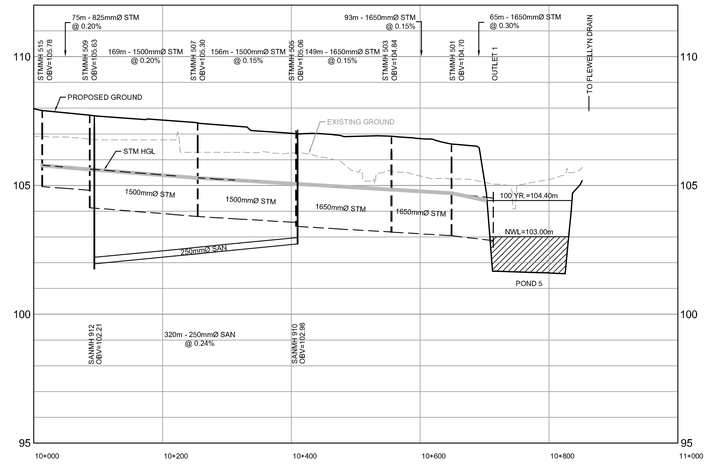
CITY OF OTTAWA
FERNBANK CDP

PROFILE DRAWINGS
STORM TRUNK ALIGNMENTS

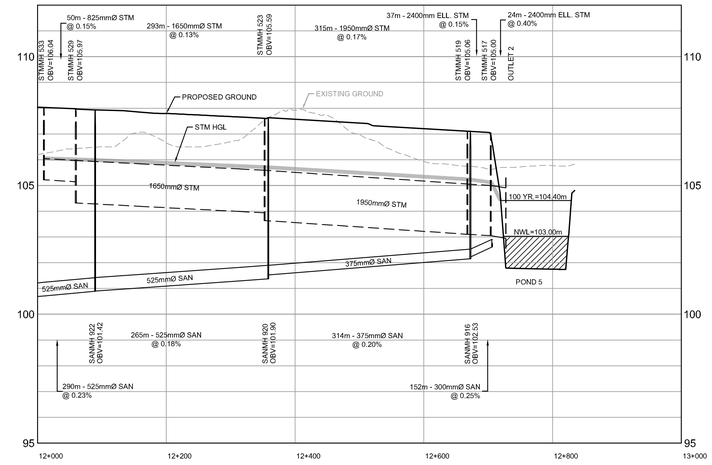
PROJECT No. 101108-0
DATE SEPTEMBER 2008
DRAWING No. 101108-PR2

PLANBLDWG - 1000mmX707mm

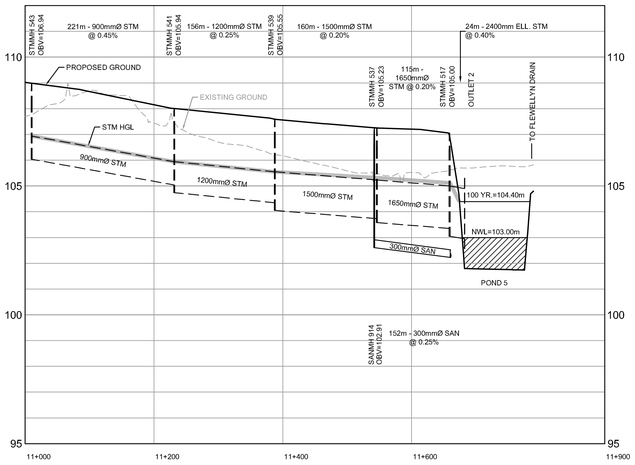
PR13 - POND 5 - MH515 TO STORM OUTLET 1 (WEST TRUNK)



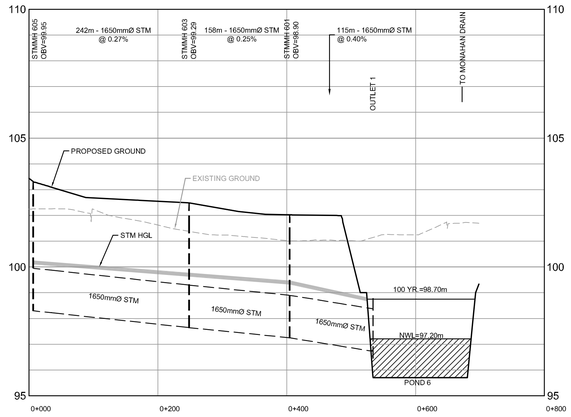
PR14 - POND 5 - MH533 TO STORM OUTLET 2 (NORTH TRUNK)



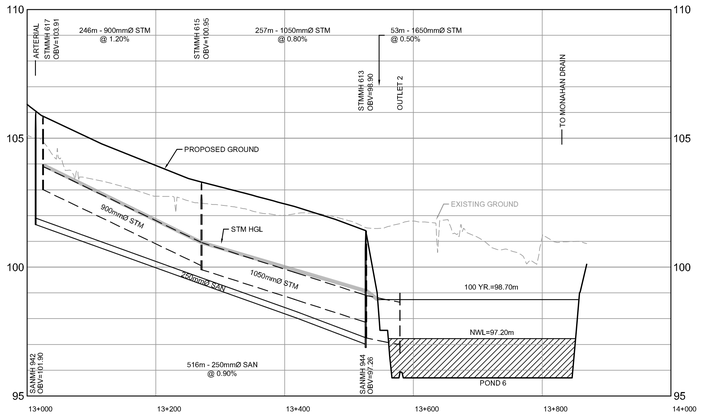
PR15 - POND 5 - MH543 STORM OUTLET 2 (EAST TRUNK)



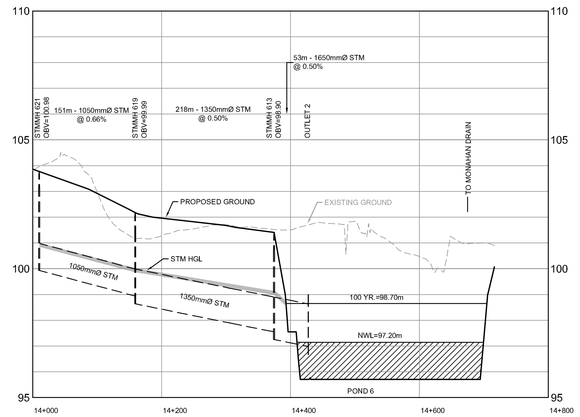
PR16 - POND 6 - MH605 TO STORM OUTLET 1 (NORTH TRUNK)



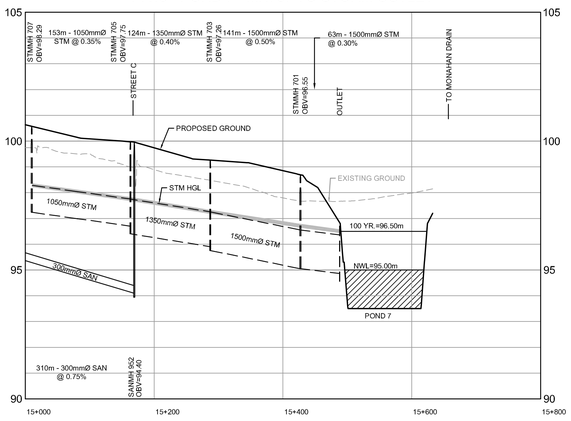
PR17 - POND 6 - MH617 TO STORM OUTLET 2 (WEST TRUNK)



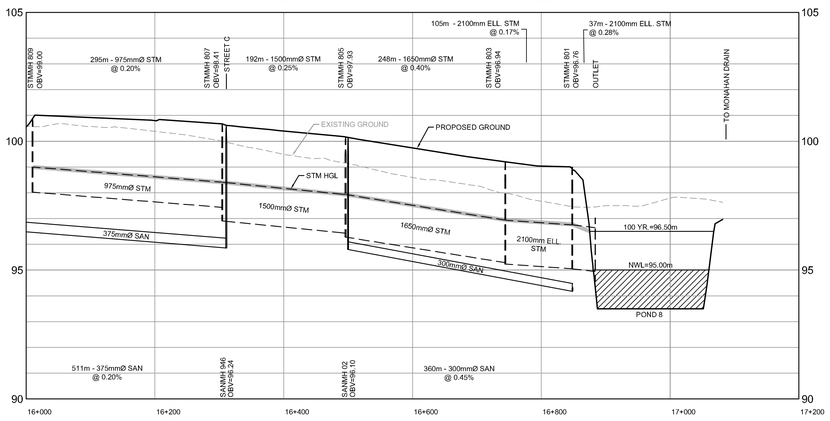
PR18 - POND 6 - MH621 TO STORM OUTLET 2 (SOUTH TRUNK)



PR19 - POND 7 - MH707 TO STORM OUTLET



PR20 - POND 8 - MH809 TO STORM OUTLET



LEGEND

- FINISHED GROUND
- EXISTING GROUND
- 35m - 375mmØ SAN @ 0.15% — SANITARY SEWER (LENGTH, SIZE & SLOPE)
- 35m - 1500mmØ STM @ 0.30% — STORM SEWER (LENGTH, SIZE & SLOPE)
- POND (100 YR.=96.50m, NWL=95.00m) — 100 YEAR WATER LEVEL; NORMAL WATER LEVEL
- STITTSVILLE TRUNK 750mm? SAN — EXISTING SANITARY SEWER
- HYDRAULIC GRADE LINE (STM)

NOTES

1. STORM HYDRAULIC GRADE LINE ANALYZED UNDER 100 YEAR STORM CONDITION.
2. FOR SANITARY HGL, SEE DRAWING 101108-PR1.

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
2	ISSUED WITH MASTER SERVICING STUDY	MAY 25/09	MAB
1	ISSUED WITH DRAFT MASTER SERVICING STUDY	SEPT 12/08	MAB

LICENSED PROFESSIONAL ENGINEER — M.A. BISSETT — PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER — J.G. RIDDELL — PROVINCE OF ONTARIO

NOVATECH ENGINEERING CONSULTANTS LTD.
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DESIGN	KJM
CHECKED	MAB
DRAWN	CV
CHECKED	MAB
APPROVED	JGR

SCALE: 1 : 4000 HORIZONTAL; 1 : 100 VERTICAL

CITY OF OTTAWA
FERNBANK CDP

PROFILE DRAWINGS
STORM TRUNK ALIGNMENTS

PROJECT No. 101108-0
DATE SEPTEMBER 2008
DRAWING No. 101108-PR3

PLANSLDWG - 1000mmX707mm

Drawing:M:\2008\101108\CAD\design\Functional\STORM.dwg Layout:101108-PR3 Updated MAY 14, 2009 at 10:07am by kmurphy