December 2022 / Rev February 2023

Volume 2

Environmental Assessment of the Township of North Dundas Waste Management Plan

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Appendix E-1
SWMM Inputs: Subcatchments

Subcatchment	Area (ha)	Width (m)	Slope (%)	% Impervious	Manning's N-Impervious	Manning's N-Pervious	Depression Storage Impervious (mm)	Depression Storage Pervious (mm)	Infiltration	Curve Number	Drying Time
101	4.9	363	7.25	6	0.015	0.25	1	5	Curve Number	74.96	7
102	6.92	875.9	11.39	0	0.015	0.25	1	5	Curve Number	74	7
201	2.246	317.14	12.7	13.8	0.015	0.25	1	5	Curve Number	76.95	7
202	2.137	319.86	6.73	0	0.015	0.25	1	5	Curve Number	74	7
203	4.517	354.3	10.59	0	0.015	0.25	1	5	Curve Number	74	7
204	4.412	330.98	10.13	0	0.015	0.25	1	5	Curve Number	74	7
205	0.729	50	2	50	0.015	0.25	1	5	Curve Number	86	7

SWMM Inputs: Storage

Depth (m)	Area (m2)	(m3)
0	2780.00	0.000
0.1	2910.00	145.500
0.2	3047.00	304.700
0.3	3185.00	477.750
0.4	3324.00	664.800
0.5	3465.00	866.250
0.6	3607.00	1082.100
0.7	3750.00	1312.500
0.8	3894.00	1557.600
0.9	4040.00	1818.000
1.0	4187.00	2093.500
1.1	4335.00	2384.250
1.2	4485.00	2691.000
1.3	4636.00	3013.400
1.4	4788.00	3351.600

Prepared by: MHK
Reviewed by: DVK

Appendix E-2
SWMM Inputs: SCS Type II Design Storms

	Return Period	2	5	10	25	50	100	100+20%
Total 24-hr Rainfall (mm)		48	62.4	72	84	93.6	103.2	123.84
Time	Time							
min	hr:min	mm/hr	mm/hr	mm/hr	mm/hr	mm/hr	mm/hr	mm/hr
0	0:00	0.53	0.69	0.79	0.92	1.03	1.14	1.36
15	0:15	0.53	0.69	0.79	0.92	1.03	1.14	1.36
30	0:30	0.53	0.69	0.79	0.92	1.03	1.14	1.36
45	0:45	0.53	0.69	0.79	0.92	1.03	1.14	1.36
60	1:00	0.53	0.69	0.79	0.92	1.03	1.14	1.36
75	1:15	0.53	0.69	0.79	0.92	1.03	1.14	1.36
90	1:30	0.53	0.69	0.79	0.92	1.03	1.14	1.36
105	1:45	0.53	0.69	0.79	0.92	1.03	1.14	1.36
120	2:00	0.62	0.81	0.94	1.09	1.22	1.34	1.61
135	2:15	0.62	0.81	0.94	1.09	1.22	1.34	1.61
150	2:30	0.62	0.81	0.94	1.09	1.22	1.34	1.61
165	2:45	0.62	0.81	0.94	1.09	1.22	1.34	1.61
180	3:00	0.62	0.81	0.94	1.09	1.22	1.34	1.61
195	3:15	0.62	0.81	0.94	1.09	1.22	1.34	1.61
210	3:30	0.62	0.81	0.94	1.09	1.22	1.34	1.61
225	3:45	0.62	0.81	0.94	1.09	1.22	1.34	1.61
240	4:00	0.77	1.00	1.15	1.34	1.50	1.65	1.98
255	4:15	0.77	1.00	1.15	1.34	1.50	1.65	1.98
270	4:30	0.77	1.00	1.15	1.34	1.50	1.65	1.98
285	4:45	0.77	1.00	1.15	1.34	1.50	1.65	1.98
300	5:00	0.77	1.00	1.15	1.34	1.50	1.65	1.98
315	5:15	0.77	1.00	1.15	1.34	1.50	1.65	1.98
330	5:30	0.77	1.00	1.15	1.34	1.50	1.65	1.98
345	5:45	0.77	1.00	1.15	1.34	1.50	1.65	1.98
360	6:00	0.96	1.25	1.44	1.68	1.87	2.06	2.48
375	6:15	0.96	1.25	1.44	1.68	1.87	2.06	2.48
390	6:30	0.96	1.25	1.44	1.68	1.87	2.06	2.48
405	6:45	0.96	1.25	1.44	1.68	1.87	2.06	2.48
420	7:00	0.96	1.25	1.44	1.68	1.87	2.06	2.48
435	7:15	0.96	1.25	1.44	1.68	1.87	2.06	2.48
450	7:30	0.96	1.25	1.44	1.68	1.87	2.06	2.48
465	7:45	0.96	1.25	1.44	1.68	1.87	2.06	2.48
480	8:00	1.30	1.68	1.94	2.27	2.53	2.79	3.34
495	8:15	1.30	1.68	1.94	2.27	2.53	2.79	3.34
510	8:30	1.30	1.68	1.94	2.27	2.53	2.79	3.34
525	8:45	1.30	1.68	1.94	2.27	2.53	2.79	3.34
540	9:00	1.54	2.00	2.30	2.69	3.00	3.30	3.96
555	9:15	1.54	2.00	2.30	2.69	3.00	3.30	3.96
570	9:30	1.73	2.25	2.59	3.02	3.37	3.72	4.46
585	9:45	1.73	2.25	2.59	3.02	3.37	3.72	4.46

Prepared by: MHK
Reviewed by: DVK

Appendix E-2
SWMM Inputs: SCS Type II Design Storms

	Return Period	2	5	10	25	50	100	100+20%
Total 24-hr Rainfall (mm)		48	62.4	72	84	93.6	103.2	123.84
600	10:00	2.21	2.87	3.31	3.86	4.31	4.75	5.70
615	10:15	2.21	2.87	3.31	3.86	4.31	4.75	5.70
630	10:30	2.98	3.87	4.46	5.21	5.80	6.40	7.68
645	10:45	2.98	3.87	4.46	5.21	5.80	6.40	7.68
660	11:00	4.61	5.99	6.91	8.06	8.99	9.91	11.89
675	11:15	4.61	5.99	6.91	8.06	8.99	9.91	11.89
690	11:30	19.97	25.96	29.95	34.94	38.94	42.93	51.52
705	11:45	52.99	68.89	79.49	92.74	103.33	113.93	136.72
720	12:00	6.91	8.99	10.37	12.10	13.48	14.86	17.83
735	12:15	6.91	8.99	10.37	12.10	13.48	14.86	17.83
750	12:30	3.55	4.62	5.33	6.22	6.93	7.64	9.16
765	12:45	3.55	4.62	5.33	6.22	6.93	7.64	9.16
780	13:00	0.67	0.87	1.01	1.18	1.31	1.44	1.73
795	13:15	0.67	0.87	1.01	1.18	1.31	1.44	1.73
810	13:30	3.94	5.12	5.90	6.89	7.68	8.46	10.15
825	13:45	3.94	5.12	5.90	6.89	7.68	8.46	10.15
840	14:00	1.44	1.87	2.16	2.52	2.81	3.10	3.72
855	14:15	1.44	1.87	2.16	2.52	2.81	3.10	3.72
870	14:30	1.44	1.87	2.16	2.52	2.81	3.10	3.72
885	14:45	1.44	1.87	2.16	2.52	2.81	3.10	3.72
900	15:00	1.44	1.87	2.16	2.52	2.81	3.10	3.72
915	15:15	1.44	1.87	2.16	2.52	2.81	3.10	3.72
930	15:30	1.44	1.87	2.16	2.52	2.81	3.10	3.72
945	15:45	1.44	1.87	2.16	2.52	2.81	3.10	3.72
960	16:00	0.86	1.12	1.30	1.51	1.68	1.86	2.23
975	16:15	0.86	1.12	1.30	1.51	1.68	1.86	2.23
990	16:30	0.86	1.12	1.30	1.51	1.68	1.86	2.23
1005	16:45	0.86	1.12	1.30	1.51	1.68	1.86	2.23
1020	17:00	0.86	1.12	1.30	1.51	1.68	1.86	2.23
1035	17:15	0.86	1.12	1.30	1.51	1.68	1.86	2.23
1050	17:30	0.86	1.12	1.30	1.51	1.68	1.86	2.23
1065	17:45	0.86	1.12	1.30	1.51	1.68	1.86	2.23
1080	18:00	0.86	1.12	1.30	1.51	1.68	1.86	2.23
1095	18:15	0.86	1.12	1.30	1.51	1.68	1.86	2.23
1110	18:30	0.86	1.12	1.30	1.51	1.68	1.86	2.23
1125	18:45	0.86	1.12	1.30	1.51	1.68	1.86	2.23
1140	19:00	0.86	1.12	1.30	1.51	1.68	1.86	2.23
1155	19:15	0.86	1.12	1.30	1.51	1.68	1.86	2.23
1170	19:30	0.86	1.12	1.30	1.51	1.68	1.86	2.23
1185	19:45	0.86	1.12	1.30	1.51	1.68	1.86	2.23
1200	20:00	0.58	0.75	0.86	1.01	1.12	1.24	1.49
1215	20:15	0.58	0.75	0.86	1.01	1.12	1.24	1.49

Prepared by: MHK
Reviewed by: DVK

Appendix E-2
SWMM Inputs: SCS Type II Design Storms

	Return Period	2	5	10	25	50	100	100+20%
Total 24-hr Rainfall (mm)		48	62.4	72	84	93.6	103.2	123.84
1230	20:30	0.58	0.75	0.86	1.01	1.12	1.24	1.49
1245	20:45	0.58	0.75	0.86	1.01	1.12	1.24	1.49
1260	21:00	0.58	0.75	0.86	1.01	1.12	1.24	1.49
1275	21:15	0.58	0.75	0.86	1.01	1.12	1.24	1.49
1290	21:30	0.58	0.75	0.86	1.01	1.12	1.24	1.49
1305	21:45	0.58	0.75	0.86	1.01	1.12	1.24	1.49
1320	22:00	0.58	0.75	0.86	1.01	1.12	1.24	1.49
1335	22:15	0.58	0.75	0.86	1.01	1.12	1.24	1.49
1350	22:30	0.58	0.75	0.86	1.01	1.12	1.24	1.49
1365	22:45	0.58	0.75	0.86	1.01	1.12	1.24	1.49
1380	23:00	0.58	0.75	0.86	1.01	1.12	1.24	1.49
1395	23:15	0.58	0.75	0.86	1.01	1.12	1.24	1.49
1410	23:30	0.58	0.75	0.86	1.01	1.12	1.24	1.49
1425	23:45	0.58	0.75	0.86	1.01	1.12	1.24	1.49

SCS Type II distribution

Source: City of Ottawa Sewer Design Guidelines 2012 (for 1:100 year return period, other storms have been extrapolated from MacDonald Cartier Airport IDF curve in City of Ottawa Design Guideline 2012)

Prepared by: MHK
Reviewed by: DVK

Appendix E-3
SWMM Inputs: SCS Type II Design Storms

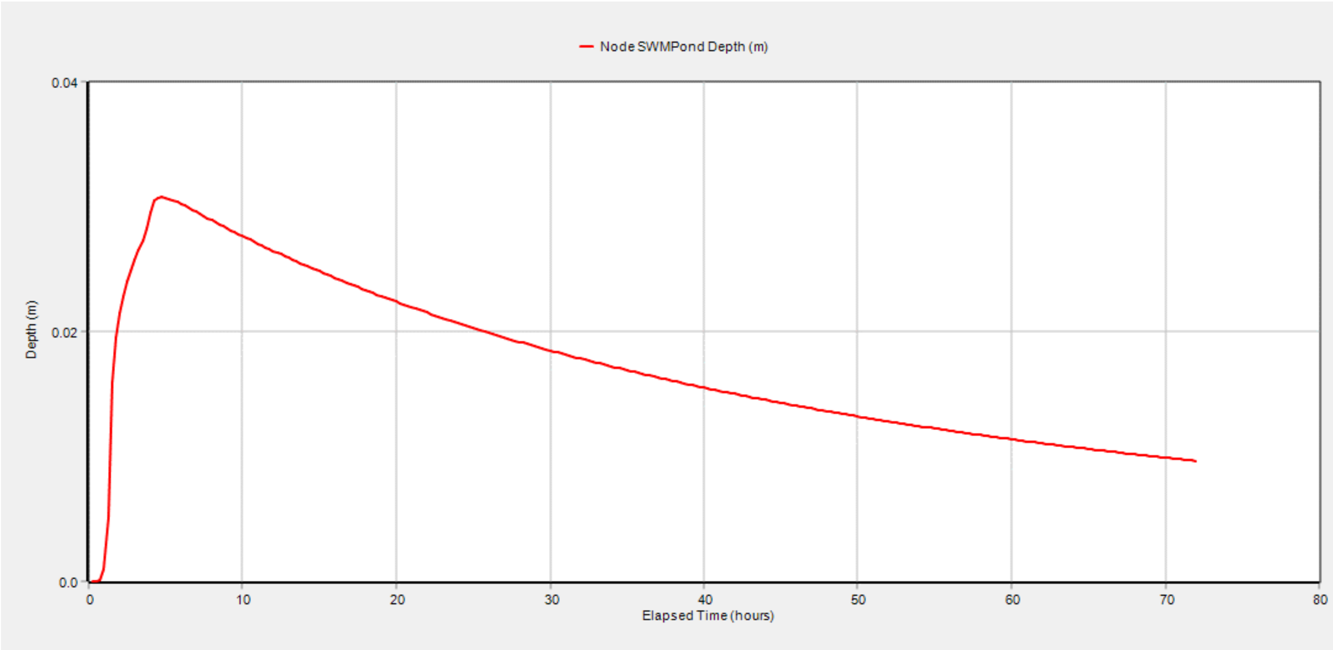
	Time	Time	2	5	10	25	50	100	100+20%
Units	Min	Hr:Min	mm/hr	mm/hr	mm/hr	mm/hr	mm/hr	mm/hr	mm/hr
Total Volume (mm)			31.88	42.54	49.53	58.26	64.85	71.68	86.01
	0	0:00	2.69	3.59	4.18	4.92	5.47	6.05	7.26
	10	0:10	3.35	4.47	5.21	6.13	6.82	7.54	9.05
	20	0:20	4.52	6.04	7.03	8.27	9.20	10.17	12.20
	30	0:30	7.11	9.48	11.04	12.99	14.46	15.98	19.18
	40	0:40	18.13	24.19	28.17	33.13	36.88	40.76	48.91
	50	0:50	79.42	105.98	123.40	145.14	161.54	178.56	214.27
	60	1:00	24.04	32.07	37.35	43.93	48.89	54.04	64.85
	70	1:10	12.15	16.21	18.87	22.20	24.71	27.31	32.77
	80	1:20	8.11	10.82	12.60	14.82	16.49	18.23	21.88
	90	1:30	6.11	8.15	9.49	11.16	12.42	13.73	16.48
	100	1:40	4.91	6.56	7.64	8.98	10.00	11.05	13.26
	110	1:50	4.13	5.51	6.41	7.54	8.40	9.28	11.14
	120	2:00	3.57	4.76	5.54	6.52	7.26	8.02	9.62
	130	2:10	3.15	4.20	4.89	5.75	6.41	7.08	8.50
	140	2:20	2.82	3.76	4.38	5.15	5.74	6.34	7.61
	150	2:30	2.56	3.42	3.98	4.68	5.21	5.76	6.91
	160	2:40	2.35	3.13	3.65	4.29	4.78	5.28	6.34
	170	2:50	2.17	2.90	3.37	3.97	4.41	4.88	5.86
	180	3:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Chicago 3 hour storm

Source: City of Ottawa Sewer Design Guidelines 2012 (for 1:100 year return period, other storms have been extrapolated from MacDonald Cartier Airport IDF curve in City of Ottawa Design Guideline 2012)

Prepared by: MHK
Reviewed by: DVK

Appendix E-4
SWMM Outputs: Pond Hydrograph for 25 mm Design Storm



Days	Hours	Depth (m)	Days	Hours	Depth (m)	Days	Hours	Depth (m)
0	0:00:00	0	1	0:00:00	0.02	2	0:00:00	0.01
0	0:15:00	0	1	0:15:00	0.02	2	0:15:00	0.01
0	0:30:00	0	1	0:30:00	0.02	2	0:30:00	0.01
0	0:45:00	0	1	0:45:00	0.02	2	0:45:00	0.01
0	1:00:00	0	1	1:00:00	0.02	2	1:00:00	0.01
0	1:15:00	0.01	1	1:15:00	0.02	2	1:15:00	0.01
0	1:30:00	0.02	1	1:30:00	0.02	2	1:30:00	0.01
0	1:45:00	0.02	1	1:45:00	0.02	2	1:45:00	0.01
0	2:00:00	0.02	1	2:00:00	0.02	2	2:00:00	0.01
0	2:15:00	0.02	1	2:15:00	0.02	2	2:15:00	0.01
0	2:30:00	0.02	1	2:30:00	0.02	2	2:30:00	0.01
0	2:45:00	0.02	1	2:45:00	0.02	2	2:45:00	0.01
0	3:00:00	0.03	1	3:00:00	0.02	2	3:00:00	0.01
0	3:15:00	0.03	1	3:15:00	0.02	2	3:15:00	0.01
0	3:30:00	0.03	1	3:30:00	0.02	2	3:30:00	0.01
0	3:45:00	0.03	1	3:45:00	0.02	2	3:45:00	0.01
0	4:00:00	0.03	1	4:00:00	0.02	2	4:00:00	0.01
0	4:15:00	0.03	1	4:15:00	0.02	2	4:15:00	0.01
0	4:30:00	0.03	1	4:30:00	0.02	2	4:30:00	0.01
0	4:45:00	0.03	1	4:45:00	0.02	2	4:45:00	0.01
0	5:00:00	0.03	1	5:00:00	0.02	2	5:00:00	0.01
0	5:15:00	0.03	1	5:15:00	0.02	2	5:15:00	0.01
0	5:30:00	0.03	1	5:30:00	0.02	2	5:30:00	0.01
0	5:45:00	0.03	1	5:45:00	0.02	2	5:45:00	0.01
0	6:00:00	0.03	1	6:00:00	0.02	2	6:00:00	0.01
0	6:15:00	0.03	1	6:15:00	0.02	2	6:15:00	0.01
0	6:30:00	0.03	1	6:30:00	0.02	2	6:30:00	0.01
0	6:45:00	0.03	1	6:45:00	0.02	2	6:45:00	0.01
0	7:00:00	0.03	1	7:00:00	0.02	2	7:00:00	0.01
0	7:15:00	0.03	1	7:15:00	0.02	2	7:15:00	0.01
0	7:30:00	0.03	1	7:30:00	0.02	2	7:30:00	0.01
0	7:45:00	0.03	1	7:45:00	0.02	2	7:45:00	0.01
0	8:00:00	0.03	1	8:00:00	0.02	2	8:00:00	0.01
0	8:15:00	0.03	1	8:15:00	0.02	2	8:15:00	0.01
0	8:30:00	0.03	1	8:30:00	0.02	2	8:30:00	0.01
0	8:45:00	0.03	1	8:45:00	0.02	2	8:45:00	0.01
0	9:00:00	0.03	1	9:00:00	0.02	2	9:00:00	0.01
0	9:15:00	0.03	1	9:15:00	0.02	2	9:15:00	0.01
0	9:30:00	0.03	1	9:30:00	0.02	2	9:30:00	0.01
0	9:45:00	0.03	1	9:45:00	0.02	2	9:45:00	0.01
0	10:00:00	0.03	1	10:00:00	0.02	2	10:00:00	0.01

Prepared by: MHK
Reviewed by: DVK

Days	Hours	Depth (m)	Days	Hours	Depth (m)	Days	Hours	Depth (m)
0	10:15:00	0.03	1	10:15:00	0.02	2	10:15:00	0.01
0	10:30:00	0.03	1	10:30:00	0.02	2	10:30:00	0.01
0	10:45:00	0.03	1	10:45:00	0.02	2	10:45:00	0.01
0	11:00:00	0.03	1	11:00:00	0.02	2	11:00:00	0.01
0	11:15:00	0.03	1	11:15:00	0.02	2	11:15:00	0.01
0	11:30:00	0.03	1	11:30:00	0.02	2	11:30:00	0.01
0	11:45:00	0.03	1	11:45:00	0.02	2	11:45:00	0.01
0	12:00:00	0.03	1	12:00:00	0.02	2	12:00:00	0.01
0	12:15:00	0.03	1	12:15:00	0.02	2	12:15:00	0.01
0	12:30:00	0.03	1	12:30:00	0.02	2	12:30:00	0.01
0	12:45:00	0.03	1	12:45:00	0.02	2	12:45:00	0.01
0	13:00:00	0.03	1	13:00:00	0.02	2	13:00:00	0.01
0	13:15:00	0.03	1	13:15:00	0.02	2	13:15:00	0.01
0	13:30:00	0.03	1	13:30:00	0.02	2	13:30:00	0.01
0	13:45:00	0.03	1	13:45:00	0.02	2	13:45:00	0.01
0	14:00:00	0.03	1	14:00:00	0.02	2	14:00:00	0.01
0	14:15:00	0.03	1	14:15:00	0.02	2	14:15:00	0.01
0	14:30:00	0.03	1	14:30:00	0.02	2	14:30:00	0.01
0	14:45:00	0.02	1	14:45:00	0.02	2	14:45:00	0.01
0	15:00:00	0.02	1	15:00:00	0.02	2	15:00:00	0.01
0	15:15:00	0.02	1	15:15:00	0.02	2	15:15:00	0.01
0	15:30:00	0.02	1	15:30:00	0.02	2	15:30:00	0.01
0	15:45:00	0.02	1	15:45:00	0.02	2	15:45:00	0.01
0	16:00:00	0.02	1	16:00:00	0.02	2	16:00:00	0.01
0	16:15:00	0.02	1	16:15:00	0.02	2	16:15:00	0.01
0	16:30:00	0.02	1	16:30:00	0.02	2	16:30:00	0.01
0	16:45:00	0.02	1	16:45:00	0.02	2	16:45:00	0.01
0	17:00:00	0.02	1	17:00:00	0.02	2	17:00:00	0.01
0	17:15:00	0.02	1	17:15:00	0.02	2	17:15:00	0.01
0	17:30:00	0.02	1	17:30:00	0.02	2	17:30:00	0.01
0	17:45:00	0.02	1	17:45:00	0.02	2	17:45:00	0.01
0	18:00:00	0.02	1	18:00:00	0.02	2	18:00:00	0.01
0	18:15:00	0.02	1	18:15:00	0.01	2	18:15:00	0.01
0	18:30:00	0.02	1	18:30:00	0.01	2	18:30:00	0.01
0	18:45:00	0.02	1	18:45:00	0.01	2	18:45:00	0.01
0	19:00:00	0.02	1	19:00:00	0.01	2	19:00:00	0.01
0	19:15:00	0.02	1	19:15:00	0.01	2	19:15:00	0.01
0	19:30:00	0.02	1	19:30:00	0.01	2	19:30:00	0.01
0	19:45:00	0.02	1	19:45:00	0.01	2	19:45:00	0.01
0	20:00:00	0.02	1	20:00:00	0.01	2	20:00:00	0.01
0	20:15:00	0.02	1	20:15:00	0.01	2	20:15:00	0.01
0	20:30:00	0.02	1	20:30:00	0.01	2	20:30:00	0.01
0	20:45:00	0.02	1	20:45:00	0.01	2	20:45:00	0.01
0	21:00:00	0.02	1	21:00:00	0.01	2	21:00:00	0.01
0	21:15:00	0.02	1	21:15:00	0.01	2	21:15:00	0.01
0	21:30:00	0.02	1	21:30:00	0.01	2	21:30:00	0.01
0	21:45:00	0.02	1	21:45:00	0.01	2	21:45:00	0.01
0	22:00:00	0.02	1	22:00:00	0.01	2	22:00:00	0.01
0	22:15:00	0.02	1	22:15:00	0.01	2	22:15:00	0.01
0	22:30:00	0.02	1	22:30:00	0.01	2	22:30:00	0.01
0	22:45:00	0.02	1	22:45:00	0.01	2	22:45:00	0.01
0	23:00:00	0.02	1	23:00:00	0.01	2	23:00:00	0.01
0	23:15:00	0.02	1	23:15:00	0.01	2	23:15:00	0.01
0	23:30:00	0.02	1	23:30:00	0.01	2	23:30:00	0.01
0	23:45:00	0.02	1	23:45:00	0.01	2	23:45:00	0.01

Appendix E-5
Ditch Sizing

Location	Drainage Area		Ditch Characteristics				Check				
	A ha	Q 100yr (model) m^3/s	Manning's Roughness Coefficient n	Slope S m/m	Bottom Width m	Side Slope X:1	From Manning's Equation (Q)n/(√ S)	Depth of Flow m	From Manning's Equation $A^{5/3}/P^{2/3}$	Cross-Sectional Area m^2	Actual Velocity m/s
Area 203 Swale	4.517	0.2500	0.035	0.003	0.00	3	0.160	0.401	0.160	0.482	0.52
Area 203 / 204 Swale	8.929	0.4800	0.035	0.001	1.00	3	0.531	0.488	0.532	1.202	0.40
Area 202 Swale	2.137	0.1500	0.035	0.003	0.00	3	0.096	0.332	0.096	0.331	0.45

Manipulation of Manning's Equation:
$Q=(AR^{2/3}\sqrt{S})/n$
where: R=A/P (Cross-Sectional Area/Wetted Perimeter)

Therefore:
$Qn/(\sqrt{S})=A^{5/3}/P^{2/3}$

Prepared by: MHK
Reviewed by: DVK

APPENDIX F

Biology

Appendix F-1 – Headwater Drainage Features Assessment

Classification: Drainage Feature Segment	Step 1			Step 2		Step 3		Step 4		Management Recommendation
	Field Data	Hydrology	Modifiers	Field Data	Riparian	Field Data	Fish and Fish Habitat	Field Data	Terrestrial Habitat	
Reach 1	April: FC = 4 / FT = 2 May: FC = 2 / FT = 2 July: FC = 1 / FT = 2	C - Contributing Functions		FT = 2 Highest Functioning Riparian Veg Type = 7	A - Important	Fish Collection Date: July 17, 2020 Results: Dry; No Fish	C - Contributing Functions	FT = 2 MMP Call Code = 0	D - Limited Functions	Conservation
Reach 2	April: FC = 4 / FT = 2 May: FC = 2 / FT = 2 July: FC = 1 / FT = 2	C - Contributing Functions		FT = 2 Highest Functioning Riparian Veg Type = 6	A - Important	Fish Collection Date: July 17, 2020 Results: Dry; No Fish	C - Contributing Functions	FT = 2 MMP Call Code = 0	D - Limited Functions	Conservation
Reach 3	April: FC = 4 / FT = 2 May: FC = 2 / FT = 2 July: FC = 1 / FT = 2	C - Contributing Functions		FT = 2 Highest Functioning Riparian Veg Type = 6	A - Important	Fish Collection Date: July 17, 2020 Results: Dry; No Fish	C - Contributing Functions	FT = 2 MMP Call Code = 0	D - Limited Functions	Conservation
Reach 4	April: FC = 4 / FT = 2 May: FC = 4 / FT = 2 July: FC = 1 / FT = 2	C - Contributing Functions		FT = 2 Highest Functioning Riparian Veg Type = 7	A - Important	Fish Collection Date: July 17, 2020 Results: Dry; No Fish	C - Contributing Functions	FT = 2 MMP Call Code = 0	D - Limited Functions	Conservation

Legend:
FC = Flow Condition
FT = Feature Type

Common Name	Scientific Name	Origin[a]	Global Rarity Status[b]	Ontario Rarity Status[b]	SARA[c]	ESA[d]
Acer negundo	Manitoba maple	(N)	G5	S5	–	–
Acer rubrum	Red maple	N	G5	S5	–	–
Acer saccharinum	Silver maple	N	G5	S5	–	–
Acer saccharum	Sugar maple	N	G5	S5	–	–
Actaea rubra	Red baneberry	N	G5	S5	–	–
Ageratina altissima	White snakeroot	N	G5T5	S5	–	–
Alisma triviale	Small-flowered water plantain	N	G5	S5	–	–
Alliaria petiolata	Garlic mustard	I	GNR	SNA	–	–
Alnus incana	Speckled alder	N	G5	S5	–	–
Ambrosia artemisiifolia	Ragweed	N	G5	S5	–	–
Ambrosia trifida	Giant ragweed	N	G5	S5	–	–
Anemone canadensis	Canada anemone	N	G5	S5	–	–
Anthemis cotula	Stinking mayweed	I	G5	SNA	–	–
Aralia nudicaulis	Wild sarsaparilla	N	G5	S5	–	–
Arctium minus	Common burdock	I	GNR	SNA	–	–
Arisaema triphyllum	Jack-in-the-pulpit	N	G5	S5	–	–
Asclepias incarnata	Swamp milkweed	N	G5	S5	–	–
Asclepias syriaca	Common milkweed	N	G5	S5	–	–
Athyrium filix-femina	Lady fern	N	G5T5	S5	–	–
Betula alleghaniensis	Yellow birch	N	G5	S5	–	–
Betula papyrifera	White birch	N	G5	S5	–	–
Bidens discoidea	Swamp beggar-ticks	N	G5	S4	–	–
Bidens frondosa	Beggar-ticks	N	G5	S5	–	–
Bromus inermis	Smooth brome	I	GNR	SNA	–	–
Carex crinita	Fringed sedge	N	G5	S5	–	–
Carex gracillima	Graceful sedge	N	G5	S5	–	–
Carex intumescens	Bladder sedge	N	G5	S5	–	–
Carex lacustris	Lake sedge	N	G5	S5	–	–
Carex lupulina	Hop sedge	N	G5	S5	–	–
Carex pseudocyperus	Cyperus-like sedge	N	G5	S5	–	–
Carex sp.	Sedge	N	?	?	–	–
Carex stipata	Awl-fruited sedge	N	G5	S5	–	–
Carex utriculata	Bladder sedge	N	G5	S5	–	–
Carex vulpinoidea	Fox sedge	N	G5	S5	–	–
Caulophyllum thalictroides	Blue cohosh	N	G4G5	S5	–	–
Chamaesyce serpyllifolia	Thyme-leaved spurge	I	G5	SNA	–	–
Cicuta bulbifera	Bulb-bearing water-hemlock	N	G5	S5	–	–
Circaea lutetiana	Enchanter’s nightshade	N	G5	S5	–	–
Cirsium arvense	Canada thistle	I	GNR	SNA	–	–
Cirsium vulgare	Bull thistle	I	GNR	SNA	–	–
Clematis virginiana	Virgin's-bower	N	G5	S5	–	–
Clinopodium vulgare	Wild basil	N	G5	S5	–	–
Conyza canadensis	Horseweed	N	G5	S5	–	–
Cornus alternifolia	Alternate-leaved dogwood	N	G5	S5	–	–
Cornus foemina	Gray dogwood	N	G5	S5	–	–
Cornus stolonifera	Red osier dogwood	N	G5	S5	–	–
Coronilla varia	Crown vetch	I	GNR	SNA	–	–
Cystopteris bulbifera	Bulblet fern	N	G5	S5	–	–
Dactylis glomerata	Orchard grass	I	GNR	SNA	–	–
Daucus carota	Wild carrot	I	GNR	SNA	–	–
Dichanthelium acuminatum	Small panic grass	N	G5T5	S4S5	–	–
Echinochloa crusgalli	Barnyard grass	I	GNR	SNA	–	–
Echium vulgare	Viper's bugloss	I	GNR	SNA	–	–
Elymus repens	Quack grass	I	GNR	SNA	–	–
Epilobium parviflorum	Small-flowered willowherb	I	GNR	SNA	–	–
Epipactis helleborine	Helleborine	I	GNR	SNA	–	–
Equisetum arvense	Field horsetail	N	G5	S5	–	–
Equisetum scirpoides	Dwarf scouring-rush	N	G5	S5	–	–
Equisetum sylvaticum	Woodland horsetail	N	G5	S5	–	–
Erigeron philadelphicus	Philadelphia fleabane	N	G5	S5	–	–
Erythronium americanum	Yellow trout-lily	N	G5	S5	–	–
Eupatorium perfoliatum	Boneset	N	G5	S5	–	–
Eutrochium maculatum	Joe-pye weed	N	G5TNR	S5	–	–
Fraxinus americana	White ash	N	G5	S5	–	–
Fraxinus pennsylvanica	Green ash	N	G5	S5	–	–
Galium palustre	Marsh bedstraw	N	G5	S5	–	–
Glyceria striata	Fowl manna grass	N	G5T5	S4S5	–	–
Heliopsis helianthoides	Ox-eye	N	G5	S5	–	–

Common Name	Scientific Name	Origin[a]	Global Rarity Status[b]	Ontario Rarity Status[b]	SARA[c]	ESA[d]
Hybrid poplar	Populus sp.	N/A	N/A	N/A	–	–
Hydrocharis morsus-ranae	Frogbit	I	GNR	SNA	–	–
Hypericum ellipticum	Pale St. John's-wort	N	G5	S5	–	–
Hypericum perforatum	Common St. John's-wort	I	GNR	SNA	–	–
Ilex verticillata	Winterberry	N	G5	S5	–	–
Impatiens capensis	Spotted jewelweed	N	G5	S5	–	–
Juncus effusus	Soft rush	N	G5	S5	–	–
Juncus sp.	Rush	N	?	?	–	–
Laportea canadensis	Wood nettle	N	G5	S5	–	–
Leersia oryzoides	Rice cut-grass	N	G5	S5	–	–
Lemna minor	Duckweed	N	G5	S5	–	–
Leucanthemum vulgare	Ox-eye daisy	I	GNR	SNA	–	–
Lonicera tatarica	Tartarian honeysuckle	I	GNR	SNA	–	–
Lotus corniculatus	Bird's-foot trefoil	I	GNR	SNA	–	–
Lycopus americanus	American water-horehound	N	G5	S5	–	–
Lycopus uniflorus	Northern water-horehound	N	G5	S5	–	–
Lysimachia nummularia	Moneywort	I	GNR	SNA	–	–
Lysimachia thyrsiflora	Tufted loosestrife	N	G5	S5	–	–
Lythrum salicaria	Purple loosestrife	I	G5	SNA	–	–
Maianthemum canadense	Canada mayflower	N	G5	S5	–	–
Malva neglecta	Common mallow	I	GNR	SNA	–	–
Matricaria chamomilla	Stinking mayweed	I	GNR	SNA	–	–
Matricaria discoidea	Pineapple-weed	I	G5	SNA	–	–
Matteuccia struthiopteris	Ostrich fern	N	G5	S5	–	–
Medicago lupulina	Black medick	I	GNR	S5	–	–
Medicago sativa	Alfalfa	I	GNR	S5	–	–
Melilotus alba	White sweet clover	I	G5	SNA	–	–
Mitella nuda	Naked mitrewort	N	G5	S5	–	–
Nepeta cataria	Catnip	I	GNR	SNA	–	–
Onoclea sensibilis	Sensitive fern	N	G5	S5	–	–
Origanum vulgare	Common marjoram	I	GNR	SNA	–	–
Osmunda cinnamomea	Cinnamon fern	N	G5	S5	–	–
Osmunda regalis	Royal fern	N	G5	S5	–	–
Panicum capillare	Witch grass	N	G5	S5	–	–
Parthenocissus inserta	Virginia creeper	N	G5	S5	–	–
Pastinaca sativa	Parsnip	I	GNR	SNA	–	–
Persicaria maculosa	Lady's-thumb	I	G3G5	SNA	–	–
Phalaris arundinacea	Reed canary grass	N	G5	S5	–	–
Phleum pratense	Timothy	I	GNR	SNA	–	–
Pinus strobus	White pine	N	G5	S5	–	–
Poa palustris	Fowl bluegrass	N	G5	S5	–	–
Poa pratensis	Kentucky bluegrass	I	G5T5?	SNA	–	–
Populus balsamifera	Balsam poplar	N	G5	S5	–	–
Populus tremuloides	Trembling aspen	N	G5	S5	–	–
Potomogeton sp.	Pond-weed	N	?	?	–	–
Prunella vulgaris	Heal-all	N	G5T5	S5	–	–
Rhamnus alnifolia	Alder-leaved buckthorn	N	G5	S5	–	–
Rhamnus cathartica	Common buckthorn	I	GNR	SNA	–	–
Rhamnus frangula	Glossy buckthorn	I	GNR	SNA	–	–
Rhus radicans	Poison-ivy	N	G5T5	S5	–	–
Rhus typhina	Staghorn sumac	N	G5	S5	–	–
Ribes americanum	Wild black currant	N	G5	S5	–	–
Ribes cynosbati	Prickly gooseberry	N	G5	S5	–	–
Ribes triste	Swamp red currant	N	G5	S5	–	–
Rubus allegheniensis	Mountain blackberry	N	G5	S5	–	–
Rubus idaeus	Red raspberry	N	G5T5	S5	–	–
Rubus occidentalis	Black raspberry	N	G5	S5	–	–
Rubus pubescens	Dwarf raspberry	N	G5	S5	–	–
Salix bebbiana	Beaked willow	N	G5	S5	–	–
Salix discolor	Pussy willow	N	G5	S5	–	–
Salix petiolaris	Slender willow	N	G5	S5	–	–
Salix pyrifolia	Balsam willow	N	G5	S5	–	–
Salix x fragilis	Crack willow	I	GNR	SNA	–	–
Sambucus racemosa	Red-berried elderberry	N	G5	S5	–	–
Scirpus atrovirens	Green bulrush	N	G5?	S5	–	–
Scirpus cyperinus	Wool-grass	N	G5	S5	–	–
Setaria pumila	Yellow foxtail	I	GNR	SNA	–	–
Sium suave	Water parsnip	N	G5	S5	–	–

Common Name	Scientific Name	Origin[a]	Global Rarity Status[b]	Ontario Rarity Status[b]	SARA[c]	ESA[d]
Solanum dulcamara	Climbing nightshade	I	GNR	SNA	–	–
Solidago canadensis	Canada goldenrod	N	G5T5	S5	–	–
Solidago rugosa	Rough goldenrod	N	G5	S5	–	–
Spiraea alba	Meadowsweet	N	G5	S5	–	–
Symphyotrichum lanceolatum	Panicled aster	N	G5T5	S5	–	–
Symphyotrichum novae-angliae	New England aster	N	G5	S5	–	–
Symphyotrichum puniceum	Red-stemmed aster	N	G5	S5	–	–
Thelypteris palustris	Marsh fern	N	G5	S5	–	–
Tilia americana	Basswood	N	G5	S5	–	–
Trifolium hybridum	Alsike clover	I	GNR	SNA	–	–
Trifolium pratense	Red clover	I	GNR	SNA	–	–
Trifolium repens	White clover	I	GNR	SNA	–	–
Trillium grandiflorum	White trillium	N	G5	S5	–	–
Turritis glabra	Tower mustard	N	G5	S5	–	–
Tussilago farfara	Colt's-foot	I	GNR	SNA	–	–
Typha latifolia	Common cattail	N	G5	S5	–	–
Ulmus americana	White elm	N	G5?	S5	–	–
Urtica dioica	Stinging nettle	N	G5T?	S5	–	–
Valeriana officinalis	Common valerian	I	GNR	SNA	–	–
Verbascum thapsus	Common mullein	I	GNR	SNA	–	–
Verbena hastata	Blue vervain	N	G5	S5	–	–
Vicia cracca	Cow-vetch	I	GNR	SNA	–	–
Viola pubescens	Yellow violet	N	G5T5	S5	–	–
Vitis riparia	Riverbank grape	N	G5	S5	–	–

[a] Origin: N = Native; (N) = Native but not in study area region; I = Introduced.
[b] Ranks based upon determinations made by the Ontario Natural Heritage Information Centre.
G = Global; S = Provincial; Ranks 1-3 are considered imperiled or rare; Ranks 4 and 5 are considered secure.
SNA = Not applicable for Ontario Ranking (e.g. Exotic species)
[c]Canada Species at Risk Act (Schedule 1)
[d]Ontario Endangered Species Act (O.Reg.230/08)

Common Name	Scientific Name	Origin[a]	Global Rarity Status[b]	Ontario Rarity Status[b]	SARA[d]	ESA[e]
Mammals						
Big brown bat	Eptesicus fuscus	N	G5	S4	–	–
Eastern red bat	*Lasiurus borealis*	N	G3G4	S4	–	–
Eastern small-footed myotis	*Myotis leibii*	N	G4	S2S3	–	Endangered
Hoary bat	*Lasiurus cinereus*	N	G3G4	S4	–	–
Little brown myotis	*Myotis lucifugus*	N	G4	S3	Endangered	Endangered
Silver-haired bat	*Lasionycteris noctivagans*	N	G3G4	S4	–	–
Red squirrel	*Tamiasciurus hudsonicus*	N	G5	S5	–	–
Striped skunk	*Mephitis mephitis*	N	G5	S5	–	–
White-tailed deer	*Odocoileus virginianus*	N	G5	S5	–	–
Woodchuck	*Marmota monax*	N	G5	S5	–	–
Birds						
American crow	*Corvus brachyrhynchos*	N	S5B	G5	–	–
American goldfinch	*Carduelis tristis*	N	S5B	G5	–	–
American redstart	*Setophaga ruticilla*	N	S5B	G5	–	–
American robin	*Turdus migratorius*	N	S5B	G5	–	–
American woodcock	*Scolopax minor*	N	S5B	G5	–	–
Baltimore oriole	*Icterus galbula*	N	S4B	G5	–	–
Common grackle	*Quiscalus quiscula*	N	S5B	G5	–	–
Common raven	*Corvus corax*	N	S5	G5	–	–
Common yellowthroat	*Geothlypis trichas*	N	S5B	G5	–	–
Downy woodpecker	*Picoides pubescens*	N	S5	G5	–	–
Eastern wood-pewee	*Contopus virens*	N	S4B	G5	Special Concern	Special Concern
European starling	*Sturnus vulgaris*	I	SNA	G5	–	–
Great crested flycatcher	*Myiarchus crinitus*	N	S4B	G5	–	–
Hairy woodpecker	*Picoides villosus*	N	S5	G5	–	–
House wren	*Troglodytes aedon*	N	S5B	G5	–	–
Killdeer	*Charadrius vociferus*	N	S5B, S5N	G5	–	–
Least flycatcher	*Empidonax minimus*	N	S4B	G5	–	–
Mourning dove	*Zenaida macroura*	N	S5	G5	–	–
Northern cardinal	*Cardinalis cardinalis*	N	S5	G5	–	–
Northern flicker	*Colaptes auratus*	N	S4B	G5	–	–
Northern waterthrush	*Parkesia noveboracensis*	N	S5B	G5	–	–
Ovenbird	*Seiurus aurocapilla*	N	S4B	G5	–	–
Pileated woodpecker	*Dryocopus pileatus*	N	S5	G5	–	–
Rose-breasted grosbeak	*Pheucticus ludovicianus*	N	S4B	G5	–	–
Ring-billed gull	*Larus delawarensis*	N	S5B, S4N	G5	–	–
Red-eyed vireo	*Vireo olivaceus*	N	S5B	G5	–	–
Ruffed grouse	*Bonasa umbellus*	N	S4	G5	–	–
Red-winged blackbird	*Agelaius phoeniceus*	N	S4	G5	–	–
Song sparrow	*Melospiza melodia*	N	S5B	G5	–	–
Turkey vulture	*Cathartes aura*	N	S5B	G5	–	–
Veery	*Catharus fuscescens*	N	S4B	G5	–	–
Warbling vireo	*Vireo gilvus*	N	S5B	G5	–	–
White-breasted nuthatch	*Sitta carolinensis*	N	S5	G5	–	–
Wild turkey	*Meleagris gallopava*	N	S5	G5	–	–
Wood thrush	*Hylocichla mustelina*	N	S4B	G5	Threatened	Special Concern
Yellow-bellied sapsucker	*Sphyrapicus varius*	N	S5B	G5	–	–
Yellow warbler	*Setophaga petechia*	N	S5B	G5	–	–
Herpetiles						
American Toad	*Bufo americanus*	N	G5	S5	–	–
Eastern Gartersnake	*Thamnophis sirtalis*	N	G5T5	S5	–	–
Gray Treefrog	*Hyla versicolor*	N	G5	S5	–	–
Green Frog	*Lithobates clamitans*	N	G5	S5	–	–
Spring peeper	*Pseudacris crucifer*	N	G5	S5	–	–
Wood frog	*Lithobates sylvaticus*	N	G5	S5	–	–

Common Name	Scientific Name	Origin[a]	Global Rarity Status[b]	Ontario Rarity Status[b]	SARA[d]	ESA[e]
Insects						
Common eastern bumblebee	*Bombus impatiens*	N	G5	S4S5	–	–
Common ringlet	*Coenonympha tullia*	N	G5	S5	–	–
Dot-tailed whiteface	*Leucorrhinia intacta*	N	G5	S5	–	–
Hobomok skipper	*Poanes hobomok*	N	G5	S5	–	–
Northern crescent	*Phyciodes cocyta*	N	G5	S5	–	–
Spreadwing	*Lestes* sp.	N	G5	S5	–	–
White admiral	*Limenitis arthemis*	N	G5	S5	–	–
White-faced meadowhawk	*Sympetrum obtrusum*	N	G5	S5	–	–
Widow skimmer	*Libellula luctuosa*	N	G5	S5	–	–
Wood satyr	*Megisto cymela*	N	G5	S5	–	–

Notes:

[a] Origin: N = Native; (N) = Native but not in study area region; I = Introduced.

[b] Ranks based upon determinations made by the Ontario Natural Heritage Information Centre (2015).
G = Global; S = Provincial; Ranks 1-3 are considered imperiled or rare; Ranks 4 and 5 are considered secure.
SNA = Not applicable for Ontario Ranking (e.g. Exotic species)

[c] Committee on the Status of Endangered Wildlife in Canada

[d] Canada Species at Risk Act (Schedule 1)

[e] Ontario Endangered Species Act (O.Reg.230/08)

Taxon	Common Name	Scientific Name	Endangered Species Act, Reg. 230/08 SARO List Status[1]	Species at Risk Act, Schedule 1 List of Wildlife SAR Status[2]	COSEWIC Status [3]	Global Rarity Rank[4]	Provincial Rarity Rank[5]	Source(s)[*]	Ontario Habitat Descriptions	Probability of Occurrence on the Site	Probability of Occurrence in the Study Area	ESA Habitat Protection Provisions[6]	References
Arthropod	Monarch	*Danaus plexippus*	SC	SC	END	G4	S2N, S4B	OOA	In Ontario, monarch is found throughout the northern and southern regions of the province. This butterfly is found wherever there is milkweed (*Asclepias* spp.) plants for its caterpillars and wildflowers that supply a nectar source for adults. It is often found on abandoned farmland, meadows, open wetlands, prairies and roadsides, but also in city gardens and parks. Important staging areas during migration occur along the north shores of the Great Lakes (COSEWIC 2010).	Moderate - suitable habitat occurs and there are records in the vicinity.	Moderate - suitable habitat occurs and there are records in the vicinity.		COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2010. COSEWIC assessment and status report on the Monarch Danaus plexippus in Canada. Ottawa ON: Committee on the Status of Endangered Wildlife in Canada; [accessed 22 November 2019]. https://www.registrelep-sararegistry.gc.ca/virtual_sara/files/cosewic/sr_Monarch_0810_e1.pdf. vii + 43 p.
Bird	Bank swallow	*Riparia riparia*	THR	THR	THR	G5	S4B	OBBA	In Ontario, bank swallow breeds in a variety of natural and anthropogenic habitats, including lake bluffs, stream and riverbanks, sand and gravel pits, and roadcuts. Nests are generally built in a vertical or near-vertical bank. Breeding sites are typically located near open foraging sites such as rivers, lakes, grasslands, agricultural fields, wetlands and riparian woods. Forested areas are generally avoided (Garrison 1999).	Low - no suitable banks or bluffs occur and none were observed during surveys.	Low no suitable banks or bluffs occur.	General (Draft) Category 1 – Breeding colony, including burrows and substrate between them Category 2 – Area within 50 m of the front of breeding colony face Category 3 – Area of suitable foraging habitat within 500 m of the outer edge of breeding colony	Garrison BA. 1999. Bank Swallow (Riparia riparia). The Birds of North America Online (AF Poole and FB Gill, eds). Ithaca NY: Cornell Lab of Ornithology; [accessed 20 November 2019]. https://doi.org/10.2173/bna.414.
Bird	Barn swallow	*Hirundo rustica*	THR	THR	THR	G5	S4B	OBBA; MNRF	In Ontario, barn swallow breeds in areas that contain a suitable nesting structure, open areas for foraging, and a body of water. This species nests in human made structures including barns, buildings, sheds, bridges, and culverts. Preferred foraging habitat includes grassy fields, pastures, agricultural cropland, lake and river shorelines, cleared rights-of-way, and wetlands (COSEWIC 2011). Mud nests are fastened to vertical walls or built on a ledge underneath an overhang. Suitable nests from previous years are reused (Brown and Brown 2019).	Moderate - although this species was not observed during targeted surveys, it may use the Site for foraging.	Moderate - suitable habitat occurs and there are records in the vicinity.	General Category 1 – Nest Category 2 – Area within 5 m of the nest Category 3 – Area between 5-200 m of the nest	Brown MB, Brown CR. 2019. Barn Swallow (Hirundo rustica). In The Birds of North America Online (P. G. Rodewald, ed), version 2.0. Ithaca NY: Cornell Lab of Ornithology; [accessed 20 November 2019]. https://doi.org/10.2173/bna.barswa.02. COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2011. COSEWIC assessment and status report on the Barn Swallow Hirundo rustica in Canada. Ottawa ON: Committee on the Status of Endangered Wildlife in Canada; [accessed 22 November 2019]. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_barn_swallow_0911_eng.pdf. ix + 37 p.
Bird	Black tern	*Chlidonias niger*	SC	—	NAR	G4	S3B	eBird	In Ontario, black tern breeds in freshwater marshlands where it forms small colonies. It prefers marshes or marsh complexes greater than 20 ha in area and which are not surrounded by wooded area. Black terns are sensitive to the presence of agricultural activities. The black tern nests in wetlands with an even combination of open water and emergent vegetation, and still waters of 0.5-1.2 m deep. Preferred nest sites have short dense vegetation or tall sparse vegetation often consisting of cattails, bulrushes and occasionally burreed or other marshland plants. Black terns also require posts or snags for perching (Weseloh 2007).	Low - no suitable large marshes occur.	Low - no suitable large marshes occur.		Weseloh C. 2007. Black Tern, pp. 590-591 in Cadman MD, Sutherland DA, Beck GG, Lepage D, Couturier AR, eds. Atlas of the Breeding Birds of Ontario, 2001-2005. Toronto ON: Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources and Ontario Nature. xxii + 706 p.
Bird	Bobolink	*Dolichonyx oryzivorus*	THR	THR	THR	G5	S4B	OBBA; MNRF	In Ontario, bobolink breeds in grasslands or graminoid dominated hayfields with tall vegetation (Gabhauer 2007). Bobolink prefers grassland habitat with a forb component and a moderate litter layer. They have low tolerance for presence of woody vegetation and are sensitive to frequent mowing within the breeding season. They are most abundant in established, but regularly maintained, hayfields, but also breed in lightly grazed pastures, old or fallow fields, cultural meadows and newly planted hayfields. Their nest is woven from grasses and forbs. It is built on the ground, in dense vegetation, usually under the cover of one or more forbs (Renfrew et al. 2015).	Low - no suitable grasslands occur, and none were observed during targeted surveys.	Moderate - suitable grassland habitat occurs and there are records in the vicinity.	General Category 1 – Nest and area within 10 m of nest Category 2 – Area between 10 – 60 m of the nest or centre of approximated defended territory Category 3 - Area of continuous suitable habitat between 60 – 300 m of the nest or centre of approximated defended territory	Gabhauer MA. 2007. Bobolink, pp. 586-587 in Cadman MD, Sutherland DA, Beck GG, Lepage D, Couturier AT, eds. Atlas of the Breeding Birds of Ontario, 2001-2005. Toronto ON: Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources and Ontario Nature. xxii + 706 p. Renfrew R, Strong AM, Perlut NG, Martin SG, Gavin TA. 2015. Bobolink (Dolichonyx oryzivorus). In The Birds of North America (PG Rodewald, ed.), version 2.0. Ithaca NY: Cornell Lab of Ornithology; [accessed 29 November 2019]. https://doi.org/10.2173/bna.176.

Taxon	Common Name	Scientific Name	Endangered Species Act, Reg. 230/08 SARO List Status[1]	Species at Risk Act, Schedule 1 List of Wildlife SAR Status[2]	COSEWIC Status [3]	Global Rarity Rank[4]	Provincial Rarity Rank[5]	Source(s)[*]	Ontario Habitat Descriptions	Probability of Occurrence on the Site	Probability of Occurrence in the Study Area	ESA Habitat Protection Provisions[6]	References
Bird	Canada warbler	*Cardellina canadensis*	SC	THR	THR	G5	S4B	eBird	In Ontario, breeding habitat for Canada warbler consists of moist mixed forests with a well-developed shrubby understory. This includes low-lying areas such as cedar and alder swamps, and riparian thickets (McLaren 2007). It is also found in densely vegetated regenerating forest openings. Suitable habitat often contains a developed moss layer and an uneven forest floor. Nests are well concealed on or near the ground in dense shrub or fern cover, often in stumps, fallen logs, overhanging stream banks or mossy hummocks (Reitsma et al. 2010).	Low - habitat is limited and none were observed during targeted surveys.	Low - habitat is limited and none were observed during targeted surveys.		McLaren P. 2007. Canada Warbler, pp. 528-529 in Cadman MD, Sutherland DA, Beck GG, Lepage D, Couturier AT, eds. Atlas of the Breeding Birds of Ontario, 2001-2005. Toronto ON: Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources and Ontario Nature. xxii + 706 p. Reitsma L, Goodnow M, Hallworth MT, Conway CJ. 2009. Canada Warbler (Cardellina canadensis). In The Birds of North America Online (A. Poole, ed.), version 2.0. Ithaca NY: Cornell Lab of Ornithology; [accessed 29 November 2019]. https://doi.org/10.2173/bna.421.
Bird	Chimney swift	*Chaetura pelagica*	THR	THR	THR	G4G5	S3B	OBBA	In Ontario, chimney swift breeding habitat is varied and includes urban, suburban, rural and wooded sites. They are most commonly associated with towns and cities with large concentrations of chimneys. Preferred nesting sites are dark, sheltered spots with a vertical surface to which the bird can grip. Unused chimneys are the primary nesting and roosting structure, but other anthropogenic structures and large diameter cavity trees are also used (COSEWIC 2007).	Low - no suitable structures were observed and none were observed during targeted surveys.	Low - no suitable structures were observed and none were observed during targeted surveys.	General Category 1 – Human-made nest/roost, or natural nest/roost cavity and area within 90 m of natural cavity	COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2007. COSEWIC assessment and status report on the Chimney Swift Chaetura pelagica in Canada. Ottawa ON: Committee on the Status of Endangered Wildlife in Canada; [accessed 22 November 2019]. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_chaetura_pelagica_e.pdf. vii + 49 p.
Bird	Common nighthawk	*Chordeiles minor*	SC	THR	SC	G5	S4B	eBird	In Ontario, these aerial foragers require areas with large open habitat. This includes farmland, open woodlands, clearcuts, burns, rock outcrops, alvars, bogs, fens, prairies, gravel pits and gravel rooftops in cities (Sandilands 2007)	Low - none were observed during targeted surveys.	Low - none were observed during targeted surveys.		Sandilands A. 2007. Common Nighthawk, pp. 308-309 in Cadman, MD, Sutherland DA, Beck GG, Lepage D, Couturier AR, eds. Atlas of the Breeding Birds of Ontario, 2001-2005. Toronto ON: Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources and Ontario Nature. xxii + 706 p.
Bird	Eastern meadowlark	*Sturnella magna*	THR	THR	THR	G5	S4B	OBBA; MNRF; NHIC	In Ontario, eastern meadowlark breeds in pastures, hayfields, meadows and old fields. Eastern meadowlark prefers moderately tall grasslands with abundant litter cover, high grass proportion, and a forb component (Hull 2019). They prefer well drained sites or slopes, and sites with different cover layers (Roseberry and Klimstra 1970).	Low - no suitable grasslands occur, and none were observed during targeted surveys.	Moderate - suitable grassland habitat occurs and there are records in the vicinity.	General Category 1 – Nest and area within 10 m of the nest Category 2 – Area between 10 – 100 m of the nest or centre of approximated defended territory Category 3 – Area of continuous suitable habitat between 100 – 300 m of the nest or centre of approximated defended territory	Hull SD, Shaffer JA, Lawrence DI. 2019. The effects of management practices on grassland birds: Eastern Meadowlark (Sturnella magna). Jamestown ND: US Geological Survey; [accessed 02 December 2019]. https://pubs.usgs.gov/pp/1842/mm/pp1842MM.pdf. Roseberry JL, Klimstra WD. 1970. The nesting ecology and reproductive performance of the Eastern Meadowlark. The Wilson Bulletin 82(3): 243-267.
Bird	Eastern whip-poor-will	*Antrostomus vociferus*	THR	THR	THR	G5	S4B	eBird	In Ontario, whip-poor-will breeds in semi-open forests with little ground cover. Breeding habitat is dependent on forest structure rather than species composition, and is found on rock and sand barrens, open conifer plantations and post-disturbance regenerating forest. Territory size ranges from 3 to 11 ha (COSEWIC 2009). No nest is constructed, and eggs are laid directly on the leaf litter (Mills 2007).	Low -habitat is limited, and none were observed during targeted surveys.	Low -habitat is limited, and none were observed during targeted surveys.	General Category 1 – Nest and area within 20 m of nest Category 2 – Area between 20-170 m from nest or centre of approximated defended territory Category 3 – Area of suitable habitat within 170-500 m of the nest, or centre of approximated defended territory	COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2009. COSEWIC assessment and status report on the Whip-poor-will Caprimulgus vociferus in Canada. Ottawa ON: Committee on the Status of Endangered Wildlife in Canada; [accessed 02 December 2019]. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_whip-poor-will_0809_e.pdf. vi + 28 p. Mills A. 2007. Whip-poor-will, pp. 312-313 in Cadman MD, Sutherland DA, Beck GG, Lepage D, Couturier AR, eds. Atlas of the Breeding Birds of Ontario, 2001-2005. Toronto ON: Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources and Ontario Nature. xxii + 706 p.

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Bird	Eastern wood-pewee	*Contopus virens*	SC	SC	SC	G5	S4B	*OBBA*	In Ontario, eastern wood-pewee inhabits a wide variety of wooded upland and lowland habitats, including deciduous, coniferous, or mixed forests. It occurs most frequently in forests with some degree of openness. Intermediate-aged forests with a relatively sparse midstory are preferred. In younger forests with a relatively dense midstory, it tends to inhabit the edges. Also occurs in anthropogenic habitats providing an open forested aspect such as parks and suburban neighborhoods. Nest is constructed atop a horizontal branch, 1-2 m above the ground, in a wide variety of deciduous and coniferous trees (COSEWIC 2012).	High - this species was observed in suitable habitat during targeted surveys.	High - this species was observed in suitable habitat during targeted surveys.		COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2012. COSEWIC assessment and status report on the Eastern Wood-pewee Contopus virensin Canada. Ottawa ON: Committee on the Status of Endangered Wildlife in Canada; [accessed 02 December 2019]. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_Eastern%20Wood-pewee_2013_e.pdf. x + 39 p.
Bird	Grasshopper sparrow *pratensis* subspecies	*Ammodramus savannarum* (pratensis subspecies)	SC	SC	SC	G5	S4B	eBird	In Ontario, grasshopper sparrow is found in medium to large grasslands with low herbaceous cover and few shrubs. It also uses a wide variety of agricultural fields, including cereal crops and pastures. Close-grazed pastures and limestone plains (e.g. Carden and Napanee Plains) support highest density of this bird in the province (COSEWIC 2013).	Low - no suitable grasslands occur, and none were observed during targeted surveys.	Moderate - suitable grassland habitat occurs and there are records in the vicinity.		COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2013. COSEWIC assessment and status report on the Grasshopper Sparrow pratensis subspecies Ammodramus savannarum pratensis in Canada. Ottawa ON: Committee on the Status of Endangered Wildlife in Canada; [accessed 02 December 2019]. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_Grasshopper%20Sparrow_2013_e.pdf. ix + 36 p.
Bird	Peregrine falcon (anatum/tundrius subspecies)	*Falco peregrinus anatum/tundrius*	SC	SC	Not at Risk	G4	S3B	eBird	In Ontario, peregrine falcon breeds in areas containing suitable nesting locations and sufficient prey resources. Such habitat includes both natural locations containing cliff faces (heights of 50 - 200 m preferred) and anthropogenic landscapes including urban centres containing tall buildings, open pit mines and quarries, and road cuts. Peregrine falcons nest on cliff ledges and crevices and building ledges. Nests consist of a simple scrape in the substrate (COSEWIC 2017).	Low - no suitable habitat occurs and none were observed during targeted surveys.	Low - no suitable habitat occurs and none were observed during targeted surveys.		COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2017. COSEWIC assessment and update status report on the Peregrine Falcon Falco peregrinus (pealei subspecies – Falco peregrinus and pealei anatum/tundrius – Falco peregrinus anatum/tundrius) in Canada. Ottawa ON: Committee on the Status of Endangered Wildlife in Canada; [accessed 02 December 2019]. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/srPeregrineFalcon2017e.pdf. vii + 45 p.
Bird	Short-eared owl	*Asio flammeus*	SC	SC	SC	G5	S2N,S4B	eBird	In Ontario, short-eared owl breeds in a variety of open habitats including grasslands, tundra, bogs, marshes, clear-cuts, burns, pastures and occasionally agricultural fields. The primary factor in determining breeding habitat is proximity to small mammal prey resources (COSEWIC 2008). Nests are built on the ground at a dry site and usually adjacent to a clump of tall vegetation used for cover and concealment (Gahbauer 2007).	Low - suitable habitat is minimal and none were observed during targeted surveys.	Moderate - suitable habitat occurs and there are records in the vicinity.		COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2008. COSEWIC assessment and update status report on the Short-eared Owl Asio flammeus in Canada. Ottawa ON: Committee on the Status of Endangered Wildlife in Canada; [accessed 02 December 2019]. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_shorteared_owl_0808_e.pdf. vi + 24 p. Gahbauer MA. 2007. Short-eared Owl, pp. 302-303 in Cadman MD, Sutherland DA, Beck GG, Lepage D, Couturier AR, eds. Atlas of the Breeding Birds of Ontario, 2001-2005. Toronto ON: Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources and Ontario Nature. xxii + 706 p.
Bird	Wood thrush	*Hylocichla mustelina*	SC	THR	THR	G4	S4B	OBBA	In Ontario, wood thrush breeds in moist, deciduous hardwood or mixed stands that are often previously disturbed, with a dense deciduous undergrowth and with tall trees for singing perches. This species selects nesting sites with the following characteristics: lower elevations with trees less than 16 m in height, a closed canopy cover (>70 %), a high variety of deciduous tree species, moderate subcanopy and shrub density, shade, fairly open forest floor, moist soil, and decaying leaf litter (COSEWIC 2012).	High - this species was observed in suitable habitat during targeted surveys.	High - this species was observed in suitable habitat during targeted surveys.		COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2012. COSEWIC assessment and status report on the Wood Thrush Hylocichla mustelina in Canada. Ottawa ON: Committee on the Status of Endangered Wildlife in Canada; [accessed 02 December 2019]. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_Wood%20Thrush_2013_e.pdf. ix + 46 p.

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Mammal	Eastern small-footed myotis	*Myotis leibii*	END	—	—	G4	S2S3	MNRF; BCI	In Ontario, eastern small-footed myotis is not known to roost in trees, but there is very little known about its roosting habits. The species generally roosts on the ground under rocks, in rock crevices, talus slopes and rock piles, but it occasionally inhabits buildings. Entrances of caves or abandoned mines where humidity is low, and temperatures are cool and sometimes subfreezing may be used as hibernacula (Humphrey 2017).	High - this species was identified during acoustic surveys.	High - this species was identified during acoustic surveys.	General	Humphrey C. 2017. Recovery Strategy for the Eastern Small-footed Myotis (Myotis leibii) in Ontario. Ontario Recovery Strategy Series. Peterborough ON: Ontario Ministry of Natural Resources; [accessed 02 December 2019]. https://files.ontario.ca/mnrf_sar_rs_esfm_final_accessible.pdf vii + 76 p.
Mammal	Little brown myotis	*Myotis lucifugus*	END	END	END	G3	S3	MNRF; BCI	In Ontario, this species' range is extensive and covers much of the province. It will roost in both natural and man-made structures. Roosting colonies require a number of large dead trees, in specific stages of decay and that project above the canopy in relatively open areas. May form nursery colonies in the attics of buildings within 1 km of water. Caves or abandoned mines may be used as hibernacula, but high humidity and stable above freezing temperatures are required (ECCC 2018).	High - this species was identified during acoustic surveys.	High - this species was identified during acoustic surveys.	General	ECCC (Environment and Climate Change Canada). 2018. Recovery Strategy for the Little Brown Myotis (Myotis lucifugus), the Northern Myotis (Myotis septentrionalis), and the Tri-colored Bat (Perimyotis subflavus) in Canada. Species at Risk Act Recovery Strategy Series. Ottawa ON: Environment and Climate Change Canada; [accessed 02 December 2019]. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/plans/Rs-TroisChauveSourisThreeBats-v01-2019Nov-Eng.pdf. ix + 172 p.
Mammal	Northern myotis	*Myotis septentrionalis*	END	END	END	G1G2	S3	MNRF; BCI	In Ontario, this species' range is extensive and covers much of the province. It will usually roost in hollows, crevices, and under loose bark of mature trees. Roosts may be established in the main trunk or a large branch of either living or dead trees. Caves or abandoned mines may be used as hibernacula, but high humidity and stable above freezing temperatures are required (ECCC 2018).	Low - this species was not identified during acoustic surveys.	Low - this species was not identified during acoustic surveys.	General	ECCC (Environment and Climate Change Canada). 2018. Recovery Strategy for the Little Brown Myotis (Myotis lucifugus), the Northern Myotis (Myotis septentrionalis), and the Tri-colored Bat (Perimyotis subflavus) in Canada. Species at Risk Act Recovery Strategy Series. Ottawa ON: Environment and Climate Change Canada; [accessed 02 December 2019]. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/plans/Rs-TroisChauveSourisThreeBats-v01-2019Nov-Eng.pdf. ix + 172 p.
Mammal	Tri-colored bat	*Perimyotis subflavus*	END	END	END	G2G3	S3?	MNRF; BCI	In Ontario, tri-colored bat may roost in foliage, in clumps of old leaves, hanging moss or squirrel nests. They are occasionally found in buildings although there are no records of this in Canada. They typically feed over aquatic areas with an affinity to large-bodied water and will likely roost in close proximity to these. Hibernation sites are found deep within caves or mines in areas of relatively warm temperatures. These bats have strong roost fidelity to their winter hibernation sites and may choose the exact same spot in a cave or mine from year to year (ECCC 2018).	Low - this species was not identified during acoustic surveys.	Low - this species was not identified during acoustic surveys.	General	ECCC (Environment and Climate Change Canada). 2018. Recovery Strategy for the Little Brown Myotis (Myotis lucifugus), the Northern Myotis (Myotis septentrionalis), and the Tri-colored Bat (Perimyotis subflavus) in Canada. Species at Risk Act Recovery Strategy Series. Ottawa ON: Environment and Climate Change Canada; [accessed 02 December 2019]. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/plans/Rs-TroisChauveSourisThreeBats-v01-2019Nov-Eng.pdf. ix + 172 p.
Reptile	Snapping turtle	*Chelydra serpentina*	SC	SC	SC	G5	S4	NHIC; MNRF; ORAA	In Ontario, snapping turtle uses a wide range of waterbodies, but shows preference for areas with shallow, slow-moving water, soft substrates and dense aquatic vegetation. Hibernation takes place in soft substrates under water. Nesting sites consist of sand or gravel banks along waterways or roadways (COSEWIC 2008).	Low - suitable habitat is minimal and none were observed during surveys.	Low - suitable habitat is minimal and none were observed during surveys.		COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2008. COSEWIC assessment and status report on the Snapping Turtle Chelydra serpentina in Canada. Ottawa ON: Committee on the Status of Endangered Wildlife in Canada; [accessed 02 December 2019]. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_snapping_turtle_0809_e.pdf. vii + 47 p.

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Vascular Plant	American ginseng	*Panax quinquefolius*	END	END	END	G3G4	S2	Range	In Ontario, American ginseng is found in moist, undisturbed and relatively mature deciduous woods often dominated by sugar maple. It is commonly found on well-drained, south-facing slopes. American ginseng grows under closed canopies in well-drained soils of glacier origin that have a neutral pH (ECCC 2018).	Low - suitable habitat is limited and none were observed during targeted surveys.	Moderate - suitable habitat may occur.	General Category 1 – Area occupied by American ginseng and area of forest or treed swamp ELC community classes within 100 m of occupied area Category 2 – Area of forest or treed swamp ELC community classes between 100-150 m of occupied area, and contiguous with category 1	ECCC (Environment and Climate Change Canada). 2018. Recovery Strategy for the American Ginseng (Panax quinquefolius) in Canada. Species at Risk Act Recovery Strategy Series. Ottawa ON: Environment and Climate Change Canada; [accessed 02 December 2019]. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/plans/rs_american_ginseng_e_final.pdf. vii + 32 p.
Vascular Plant	Butternut	*Juglans cinerea*	END	END	END	G4	S2?	Range	In Ontario, butternut is found along stream banks, on wooded valley slopes, and in deciduous and mixed forests. It is commonly associated with beech, maple, oak and hickory (Voss and Reznicek 2012). Butternut prefers moist, fertile, well-drained soils, but can also be found in rocky limestone soils. This species is shade intolerant (Farrar 1995).	Low - none were observed during target surveys on Site or within 50m of the Site.	Low - Moderate - none were observed however the entire Study Area was not accessed for surveys.	General (as of June 30, 2013)	Farrar JL. 1995. Trees in Canada. Markham, ON: Fitzhenry & Whiteside Limited and Ottawa, ON: Canadian Forest Service, Natural Resources Canada. 502 p. Voss EG, Reznicek AA. 2012. Field Manual of Michigan Flora. Ann Arbour MI: University of Michigan Press. 990 p.
Vascular Plant	Eastern prairie fringed-orchid	*Platanthera leucophaea*	END	END	END	G2G3	S2	Range	In Ontario, eastern prairie fringed-orchid grows in wet prairies, fens, bogs, wet meadows, and wet successional fields. It grows in full sun in neutral to mildly calcareous substrates, and occasionally grows along roadsides or lake margins (Eastern Prairie Fringed-orchid Recovery Team 2010). This species is found only in southern Ontario, and only two locations are currently known on sand spits along the shore of Lake Erie.	Low - suitable habitat is minimal and none were observed during targeted surveys.	Low - suitable habitat is minimal and none were observed during surveys.	Regulated In the geographic areas of: the City of Ottawa; Counties of Bruce, Essex, Grey, Lambton, Lanark, Lennox and Addington, and Simcoe; Municipality of Chatham-Kent; Regional Municipality of York; and United Counties of Leeds and Grenville, and United Counties of Stormont, Dundas and Glengarry. Regulated Habitat: • fens, tallgrass prairies, and moist old fields	Eastern Prairie Fringed-orchid Recovery Team. 2010. Recovery strategy for the Eastern Prairie Fringed-orchid (Platanthera leucophaea) in Ontario. Ontario Recovery Strategy Series. Peterborough ON: Ontario Ministry of Natural Resources; [accessed 02 December 2019]. https://www.ontario.ca/page/eastern-prairie-fringed-orchid-recovery-strategy. vi + 30 p.

Notes:

[1] *Endangered Species Act* (ESA), 2007. General (O.Reg 242/08 last amended 29 June 2020 as O.Reg 328/20). Species at Risk in Ontario List (O.Reg 230/08 last amended 1 Aug 2018 as O. Reg 404/18, s. 1.); Schedule 1 (Extirpated - EXP), Schedule 2 (Endangered - END), Schedule 3 (Threatened - THR), Schedule 4 (Special Concern - SC)

[2] *Species at Risk Act* (SARA), 2002. Schedule 1 (Last amended 23 April 2021); Part 1 (Extirpated), Part 2 (Endangered), Part 3 (Threatened), Part 4 (Special Concern)

[3] Committee on the Status of Endangered Wildlife in Canada (COSEWIC) http://www.cosewic.gc.ca/

[4] Global Ranks (GRANK) are Rarity Ranks assigned to a species based on their range-wide status. GRANKS are assigned by a group of consensus of Conservation Data Centres (CDCs), scientific experts and the Nature Conservancy. These ranks are not legal designations. G1 (Extremely Rare), G2 (Very Rare), G3 (Rare to uncommon), G4 (Common), G5 (Very Common), GH (Historic, no record in last 20yrs), GU (Status uncertain), GX (Globally extinct), ? (Inexact number rank), G? (Unranked), Q (Questionable), T (rank applies to subspecies or variety). Last assessed August 2011

[5] Provincial Ranks (SRANK) are Rarity Ranks assigned to a species or ecological communities, by the Natural Heritage Information Centre (NHIC). These ranks are not legal designations. SRANKS are evaluated by NHIC on a continual basis and updated lists produced annually. SX (Presumed Extirpated), SH (Possibly Extirpated - Historical), S1 (Critically Imperiled), S2 (Imperiled), S3 (Vulnerable), S4 (Apparently Secure), S5 (Secure), SNA (Not Applicable), S#S# (Range Rank), S? (Not ranked yet), SAB (Breeding Accident), SAN (Non-breeding Accident), SX (Apparently Extirpated). Last assessed November 2019.

[6] General Habitat Protection is applied when a species is newly listed as endangered or threatened on the SARO list under the ESA, 2007. The definition of general habitat applies to areas that a species currently depends on. These areas may include dens and nests, wetlands, forests and other areas essential for breeding, rearing, feeding, hibernation and migration. General habitat protection will also apply to all listed endangered or threatened species without a species-specific habitat regulation as of June 30, 2013 (ESA 2007, c.6, s.10 (2)). Regulated Habitat is species-specific habitat used as the legal description of that species habitat. Once a species-specific habitat regulation is created, it replaces general habitat protection. Refer to O.Reg 242/08 for full details regarding regulated habitat.

[7] Refer to the individual species' federal recovery strategy for a full description of the critical habitat (http://www.sararegistry.gc.ca/sar/recovery/recovery_e.cfm)

[+] Species Codes derived from the following sources: Birds – 53rd AOU Supplement (2012); Amphibians – Marsh Monitoring Program (Bird Studies Canada 2003); Fish – Golder; Reptiles – Golder.

*NHIC (Natural Heritage Information Centre); ROM (Royal Ontario Museum); OBBA (Ontario Breeding Bird Atlas); Herp Atlas (Reptiles and Amphibians of Ontario); Odonata Atlas (of Ontario); Mammal Atlas (of Ontario); BCI (Bat Conservation International); Butterfly Atlas (Ontario Butterfly Atlas)

'—' No status

OOA = Ontario Odonate Atlas; OBBA = Ontario Breeding Bird Atlas; BCI = Bat Conservation International; eBird = Cornell University eBird Web Application; ORAA = Ontario Reptile and Amphibian Atlas; NHIC = Natural Heritage Information Centre; MNRF = Ministry of Natural Resources and Forestry

APPENDIX G

Cultural Heritage

Appendix G-1 MHSTCI Checklist
Appendix G-2 Stage 1 Archaeology Assessment

Appendix G-1 MHSTCI Checklist

Clear Form Print Form

Ministry of Tourism, Culture and Sport

Programs & Services Branch
401 Bay Street, Suite 1700
Toronto ON M7A 0A7

Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes

A Checklist for the Non-Specialist

The **purpose of the checklist** is to determine:

- if a property(ies) or project area:
  - is a recognized heritage property
  - may be of cultural heritage value
- it includes all areas that may be impacted by project activities, including – but not limited to:
  - the main project area
  - temporary storage
  - staging and working areas
  - temporary roads and detours

Processes covered under this checklist, such as:

- *Planning Act*
- *Environmental Assessment Act*
- *Aggregates Resources Act*
- *Ontario Heritage Act* – Standards and Guidelines for Conservation of Provincial Heritage Properties

Cultural Heritage Evaluation Report (CHER)

If you are not sure how to answer one or more of the questions on the checklist, you may want to hire a qualified person(s) (see page 5 for definitions) to undertake a cultural heritage evaluation report (CHER).

The CHER will help you:

- identify, evaluate and protect cultural heritage resources on your property or project area
- reduce potential delays and risks to a project

Other checklists

Please use a separate checklist for your project, if:

- you are seeking a Renewable Energy Approval under Ontario Regulation 359/09 – separate checklist
- your Parent Class EA document has an approved screening criteria (as referenced in Question 1)

Please refer to the Instructions pages for more detailed information and when completing this form.

Project or Property Name

INDIVIDUAL EA OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

Project or Property Location (upper and lower or single tier municipality)

Boyne Road Landfill, 12620 Boyne Road, Township of North Dundas

Proponent Name

Township of North Dundas

Proponent Contact Information

Doug Froats, Director, Waste Management, Planning, Building & Law Enforcement, Township of North Dundas

Screening Questions

	Yes	No
1. Is there a pre-approved screening checklist, methodology or process in place?	☐	☑

If Yes, please follow the pre-approved screening checklist, methodology or process.

If No, continue to Question 2.

Part A: Screening for known (or recognized) Cultural Heritage Value

	Yes	No
2. Has the property (or project area) been evaluated before and found **not** to be of cultural heritage value?	☐	☑

If Yes, do **not** complete the rest of the checklist.

The proponent, property owner and/or approval authority will:

- summarize the previous evaluation and
- add this checklist to the project file, with the appropriate documents that demonstrate a cultural heritage evaluation was undertaken

The summary and appropriate documentation may be:

- submitted as part of a report requirement
- maintained by the property owner, proponent or approval authority

If No, continue to Question 3.

	Yes	No
3. Is the property (or project area):		
a. identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value?	☐	☑
b. a National Historic Site (or part of)?	☐	☑
c. designated under the *Heritage Railway Stations Protection Act*?	☐	☑
d. designated under the *Heritage Lighthouse Protection Act*?	☐	☑
e. identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office (FHBRO)?	☐	☑
f. located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site?	☐	☑

If Yes to any of the above questions, you need to hire a qualified person(s) to undertake:

- a Cultural Heritage Evaluation Report, if a Statement of Cultural Heritage Value has not previously been prepared or the statement needs to be updated

If a Statement of Cultural Heritage Value has been prepared previously and if alterations or development are proposed, you need to hire a qualified person(s) to undertake:

- a Heritage Impact Assessment (HIA) – the report will assess and avoid, eliminate or mitigate impacts

If No, continue to Question 4.

Part B: Screening for Potential Cultural Heritage Value

		Yes	No
4.	Does the property (or project area) contain a parcel of land that:		
a.	is the subject of a municipal, provincial or federal commemorative or interpretive plaque?	☐	☑
b.	has or is adjacent to a known burial site and/or cemetery?	☐	☑
c.	is in a Canadian Heritage River watershed?	☐	☑
d.	contains buildings or structures that are 40 or more years old?	☐	☑

Part C: Other Considerations

		Yes	No
5.	Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area):		
a.	is considered a landmark in the local community or contains any structures or sites that are important in defining the character of the area?	☐	☑
b.	has a special association with a community, person or historical event?	☐	☑
c.	contains or is part of a cultural heritage landscape?	☐	☑

If Yes to one or more of the above questions (Part B and C), there is potential for cultural heritage resources on the property or within the project area.

You need to hire a qualified person(s) to undertake:

- a Cultural Heritage Evaluation Report (CHER)

If the property is determined to be of cultural heritage value and alterations or development is proposed, you need to hire a qualified person(s) to undertake:

- a Heritage Impact Assessment (HIA) – the report will assess and avoid, eliminate or mitigate impacts

If No to all of the above questions, there is low potential for built heritage or cultural heritage landscape on the property.

The proponent, property owner and/or approval authority will:

- summarize the conclusion
- add this checklist with the appropriate documentation to the project file

The summary and appropriate documentation may be:

- submitted as part of a report requirement e.g. under the *Environmental Assessment Act, Planning Act* processes
- maintained by the property owner, proponent or approval authority

Instructions

Please have the following available, when requesting information related to the screening questions below:

- a clear map showing the location and boundary of the property or project area
  - large scale and small scale showing nearby township names for context purposes
- the municipal addresses of all properties within the project area
- the lot(s), concession(s), and parcel number(s) of all properties within a project area

For more information, see the Ministry of Tourism, Culture and Sport's Ontario Heritage Toolkit or Standards and Guidelines for Conservation of Provincial Heritage Properties.

In this context, the following definitions apply:

- **qualified person(s)** means individuals – professional engineers, architects, archaeologists, etc. – having relevant, recent experience in the conservation of cultural heritage resources.
- **proponent** means a person, agency, group or organization that carries out or proposes to carry out an undertaking or is the owner or person having charge, management or control of an undertaking.

1. Is there a pre-approved screening checklist, methodology or process in place?

An existing checklist, methodology or process may already be in place for identifying potential cultural heritage resources, including:

- one endorsed by a municipality
- an environmental assessment process e.g. screening checklist for municipal bridges
- one that is approved by the Ministry of Tourism, Culture and Sport (MTCS) under the Ontario government's Standards & Guidelines for Conservation of Provincial Heritage Properties [s.B.2.]

Part A: Screening for known (or recognized) Cultural Heritage Value

2. Has the property (or project area) been evaluated before and found not to be of cultural heritage value?

Respond 'yes' to this question, if all of the following are true:

A property can be considered not to be of cultural heritage value if:

- a Cultural Heritage Evaluation Report (CHER) - or equivalent - has been prepared for the property with the advice of a qualified person and it has been determined not to be of cultural heritage value and/or
- the municipal heritage committee has evaluated the property for its cultural heritage value or interest and determined that the property is not of cultural heritage value or interest

A property may need to be re-evaluated, if:

- there is evidence that its heritage attributes may have changed
- new information is available
- the existing Statement of Cultural Heritage Value does not provide the information necessary to manage the property
- the evaluation took place after 2005 and did not use the criteria in Regulations 9/06 and 10/06

Note: Ontario government ministries and public bodies [prescribed under Regulation 157/10] may continue to use their existing evaluation processes, until the evaluation process required under section B.2 of the Standards & Guidelines for Conservation of Provincial Heritage Properties has been developed and approved by MTCS.

To determine if your property or project area has been evaluated, contact:

- the approval authority
- the proponent
- the Ministry of Tourism, Culture and Sport

3a. Is the property (or project area) identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value e.g.:

i. designated under the *Ontario Heritage Act*

- individual designation (Part IV)
- part of a heritage conservation district (Part V)

Individual Designation – Part IV

A property that is designated:

- by a municipal by-law as being of cultural heritage value or interest [s.29 of the *Ontario Heritage Act*]
- by order of the Minister of Tourism, Culture and Sport as being of cultural heritage value or interest of provincial significance [s.34.5]. **Note**: To date, no properties have been designated by the Minister.

Heritage Conservation District – Part V

A property or project area that is located within an area designated by a municipal by-law as a heritage conservation district [s. 41 of the *Ontario Heritage Act*].

For more information on Parts IV and V, contact:

- municipal clerk
- Ontario Heritage Trust
- local land registry office (for a title search)

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ii. subject of an agreement, covenant or easement entered into under Parts II or IV of the *Ontario Heritage Act*

An agreement, covenant or easement is usually between the owner of a property and a conservation body or level of government. It is usually registered on title.

The primary purpose of the agreement is to:

- preserve, conserve, and maintain a cultural heritage resource
- prevent its destruction, demolition or loss

For more information, contact:

- Ontario Heritage Trust - for an agreement, covenant or easement [clause 10 (1) (c) of the *Ontario Heritage Act*]
- municipal clerk – for a property that is the subject of an easement or a covenant [s.37 of the *Ontario Heritage Act*]
- local land registry office (for a title search)

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iii. listed on a register of heritage properties maintained by the municipality

Municipal registers are the official lists - or record - of cultural heritage properties identified as being important to the community.

Registers include:

- all properties that are designated under the *Ontario Heritage Act* (Part IV or V)
- properties that have not been formally designated, but have been identified as having cultural heritage value or interest to the community

For more information, contact:

- municipal clerk
- municipal heritage planning staff
- municipal heritage committee

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iv. subject to a notice of:

- intention to designate (under Part IV of the *Ontario Heritage Act*)
- a Heritage Conservation District study area bylaw (under Part V of the *Ontario Heritage Act*)

A property that is subject to a **notice of intention to designate** as a property of cultural heritage value or interest and the notice is in accordance with:

- section 29 of the *Ontario Heritage Act*
- section 34.6 of the *Ontario Heritage Act.* **Note**: To date, the only applicable property is Meldrum Bay Inn, Manitoulin Island. [s.34.6]

An area designated by a municipal by-law made under section 40.1 of the *Ontario Heritage Act* as a **heritage conservation district study area**.

For more information, contact:

- municipal clerk – for a property that is the subject of notice of intention [s. 29 and s. 40.1]
- Ontario Heritage Trust

v. included in the Ministry of Tourism, Culture and Sport's list of provincial heritage properties

Provincial heritage properties are properties the Government of Ontario owns or controls that have cultural heritage value or interest.

The Ministry of Tourism, Culture and Sport (MTCS) maintains a list of all provincial heritage properties based on information provided by ministries and prescribed public bodies. As they are identified, MTCS adds properties to the list of provincial heritage properties.

For more information, contact the MTCS Registrar at registrar@ontario.ca.

3b. Is the property (or project area) a National Historic Site (or part of)?

National Historic Sites are properties or districts of national historic significance that are designated by the Federal Minister of the Environment, under the *Canada National Parks Act*, based on the advice of the Historic Sites and Monuments Board of Canada.

For more information, see the National Historic Sites website.

3c. Is the property (or project area) designated under the *Heritage Railway Stations Protection Act*?

The *Heritage Railway Stations Protection Act* protects heritage railway stations that are owned by a railway company under federal jurisdiction. Designated railway stations that pass from federal ownership may continue to have cultural heritage value.

For more information, see the Directory of Designated Heritage Railway Stations.

3d. Is the property (or project area) designated under the *Heritage Lighthouse Protection Act*?

The *Heritage Lighthouse Protection Act* helps preserve historically significant Canadian lighthouses. The Act sets up a public nomination process and includes heritage building conservation standards for lighthouses which are officially designated.

For more information, see the Heritage Lighthouses of Canada website.

3e. Is the property (or project area) identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office?

The role of the Federal Heritage Buildings Review Office (FHBRO) is to help the federal government protect the heritage buildings it owns. The policy applies to all federal government departments that administer real property, but not to federal Crown Corporations.

For more information, contact the Federal Heritage Buildings Review Office.

See a directory of all federal heritage designations.

3f. Is the property (or project area) located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site?

A UNESCO World Heritage Site is a place listed by UNESCO as having outstanding universal value to humanity under the Convention Concerning the Protection of the World Cultural and Natural Heritage. In order to retain the status of a World Heritage Site, each site must maintain its character defining features.

Currently, the Rideau Canal is the only World Heritage Site in Ontario.

For more information, see Parks Canada – World Heritage Site website.

Part B: Screening for potential Cultural Heritage Value

4a. Does the property (or project area) contain a parcel of land that has a municipal, provincial or federal commemorative or interpretive plaque?

Heritage resources are often recognized with formal plaques or markers.

Plaques are prepared by:

- municipalities
- provincial ministries or agencies
- federal ministries or agencies
- local non-government or non-profit organizations

For more information, contact:

- municipal heritage committees or local heritage organizations – for information on the location of plaques in their community
- Ontario Historical Society's Heritage directory – for a list of historical societies and heritage organizations
- Ontario Heritage Trust – for a list of plaques commemorating Ontario's history
- Historic Sites and Monuments Board of Canada – for a list of plaques commemorating Canada's history

4b. Does the property (or project area) contain a parcel of land that has or is adjacent to a known burial site and/or cemetery?

For more information on known cemeteries and/or burial sites, see:

- Cemeteries Regulations, Ontario Ministry of Consumer Services – for a database of registered cemeteries
- Ontario Genealogical Society (OGS) – to locate records of Ontario cemeteries, both currently and no longer in existence; cairns, family plots and burial registers
- Canadian County Atlas Digital Project – to locate early cemeteries

In this context, adjacent means contiguous or as otherwise defined in a municipal official plan.

4c. Does the property (or project area) contain a parcel of land that is in a Canadian Heritage River watershed?

The Canadian Heritage River System is a national river conservation program that promotes, protects and enhances the best examples of Canada's river heritage.

Canadian Heritage Rivers must have, and maintain, outstanding natural, cultural and/or recreational values, and a high level of public support.

For more information, contact the Canadian Heritage River System.

If you have questions regarding the boundaries of a watershed, please contact:

- your conservation authority
- municipal staff

4d. Does the property (or project area) contain a parcel of land that contains buildings or structures that are 40 or more years old?

A 40 year 'rule of thumb' is typically used to indicate the potential of a site to be of cultural heritage value. The approximate age of buildings and/or structures may be estimated based on:

- history of the development of the area
- fire insurance maps
- architectural style
- building methods

Property owners may have information on the age of any buildings or structures on their property. The municipality, local land registry office or library may also have background information on the property.

Note: 40+ year old buildings or structure do not necessarily hold cultural heritage value or interest; their age simply indicates a higher potential.

A building or structure can include:

- residential structure
- farm building or outbuilding
- industrial, commercial, or institutional building
- remnant or ruin
- engineering work such as a bridge, canal, dams, etc.

For more information on researching the age of buildings or properties, see the Ontario Heritage Tool Kit Guide Heritage Property Evaluation.

Part C: Other Considerations

5a. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) is considered a landmark in the local community or contains any structures or sites that are important to defining the character of the area?

Local or Aboriginal knowledge may reveal that the project location is situated on a parcel of land that has potential landmarks or defining structures and sites, for instance:

- buildings or landscape features accessible to the public or readily noticeable and widely known
- complexes of buildings
- monuments
- ruins

5b. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) has a special association with a community, person or historical event?

Local or Aboriginal knowledge may reveal that the project location is situated on a parcel of land that has a special association with a community, person or event of historic interest, for instance:

- Aboriginal sacred site
- traditional-use area
- battlefield
- birthplace of an individual of importance to the community

5c. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) contains or is part of a cultural heritage landscape?

Landscapes (which may include a combination of archaeological resources, built heritage resources and landscape elements) may be of cultural heritage value or interest to a community.

For example, an Aboriginal trail, historic road or rail corridor may have been established as a key transportation or trade route and may have been important to the early settlement of an area. Parks, designed gardens or unique landforms such as waterfalls, rock faces, caverns, or mounds are areas that may have connections to a particular event, group or belief.

For more information on Questions 5.a., 5.b. and 5.c., contact:

- Elders in Aboriginal Communities or community researchers who may have information on potential cultural heritage resources. Please note that Aboriginal traditional knowledge may be considered sensitive.
- municipal heritage committees or local heritage organizations
- Ontario Historical Society's "Heritage Directory" - for a list of historical societies and heritage organizations in the province

An internet search may find helpful resources, including:

- historical maps
- historical walking tours
- municipal heritage management plans
- cultural heritage landscape studies
- municipal cultural plans

Information specific to trails may be obtained through Ontario Trails.

APPENDIX B – SUPPLEMENTARY SCREENING DOCUMENTATION

Screening Criteria	Results
PART A	
Has the property (or project area) been evaluated before and found not to be of cultural heritage value?	The study area has not been previously evaluated.
Is the property (or project area):	
identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value?	Search of the *Ontario Heritage Act* (OHA) *Register*, and consultation with heritage planning staff at the Township and Ontario Heritage Trust (OHT), confirmed there are no protected heritage properties within the study area.
a National Historic Site (or part of)?	Search of the *Parks Canada Directory of Federal Heritage Designations* determined that no part of the study area is, or part, of a National Historic Site.
designated under the *Heritage Railways Stations Protection Act*?	Search of the *Parks Canada Directory of Federal Heritage Designations* determined that no part of the study area is designated under the *Heritage Railways Stations Protection Act.*
designated under the Heritage Lighthouse Protection Act?	No part of the study area is designated under the *Heritage Lighthouse Protection Act*.
identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office (FHBRO)?	Search of the *Parks Canada Directory of Federal Heritage Designations* determined that no buildings in the study area are identified by FHBRO.
located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site?	No part of the study area is located within a UNESCO World Heritage Site.
PART B	
Does the property (or project area) contain a parcel of land that:	
is the subject of a municipal, provincial or federal commemorative or interpretive plaque?	Search of the Ontario Heritage Trust (OHT) *Plaque Database*, and consultation with plaque management staff at the OHT, determined no plaques are located within the study area.
Screening Criteria	**Results**

Screening Criteria	Results
has or is adjacent to a known burial and/or cemetery?	Search of the OHT *Places of Worship Inventory*, and desktop research confirmed there are no cemeteries located within the study area.
is in a Canadian Heritage River watershed?	Search of the *Canadian Heritage River System* online list determined the study area is not located within the watershed of a Canadian Heritage River.
contains buildings or structures that are 40 or more years old?	The study area was found to have no properties with buildings or structures 40 or more years old of potential cultural heritage value or interest (CHVI) through the desktop research and review of: ▪ The *Ontario Historical County Maps Project* web mapping application – Dundas County 1862 ▪ 1:25,000 national topographic system (NTS) maps available through the online *Historical Topographic Map Digitization Project* – Winchester Sheets 1908, 1915, 1920, 1933 ▪ 20th century aerial imagery accessed through the University of Toronto Map and Data Library ▪ Google Satellite and Street View imagery
PART C	
Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area):	
is considered a landmark in the local community or contains any structures or sites that are important in defining the character of the area?	Desktop analysis determined that the study area does not contain potential landmarks or structures important in defining the character of the area.
has a special association with a community, person or historical event?	Desktop analysis determined that the study area does not contain potential built heritage resources and/ or cultural heritage landscapes with special associations to a community, person, or historical event.
contains or is part of a cultural heritage landscape?	Desktop analysis determined that the study area does not contain or is part of a cultural heritage landscape.

Appendix G-2 Stage 1 Archaeology Assessment

ORIGINAL REPORT

Stage 1 Archaeological Assessment

Boyne Road Landfill Expansion, Part of Lot 8, Concession 6, Geographic Township of Winchester, now the Township of North Dundas, United Counties of Stormont, Dundas, and Glengarry

Licensee: Randy Hahn, Ph.D. (P1107)
PIF Number: P1107-0045-2021

Submitted to:

Doug Froats
Director of Waste Management
Township of North Dundas
636 St. St. Lawrence Street
P.O. Box 489
Winchester, ON K0C 2K0

Submitted by:

Golder Associates Ltd.
1931 Robertson Road, Ottawa, Ontario, K2H 5B7, Canada

+1 613 592 9600

1648253

November 18, 2021

Distribution List

1 e-copy - Township of North Dundas

1 e-copy - Ministry of Heritage, Sport, Tourism, and Culture Industries

1 e-copy - Golder Associates Ltd.

Executive Summary

The Executive Summary highlights key points from the report only; for complete information and findings, as well as the limitations, the reader should examine the complete report.

Golder Associates Ltd. (Golder) was retained by the Township of North Dundas to complete a Stage 1 archaeological assessment in support of the Environmental Assessment of the Township of North Dundas waste management plan. The Environmental Assessment included a review of waste management 'Alternatives To' and identified the expansion of the Boyne Road Landfill located at 12620 Boyne Road as the preferred 'Alternative To'. The study area for the landfill expansion is an approximately 22 hectare area which includes the existing Boyne Road Landfill and is located on part of Lot 8, Concession 6, Geographic Township of Winchester, now the Township of North Dundas, United Counties of Stormont, Dundas, and Glengarry, Ontario (Maps 1 and 2).

The objectives of the Stage 1 archaeological assessment are defined in the Ontario Ministry of Heritage, Sport, Tourism, and Culture Industries' (MHSTCI) *Standards and Guidelines for Consultant Archaeologists* (2011).
A Stage 1 archaeological assessment background study provides information about the project area, evaluates archaeological potential, and provides recommendations as to whether further work is required.

Evidence for human occupation of Eastern Ontario dates to at least 11,000 BP following the retreat of the Champlain Sea. During the succeeding Archaic Period (10,000 BP to 2,500 BP), the environment of Eastern Ontario approached modern conditions with the Ottawa River and its many tributaries including the South Nation River serving as a major transportation route that facilitated trade in copper mined from surface deposits near Lake Superior. The Woodland Period (2,500 BP to 400 BP) saw the introduction of pottery and agriculture which led to the development of semi-permanent and permanent villages in Southern Ontario. Within Eastern Ontario, Woodland Period subsistence strategies were still primarily based on hunting and gathering and their migratory routes followed seasonal patterns to known hunting locations. European contact began in 1610 following the expedition of French explorer Étienne Brûlé who passed through the area that would become Ottawa. The Township of Winchester was initially settled by Europeans in 1819. Although the study area is located along a historical road connecting Winchester to the former community of Boyne, the study area appears to have primarily remained woodlot until the latter half of the 20th century. The study area presently includes the site of the Boyne Road Landfill.

A property inspection was conducted by the licensee, Randy Hahn (P1107), on July 14, 2021. The Stage 1 archaeological assessment determined that portions of the study area have archaeological potential due to the proximity to a historical road, but the integrity of the archaeological potential has been impacted by the existing landfill activities and other 20th century landscape disturbance. Based on this assessment, the southern portion of the study area is identified as having low archaeological potential.

This Stage 1 archaeological assessment resulted in the following recommendations:

1) No further archaeological assessments are required for the study area as shown on Map 9.

2) Should archaeological resources be identified during the landfill expansion in the areas identified as having low archaeological potential on Map 9, a licensed archaeologist should be contacted and additional archaeological assessment may be required.

3) Should landscape disturbance extend beyond the present Stage 1 study area, additional archaeological assessment may be required.

This report is submitted to the Ministry of Heritage, Sport, Tourism and Culture Industries as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c. 0.18. The report is reviewed to ensure that the licensed consultant archaeologist has met the terms and conditions of their archaeological license, and that the archaeological field work and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario.

Project Personnel

Project Manager	Yannick Marcerou, M.Eng, P.Eng.
Project Director	Paul Smolkin, P.Eng.
Senior Review	Aaron Mior, M.MA. (P1077), Senior Archaeologist
Licensee/Site Inspection	Randy Hahn, Ph.D. (P1107), Archaeologist
Report Preparation	Randy Hahn, Ph.D. (P1107), Archaeologist
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Abbreviations

ASDB	Archaeological Site Database maintained by MHSTCI
BP	Before Present, taken to mean before 1950 and used as an alternative to BC/AD
CHVI	Cultural Heritage Value or Interest
Golder	Golder Associates Ltd.
m	Metre(s)
km	Kilometre(s)
MHSTCI	Ministry of Heritage, Sport, Tourism and Culture Industries
PIF	Project Information Form

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1.0 PROJECT CONTEXT

1.1 Development Context

Golder Associates Ltd. (Golder) was retained by the Township of North Dundas to complete a Stage 1 archaeological assessment in support of the Environmental Assessment of the Township of North Dundas waste management plan. The Environmental Assessment included a review of waste management ‘Alternatives To’ and identified the expansion of the Boyne Road Landfill located at 12620 Boyne Road as the preferred ‘Alternative To’. The study area for the landfill expansion is an approximately 22 hectare area which includes the existing Boyne Road Landfill and is located on part of Lot 8, Concession 6, Geographic Township of Winchester, now the Township of North Dundas, United Counties of Stormont, Dundas, and Glengarry, Ontario (Maps 1 and 2).

Permission to enter the study area was provided by the client with no limitations or restrictions.

1.2 Objectives

The objectives of this Stage 1 archaeological assessment follow the MHSTCI *Standards and Guidelines for Consultant Archaeologists* (2011, p. 13):

- To provide information about the study area’s geography, history, previous archaeological fieldwork and current land conditions;
- To evaluate in detail the study area’s archaeological potential, which will support recommendations for Stage 2 survey for all or parts of the property; and,
- To recommend appropriate strategies for Stage 2 survey, if applicable.

2.0 HISTORICAL CONTEXT

2.1 Regional Indigenous History

Eastern Ontario was covered by the Laurentide ice sheet until approximately 11,000 years before present (BP). Following the period of deglaciation, Eastern Ontario was inundated by the Champlain Sea which is interpreted to have extended from the Rideau Lakes in the south, along the Ottawa Valley and St. Lawrence areas and terminating in the vicinity of Petawawa in the west. The exact western boundary is unconfirmed as current elevation levels reflect the isostatic adjustment of the land following the melting of the glaciers which has obscured definitive traces of the Champlain Sea shoreline at the time of its existence. The eastern portion of the sea extended into the Atlantic Ocean.

During much of the Paleo Period (11,000. to 10,000 BP) Eastern Ontario would have remained inundated by the Champlain Sea, although as the Champlain Sea receded towards the end of this period it is possible that people migrated along the changing waterfront landscape eventually moving into the Ottawa Valley (Watson 1999a).

The ridges and old shorelines of the Champlain Sea and early Ottawa River channels generally represent areas most likely to contain evidence of Paleo occupation in this region, however identifying the location and dates of these ancient shorelines has proved challenging. The boundaries of the Champlain Sea are not marked by a continuous identifiable shoreline, especially along the western shore where rocky conditions were not favorable to the formation of beaches (Chapman and Putnam 1973). Attempts to use deposits of marine mollusk shells as a source for radiocarbon dates to delineate the transgression of the shorelines have proved unreliable as shells absorb carbon at different rates according to their depth below the surface and geological location (Robinson 2012). Additionally, earlier interpretations showing discrete stages of regression (see Chapman 1937) have proven not to be supported by the geological record. Unlike the catastrophic flood events during the Younger Dryas climatic event that led to the rapid formation of the Champlain Sea, its regression was a slow process occurring as sea waters drained during isostatic rebound (Robinson 2012). The interpretation of the presence of shorelines is further complicated by the fact that isostatic rebound may have raised the Ottawa region above its current elevation before it receded to its current level (Fulton and Richard 1987). Flooding resulting from the overflow of glacial Lake Agassiz also eroded and manipulated topographic landforms within the evolving landscape (Fulton et al. 1987). As a consequence, only the margins of the Champlain Sea at its maximum extent, a time when the Ottawa region would have been fully submerged, have been reliably mapped due to the rapid inundation creating pronounced shoreline features (Loring 1980). Although recent studies using various dating techniques that do not rely upon deposits of mollusk shells have provided some favourable results (Tremblay 2008), considerable work remains in developing the chronology of the Champlain Sea's regression.

The earliest possible settlement in the Ottawa Valley and its tributaries including the South Nation River would have occurred during the recession of the Champlain Sea when the vegetation and wildlife began to develop within the area, which enabled the sustainability of humans (Watson 1999a). The ridges and old shorelines of the Champlain Sea and early Ottawa River channels reflect areas most likely to contain evidence of Paleo Period occupation in the region. Archaeological and geological investigations in the Ottawa Valley have suggested these early sites may be identified within the 550 foot (167.6 m) or higher contour topography, although additional research may be required to confidently assess this correlation (Kennedy 1976).

Evidence of human occupation during this period has been documented by a variety of archaeological discoveries including fluted points (laurel leaf shaped points with a channel flake scar extending from the base of the point) recorded in the Rideau Lakes area (Watson 1982; 1999b). In Ottawa, sites interpreted to have produced Paleo Period material have been recorded near Greenbank Road (Swayze 2003), Albion Road and Rideau Road (Swayze 2004), although the lack of diagnostic material represented at these sites and the inferred climatic environment suggests these sites may rather be reflective of Archaic Period occupation following the recession of the Champlain Sea.

During the succeeding Archaic Period (ca. 10,000 to 2,800 BP), the environment of Eastern Ontario approached modern conditions (Ellis et al. 1990). Occupation within the Ottawa Valley developed as the environment became habitable, with an Early Archaic Dovetail projectile point recovered in Ottawa South sometime around 1918-1920 (Pilon and Fox 2015) potentially representing the earliest diagnostic evidence of humans in the area.

Archaic Period inhabitants generally continued to employ a hunter-gatherer subsistence strategy focused on localized faunal and floral resources including deer, fish, berries and nuts. The McIntyre Site, located on the north shore of Rice Lake and south of Peterborough, contained the remains of a large variety of floral and faunal species and reflects the diversity of subsistence resources available during this period (Ellis et al. 1990). Plant remains recovered from the site included butternut, acorn, hickory, plum, cherry, blueberry and hawthorn. Faunal remains included deer, canine, beaver, muskrat, bear, and a large variety of fish including bass, bullheads, and suckers. The inhabitants of the site may also have been gathering wild rice (McAndrews 1984). In the Ottawa Valley, a stone fish weir likely dating to the Archaic Period found upstream from Morrison Island and Allumette Island demonstrates the increasingly sophisticated technology that was being employed during the period (Allen 2010).

The Ottawa River and its tributaries were important routes for the movement of natural copper, either through direct trade between individual groups, or through trips to Lake Superior to exploit the surface deposits located there. Copper artifacts similar to those documented on Allumette Island in the Ottawa River have been discovered in Wisconsin, Michigan, New York State and Manitoba (Kennedy 1970). This commodity, as well as other tradable goods, was presumably transported by canoes and other vessels along the navigable waterways including the Ottawa River.

The earliest evidence of human burials within the Ottawa Valley are interpreted to date to the Archaic Period (Pilon and Young 2009). Excavations at Allumette and Morrison Islands have found burial sites containing the remains of dozens of individuals within deposits that appear to have been used continuously for millennia (Kennedy 1966). The inclusion of grave offerings such as natural copper pieces in burials found at the site of Coteau-du-Lac provides evidence for Archaic Period ritual practice (Pilon and Young 2009). Other sites with Archaic Period components within the Ottawa Valley region have been noted on Aylmer Island, Chaudière Falls, Wilber Lake, Leamy Lake, the Rideau Lakes (Watson 1982), Jessups Falls, and in Pendleton (Daechsel 1980). Archaic sites have been documented within the vicinity of the Rideau River

(Golder 2017), and evidence from archaeological investigations around Honey Gables, Albion Road and Rideau Road may contain Early Archaic Period material (Swayze 2004). Evidence of Archaic Period occupation has also been recovered from isolated find spots within the City of Ottawa (Jamieson 1989), although the context of many of these have been poorly documented.

The Woodland Period (*ca*. 2,800 to 450 BP) is primarily distinguished from the Archaic Period by the introduction of ceramics (Wright 1972). Early Woodland Period inhabitants continued to live as hunters, gatherers and fishers in much the same way as earlier populations had done. They also shared an elaborate burial ceremonialism influenced by the inclusion of exotic artifacts within grave deposits (Spence et al. 1990, p. 129).

By the Middle Woodland Period (2,400 to 1,150 BP) regional cultural expressions or traditions have been distinguished by archaeologists. These traditions have been identified based on patterns of ceramic decorations, use of lithic materials, and are the primary basis to differentiate the Middle Woodland Period from the Early Woodland Period. A greater number of known sites from this period have been investigated allowing archaeologists to develop a better picture of the seasonal round followed in order to exploit a variety of resources within a home territory. Through the late fall and winter, small groups would occupy an inland “family” hunting area. In the spring, these dispersed families would congregate at specific lakeshore sites to fish, hunt in the surrounding forest, and socialize. This gathering would last through to the late summer when large quantities of food would be stored for the approaching winter.

Along the Ottawa River, Middle Woodland Period sites have been identified in the northwest end of Ottawa at Marshall’s and Sawdust Bays (Daechsel 1980; Daechsel 1981), Rockcliffe Park (Pilon 2008; Pilon and Boswell 2015), as well as at Leamy Lake (Laliberte 1995), along the Rideau River (Golder 2017; Patterson 2016) and within the City of Ottawa west of Bank Street (Golder 2014). Sawdust Bay 2 (BiGb-6), located approximately 750 m west of where the Mississippi River drains into the Ottawa River, represents a camp site radiocarbon dated to 1560 BP (± 290 BP) and interpreted to reflect the Point Peninsula Tradition. The corresponding artifact assemblage shows that subsistence was focused on hunting fauna living in the adjacent lakes and swamps. The Leamy Lake and Rockcliffe Park Sites, all located in the area around the mouth of the Gatineau River and the east shore of the Ottawa River, show evidence of seasonal warm weather settlement spanning a period from 4000 BP up to at least the Middle Woodland period (Pilon and Boswell 2015).

Another significant development of the Woodland Period was the introduction of agriculture and appearance of domesticated plants ca. 1,450 BP. Initially, only a minor addition to the diet, the cultivation of corn, beans, squash, sunflowers and tobacco gained economic importance during the Late Woodland Period. Unlike in Southern Ontario, where the shift in subsistence resulted in the development of semi-permanent and permanent villages, evidence suggests that the Ottawa Valley remained primarily occupied by mobile hunter-gatherers. In part, this was because the terrain was less than suitable for early agriculture. It was also a reflection of the increased pressure on hunting territories and conflict over trade routes at the end of the Woodland Period.

By the end of the Late Woodland Period, distinct regional populations occupied specific areas of Southern Ontario separated by vast stretches of largely unoccupied land, including the Huron along the north shore of Lake Ontario, and the St. Lawrence Iroquois along the St. Lawrence River. Facing persistent hostilities with Iroquoian populations based in what is now

New York State, the Huron moved from the north shore of Lake Ontario to the Lake Simcoe and Georgian Bay region. The St. Lawrence Iroquois relocating sometime in the late 16th century with refugees possibly dispersing among the Algonquin populations in the Ottawa Valley region (Pendergast 1999).

The Algonquins, who occupied the lands north of the Huron, had historical hunting territories in the Ottawa Valley that may have extended as far east as the St. Maurice River in Quebec. They also claimed the lowlands south of the St. Lawrence River after the disappearance of the St. Lawrence Iroquois in the late 16th century (Trigger and Day 1994). At the time of initial contact, the French documented several Algonquin groups residing in the vicinity of the study area (Heidenreich and Wright 1987). These included the Kichesipirini of Morrison Island, the Matouweskarini along the Madawaska River to the west, the Onontchataronon in the Gananoque River basin to the southwest, and the Weskarini, the largest of the three, situated in the Petite Nation River basin to the northeast.

Late Woodland Period sites have been recorded throughout the Ottawa Valley. Two small Late Woodland sites were identified on a property near the Village of Cumberland (Ferris 2002). A significant Woodland Period occupation has also been identified at the Leamy Lake site and several burials dating to the Archaic Period have also been documented on the north side of the Ottawa River, just east of the Chaudière Falls. Many of these burials were observed during the mid-19th century, with upwards of twenty individuals documented along the northern shore of the Ottawa River between the Chaudière Falls and the Gatineau River. Many of these interments were associated with red ochre deposits, although there does not appear to be a consistent deposition positional pattern to those recorded (Pilon and Boswell 2015).

Though it is often difficult to link archaeological sites to specific historical Indigenous groups, the Highland Lake site (BiGh-1), located west of Ottawa, may be an Algonquin site associated with the Matouweskarini (von Gernet 1992). Ottawa Valley Algonquin sites typically consist of shallow deposits characteristic of seasonal occupation by small family groups within family or band territorial limits and are typically located on the headwaters of major tributaries (Pendergast 1999). Exceptions include a number of summer camps identified at Morrison Island and Leamy Lake where larger groups came together (Pilon and Boswell 2015).

The Algonquins’ location along the same river networks used for transportation by early French traders positioned them to monopolize the early fur trade with the two communities becoming close allies following Champlain’s expedition in 1603. Competition for furs increased existing tensions between the Algonquin communities and their neighbours including the Haudenosaunee Nations, such as the Mohawk, residing to the south in what is now Ontario and New York State. The 17th century saw a long period of conflict known as the Beaver Wars between the Algonquin and the Haudenosaunee that resulted in the significant disruption of life. Mohawk raids against Algonquin villages in the Upper Ottawa and St. Lawrence Valleys resulted in the abandonment or destruction of many Algonquin settlements in these areas (Trigger and Day 1994). Some Algonquin’s found refuge in French settlements such as Trois-Riviéres, Quebec City, Sillery, and Montreal while others may have retreated to interior locations along the Ottawa River’s tributaries (Holmes 1993). At the end of the 17th century, the Haudenosaunee were driven out of much of Southern Ontario by the Mississaugas though they continued to occupy parts of Eastern Ontario on a seasonal basis.

The French brokered a peace treaty in 1701 at Montreal where the Algonquin, the French, and the Haudenosaunee agreed to peacefully share the lands around the Great Lakes (INAC 2011). In exchange for peace, the Algonquin gave the Haudenosaunee secure access to furs which the Haudenosaunee used to secure their alliance with the British. Between 1712-1716, Algonquins were noted as living along the Gatineau River with the Haudenosaunee occupation located south of the St. Lawrence River (Holmes 1993). By 1740, Algonquin communities were present in the vicinity of Trois-Riviéres, Riviere Lievre and Mohawk community members were residing near Lake of Two Mountains (Holmes 1993).

Following the Seven Years' War in the mid-18th century, the defeat of the French, Algonquin, and their allies by the British and the Haudenosaunee resulted in the further loss of Algonquin hunting territories in southern Quebec and eastern Ontario as the British seized France's colonies. The extension of Quebec's boundaries in 1774 through the Quebec Act and the use of the Ottawa River as the boundary of Upper and Lower Canada following the 1791 Constitution Act separated the Algonquins between two government administrations (AOP n.d.).

Britain's colonial policy differed from the French in that the Crown was much more interested in securing land surrenders from the Indigenous populations for settlement by Europeans. The Royal Proclamation of 1763 issued by King George III enabled the Crown to monopolize the purchase of Indigenous lands west of Quebec. Although the proclamation recognized Indigenous rights to their land and hunting grounds, it also provided a way through which these rights could be taken away (Surtees 1994). Land cession agreements between Indigenous groups and the Crown increased following the War of 1812 as a new wave of settlers arrived in Upper Canada primarily from Britain. The Crown implemented annuity systems in the purchase of lands from Indigenous peoples where the interest payments of settlers on the land would cover the cost of the annuity rather than pay a one-time lump sum. By the 1850s, Indigenous groups had become cautious of these agreements and began to demand the retention of reserved land and preservation of hunting and fishing rights (Surtees 1994).

Between 1783 and 1784, Captain William Redford Crawford negotiated on behalf of the Crown with the Mississauga chiefs living in the Bay of Quinte region. In the so-called "Crawford Purchase," Crawford negotiated for the lands located east of the Bay of Quinte to the Trent River. This agreement was intended to provide land to the United Empire Loyalists and Indigenous allies following the American Revolution (Ontario 2020). The lands covered by the Crawford Purchase now includes the communities of Kingston and Brockville. The Crown again negotiated with the Mississauga of the Bay of Quinte and Kingston areas during the Rideau Purchase (1819/1822) which included a portion of Algonquin territory in the Ottawa Valley (Surtees 1994). The Algonquin and Nipissing, who were left out of the talks, protested the purchase, but were largely ignored (Holmes 1993). The Rideau Canal was later built through the territory of the Rideau Purchase.

In 1839, the Crown denied the Algonquins and Nipissings the right to lease portions of their land, including islands in the Ottawa River, to settlers with whom they had previously been collecting rent payments (Holmes 1993). Furthermore, the Crown did little to prevent further additional encroachments by settlers on Indigenous lands.

A reserve was purchased for use by the Algonquins in Golden Lake in 1873 (Holmes 1993). The Golden Lake reserve, now known as the Algonquins of Pikwakanagan First Nation, has a registered population of around 2,000 people with over 400 living on the reserve (INAC 2013). Additional reserves and settlements for the Algonquins were established in Quebec during the mid-20th century.

The Indian Act of 1876 framed the relationship between the Canadian government and Canada's Indigenous peoples as a paternalistic one where the government served as their guardian until their cultures were able to integrate into Canadian society (INAC 2011). The Department of Indian Affairs was granted the authority to make policy decisions such as determine who was classified as Indigenous, manage their lands, resources and money, and promote "civilization". The consequence was the further erosion of Indigenous rights to autonomy and self-governance. The implementation of residential schools and adoption of Algonquin children by non-Indigenous families in the mid-20th century reflected further discrimination and the disregard of rights (AOP ND).

The Algonquins of Ontario today consist of ten communities: Antoine, Algonquins of Pikwakanagan First Nation, Bonnechere, Greater Golden Lake, Kijicho Manito Madaouskarini, Mattawa/North Bay, Ottawa, Shabot Obaadjiwan, Snimikobi, and Whitney and Area (AOO ND).

The Ottawa Valley is unceded Algonquin land and land claim negotiations with Canada and Ontario are in progress. The Algonquin and the Government of Canada signed an agreement in principle to transfer 117,500 acres of Crown lands in Eastern Ontario to the Algonquin (INAC 2016; Tasker 2016). While this represents an important step in the negotiations, the talks are ongoing.

2.2 Post-Contact Regional History

Samuel de Champlain was the first European to document his explorations of the Ottawa Valley, initially in 1613 and again in 1615. He was preceded by two of his emissaries, Étienne Brûlé around 1610 and Nicholas de Vigneau in 1611. It is likely that all three travelled at least the lower reaches of the Rideau River. In the wake of Champlain's voyages, the Ottawa River became the principal route for explorers, missionaries and fur traders travelling from the St. Lawrence River to the interior, and throughout the 17th and 18th centuries this route remained an important link in the French fur trade.

At the time of initial contact, the French documented three Algonquin groups residing in the vicinity of the study area (Heidenreich and Wright 1987). These included the Matouweskarini along the Madawaska River to the west, the Onontchataronon in the Gananoque River basin to the southwest, and the Weskarini, the largest of the three, situated in the Petite Nation River basin northeast of the study area. While prolonged occupation of the region may have been avoided as a result of hostilities with Iroquoian speaking populations to the south, at least the northern reaches of the South Nation River basin were undoubtedly used as hunting territories by the Algonquin at this time. The recovery of European trade goods (e.g., iron axes, copper kettle pieces and glass beads) from Indigenous sites throughout the Ottawa River drainage basin has provided evidence of the extent of contact between the Indigenous peoples and the fur traders during this period. The English, upon assuming possession of New France, continued to use the Ottawa River as an important transportation corridor.

Significant European settlement of the region did not occur until United Empire Loyalists and other immigrants began to move to lands along the Ottawa River and its tributaries in the late 18th and early 19th centuries. Commonly acknowledged as the first permanent European resident in the area that would become Hull, Philemon Wright settled in Hull Township with five families and 33 men in 1800 (Bond 1984). The community along the north shore of the Ottawa River grew over the next few years and by 1805 Wright had begun significant lumbering activity in the region. It would take several more years for permanent settlement to spread to the south side of the Ottawa River.

The scarcity of roads and poor state of transportation beyond the Ottawa River shoreline slowed settlement in many parts of the Ottawa Valley (Belden 1879); although with the construction of the Rideau Canal (1827 - 1832) the new settlement of Bytown experienced its first major growth in population. This resulted in the development of two areas: Lower Bytown east of the Canal, primarily populated by French Canadian and Irish labourers and merchants, and Upper Bytown to the west of the Canal with a predominantly white Anglo-Saxon Protestant population. Bytown was incorporated as the City of Ottawa on January 1, 1855, with a population of 10,000. The selection of Ottawa as the capital of Canada in 1857 was the major catalyst in the subsequent development of the city.

2.2.1 Winchester Township

The first European immigrants to Winchester Township settled along the Nation River in 1819 (Mika and Mika 1983, p. 657). Many of the lots in the Township were awarded to the children of United Empire Loyalists, but most chose to sell their lands which were eventually settled by other immigrants. Early settlement and development was made difficult by the lack of roads. In the 1830s, the villages of Winchester and Chesterville developed following the construction of flour and sawmills (Mika and Mika 1983, p. 657). The construction of the Canadian Pacific Railway Line in 1887 led to increased prosperity, particularly in Chesterville which saw its population grow from around 500 in 1884 to over 750 in 1890 (Harkness 1946).

During the 20th century, agriculture retains a significant role. The establishment of Highway 31 in 1927 (Bevers ND) provided a convenient route to Ottawa and many of its present residence commute to the city.

2.3 Study Area History

Land registry records for Lot 8, Concession 6 of Winchester Township indicate the lot was first granted by the Crown to Hannah Louchs in 1801 (reg. no. 557). The land was sold to John Crysler in 1808 and then to John Richardson in 1811 (reg. no. 191, 1172). In 1839, the entire lot was transferred to Peter McGill and the Trustees of Thomas B. Anderson (reg. no. 438). John Hutt purchased the entire lot in 1855 (reg. no. 438) and he appears to have owned it until 1895 when he willed the property to George (west half) and John (east half) Hutt (reg. no. 8118). The property appears to have remained in the Hutt family until the early 20th century.

An 1879 plan of Winchester Township (Map 3) shows the name “Jno B Hutt” on the property. This is likely the John Hutt who is listed in the land registry records. No structures are shown on the property during this time. However, a structure is shown to the south on the adjacent lot (Lot 7, Concession 5) associated with the same name so it is likely that John Hutt resided to the south. He may have used the southern portions of Lot 8, Concession 6, for agriculture while the northern end was left unused. A road going to the nearby village of Winchester is shown running along the north end of the study area and the settlement of Boyne is located in the approximate location of the schoolhouse between lots 12 and 13 of Concession 6.

Canada Census records for 1861 list John Hutt as a 46 year old farmer. He is listed as residing in a brick house, which is likely the house shown on Lot 7. Given the early date of this record, the fact that John Hutt has already built a brick home suggests that he was already well established on his property by this time and was successful enough to afford the construction of a brick house rather than the log or frame house most common during this period. Indeed, all the other families listed on the same page in the Census records are residing in log and frame houses, expect for John Hutt.

The 20th century history of the study area is shown by aerial photographs (Map 4) and topographic maps (Maps 5 and 6). A topographic map from 1908 (Map 5) indicates that the southern end of the study area was woodlot. No structures are shown within 300 m of the study area. Two streams are located over 300 m to the east and west. A 1933 topographic map shows little change within the study area (Map 6). A 1954 air photo (Map 4) shows the study area prior to its use as a landfill. The southwest corner is an agricultural field while much of the rest of the study area is woodlot or unused lands. The 1972 air photo (Map 4) shows the beginnings of the landfill with much of the rest of the property remaining woodlot. The 1985 air photo (Map 4) shows the impact of the expanding landfill with a larger area disturbed. The drainage ditch located in the northeast corner is now visible suggesting the drain date to between 1972 and 1985.

3.0 ARCHAEOLOGICAL CONTEXT

3.1 Study Area Environment

The study area is located within the Winchester Clay Plains physiographic region, a low-lying area within the South Nation River drainage basin. The original vegetation of the plains consisted primarily of red maple, elm, white and black ash which are all species characteristic of swamp-forest environments (Chapman and Putnam 1984, p. 203). The original forests of the region were largely removed, and the swamps drained to convert the land to agriculture. The South Nation River is located approximately 4.5 km to the south.

The surficial geology (Map 7) is shown to consist of organic deposits over much of the study area. The southwestern corner indicates clay, silty clay and silt.

The portion of the study area located along Boyne Road is presently being used as a landfill. The southern half is primarily woodlot with the exception of the southwestern corner which is an agricultural field (Map 2).

3.2 Previous Archaeology

The MHSTCI's Archaeological Report Database was searched on July 8, 2021, for previous archaeological assessments completed within 50 m of the study area. Although the archaeological report database did not show any archaeological assessments within 50 m, Golder's archaeological report database indicates CARF (1992) conducted a Stage 1 archaeological assessment for a proposed water transmission main. One of six proposed routes followed Boyne Road and appears to pass within 50 m of the present study area (Map 8). CARF identified this route as having low archaeological potential for historical and Indigenous archaeological resources.

Other archaeological assessments conducted within the vicinity of the study area have been limited. CARF (1997, 2000) conducted Stage 1 and 2 archaeological assessments for a new 7 km long sewage system running from an existing sewage lagoon located northeast of the Village of Winchester to the South Nation River. A portion of the sewage system corridor followed Belanger Road located approximately 600 m to the west of the study area. More recently, a Stage 1 and 2 archaeological assessment (P027-125-2011) and Stage 2 archaeological assessment (P052-0753-2016) were conducted for the Mighty Solar Farm located over 5 km to the east.

3.3 Known Archaeological Sites

The primary source of information regarding known archaeological sites in the MHSTCI archaeological sites database. The database was consulted on July 8, 2021, which indicated there are no registered archaeological sites located within 1 km of the study area.

3.4 Assessing Archaeological Potential

Archaeological potential is established by determining the likelihood that archaeological resources may be present within a specific study area. In accordance with the MHSTCI's 2011 *Standards and Guidelines for Consultant Archaeologists* the following are features or characteristics that indicate archaeological potential:

- Previously identified archaeological sites;
- Water sources:
  - Primary water sources (lakes, rivers, streams, creeks);
  - Secondary water sources (intermittent streams and creeks; springs; marshes; swamps);
  - Features indicating past water sources (e.g. glacial lake shorelines indicated by the presence of raised gravel, sand, or beach ridges; relic river or stream channels indicated by clear dip or swale in the topography; shorelines of drained lakes or marshes; and cobble beaches);
  - Accessible or inaccessible shoreline (e.g., high bluffs, swamps or marsh fields by the edge of a lake; sandbars stretching into marsh);
- Elevated topography (eskers, drumlins, large knolls, plateaux);
- Pockets of well drained sandy soil, especially near areas of heavy soil or rocky ground; Distinctive land formations that might have been special or spiritual places, such as waterfalls, rock outcrops, caverns, mounds, and promontories and their bases (there may be physical indicators of their use, such as burials, structures, offerings, rock paintings or carvings);
- Resource areas including:
  - Food or medicinal plants;
  - Scarce raw minerals (e.g. quartz, copper, ochre or outcrops of chert);
  - Early Euro-Canadian industry (fur trade, mining, logging);
- Areas of Euro-Canadian settlement; and,
- Early historical transportation routes.

In recommending a Stage 2 property survey based on determining archaeological potential for a study area, the MHSTCI stipulates the following:

- No areas within 300 m of a previously identified site; water sources; areas of early Euro-Canadian Settlement; or locations identified through local knowledge or informants can be recommended for exemption from further assessment;
- No areas within 100 m of early transportation routes can be recommended for exemption from further assessment; and,
- No areas within the property containing an elevated topography; pockets of well-drained sandy soil; distinctive land formations; or resource areas can be recommended for exemption from further assessment.

3.5 Features Indicating Archaeological Potential has been Removed

Archaeological potential can be determined not to be present when the area has been subject to extensive and deep land alterations that severely damaged the integrity of any archaeological resources, including:

- Quarrying;
- Major landscaping involving grading below topsoil;
- Building footprints; and,
- Sewage and infrastructure development.

3.6 Potential for Archaeological Resources

The study area has potential for historical Euro-Canadian archaeological resources within 100 m of Boyne Road which historic mapping indicates follows the alignment of a 19th century road leading to Winchester. No registered archaeological sites are known within 1 km of the study area. No historical water sources are shown within 300 m of the study area on the historic maps or aerial photographs.

The presence of the Boyne Road Landfill in the northern half of the study area indicates that the archaeological potential within the existing landfill footprint has likely been impacted.

4.0 SITE INSPECTION

A visual inspection of the study area was conducted by the licensee, Randy Hahn, PhD (P1107) of Golder on July 14, 2021, under PIF P1107-0045-2021. The weather consisted of mixed sun and clouds with a high of 27 degrees Celsius.

The northern half of the study area consists of the existing Boyne Road Landfill (Images 1 to 3, pp. 25-26). Much of this area has been impacted by activities associated with the landfill and is surrounded by large earthen berms that separate the landfill from the surrounding land (Image 4, p. 26).

On the west end of the study area there is an old gravel road that leads to the south end of the property (Image 5, p. 27). This road appears to have been artificially raised above the neighbouring farmland, likely using soils from a drainage ditch that runs alongside much of the road (Image 6, p. 27). Ditches built around the perimeter of the landfill to accommodate site drainage do not correspond to any water sources shown on the historical plans or topographic maps and thus reflects modern drainage patterns.

The southern half of the study area is mostly woodlot (Images 7 to 9, pp. 28-29) with the southwest corner consisting of agricultural fields. The southern portion of the study area contains several abandoned 20th century vehicles and other modern waste (Images 11 to 13, pp. 30-31). These modern garbage piles are likely associated with the 20th century use of the agricultural fields to the south.

The landfill's perimeter ditch has created wet conditions within the northeast corner (Image 14, p. 31). Background research indicates that these conditions date to the construction of the drains sometime after 1972 (see Section 2.3).

5.0 ANALYSIS AND CONCLUSIONS

Although the study area was identified as having archaeological potential within 100 m of Boyne Road, this archaeological potential has been impacted by the existing Boyne Road Landfill. The landfill has resulted in disturbance below grade in the northern half of the study area and significant landscape alteration as seen by the presence of large berms around its boundaries. A previous Stage 1 archaeological assessment conducted by CARF (1992) that covers a portion of the present Stage 1 study area along Boyne Road also indicated that this area had low potential for archaeological resources.

The southern portion of the study area is not associated with any features indicating archaeological potential and is thus considered to have low potential for archaeological resources. The drainage canals located within the study area reflect 20th century alterations to the landscape and background research shows they do not correspond to any historical water sources located within 300 m. As such, the study area does not meet the requirements for further archaeological assessment based on the MHSTCI *Standards and Guidelines for Consultant Archaeologists* (2011) and no further archaeological assessments are recommended for the Stage 1 study area.

6.0 RECOMMENDATIONS

This Stage 1 archaeological assessment resulted in the following recommendations:

1) No further archaeological assessments are required for the study area as shown on Map 9.

2) Should archaeological resources be identified during the landfill expansion in the areas identified as having low archaeological potential on Map 9, a licensed archaeologist should be contacted and additional archaeological assessment may be required.

3) Should landscape disturbance extend beyond the present Stage 1 study area, additional archaeological assessment may be required.

7.0 ADVICE ON COMPLIANCE WITH LEGISLATION

This report is submitted to the Ministry of Heritage, Sport, Tourism and Culture Industries, as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario.
When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Heritage, Sport, Tourism and Culture Industries, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.

It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest , and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the *Ontario Heritage Act*.

Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the *Ontario Heritage Act*.

The *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33, requires that any person discovering or having knowledge of a burial site shall immediately notify the police or coroner. It is recommended that the Registrar of Cemeteries at the Ontario Ministry of Consumer Services is also immediately notified.

Archaeological sites recommended for further archaeological fieldwork or protection remain subject to Section 48(1) of the *Ontario Heritage Act* and may not be altered, or have artifacts removed from them, except by a person holding an archaeological licence.

8.0 IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the archaeological profession currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

This report has been prepared for the specific site, design objective, developments and purpose described to Golder by the Township of North Dundas (the Client). The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges the electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client cannot rely upon the electronic media versions of Golder's report or other work products.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project.

Special risks occur whenever archaeological investigations are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain archaeological resources. The sampling strategies incorporated in this study comply with those identified in the Ministry of Heritage, Sport, Tourism and Culture Industries' *Standards and Guidelines for Consultant Archaeologists* (2011).

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10.0 IMAGES

Image 1: Entrance to the Boyne Road Landfill, view southeast. The large berm that surrounds the landfill is behind the sign on the left.

Image 2: View northeast showing conditions within the landfill. The entire landfill footprint has been disturbed and contains no archaeological potential.

Image 3: View southwest showing conditions within the Boyne Road Landfill.

Image 4: One of the large berms that surround the landfill portion of the study area, view northeast.

Image 5: An overgrown road located along the western edge of the study area, view southeast. The road is artificially raised above the neighbouring farmland. A large berm runs parallel to the left separating the road from the landfill.

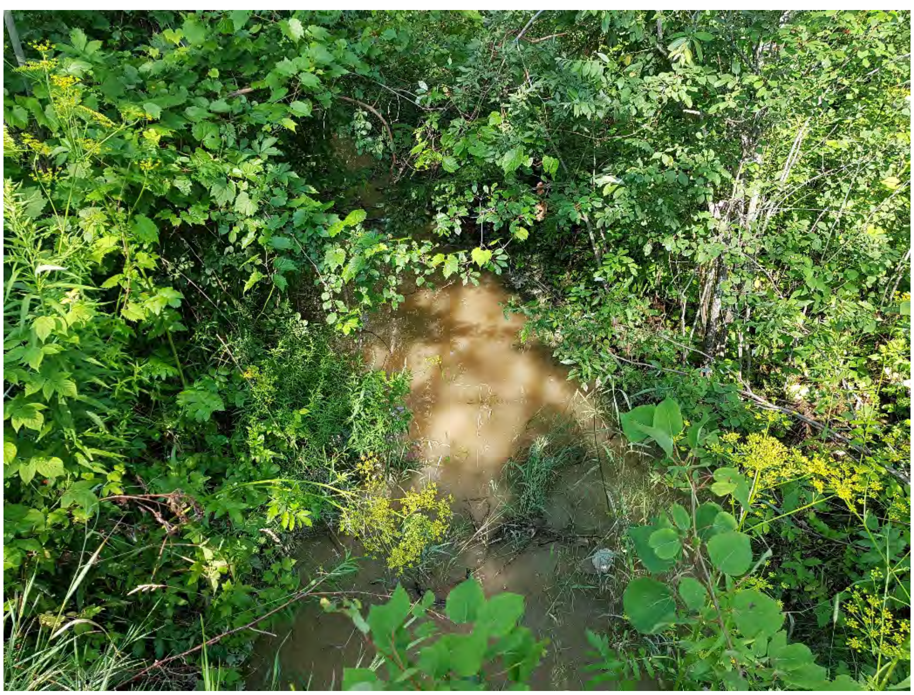


Image 6: Modern drainage ditch running through the study area, view northeast.

Image 7: Field conditions within the wood lot located at the southern end of the study area, view north.

Image 8: Field conditions within the wood lot located at the southern end of the study area, view northwest.

Image 9: Open meadow area located south of the present landfill boundaries, view southeast.

Image 10: Agricultural field located in the southwest corner of the study area, view southeast.

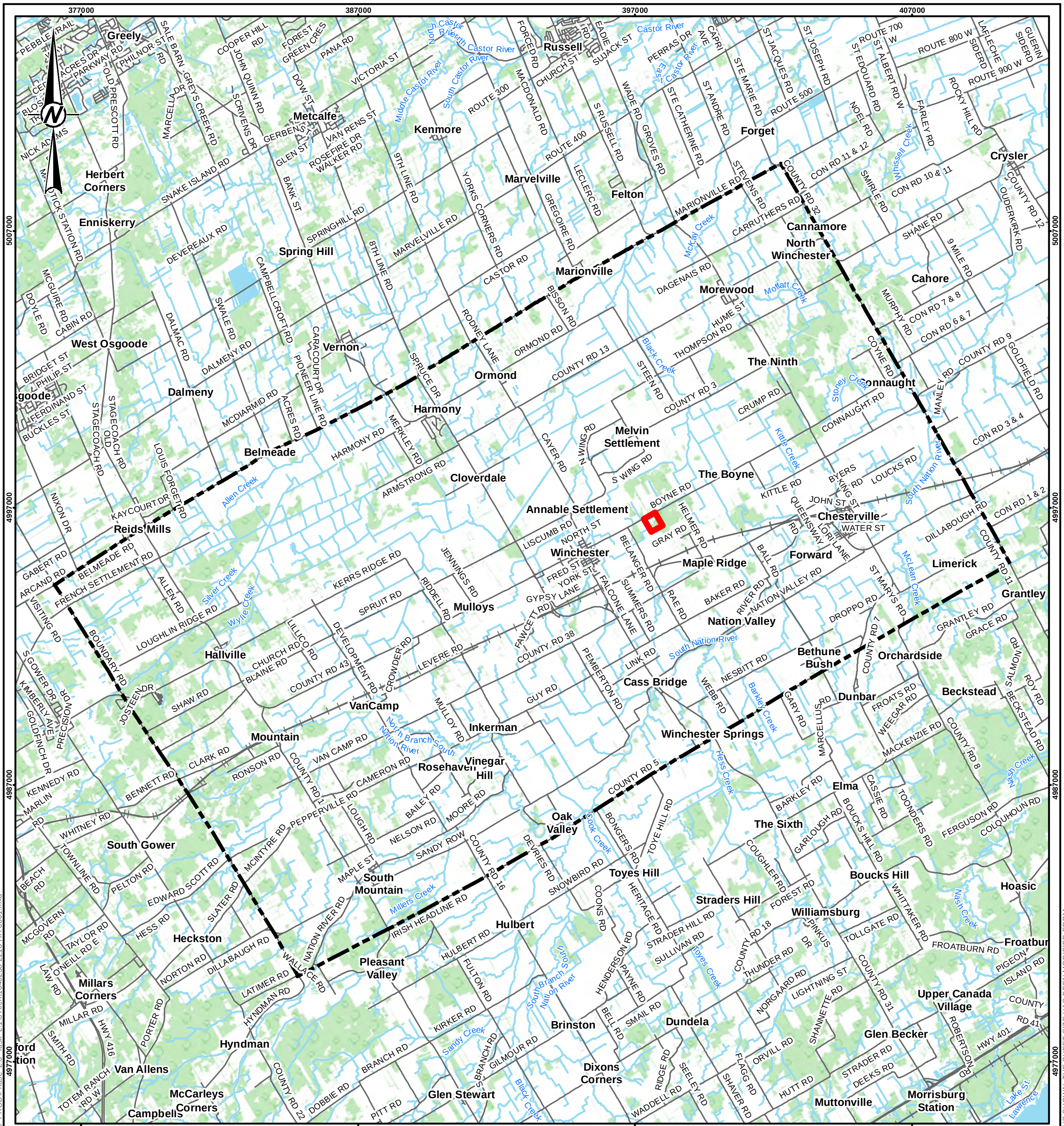
Image 11: 20th century garbage pile located in the southeast portion of the study area, view southeast.

Image 12: Abandoned trailer located near the southeast corner of the study area, view southeast.

Image 13: Abandoned bus located within the southeast portion of the study area, view southeast.

Image 14: Wet field conditions caused by modern drainage in the northeast corner of the study area, view southeast.

11.0 MAPS



LEGEND

TOWNSHIP OF NORTH DUNDAS

STUDY AREA

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COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
KEY MAP

CONSULTANT

YYYY-MM-DD	2021-11-18
DESIGNED	----
PREPARED	JEM
REVIEWED	RH
APPROVED	AM

PROJECT NO.	PHASE/TASK	REV.	MAP
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LEGEND

- WATERCOURSE
- ROADWAY
- STUDY AREA

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CLIENT

TOWNSHIP OF NORTH DUNDAS

PROJECT

INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE

SITE PLAN

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-10-18
DESIGNED	----
PREPARED	JEM
REVIEWED	RH
APPROVED	AM

PROJECT NO.	PHASE/TASK	REV.	MAP
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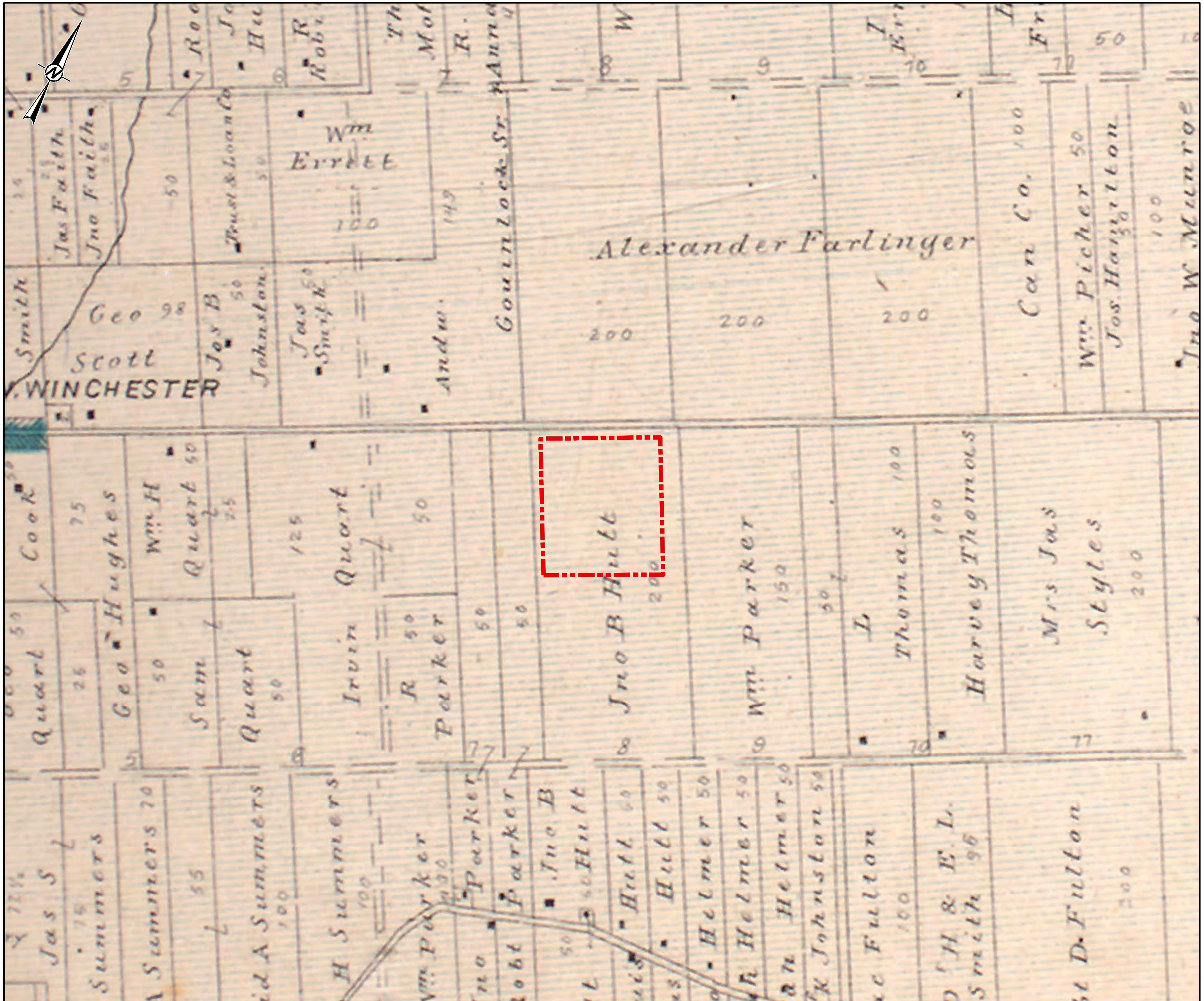

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CLIENT

TOWNSHIP OF NORTH DUNDAS

PROJECT

INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE

1879 PLAN OF WINCHESTER TOWNSHIP

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-10-18
DESIGNED	----
PREPARED	JEM
REVIEWED	RH
APPROVED	AM

PROJECT NO.	PHASE/TASK	REV.	MAP
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STUDY AREA

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CLIENT

TOWNSHIP OF NORTH DUNDAS

PROJECT

INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE

AERIAL PHOTOGRAPHS

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-10-18
DESIGNED	----
PREPARED	JEM
REVIEWED	RH
APPROVED	AM

PROJECT NO.	PHASE/TASK	REV.	MAP
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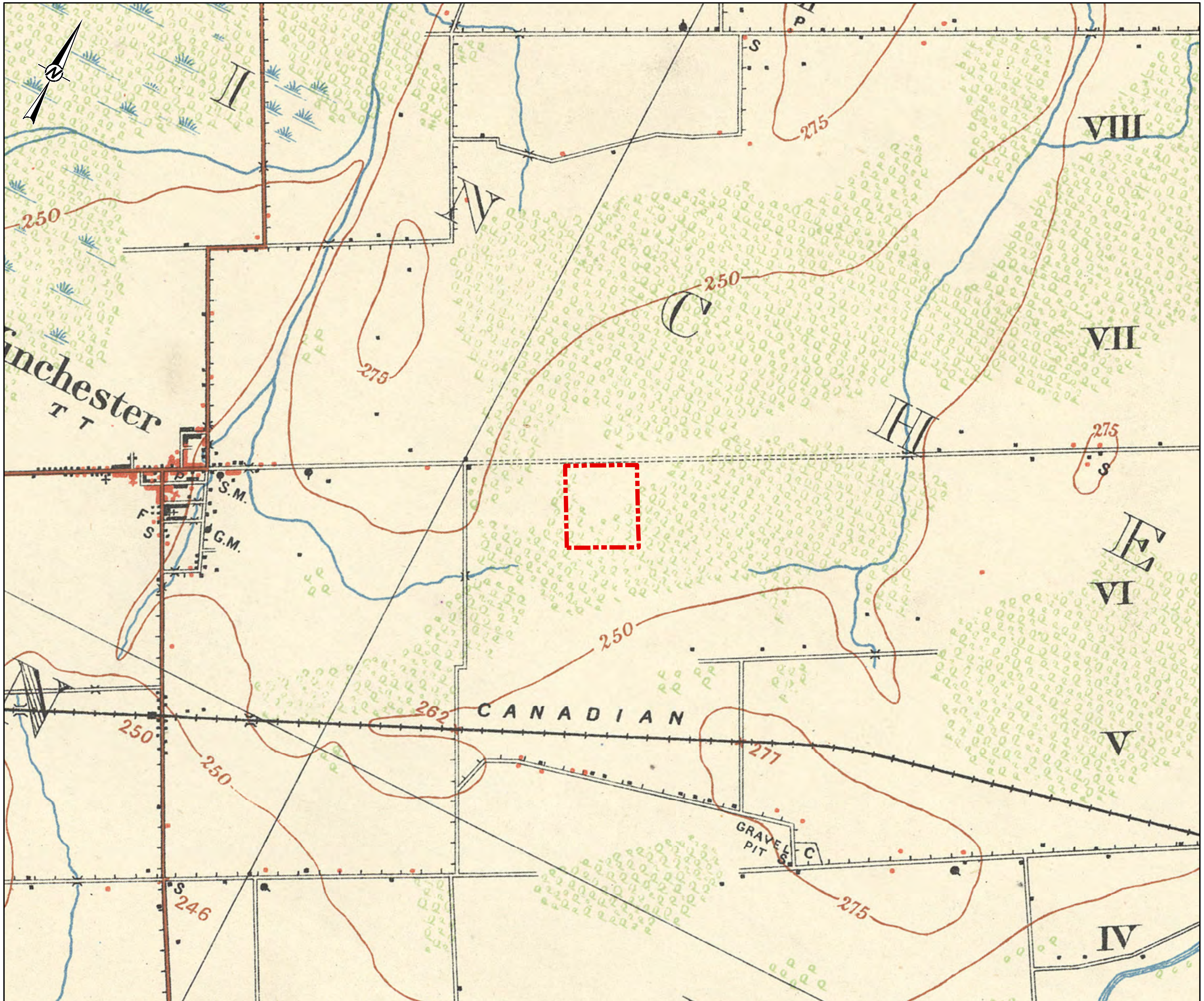

LEGEND

STUDY AREA

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CLIENT

TOWNSHIP OF NORTH DUNDAS

PROJECT

INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE

1908 TOPOGRAPHIC MAP

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-10-18
DESIGNED	----
PREPARED	JEM
REVIEWED	RH
APPROVED	AM

PROJECT NO.	PHASE/TASK	REV.	MAP
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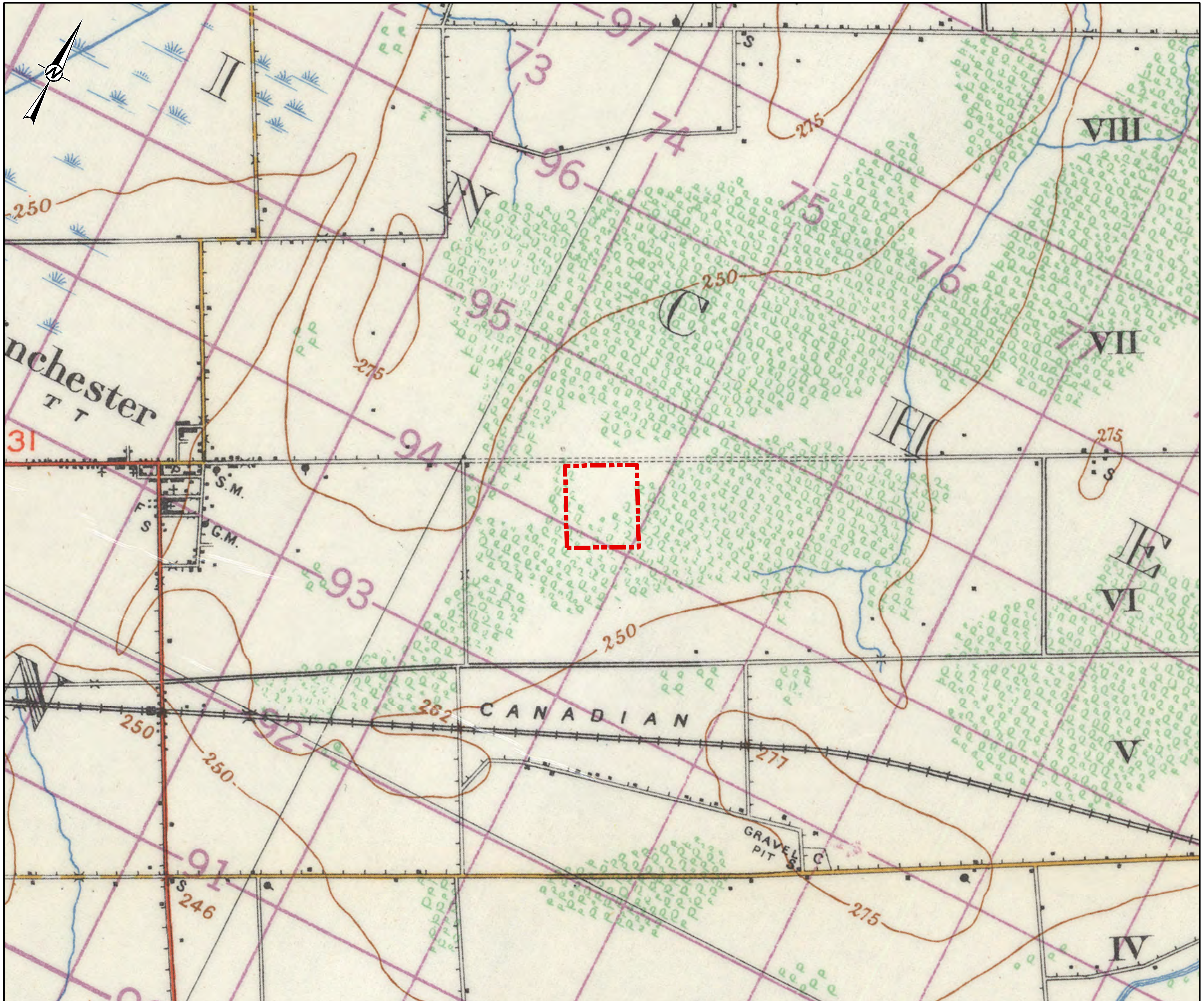

LEGEND

STUDY AREA

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CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
1933 TOPOGRAPHIC MAP

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-10-18
DESIGNED	----
PREPARED	JEM
REVIEWED	RH
APPROVED	AM

PROJECT NO.	PHASE/TASK	REV.	MAP
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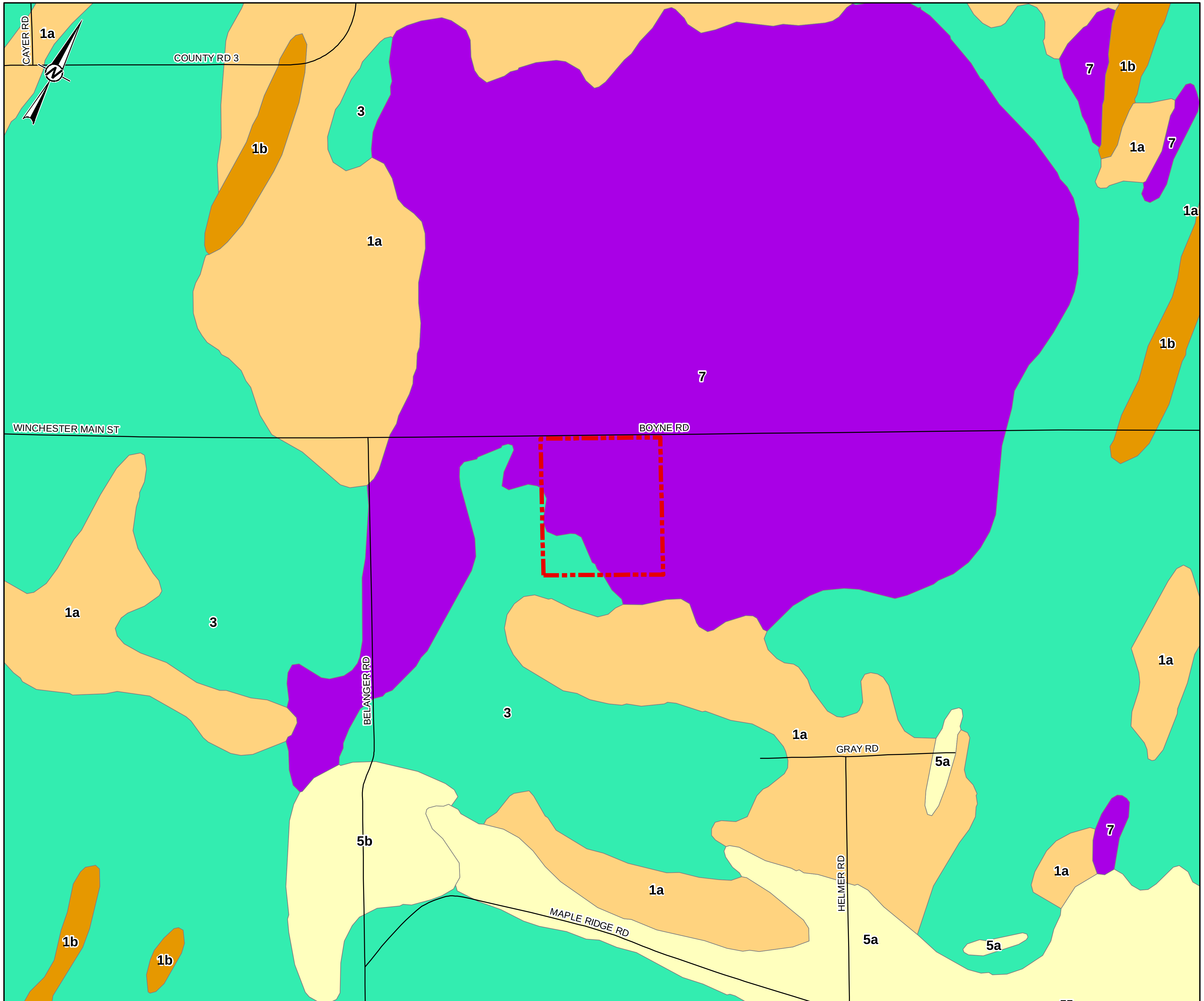

LEGEND

ROADWAY

7. ORGANIC DEPOSITS: MUCK & PEAT

5a: NEARSHORE SEDIMENTS: GRAVEL, SAND & BOULDERS

5b: NEARSHORE SEDIMENTS: FINE TO MEDIUM GRAINED SAND

3. OFFSHORE MARINE DEPOSITS: CLAY, SILTY CLAY & SILT

1a. TILL, PLAIN WITH LOCAL RELIEF <5 m

1b. TILL, DRUMLINIZED

zz. WATERBODY

STUDY AREA

REFERENCE(S)

1. BÉLANGER, J. R. 2008 URBAN GEOLOGY OF THE NATIONAL CAPITAL AREA, GEOLOGICAL SURVEY OF CANADA, OPEN FILE 5311, 1 DVD.
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: MTM ZONE 9

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CLIENT

TOWNSHIP OF NORTH DUNDAS

PROJECT

INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE

SURFICIAL GEOLOGY

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-10-18
DESIGNED	----
PREPARED	JEM
REVIEWED	RH
APPROVED	AM

PROJECT NO.	PHASE/TASK	REV.	MAP
1648253	2.0/2.2.0	0	7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

25mm

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LEGEND

- WATERCOURSE
- ROADWAY
- STAGE 1 ARCHAEOLOGICAL ASSESSMENT (CARF 1992; 92-65) - APPROXIMATE LOCATION
- STUDY AREA

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

0 40 80 160

1:4,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
PREVIOUS ARCHAEOLOGICAL ASSESSMENTS WITHIN 50 M

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-10-18
DESIGNED	----
PREPARED	JEM
REVIEWED	RH
APPROVED	AM

PROJECT NO.	PHASE/TASK	REV.	MAP
1648253	2.0/2.2.0	0	8

LEGEND

- IMAGE LOCATION AND DIRECTION
- WATERCOURSE
- ROADWAY
- DISTURBED BY EXISTING LANDFILL
- LOW ARCHAEOLOGICAL POTENTIAL - NO FURTHER ARCHAEOLOGY
- STUDY AREA

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

0 40 80 160

1:4,000 METRES

CLIENT

TOWNSHIP OF NORTH DUNDAS

PROJECT

INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE

STAGE 1 RESULTS, RECOMMENDATIONS, AND PHOTO LOCATIONS

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-10-18
DESIGNED	----
PREPARED	JEM
REVIEWED	RH
APPROVED	AM

PROJECT NO.	PHASE/TASK	REV.	MAP
1648253	2.0/2.2.0	0	9

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Signature Page

We trust that this report meets your current needs. If you have any questions, or if we may be of further assistance, please contact the undersigned.

Golder Associates Ltd.

Randy Hahn, Ph.D.
Staff Archaeologist

Aaron Mior, M.MA.
Senior Archaeologist

RH/AM/ca

https://golderassociates.sharepoint.com/sites/117046/project files/5 technical work/9 - ea technical studies/6 - archeology/stage 1 archaeology/03 final report/p1107-0045-2021_re_18november2021.docx

APPENDIX H

Traffic

NORTH DUNDAS WASTE MANAGEMENT EA

BOYNE ROAD LANDFILL EXPANSION
TOWNSHIP OF WINCHESTER, ONTARIO

TRAFFIC IMPACT STUDY

November 24, 2021

D. J. Halpenny & Associates Ltd.
CONSULTING TRANSPORTATION ENGINEERS
P. O. BOX 774, MANOTICK, ONTARIO K4M 1A7

NORTH DUNDAS WASTE MANAGEMENT EA

BOYNE ROAD LANDFILL EXPANSION
TOWNSHIP OF WINCHESTER, ONTARIO

TRAFFIC IMPACT STUDY

November 24, 2021

Prepared for:

Township of North Dundas
636 St. Lawrence Street
Winchester, ON   K0C 2K0

749 TIS Report_2.doc

D. J. Halpenny & Associates Ltd.
Consulting Transportation Engineers
P.O. Box 774, Manotick, ON   K4M 1A7 - Tel (613) 692-8662 - David@DJHalpenny.com

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NORTH DUNDAS WASTE MANAGEMENT EA

BOYNE ROAD LANDFILL
TOWNSHIP OF WINCHESTER, ONTARIO

TRAFFIC IMPACT STUDY

1. INTRODUCTION

The Township of North Dundas is in the process of preparing an Environmental Assessment (EA) study, which will assess the Township's long-term waste management over a 25 year planning period. The existing Boyne Road Landfill facility is located east of the Village of Winchester at 12620 Boyne Road.

As part of the study for the Environmental Assessment of the Township of North Dundas Waste Management Plan, a Traffic Impact Study is required, which will examine the impact of the proposed expansion of the landfill facility on the surrounding roadway network. The study will assess the operation of the site access and critical intersections in close proximity to the facility during the peak hours of the site and adjacent roads. Figure 1.1 shows the location of the Boyne Road Landfill site.

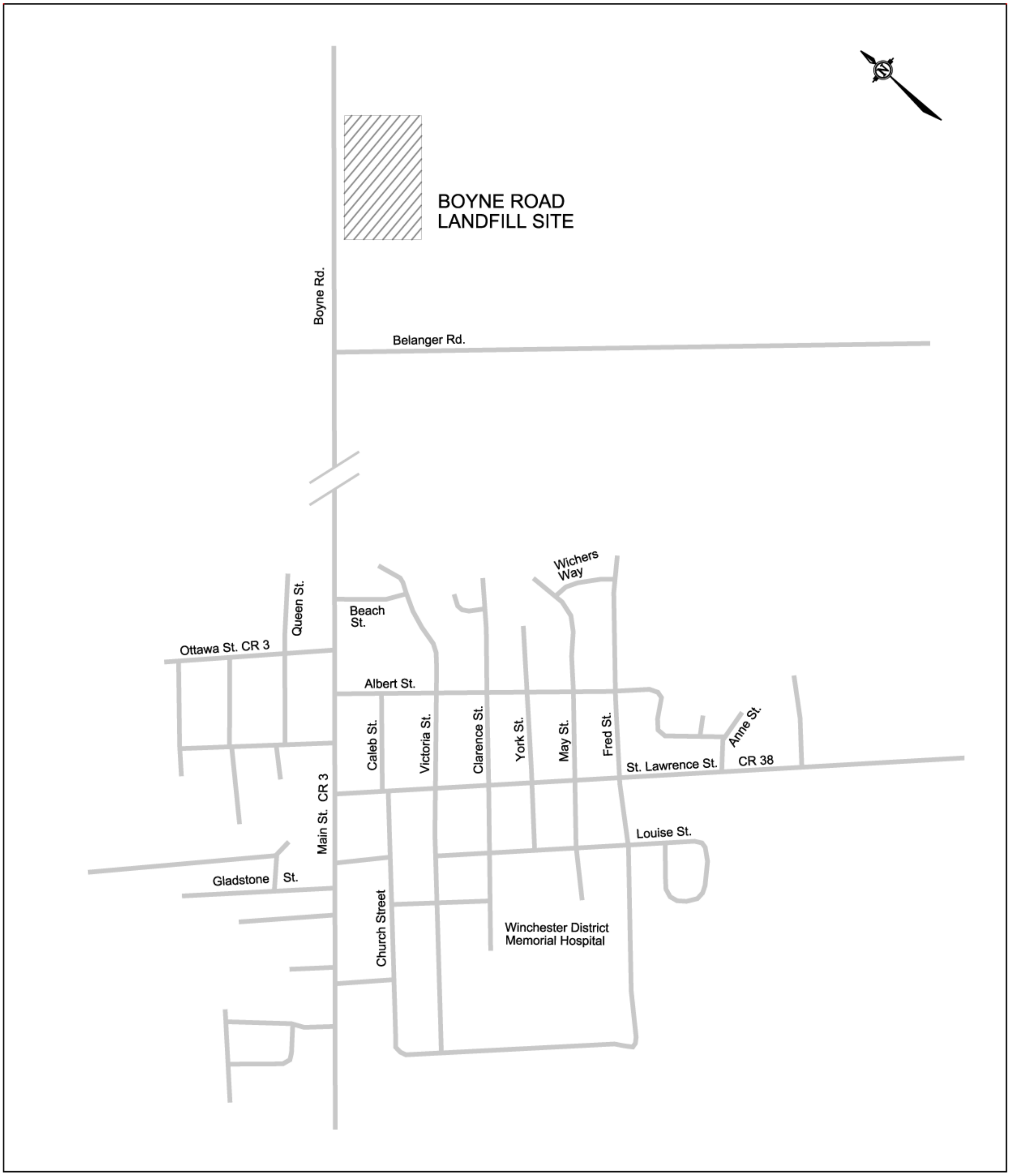
The firm of D. J. Halpenny & Associates Ltd. has been retained to prepare a Traffic Impact Study report related to the proposed expansion of the Boyne Road Landfill site. The report will examine the operation of major intersections and recommend any modifications to the municipal road network which would be triggered by the expansion of the landfill site.

1.1 Purpose and Scope of Work

The purpose of the Traffic Impact Study (TIS) will be to examine the impact that the proposed expansion of the North Dundas Waste Management Facility will have on the adjacent roads. The TIS report is being prepared as part of the Environmental Assessment study for the long-term expansion of the facility.

The landfill site is located along the south side of Boyne Road approximately 3 kilometres east of the Village of Winchester. The study will evaluate the operation of the Access/Boyne, St. Lawrence/Main and County Road (CR) 7/Boyne intersections, and examine the lane configuration and left turn lane warrants. The analysis will be conducted for the traffic using the 2021 traffic counts, and the expected 2048 traffic, which represents the end of the 25 year planning period. The time period for the analysis would be the weekday peak AM and PM hours, which are expected to be the peak traffic periods for the landfill facility and of the background traffic.

FIGURE 1.1
SITE LOCATION PLAN



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2. ADJACENT ROADS AND INTERSECTIONS

2.1 ROADWAYS

Boyne Road (Main Street) - The landfill site is located along Boyne Road. Boyne Road is an east-west arterial road under the jurisdiction of the Township of North Dundas. The road travels between the village limit of Winchester to the west and County Road 7 (CR 7) to the east, a length of approximately 8.6 km. Boyne Road is a rural road with a 7.2 m paved surface and gravel shoulders. The speed limit is posted at 80 km/h.

Main Street - Main Street travels through the Village of Winchester connecting to the west limit of Boyne Road. Main Street (CR 3) is under the jurisdiction of the United Counties of Stormont, Dundas and Glengarry from CR 31 to the west, connecting to and travelling north along Ottawa Street east of the village core. Main Street has an urban cross section, which changes to a rural cross section as it extends towards the village limit. The street has a sidewalk on the north side of the road which terminates at Ottawa Street, and a sidewalk on the south side which extends to the urban limit of the road. The speed limit along Main Street is posted at 50 km/h.

St. Lawrence Street - St. Lawrence Street (CR 38) is a north-south arterial road under the jurisdiction of the United Counties of Stormont, Dundas and Glengarry. The street is located 2.8 km west of the Boyne Road Landfill site. St. Lawrence Street has an urban cross section with sidewalks on both sides of the roadway and extends south through the village from Main Street. The posted speed limit is 50 km/h.

County Road 7 - CR 7 is a north-south rural road under the jurisdiction of the United Counties of Stormont, Dundas and Glengarry. The road is located 6.6 km east of the Boyne Road Landfill site. CR 7 has a paved surface with gravel shoulders with a posted speed limit of 80 km/h.

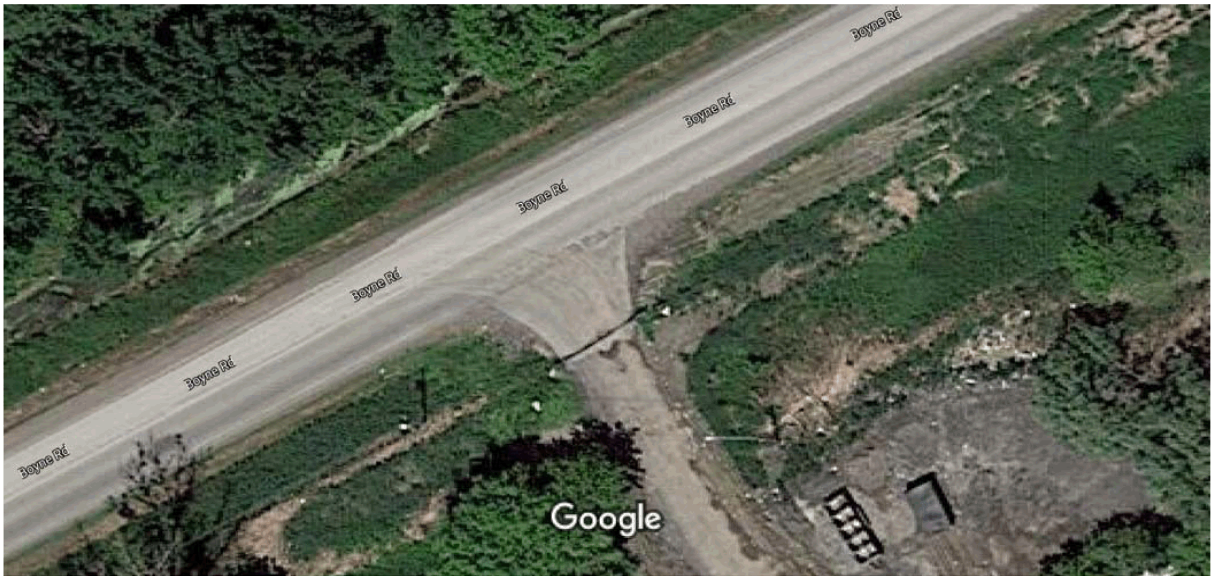
2.2 INTERSECTIONS

Access/Boyne Intersection - The site access and Boyne Road is a “T” intersection with the access to the landfill representing the northbound approach to the intersection. The site access is a private approach with an implied stop. Boyne Road would form the eastbound and westbound approaches to the intersection. There are no exclusive turn lanes at any of the approaches to the intersection. The intersection will be analyzed as a two-way stop-controlled intersection. The intersection has the following lane configuration:

Northbound Access	One shared left/right turn lane (Implied stop)
Eastbound Boyne Road	One shared through/right lane
Westbound Boyne Road	One shared left/through lane

Below is an aerial photograph of the site access intersection obtained from Google Mapping.

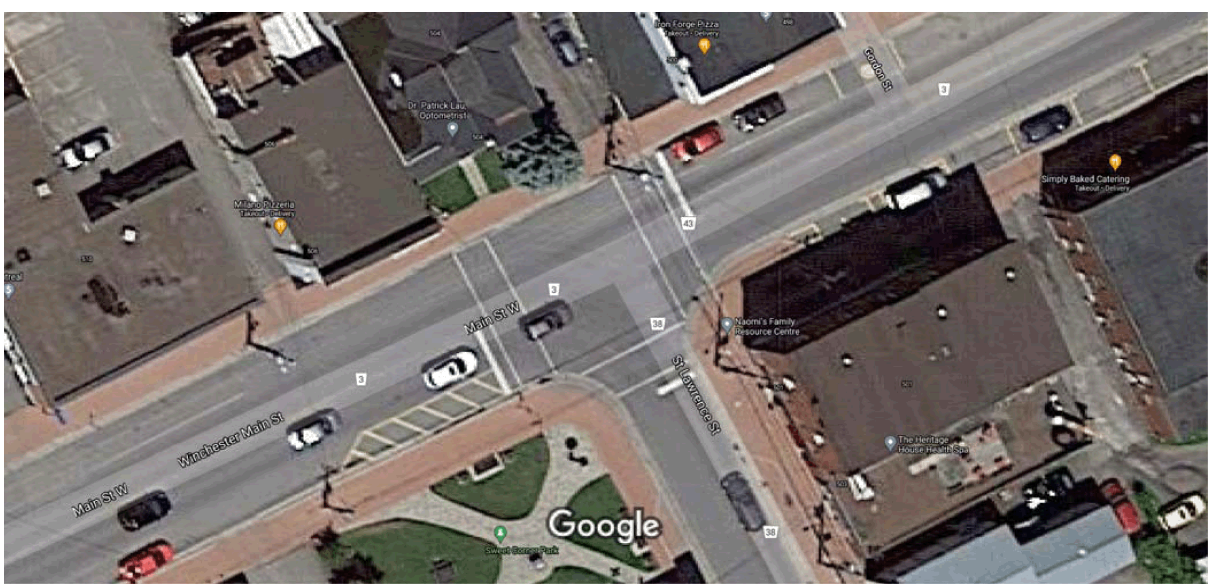
Access/Boyne Intersection



St. Lawrence/Main Intersection - The intersection of St. Lawrence Street and Main Street within the Village of Winchester is a "T" intersection controlled by all-way stop signs. The intersection is located 2.8 km. west of the landfill access onto Boyne Road. All approaches are a single lane with no exclusive turn lanes. The intersection has the following lane configuration along with an aerial photograph of the intersection.

Northbound St. Lawrence St.	One shared left/right turn lane (stop sign)
Eastbound Main Street	One shared through/right lane (stop sign)
Westbound Main Street	One shared left/through lane (stop sign)

St. Lawrence/Main Intersection

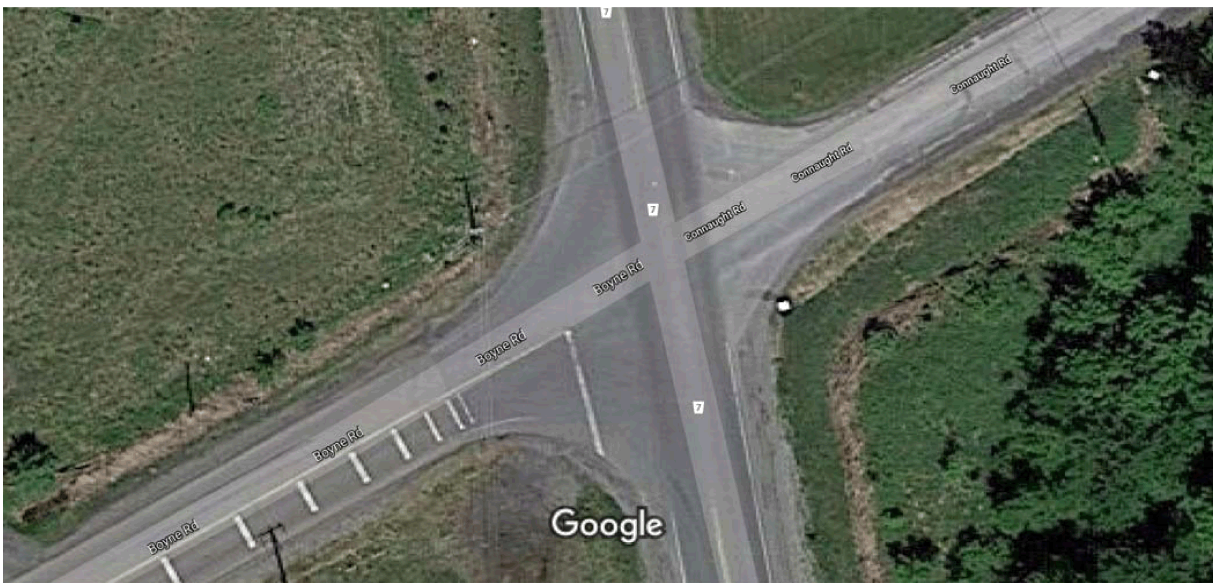


<u>CR 7/Boyne Intersection</u> - The intersection of CR 7 and Boyne Road is located 6.6 km east of the landfill access. The intersection is a two-way stop-controlled intersection with stop signs placed at the eastbound Boyne Road and westbound Connaught Road approaches. There are no exclusive turn lanes at any of the approaches to the intersection, which has the following lane configuration:

Northbound CR 7	One shared left/through/right lane
Southbound CR 7	One shared left/through/right lane
Eastbound Boyne Road	One shared left/through/right lane (stop sign)
Westbound Connaught Rd.	One shared left/through/right lane (stop sign)

Below is an aerial photograph of the CR 7/Boyne intersection obtained from Google Mapping.

CR 7/Boyne Intersection

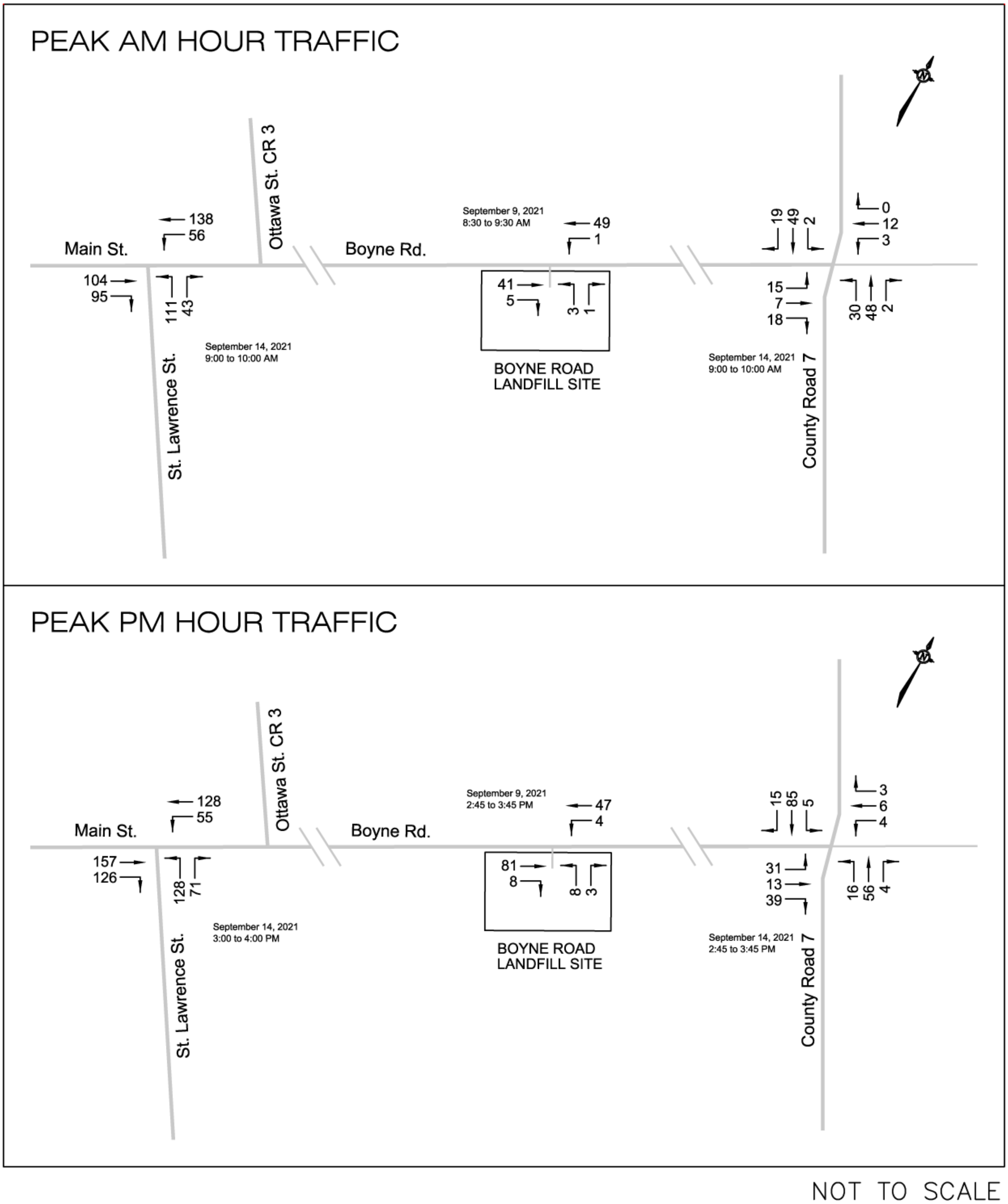


The peak hour traffic was determined from counts taken by the project team at the Access/Boyne intersection on September 8, 2021, and at the St. Lawrence/Main and CR 7/Boyne intersections on September 14, 2021. Figure 2.1 shows the 2021 peak hour traffic counts with a count summary table presented in the Appendix as Exhibit 1 for the Access/Boyne intersection, Exhibit 2 the St. Lawrence/Main intersection, and Exhibit 3 the CR 7/Boyne intersection.

3. PROPOSED BOYNE ROAD LANDFILL EXPANSION

The Boyne Road Landfill site is an existing landfill facility located along the south side of Boyne Road approximately 3 km east of the Village of Winchester. The Environmental

FIGURE 2.1
2021 PEAK AM AND PM HOUR TRAFFIC COUNTS



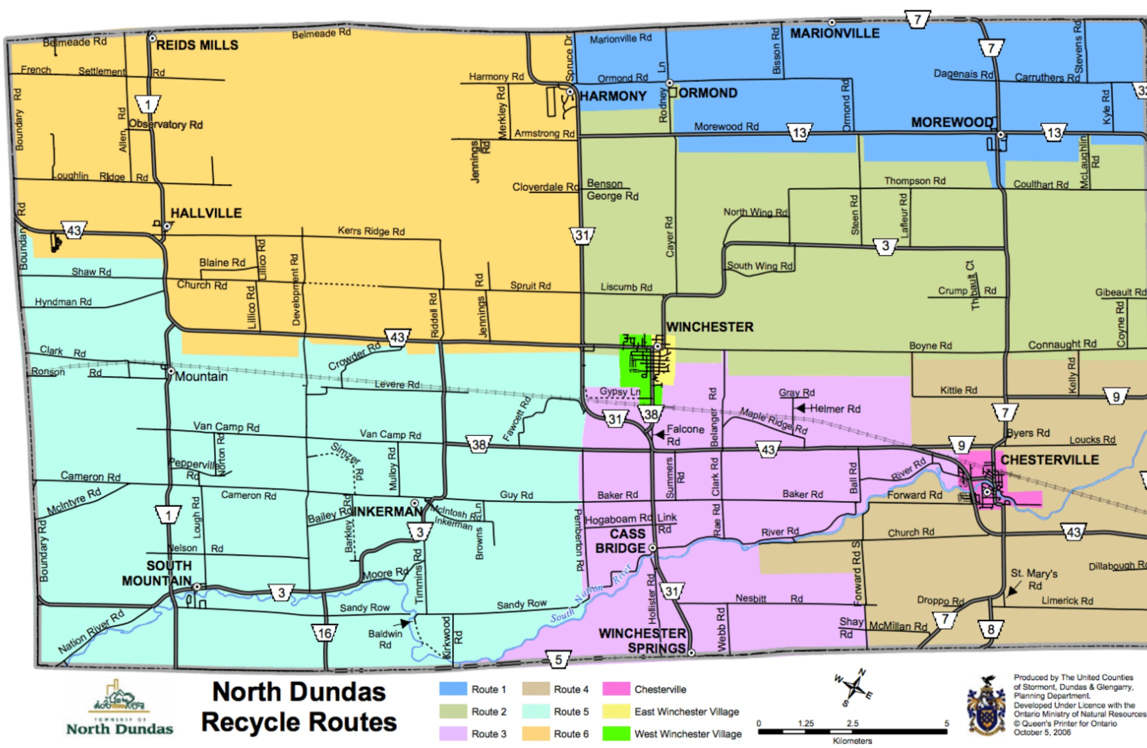
Assessment study is being undertaken to provide long-term waste management for the 25 year planning period, which will extend the life of the landfill to the year 2048.

The landfill facility would be open weekdays from 8:00 AM to 4:00 PM, and on Saturdays from 8:00 AM to 12:00 PM May through November and only one Saturday a month from 8:00 AM to 12:00 PM November through May. The facility would receive waste and recyclable materials, as well as brush and wood. Trips would originate mainly from the two main municipalities of Winchester to the west along Boyne Road, and Chesterville to the east along Boyne Road then south along CR 7. The site will have one access point onto Boyne Road. The proposed landfill expansion consists mostly of a horizontal expansion of the landfill footprint on the south side of the existing waste disposal footprint.

4. ROUTES FOR WASTE AND RECYCLING COLLECTION

The Boyne Road Landfill facility accepts waste and recyclables from the communities of Winchester, Chesterville, Morewood, Inkerman and South Mountain, plus the rural area within the Township of North Dundas. The truck routes to the major communities have already been established and are the shortest and most convenient routes along County roads. The major route not designated as a County road is Boyne Road where the landfill facility is located. Boyne Road stretches from the Village of Winchester to County Road 7. Figure 4.1, shows the collection route for both waste and recyclables.

FIGURE 4.1
WASTE COLLECTION ROUTE MAP



The traffic counts taken at the St. Lawrence/Main and CR 7/Boyne intersections were conducted on Tuesday, September 14, 2021. Tuesday is the day for the collection of waste and recyclables by municipal trucks for Routes 1 and 2, which includes the communities of Morewood, Inkerman and South Mountain. Traffic counts at the site access were taken on Thursday, September 9, 2021, and would include municipal trucks collecting waste and recyclables in the Chesterville and East Winchester areas.

Some of the waste and recycling material is dropped off by contractors by truck or trailer, which would travel from the construction site to the landfill facility. These routes would vary depending on the location of the project site. Alternate truck routes would not be as efficient and may have greater impact on the surrounding area as the established routes.

5. TRAFFIC ANALYSIS

5.1 Trip Generation

The site generated trips were calculated for two scenarios, to determine the most representative AM and PM peak hour trips for use in the study.

5.1.1 Scenario 1 - Average Trips

The first scenario utilized the number of monthly trips to/from the facility, averaged the trips to hourly trips, and then applied a peaking factor (PF) which converted the average hour trips to peak hour trips by applying a conservative PF of 2.0. Traffic counts have determined a PF of 1.5 as being typical in converting average hour traffic to peak hour traffic. The trips were then increased by 5.5 percent, which is the expected increase in landfill traffic over the 25 year planning period.

Traffic counts of vehicles entering and exiting the landfill facility were obtained from the Township on a vehicles per month basis. The average counts were taken for two time periods, with the traffic analysis using the greater number of trips which occurred between April 1st and October 31st:

April 1st to October 31st -	460 vehicles/month	35% Heavy vehicle
November 1st to March 31st -	285 vehicles/month	42% Heavy vehicle

For the April 1st to October 31st time period and a 5½ day week (44 hr):

Average vehicle trips per hour
460 veh per month / (44 hr per week x 4 weeks per month) = 2.61 or 3 veh/hr

Peak vehicle trips per hour
3 veh/hr x 2.0 peaking factor x 1.055 (landfill expansion) = 6.33 or 7 veh/hr

	Entering	Exiting	Total
AM/PM Peak Hour Vehicle Trips	7	7	14

5.1.2 Scenario 2 - Site Trips Determined From Traffic Counts

The second scenario used the existing site trip counts entering and exiting the facility, which were taken on September 9, 2021 between 8:00 AM and 10:00 AM and between 2:00 PM and 4:00 PM. Observations and counts showed that peak periods occurred when the landfill facility just opened and trucks were leaving and waste was dropped off from the previous day, and when waste was dropped off at the end of the work day.

September 9, 2021 traffic count - 2 hour peak AM and PM time period

	Entering		Exiting	
	EB right	WB left	NB left	NB right
2 hr AM Vehicle Trips	8	1	6	2
2 hr PM Vehicle Trips	14	5	15	3

The trips from the 2 hour AM and PM time period were increased by 5.5 percent at each approach, which is the expected increase in traffic due to the landfill expansion over the 25 year planning period to the year 2048. The 2 hour trip period was then averaged to get a peak AM and PM hour, and a peaking factor (PF) of 2.0 was applied.

The traffic counts would form the base for the calculation of the expected trips during the April 1st to October 31st time period. The expected 2048 trips were calculated using the above adjustment factors with the peak AM and PM hour trips shown below.

	Entering	Exiting	Total
AM Peak Hour Vehicle Trips	11	10	21
PM Peak Hour Vehicle Trips	21	20	41

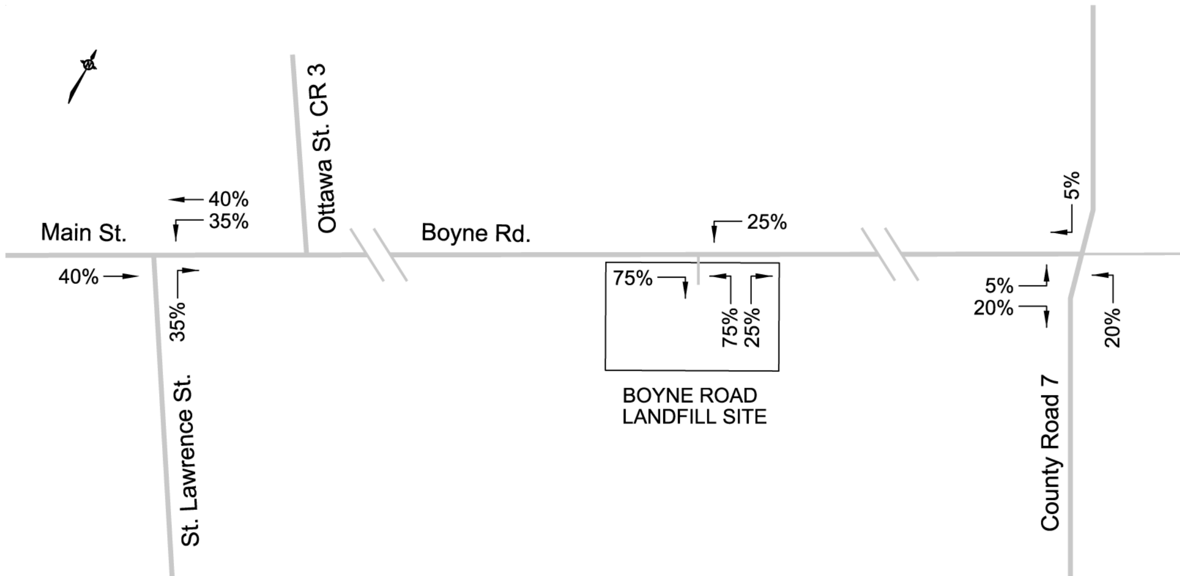
5.2 Trip Distribution

The impact assessment study has utilized the trips for Scenario 2, which were calculated from the counts as discussed in Section 5.1.2. The higher number of trips would reflect the trip pattern of waste being dropped off at the facility at the beginning and end of the work day.

The distribution of expected site generated trips entering and exiting the landfill facility was determined from the examination of the peak AM and PM hour traffic movements along Boyne Road past the site, and at the St. Lawrence/Main and CR 7/Boyne intersections. Site generated trips were distributed onto the adjacent roads in the proportions shown on Figure 5.1.

Figure 5.2 shows the expected weekday peak AM and PM hour site generated trips for the development using the expected trips calculated from the existing traffic counts (Scenario 2).

FIGURE 5.1
TRIP DISTRIBUTION ON THE ROAD NETWORK



6. TRAFFIC IMPACT

6.1 2048 Background and Total Traffic Volumes

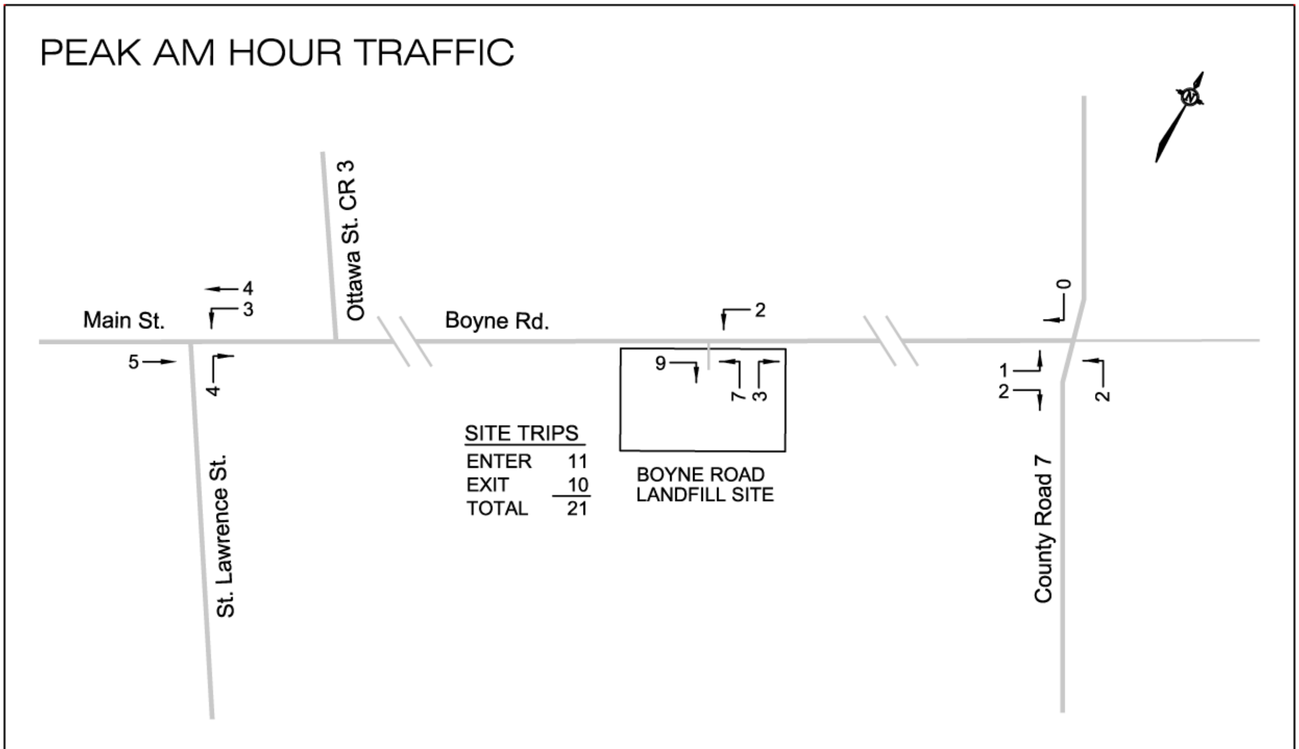
The 2048 background traffic would consist of the future traffic, which would include future development, but would not include the expected trips from the landfill facility. The 2021 traffic counts taken at the Access/Boyne, St. Lawrence/Main and CR 7/Boyne intersections were projected to the year 2048, which represents the horizon year of the 25 year planning period.

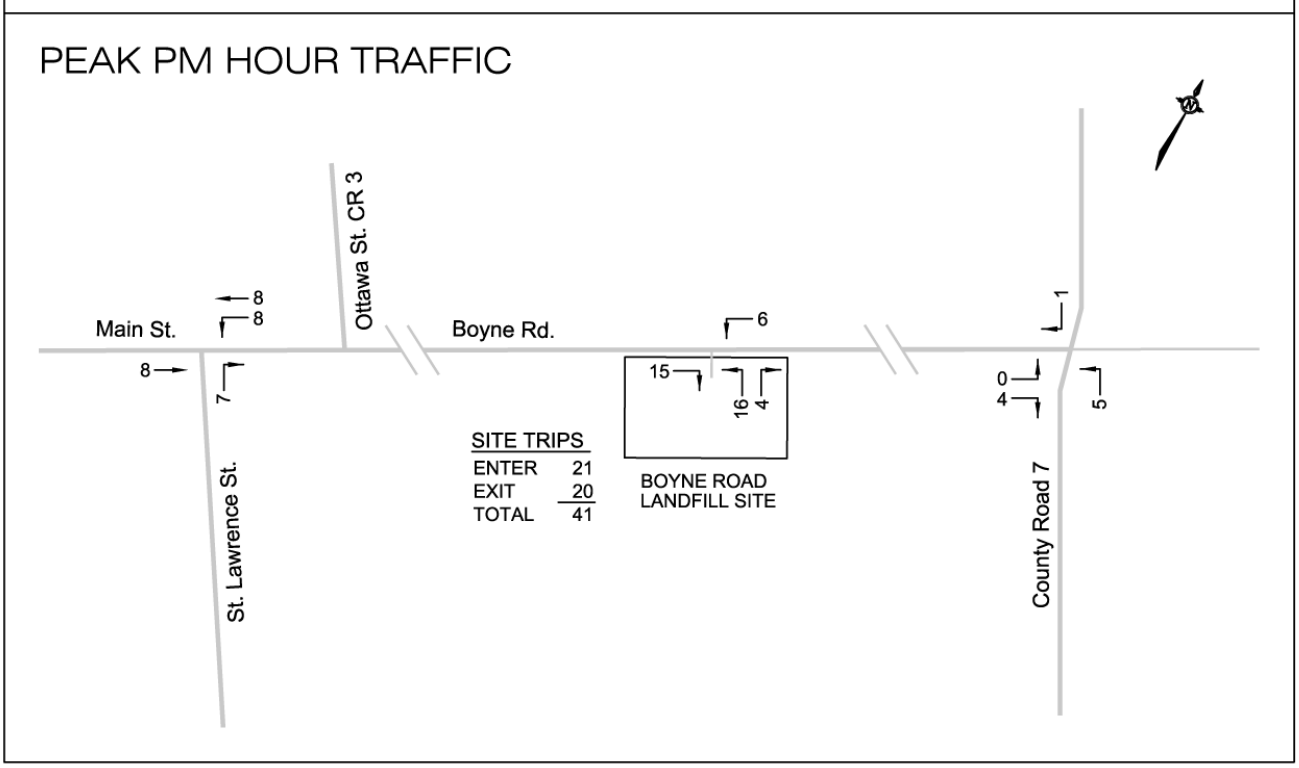
The future background traffic was determined by applying the following two factors, which would increase the September 2021 traffic counts to the peak AM and PM hour pre-COVID-19 traffic (normalize to typical peak hour traffic), and the traffic resulting from future development in the Township (2048 background traffic). Trips to/from the landfill facility were not adjusted for COVID-19 as it was assumed that there would be little change in household or construction waste due to home improvements or contractors. The following are the two factors:

1) Typical Peak Hour Traffic (pre-COVID-19)

The September 2021 traffic counts would need to be increased to account for the decreased traffic due to the COVID-19 outbreak, which resulted from both the temporary job loss of some of the work force, and allowing some workers to work remotely from home. To convert the 2021 counts to the expected pre-COVID-19 traffic volumes, a conversion factor was applied to the counts. Traffic counts were obtained from the United Counties of Prescott and Russell, which were taken along Russell Road 1.5 km east of the Drouin/Russell intersection. The location is approximately 2.5 km

FIGURE 5.2
PEAK AM AND PM HOUR SITE GENERATED TRIPS





NOT TO SCALE

east of the east city limit of the City of Ottawa and would be influenced by federal government employees working remotely. The July 2018 peak hour counts were compared to the September 2020 counts at the east approach to the Drouin/Russell intersection. The counts showed that the 2020 counts were 11 percent lower during the peak AM hour and 15 percent lower during the peak PM hour. The counts are shown below:

Count Date	AM	PM
July 2018	491	524
September 2020	441	457
	-11%	**-15%**

The study has therefore assumed a 15 percent COVID-19 adjustment factor, which was applied to the 2021 through traffic along Boyne Road to increase traffic at the site access, and at all approaches to the St. Lawrence/Main and CR 7/Boyne intersections, which converted the 2021 counts to pre-COVID-19 traffic volumes.

2) Future 2048 Background Traffic

The second factor represents the increase in traffic due to future development outside the study area. The study has examined the growth in population determined from projections obtained from the Township's Municipal Department, which were completed as part of the Township's Official Plan. The projections have shown the population to increase from 12,107 in 2021 to 13,236 in 2036. This would translate to an annual average compounded increase of 0.596 percent. Considering the growth projections discussed above, the study has assumed an annual average compounded growth of 1.0 percent, which was applied to the 2021 pre-COVID-19 through traffic along Boyne Road at the site access, and at all approaches to the St. Lawrence/Main and CR 7/Boyne intersections. The growth rate translates to the factor below, which was applied to the typical traffic (pre-COVID-19).

1.0% Annual Increase

2021 → 2048 1.308

Figure 6.1 shows the expected 2048 peak AM and PM hour background traffic utilizing the COVID-19 and future background traffic projections discussed above.

The total traffic volumes are the addition of the 2048 background traffic (Figure 6.1) and the expected site generated trips (Figure 5.2). Figure 6.2 shows the 2048 total volume of traffic at the landfill facility access and the critical intersections within the Haul Route Study Area.

FIGURE 6.1
2048 PEAK AM AND PM HOUR BACKGROUND TRAFFIC

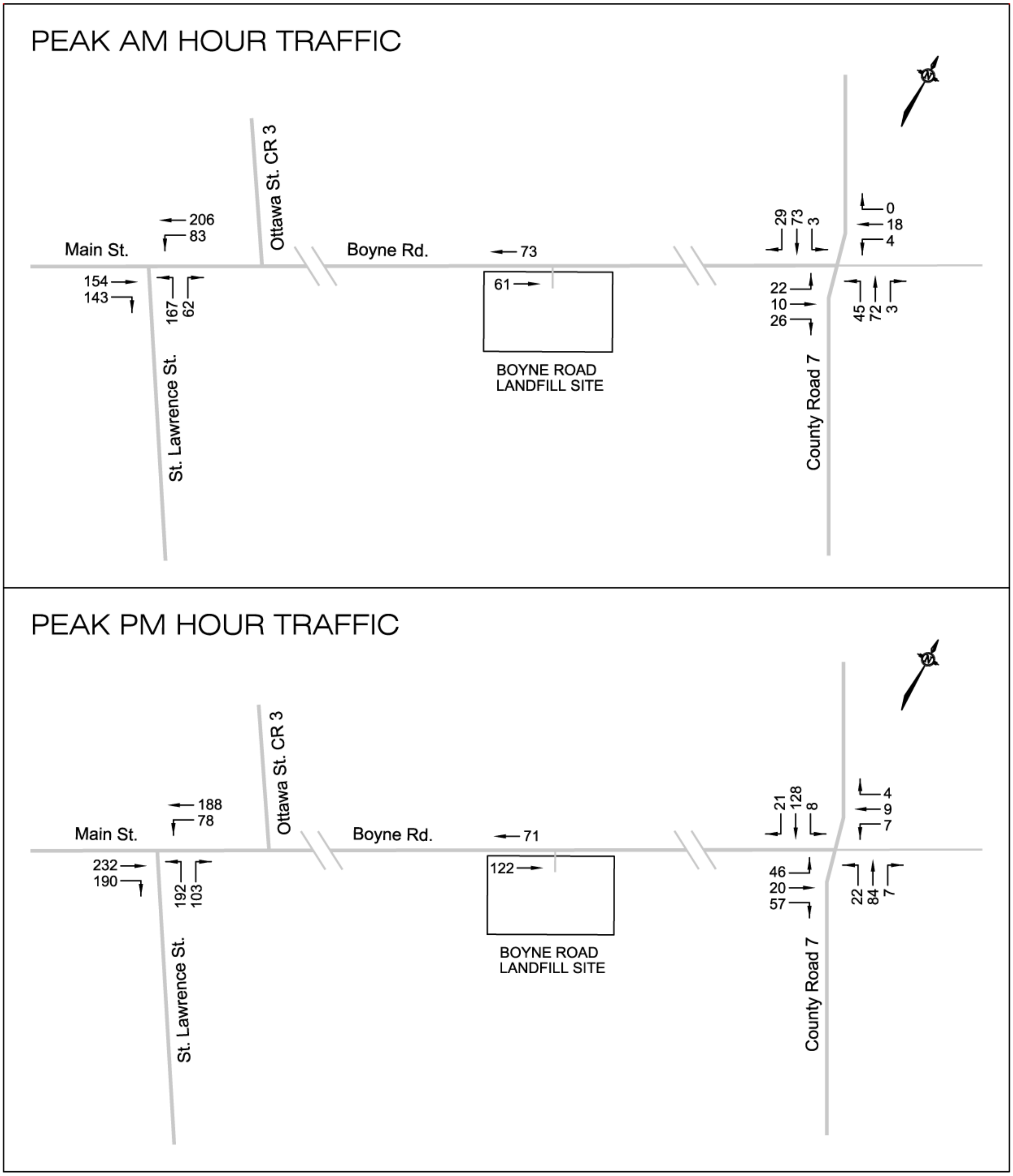


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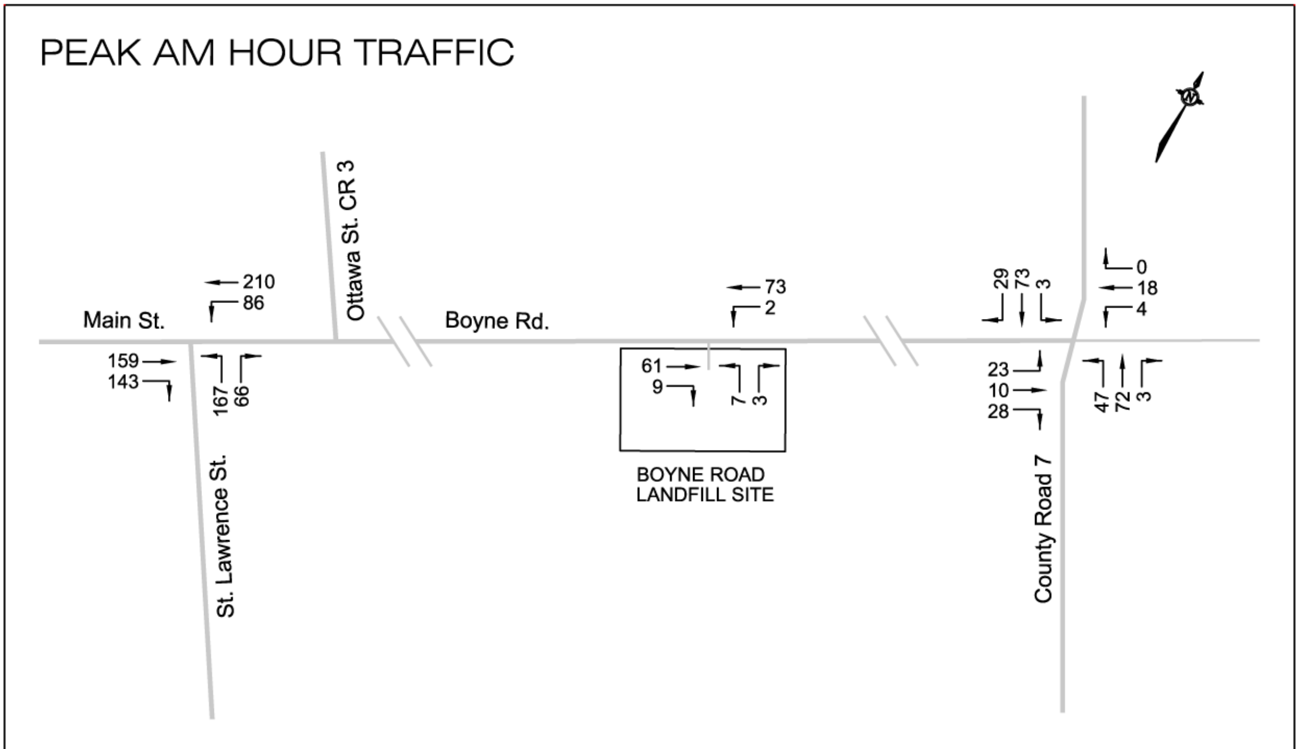
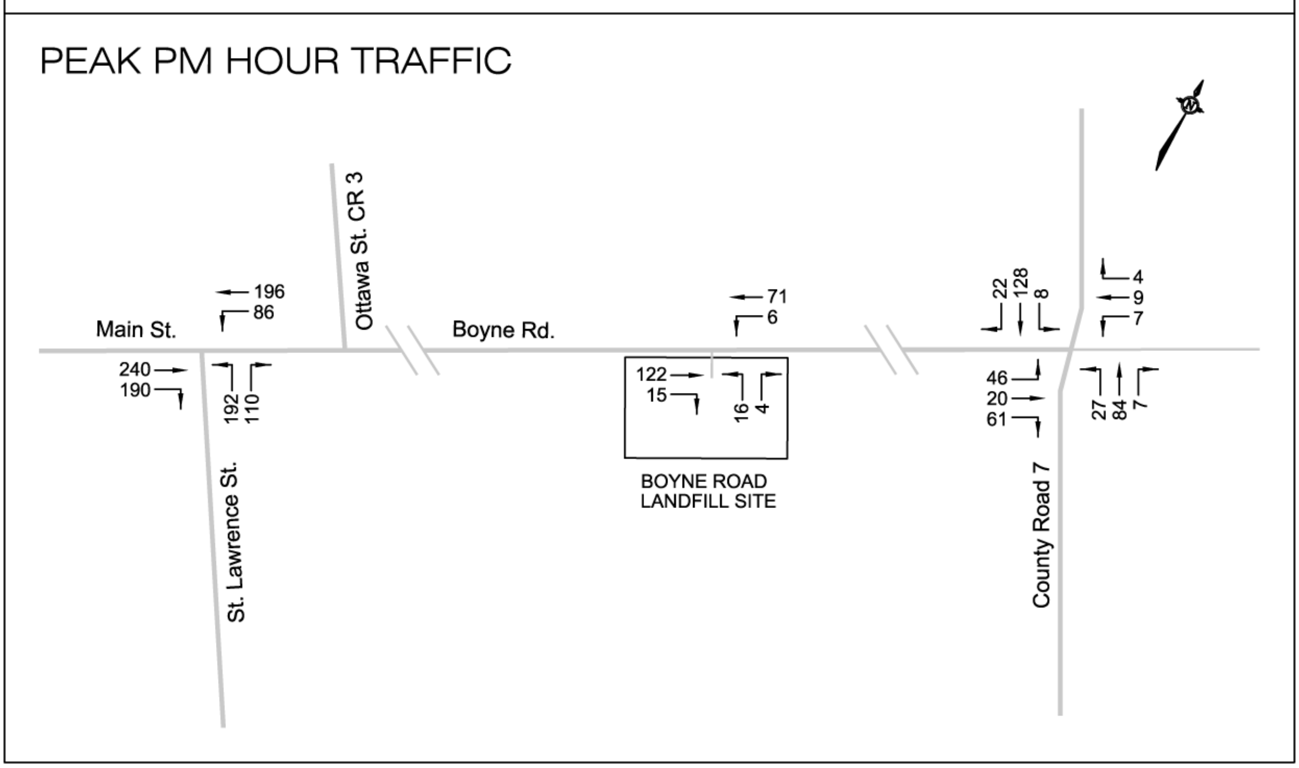
FIGURE 6.2
2048 PEAK AM AND PM HOUR TOTAL TRAFFIC





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6.2 Traffic Analysis

The Traffic Impact Study examined the operation of the intersections of Access/Boyne, St. Lawrence/Main and CR 7/Boyne. The analysis periods were the peak AM and PM hour for the existing traffic counts, and 2048 projected traffic (which represents the horizon year of the expanded landfill facility's planning period). The analysis used the *Highway Capacity Software, Version 7.9.5,* which utilizes the analysis procedure as documented in the Transportation Research Board (TRB) publication, *Highway Capacity Manual (HCM) 2010 and HCM 6th Edition*.

For unsignalized intersections, the level of service of each lane movement and approach is determined as a function of the delay of vehicles at the approach. The following relates the level of service (LOS) of each lane movement with the expected control delay at the approach.

LEVEL OF SERVICE	CONTROL DELAY	
Level of Service A	0-10 sec./vehicle	Little or No Delay
Level of Service B	>10-15 sec./vehicle	Short Traffic Delays
Level of Service C	>15-25 sec./vehicle	Average Traffic Delays
Level of Service D	>25-35 sec./vehicle	Long Traffic Delays
Level of Service E	>35-50 sec./vehicle	Very Long Traffic Delays
Level of Service F	>50 sec./vehicle	Extreme Delays – Demand Exceeds Capacity

The expected length of queue at the critical lane movements for an unsignalized stop-controlled intersection was determined by the calculation of the 95th percentile queue at each lane approach. The 95th percentile queue length is the calculated 95th greatest queue length out of 100 occurrences at a movement during a 15-minute peak period. The 95th percentile queue length is a function of the capacity of a movement and the total expected traffic, with the calculated value determining the magnitude of the queue by representing the queue length as fractions of vehicles.

The results of the analysis are discussed in the following sections.

Access and Boyne Road Intersection

The site access to the Boyne Road Landfill facility is a single access point shared by the municipal waste management vehicles, contractors and private homeowners in the Township. The landfill facility will be operational from 8:00 AM to 4:00 PM weekdays, and 8:00 AM to 12:00 PM Saturdays from May through November. The traffic study has examined the operation of the site access and adjacent roads during the peak trip period of the facility when vehicles are entering/exiting at the beginning of the day and at the end of the day.

The existing configuration of the Access/Boyne intersection is a "T" intersection with Boyne Road forming the eastbound and westbound approaches and the site access the northbound approach. All approaches are a single lane with no exclusive turn lanes as discussed in Section 2.2 of this report. The northbound site exit approach would have an implied stop sign.

An operational analysis of the intersection was performed using the weekday 2021 traffic counts taken on September 9, 2021 and shown in Figure 2.1. The analysis determined that the westbound Boyne Road left/through movement and northbound left/right access movement both functioned at a Level of Service (LOS) "A" during the peak AM hour (8:30 to 9:30 AM) and during the peak PM hour (2:45 to 3:45 PM). The results are summarized in Table 6.1 with the summary sheets provided in the Appendix as Exhibit 4 for the 2021 peak AM hour and Exhibit 5 for the peak PM hour.

TABLE 6.1
SITE ACCESS AND BOYNE ROAD INTERSECTION – LOS & Delay

Intersection Approach	**PEAK AM HOUR** 2021 Count **2048** Total		**PEAK PM HOUR** 2021 Count **2048** Total	
	LOS	**Delay (sec.)**	**LOS**	**Delay (sec.)**
WB Left/Through – Boyne Road	A **A**	7.7 **7.7**	A **A**	7.8 **7.9**
NB Left/Right - Site Access	A **A**	9.3 **9.6**	A **B**	9.7 **10.3**

The expected 2048 traffic was determined as shown in Figure 6.2, which included the future site generated trips and background traffic along Boyne Road. A left turn lane warrant analysis was performed for the 2048 total peak AM and PM hour volume of traffic at the westbound Boyne Road approach. The analysis utilized the left turn lane warrant graphs from the Ministry of Transportation Ontario (MTO) publication, *Geometric Design Standards for Ontario Highways*. The analysis determined that the westbound Boyne Road approach did not trigger the warrant for an exclusive westbound left turn lane into the site. The 2048 traffic analysis will be conducted using the existing intersection geometry. The left turn lane warrant analysis is provided in the Appendix as Exhibit 6.

The operation analysis using the expected 2048 total traffic and the existing intersection geometry determined that all approaches functioned at a LOS "A" during the peak AM hour. During the peak PM hour, the westbound Boyne Road approach functioned at a LOS "A" and northbound site Access approach at a LOS "B". Table 6.1 summarizes the operation of the intersection with the analysis sheets provided as Exhibit 7 for the peak AM hour and Exhibit 8 for the peak PM hour. The peak PM hour 95th percentile queue was determined to be 0.0 vehicles for the westbound Boyne Road approach and 0.1 vehicles for the northbound site access.

The intersection would operate at an acceptable level of service, resulting in no requirement for modifications triggered by the expansion of the landfill facility.

Main Street and St. Lawrence Street Intersection

The St. Lawrence/Main intersection is an all-way stop-controlled intersection in the village core and is located 2.8 km west of the site. The intersection is a “T” intersection with St. Lawrence Street forming the northbound approach, and Main Street the eastbound and westbound approaches. Main Street is the extension of Boyne Road within the village limits. The peak hour traffic during the operational hours of the landfill facility occurred between 9:00 and 10:00 AM, and 3:00 and 4:00 PM.

The existing traffic counts were taken on September 14, 2021. The operational analysis determined that all approaches functioned at a LOS “A” during the peak AM hour. During the peak PM hour, the eastbound and northbound approaches functioned at a LOS “B”, and westbound approach at a LOS “A”. The analysis work sheets are provided in the Appendix as Exhibit 9 for the peak AM hour and Exhibit 10 for the peak PM hour. The intersection operation is summarized in Table 6.2.

TABLE 6.2
MAIN STREET AND ST. LAWRENCE STREET INTERSECTION – LOS & Delay

Intersection Approach	**PEAK AM HOUR** 2021 Count (2048) Background **2048** Total		**PEAK PM HOUR** 2021 Count (2048) Background **2048** Total	
	LOS	**Delay (sec.)**	**LOS**	**Delay (sec.)**
EB Through/Right – Main St.	A (B) **B**	9.0 (11.7) **12.0**	B (C) **C**	10.3 (17.4) **18.6**
WB Left/Through – Main St.	A (B) **B**	9.5 (12.5) **12.8**	A (B) **B**	9.9 (13.6) **14.4**
NB Left/Right - St. Lawrence St.	A (B) **B**	9.4 (11.9) **12.1**	B (B) **C**	10.3 (14.9) **15.5**

The 2048 background traffic is the expected volume of traffic derived from the traffic counts, and increased using a COVID-19 adjustment factor and an annual average compounded growth factor. The background traffic analysis does not include existing or future trips generated by the landfill facility. The 2048 analysis determined that all approaches functioned at a LOS “B” during the peak AM hour. During the peak PM hour the westbound and northbound approaches functioned at a LOS “B”, and the eastbound approach at a LOS ”C”. Table 6.2 summarizes the operation of the intersection with the analysis sheets provided as Exhibit 11 and Exhibit 12.

Following the expansion of the site, all approaches functioned at a LOS “B” during the 2048 peak AM total traffic. During the peak PM hour the eastbound and northbound approaches functioned at a LOS “C” and westbound at a LOS “B”. The analysis sheets are provided as Exhibits 13 and 14, with Table 6.2 summarizing the operation of the intersection. The 95th percentile queue during the peak PM hour was determined to be 5.3 vehicles at the eastbound approach, 2.7 vehicles at the westbound approach, and 3.2 vehicles at the northbound approach.

The intersection would operate at an acceptable level of service, resulting in no requirement for modifications triggered by the expansion of the landfill facility.

County Road 7 and Boyne Road (Connaught Road) Intersection

The intersection of CR 7/Boyne is located 6.6 km east of the site with CR 7 forming the northbound and southbound approaches, Boyne Road the eastbound approach, and Connaught Road the westbound approach. The intersection is a two-way stop-controlled intersection with stop signs installed at the Boyne Road and Connaught Road approaches. All approaches consist of a single lane with shared turning movements. Traffic counts taken on September 14, 2021 determined that the peak AM hour occurred between 9:00 and 10:00 AM, and peak PM hour between 2:45 and 3:45 PM.

The existing 2021 traffic counts determined that the approaches to the intersection functioned at a LOS “A” or “B” during both the peak AM and PM hours. Table 6.3 summarizes the operation of the intersection with the analysis sheets provided as Exhibit 15 for the peak AM hour and Exhibit 16 for the peak PM hour.

TABLE 6.3
CR 7 AND BOYNE ROAD INTERSECTION – LOS & Delay

Intersection Approach	**PEAK AM HOUR** 2021 Count (2048) Background **2048** Total		**PEAK PM HOUR** 2021 Count (2048) Background **2048** Total	
	LOS	**Delay (sec.)**	**LOS**	**Delay (sec.)**
EB Left/Through/Right – Boyne Rd.	A (B) **B**	9.6 (10.3) **10.4**	B (B) **B**	10.1 (11.3) **11.4**
WB Left/Through/Right - Cannaught	B (B) **B**	10.3 (11.3) **11.3**	B (B) **B**	10.1 (11.2) **11.3**
NB Left/Through/Right – CR 7	A (A) **A**	7.4 (7.6) **7.6**	A (A) **A**	7.5 (7.6) **7.6**
SB Left/Through/Right – CR 7	A (A) **A**	7.3 (7.4) **7.4**	A (A) **A**	7.4 (7.4) **7.4**

The operational analysis using the 2048 background traffic (excluding site trips) determined that the eastbound and westbound approaches functioned at a LOS “B” and northbound and southbound CR 7 approaches at a LOS “A” during both the peak AM and PM hours. The operational analysis worksheets are provided as Exhibit 17 and 18, with Table 6.3 summarizing the analysis.

The analysis of the total traffic at the year 2048 determined that the intersection would continue to operate at the same level of service as the 2048 background traffic, with the eastbound and westbound approaches functioning at a LOS “B” and northbound and southbound approaches at a LOS “A” during both the peak AM and PM hour. Table 6.3 summarizes the results with the analysis sheets provided as Exhibit 19 and Exhibit 20. The 95th percentile queue at the approaches for the 2048 peak PM hour traffic was 0.7

vehicles at the eastbound Boyne Road approach and 0.1 vehicles at the northbound CR 7 approach.

The intersection would operate at an acceptable level of service, resulting in no requirement for modifications triggered by the expansion of the landfill facility.

6.3 Agricultural Equipment on the Public Roads

A large portion of the Township of North Dundas contains agricultural land. Farm equipment constantly travels between fields and the main farming compound along public roads. The equipment is usually large and travels at a low speed. Traffic Counts taken in September 2021 during the two hour AM and two hour PM peak periods recorded the following farm vehicles and movements at the intersections:

	AM	PM
Access/Boyne	No vehicles	No vehicles
St. Lawrence/Main	1 EB Through (8:45-9:00)	1 NB Right (2:15-2:30) 1 EB Right (3:45-4:00)
CR 7/Boyne	1 SB Through (8:15-8:30) 2 SB Through (8:30-8:45) 1 EB Through (9:00-9:15)	1 SB Through (3:15-3:30)

The volume of farm vehicles and observations during the counting period did not identify any major impacts at intersections or along the roadways due to the equipment.

7. FINDINGS AND RECOMMENDATIONS

The Township of North Dundas is preparing an Environmental Assessment (EA) study in support of the expansion of the existing landfill facility at 12620 Boyne Road. The site is located 2.8 km east of the village core. The EA will assess the impacts of long-term continued use of the Boyne Road Landfill site over a 25 year planning period to a horizon year of 2048.

The Traffic Impact Study report has been prepared as part of the EA study and examined the impact of the additional traffic generated by the landfill expansion at the site access onto Boyne Road, and the St. Lawrence/Main and CR 7/Boyne intersections. The analysis considered the weekday peak AM and PM hours for the expected traffic at the year 2048. The following summarizes the findings of the study:

1. The trip generation analysis determined that following the expansion of the Boyne Landfill site, the facility would generate 11 trips entering and 10 trips exiting the site during the weekday peak AM hour for a total of 21 vehicle trips, and 21 trips entering and 20 trips exiting during the peak PM hour for a total of 41 vehicle trips.

2. The traffic analysis adjusted the 2021 traffic counts to the expected year 2021 pre-COVID-19 volume of traffic by utilizing a factor that was determined from the comparison of pre-COVID-19 and COVID-19 counts taken along a county road at the east limit of the City of Ottawa in the United Counties of Prescott and Russell. The examination of counts determined that the 2021 counts should be increased by 15 percent to represent pre-COVID-19 traffic volumes. The peak hour background traffic counts were further increased by an annual average compounded rate of 1.0 percent to the year 2048 to account for future development in the Township.

3. The landfill site is currently operating with one access onto Boyne Road. The access is a single lane entering and one lane exiting the site. An analysis of the expected 2048 traffic determined that there would be no roadway modifications required to the site access and Boyne Road intersection due to the expansion of the landfill facility. The traffic analysis further examined the St. Lawrence/Main intersection in the Village of Winchester, and CR 7/Boyne intersection located 6.6 km east of the site. The expected site trips at both intersections would have a minor impact on the operation of the intersections with no modifications required.

Prepared by:

David J. Halpenny, M. Eng., P. Eng.

APPENDIX

TRAFFIC COUNTS

LEFT TURN LANE WARRANT ANALYSIS

OPERATIONAL ANALYSIS WORK SHEETS

EXHIBIT 1
PEAK AM AND PM HOUR TRAFFIC COUNTS (Sept. 9, 2021) – Site Access/Boyne

All Vehicles

Time Period	Westbound			Eastbound			Northbound			Southbound			
AM	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**Total**
08:00 – 08:15	0	12	-	-	7	2	1	-	1	-	-	-	**1**
08:15 – 08:30	0	9	-	-	7	0	1	-	0	-	-	-	**0**
08:30 – 08:45	0	13	-	-	12	1	0	-	0	-	-	-	**0**
08:45 – 09:00	0	14	-	-	5	1	2	-	0	-	-	-	**0**
09:00 – 09:15	0	12	-	-	17	1	0	-	0	-	-	-	**0**
09:15 – 09:30	1	10	-	-	7	2	1	-	1	-	-	-	**1**
09:30 – 09:45	0	12	-	-	12	0	1	-	0	-	-	-	**0**
09:45 – 10:00	0	15	-	-	19	1	0	-	0	-	-	-	**0**
PM													
02:00 – 02:15	0	12	-	-	16	2	0	-	0	-	-	-	**0**
02:15 – 02:30	1	11	-	-	20	1	1	-	0	-	-	-	**0**
02:30 – 02:45	0	9	-	-	17	2	2	-	0	-	-	-	**0**
02:45 – 03:00	1	10	-	-	17	2	2	-	1	-	-	-	**1**
03:00 – 03:15	1	13	-	-	17	1	2	-	0	-	-	-	**0**
03:15 – 03:30	2	11	-	-	21	0	2	-	0	-	-	-	**0**
03:30 – 03:45	0	13	-	-	26	5	2	-	2	-	-	-	**2**
03:45 – 04:00	0	11	-	-	12	1	4	-	0	-	-	-	**0**

Truck & Bus Traffic

Time Period	Westbound			Eastbound			Northbound			Southbound			
AM	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**Total**
08:00 – 08:15	0	0	-	-	0	1	1	-	1	-	-	-	**1**
08:15 – 08:30	0	1	-	-	1	0	1	-	0	-	-	-	**0**
08:30 – 08:45	0	1	-	-	2	1	0	-	0	-	-	-	**0**
08:45 – 09:00	0	2	-	-	1	0	1	-	0	-	-	-	**0**
09:00 – 09:15	0	1	-	-	3	0	0	-	0	-	-	-	**0**
09:15 – 09:30	0	1	-	-	1	0	1	-	1	-	-	-	**1**
09:30 – 09:45	0	0	-	-	0	0	0	-	0	-	-	-	**0**
09:45 – 10:00	0	0	-	-	4	0	0	-	0	-	-	-	**0**
PM													
02:00 – 02:15	0	1	-	-	2	1	0	-	0	-	-	-	**0**
02:15 – 02:30	1	0	-	-	1	0	1	-	0	-	-	-	**0**
02:30 – 02:45	0	1	-	-	3	2	2	-	0	-	-	-	**0**
02:45 – 03:00	0	0	-	-	1	1	2	-	1	-	-	-	**1**
03:00 – 03:15	0	5	-	-	1	0	0	-	0	-	-	-	**0**
03:15 – 03:30	2	1	-	-	2	0	2	-	0	-	-	-	**0**
03:30 – 03:45	0	1	-	-	1	2	0	-	1	-	-	-	**1**
03:45 – 04:00	0	3	-	-	0	0	1	-	0	-	-	-	**0**

EXHIBIT 2
PEAK AM AND PM HOUR TRAFFIC COUNTS (Sept. 14, 2021) – St. Lawrence/Main

All Vehicles

Time Period	Westbound			Eastbound			Northbound			Southbound			
AM	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**Total**
08:00 – 08:15	11	22	-	-	19	20	25	-	8	-	-	-	**8**
08:15 – 08:30	9	15	-	-	16	28	22	-	7	-	-	-	**7**
08:30 – 08:45	10	17	-	-	12	17	22	-	6	-	-	-	**6**
08:45 – 09:00	14	25	-	-	22	28	27	-	7	-	-	-	**7**
09:00 – 09:15	14	25	-	-	23	27	22	-	8	-	-	-	**8**
09:15 – 09:30	15	38	-	-	23	26	36	-	14	-	-	-	**14**
09:30 – 09:45	11	37	-	-	24	23	29	-	8	-	-	-	**8**
09:45 – 10:00	16	38	-	-	34	19	24	-	13	-	-	-	**13**
PM													
02:00 – 02:15	12	43	-	-	21	29	26	-	14	-	-	-	**14**
02:15 – 02:30	15	34	-	-	45	27	22	-	18	-	-	-	**18**
02:30 – 02:45	10	23	-	-	39	29	26	-	10	-	-	-	**10**
02:45 – 03:00	18	27	-	-	45	31	27	-	12	-	-	-	**12**
03:00 – 03:15	29	35	-	-	38	30	26	-	9	-	-	-	**9**
03:15 – 03:30	11	28	-	-	44	34	36	-	17	-	-	-	**17**
03:30 – 03:45	6	30	-	-	31	25	40	-	24	-	-	-	**24**
03:45 – 04:00	9	35	-	-	44	37	26	-	21	-	-	-	**21**

Truck & Bus Traffic

Time Period	Westbound			Eastbound			Northbound			Southbound			
AM	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**Total**
08:00 – 08:15	0	0	-	-	3	1	2	-	0	-	-	-	**0**
08:15 – 08:30	0	0	-	-	2	1	1	-	0	-	-	-	**0**
08:30 – 08:45	1	0	-	-	0	1	0	-	0	-	-	-	**0**
08:45 – 09:00	0	0	-	-	1	0	3	-	0	-	-	-	**0**
09:00 – 09:15	0	1	-	-	1	1	0	-	0	-	-	-	**0**
09:15 – 09:30	2	2	-	-	1	0	2	-	1	-	-	-	**1**
09:30 – 09:45	1	1	-	-	2	1	0	-	0	-	-	-	**0**
09:45 – 10:00	0	3	-	-	4	1	0	-	1	-	-	-	**1**
PM													
02:00 – 02:15	0	0	-	-	0	0	0	-	0	-	-	-	**0**
02:15 – 02:30	1	2	-	-	1	0	0	-	0	-	-	-	**0**
02:30 – 02:45	1	0	-	-	1	1	1	-	1	-	-	-	**1**
02:45 – 03:00	2	1	-	-	2	0	1	-	1	-	-	-	**1**
03:00 – 03:15	0	1	-	-	1	1	0	-	0	-	-	-	**0**
03:15 – 03:30	0	0	-	-	3	1	1	-	0	-	-	-	**0**
03:30 – 03:45	0	0	-	-	3	0	1	-	0	-	-	-	**0**
03:45 – 04:00	0	0	-	-	2	0	1	-	1	-	-	-	**1**

EXHIBIT 3
PEAK AM AND PM HOUR TRAFFIC COUNTS (Sept. 14, 2021) – CR 7/Boyne

All Vehicles

Time Period	Westbound			Eastbound			Northbound			Southbound			
AM	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**Total**
08:00 – 08:15	3	1	2	0	1	2	5	21	2	0	13	5	**55**
08:15 – 08:30	1	0	0	2	0	3	5	10	0	0	22	5	**48**
08:30 – 08:45	1	1	0	2	2	3	3	10	0	1	18	3	**44**
08:45 – 09:00	0	1	0	2	3	4	4	13	1	0	11	8	**47**
09:00 – 09:15	1	1	0	4	1	6	6	9	0	1	8	6	**43**
09:15 – 09:30	1	3	0	5	1	2	7	14	1	1	17	5	**57**
09:30 – 09:45	1	5	0	3	2	4	11	12	1	0	13	3	**55**
09:45 – 10:00	0	3	0	3	3	6	6	13	0	0	11	5	**50**
PM													
02:00 – 02:15	0	3	0	2	4	5	5	15	2	1	13	7	**57**
02:15 – 02:30	1	2	1	7	2	8	10	6	1	0	14	5	**57**
02:30 – 02:45	1	5	0	1	3	8	9	10	1	0	24	1	**63**
02:45 – 03:00	2	2	1	6	2	12	6	20	0	1	19	10	**81**
03:00 – 03:15	0	1	1	9	5	8	3	9	0	1	17	3	**57**
03:15 – 03:30	1	2	1	8	3	12	2	13	1	0	20	1	**64**
03:30 – 03:45	1	1	0	8	3	7	5	14	3	3	29	1	**75**
03:45 – 04:00	2	1	0	4	2	10	6	17	0	1	27	3	**73**

Truck & Bus Traffic

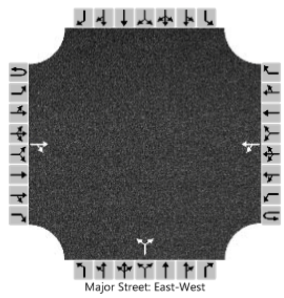
Time Period	Westbound			Eastbound			Northbound			Southbound			
AM	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**LT**	**ST**	**RT**	**Total**
08:00 – 08:15	0	0	0	0	1	1	0	3	0	0	1	0	**6**
08:15 – 08:30	0	0	0	0	0	1	2	2	0	0	4	1	**10**
08:30 – 08:45	0	0	0	0	0	0	0	1	0	0	3	0	**4**
08:45 – 09:00	0	0	0	0	1	2	0	3	0	0	3	2	**11**
09:00 – 09:15	0	0	0	0	1	1	0	1	0	0	1	2	**6**
09:15 – 09:30	0	0	0	0	0	0	0	0	0	0	0	1	**1**
09:30 – 09:45	0	0	0	0	1	0	0	1	0	0	3	0	**5**
09:45 – 10:00	0	0	0	0	2	0	1	1	0	0	1	0	**5**
PM													
02:00 – 02:15	0	0	0	0	0	0	1	1	0	0	1	2	**5**
02:15 – 02:30	0	0	0	0	1	0	1	0	0	0	2	0	**4**
02:30 – 02:45	1	0	0	0	0	0	1	1	0	0	2	0	**5**
02:45 – 03:00	0	1	1	3	0	1	1	1	0	0	1	3	**12**
03:00 – 03:15	0	0	1	2	0	0	0	1	0	0	2	0	**6**
03:15 – 03:30	0	0	0	0	0	1	0	2	0	0	1	0	**4**
03:30 – 03:45	0	0	0	0	0	0	0	1	0	0	3	0	**4**
03:45 – 04:00	0	0	0	0	0	0	0	0	0	0	3	0	**3**

EXHIBIT 4
2021 EXISTING PEAK AM HOUR TRAFFIC ANALYSIS – Site Analysis/Boyne

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst		Intersection	Site/Boyne
Agency/Co.		Jurisdiction	Township of Winchester
Date Performed	9/23/2021	East/West Street	Boyne Road
Analysis Year	2021	North/South Street	Site Access
Time Analyzed	Peak AM Hour	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Boyne Road Landfill		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			41	5		1	49			3		1				
Percent Heavy Vehicles (%)						40				40		40				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.50				6.80		6.60				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.56				3.86		3.66				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						1					4					
Capacity, c (veh/h)						1345					836					
v/c Ratio						0.00					0.01					
95% Queue Length, Q_{95} (veh)						0.0					0.0					
Control Delay (s/veh)						7.7					9.3					
Level of Service (LOS)						A					A					
Approach Delay (s/veh)					0.2				9.3							
Approach LOS									A							

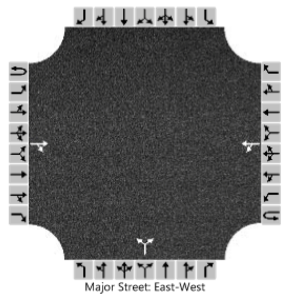
 HCS™ TWSC Version 7.9.5 2021_ex_am.xtw Generated: 10/5/2021 7:48:31 AM

EXHIBIT 5
2021 EXISTING PEAK PM HOUR TRAFFIC ANALYSIS – Site Analysis/Boyne

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst		Intersection	Site/Boyne
Agency/Co.		Jurisdiction	Township of Winchester
Date Performed	9/23/2021	East/West Street	Boyne Road
Analysis Year	2021	North/South Street	Site Access
Time Analyzed	Peak PM Hour	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Boyne Road Landfill		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			81	8		4	47			8		3				
Percent Heavy Vehicles (%)						40				40		40				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.50				6.80		6.60				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.56				3.86		3.66				

Delay, Queue Length, and Level of Service

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Flow Rate, v (veh/h)						4					12					
Capacity, c (veh/h)						1289					784					
v/c Ratio						0.00					0.02					
95% Queue Length, Q_{95} (veh)						0.0					0.0					
Control Delay (s/veh)						7.8					9.7					
Level of Service (LOS)						A					A					
Approach Delay (s/veh)					0.6				9.7							
Approach LOS									A							

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EXHIBIT 6
2048 WESTBOUND LEFT TURN LANE WARRANT ANALYSIS – Site Access/Boyne

TRAFFIC

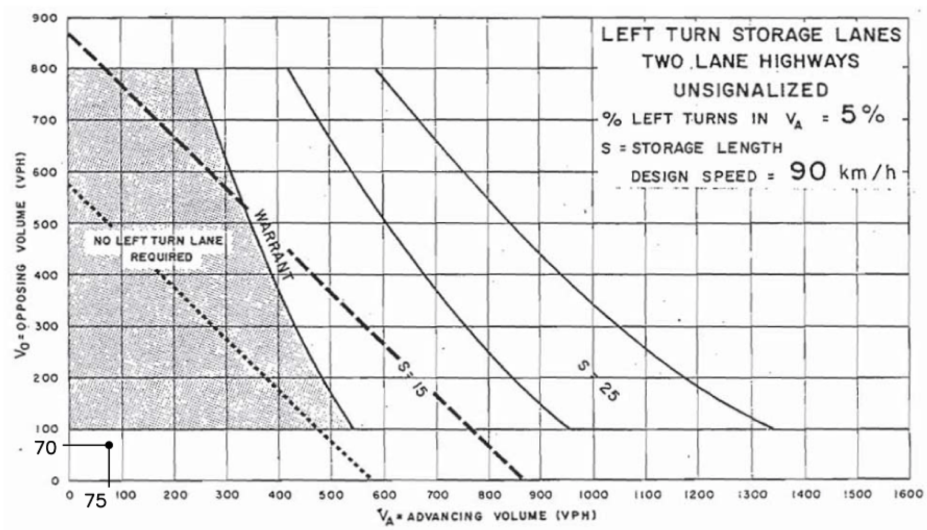
V_O = 70 vph
V_A = 75 vph
V_L = 2 vph

V_L/V_A = 2.67%

POSTED SPEED
80 km/h

WARRANT

No LEFT TURN
LANE REQUIRED



WESTBOUND LEFT
PEAK AM HOUR

TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

TRAFFIC

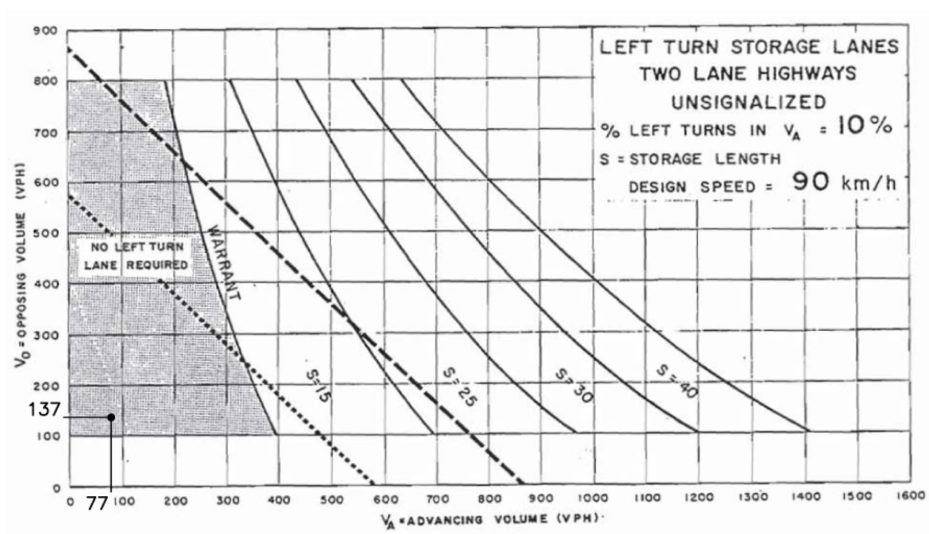
V_O = 137 vph
V_A = 77 vph
V_L = 6 vph

V_L/V_A = 7.79%

POSTED SPEED
80 km/h

WARRANT

No LEFT TURN
LANE REQUIRED



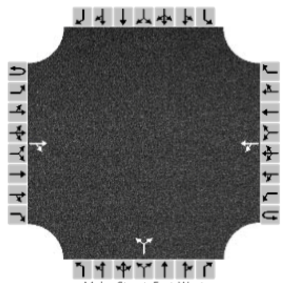
WESTBOUND LEFT
PEAK PM HOUR

EXHIBIT 7
2048 TOTAL PEAK AM HOUR TRAFFIC ANALYSIS – Site Analysis/Boyne

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst		Intersection	Site/Boyne
Agency/Co.		Jurisdiction	Township of Winchester
Date Performed	9/23/2021	East/West Street	Boyne Road
Analysis Year	2048	North/South Street	Site Access
Time Analyzed	Peak AM Hour (Total)	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Boyne Road Landfill		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			61	9		2	73			7		3				
Percent Heavy Vehicles (%)						40				40		40				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.50				6.80		6.60				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.56				3.86		3.66				

Delay, Queue Length, and Level of Service

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Flow Rate, v (veh/h)						2					11					
Capacity, c (veh/h)						1314					791					
v/c Ratio						0.00					0.01					
95% Queue Length, Q_{95} (veh)						0.0					0.0					
Control Delay (s/veh)						7.7					9.6					
Level of Service (LOS)						A					A					
Approach Delay (s/veh)					0.2				9.6							
Approach LOS									A							

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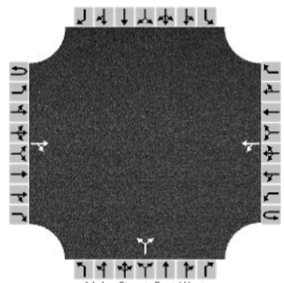
EXHIBIT 8
2048 TOTAL PEAK PM HOUR TRAFFIC ANALYSIS – Site Analysis/Boyne

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst		Intersection	Site/Boyne
Agency/Co.		Jurisdiction	Township of Winchester
Date Performed	9/23/2021	East/West Street	Boyne Road
Analysis Year	2048	North/South Street	Site Access
Time Analyzed	Peak PM Hour (Total)	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Boyne Road Landfill		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			122	15		6	71			16		4				
Percent Heavy Vehicles (%)						40				40		40				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.50				6.80		6.60				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.56				3.86		3.66				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						7					22					
Capacity, c (veh/h)						1230					701					
v/c Ratio						0.01					0.03					
95% Queue Length, Q_{95} (veh)						0.0					0.1					
Control Delay (s/veh)						7.9					10.3					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)					0.7				10.3							
Approach LOS									B							

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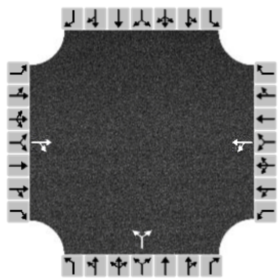
EXHIBIT 9
2021 EXISTING PEAK AM HOUR TRAFFIC ANALYSIS – St. Lawrence/Main

HCS7 All-Way Stop Control Report

General Information		Site Information	
Analyst		Intersection	Main/St. Lawrence
Agency/Co.		Jurisdiction	Township of Winchester
Date Performed	9/23/2021	East/West Street	Main Street
Analysis Year	2021	North/South Street	St. Lawrence Street
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.92
Time Analyzed	Peak AM Hour		
Project Description	Boyne Road Landfill		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume		104	95	56	138		111		43			
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	TR			LT			LR					
Flow Rate, v (veh/h)	216			211			167					
Percent Heavy Vehicles	5			5			3					
Departure Headway and Service Time												
Initial Departure Headway, hd (s)	3.20			3.20			3.20					
Initial Degree of Utilization, x	0.192			0.187			0.149					
Final Departure Headway, hd (s)	4.40			4.73			4.91					
Final Degree of Utilization, x	0.264			0.277			0.229					
Move-Up Time, m (s)	2.0			2.0			2.0					
Service Time, ts (s)	2.40			2.73			2.91					
Capacity, Delay and Level of Service												
Flow Rate, v (veh/h)	216			211			167					
Capacity	819			761			732					
95% Queue Length, Q_{95} (veh)	1.1			1.1			0.9					
Control Delay (s/veh)	9.0			9.5			9.4					
Level of Service, LOS	A			A			A					
Approach Delay (s/veh)	9.0			9.5			9.4					
Approach LOS	A			A			A					
Intersection Delay, s/veh | LOS	9.3						A					

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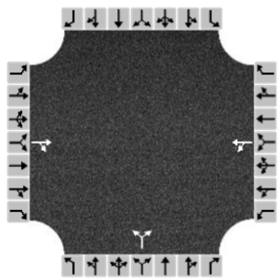
EXHIBIT 10
2021 EXISTING PEAK PM HOUR TRAFFIC ANALYSIS – St. Lawrence/Main

HCS7 All-Way Stop Control Report

General Information		Site Information	
Analyst		Intersection	Main/St. Lawrence
Agency/Co.		Jurisdiction	Township of Winchester
Date Performed	9/23/2021	East/West Street	Main Street
Analysis Year	2021	North/South Street	St. Lawrence Street
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.92
Time Analyzed	Peak PM Hour		
Project Description	Boyne Road Landfill		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume		157	126	55	128		128		71			
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	TR			LT			LR					
Flow Rate, v (veh/h)	308			199			216					
Percent Heavy Vehicles	2			5			3					

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20					
Initial Degree of Utilization, x	0.273			0.177			0.192					
Final Departure Headway, hd (s)	4.52			5.00			5.06					
Final Degree of Utilization, x	0.386			0.276			0.304					
Move-Up Time, m (s)	2.0			2.0			2.0					
Service Time, ts (s)	2.52			3.00			3.06					

Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	308			199			216					
Capacity	797			720			712					
95% Queue Length, Q_{95} (veh)	1.8			1.1			1.3					
Control Delay (s/veh)	10.3			9.9			10.3					
Level of Service, LOS	B			A			B					
Approach Delay (s/veh)	10.3			9.9			10.3					
Approach LOS	B			A			B					
Intersection Delay, s/veh | LOS	10.2						B					

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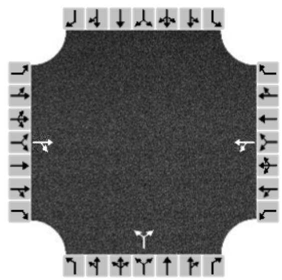
EXHIBIT 11
2048 BACKGROUND PEAK AM HOUR TRAFFIC ANALYSIS – St. Lawrence/Main

HCS7 All-Way Stop Control Report

General Information		Site Information	
Analyst		Intersection	Main/St. Lawrence
Agency/Co.		Jurisdiction	Township of Winchester
Date Performed	9/23/2021	East/West Street	Main Street
Analysis Year	2048	North/South Street	St. Lawrence Street
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.92
Time Analyzed	Peak AM Hour (Background)		
Project Description	Boyne Road Landfill		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume		154	143	83	206		167		62			
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	TR			LT			LR					
Flow Rate, v (veh/h)	323			314			249					
Percent Heavy Vehicles	5			5			3					

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20					
Initial Degree of Utilization, x	0.287			0.279			0.221					
Final Departure Headway, hd (s)	4.89			5.23			5.53					
Final Degree of Utilization, x	0.439			0.456			0.382					
Move-Up Time, m (s)	2.0			2.0			2.0					
Service Time, ts (s)	2.89			3.23			3.53					

Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	323			314			249					
Capacity	736			689			651					
95% Queue Length, Q_{95} (veh)	2.2			2.4			1.8					
Control Delay (s/veh)	11.7			12.5			11.9					
Level of Service, LOS	B			B			B					
Approach Delay (s/veh)	11.7			12.5			11.9					
Approach LOS	B			B			B					
Intersection Delay, s/veh | LOS	12.0						B					

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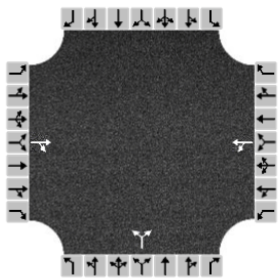
EXHIBIT 12
2048 BACKGROUND PEAK PM HOUR TRAFFIC ANALYSIS – St. Lawrence/Main

HCS7 All-Way Stop Control Report

General Information		Site Information	
Analyst		Intersection	Main/St. Lawrence
Agency/Co.		Jurisdiction	Township of Winchester
Date Performed	9/23/2021	East/West Street	Main Street
Analysis Year	2048	North/South Street	St. Lawrence Street
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.92
Time Analyzed	Peak PM Hour (Background)		
Project Description	Boyne Road Landfill		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume		232	190	78	188		192		103			
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	TR			LT			LR					
Flow Rate, v (veh/h)	459			289			321					
Percent Heavy Vehicles	2			5			3					
Departure Headway and Service Time												
Initial Departure Headway, hd (s)	3.20			3.20			3.20					
Initial Degree of Utilization, x	0.408			0.257			0.285					
Final Departure Headway, hd (s)	5.15			5.74			5.81					
Final Degree of Utilization, x	0.656			0.461			0.518					
Move-Up Time, m (s)	2.0			2.0			2.0					
Service Time, ts (s)	3.15			3.74			3.81					
Capacity, Delay and Level of Service												
Flow Rate, v (veh/h)	459			289			321					
Capacity	699			627			619					
95% Queue Length, Q_{95} (veh)	4.9			2.4			3.0					
Control Delay (s/veh)	17.4			13.6			14.9					
Level of Service, LOS	C			B			B					
Approach Delay (s/veh)	17.4			13.6			14.9					
Approach LOS	C			B			B					
Intersection Delay, s/veh | LOS	15.6						C					

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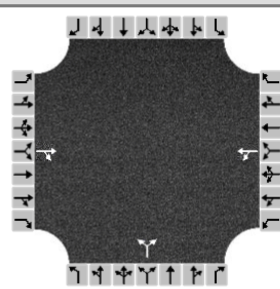
EXHIBIT 13
2048 TOTAL PEAK AM HOUR TRAFFIC ANALYSIS – St. Lawrence/Main

HCS7 All-Way Stop Control Report

General Information		Site Information	
Analyst		Intersection	Main/St. Lawrence
Agency/Co.		Jurisdiction	Township of Winchester
Date Performed	9/23/2021	East/West Street	Main Street
Analysis Year	2048	North/South Street	St. Lawrence Street
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.92
Time Analyzed	Peak AM Hour (Total)		
Project Description	Boyne Road Landfill		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume		162	143	86	210		167		66			
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	TR			LT			LR					
Flow Rate, v (veh/h)	332			322			253					
Percent Heavy Vehicles	5			5			3					

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20					
Initial Degree of Utilization, x	0.295			0.286			0.225					
Final Departure Headway, hd (s)	4.94			5.26			5.56					
Final Degree of Utilization, x	0.454			0.470			0.391					
Move-Up Time, m (s)	2.0			2.0			2.0					
Service Time, ts (s)	2.94			3.26			3.56					

Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	332			322			253					
Capacity	729			684			647					
95% Queue Length, Q_{95} (veh)	2.4			2.5			1.9					
Control Delay (s/veh)	12.0			12.8			12.1					
Level of Service, LOS	B			B			B					
Approach Delay (s/veh)	12.0			12.8			12.1					
Approach LOS	B			B			B					
Intersection Delay, s/veh | LOS	12.3						B					

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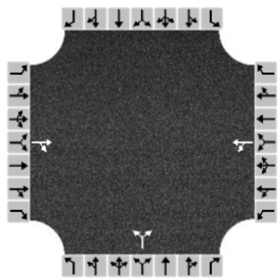
EXHIBIT 14
2048 TOTAL PEAK PM HOUR TRAFFIC ANALYSIS – St. Lawrence/Main

HCS7 All-Way Stop Control Report

General Information		Site Information	
Analyst		Intersection	Main/St. Lawrence
Agency/Co.		Jurisdiction	Township of Winchester
Date Performed	9/23/2021	East/West Street	Main Street
Analysis Year	2048	North/South Street	St. Lawrence Street
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.92
Time Analyzed	Peak PM Hour (Total)		
Project Description	Boyne Road Landfill		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume		240	190	86	196		192		110			
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	TR			LT			LR					
Flow Rate, v (veh/h)	467			307			328					
Percent Heavy Vehicles	2			5			3					
Departure Headway and Service Time												
Initial Departure Headway, hd (s)	3.20			3.20			3.20					
Initial Degree of Utilization, x	0.415			0.272			0.292					
Final Departure Headway, hd (s)	5.23			5.81			5.89					
Final Degree of Utilization, x	0.679			0.495			0.537					
Move-Up Time, m (s)	2.0			2.0			2.0					
Service Time, ts (s)	3.23			3.81			3.89					
Capacity, Delay and Level of Service												
Flow Rate, v (veh/h)	467			307			328					
Capacity	688			620			612					
95% Queue Length, Q_{95} (veh)	5.3			2.7			3.2					
Control Delay (s/veh)	18.6			14.4			15.5					
Level of Service, LOS	C			B			C					
Approach Delay (s/veh)	18.6			14.4			15.5					
Approach LOS	C			B			C					
Intersection Delay, s/veh | LOS	16.5						C					

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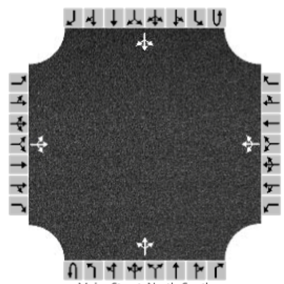
EXHIBIT 15
2021 EXISTING PEAK AM HOUR TRAFFIC ANALYSIS – CR 7/ Boyne

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst		Intersection	CR 7/Boyne
Agency/Co.		Jurisdiction	Township of Winchester
Date Performed	9/23/2021	East/West Street	Boyne Road
Analysis Year	2021	North/South Street	County Road 7
Time Analyzed	Peak AM Hour	Peak Hour Factor	0.92
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Boyne Road Landfill		

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		15	7	18		3	12	0		30	48	2		2	49	19
Percent Heavy Vehicles (%)		1	5	4		1	1	1		5				1		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.11	6.55	6.24		7.11	6.51	6.21		4.15				4.11		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.05	3.34		3.51	4.01	3.31		2.25				2.21		

Delay, Queue Length, and Level of Service

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Flow Rate, v (veh/h)			43				16			33				2		
Capacity, c (veh/h)			825				692			1507				1557		
v/c Ratio			0.05				0.02			0.02				0.00		
95% Queue Length, Q_{95} (veh)			0.2				0.1			0.1				0.0		
Control Delay (s/veh)			9.6				10.3			7.4				7.3		
Level of Service (LOS)			A				B			A				A		
Approach Delay (s/veh)	9.6				10.3				2.9				0.2			
Approach LOS	A				B											

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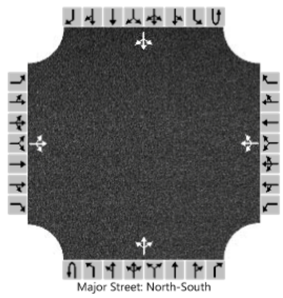
EXHIBIT 16
2021 EXISTING PEAK PM HOUR TRAFFIC ANALYSIS – CR 7/ Boyne

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst		Intersection	CR 7/Boyne
Agency/Co.		Jurisdiction	Township of Winchester
Date Performed	9/23/2021	East/West Street	Boyne Road
Analysis Year	2021	North/South Street	County Road 7
Time Analyzed	Peak PM Hour	Peak Hour Factor	0.92
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Boyne Road Landfill		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		31	13	39		4	6	3		16	56	4		5	85	15
Percent Heavy Vehicles (%)		3	5	5		5	1	5		5				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Approach	Eastbound				Westbound				Northbound				Southbound			
Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.13	6.55	6.25		7.15	6.51	6.25		4.15				4.13		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.53	4.05	3.35		3.55	4.01	3.35		2.25				2.23		

Delay, Queue Length, and Level of Service

Approach	Eastbound				Westbound				Northbound				Southbound			
Flow Rate, v (veh/h)			90				14			17				5		
Capacity, c (veh/h)			802				721			1463				1530		
v/c Ratio			0.11				0.02			0.01				0.00		
95% Queue Length, Q_{95} (veh)			0.4				0.1			0.0				0.0		
Control Delay (s/veh)			10.1				10.1			7.5				7.4		
Level of Service (LOS)			B				B			A				A		
Approach Delay (s/veh)	10.1				10.1				1.6				0.4			
Approach LOS	B				B											

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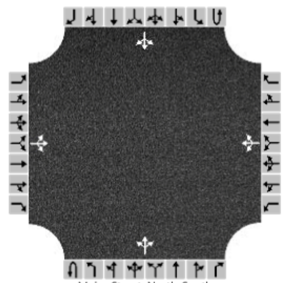
EXHIBIT 17
2048 BACKGROUND PEAK AM HOUR TRAFFIC ANALYSIS – CR 7/ Boyne

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst		Intersection	CR 7/Boyne
Agency/Co.		Jurisdiction	Township of Winchester
Date Performed	9/23/2021	East/West Street	Boyne Road
Analysis Year	2048	North/South Street	County Road 7
Time Analyzed	Peak AM Hour (Background)	Peak Hour Factor	0.92
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Boyne Road Landfill		

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		22	10	27		4	18	0		46	72	3		3	73	29
Percent Heavy Vehicles (%)		1	5	4		1	1	1		5				1		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.11	6.55	6.24		7.11	6.51	6.21		4.15				4.11		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.05	3.34		3.51	4.01	3.31		2.25				2.21		

Delay, Queue Length, and Level of Service

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Flow Rate, v (veh/h)			64				24			50				3		
Capacity, c (veh/h)			737				595			1461				1522		
v/c Ratio			0.09				0.04			0.03				0.00		
95% Queue Length, Q_{95} (veh)			0.3				0.1			0.1				0.0		
Control Delay (s/veh)			10.3				11.3			7.6				7.4		
Level of Service (LOS)			B				B			A				A		
Approach Delay (s/veh)	10.3				11.3				3.0				0.2			
Approach LOS	B				B											

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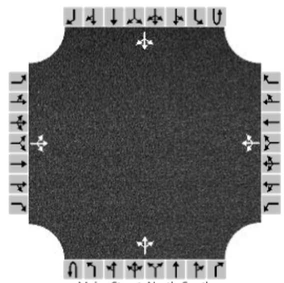
EXHIBIT 18
2048 BACKGROUND PEAK PM HOUR TRAFFIC ANALYSIS – CR 7/ Boyne

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst		Intersection	CR 7/Boyne
Agency/Co.		Jurisdiction	Township of Winchester
Date Performed	9/23/2021	East/West Street	Boyne Road
Analysis Year	2048	North/South Street	County Road 7
Time Analyzed	Peak PM Hour (Background)	Peak Hour Factor	0.92
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Boyne Road Landfill		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		47	20	59		7	9	4		24	84	7		8	128	22
Percent Heavy Vehicles (%)		3	5	5		5	1	5		5				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.13	6.55	6.25		7.15	6.51	6.25		4.15				4.13		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.53	4.05	3.35		3.55	4.01	3.35		2.25				2.23		

Delay, Queue Length, and Level of Service

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Flow Rate, v (veh/h)			137				22			26				9		
Capacity, c (veh/h)			705				602			1397				1488		
v/c Ratio			0.19				0.04			0.02				0.01		
95% Queue Length, Q_{95} (veh)			0.7				0.1			0.1				0.0		
Control Delay (s/veh)			11.3				11.2			7.6				7.4		
Level of Service (LOS)			B				B			A				A		
Approach Delay (s/veh)	11.3				11.2				1.7				0.4			
Approach LOS	B				B											

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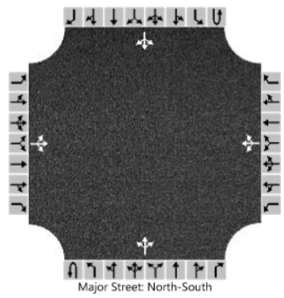
EXHIBIT 19
2048 TOTAL PEAK AM HOUR TRAFFIC ANALYSIS – CR 7/ Boyne

HCS7 Two-Way Stop-Control Report

General Information / Site Information

General Information		Site Information	
Analyst		Intersection	CR 7/Boyne
Agency/Co.		Jurisdiction	Township of Winchester
Date Performed	9/23/2021	East/West Street	Boyne Road
Analysis Year	2048	North/South Street	County Road 7
Time Analyzed	Peak AM Hour (Total)	Peak Hour Factor	0.92
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Boyne Road Landfill		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		23	10	28		4	18	0		47	72	3		3	73	29
Percent Heavy Vehicles (%)		1	5	4		1	1	1		5				1		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Approach	Eastbound				Westbound				Northbound				Southbound			
Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.11	6.55	6.24		7.11	6.51	6.21		4.15				4.11		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.05	3.34		3.51	4.01	3.31		2.25				2.21		

Delay, Queue Length, and Level of Service

Approach	Eastbound				Westbound				Northbound				Southbound			
Flow Rate, v (veh/h)			66				24			51				3		
Capacity, c (veh/h)			736				593			1461				1522		
v/c Ratio			0.09				0.04			0.03				0.00		
95% Queue Length, Q_{95} (veh)			0.3				0.1			0.1				0.0		
Control Delay (s/veh)			10.4				11.3			7.6				7.4		
Level of Service (LOS)			B				B			A				A		
Approach Delay (s/veh)	10.4				11.3				3.1				0.2			
Approach LOS	B				B											

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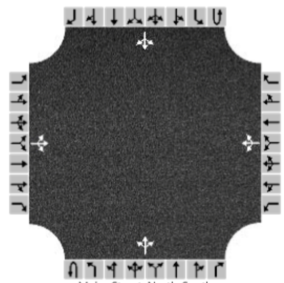
EXHIBIT 20
2048 TOTAL PEAK PM HOUR TRAFFIC ANALYSIS – CR 7/ Boyne

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst		Intersection	CR 7/Boyne
Agency/Co.		Jurisdiction	Township of Winchester
Date Performed	9/23/2021	East/West Street	Boyne Road
Analysis Year	2048	North/South Street	County Road 7
Time Analyzed	Peak PM Hour (Total)	Peak Hour Factor	0.92
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Boyne Road Landfill		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		46	20	61		7	9	4		27	84	7		8	128	22
Percent Heavy Vehicles (%)		3	5	5		5	1	5		5				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.13	6.55	6.25		7.15	6.51	6.25		4.15				4.13		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.53	4.05	3.35		3.55	4.01	3.35		2.25				2.23		

Delay, Queue Length, and Level of Service

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Flow Rate, v (veh/h)			138				22			29				9		
Capacity, c (veh/h)			703				595			1397				1488		
v/c Ratio			0.20				0.04			0.02				0.01		
95% Queue Length, Q_{95} (veh)			0.7				0.1			0.1				0.0		
Control Delay (s/veh)			11.4				11.3			7.6				7.4		
Level of Service (LOS)			B				B			A				A		
Approach Delay (s/veh)	11.4				11.3				1.9				0.4			
Approach LOS	B				B											

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