Township of North Glengarry
Alexandria Sewage Lagoon Treatment Facility
Municipal Class 'C' Environmental Assessment
Environmental Study Report – Appendices A-H

Prepared for:

Corporation of the Township of North Glengarry
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January 2017

APPENDIX A

HUTCHINSON ENVIRONMENT SERVICES REPORT (2014)

Hutchinson

Environmental Sciences Ltd.

Water Quality Assessment and Ammonia Modelling Update in Support of Re-rating the Alexandria Sewage Works

Prepared for: Township of North Glengarry
Job #: J120065

April 2014

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Environmental Sciences Ltd.

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April 14, 2014 HESL Job #: J120065

Mr. Dean McDonald
Water Works Manager
Township of North Glengarry
90 Main Street
Alexandria, ON KOC 1AO

Dear Mr. McDonald:

Re: J120065 - Water Quality Assessment and Ammonia Modelling Update in Support of re-rating the Alexandria Sewage Works – Final Report

I am pleased to present the final report on the Delisle River water quality assessment and ammonia modelling review and update in support of re-rating the Alexandria Sewage Works. We thank you for the opportunity to work on this interesting assignment, and look forward to the next stages of the project.

Sincerely,
Hutchinson Environmental Sciences Ltd.

Deborah L. Sinclair, M.A.Sc.
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Signatures

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Neil J. Hutchinson, Ph.D.
Principal Scientist

Executive Summary

The Township of North Glengarry is planning on re-rating the Alexandria Sewage Works from its current rated capacity of 3,237 m^3/d to 5,500m^3/d by demonstrating additional treatment capacity above current design flows. In November 2012, Hutchinson Environmental Sciences Limited (HESL) was retained by McIntosh Perry Consulting Engineers on behalf of the Township of North Glengarry to undertake a water quality sampling program of the Delisle River, review modeling files, reconsider effluent limits, and consider alternative methods for phosphorus offsetting to the Delisle River. This was undertaken to add to previous investigations of the discharge of effluent from the Alexandria WWTP and effects on the Delisle River that were undertaken by AECOM in 2012.

The results of this study, in combination with the AECOM report, are to be used in support of the re-rating requirements of the ECA.

The Alexandria lagoons discharge to the Pilot Drain, an agricultural swale, which conveys effluent to the Delisle River approximately 700 m downstream. The Delisle River is a Policy 2 system for total phosphorus, in that concentrations exceed the Provincial Water Quality Objective (PWQO; MOE 1994) of 0.03 mg/L for Protection of Aquatic Life. The major land use in the watershed is agriculture, predominantly dairy farming.

Our approach to the study contained the following elements:

- A surface water sampling program was undertaken to assess differences between up and downstream phosphorus concentrations at the PWQMN stations and to improve the understanding of nitrogen dynamics. Eight sampling events from November 2012 to October 2013 at 6 stations were carried out.
- A diurnal dissolved oxygen survey was carried out to describe the oxygen status of the River and help determine if plant respiration resulted in anoxic conditions.
- A benthic study was undertaken to assess the impact of the lagoon discharge on the biological community of the River.
- Review of AECOM's (2012) modeling files and approach to calculate the un-ionized ammonia concentrations. Specifically the $7Q_{20}$ flows and 75th percentile pH values used for the calculations.

The main findings of the study were:

1. Nitrification of the Alexandria effluent occurs as it flows through the Pilot Drain reducing the loading of ammonia to the Delisle River.

2. The Pilot Drain acts as a source of TSS to the Delisle River during high flow conditions due to runoff from the surrounding catchment.

3. There was no significant increase in total phosphorus concentrations in the Delisle River downstream in the far field (Alex 6) during field investigations. These results are consistent with the PWQMN total phosphorus results for the same period, but differ from the long-term (2000 to 2013) PWQMN total phosphorus measurements that do show an increase in total phosphorus concentrations.

4. Total ammonia concentrations measured in the Delisle River downstream were higher than those measured upstream of the Alexandria WWTP discharge. Un-ionized ammonia concentrations were below the PWQO in the Delisle River at all sites during every sampling event, indicating that the elevated concentrations were not harmful to aquatic life.

5. Diurnal dissolved oxygen concentrations were similar at the upstream and downstream stations, indicating that plant respiration causing anoxic conditions does not contribute to an increase in phosphorus in the river downstream of the plant discharge.

6. Benthic investigation found no substantial difference in community composition upstream and downstream of the plant effluent discharge.

7. Total Ammonia effluent limits of 1 mg/L and 3 mg/L for May to October (spring/summer) and November to April (fall/winter) will meet PWQO under a proposed flow rate 5,500 m^3/d.

8. A total phosphorus effluent limit of 0.04 mg/L is necessary to maintain existing upstream water quality in the Delisle River under a proposed flow rate 5,500 m^3/d. The current total phosphorus effluent limit for the Alexandria lagoons is a monthly average of 0.5 mg/L. It is MOE policy (B-1-5) that no further degradation of water quality will be allowed for total phosphorus. Under this scenario, the proposed increase in flow from 3,237 m^3/d to 5,500 m^3/d would relate to a proportional reduction in the phosphorus limit to 0.3 mg/L to maintain existing loadings into the Delisle River.

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1. Introduction

The Township of North Glengarry is planning on re-rating the Alexandria Sewage Works from it's current rated capacity of 3,237 m^3/d to 5,500m^3/d by demonstrating additional treatment capacity above current design flows. In September 2012 AECOM completed an Assimilative Capacity Study and Lagoon Performance Assessment for the Alexandria Sewage Works (AECOM 2012) for the Township of North Glengarry. In October of 2012, Hutchinson Environmental Sciences Limited (HESL) prepared a review of AECOM's report that contained a number of comments on the report, questions regarding modelling calculations, and recommendations for follow up.

In November 2012, Hutchinson Environmental Sciences Limited (HESL) was retained by McIntosh Perry Consulting Engineers on behalf of the Township of North Glengarry to undertake a water quality sampling program of the Delisle River, review AECOM's modeling files, and reconsider the effluent limits proposed by AECOM. This report presents the results from the field investigations and review and update of AECOM's modelling results.

The results of this study, in combination with the AECOM report, are to be used in support of the re-rating requirements of the ECA.

1.1 Background

The Alexandria lagoons discharge to the Pilot Drain, an agricultural swale, which conveys effluent to the Delisle River approximately 700 m downstream (Figure 1). The Delisle River is a Policy 2 system for total phosphorus, in that concentrations exceed the Provincial Water Quality Objective (PWQO; MOE 1994) of 0.03 mg/L for Protection of Aquatic Life. The major land use in the watershed is agriculture, predominantly dairy farming.

The Alexandria Sewage Works operates under amended Environmental Compliance Approval (ECA) 9324-8WKJD2 dated August 2, 2012. The existing ECA requirements are:

a) Average daily flow (ADF) of 3,237 m^3/d;
b) Annual average concentrations and loadings of cBOD5, suspended solids, and phosphorus, total residual chlorine, and *E. coli* not to exceed the values outlined in Table 1
c) The pH of the effluent must be maintained within the range of 6.0 to 9.5 at all times.

Table 1. ECA Effluent Limits

Parameter	Monthly Average
$cBOD_5$	30 mg/L
TSS	40 mg/L
TP	0.5 mg/L
Total Residual Chlorine	0.02 mg/L
E. *coli* (geometric mean)	200 org/100 mL

Note: org – number of organisms

The Township of North Glengarry wishes to increase the Alexandria plant capacity from its current rated capacity of 3,237 m^3/d to 5,500 m^3/d to meet demand in the Township.

1.2 Study Scope

Hutchinson Environmental Sciences Ltd. was retained by McIntosh Perry Consulting Engineers on behalf of the Township of North Glengarry to conduct additional studies as a follow up to AECOM's report (AECOM 2012). The results of this study, in combination with the AECOM report, are to be used in support of the re-rating requirements of the ECA.

The HESL work plan is summarized as follows:

1. ***Surface Water Sampling –*** A surface water sampling program for the Delisle River was initiated to assess the cause of differences between up and downstream phosphorus concentrations at the PWQMN stations and to improve the understanding of nitrogen dynamics. Eight sampling events from November 2012 to October 2013 at 6 stations were carried out.
2. ***Diurnal Dissolved Oxygen Survey –*** A diurnal dissolved oxygen survey was carried out to describe the oxygen status of the river and help determine if plant respiration resulted in anoxic conditions which would contribute to the increases in phosphorus in the river downstream of the effluent discharge that were described by AECOM (2012).
3. ***Benthic Study –*** A benthic study was undertaken to assess the impact of the lagoon discharge on the biological community of the Delisle River.
4. ***Review of AECOM's modeling data –***AECOM's approach to calculate the un-ionized ammonia concentrations was reviewed = specifically the 7Q20 flows and 75th percentile pH values used for the calculations.
5. ***Alternative methods –*** Discussions between the municipality, MOE and the Conservation Authority regarding phosphorus offsets for the lagoon operations were recommended.

This report presents the results of Tasks 1 to 4.

2. Methods

2.1 Water Quality Sampling

A surface water sampling program for the Delisle River was initiated to assess the cause of differences between up and downstream phosphorus concentrations at the PWQMN stations that were documented by AECOM (2012). Eight sampling events were conducted from November 2012 to October 2013. The field sampling was undertaken by Township of North Glengarry staff. HESL scientists accompanied Township during the first two sampling events (November 25, 2012 and April 30, 2013) to familiarize Township staff with the proposed sample stations and collect initial sets of samples. Township staff was trained to collect further sets of water samples in 2013. Sample locations and dates are presented in Table 2 and on Figure 1.

Table 2 Sampling Locations

Site Name	Location	Sampling Dates
Alex 1	Delisle River upstream at McCormick Rd/PWQMN station	November 25, 2012, April 29, June 4, June 26, July 24 August 1, September 19, and October 16, 2013
Alex 2	Pilot Drain upstream of confluence with Delisle River	November 25, 2012, April 29, June 4, June 26, July 24 August 1, September 19, and October 16, 2013
Alex 3	Delisle River 100 m downstream of confluence with Pilot Drain, at MacPhee Rd.	November 25, 2012, April 29, June 4, June 26, July 24 August 1, September 19, and October 16, 2013
Alex 4	Delisle River 350 m downstream of confluence with Pilot Drain	April 29, June 4, June 26, July 24 August 1, September 19, and October 16, 2013
Alex 5	Delisle River 1.1 km downstream of confluence with Pilot Drain	April 29, June 4, June 26, July 24 August 1, September 19, and October 16, 2013
Alex 6	Delisle River at Glen Robertson Road/PWQMN station, 2 km downstream	November 25, 2012, April 29, June 4, June 26, July 24 August 1, September 19, and October 16, 2013
Effluent	Collected from the plant effluent	November 25, 2012, April 29, June 4, June 26, July 24 August 1, September 19, and October 16, 2013

These sample locations were chosen to describe upstream conditions in the Delisle River (Alex 1), effluent and Pilot Drain conditions (effluent + Alex 2), effluent inflow plus Delisle River chemistry (Alex 3) and far field Delisle River chemistry (Alex 6). Alex 4 and Alex 5 stations were added during the April 2013 sampling event to provide some discrimination between Alex 3 and Alex 4 due to the presence of drains and tributaries between these two stations.

Samples were analysed for total phosphorus, total ammonia (as N), NO_3 (as N), Total Kjeldahl Nitrogen (TKN), Total Suspended Solids (TSS), Carbonaceous Biochemical Oxygen Demand (cBOD), and field measurements of temperature, pH and dissolved oxygen. Field measurements of temperature and pH were used to calculated un-ionized ammonia.

Figure 1 Delisle River Surface Water Sampling Stations

2.2 Diurnal Oxygen Survey

A 7 day diurnal dissolved oxygen (DO) survey was completed from August 1 to August 8, 2013 to determine the presence of any oxygen depression or sag downstream of the plant effluent. Two dissolved oxygen (DO) loggers (Optical Dissolved Oxygen Loggers, HOBO Model U26-001) were installed in the Delisle River upstream, and 400 m downstream of the plant discharge (Figure 1). The DO loggers were calibrated prior to deployment, and programmed to measure temperature and dissolved oxygen every 30 minutes. The loggers were retrieved on August 8, 2013.

2.1 Benthic Invertebrate Investigation

Benthic invertebrates were sampled from the Delisle River on August 1, 2013 by HESL staff in accordance with OBBN protocol (Jones et al, 2007). Samples were collected from Alex 1, Alex 3, Alex 5, and Alex 6 (Figure 1). Composite samples were stained with Bengal Rose dye, preserved in isopropyl alcohol and submitted to Natural Resource Solutions Inc. in Waterloo, Ontario for taxonomic identification and enumeration. A minimum of 300 individuals were identified to the phylogenetic level of family and characteristics of the communities were assessed using a variety of metrics.

Taxonomic data were organized into a variety of compositional metrics, including: abundance, richness, density, Simpson's diversity, Shannon's evenness and % EPT (Ephemeroptera, Plecoptera and Trichoptera). The metrics were chosen based on their popularity in the literature and appropriateness for the dataset. The Modified Hillsenhoff's Biotic Index was also calculated as it was developed as a rapid indication of organic pollution through the evaluation of tolerance values.

3. Field Results

3.1 Flow

Water survey of Canada (WSC) has a long-term gauging station in the Delisle River (02MC036; Figure 1) located at Glen Robertson Road (HESL site Alex 6). This station is located approximately 2 km downstream of the Alexandria Sewage Works. Flows from November 2012 to August 2013 were not available for the WSC station. Provisional flows for these dates were provided Raison Region Conservation Authority (RRCA), and are subject to verification by WSC but were used for the analysis as the only alternative. Effluent flow rates from the Alexandria plant were provided by North Glengarry's Water Works department for each sampling date. Flow measurements for the Delisle River and the Alexandria Plant are provided in Table 3.

The WSC station is located downstream of the Alexandria plant discharge, and therefore flows estimated for this station include the contribution from the Alexandria plant. Alexandria effluent flow rates were subtracted from the WSC flow rate for each sampling event to estimate the upstream flow in the Delisle River.

During the sampling events effluent flows ranged from 26 L/s on August 1, 2013 to 68 L/s on April 29, 2013. Higher flows (60 L/s were also recorded during the June 4 and 26 sampling events). In the Delisle River, flows ranged from 146 L/s on October 16, 2013 to 4109 L/s on June 26, 2013. Effluent discharge from the plant ranged between 1% (June 2013) and 24% (October 16, 2013) of the flow in the Delisle River (Table 3).

Table 3 Delisle River and Alexandria Flow (L/s)

Date	Alexandria Effluent	Delisle River Downstream[1]	Delisle River Upstream[2]	% Delisle Flow
25-Nov-12	28	260	232	12%
29-Apr-13	68	1908	1841	4%
4-Jun-13	60	3882	3822	2%
26-Jun-13	60	4169	4109	1%
24-Jul-13	33	393	360	9%
1-Aug-13	26	464	438	6%
19-Sep-13	27	195	168	16%
16-Oct-13	35	180	146	24%

Notes: 1. Flows from November 2012 to August 2013 were not available from WSC. Provisional flows for these dates were estimated by RRCA, and are subject to verification by WSC.2. Estimated by subtracting effluent flow from downstream Delisle River flow.

3.2 Water Quality

The following section describes Delisle River water quality up and downstream of the Alexandria outfall. Results are summarized in Table 4 and on Figures 2 to 9. Water quality results for each sampling event are provided in Appendix A.

Water quality results are compared to Ontario Ministry of Environment's (MOE) Provincial Water Quality Objectives (PWQO) for the protection of aquatic life (MOE, 1994) where appropriate (total phosphorus, un-ionized ammonia, dissolved oxygen, and pH). The PWQOs are numerical and narrative criteria that serve as chemical and physical indicators representing a satisfactory level for surface waters of Ontario. The PWQOs are set at a level of water quality that is protective of all forms of aquatic life and all aspects of the aquatic life cycles during indefinite exposure to the water. Nitrate values are compared to the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life (CWQG; CCME 2012).

Table 4 Average Concentrations (mg/L) of Measured Parameters in the Delisle River (Alex 1, Alex 3, Alex 4, Alex 5), Alexandria Effluent (Effluent), and Pilot Drain Outflow (Alex 2)

Parameter	Alex1	Effluent	Alex2	Alex3	Alex4	Alex5	Alex6
TP	0.034	0.128	0.117	0.062	0.040	0.043	0.037
TSS	6.4	4.4	18.3	9.0	8.4	9.5	8.8
NH_3-N	0.075	1.796	1.088	0.148	0.100	0.123	0.122
Un-ionized NH_3-N	0.0011	0.0178	0.0102	0.0022	0.0009	0.0012	0.0015
NO_3-N	0.69	0.90	1.53	0.77	0.72	0.74	0.76
TKN-N	0.82	3.08	2.08	0.94	0.85	0.85	0.83
cBOD5	<2	3	3	<2	<2	<2	3
DO	10.01	7.71	7.07	8.79	7.34	7.52	8.99

Note: all parameters in mg/L

3.2.1 Phosphorus

Total phosphorus concentrations are provided for each monitoring site by date in Figure 2 and in Appendix A. A summary of phosphorus concentrations by site are provided in Table 4 and on Figures 2 and 3.

At Alex 1, average total phosphorus concentration was 0.034 mg/L, above the PWQO of 0.03 mg/L for the protection of aquatic life in rivers Concentrations ranged from 0.022 to 0.058 mg/L, and were above the PWQO on the April 6 (0.0351 mg/L), July 24 (0.0579 mg/L) and August 1 (0.0517 mg/L) sampling events.

In the effluent, total phosphorus concentrations ranged from 0.045 to 0.331 mg/L, with an average total phosphorus concentration of 0.128 mg/L, well within the limit of 0.5 mg/L in the ECA. The concentrations in the Pilot drain upstream of the confluence with the Delisle River ranged from 0.042 to 0.276 mg/L, with an average concentration of 0.117 mg/L. Overall, concentrations measured in the Pilot Drain, were not significantly different from those measured in the effluent (Paired t-test, p >0.3; and Figures 2 and 3) indicating that the ditch and associated land uses had no effect on effluent total phosphorus concentrations before discharging to the Delisle River.

Delisle River concentrations downstream of the Pilot Drain were higher than those measured upstream. At Alex 3, the average total phosphorus concentration (0.0062 mg/L) was twice the average concentration upstream at Alex 1. These samples were collected from the location of the plume in the Delisle River, before it was well mixed with the rest of the receiver. Concentrations decreased with distance downstream as the plume became mixed with the receiver. Average concentrations at Alex 4 and 5 were 0.040 mg/L and 0.043 mg/L respectively. At the far field station, Alex 6, total phosphorus concentrations ranged from 0.030 to 0.042 mg/L, with an average concentration of 0.037 mg/L. Concentrations were above the PWQO on all but the September 19 sampling event.

Figure 2 Total Phosphorus in the Delisle River (Alex 1, Alex 3, Alex 4, Alex 5), Alexandria Effluent (Effluent), and Pilot Drain (Alex 2)

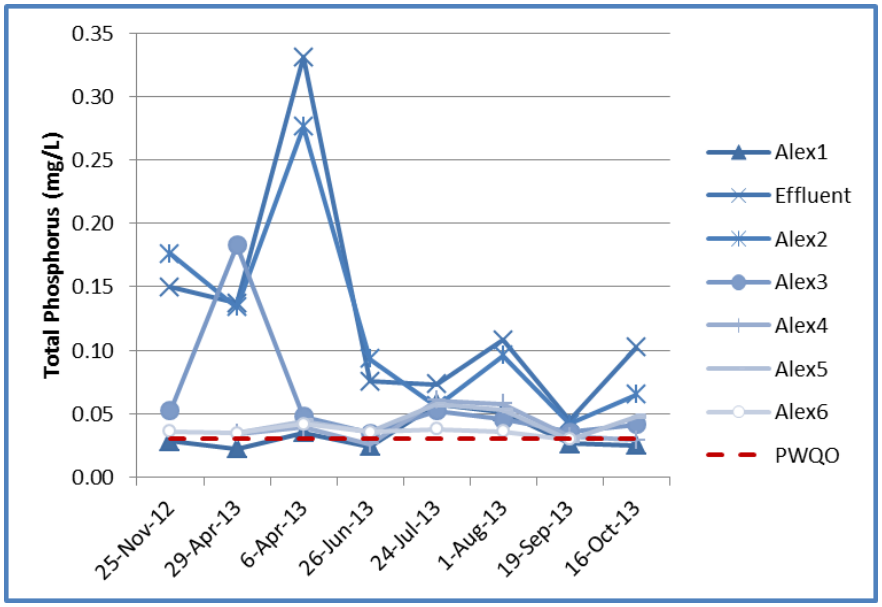
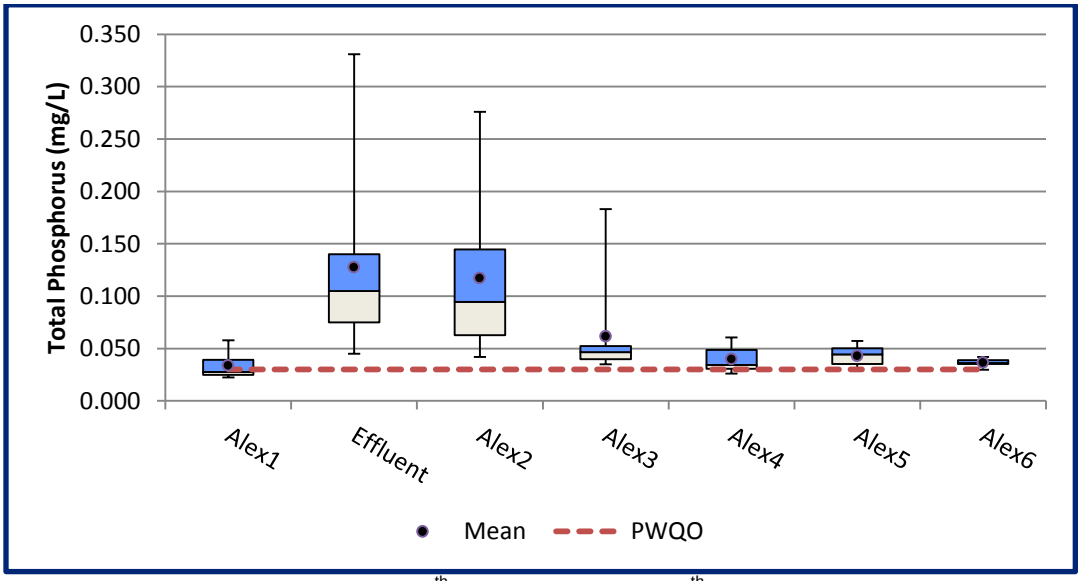


Figure 3 Box and Whisker Plots of TP concentrations in Delisle River and Plant Effluent



Note: boxplots represent minimum, 25th percentile, median, 75th percentile, and maximum values

Overall, the far field concentrations (Alex 6, 0.037 +/- 0.004 mg/L, Table 5) were not significantly different from those measured at the upstream background station at Alex 1 (0.034 +/- 0.014 mg/L; Paired t-test, *p* >0.29), indicating no significant phosphorus enrichment from the Alexandria lagoon discharge. PWQMN measurements for the same time period also showed no significant difference. The average 2012-2013 concentration at the PWQMN upstream site (Delisle River at McCormick Road Stn. 12008600202; 0.038 +/- 0.011 mg/L) was not significantly different (p>0.12) than the average concentration of 0.031 +/- 0.009 mg/L measured at the downstream PWQMN Site McCormick Road (Stn. 12008600102). Long-term (2000 to 2013) total phosphorus measurements from the PWQMN stations in the Delisle River at McCormick Road (12008600202; 0.035 mg/L average) and Glen Robertson Road (12008600102; 0.090 mg/L average) do show an increase in total phosphorus concentrations downstream but the reasons for the difference are not clear at this time.

Table 5 Average Concentrations (mg/L) of Total Phosphorus Measured by HESL and PWQMN in 2012-2013.

PWQMN: 2012-2013		HESL Field Studies : 2012-2013			PWQMN: 2012-2013	
Date	**Upstream**	**Date**	**Alex1**	**Alex6**	**Date**	**Downstream**
21-Nov-12	0.022	25-Nov-12	0.029	0.036	21-Nov-12	0.025
		29-Apr-13	0.022	0.035		
22-May-13	0.038	4-Jun-13	0.035	0.042	22-May-13	0.047
19-Jun-13	0.025	26-Jun-13	0.024	0.036	19-Jun-13	0.033
		24-Jul-13	0.058	0.038		
20-Aug-13	0.032	1-Aug-13	0.052	0.036	20-Aug-13	0.043
24-Sep-13	0.045	19-Sep-13	0.027	0.030	24-Sep-13	0.053
22-Oct-13	0.024	16-Oct-13	0.025	0.042	22-Oct-13	0.029
Mean	0.031		0.034	0.037		0.038
SD	0.009		0.014	0.004		0.011

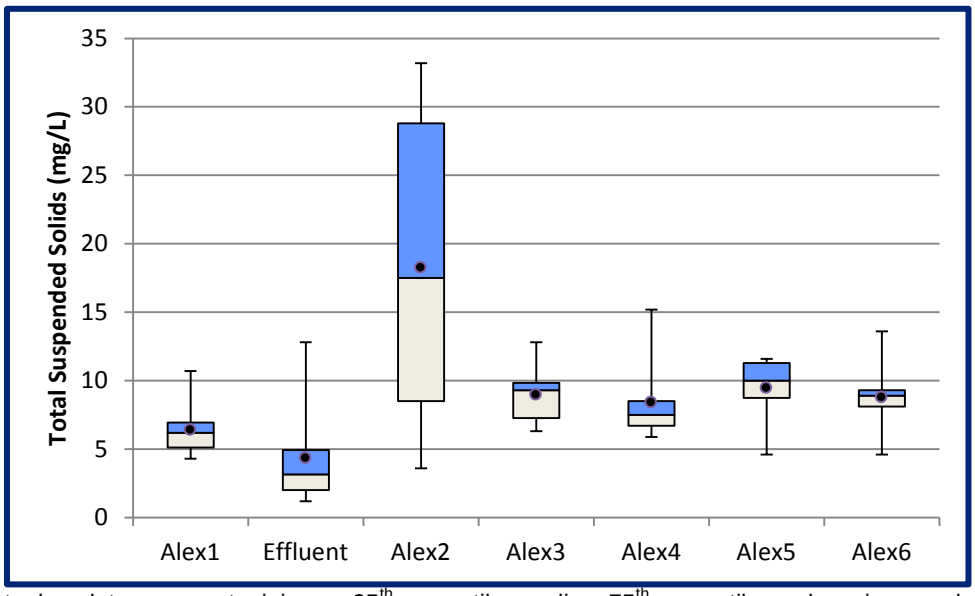
3.2.1 Total Suspended Solids

Total suspended solids concentrations were relatively low in the Delisle River. At the upstream station, concentrations ranged from 4.3 to 10.7 mg/L with an average concentration of 6.4 mg/L. Effluent concentrations were also low (Figure 3), and ranged from 1.2 to 12.8 mg/L, with an average concentration of 4.4 mg/L. The TSS concentrations in the effluent were not significantly different from those in the Delisle River upstream (paired t-test, p=0.06).

The average TSS concentration in the Pilot drain was 18.3 mg/L, which was significantly higher than the concentration measured in the effluent (Paired t-test, p <0.01). This establishes that the Pilot Drain was a source of suspended solids to the effluent (i.e from erosion or runoff) before it was discharged to the Delisle River.

TSS concentrations were higher in the Delisle River downstream of the Pilot Drain. At Alex 3, the average TSS concentration was 9.0 mg/L, and remained relatively consistent downstream to Alex 6. The average concentration at the far field station, Alex 6, was 8.8 mg/L. Although this was higher than the average Alex 1, the difference was not significantly different (t-test, p>0.05).

Figure 4 Box and Whisker Plots of TSS concentrations (mg/L) in Delisle River and Plant Effluent



Note: boxplots represent minimum, 25th percentile, median, 75th percentile, and maximum values

3.2.1 Nitrogen

Concentrations of TKN (organic nitrogen + ammonia), nitrate-N and ammonia-N were low in the Delisle River upstream of the Pilot Drain (Table 4, Figures 5 to 8). On average, the concentrations of TKN, nitrate-N, and ammonia-N were 0.82 mg/L, 0.69 mg/L and 0.075 mg/L, respectively. Concentrations of un-ionized ammonia were below the PWQO of 0.0164 mg-N/L during all sampling events (concentrations ranged from 0.0004 to 0.0022 mg-N/L).

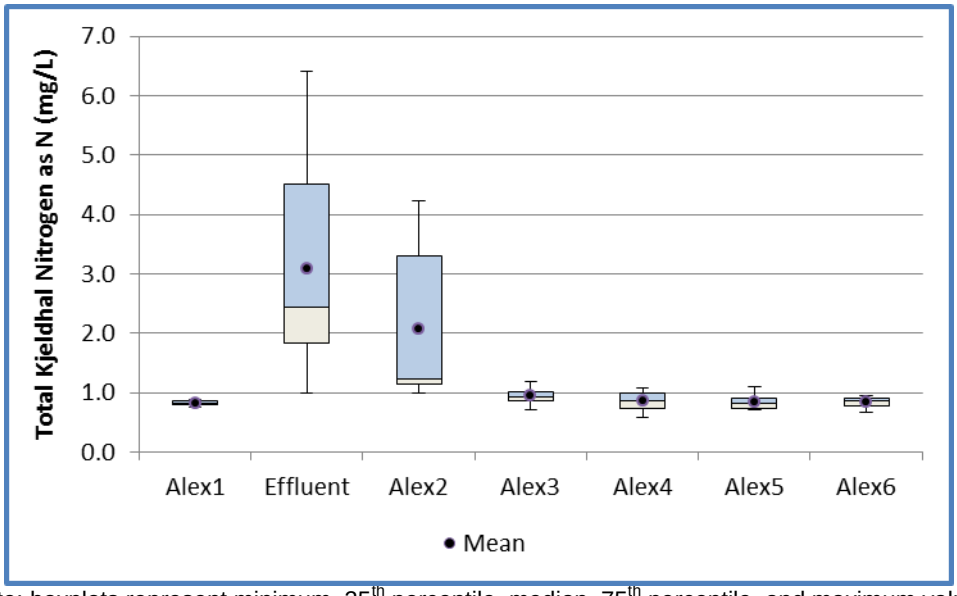
Total ammonia-N and TKN concentrations of the effluent were highest during the fall and spring sampling events, and lower during the summer sampling events (Appendix A). Concentrations of total ammonia ranged from 0.05 mg/L on September 19 2013 to 5.98 mg/L on June 4, 2013, with an average concentration of 1.796 mg/L. Un-ionized ammonia concentrations ranged from 0.0003 to 0.0565 mg-N/L, with an average concentration of 0.0178 mg-N/L. Concentrations were highest, and above the PWQO of 0.0164 mg-N/L during the April 29 and June 4 sampling events (0.0289 and 0.0565 mg-N/L respectively) when total ammonia concentrations were also the highest. Nitrate concentrations were low for WWTP effluent and ranged 0.17 to 1.66 mg-N/L, with an average concentration of 0.90 mg-N/L. The low nitrate concentrations indicate that little nitrification (conversion of ammonia to nitrate) occurred in the lagoon system.

Concentrations of total ammonia and TKN were lower at the outflow of the Pilot Drain (Alex 2) than in the plant effluent (Figures 5 and 6). Average TKN and total ammonia concentrations were 2.08 and 1.08 mg-N/L respectively (Table 4). Conversely, nitrate concentrations were higher (1.53 mg/L-N) in the Pilot Drain outflow than in the effluent (Table 4, Figure 8). Concentrations of total ammonia, TKN and nitrate were significantly different at the Pilot Drain outflow (Alex 2) than in the effluent (paired t-tests, $p<0.05$, $p<0.03$, and $p<0.01$ respectively, Appendix A). The increase in nitrate concentrations and decrease in

total ammonia and TKN concentrations is from of the conversion of ammonia to nitrate through nitrification. Further discussion on ammonia reduction in the Pilot Drain is provided in Section 3.2.1.

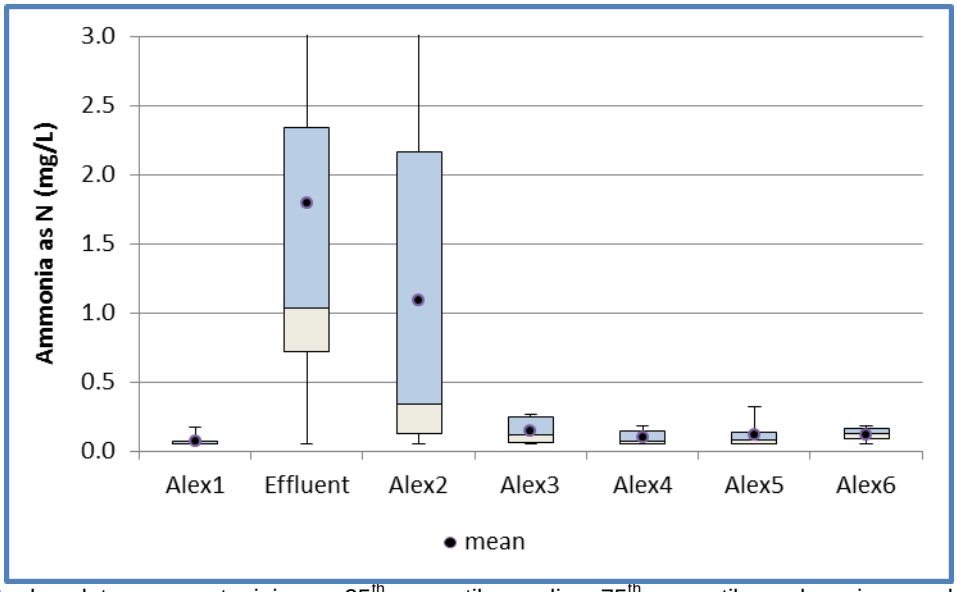
Immediately downstream of the Pilot Drain, the average concentrations of nitrogen species in the Delisle River at Alex 3 were higher than upstream (Table 4, Figures 5 and 6). By Alex 6, concentrations of TKN and nitrate returned to background values. Ammonia concentrations measured at Alex 3 (average NH_3 of 0.148 mg/L–N) were approximately twice those measured at the upstream station (average NH_3 of 0.075 mg/L–N). This is expected as Alex 3 is located 100 m downstream of the confluence with the Pilot Drain, and samples were collected from the southern bank, where the Pilot Drain discharges. The average total ammonia concentration decreased to 0.100 mg/L-N at Alex 4, 350 m downstream, but increased at the far field stations Alex 5 and Alex 6 (0.123 and 0.122 mg/L-N respectively). Between Alex 4 and Alex 6 there are 3 tributaries and drainage features visible on the aerial imagery (Figure 1). The tributaries flow through agricultural fields and cattle pastures before discharging into the Delisle River. The increase in ammonia between these stations may be due to loadings from the watershed. Although concentrations increased between stations 4 and 6, concentrations measured at these stations were not significantly different (ANOVA, $p>0.05$). Although average ammonia concentrations at Alex 4 and 5 were higher than Alex 1, they were not significantly different from Alex 1 (paired t test, p values >0.05). However total ammonia concentrations at Alex 6 were significantly higher than those measured at Alex 1 (paired t test, $p <0.02$). Un-ionized ammonia and nitrate concentrations were below their respective PWQO and CCME guideline values at all downstream stations during all sampling events.

Figure 5 Box and Whisker Plots of Total Kjeldahl Nitrogen concentrations (mg/L) in Delisle River and Plant Effluent



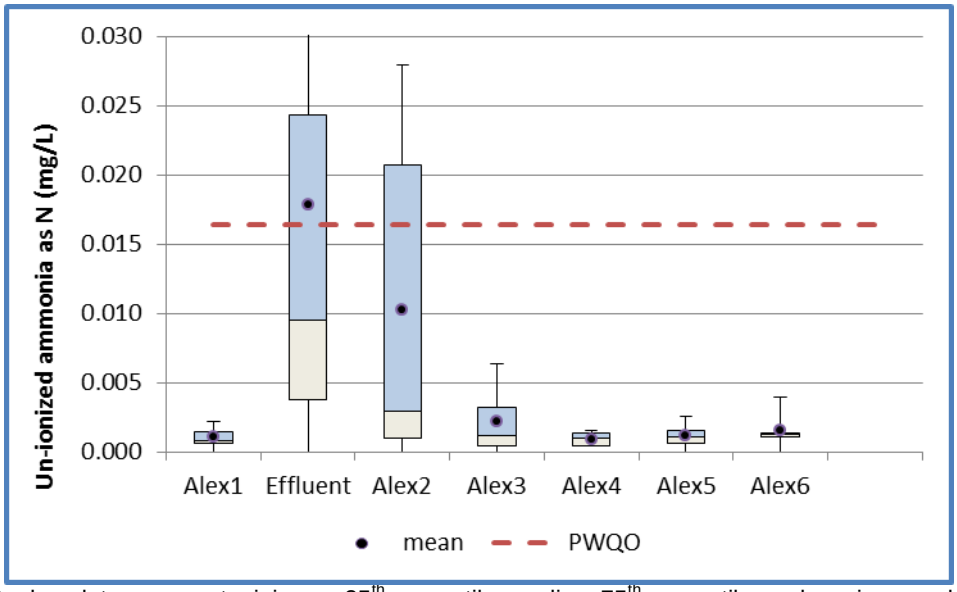
Note: boxplots represent minimum, 25th percentile, median, 75th percentile, and maximum values

Figure 6 Box and Whisker Plots of Total Ammonia concentrations (mg/L) in Delisle River and Plant Effluent



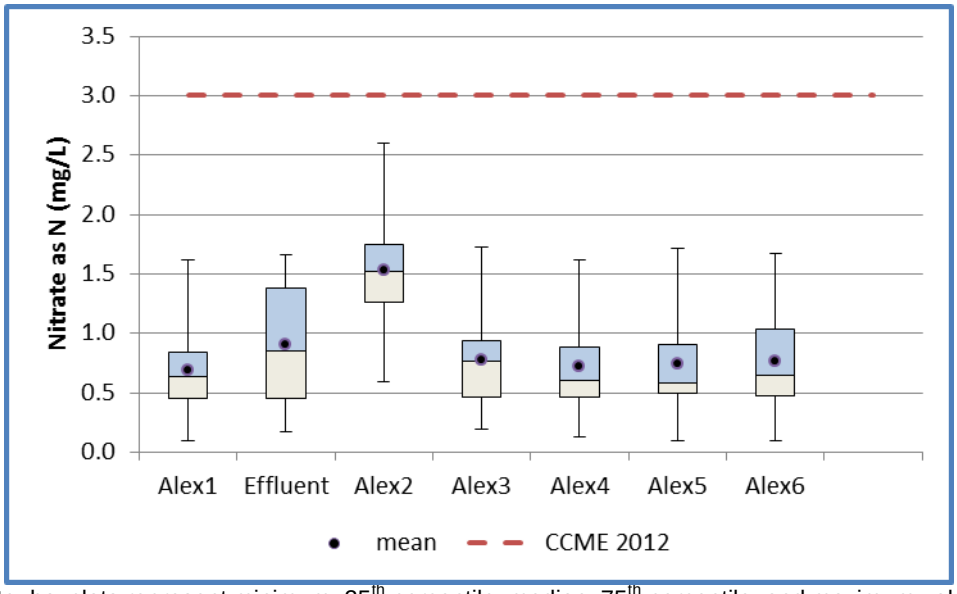
Note: boxplots represent minimum, 25th percentile, median, 75th percentile, and maximum values

Figure 7 Box and Whisker Plots of Un-Ionized Ammonia concentrations (mg/L) in Delisle River and Plant Effluent



Note: boxplots represent minimum, 25th percentile, median, 75th percentile, and maximum values

Figure 8 Box and Whisker Plots of Nitrate concentrations (mg/L) in Delisle River and Plant Effluent

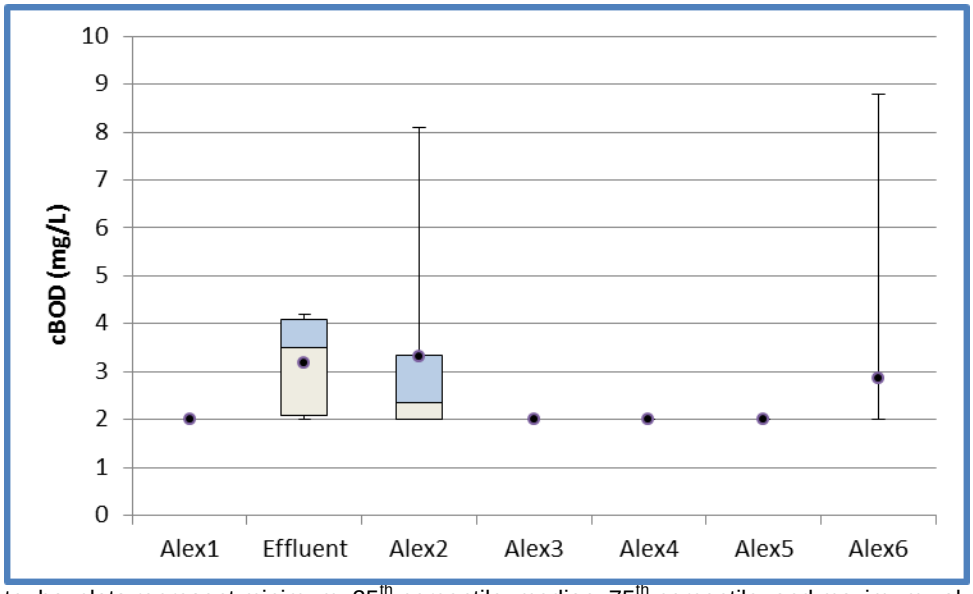


Note: boxplots represent minimum, 25th percentile, median, 75th percentile, and maximum values

3.2.2 Carbonaceous Biochemical Oxygen Demand

Carbonaceous Biochemical Oxygen Demand (cBOD) was low at all stations in the Delisle River. Values were below detection of 2.0 mg/L except at Alex 6 on October 16 (cBOD = 8.8 mg/L). The cBOD of the effluent was low, with an average concentration of 3 mg/L. Based on these data there is no strong biochemical oxygen demand on the Delisle River from the Alexandria Sewage Works.

Figure 9 Box and Whisker Plots of $cBOD_5$ concentrations (mg/L) in Delisle River and Plant Effluent



Note: boxplots represent minimum, 25th percentile, median, 75th percentile, and maximum values

3.2.1 Pilot Drain Water Quality

Water samples were collected of the effluent (Effluent) and at the Pilot Drain outflow (Alex 2) during every sampling event to determine if the Pilot Drain provided assimilation or was a source of contaminants.

Section 3.2 (Water Quality) documents statistical differences between total ammonia, nitrate, TKN, and TSS concentrations in the Pilot Drain and concentrations measured in the effluent. The drain had no effect (no statistical difference) on effluent total phosphorus concentrations and $CBOD_5$ before discharging to the Delisle River. Table 6 compares water quality of the effluent to that of the Pilot Drain for total ammonia, nitrate, TKN, and TSS.

Concentrations of total ammonia decreased in the Pilot Drain with the exception of the November 25, 2012 and September 19, 2013 events. On November 2012 the increase in ammonia (by 0.03 mg/L) is likely due to ammonification during the colder months, on October 25, 2013 the total ammonia concentration in the effluent was below the detection limit (0.05 mg/L), and any further reduction could not be measured. In the summer months (June through August 2013) nitrification of ammonia was high, and on June 4, 2013 ammonia concentrations decreased from 5.98 mg/L in the effluent to 2.6 mg/L in the Pilot Drain (Table 5). The median reduction in ammonia concentrations was 0.65 mg/L in the spring/summer (May to October) sampling events, and 0.38 mg/L in the fall/winter (November to April) sampling events. It should be noted that the spring/summer value is based on 6 sampling events, and the fall/winter value is based on two sampling events. Continued sampling of both the effluent and Pilot Drain should be conducted to support these values. Similar reductions in TKN concentrations were observed (Table 6).

The increases in nitrate concentrations generally corresponded to the decreases in total ammonia concentrations. Increases in nitrate concentrations were highest in the summer months (median increase of 0.77 mg/L), due to nitrification of ammonia, and lower in the fall/winter months (median increase of 0.25mg/L). The exception was September 2013 where nitrate concentrations decreased from 1.66 to 1.52 mg/L.

The Pilot Drain can be a significant source of TSS to the Alexandria effluent. During the November 2012 to June 2013 sampling events TSS concentrations increased by 20 to 30 mg/L (160 to 2500%). From July to October 2013 TSS concentrations increased from 2 to 7 mg/L. The higher loading from November to June 2013 likely corresponds to runoff during high flow conditions.

Table 6 Comparison of Water Quality in the Pilot Drain and Plant Effluent

	Ammonia as N				Nitrate as N				TKN				TSS			
Date	Effluent	Alex2	Reduction	Reduction (%)	Effluent	Alex2	Increase	Increase (%)	Effluent	Alex2	Reduction	Reduction (%)	Effluent	ALEX 2	Increase	Increase (%)
25-Nov-12	2.12	2.15	-0.03	-1%	1.35	1.72	0.37	27%	4.5	3.22	1.28	28%	2	24	22	1100%
29-Apr-13	3.00	2.21	0.79	26%	0.46	0.59	0.13	28%	4.53	3.52	1.01	22%	6	28	22	367%
4-Jun-13	5.98	3.38	2.60	43%	0.17	1.83	1.66	976%	6.4	4.23	2.17	34%	12.8	33	20	159%
26-Jun-13	0.971	0.437	0.534	55%	1.24	2.6	1.36	110%	1.99	1.26	0.73	37%	1.2	31	30	2500%
24-Jul-13	1.09	0.239	0.85	78%	0.44	1.1	0.66	150%	2.33	1.21	1.12	48%	3.4	5.8	2	71%
1-Aug-13	0.858	0.101	0.757	88%	0.45	1.32	0.87	193%	2.56	0.98	1.58	62%	4.6	11	6	141%
19-Sep-13	<0.05	0.05	0	0%	1.66	1.52	-0.14	-8%	0.98	1.17	-0.19	-19%	2	3.6	2	80%
16-Oct-13	0.302	0.137	0.165	55%	1.45	1.53	0.08	6%	1.33	1.04	0.29	22%	2.9	9.4	7	224%
Minimum	0.30	0.05	-0.03	-1%	0.17	0.59	-0.14	-8%	0.98	0.98	-0.19	-19%	1	4	2	71%
Maximum	5.98	3.38	2.60	88%	1.66	2.60	1.66	976%	6.40	4.23	2.17	62%	13	33	30	2500%
Median																
May-Oct	0.97	0.19	0.65	55%	0.85	1.53	0.77	130%	2.16	1.19	0.93	35%	3.2	10	6	150%
Nov-Apr	2.56	2.18	0.38	12%	0.91	1.16	0.25	28%	4.52	3.37	1.15	25%	4.0	26	22	733%

Notes: all concentrations in mg/L unless otherwise noted.

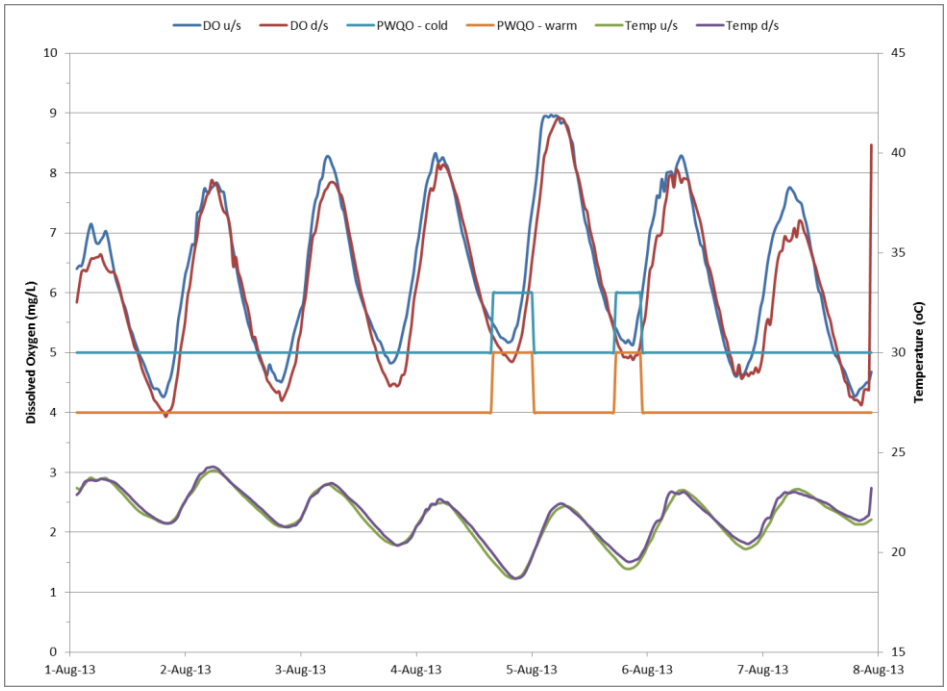
3.3 Dissolved Oxygen Survey

Continuous measurements of dissolved oxygen concentrations at Alex 1 and Alex 4 from August 1st to August 8th provide a record of diurnal changes related to photosynthesis (which produces oxygen) and respiration (which consumes oxygen) of aquatic plants (Figure 10). The upstream logger was placed in a swift moving area of the River; the downstream logger was placed in a slow moving area of the river with abundant macrophyte growth. The location of the downstream logger was chosen, because the characteristics of the river at this site (slow moving and abundant macrophyte growth) would display the greatest demand on dissolved oxygen in the river.

The dissolved oxygen upstream ranged from 4.26 mg/L to 8.97 mg/L during the period of measure. Daily fluctuations in DO were approximately 3.5 mg/L. Dissolved oxygen concentrations were lowest in the early morning (approximately 7 am), and highest in the early night (approximately 7 pm). Concentrations were consistently above the PWQO for warm water biota. Concentrations dropped below the PWQO for cold water biota in the early mornings when DO was lowest.

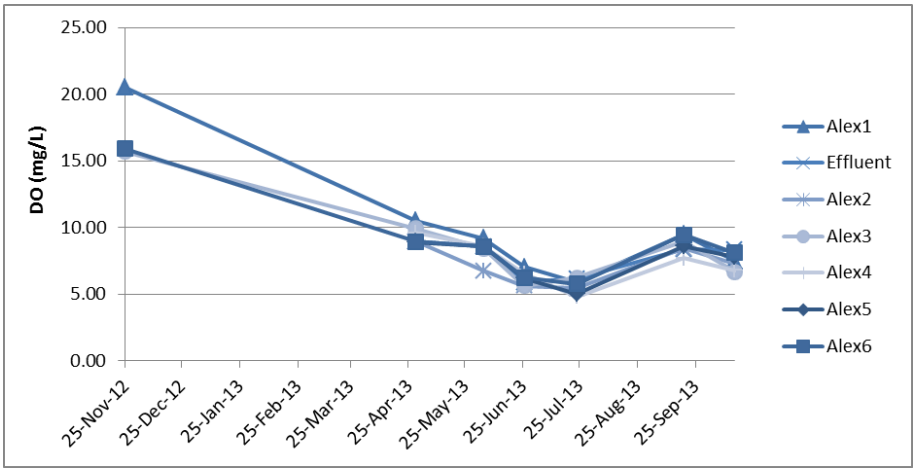
The dissolved oxygen downstream was slightly less than the upstream concentrations, and ranged from 3.93 mg/L to 8.93 mg/L during deployment. Daily fluctuations in DO were approximately 3.7 mg/L. Similar to the pattern observed at Alex 1, the dissolved oxygen concentrations were lowest in the early morning and highest in the early evening. Dissolved oxygen concentrations were below the PWQO for cold water biota in the early mornings, however the concentrations were slightly lower, and the period extended longer than that measured upstream. Dissolved concentrations were below the PWQO for warm water biota on three occasions, August 2, August 5, and August 6 but were only slightly below the PWQO and for a brief period (≤3 hours). The lower dissolved oxygen concentrations measured downstream is a result of respiration from abundant macrophyte growth in the river.

Figure 10 Diurnal Dissolved Oxygen Concentrations (mg/L) and Temperatures (°C) in the Delisle River at Alex 1 and Alex 4



Dissolved oxygen concentrations in the Delisle River were highest during the fall (November 2012) sampling event (Figure 11). From April to July 2013 concentrations decreased from approximately 10 mg/L to 5 mg/L, coincident with higher temperatures. In September and October concentrations increased As the water cooled Concentrations were above the PWQO for warm and cold water biota except at Alex 4 on July 25. The dissolved oxygen concentration measured at Alex 4 was 4.81 mg/L, just below the PWQO for cold water biota of 5 mg/L.

Figure 11 Measured dissolved oxygen concentrations (mg/L) in the Delisle River during sampling events



3.4 Benthic Invertebrate Investigation

Benthic invertebrates were sampled at four stations (Alex 1, Alex 3, Alex 5 and Alex 6) on August 1, 2013. The following presents a summary of the results. Raw taxonomic data is provided in Appendix B.

3.4.1 Habitat

A summary of benthic habitat conditions is provided in Table 7. At Alex 1 the water depth was shallow and flow was subsequently fast. Rocky substrates were abundant, partly because of rock used during adjacent road and bridge construction, and lesser quantities of other substrates such as silt, sand and organic debris were noted. The riffle-like environment supported moderate growth of emergent macrophytes along the river edges and the accumulation of periphyton on rocky substrates. At Alex 3 the habitat was characterized by depositional conditions as water flow was slow and substrates were unconsolidated. Macrophyte growth was abundant along the margins of the watercourse. At Alex 5 water flow was slow with depositional conditions and accumulations of various species of aquatic vegetation and periphyton. The habitat at Alex 6 was more similar to Alex 1 than Alex 3 or 5. Rocky substrates were dominant with fast flows in the riffle-like environment. Water depths were shallow at the sample sites and aquatic vegetation and periphyton were abundant.

3.4.1 Community Composition

A summary of benthic community composition is provided in Table 8. A total of 826 benthic invertebrates were collected and identified from Alex 1. The sample was dominated by *Chironomidae* (n=535, 65% of the sample) but 31 other families were also identified. *Chironomidae* are often dominant in waterbodies that are poorly oxygenated because they are able to store oxygen in hemoglobin. Diversity and evenness metric results were relatively low because of the dominance of *Chironomidae*. The percent of EPT (*Ephemeroptera*, *Plecoptera* and *Trichoptera*) was 18%, mainly because of the presence of *Caenidae*, *Baetidae* and *Hydroptilidae* which all feed on periphyton and/or macrophytes. *Elmidae, Hyallelidae*, and *Empididae* were also relatively abundant. A Modified HBI score based on tolerance values for each family of benthic invertebrate was 6.54 which equates to “poor” water quality where “very substantial pollution is likely”.

Table 7 Benthic habitat characteristics in the Delisle River.

Station	Substrates	Water Depth (m)	Flow	Aquatic Vegetation
Alex 1	Rocky substrates with silt. Lesser accumulations of sand and organic detritus.	0.1-0.2	Fast	Emergent vegetation, periphyton
Alex 3	Rocky substrates with underlying silt and organics	0.1-0.5	Slow	Emergent vegetation, water lilies, milfoil spp., abundant periphyton
Alex 5	Rocky substrates with underlying silt and organics	0.3-1.5	Slow	Emergent vegetation, water lilies, milfoil spp., abundant periphyton
Alex 6	Rocky substrates including cobble and gravel	0.1-0.4	Fast	Emergent vegetation, abundant periphyton

Table 8 Benthic invertebrate metrics for the Delisle River.

Metric	Alex 1	Alex 3	Alex 5	Alex 6
Abundance	826	357	426	1287
Richness	32	29	35	26
Simpson's Diversity	0.57	0.83	0.88	0.78
Shannon	1.59	2.36	2.60	1.73
%EPT	18	12	8	44
Hilsenhoff Score	6.54	6.79	6.72	5.53
Water Quality	Poor	Poor	Poor	Fair
Degree of Organic Pollution	Very substantial pollution likely	Very substantial pollution likely	Very substantial pollution likely	Fairly substantial pollution likely

A total of 359 benthic individuals in 29 taxa were collected at this station at Alex 3. *Chironomidae* were the most dominant taxa (n=129, 36%), followed by *Caenidae*, *Coegrionidae*, *Corixidae* and *Hyalellidae*. Diversity and evenness values were 0.82 and 2.36, respectively, indicating relatively good water quality. The Modified HBI value of 6.79 indicated “poor” water quality” and “very substantial pollution likely”.

At Alex 5 no single taxon dominated the community, resulting in the highest diversity and evenness scores amongst the four sites. *Hyalellidae* were the most abundant taxa followed by *Chironomidae*, *Elmidae*, *Coegrionidae*, *Asellidae* and *Valvatidae. Hyalellidae* are more common in lotic waters than the other common Amphipod family *Gammaridae*. Amphipods are most commonly found in the shallows of streams, lakes and ponds and are generally found near woody debris or aquatic vegetation. %EPT was the lowest of the four sites and Hilsenhoff HBI scores were the highest of the four sites indicating the greatest degree of organic enrichment and “poor” water quality.

Abundance was highest at Alex 6 with 1287 individuals. Richness was low with 26 taxa. Four taxa dominated the sample: *Baetidae*, *Hydropsychidae*, *Chironomidae*, and *Simulidae*. The % EPT was highest of the four sites (44%) due to the abundance of *Baetidae* and *Hydropsychidae* in the sample. %EPT is generally a good indication of water quality because many *Ephemeroptera*, *Plecoptera* and *Trichoptera* are sensitive to stressors. The higher %EPT at Alex 6 indicates better water quality conditions than the upstream sites. This finding is substantiated by the lowest HBI score and “fair” water quality classification.

3.4.2 Discussion

Benthic invertebrate communities at the sample sites in the Delisle River were dominated by *Chironomidae,* with *Baetidae*, *Hydropsychidae*, and *Elmidae* abundant at the most downstream station (Alex 6). The upstream reference site (Alex 1) exemplified degraded conditions through low diversity, evenness, and %EPT and “fairly poor” water quality as diagnosed through the HBI. Downstream of the Alexandria effluent (at Alex 3 and 5), the diversity and evenness increased indicating improved conditions while %EPT and the HBI indicated degraded conditions.

Benthic habitat varied from rocky, fast flowing, riffle-like environments at Alex 1 to depository, slow-moving, unconsolidated organics at Alex 3 and 5. Habitat characteristics are an influential factor in determining benthic invertebrate communities and must be taken into account when completing bioassessments. Riffles generally contain higher dissolved oxygen concentrations caused by turbulent flow than depository runs. Higher dissolved oxygen concentrations, combined with a greater variety of rocky substrates generally increase habitat quality with results evident through a well-balanced and diverse benthic invertebrate community. These bioassessment results however, do not indicate a substantial difference between the two downstream sites (Alex 3 and Alex 5) and the upstream site (Alex 1). Further downstream, Alex 6 contained a similar habitat to Alex 1 and all of the metric results except richness indicated better benthic habitat and subsequently better water quality conditions than the reference site. Overall, these results suggest that habitat conditions had an important influence on the benthic community and that the effluent discharge had little effect in the near field and no effect in the far field.

3.5 Field Investigations Summary

During the field sampling events, there was no significant difference between the concentrations of total phosphorus, total suspended solids, TKN concentrations measured at upstream of the Pilot Drain and those measured downstream in the far field. There was a significant difference between total ammonia concentrations measured downstream (Alex 6) than those measured upstream, indicating an increase in total ammonia in the river. Concentrations were all below the PWQO for un-ionized ammonia at all stations in the Delisle River during every sampling event.

Effluent flow through the Pilot Drain influenced the quality of the effluent. Concentrations of total ammonia, TKN and TSS were significantly different between the effluent and Pilot Drain outflow samples. Total ammonia, nitrate, and TKN concentrations decreased and TSS concentrations increased through the Pilot Drain. Total ammonia and TKN decreased from the conversion of ammonia to nitrate through nitrification; causing an increase in nitrate concentrations. The Pilot Drain had no effect on effluent total phosphorus concentrations and $CBOD_5$ before discharging to the Delisle River. The Pilot Drain therefore reduces the loading of ammonia to the Delisle River from the Alexandria plant and acts as a source of TSS to the Delisle River. The reduction in ammonia concentrations averaged 0.65 mg/L in the spring/summer (May to October) sampling events, and 0.38 mg/L in the fall/winter (November to April) sampling events.

Diurnal dissolved oxygen concentrations were similar at the upstream and downstream stations. At both stations, dissolved oxygen concentrations fell below the PWQO for cold and warm water biota in the early morning. The concentrations were lower, and the period extended longer at the downstream station than upstream. At the downstream station, dissolved oxygen concentrations fell below the PWQO for warm water biota on three occasions, August 2, August 5, and August 6 for a short period (≤3 hours).

Results of the benthic invertebrate investigation found that although the habitat at the upstream site was better than the downstream Alex 3 and Alex 5 sites, the benthic community composition did not indicate a substantial difference between these sites. In addition, the community composition at the far field site,

Alex 6, indicated better benthic habitat and subsequently better water quality conditions than the upstream site.

4. Review of AECOM's Modeling Data

The Township of North Glengarry is planning on re-rating the Alexandria Sewage Lagoons from their current rated capacity of 3,237 m^3/d to 5,500 m^3/d. AECOM (2013) completed mass balance loading and mixing zone analyses for the plant regulated parameters under current and future modeling scenarios. HESL's preliminary examination of AECOM's ammonia modeling calculations (HESL October 2012) suggested that they may have used $7Q_20$ flow values that were too low and pH and temperature values that were too high when estimating un-ionized ammonia concentrations. This would have resulted in overly conservative effluent ammonia limits. We have reviewed and updated AECOM's $7Q_{20}$ and ammonia calculations.

The results of these analyses, in combination with the AECOM report, are recommended for use in support of the re-rating requirements of the ECA.

4.1 7Q20 calculations

Effluent discharge to any receiver requires the determination that the receiver can effectively assimilate or dilute the effluent. In Ontario streams and rivers, the $7Q_{20}$ is the basic design flow used by the Ministry of the Environment as the starting point for assimilation studies (MOE 1994). The $7Q_{20}$ represents the minimum 7-day average flow with a recurrence period of 20 years. This value determines the 5% chance of there not being adequate stream flow to properly dilute the effluent discharge.

Table 9 of AECOM's report presented prorated monthly, seasonal (May to October and November to April) and annual $7Q_{20}$ estimates for the Delisle River upstream of the Alexandria Sewage Works (provided in Table 9 below). AECOM estimated these values by prorating the $7Q_{20}$ estimates from the WSC gauging station located at Glen Robertson Road (02MC036) to the upstream catchment area of the Delisle River at McCormick Road (area ratio of 0.89). As the WSC station is located downstream of the Alexandria Sewage Works, AECOM subtracted effluent flows before calculating the statistics.

Table 9 Prorated $7Q_{20}$ Estimates (L/s) for the Delisle River Upstream of the Alexandria Sewage Works

Period	**AECOM** $7Q_{20}$ **Estimate**	**HESL** $7Q_{20}$ **Estimate**
May-October	76.9	85.6
November-April	281.9	285.6
Annual	112.5	112.5

Using the downstream flow values corrected for Alexandria effluent, HESL calculated seasonal and annual $7Q_{20}$ values by determining the 5% value of average 7 day flows. These values were prorated for the upstream catchment area ratio of 0.89 (Appendix C; Table 9). The annual $7Q_{20}$ of 112.5 L/s value was

the same as AECOM's, but the May to October (85.6 L/s) and November to April (285.6 L/s) were slightly higher than AECOM's values.

7Q20 flows are lower in the summer but ammonia concentrations are lower during this period as well. Higher ammonia levels occur along with higher flows in the winter period. A model with seasonal 75th percentile statistics for water quality and seasonal 7Q20 values for flow was used to account for the seasonal differences in nitrogen dynamics.

4.2 Ammonia Effluent Limits

We derived effluent ammonia limits by a) accounting for the seasonal differences in flow and ammonia concentrations as described above and b) accounting for the observed nitrification in the Pilot Drain. AECOM recommended total ammonia effluent limits of 0.42 mg/L and 2.58 mg/L for spring/summer and fall/winter respectively. These values were derived using a CORMIX model that did not account for nitrification processes in the Pilot Drain. Water quality sampling from November 2012 to October 2013 found that a significant amount of nitrification occurs in the Pilot Drain in the spring/summer months (Table 6). A mass balance loading analysis with a nitrification component was used to estimate total ammonia effluent limits for May to October (spring/summer) and November to April (fall/winter) under the proposed flow rate.

Upstream loads in the Delisle River were estimated using the long-term monitoring data from the PWQMN station located at McCormick Road (12008600202). The 75th percentile total ammonia concentrations were calculated for the May to October (spring/summer) and November to April (fall/winter) periods using data from 2000 to 2013 (Table 10). These values were multiplied by the seasonal $7Q_{20}$ values estimated for Delisle River upstream of the Alexandria Sewage Works.

Table 10 Model Input Data

	Delisle River Upstream		Plant Effluent and Pilot Drain			Delisle River Downstream	
Period	$7Q_{20}$ (L/s)	75th% NH_3 (mg/L) [1]	Proposed Flow (m^3/s)	Proposed Flow (L/s)	NH_3 Loss from Nitrification (mg/L)	75% pH	75% Temp (°C)
May-Oct	85.6	0.033	5,500	63.7	0.65	8.4	22.4
Nov-April	285.6	0.039	5,500	63.7	0.38	8.3	7.9

Loads from the Alexandria plant were estimated using the proposed flow of 5,500 m^3/d (63.7 L/s) and deriving the total ammonia concentration required to meet PWQO of 0.0164 mg/L-N in the Delisle River downstream. The reductions in effluent ammonia concentrations (Table 10), as estimated from nitrification in the Pilot Drain (Table 10), were subtracted from the plant effluent ammonia to determine the ammonia load at the outflow of the Pilot Drain. The resultant Pilot Drain loads were added to those calculated for the Delisle River to estimate downstream water quality (Table 11).

Downstream un-ionized ammonia concentrations were determined using seasonal (May to October and November to April) 75th percentile pH and temperature values (Table 10) calculated from the downstream PWQMN (12008600102) data from 2000 to 2013.

Table 11 Mass Balance Model of Ammonia in the Delisle River: proposed discharge of 5,500m^3/d.

Model Component	Season	May-Oct	Nov-April
Delisle Upstream	75% NH3 (mg/L)	0.033	0.039
	7Q20 Flow (L/s)	85.6	285.6
	Load (mg/s)	3	11
Effluent and Pilot Drain	Effluent NH3 (mg/L)	0.96	3.05
	Loss from Nitrification (mg/L)	0.65	0.38
	Concentration in Pilot Drain outflow (mg/L)	0.31	2.67
	Effluent Flow (L/s)	63.7	63.7
	Pilot Drain Load (mg/s)	20	170
Delisle Downstream	Total Load in Delisle River (mg/s)	23	181
	Total Flow in Delisle River (L/s)	149.3	349.3
	Predicted NH3 in Delisle River (mg/L)	0.153	0.519
	Predicted UAN (mg/L) at 75% pH and Temp	0.0164	0.0162

Plant effluent ammonia concentrations of 0.96 mg/L-N for May to October and 3.05 mg/L-N for November to April would meet the PWQO of 0.0164 mg/L-N downstream, at the point of complete mixing under $7Q_{20}$ Delisle River flow, and 75% upstream ammonia concentrations. These values are based on losses of ammonia in the Pilot Drain of 0.65 mg/L in May to October, and 0.38 mg/L from November to April. The May to October value is based on six sampling events, however the November to April value is based on two sampling events. Additional sampling (4 events) of both the effluent and Pilot Drain under fall/winter conditions should be conducted to verify winter nitrification in the Pilot Drain In addition, further nitrification will occur in the Delisle River.

4.3 Model Verification – Measured vs Modelled Concentrations

The above modeling approach added the Pilot Drain loads to upstream Delisle River loads to estimate downstream water quality. Traditionally in mass balance modeling the plant loads are added directly to the receiver without accounting for nitrification. Monitoring results found that significant nitrification occurs in the Pilot Drain before discharge to the receiver. Our modeling approach accounts for nitrification processes which would reduce the ammonia load from the plant effluent to the Delisle River.

Using the measured water quality data from our sampling events, measured plant and Delisle River flows for the days of sampling (Appendix D) HESL modelled downstream ammonia concentrations for each sampling event (Table 12; Appendix D). These results were compared to the ammonia concentrations measured at Alex 5, located 1.1 km downstream.

Overall, there is good agreement between the measured and modelled values, with the model underestimating the ammonia concentrations at the Alex 5 site by 0.008 mg/L or 6% where the calculations accounted for nitrification within the Pilot Drain ("Pilot Drain Values", Table 12), In contrast, the model overestimated ammonia concentrations at the Alex 5 site by 0.02 mg/L or 12% if the calculations did not account for nitrification ("Plant Effluent Values", Table 12).

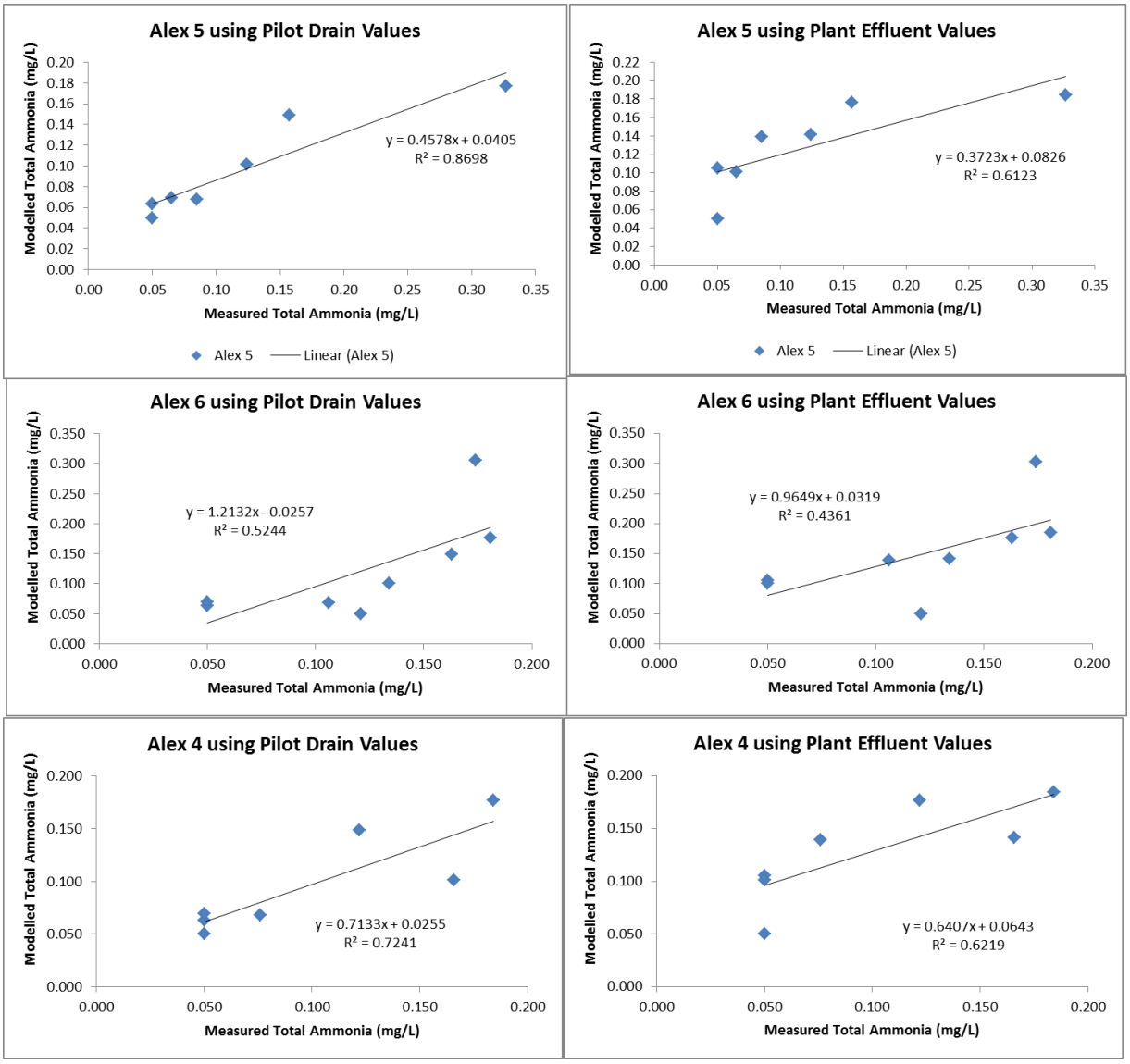
Table 12 Comparison of Measured and Modelled Ammonia Concentrations in the Delisle River

		Pilot Drain Values			Plant Effluent Values		
Date	**Measured Alex 5**	**Modelled Alex 5**	**Difference (mg/L)**	**Difference (%)**	**Modelled Alex 5**	**Difference (mg/L)**	**Difference (%)**
25-Nov-12	no data						
29-Apr-13	0.157	0.149	-0.008	-6	0.177	0.020	11
4-Jun-13	0.124	0.101	-0.023	-23	0.141	0.017	12
26-Jun-13	0.327	0.177	-0.150	-85	0.184	-0.143	-77
24-Jul-13	0.085	0.068	-0.017	-26	0.139	0.054	39
1-Aug-13	0.050	0.063	0.013	21	0.105	0.055	53
19-Sep-13	0.050	0.050	0.000	0	0.050	0.000	0
16-Oct-13	0.065	0.069	0.004	6	0.101	0.036	36
Median			**-0.008**	**-6**		**0.020**	**12**

Notes: Samples were not collected from Alex 5 during the November 2012 sampling event. Full data Tables are provided in Appendix D.

A scatter plot of measured versus modelled ammonia concentrations were prepared for the Pilot Drain and the plant effluent models for Alex 5 and the other two downstream stations (Alex 4 and Alex 6). There was better agreement between the values when the Pilot Drain ammonia values were used, and a weaker agreement when the plant effluent ammonia values were used for all stations. These results confirm our initial assessment (HESL October 2012) that *"…the [AECOM] model overestimates total ammonia concentrations in April, May and June and un-ionized ammonia in most months (Table 12). This outcome likely reflects the mass balance approach taken which treats ammonia as a conservative parameter and does not account for nitrification processes in the river, or to the temperature/pH combinations used to estimate un-ionized ammonia."* The current results support the need to account for nitrification in the Pilot Drain when modelling the influence of the Alexandria Sewage Works on total ammonia concentrations in the Delisle River, correct for the overestimation of ammonia in the river reported by AECOM (2012) and bring further confidence to our ammonia effluent limits.

Figure 12 Scatter plot of measured vs predicted Total Ammonia concentrations in the Delisle River using Pilot Drain (left panels) and Plant Effluent (right panel) values.



4.4 Total Phosphorus Effluent Limits

The current effluent limit for total phosphorus for the Alexandria lagoons is a monthly average of 0.5 mg/L. In 2013 the annual average total phosphorus concentration of the Alexandria Effluent was 0.19 mg/L (Table 13).

Table 13 Performance Metrics for Alexandria Lagoon in 2013.

	Total Flows	Average Daily Flow	Maximum Daily Flow	cBOD5	TSS	TP	TAN	TKN	Nitrate	E. coli	pH	Temp	Cl_2
Month	(m^3)	(m^3)	(m^3)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	%		°C	mg/L
Jan	135,619	4,374	9,007	8.0	7.8	0.28	7.16	9.44	0.28	6	7.39	3.5	0.01
Feb	106,923	3,818	6,085	16.3	17.8	0.43	7.35	10.85	0.23	2	7.21	2.0	0.01
Mar	181,048	5,840	12,887	14.5	15.8	0.37	6.51	10.21	0.15	2	7.09	4.1	0.01
Apr	260,673	8689	13888	5.8	8.4	0.19	3.35	5.49	0.72	107	7.78	6.9	0.01
May	105,537	3404	5616	4.5	5.3	0.21	3.89	6.03	0.38	5	7.51	17.8	0.01
Jun	205,832	6861	14565	3.0	3.0	0.21	3.16	4.00	0.78	2	7.25	20.9	0.02
Jul	108,897	3512	6349	3.0	3.0	0.08	0.52	2.05	0.94	2	7.22	24.4	0.01
Aug	67,520	2178	2908	3.0	3.0	0.09	1.41	3.09	0.70	2	7.23	22.8	0.01
Sep	90,578	3019	7100	3.0	3.0	0.05	0.30	1.44	1.44	3	7.26	17.9	0.01
Oct	82,044	2646	4688	3.0	3.0	0.08	0.72	2.12	1.38	2	7.35	13.1	0.01
Nov	121,189	4039	7227	3.2	3.2	0.11	3.05	5.02	1.65	2	7.29	7.2	0.01
Dec	82,420	2658	3867	5.4	8.6	0.23	7.77	10.23	0.68	3	7.17	2.4	0.01
Total	1,548,280												
Average		4253		6.1	6.8	0.19	3.77	5.83	0.78	12	7.62	13.06	0.01
Minimum				3.0	3.0	0.05	0.30	1.44	0.15	2			
Maximum			14565	16.25	17.8	0.43	7.77	10.85	1.65	107	8.68	26.80	0.02
Criteria		3237		30	40	0.50					6.0 - 9.5		0.02

The Township of North Glengarry has requested that HESL review the total phosphorus effluent limit under the rerated capacity of 5,500 m^3/d.

The Delisle River is Policy 2 for total phosphorus, in that the 75th percentile concentration (0.040 mg/L) exceeds the Provincial Water Quality Objective (PWQO; MOE 1999) of 0.03 mg/L. MOE's Procedure B-1-5, Deriving Receiving–Water based, Point-Source Effluent Requirements for Ontario Waters (MOE 1994) states:

> *In areas with water quality not meeting the PWQO for a specific contaminant (Policy 2), no further degradation of water quality will be allowed for that contaminant. All reasonable and practical measures to improve water quality shall be undertaken…Expansion of existing discharges to Policy 2 receivers will only be permitted if the concentration and total load of the Policy 2 contaminate (in this case TP) to the receiving stream is not increased.*

It is possible to attain a Directors Deviation from Policy 2 for a specific parameter; however this is subject to approval of the MOE.

According to MOE policy, total phosphorus concentrations in the Delisle River downstream of the Alexandria lagoon outfall plant effluent should not be further degraded. Results of our field investigations and PWQMN data for the same period of 2012-2013 found that there was no significant increase in total phosphorus concentrations downstream at the far field site (Alex 6), compared with upstream values (Section 3.2.1, Table 5).

A mass balance loading analysis was used to estimate total phosphorus limits that will result in no change from existing upstream water quality under the proposed flow rate of 5,500 m^3/d.

Upstream loads in the Delisle River were estimated using the long-term monitoring data from the PWQMN station located at McCormick Road (12008600202). The 75th percentile total phosphorus concentration of 0.040 mg/L was multiplied by the $7Q_{20}$ of 112.5 L/s. Loads from the Alexandria plant were estimated using the proposed flow of 5,500 m^3/d (63.7 L/s) and solving the total phosphorus

concentration required to meet 0.04 mg/L in the Delisle River downstream. Under this scenario, an effluent limit of 0.041 mg/L total phosphorus would be required to maintain existing total phosphorus concentrations in the Delisle River (Table 14).

Table 14 Mass Balance Model of Phosphorus in the Delisle River: proposed discharge of 5,500m^3/d (63.7 L/s).

Model Component		Annual
Delisle Upstream	75% TP (mg/L)	0.040
	7Q20 Flow (L/s)	112.5
	Load (mg/s)	4.5
Effluent	Effluent TP (mg/L)	0.04
	Effluent Flow (L/s)	63.7
	Pilot Drain Load (mg/s)	2.6
Delisle Downstream	Total Load in Delisle River (mg/s)	7.1
	Total Flow in Delisle River (L/s)	176.2
	Predicted TP in Delisle River (mg/L)	0.040

The current ECA provides for a monthly average total phosphorus effluent limit of 0.5 mg/L. The discharge of currently permitted effluent volumes at 0.5 mg/L would clearly result in some degradation of downstream water quality, based on the above calculations and we assume that this was acknowledged in the existing ECA. The proposed increase in flow from 3,237 m^3/d to 5,500 m^3/d could be achieved by a proportional reduction in the phosphorus limit to 0.3 mg/L. This would maintain the currently permitted loadings into the Delisle River but could cause a measurable increase from current total phosphorus concentrations.

Phosphorus offsets could be used to reduce other phosphorus loads to the River, under the direction of MOE, allowing discharge under the current effluent concentration limit, or to offset the currently permitted loads into a Policy 2 receiver.

5. Conclusions and Recommendations

A field monitoring program of the Delisle River and Alexandria effluent discharge was carried out between November 2012 and October 2013 and the results used to characterise water quality and benthic invertebrates in the river and to inform additional assimilation modelling of the Alexandria discharge. The results of this study, in combination with the AECOM report, will be used in support of the re-rating requirements of the ECA.

Our analysis produced the following conclusions and recommendations:

5.1 Conclusions

1. Nitrification of the Alexandria effluent occurs as it flows through the Pilot Drain reducing the loading of ammonia to the Delisle River.

2. The Pilot Drain acts as a source of TSS to the Delisle River during high flow conditions due to runoff from the surrounding catchment.

3. Results of the field investigations found that there was no significant increase in total phosphorus concentrations in the Delisle River downstream in the far field (Alex 6). Our results are consistent with the PWQMN total phosphorus results for the same period. The 2013 results differ from the long-term (2000 to 2013) total phosphorus measurements from the PWQMN stations in the Delisle River that do show an increase in total phosphorus concentrations downstream but the reasons for the difference are not known at this time.

4. Total ammonia concentrations measured in the Delisle River downstream (Alex 6) were higher than those measured upstream of the Alexandria WWTP discharge. Un-ionized ammonia concentrations were below the PWQO in the Delisle River at all sites during every sampling event, indicating that the elevated concentrations were not harmful to aquatic life.

5. During the field investigation concentrations of TSS, TKN, nitrate, and cBOD in the Delisle River showed no difference at the far field site (Alex 6) compared to the measured upstream concentrations (Alex 1).

6. Diurnal dissolved oxygen concentrations were similar at the upstream and downstream stations, indicating that plant respiration causing anoxic conditions does not contribute to an increase in phosphorus in the river downstream of the plant discharge.

7. Benthic investigation found no substantial difference in community composition upstream and downstream of the plant effluent discharge. In fact, the community composition downstream at the far field site, Alex 6, indicated better benthic habitat and subsequently better water quality conditions than at the reference site.

8. $7Q_{20}$ Flow statistics of 85.6 L/s for May to October and 285.6 L/s for November to April were calculated for the Delisle River upstream of the Alexandria plant effluent and used in a mass balance model of effluent loadings.

9. A mass balance loading analysis was used to estimate total ammonia and total phosphorus effluent limits under the proposed flow rate of 5,500 m^3/d.

10. Total Ammonia effluent limits of 1 mg/L and 3 mg/L for May to October (spring/summer) and November to April (fall/winter) will meet PWQO under a proposed flow rate 5,500 m^3/d.

11. A total phosphorus effluent limit of 0.04 mg/L is necessary to maintain existing upstream water quality in the Delisle River under a proposed flow rate 5,500 m^3/d. The current total phosphorus effluent limit for the Alexandria lagoons is a monthly average of 0.5 mg/L. It is MOE policy (B-1-

5) that no further degradation of water quality will be allowed for total phosphorus. Under this scenario, the proposed increase in flow from 3,237 m^3/d to 5,500 m^3/d would relate to a proportional reduction in the phosphorus limit to 0.3 mg/L to maintain existing loadings into the Delisle River.

5.2 Recommendations

1. An annual surface water sampling program should be initiated for the Delisle River to confirm the assessments made from the 2013 program and the predictions made for the expanded discharge. Four events (2 during summer low flow dry conditions and 2 in late fall/winter conditions) should be conducted. During each sampling event water quality samples should be collected from Alex 1, Alex 2, Alex 3, Alex 6, the effluent at the point of discharge and where the Pilot Drain meets the river to confirm nitrification and assimilation processes. Samples should be analysed for TP, TSS, total ammonia, and nitrate. Field measurements of temperature, conductivity, pH and dissolved oxygen should be collected at each station.

2. Annual memoranda should be prepared to summarize the results from the year's sampling events, and to update results to previous years. Results should be reviewed after two years and the sampling program reduced to every two years thereafter, if the results warrant.

3. The Township of North Glengarry should continue to consider alternative methods for reducing phosphorus and ammonia loadings to the Delisle River. Discussions between the municipality, MOE and the Conservation Authority regarding phosphorus offsets, and redirection of plant effluent may reduce the need for additional treatment.

6. References

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Appendix A. Water Chemistry and Statistical Analysis Results

Table A1. Delisle River Water Quality Sampling Results (November 2012 to October 2013)

		Sample ID	ALEX 1	Effluent	ALEX 2	ALEX 3	Alex 6	ALEX 1	EFFLUENT	ALEX 2	ALEX 3
	PWQO	Date	25/11/2012	25/11/2012	25/11/2012	25/11/2012	25/11/2012	4/29/2013	4/29/2013	4/29/2013	4/29/2013
Field Parameters											
pH			8.5			8.51	8.43	7.86	7.6	7.66	7.76
Temperature			0.36			0.35	0.8	13.7	13.7	14.7	13.9
Dissolved Oxygen			20.5			15.7	15.9	10.51	8.95	8.95	9.93
Laboratory Analyses											
Total Suspended Solids			5.6	2	24	9.6	9.2	6.8	6	28	12.8
Ammonia, Total (as N)			0.085	2.12	2.15	0.242	0.174	0.073	3	2.21	0.256
Un-ionized Ammonia (as N)	0.0164							0.0013	0.0289	0.0263	0.0036
Nitrate-N (NO3-N)	3		0.9300	1.3500	1.7200	0.9700	1.0300	0.5	0.46	0.59	0.49
Total Kjeldahl Nitrogen			0.75	4.5	3.22	0.89	0.8	0.75	4.53	3.52	1.09
Total Phosphorus	0.03		0.02855	0.1479	0.1761	0.0523	0.0359	0.0224	0.137	0.134	0.183
BOD			<2.0	2	<2.0	<2.0	<2.0	<2.0	4.2	4.7	<2.0

Table A1. Delisle River Water Quality Sampling Results (November 2012 to October 2013)

		Sample ID	ALEX 4	ALEX 5	ALEX 6	ALEX 1	EFFLUENT	ALEX 2	ALEX 3	ALEX 4	ALEX 5
	PWQO	Date	4/29/2013	4/29/2013	4/29/2013	41370	41370	41370	41370	41370	41370
Field Parameters											
pH			7.67	7.68	7.6	7.6	7.48	7.37	7.5	7.37	7.48
Temperature			13.6	12.5	12.5	17.9	17.1	18.7	18.3	17.5	17.1
Dissolved Oxygen			9.59	8.9	8.95	9.18	8.56	6.76	8.44	8.62	8.56
Laboratory Analyses											
Total Suspended Solids			15.2	11.6	9.6	5.4	12.8	33.2	10.6	7.4	9.2
Ammonia, Total (as N)			0.122	0.157	0.163	<0.050	5.98	3.38	0.271	0.166	0.124
Un-ionized Ammonia (as N)	0.0164		0.00136801	0.00165661	0.00143311	0.00065862	0.05651	0.0279559	0.002927956	0.0012569	0.0011718
Nitrate-N (NO3-N)	3		0.57	0.58	0.47	0.81	0.17	1.8300	0.8600	0.8500	0.9800
Total Kjeldahl Nitrogen			0.5700	0.7300	0.8400	0.8600	6.4000	4.23	1.18	1.08	0.9
Total Phosphorus	0.03		0.0343	0.035	0.0348	0.0351	0.331	0.276	0.0479	0.0395	0.0443
BOD			<2.0	<2.0	<2.0	<2.0	3.7	8.1	<2.0	<2.0	<2.0

Table A1. Delisle River Water Quality Sampling Results (November 2012 to October 2013)

		Sample ID	ALEX 6	ALEX 1	EFFLUENT	ALEX 2	ALEX 3	ALEX 4	ALEX 5	ALEX 6	ALEX 1	EFFLUENT
	PWQO	Date	06/04/2013	6/26/2013	6/26/2013	6/26/2013	6/26/2013	6/26/2013	6/26/2013	6/26/2013	7/24/2013	7/24/2013
Field Parameters												
pH			7.48	7.35	7.32	7.28	7.23	7.29	7.27	7.25	7.54	7.19
Temperature			17.1	21.1	24.1	22.3	21.8	21.2	21.4	21.5	22.2	23.4
Dissolved Oxygen			8.56	7.05	5.87	5.6	5.62	6.52	6.21	6.22	5.92	6.17
Laboratory												
Total Suspended Solids			8.6	6.8	1.2	31.2	9.6	9	11.2	13.6	7.4	3.4
Ammonia, Total (as N)			0.134	0.173	0.971	0.437	0.162	0.184	0.327	0.181	0.052	1.09
Un-ionized A	0.0164		0.0013	0.0016	0.0106	0.0038	0.0012	0.0015	0.0026	0.0014	0.0008	0.0084
Nitrate-N (N	3		1.03	1.62	1.24	2.6	1.73	1.62	1.71	1.67	0.29	0.44
Total Kjeldahl Nitrogen			0.91	0.89	1.99	1.26	1	0.99	1.1	0.95	0.87	2.33
Total Phosp	0.03		0.0419	0.0242	0.0754	0.0932	0.0349	0.0262	0.0355	0.0356	0.0579	0.0731
BOD			<2.0	<2.0	2.1	2.9	<2.0	<2.0	<2.0	<2.0	<2.0	3.3

Table A1. Delisle River Water Quality Sampling Results (November 2012 to October 2013)

		Sample ID	ALEX 2	ALEX 3	ALEX 4	ALEX 5	ALEX 6	ALEX1	EFFLUENT	ALEX2	ALEX3	ALEX4
	PWQO	Date	7/24/2013	7/24/2013	7/24/2013	7/24/2013	7/24/2013	08/01/2013	08/01/2013	08/01/2013	08/01/2013	08/01/2013
Field Parameters												
pH			7.3	7.04	7.3	7.45	7.4	no data	no data	no data	no data	no data
Temperature			21.9	21.1	22	21.7	22.7	no data	no data	no data	no data	no data
Dissolved Oxygen			5.43	6.25	4.81	5.03	5.76	no data	no data	no data	no data	no data
Laboratory												
Total Suspended Solids			5.8	7.6	6	11.4	9.2	10.7	4.57	11	9	8
Ammonia, Total (as N)			0.239	0.054	0.076	0.085	0.106	0.061	0.858	0.101	0.085	<0.050
Un-ionized A	0.0164		0.0021	0.0002	0.0007	0.0010	0.0013					
Nitrate-N (N	3		1.1	0.36	0.36	0.43	0.48	<0.10	0.45	1.32	0.19	0.13
Total Kjeldahl Nitrogen			1.21	0.89	1.01	0.9	0.89	0.84	2.56	0.98	0.77	0.69
Total Phosp	0.03		0.0562	0.0526	0.0605	0.0572	0.038	0.0517	0.108	0.0957	0.0454	0.0578
BOD			2.6	<2.0	<2.0	<2.0	<2.0	<2.0	4.1	<2.0	<2.0	<2.0

Table A1. Delisle River Water Quality Sampling Results (November 2012 to October 2013)

		Sample ID	ALEX5	ALEX6	ALEX 1	EFFLUENT	ALEX 2	ALEX 3	ALEX 4	ALEX 5	ALEX 6	ALEX 1
	PWQO	Date	08/01/2013	08/01/2013	9/19/2013	9/19/2013	9/19/2013	9/19/2013	9/19/2013	9/19/2013	9/19/2013	10/16/2013
Field Parameters												
pH			7.48	7.25	7.64	7.28	7.46	7.43	7.34	7.51	7.46	7.47
Temperature			23.8	23.6	15.6	16.3	16.6	15.3	15.5	15.3	15.9	14
Dissolved Oxygen			no data	no data	9.47	8.35	8.42	8.93	7.71	8.59	9.43	7.46
Laboratory												
Total Suspended Solids			10	7.2	4.3	<2.0	3.6	6.3	5.9	4.6	4.6	4.3
Ammonia, Total (as N)			<0.050	<0.050	<0.050	<0.050	0.05	<0.050	<0.050	<0.050	0.121	0.053
Un-ionized A	0.0164				0.0006	0.0003	0.0004	0.0004	0.0003	0.0004	0.0010	0.0004
Nitrate-N (N	3		0.1	<0.10	0.77	1.66	1.52	0.92	0.91	0.82	0.78	0.5
Total Kjeldahl Nitrogen			0.72	0.72	0.81	0.98	1.17	0.98	0.86	0.75	0.9	0.8
Total Phospl	0.03		0.0528	0.0363	0.0265	0.045	0.0421	0.0355	0.032	0.0291	0.0298	0.0252
BOD			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

Table A1. Delisle River Water Quality Sampling Results (November 2012 to October 2013)

		Sample ID	EFFLUENT	ALEX 2	ALEX 3	ALEX 4	ALEX 5	ALEX 6
	PWQO	Date	10/16/2013	10/16/2013	10/16/2013	10/16/2013	10/16/2013	10/16/2013
Field Parameters								
pH			7.44	7.25	7.48	7.54	7.35	7.35
Temperature			15	14.6	14	13.7	13.9	14.1
Dissolved Oxygen			8.33	7.26	6.68	6.79	7.8	8.1
Laboratory								
Total Suspended Solids			2.9	9.4	6.3	7.5	8.3	8.4
Ammonia, Total (as N)			0.302	0.137	0.062	<0.050	0.065	<0.050
Un-ionized A	0.0164		0.0022	0.0006	0.0005	0.0004	0.0004	0.0003
Nitrate-N (N	3		1.45	1.53	0.67	0.6	0.55	0.52
Total Kjeldahl Nitrogen			1.33	1.04	0.72	0.76	0.82	0.66
Total Phosp	0.03		0.102	0.0651	0.0415	0.0295	0.0477	0.0416
BOD			4.1	2.1	<2.0	<2.0	<2.0	8.8

Total Phosphorus (mg/L)

t-Test: Paired Two Sample for Means

	Alex1	*Alex6*	
Mean	0.03394375	0.0367375	
Variance	0.000182811	1.5137E-05	
Observations	8	8	
Pearson Correlation	0.205135293		
Hypothesized Mean Difference	0		
df	7		
t Stat	-0.595011101		
P(T<=t) one-tail	0.285280882		
t Critical one-tail	1.894578605		
P(T<=t) two-tail	0.570561764	no difference	
t Critical two-tail	2.364624252		

Total Suspended Solids (mg/L)

t-Test: Paired Two Sample for Means

	Alex1	*Alex6*	
Mean	6.4125	8.8	
Variance	4.324107143	6.342857143	
Observations	8	8	
Pearson Correlation	0.144572983		
Hypothesized Mean Difference	0		
df	7		
t Stat	-2.232103191		
P(T<=t) one-tail	0.030390975		
t Critical one-tail	1.894578605		
P(T<=t) two-tail	0.060781949		
t Critical two-tail	2.364624252	no difference	

Ammonia as N

t-Test: Paired Two Sample for Means

	Alex1	*Alex6*	
Mean	0.074625	0.122375	
Variance	0.001737982	0.002661982	
Observations	8	8	
Pearson Correlation	0.591514673		
Hypothesized Mean Difference	0		
df	7		
t Stat	-3.135484146		
P(T<=t) one-tail	0.008241432		
t Critical one-tail	1.894578605		
P(T<=t) two-tail	0.016482864	difference	
t Critical two-tail	2.364624252		

Ammonia as N

t-Test: Paired Two Sample for Means

	Alex1	*Alex6*	
Mean	0.074625	0.122375	
Variance	0.001737982	0.002661982	
Observations	8	8	
Pearson Correlation	0.591514673		
Hypothesized Mean Difference	0		
df	7		
t Stat	-3.135484146		
P(T<=t) one-tail	0.008241432		
t Critical one-tail	1.894578605		
P(T<=t) two-tail	0.016482864	difference	
t Critical two-tail	2.364624252		

Ammonia as N

t-Test: Paired Two Sample for Means

	Alex3	*Alex6*	
Mean	0.14775	0.122375	
Variance	0.009375643	0.002661982	
Observations	8	8	
Pearson Correlation	0.684828323		
Hypothesized Mean Difference	0		
df	7		
t Stat	0.995756256		
P(T<=t) one-tail	0.176268071		
t Critical one-tail	1.894578605		
P(T<=t) two-tail	0.352536142		
t Critical two-tail	2.364624252	no difference	

Ammonia as N

t-Test: Paired Two Sample for Means

	Alex5	*Alex6*	
Mean	0.122571429	0.115	
Variance	0.009706286	0.002598	
Observations	7	7	
Pearson Correlation	0.781085166		
Hypothesized Mean Difference	0		
df	6		
t Stat	0.299970101		
P(T<=t) one-tail	0.387160473		
t Critical one-tail	1.943180281		
P(T<=t) two-tail	0.774320946	no difference	
t Critical two-tail	2.446911851		

Ammonia as N

Ammonia (Alex 3 to Alex 6)
Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Alex3	8	1.182	0.14775	0.009375643
Alex4	7	0.698	0.099714286	0.003328571
Alex5	7	0.858	0.122571429	0.009706286
Alex6	8	0.979	0.122375	0.002661982

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.008676182	3	0.002892061	0.462807985	0.710673	2.975154
Within Groups	0.162472518	26	0.006248943			
Total	0.1711487	29				

Nitrate as N

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Alex3	8	6.25	0.78125	0.230241071
Alex4	7	5.04	0.72	0.2296
Alex5	7	5.17	0.738571429	0.262047619
Alex6	8	6.4	0.8	0.270342857

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.030706786	3	0.010235595	0.041234363	0.988578	2.975154
Within Groups	6.453973214	26	0.248229739			
Total	6.48468	29				

Nitrate as N

t-Test: Paired Two Sample for Means

	Alex1	*Alex6*	
Mean	0.69	0.8	
Variance	0.217657143	0.270342857	
Observations	8	8	
Pearson Correlation	0.956409923		
Hypothesized Mean Diffe	0		
df	7		
t Stat	-2.008316044		
P(T<=t) one-tail	0.042287792		
t Critical one-tail	1.894578605		
P(T<=t) two-tail	0.084575584		
t Critical two-tail	2.364624252	There is no significant difference	

TKN

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Alex3	8	7.43	0.92875	0.026241071
Alex4	7	5.96	0.851428571	0.035047619
Alex5	7	5.92	0.845714286	0.018261905
Alex6	8	10.37	1.29625	1.685741071

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1.060454524	3	0.353484841	0.746977077	0.533926	2.975154
Within Groups	12.30373214	26	0.473220467			
Total	13.36418667	29				

TKN

t-Test: Paired Two Sample for Means

	Alex1	*Alex6*	
Mean	0.82125	1.29625	
Variance	0.0028125	1.685741071	
Observations	8	8	
Pearson Correlation	-0.512793887		
Hypothesized Mean Diffe	0		
df	7		
t Stat	-1.012941867		
P(T<=t) one-tail	0.172406555		
t Critical one-tail	1.894578605		
P(T<=t) two-tail	0.34481311		
t Critical two-tail	2.364624252	There is no significant difference	

Appendix B. Benthic Macroinvertebrate Taxonomic Data

	Sample	HESL Alex 1 J120065	HESL Alex 3 J120065	HESL ALEX 5 J120065	HESL Alex 6 J120065
	Date Sampled	01-Aug-13	01-Aug-13	01-Aug-13	01-Aug-13
	Percentage Picked	10%	17%	5%	4.00%
ORDER (other)	FAMILY				
Ephemeroptera	Caenidae	66	28	16	5
	Ephermeridae	1	-	1	-
	Heptageniidae	3	-	1	2
	Baetidae	36	4	3	285
	Leptohyphidae	-	-	-	1
Plecoptera		-	-	-	-
Trichopera	Hydroptilidae	30	3	11	12
	Leptoceridae	1	3	-	11
	Polycentropodidae	3	4	-	-
	Hydropsychidae	6	-	-	240
	Philopotamidae	-	-	-	7
	Brachycentridae	2	-	-	2
Odonata	Coengrionidae	6	27	26	1
	Libellulidae	-	-	-	-
	Corduliidae	-	-	-	-
	Aeshnidae	-	1	-	-
Megaloptera	Sialidae	-	-	1	-
Hemiptera	Veliidae	-	-	3	-
	Corixidae	-	25	18	-
	Gerridae	-	3	1	1
	Pleidae	-	-	2	-
	Mesoveliidae	2	-	1	-
Coleoptera	Elmidae	27	16	55	20
	Haliplidae	-	-	1	-
	Hydrophilibae	-	1	1	1
	Chrysomelidae	-	-	-	-
Lepidoptera	Crambidae	-	1	2	-
Isopoda	Asellidae	8	7	25	6
Amphipoda	Hyallelidae	21	51	99	1
	Gammaridae	1	-	-	1
	Crangonyctidae	9	-	-	-
Gastropoda	Ancylidae	2	-	4	-
	Valvatidae	6	12	23	1
	Physidae	1	2	3	-
	Planorbidae	-	-	2	-
	Lymnaeidae	-	-	-	-
Diptera	Chironomidae	535	129	74	271
	Ceratopogonidae	11	9	4	1
	Tabanidae	1	-	1	-
	Chaoboridae	-	-	-	-
	Simulidae	7	-	-	394
	Empididae	24	-	-	2
	Culicidae	-	2	-	-
	Ephydridae	-	1	-	-
Tricladia		5	5	14	10
Trombidiformes	Arrenuridae	-	6	4	-
	limnesiidae	-	2	3	-
	Unionicolidae	-	-	2	-
	Mideopsidae	1	1	7	-
	Pionidae	-	-	1	-
	Hydrodromidae	-	2	2	1
	Oxidae	-	-	-	-
	Libertiidae	-	-	-	-
	Torrenticolidae	-	-	-	1
	Sperchontidae	3	-	-	-
	Hygrobatidae	2	-	-	-
	unknown nymph sp.	-	4	-	-
Hirudinae	Glossiphoniidae	-	-	-	-
Mollusca	Sphaeriidae	1	2	3	7
Sarcoptiformes	Hydrozetidae	-	-	1	-
Oligochaetes (subclass)		2	6	11	3
Nemata (Phylum)		2	-	-	-
Nematomorpha (Phylum)		1	-	-	-
Anthoathecata	Hydridae	-	1	-	-
Total		826	357	426	1287

Appendix C. $7Q_{20}$ Flow Statistics

Spring Summer				
	Stream Indicator		Flow	Flow
		% VALUE	m3/s	L/s
	7Q2	50	0.47650236	476.502364
	7Q5	80	0.17821857	178.218571
	7Q10	90	0.12882083	128.820825
	7Q20	95	0.09619529	96.1952857
	7Q50	98	0.07893731	78.9373143
	7Q100	99	0.05486314	54.8631429
	Average		1.26663328	1266.63328
prorating	Area	7Q20		7Q2
US	142.6586	0.08563841	85.6384137	424.209007
DS	160.2445	0.09619529		476.502364
%	0.89025583			

Spring Summer				
	Stream Indicator		Flow	Flow
		% VALUE	m3/s	L/s
	7Q2	50	0.47650236	476.502364
	7Q5	80	0.17821857	178.218571
	7Q10	90	0.12882083	128.820825
	7Q20	95	0.09619529	96.1952857
	7Q50	98	0.07893731	78.9373143
	7Q100	99	0.05486314	54.8631429
	Average		1.26663328	1266.63328
prorating	Area	7Q20		7Q2
US	142.6586	0.08563841	85.6384137	424.209007
DS	160.2445	0.09619529		476.502364
%	0.89025583			

All Data					
	Stream Indicator		Flow	Flow	
		% VALUE	m3/s	L/s	
	7Q2	50	1.29184772	1291.84772	
	7Q5	80	0.29770714	297.707143	
	7Q10	90	0.17461365	174.613646	
	7Q20	95	0.12639583	126.395833	
	7Q50	98	0.09246526	92.4652606	
	7Q100	99	0.07960754	79.6075417	
	Average		2.64563696	2645.63696	
		7Q20		7Q2	
prorating	Area	m3/s	L/s	m3/s	L/s
DS	160.2445	0.12639583	126.395833	1.29184772	1291.84772
US	142.6586	0.11252463	112.524627	1.15007496	1150.07496
%	0.89025583				

Appendix D. Modelling Worksheets

Alex 5

Comparison of modelled and measured total ammonia concentrations - measured Pilot Drain ammonia values

	Delisle R. Upstream			Pilot Drain Loading			Delisle R. Downstream (Alex 5)					
	Flow	NH3	NH3 Load	Effluent Flow	Pilot Drain NH3	Pilot Drain Load	NH3 Load	Flow	Alex 5 NH3	Modelled NH3	Difference	
Date	L/s	mg/L	mg/s	L/s	mg/L	mg/s	mg/s	L/s	mg/L	mg/L	mg/L	%
25-Nov-12	232	0.085	20	27.8	2.2	60	80	260				
29-Apr-13	1841	0.073	134	67.5	2.2	149	284	1908	0.157	0.149	-0.008	-6
4-Jun-13	3822	0.050	191	59.6	3.4	201	393	3882	0.124	0.101	-0.023	-23
26-Jun-13	4109	0.173	711	59.9	0.4	26	737	4169	0.327	0.177	-0.150	-85
24-Jul-13	360	0.052	19	33.0	0.2	8	27	393	0.085	0.068	-0.017	-26
1-Aug-13	438	0.061	27	25.8	0.1	3	29	464	0.050	0.063	0.013	21
19-Sep-13	168	0.050	8	27.0	0.1	1	10	195	0.050	0.050	0.000	0
16-Oct-13	146	0.053	8	34.6	0.1	5	12	180	0.065	0.069	0.004	6
							Median				-0.008	-6

Alex 5

Comparison of modelled and measured total ammonia concentrations - measured plant effluent ammonia values

	Delisle R. Upstream			Plant Loading			Delisle R. Downstream (Alex 5)					
	Flow	NH3	NH3 Load	Effluent Flow	Effluent NH3	Effluent Load	Load	Flow	Alex 5 NH3	Modelled NH3	Difference	
Date	L/s	mg/L	mg/s	L/s	mg/L	mg/s	mg/s	L/s	mg/L	mg/L	mg/L	%
25-Nov-12	232	0.085	20	27.8	2.1	59	79	260				
29-Apr-13	1841	0.073	134	67.5	3.0	203	337	1908	0.157	0.177	0.020	11
4-Jun-13	3822	0.050	191	59.6	6.0	356	548	3882	0.124	0.141	0.017	12
26-Jun-13	4109	0.173	711	59.9	1.0	58	769	4169	0.327	0.184	-0.143	-77
24-Jul-13	360	0.052	19	33.0	1.1	36	55	393	0.085	0.139	0.054	39
1-Aug-13	438	0.061	27	25.8	0.9	22	49	464	0.050	0.105	0.055	53
19-Sep-13	168	0.050	8	27.0	0.1	1	10	195	0.050	0.050	0.000	0
16-Oct-13	146	0.053	8	34.6	0.3	10	18	180	0.065	0.101	0.036	36
							Median				0.020	12

Alex 6

Comparison of modelled and measured total ammonia concentrations - measured Pilot Drain ammonia values

	Delisle R. Upstream			Plant Load using Pilot Drain NH3 Values				Delisle R. Downstream (Alex 6)				
Date	Flow	Delisle NH3 Conc	Delisle Ammonia Load	Effluent Flow	Pilot Drain Conc	Pilot Drain Load	NH3 Load	Flow	Alex 6 Measured NH3 Conc	Modelled NH3 Conc	Difference	
	L/s	mg/L	mg/s	L/s	mg/L	mg/s	mg/s	L/s	mg/L	mg/L	mg/L	%
25-Nov-12	232	0.085	20	27.8	2.2	60	80	260	0.174	0.306	0.132	43
29-Apr-13	1841	0.073	134	67.5	2.2	149	284	1908	0.163	0.149	-0.014	-10
4-Jun-13	3822	0.050	191	59.6	3.4	201	393	3882	0.134	0.101	-0.033	-32
26-Jun-13	4109	0.173	711	59.9	0.4	26	737	4169	0.181	0.177	-0.004	-2
24-Jul-13	360	0.052	19	33.0	0.2	8	27	393	0.106	0.068	-0.038	-57
1-Aug-13	438	0.061	27	25.8	0.1	3	29	464	0.050	0.063	0.013	21
19-Sep-13	168	0.050	8	27.0	0.1	1	10	195	0.121	0.050	-0.071	-142
16-Oct-13	146	0.053	8	34.6	0.1	5	12	180	0.050	0.069	0.019	28
							Median				-0.009	-6

Alex 6

Comparison of modelled and measured total ammonia concentrations - measured plant effluent ammonia values

	Delisle R. Upstream			Plant Load using Effluent NH3 Values				Delisle R. Downstream (Alex 6)				
Date	Flow	Delisle NH3 Conc	Delisle Ammonia Load	Effluent Flow	Effluent NH3 Conc	Effluent Load	Load	Flow	Alex 6 Measured NH3 Conc	Modelled NH3 Conc	Difference	
	L/s	mg/L	mg/s	L/s	mg/L	mg/s	mg/s	L/s	mg/L	mg/L	mg/L	%
25-Nov-12	232	0.085	20	27.8	2.1	59	79	260.1	0.174	0.303	0.129	42
29-Apr-13	1841	0.073	134	67.5	3.0	203	337	1908.4	0.163	0.177	0.014	8
4-Jun-13	3822	0.050	191	59.6	6.0	356	548	3881.7	0.134	0.141	0.007	5
26-Jun-13	4109	0.173	711	59.9	1.0	58	769	4168.9	0.181	0.184	0.003	2
24-Jul-13	360	0.052	19	33.0	1.1	36	55	392.8	0.106	0.139	0.033	24
1-Aug-13	438	0.061	27	25.8	0.9	22	49	463.7	0.050	0.105	0.055	53
19-Sep-13	168	0.050	8	27.0	0.1	1	10	194.7	0.121	0.050	-0.071	-142
16-Oct-13	146	0.053	8	34.6	0.3	10	18	180.2	0.050	0.101	0.051	50
							Median				0.023	16

Alex 4

Comparison of modelled and measured total ammonia concentrations - measured Pilot Drain ammonia values

	Delisle R. Upstream			Plant Load using Pilot Drain NH3 Values				Delisle R. Downstream (Alex 4)				
Date	Flow	Delisle NH3 Conc	Delisle Ammonia Load	Effluent Flow	Pilot Drain Conc	Pilot Drain Load	NH3 Load	Flow	Alex 4 Measured NH3 Conc	Modelled NH3 Conc	Difference	
	L/s	mg/L	mg/s	L/s	mg/L	mg/s	mg/s	L/s	mg/L	mg/L	mg/L	%
25-Nov-12	232	0.085	20	27.8	2.2	60	80	260				
29-Apr-13	1841	0.073	134	67.5	2.2	149	284	1908	0.122	0.149	0.027	18
4-Jun-13	3822	0.050	191	59.6	3.4	201	393	3882	0.166	0.101	-0.065	-64
26-Jun-13	4109	0.173	711	59.9	0.4	26	737	4169	0.184	0.177	-0.007	-4
24-Jul-13	360	0.052	19	33.0	0.2	8	27	393	0.076	0.068	-0.008	-12
1-Aug-13	438	0.061	27	25.8	0.1	3	29	464	0.050	0.063	0.013	21
19-Sep-13	168	0.050	8	27.0	0.1	1	10	195	0.050	0.050	0.000	0
16-Oct-13	146	0.053	8	34.6	0.1	5	12	180	0.050	0.069	0.019	28
							Median				0.000	0

Alex 4

Comparison of modelled and measured total ammonia concentrations - measured plant effluent ammonia values

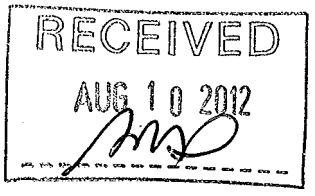
	Delisle R. Upstream			Plant Load using Effluent NH3 Values				Delisle R. Downstream (Alex 4)				
Date	Flow	Delisle NH3 Conc	Delisle Ammonia Load	Effluent Flow	Effluent NH3 Conc	Effluent Load	Load	Flow	Alex 4 Measured NH3 Conc	Modelled NH3 Conc	Difference	
	L/s	mg/L	mg/s	L/s	mg/L	mg/s	mg/s	L/s	mg/L	mg/L	mg/L	%
25-Nov-12	232	0.085	20	27.8	2.1	59	79	260.1				
29-Apr-13	1841	0.073	134	67.5	3.0	203	337	1908.4	0.122	0.177	0.055	31
4-Jun-13	3822	0.050	191	59.6	6.0	356	548	3881.7	0.166	0.141	-0.025	-18
26-Jun-13	4109	0.173	711	59.9	1.0	58	769	4168.9	0.184	0.184	0.000	0
24-Jul-13	360	0.052	19	33.0	1.1	36	55	392.8	0.076	0.139	0.063	45
1-Aug-13	438	0.061	27	25.8	0.9	22	49	463.7	0.050	0.105	0.055	53
19-Sep-13	168	0.050	8	27.0	0.1	1	10	194.7	0.050	0.050	0.000	0
16-Oct-13	146	0.053	8	34.6	0.3	10	18	180.2	0.050	0.101	0.051	50
							Median				0.051	31

APPENDIX B

MOECC AMENDED ENVIRONMENTAL COMPLIANCE APPROVAL

Ontario

Ministry of the Environment
Ministère de l'Environnement



AMENDED ENVIRONMENTAL COMPLIANCE APPROVAL

NUMBER 9324-8WKJD2
Issue Date: August 2, 2012

The Corporation of the Township of North Glengarry
90 Main St S
Post Office Box, No. 700
Alexandria, Ontario
K0C 1A0

Site Location: Alexandria Sewage Works
90 Main St South
North Glengarry Township, United Counties of Stormont, Dundas & Glengarry

You have applied under section 20.2 of Part II.1 of the Environmental Protection Act, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

the existing municipal sewage works serving the Town of Alexandria, for the collection, transmission, treatment and disposal of domestic sewage, with a sewage treatment facility having a *Rated Capacity* of 3,237 m^3/d, discharging to Deslie River and consisting of the following:

Trunk Sanitary Sewers

- sanitary sewer along Garry River Bed from 37 metres west of Dominion Street to Bishop Street, then along Bishop Street from the south side of the Garry River to 49 metres north of Centre Street, then along an easement from Bishop Street to the east town limit and then along an easement from the east town limit to the Sewage Pumping Station located on McCormick Road just southwest of the CNR;

Sanitary Sewage Forcemain

- a 450 mm diameter sanitary sewage forcemain along McCormick Road from the Sewage Pumping Station to the Lagoon Easement and then along the Lagoon Easement from McCormick Road to the Influent Structure of the Sewage Treatment Plant;

Sewage Treatment Facility

Influent Structure

- one (1) 4 m x 4 m x 8 m splitter chamber receiving raw sewage from the 450 mm diameter

forcemain and with two (2) 450 mm diameter discharge pipes, one to the Aeration Cell and the other to Cell A (bypass);

Aeration Cell

- one (1) aeration cell equipped with three (3) aerators, discharging to the facultative lagoon Cell C;

Facultative Lagoons

- three (3) facultative lagoon cells with interior berm faces lined with geotextile fabric and riprap, operating in series:

  Cell A with approximate area of 5.5 hectares;
  Cell B with approximate area of 5.2 hectares;
  Cell C with approximate area of 6.5 hectares;

- two (2) 525 mm diameter connection pipes, one between Cell A and Cell B and one between Cell B and Cell C;
- one (1) 500 mm diameter connection pipe from the outlet of Cell A to the chlorine contact chamber;

Phosphorus Removal System

- one (1) 50,000 L chemical storage tank;
- one (1) dosing pump rated at 18 L/h;
- one (1) dispersion chamber downstream of the aeration cell;

Disinfection

- one (1) 233.8 m^3 chlorine contact chamber with a multi-pass plug flow configuration and a baffle upstream of the flow meter;
- one (1) 18,000 L sodium hypochlorite storage tanks in a spill containment area and two (2) positive displacement chemical feed pumps (one standby);

Dechlorination

- one (1) 12.1 m^3 dechlorination contact chamber with a multi-pass plug flow configuration;
- one (1) ORP probe located at the dechlorination chamber outlet;
- two (2) 1,000 L sodium bisulphite storage totes or alternative dechlorination chemicals, such as calcium thiosulphate, sodium sulphite or sodium ascorbate storage totes in a spill containment area and two (2) positive displacement chemical feed pumps (one standby);

Effluent Flow Monitoring

- one (1) 1,2 m wide sharp crested weir equipped with an ultrasonic level detector in the channel between the chlorine contact chamber and the dechlorination contact chamber;

Outfall

- one (1) 500 mm diameter outfall pipe from the dechlorination contact chamber to the existing perimeter ditch and ultimately to Deslie River;

Sludge Dewatering

- a dewatering cell lined with non-woven material and impermeable liner, equipped with a series of Geotubes for dewatering of sludge from the lagoon cells;
- a sump fitted with a pump to collect and pump effluent back to the lagoons;

Sampling

- automatic samplers for collection of 24-hour composite samples of raw sewage at the influent structure, aerated lagoon effluent at the splitter chamber, and final effluent at the outlet structure of the dechlorination tank;

Miscellaneous

- all other controls, electrical equipment, instrumentation, piping, pumps, valves and appurtenances essential for the proper operation of the aforementioned sewage works;

all in accordance with the submitted documents listed in Schedule A.

For the purpose of this environmental compliance approval, the following definitions apply:

"Approval" means this entire document and any schedules attached to it, and the application;

"Average Daily Flow" means the cumulative total sewage flow to the sewage works during a calendar year divided by the number of days during which sewage was flowing to the sewage works that year;

"*BOD5* " (also known as $TBOD_5$) means five day biochemical oxygen demand measured in an unfiltered sample and includes carbonaceous and nitrogenous oxygen demand;

"By-pass" means any discharge from the Works that does not undergo any treatment or only receives partial treatment before it is discharged to the environment;

"*CBOD5* " means five day carbonaceous (nitrification inhibited) biochemical oxygen demand measured in an unfiltered sample;

"Daily Concentration" means the concentration of a contaminant in the effluent discharged over any single day, as measured by a composite or grab sample, whichever is required;

"Director" means a person appointed by the Minister pursuant to section 5 of the *EPA* for the purposes of Part II.1 of the *EPA;*

"District Manager" means the District Manager of the *Ministry's* Cornwall Office;

"EPA" means the Environmental Protection Act, R.S.O. 1990, c.E.19, as amended;

"E. Coli" refers to the thermally tolerant forms of Escherichia that can survive at 44.5 degrees Celsius;

"Geometric Mean Density" is the nth root of the product of multiplication of the results of n number of samples over the period specified;

"Ministry" means the ministry of the government of Ontario responsible for the *EPA* and *OWRA* and includes all officials, employees or other persons acting on its behalf;

"Monthly Average Concentration" means the arithmetic mean of all *Daily Concentrations* of a contaminant in the effluent sampled or measured, or both, during a calendar month;

"Owner" means The Corporation of the Township of North Glengarry and its successors and assignees;

"*OWRA* " means the Ontario Water Resources Act, R.S.O. 1990, c. O.40, as amended

"Rated Capacity" means the *Average Daily Flow* for which the Works are approved to handle;

"Regional Director" means the Regional Director of the Eastern Region of the *Ministry* ; and

"Works" means the sewage works described in the *Owner* 's application, and this *Approval.*

You are hereby notified that this environmental compliance approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL PROVISIONS

(1) The *Owner* shall ensure that any person authorized to carry out work on or operate any aspect of the *Works* is notified of this *Approval* and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.

(2) Except as otherwise provided by these conditions, the *Owner* shall design, build, install, operate and maintain the *Works* in accordance with the description given in this *Approval* , and the application for approval of the W*orks.*

(3) Where there is a conflict between a provision of any document in the schedule referred to in this

Approval and the conditions of this *Approval* , the Conditions in this *Approval* shall take precedence, and where there is a conflict between the documents in the schedule, the document bearing the most recent date shall prevail.

(4) Where there is a conflict between the documents listed in the Schedule submitted documents, and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.

(5) The Conditions of this *Approval* are severable. If any Condition of this *Approval* , or the application of any requirement of this *Approval* to any circumstance, is held invalid or unenforceable, the application of such condition to other circumstances and the remainder of this *Approval* shall not be affected thereby.

(6) The approval granted by this *Approval* is based upon a review of the *Works* in the context of its effect on the environment, its process performance and general principles of wastewater engineering. The review did not include a consideration of the architectural, mechanical, electrical or structural components and minor details of the *Works* except to the extent necessary to review the *Works* .

2. EXPIRY OF APPROVAL

This *Approval* will cease to apply to those parts of the *Works* which have not been constructed within five (5) years of the date of this *Approval* .

3. CHANGE OF OWNER

(1) The *Owner* shall notify the *District Manager* and the *Director* , in writing, of any of the following changes within 30 days of the change occurring:

(a) change of *Owner* ;

(b) change of address of the *Owner* ;

(c) change of partners where the *Owner* is or at any time becomes a partnership, and a copy of the most recent declaration filed under the Business Names Act, R.S.O. 1990, c.B17 shall be included in the notification to the *District Manager* ;

(d) change of name of the corporation where the *Owner* is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Information Act, R.S.O. 1990, c. C39 shall be included in the notification to the *District Manager* ;

(2) In the event of any change in ownership of the *Works* , other than a change to a successor municipality, the *Owner* shall notify in writing the succeeding owner of the existence of this *Approval* , and a copy of such notice shall be forwarded to the *District Manager* and the *Director* .

4. RECORD DRAWINGS

(1) A set of as-built drawings showing the works "as constructed" shall be prepared. These drawings shall be kept up to date through revisions undertaken from time to time and a copy shall be retained at the *Works* for the operational life of the *Works.*

5. BY-PASSES

(1) Any *By-pass* of sewage from any portion of the *Works* is prohibited, except where:

(a) it is necessary to avoid loss of life, personal injury, danger to public health or severe property damage;

(b) the *District Manager* agrees that it is necessary for the purpose of carrying out essential maintenance and the *District Manager* has given prior written acknowledgment of the *by-pass* ; or

(c) the *Regional Director* has given prior written acknowledgment of the *By-pass* .

(2) The *Owner* shall collect at least one grab sample of the *By-pass* and have it analyzed for the parameters listed in Table 6 using the protocols in Condition 9.

(3) The *Owner* shall maintain a logbook of all *By-pass* events which shall include, at a minimum, the time, location, duration, quantity of *By-pass* , the authority for *By-pass* pursuant to subsection (1), and the reasons for the occurrence.

6. EFFLUENT OBJECTIVES

(1) The *Owner* shall use best efforts to design, construct and operate the *Works* with the objective that the concentrations of the materials named below as effluent parameters are not exceeded in the effluent from the *Works* .

Table 1 - Effluent Objectives

Effluent Parameter	**Concentration Objective** (milligrams per litre unless otherwise indicated)
CBOD5	25
Total Suspended Solids	25
Total Phosphorus	0.4
Total Residual Chlorine	Non-detectable
E. Coli	150 organisms/100 mL Monthly *Geometric Mean Density*

(2) The *Owner* shall use best efforts to:

(a) maintain the pH of the effluent from the *Works* within the range of 6.5 - 9.0, inclusive, at all times;

(b) operate the works within the *Rated Capacity* of the *Works;*

(c) ensure that the effluent from the *Works* is essentially free of floating and settleable solids and does not contain oil or any other substance in amounts sufficient to create a visible film or sheen or foam or discolouration on the receiving waters;

(3) The *Owner* shall include in all reports submitted in accordance with Condition 10 a summary of the efforts made and results achieved under this Condition.

7. EFFLUENT LIMITS

(1) The *Owner* shall design and construct the *Works* and operate and maintain the *Works* such that the concentrations of the materials named below as effluent parameters are not exceeded in the effluent from the Sewage Treatment Facility.

Table 2 - Effluent Limits

Effluent Parameter	**Average Concentration** (milligrams per litre unless otherwise indicated)
Column 1	Column 2
CBOD5	30
Total Suspended Solids	40
Total Phosphorus	0.5
Total Residual Chlorine	0.02
pH of the effluent maintained between 6.0 to 9.5, inclusive, at all times	

(2) For the purposes of determining compliance with and enforcing subsection (1):

(a) The *Monthly Average Concentration* of a parameter named in Column 1 of Table 2 shall not exceed the corresponding maximum concentration set out in Column 2 of Table 2.

(b) The pH of the effluent shall be maintained within the limits outlined in Table 2, at all times.

(3) Notwithstanding subsection (1), the *Owner* shall operate and maintain the *Works* such that the effluent is continuously disinfected so that the monthly *Geometric Mean Density* of *E. Coli* does not exceed 200 organisms per 100 millilitres of effluent discharged from the *works* .

(4) The effluent requirements set out in this Condition shall apply upon issuance of this *Approval*

8. OPERATION AND MAINTENANCE

(1) The *Owner* shall exercise due diligence in ensuring that, at all times, the *Works* and the related

equipment and appurtenances used to achieve compliance with this *Approval* are properly operated and maintained. Proper operation and maintenance shall include effective performance, adequate funding, adequate operator staffing and training, including training in all procedures and other requirements of this *Approval* and the *Act* and regulations, adequate laboratory facilities, process controls and alarms and the use of process chemicals and other substances used in the *Works* .

(2) The *Owner* shall prepare an operations manual within six (6) months of *Substantial Completion* of the *Proposed Works* , that includes, but not necessarily limited to, the following information:

(a) operating procedures for routine operation of the *Works* ;

(b) inspection programs, including frequency of inspection, for the *Works* and the methods or tests employed to detect when maintenance is necessary;

(c) repair and maintenance programs, including the frequency of repair and maintenance for the *Works* ;

(d) procedures for the inspection and calibration of monitoring equipment;

(e) a spill prevention control and countermeasures plan, consisting of contingency plans and procedures for dealing with equipment breakdowns, potential spills and any other abnormal situations, including notification of the *District Manager* ; and

(f) procedures for receiving, responding and recording public complaints, including recording any followup actions taken.

(3) The *Owner* shall maintain the operations manual current and retain a copy at the location of the *Works* for the operational life of the *Works* . Upon request, the *Owner* shall make the manual available to *Ministry* staff.

(4) The *Owner* shall provide for the overall operation of the *Works* with an operator who holds a licence that is applicable to that type of facility and that is of the same class as or higher than the class of the facility in accordance with Ontario Regulation 129/04.

9. MONITORING AND RECORDING

The *Owner* shall carry out the following monitoring program:

(1) All samples and measurements taken for the purposes of this *Approval* are to be taken at a time and in a location characteristic of the quality and quantity of the effluent stream over the time period being monitored.

(2) For the purposes of this condition, the following definitions apply:

(a) Weekly means once each week;
(b) Biweekly means once every two weeks;
(c) Monthly means once every month;
(d) Annually means once every year.

(3) Samples shall be collected at the following sampling points, at the frequency specified, by means of the specified sample type and analyzed for each parameter listed and all results recorded:

Table 3 - Raw Sewage Monitoring		
Parameters	**Sample Type**	**Frequency**
BOD5	Composite	Monthly
Total Suspended Solids	Composite	Monthly
Total Phosphorus	Composite	Monthly
Total Kjeldahl Nitrogen	Composite	Monthly

Table 4 - Aerated Cell Effluent Monitoring		
Parameters	**Sample Type**	**Frequency**
CBOD5	Composite or Grab	Monthly
Total Suspended Solids	Composite or Grab	Monthly
Total Phosphorus	Composite or Grab	Monthly
Total Ammonia Nitrogen	Composite	Weekly
Nitrate	Composite	Weekly
Nitrite	Composite	Weekly
pH	Grab	Biweekly
Temperature	Grab	Weekly

Table 5 - Final Effluent Monitoring		
Parameters	**Sample Type**	**Frequency**
CBOD5	Composite	Weekly
Total Suspended Solids	Composite	Weekly
Total Phosphorus	Composite	Weekly
Total Ammonia Nitrogen	Composite	Weekly
Nitrate	Composite	Weekly
Nitrite	Composite	Weekly
E. Coli	Grab	Weekly
Total Residual Chlorine	Grab	Weekly
pH	Grab	Weekly
Temperature	Grab	Weekly

Table 6 - *By-pass* Monitoring		
Parameters	**Sample Type**	**Frequency**
BOD5	Grab	Every two hours
Total Suspended Solids	Grab	Every two hours
Total Phosphorus	Grab	Every two hours
E. Coli	Grab	Every two hours

(4) The *Owner* shall submit, within three (3) months of the issuance of this *Approval* , a plan on groundwater monitoring including number and location of wells for approval by the *District Manager* as indicated in Table 7.

(5) The *Owner* shall establish, within nine (9) months from the date of approval of the plan referenced in subsection (4), permanent groundwater monitoring well(s) down-gradient of the Alexandria Sewage Treatment Plant and collect samples at the frequency specified, by means of the specified sample type and analyzed for each parameter listed in Table 7 and all results recorded:

Table 7 - Groundwater Monitoring	
Frequency	Annually
Sample Type	Grab
Parameters	Total Organic Carbon, Total Phosphorus, Total Kjeldahl Nitrogen, Nitrite, Nitrate, *E. Coli*

(6) Upon the establishment of the groundwater monitoring well(s), background groundwater quality must be established by collecting one set of groundwater samples and having them analyzed for the parameters outlined in Table 7. Thereafter, groundwater quality must be monitored annually by collecting samples from the monitoring well(s) and having them analyzed for the parameters outlined in Table 7.

(7) The methods and protocols for sampling, analysis and recording shall conform, in order of precedence, to the methods and protocols specified in the following:

(a) the Ministry's Procedure F-10-1, "Procedures for Sampling and Analysis Requirements for Municipal and Private Sewage Treatment Works (Liquid Waste Streams Only), as amended from time to time by more recently published editions;

(b) the Ministry's publication "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater" (January 1999), ISBN 0-7778-1880-9, as amended from time to time by more recently published editions;

(c) the publication "Standard Methods for the Examination of Water and Wastewater" (21st edition), as amended from time to time by more recently published editions.

(8) The temperature and pH of the effluent from the *Works* shall be determined in the field at the time of sampling for Total Ammonia Nitrogen. The concentration of un-ionized ammonia shall be calculated using the total ammonia concentration, pH and temperature using the methodology stipulated in "Ontario's Provincial Water Quality Objectives" dated July 1994, as amended, for ammonia (un-ionized).

(9) The *Owner* shall install and maintain continuous flow measuring devices, to measure the flow rate of sewage to and effluent from the Alexandria Sewage Treatment Plant with an accuracy to within plus or minus 15 per cent (+/- 15%) of the actual flow rate for the entire design range of the flow measuring device, and record the flow rate at a daily frequency.

10. REPORTING

(1) Ten (10) days prior to the date of a planned *By-pass* being conducted pursuant to Condition 5 and as soon as possible for an unplanned *By-pass* , the *Owner* shall notify the *District Manager* (in writing) of the pending start date, in addition to an assessment of the potential adverse effects on the environment and the duration of the *By-pass* .

(2) The *Owner* shall report to the *District Manager* or designate, any exceedence of any parameter specified in Condition 7 orally, as soon as reasonably possible, and in writing within seven (7) days of the exceedence.

(3) In addition to the obligations under Part X of the Environmental Protection Act, the *Owner* shall, within 10 working days of the occurrence of any reportable spill as defined in Ontario Regulation 675/98, bypass or loss of any product, by-product, intermediate product, oil, solvent, waste material or any other polluting substance into the environment, submit a full written report of the occurrence to the *District Manager* describing the cause and discovery of the spill or loss, clean-up and recovery measures taken, preventative measures to be taken and schedule of implementation.

(4) The *Owner* shall, upon request, make all manuals, plans, records, data, procedures and supporting documentation available to *Ministry* staff.

(5) The *Owner* shall prepare, and submit to the *District Manager,* a performance report, on an annual basis, within ninety (90) days following the end of the period being reported upon. The first such report shall cover the first annual period following the commencement of operation of the *Works* and subsequent reports shall be submitted to cover successive annual periods following thereafter. The reports shall contain, but shall not be limited to, the following information:

(a) a summary and interpretation of all monitoring data and a comparison to the effluent limits outlined in Condition 7, including an overview of the success and adequacy of the *Works* ;

(b) a summary and interpretation of all groundwater monitoring data;

(c) a description of any operating problems encountered and corrective actions taken;

(d) a summary of all maintenance carried out on any major structure, equipment, apparatus, mechanism or thing forming part of the *Works* ;

(e) a summary of any effluent quality assurance or control measures undertaken in the reporting period;

(f) a summary of the calibration and maintenance carried out on all effluent monitoring equipment; and

(g) a description of efforts made and results achieved in meeting the Effluent Objectives of Condition 6.

(h) a tabulation of the volume of sludge generated in the reporting period, an outline of anticipated volumes to be generated in the next reporting period and a summary of the locations to where the sludge was disposed;

(i) a summary of any complaints received during the reporting period and any steps taken to address the complaints;

(j) a summary of all *By-pass* , spill or abnormal discharge events; and

(k) any other information the *District Manager* requires from time to time.

11 . FLOW MONITORING

(1) the *Owner* shall submit to the *Director* by September 30, 2012, either an application for re-rating the Alexandria Sewage Treatment Plant or a plan (with implementation timeline) to come into compliance with the existing *Rated Capacity* .

(2) the submission required in subsection (1) shall include the results of the assessment of the lagoons performance and receiving stream and confirmation that Alexandria Sewage Facility at the proposed *Rated Capacity* will have no adverse impact on the receiver.

(3) if the results of the assessment referenced in subsection (2) show that the Alexandria Sewage Facility at the proposed *Rated Capacity* have or will have adverse impacts on the receiver then the application for re-rating shall also include recommendations for additional treatment, the detailed engineering design and the timeline for the implementation.

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is imposed to ensure that the *Works* are built and operated in the manner in which they were described for review and upon which approval was granted. This condition is also included to emphasize the precedence of Conditions in the *Approval* and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review. The condition also advises

the Owners their responsibility to notify any person they authorized to carry out work pursuant to this *Approval* the existence of this *Approval* .

2. Condition 2 is included to ensure that the *Works* are constructed in a timely manner so that standards applicable at the time of Approval of the *Works* are still applicable at the time of construction, to ensure the ongoing protection of the environment.

3. Condition 3 is included to ensure that the *Ministry* records are kept accurate and current with respect to the approved works and to ensure that subsequent owners of the *Works* are made aware of the *Approval* and continue to operate the *Works* in compliance with it.

4. Condition 4 is included to ensure that the *Works* are constructed in accordance with the approval and that record drawings of the *Works* "as constructed" are maintained for future references.

5. Condition 5 is included to indicate that by-passes of untreated sewage to the receiving watercourse is prohibited, save in certain limited circumstances where the failure to *By-pass* could result in greater injury to the public interest than the *By-pass* itself where a *By-pass* will not violate the approved effluent requirements, or where the *By-pass* can be limited or otherwise mitigated by handling it in accordance with an approved contingency plan. The notification and documentation requirements allow the *Ministry* to take action in an informed manner and will ensure the *Owner* is aware of the extent and frequency of *By-pass* events.

6. Condition 6 is imposed to establish non-enforceable effluent quality objectives which the *Owner* is obligated to use best efforts to strive towards on an ongoing basis. These objectives are to be used as a mechanism to trigger corrective action proactively and voluntarily before environmental impairment occurs and before the compliance limits of Condition 7 are exceeded.

7. Condition 7 is imposed to ensure that the effluent discharged from the *Works* to the receiving river meets the *Ministry* 's effluent quality requirements thus minimizing environmental impact on the receiver and to protect water quality, fish and other aquatic life in the receiving water body.

8. Condition 8 is included to require that the *Works* be properly operated, maintained, funded, staffed and equipped such that the environment is protected and deterioration, loss, injury or damage to any person or property is prevented. As well, the inclusion of a comprehensive operations manual governing all significant areas of operation, maintenance and repair is prepared, implemented and kept up-to-date by the owner and made available to the *Ministry* . Such a manual is an integral part of the operation of the *Works* . Its compilation and use should assist the *Owner* in staff training, in proper plant operation and in identifying and planning for contingencies during possible abnormal conditions. The manual will also act as a benchmark for *Ministry* staff when reviewing the *Owner'* s operation of the work.

9. Condition 9 is included to enable the *Owner* to evaluate and demonstrate the performance of the *Works* , on a continual basis, so that the *Works* are properly operated and maintained at a level which is consistent with the design objectives and effluent limits specified in the *Approval* and that the *Works* does not cause any impairment to the receiving watercourse.

10. Condition 10 is included to provide a performance record for future references, to ensure that the *Ministry* is made aware of problems as they arise, and to provide a compliance record for all the terms and conditions outlined in this *Approval,* so that the *Ministry* can work with the *Owner* in resolving any problems in a timely manner.

11. Condition 11 is included to make the *Owner* aware that the *Works* shall be operated within the *Rated Capacity* of 3,237 cubic metres per day unless approval of a new *Rated Capacity* is granted by the *Director* .

Schedule A

1. Final plans and specifications prepared by J.L. Richards and Associates Ltd., Consulting Engineers, dated 1962;
2. Specifications and drawings prepared by the Greer Galloway Group Inc., Consulting Engineers, dated 1993;
3. Application for Approval of Municipal and Private Sewage Works submitted by Mark Priddle of McIntosh Perry Consulting Engineers Ltd, received on February 9, 2009 together with report titled "Technical Brief Proposed Amendments - Alexandria Sewage Treatment Plant Lagoons Township of North Glengarry" prepared by McIntosh Perry Consulting Engineers Ltd, dated February 2009;
4. Application for Approval of Municipal and Private Sewage Works dated July 24, 2009, with cover letter submitted by Mark Priddle of McIntosh Perry Consulting Engineers Ltd, dated July 22 and received on July 27, 2009, including all reports and supporting documents;
5. Application for Approval of Municipal and Private Sewage Works dated March 19, 2010, with cover letter submitted by Mark Priddle of McIntosh Perry Consulting Engineers Ltd, dated March 16 and received on March 23, 2010 , including all reports and supporting documents;
6. Application for Approval of Sewage Works submitted by Mark Priddle of McIntosh Perry Consulting Engineers, dated June 03, 2011 with supporting documentation for amendment to include sludge dewatering cell, alternate chemicals for dechlorination and minor upgrades.
7. Application for Approval of Sewage Works submitted by Lisa Marshall of McIntosh Perry Consulting Engineers, received on May 8, 2012 for amendment to bypass monitoring requirements.

Upon issuance of the environmental compliance approval, I hereby revoke Approval No(s). 2561-8UZNU3 issued on June 8, 2012

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

1. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed

Pursuant to subsection 139(3) of the Environmental Protection Act, a hearing may not be required with respect to any terms and conditions in this environmental compliance approval, if the terms and conditions are substantially the same as those contained in an approval that is amended or revoked by this environmental compliance approval.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The environmental compliance approval number;
6. The date of the environmental compliance approval;
7. The name of the Director, and;
8. The municipality or municipalities within which the project is to be engaged in

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
655 Bay Street, Suite 1500
Toronto, Ontario
M5G 1E5

AND

The Director appointed for the purposes of
Part II.1 of the Environmental Protection Act
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 2nd day of August, 2012

Mansoor Mahmood, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

FL/

c: District Manager, MOE Cornwall
Lisa Marshall, McIntosh Perry Consulting Engineers Ltd.

APPENDIX C

WASTEWATER TREATMENT OPERATIONAL DATA (2013-2015)

Appendix A:

NORTH GLENGARRY WATER WORKS
WASTEWATER TREATMENT PERFORMANCE RESULTS

Municipality: North Glengarry
Project: Alexandria STP
Year: 2013
Receiving Stream: Delisle River
Design Capacity:
Approved Capacity: 3237 m^3/day

Description: 1 Pumping Station, 1 Aerated Cell, 3 Facultative Cells
Continuous Discharge with Phosphorous Removal. Effluent Chlorinated and Dechlorinated

MONTH	Flows			Biochemical O_2 Demand			Suspended Solids			Phosphorus		
	Total Flows (m^3)	Average Daily Flow (m^3)	Maximum Daily Flow (m^3)	Average Raw $CBOD_5$ (mg/L)	Average Effluent $CBOD_5$ (mg/L)	Percent Removal %	Average Raw SS (mg/L)	Average Effluent SS (mg/L)	Percent Removal %	Average Raw TP (mg/L)	Average Effluent TP (mg/L)	Percent Removal %
Jan	135,619	4,374	9,007	49.5	8.0	83.8	62.0	7.8	87.4	1.04	0.28	73.1
Feb	106,923	3,818	6,085	56.0	16.3	71.0	64.0	17.8	72.2	0.96	0.43	55.2
Mar	181,048	5,840	12,887	79.5	14.5	81.8	88.0	15.8	82.0	0.94	0.37	60.6
Apr	260,673	8689	13888	20.0	5.8	71.0	35.0	8.4	76.0	0.55	0.19	65.5
May	105,537	3404	5616	69.0	4.5	93.5	71.0	5.3	92.5	1.11	0.21	81.1
Jun	205,832	6861	14565	39.5	3.0	92.4	58.0	3.0	94.8	1.00	0.21	79.0
Jul	108,897	3512	6349	38.0	3.0	92.1	160.0	3.0	98.1	0.73	0.08	89.0
Aug	67,520	2178	2908	103.5	3.0	97.1	68.0	3.0	95.6	1.34	0.09	93.3
Sep	90,578	3019	7100	68.0	3.0	95.6	60.0	3.0	95.0	3.75	0.05	98.7
Oct	82,044	2646	4688	70.0	3.0	95.7	74.0	3.0	95.9	1.69	0.08	95.3
Nov	121,189	4039	7227	40.0	3.2	92.0	42.0	3.2	92.4	0.79	0.11	86.1
Dec	82,420	2658	3867	76.5	5.4	92.9	68.0	8.6	87.4	1.19	0.23	80.7
Total	1,548,280											
Average		4253		59.1	6.1	88	70.8	6.8	89	1.26	0.19	80
Maximum			14565	103.5	16.25	97	160.0	17.8	98	3.75	0.43	99
Criteria		3237			30			40			0.50	

NORTH GLENGARRY WATER WORKS
WASTEWATER TREATMENT PERFORMANCE RESULTS
2013

MONTH	Ammonia			TKN			Nitrite			Nitrate		
	Average Raw Ammonia (mg/L)	Average Effluent Ammonia (mg/L)	Percent Removal %	Average Raw TKN (mg/L)	Average Effluent TKN (mg/L)	Percent Removal %	Average Raw Nitrite (mg/L)	Average Effluent Nitrite (mg/L)	Percent Removal %	Average Raw Nitrate (mg/L)	Average Effluent Nitrate (mg/L)	Percent Removal %
Jan	n/a	7.16	#VALUE!	11.20	9.44	15.7	n/a	0.28	#VALUE!	n/a	0.28	#VALUE!
Feb	n/a	7.35	#VALUE!	13.30	10.85	18.4	n/a	0.19	#VALUE!	n/a	0.23	#VALUE!
Mar	n/a	6.51	#VALUE!	11.50	10.21	11.2	n/a	0.09	#VALUE!	n/a	0.15	#VALUE!
Apr	n/a	3.35	#VALUE!	5.02	5.49	-9.4	n/a	0.22	#VALUE!	n/a	0.72	#VALUE!
May	n/a	3.89	#VALUE!	14.30	6.03	57.8	n/a	0.25	#VALUE!	n/a	0.38	#VALUE!
Jun	n/a	3.16	#VALUE!	6.65	4.00	39.8	n/a	0.68	#VALUE!	n/a	0.78	#VALUE!
Jul	n/a	0.52	#VALUE!	9.55	2.05	78.5	n/a	0.28	#VALUE!	n/a	0.94	#VALUE!
Aug	n/a	1.41	#VALUE!	17.70	3.09	82.5	n/a	0.38	#VALUE!	n/a	0.70	#VALUE!
Sep	n/a	0.30	#VALUE!	21.25	1.44	93.2	n/a	0.20	#VALUE!	n/a	1.44	#VALUE!
Oct	n/a	0.72	#VALUE!	17.30	2.12	87.7	n/a	0.19	#VALUE!	n/a	1.38	#VALUE!
Nov	n/a	3.05	#VALUE!	14.20	5.02	64.6	n/a	0.70	#VALUE!	n/a	1.65	#VALUE!
Dec	n/a	7.77	#VALUE!	21.60	10.23	52.6	n/a	0.38	#VALUE!	n/a	0.68	#VALUE!
Total												
Average	#DIV/0!	3.77	#VALUE!	13.63	5.83	49	#DIV/0!	0.32	#VALUE!	#DIV/0!	0.78	#VALUE!
Maximum	0	7.77	#VALUE!	21.6	10.85	93	0	0.7	#VALUE!	0	1.65	#VALUE!
Criteria												

NORTH GLENGARRY WATER WORKS
WASTEWATER TREATMENT PERFORMANCE RESULTS
2013

MONTH	Hydrogen Sulphide			E. coli			pH	Temp	Cl_2
	Average Raw H_2S (mg/L)	Average Effluent H_2S (mg/L)	Percent Removal %	Average Raw E.coli cts/100ml	Average Effluent E.coli cts/100ml	Percent Removal %	Average Effluent pH	Average Effluent Temp ^oC	Average Effluent Cl_2 mg/L
Jan	n/a	0.01	#VALUE!	n/a	6	#VALUE!	7.39	3.5	0.01
Feb	n/a	0.02	#VALUE!	n/a	2	#VALUE!	7.21	2.0	0.01
Mar	n/a	0.04	#VALUE!	n/a	2	#VALUE!	7.09	4.1	0.01
Apr	n/a	0.03	#VALUE!	n/a	107	#VALUE!	7.78	6.9	0.01
May	n/a	0.01	#VALUE!	n/a	5	#VALUE!	7.51	17.8	0.01
Jun	n/a	0.01	#VALUE!	n/a	2	#VALUE!	7.25	20.9	0.02
Jul	n/a	0.01	#VALUE!	n/a	2	#VALUE!	7.22	24.4	0.01
Aug	n/a	0.01	#VALUE!	n/a	2	#VALUE!	7.23	22.8	0.01
Sep	n/a	0.01	#VALUE!	n/a	3	#VALUE!	7.26	17.9	0.01
Oct	n/a	0.01	#VALUE!	n/a	2	#VALUE!	7.35	13.1	0.01
Nov	n/a	0.01	#VALUE!	n/a	2	#VALUE!	7.29	7.2	0.01
Dec	n/a	0.01	#VALUE!	n/a	3	#VALUE!	7.17	2.4	0.01
Total									
Average	#DIV/0!	0.02	#VALUE!	#DIV/0!	4	#VALUE!	7.62	13.06	0.01
Maximum	0	0.04	#VALUE!	0	107	#VALUE!	8.68	26.80	0.02
Criteria					200		6.0 - 9.5		0.02

Appendix A:

NORTH GLENGARRY WATER WORKS
WASTEWATER TREATMENT PERFORMANCE RESULTS

Municipality: North Glengarry
Project: Alexandria STP
Year: 2014
Receiving Stream: Delisle River
Design Capacity:
Approved Capacity: 3237 m^3/day

Description: 1 Pumping Station, 1 Aerated Cell, 3 Facultative Cells
Continuous Discharge with Phosphorous Removal. Effluent Chlorinated and Dechlorinated

MONTH	Flows			Biochemical O_2 Demand			Suspended Solids			Phosphorus		
	Total Flows (m^3)	Average Daily Flow (m^3)	Maximum Daily Flow (m^3)	Average Raw $CBOD_5$ (mg/L)	Average Effluent $CBOD_5$ (mg/L)	Percent Removal %	Average Raw SS (mg/L)	Average Effluent SS (mg/L)	Percent Removal %	Average Raw TP (mg/L)	Average Effluent TP (mg/L)	Percent Removal %
Jan	106,033	3,420	7,427	53.0	20.8	60.8	50.0	16.8	66.4	0.93	0.41	55.9
Feb	70,612	2,522	5,883	127.0	17.5	86.2	52.0	17.5	66.3	1.30	0.42	67.7
Mar	89,325	2,881	5,151	55.3	20.8	62.4	77.3	20.8	73.1	0.70	0.43	38.6
Apr	343,248	11442	21584	20.0	10.8	46.0	20.0	10.8	46.0	0.40	0.21	47.5
May	152,613	4923	11049	106.5	4.0	96.2	50.0	4.2	91.6	1.00	0.13	87.0
Jun	111,980	3733	8071	178.0	4.2	97.6	68.0	3.2	95.3	1.30	0.14	89.2
Jul	101,233	3266	9348	174.0	6.8	96.1	48.0	7.0	85.4	1.20	0.17	85.8
Aug	77,522	2501	4941	104.0	3.5	96.6	48.0	3.7	92.3	1.50	0.15	90.0
Sep	60,403	2013	2662	106.0	3.0	97.2	91.0	3.0	96.7	1.90	0.11	94.2
Oct	74,586	2406	3566	132.0	3.0	97.7	76.0	3.2	95.8	1.30	0.13	90.0
Nov	70,590	2353	4883	95.0	8.3	91.3	114.0	10.0	91.2	4.40	0.21	95.2
Dec	101,640	3279	8676	158.0	13.8	91.3	45.0	19.6	56.4	1.10	0.39	64.5
Total	1,359,785											
Average		3728		109.1	9.7	85	61.6	10.0	80	1.42	0.24	75
Maximum			21584	178	20.8	98	114.0	20.8	97	4.4	0.43	95
Criteria		3237			30			40			0.50	

NORTH GLENGARRY WATER WORKS
WASTEWATER TREATMENT PERFORMANCE RESULTS
2014

MONTH	Ammonia			TKN			Nitrite			Nitrate		
	Average Raw Ammonia (mg/L)	Average Effluent Ammonia (mg/L)	Percent Removal %	Average Raw TKN (mg/L)	Average Effluent TKN (mg/L)	Percent Removal %	Average Raw Nitrite (mg/L)	Average Effluent Nitrite (mg/L)	Percent Removal %	Average Raw Nitrate (mg/L)	Average Effluent Nitrate (mg/L)	Percent Removal %
Jan	n/a	10.70		11.90	13.60	-14.3	n/a	0.10		n/a	0.13	
Feb	n/a	11.38		18.00	15.60	13.3	n/a	0.10		n/a	0.30	
Mar	n/a	9.14		15.70	15.30	2.5	n/a	0.87		n/a	0.28	
Apr	n/a	4.64		2.84	5.10	-79.6	n/a	0.27		n/a	0.33	
May	n/a	1.58		11.20	8.11	27.6	n/a	0.27		n/a	0.53	
Jun	n/a	1.88		17.70	3.65	79.4	n/a	0.10		n/a	0.33	
Jul	n/a	1.87		16.00	4.24	73.5	n/a	0.23		n/a	0.38	
Aug	n/a	2.77		17.30	4.84	72.0	n/a	0.62		n/a	0.35	
Sep	n/a	1.23		24.20	2.41	90.0	n/a	0.10		n/a	0.54	
Oct	n/a	4.92		18.50	7.37	60.2	n/a	0.22		n/a	0.38	
Nov	n/a	8.59		18.40	11.35	38.3	n/a	0.19		n/a	0.53	
Dec	n/a	11.08		16.30	14.65	10.1	n/a	0.10		n/a	0.40	
Total												
Average		5.82		15.67	8.85	31		0.26			0.37	
Maximum		11.38		24.2	15.6	90		0.87			0.54	
Criteria												

NORTH GLENGARRY WATER WORKS
WASTEWATER TREATMENT PERFORMANCE RESULTS
2014

MONTH	Hydrogen Sulphide			E. coli			pH	Temp	Cl_2
	Average Raw H_2S (mg/L)	Average Effluent H_2S (mg/L)	Percent Removal %	Average Raw E.coli cts/100ml	Average Effluent E.coli cts/100ml	Percent Removal %	Average Effluent pH	Average Effluent Temp ^oC	Average Effluent Cl_2 mg/L
Jan	n/a	0.08		n/a	2		7.1	3.2	0.01
Feb	n/a	0.03		n/a	2		7.03	2.8	0.01
Mar	n/a	0.04		n/a	2		7.33	4.2	0.01
Apr	n/a	0.02		n/a	3		7.33	7.4	0.01
May	n/a	0.01		n/a	1		7.44	16.1	0.01
Jun	n/a	0.01		n/a	2		7.1	22.5	0.01
Jul	n/a	0.02		n/a	5		7.23	22.9	0.01
Aug	n/a	0.01		n/a	3		7.17	22.7	0.11
Sep	n/a	0.01		n/a	2		7.18	18.7	0.01
Oct	n/a	0.01		n/a	2		7.36	12.1	0.01
Nov	n/a	0.01		n/a	2		7.9	5.6	0.01
Dec	n/a	0.02		n/a	2		7.76	3.3	0.01
Total									
Average		0.02			2		7.33	13.06	0.02
Maximum		0.08			5		7.90	26.80	0.11
Criteria					200		6.0 - 9.5		0.02

Appendix A:

NORTH GLENGARRY WATER WORKS

WASTEWATER TREATMENT WORKS PERFORMANCE RESULTS

Municipality: *North Glengarry*
Project: *Alexandria STP*
Description: *1 Pumping Station, 1 Aerated Cell, 3 Faculative Cells*
Continuous Discharge with Phosphorous Removal

Year: *2015*
Receiving Stream: *Delisle River*
Design Capacity: *3237 m^3 /day*

MONTH	Flows			Biochemical O_2 Demand			Suspended Solids			Phosphorus		
	Total Flows (m^3)	Average Daily Flow (m^3)	Maximum Daily Flow (m^3)	Average Raw $CBOD_5$ (mg/L)	Average Effluent $CBOD_5$ (mg/L)	Percent Removal %	Average Raw SS (mg/L)	Average Effluent SS (mg/L)	Percent Removal %	Average Raw TP (mg/L)	Average Effluent TP (mg/L)	Percent Removal %
Jan	78,830	2,505	3,793	50.5	16.3	67.8	52.0	17.0	67.3	1.01	0.37	63.9
Feb	52,839	1,887	2,244	121.0	34.8	71.3	100.0	28.8	71.3	2.25	0.36	84.1
Mar	100,563	3,352	6,144	112.0	48.4	56.8	76.0	41.6	45.3	1.08	0.52	52.1
Apr	198,246	6,608	11,470	66.5	10.4	84.3	40.5	10.4	74.3	1.32	0.25	81.3
May	87,520	2,823	3,584	226.0	6.4	97.2	68.0	10.6	84.4	1.48	0.26	82.3
Jun	96,011	3,200	5,262	140.5	3.6	97.5	66.0	3.0	95.5	1.21	0.20	83.8
Jul	74,332	2,398	3,953	298.5	3.2	98.9	68.0	3.1	95.4	0.96	0.11	88.6
Aug	54,919	1,772	1,955	160.3	3.0	98.1	69.3	3.1	95.5	1.73	0.09	94.9
Sep	76,774	2,559	3,983	176.5	3.0	98.3	78.0	3.0	96.2	1.30	0.06	95.6
Oct	91,452	2,950	5,905	129.0	3.3	97.4	62.0	3.3	94.6	1.30	0.05	96.3
Nov	106,845	3,562	5,068	179.5	3.1	98.3	74.0	3.2	95.7	0.82	0.07	91.7
Dec	139,979	4,515	6,584	117.5	3.3	97.2	181.0	3.3	98.2	2.89	0.09	97.0
Total	1,158,310											
Average		3178		148.2	11.6	89	77.9	10.9	84	1.44	0.20	84
Maximum			11470	298.5	48.4	99	181.0	41.6	98	2.885	0.516	97
Criteria		3237			30			40			0.50	

Appendix A:

NORTH GLENGARRY WATER WORKS
WASTEWATER TREATMENT PERFORMANCE RESULTS
2015

MONTH	Ammonia			TKN			Nitrite			Nitrate		
	Average Raw Ammonia (mg/L)	Average Effluent Ammonia (mg/L)	Percent Removal %	Average Raw TKN (mg/L)	Average Effluent TKN (mg/L)	Percent Removal %	Average Raw Nitrite (mg/L)	Average Effluent Nitrite (mg/L)	Percent Removal %	Average Raw Nitrate (mg/L)	Average Effluent Nitrate (mg/L)	Percent Removal %
Jan	n/a	11.03		17.4	14.3	18.1	n/a	0.2		n/a	0.3	
Feb	n/a	12.43		26.2	16.0	38.8	n/a	0.1		n/a	0.2	
Mar	n/a	10.85		16.5	16.7	-1.0	n/a	0.1		n/a	0.2	
Apr	n/a	6.04		8.8	7.5	15.0	n/a	0.1		n/a	0.3	
May	n/a	2.34		17.8	4.7	73.5	n/a	0.2		n/a	0.5	
Jun	n/a	3.19		16.6	4.4	73.3	n/a	0.5		n/a	0.6	
Jul	n/a	0.21		16.2	1.5	90.9	n/a	0.1		n/a	0.3	
Aug	16.1	0.18	98.9	12.4	1.3	89.4	n/a	0.1		n/a	0.2	
Sep	n/a	0.16		15.3	1.3	91.8	n/a	0.1		n/a	0.4	
Oct	n/a	0.57		18.7	1.6	91.2	n/a	0.1		n/a	1.0	
Nov	n/a	3.60		14.2	5.1	64.0	n/a	0.5		n/a	1.2	
Dec	n/a	6.13		7.9	7.1	9.8	n/a	0.4		n/a	1.3	
Total												
Average		4.73		15.65	6.79	55		0.20			0.53	
Maximum		12.425		26.2	16.666667	92		0.496			1.25	
Criteria												

Appendix A:

NORTH GLENGARRY WATER WORKS
WASTEWATER TREATMENT PERFORMANCE RESULTS
2015

MONTH	Hydrogen Sulphide			E. coli			pH	Temp	Cl_2
	Average Raw H_2S (mg/L)	Average Effluent H_2S (mg/L)	Percent Removal %	Average Raw E.coli cts/100ml	Average Effluent E.coli cts/100ml	Percent Removal %	Average Effluent pH	Average Effluent Temp ^oC	Average Effluent Cl_2 mg/L
Jan	n/a	0.1		n/a	3.2		7.03	2.4	0.01
Feb	n/a	0.2		n/a	2.0		6.90	3.2	0.00
Mar	n/a	0.1		n/a	2.0		6.74	2.3	0.01
Apr	n/a	0.0		n/a	2.2		7.21	8.0	0.01
May	n/a	0.0		n/a	2.0		7.52	18.0	0.04
Jun	n/a	0.0		n/a	2.7		7.03	21.0	0.03
Jul	n/a	0.0		n/a	4.7		7.32	23.4	0.02
Aug	n/a	0.0		n/a	2.1		7.40	22.6	0.01
Sep	n/a	0.0		n/a	2.0		7.63	20.3	0.01
Oct	n/a	0.0		n/a	2.0		7.53	10.0	0.01
Nov	n/a	0.0		n/a	6.0		7.43	7.7	0.01
Dec	n/a	0.0		n/a	2.0		7.46	3.1	0.01
Total									
Average		0.04			3		7.62	13.06	0.01
Maximum		0.17			5.99125		7.63	26.80	0.04
Criteria					200		6.0 - 9.5		0.02

APPENDIX D
GAUGE STATION 02MC028 FLOWS
DELISLE RIVER

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Wateroffice

Daily Discharge Data for RIVIERE DELISLE NEAR ALEXANDRIA (02MC028)

Graph | Table

Station: 02MC028

Data Type: Daily

Parameter Type: Flow

for 2013

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2013 Daily Discharge (m^3/s)

This table provides daily data for a station.

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	.46 B	2.33 B	.464 B	9.46	1.16	1.01	3.97	.097	.058	.433	2.08	.574 E
2	.403 B	1.85 B	.448 B	10.4	1.05	1.89	2.05	.149	.107	.525	3.04	.466 E
3	.356 B	1.52 B	.431 B	10.2	.91	2.97	1.51	.289	.135	.41 E	2.23	.467 E
4	.317 B	1.26 B	.422 B	6.86	.799	1.92	1.2	.244	.145	.393	1.69	.507 E
5	.281 B	1.05 B	.435 B	6.51	.714	1.29	1.04	.179	.146	.288	1.34	.629 E
6	.252 B	.88 B	.482 B	6.79	.69	1.02	1.17	.134	.108	.236	1.14	1.02
7	.236 B	.745 B	.492 B	6.19	.615	2.19	1.16	.113	.079	.248	1.09	1.34
8	.238 B	.641 B	.467 B	8.06	.547	4.76	1.01	.092	.064	.59	1.01	1.13
9	.349 B	.559 B	.476 B	11.8	.501	3.58	.895	.073	.047	.679	.886	1.02
10	.466 B	.486 B	.538 B	14.1	.492	2.17	.758	.06	.04	.577	1.09	.931
11	.47 B	.528 B	.629 B	12.8	.654	3.04	.671	.047	.043	.519	2.24	.821
12	.513 B	.573 B	.754 B	8.78	1.01	8.9	.599	.037	.423	.551	2.48	.721
13	.743 B	.484 B	1.39 B	6.95	.787	10.8	.523	.033	1.56	.431	1.85	.631
14	1.82 B	.457 B	2.06 B	8.36	.552	5.82	.464	.051	1.06	.376	1.37	.55 B
15	3.04 B	.505 B	1.92 B	8.48	.487	2.35	.391	.068	.741	.322	1.26	.478 B
16	2.99	.451 B	1.73 B	7.42	.46	1.61	.324	.061	.625	.329	1.19	.414 B
17	2.5	.381 B	1.59 B	7.61	.429	1.85	.254	.044	.582	.445	1.1	.359 B
18	2.02 B	.327 B	1.48 B	7.03	.409	1.75	.255	.031	.489	.7	1.31	.31 B
19	1.86 B	.283 B	1.44 B	5.52	.364	1.29	.364	.024	.414	.754	1.43	.268 B
20	1.72 B	.254 B	1.5 B	5.34	.309	1.03	.622	.021	.34	.717	1.24	.232 B
21	1.33 B	.232 B	1.43 B	4.59	.347	.91	.85	.016	.282 E	.689	1.02	.201 B
22	1.04 B	.217 B	1.29 B	3.28	.475	.804	.607	.014	1.54	.64	.963	.177 B
23	.836 B	.21 B	1.16 B	2.63	1.39	.807	.488	.015	2.13	.638	1.25	.157 B
24	.685 B	.246 B	1.08 B	2.21	3.23	1.19	.394	.014	1.33	.623	1.13	.141 B
25	.564 B	.308 B	1.03 B	2.04	3.55	2.73	.303	.01	.974	.572	.883	.128 B
26	.463 B	.385 B	1.02	1.92	2.4	2.73 E	.231	.008	.757	.528	.803	.117 B

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
27	.382 B	.449 B	1.16	1.8	1.9	1.89 E	.176	.009	.635	.673	.739	.113 B
28	.32 B	.472 B	1.71	1.64	1.31	2.47	.144	.009	.568	.93	.783	.126 B
29	.307 B		3.29	1.42	1.01	7.34	.138	.008	.522	.857	.8	.126 B
30	.468 B		5.28	1.26	1.28	8.76	.121	.008	.498	.769	.762	.118 B
31	2.1 B		6.83		1.39		.109	.015		.707		.109 B
Mean	0.953	0.646	1.43	6.38	1.01	3.03	0.735	0.064	0.548	0.553	1.34	0.464
Max	3.04	2.33	6.83	14.1	3.55	10.8	3.97	0.289	2.13	0.930	3.04	1.34
Min	0.236	0.210	0.422	1.26	0.309	0.804	0.109	0.008	0.040	0.236	0.739	0.109
Total	29.529	18.083	44.428	191.45	31.221	90.871	22.791	1.973	16.442	17.149	40.199	14.381
Total Dam^3	2550	1560	3840	16500	2700	7850	1970	170	1420	1480	3470	1240

This table provides the annual statistics of daily data.

Overall Mean (m^3/s)	Maximum Daily (m^3/s)	Minimum Daily (m^3/s)	Total Discharge (m^3/s)	Total Discharge in dam^3
1.42	14.1 on Apr 10	0.008 on Aug 26	518.517	44800

Maximum Instantaneous: 14.4 on Apr 10 at 19:05 EST

Minimum Instantaneous: .008 on Aug 25 at 19:30 EST

- A = Partial Day
- D = Dry
- R = Revised within the last two years
- B = Ice Conditions
- E = Estimated
- P = Partial dry

Station Information

Active or discontinued:
Active
Province / Territory:
Ontario
Latitude:
45° 19' 37" N
Longitude:
74° 38' 37" W
Gross drainage area:
84.52 km^2
Effective drainage area:
N/A
Record length:
25 Years
Period of record
1985 - 2016
Regulation type:
Natural
Regulation length:
N/A
Real-time data available:
Yes
Sediment data available:
No
Type of water body:
River
RHBN:
No
EC Regional Office:
BURLINGTON
Data contributed by:
N/A
Datum of published data:

ASSUMED DATUM

Data Collection History

This table contains information pertaining to the historical changes of defined elements in the operation of a station.

Period of operation	Type	Operation schedule	Gauge type
1985 - 1998	Flow	Continuous	Recorder
2006 - 2016	Flow & Level	Continuous	Recorder

Historical Hydrometric Remarks:
STATION ACTIVATED MAY 22, 1985

Click here for further information on remarks.

Date modified: 2014-06-05

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Wateroffice

Daily Discharge Data for RIVIERE DELISLE NEAR ALEXANDRIA (02MC028)

Graph | Table

Station: 02MC028

Data Type: Daily

Parameter Type: Flow

for 2014

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2014 Daily Discharge (m^3/s)

This table provides daily data for a station.

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	.102 B	.562 B	.449 B	1.67 B	4.96	.265	.345	.197	.078	.014	.274	.505 B
2	.095 B	.52 B	.399 B	1.88 B	7.65	.25	.294	.171	.087	.014	.246	.445 B
3	.089 B	.492 B	.358 B	2.08 B	6.13	.241	.265	.165	.09	.021	.248	.392 B
4	.084 B	.468 B	.32 B	2.43 B	3.91	.234	.26	.169	.089	.032	.234	.35 B
5	.091 B	.446 B	.287 B	3.66 B	3.67	.229	.252	.16	.075	.042	.249	.316 B
6	.65 B	.427 B	.261 B	4.46 B	3.07	.228	.211	.165	.07	.047	.257	.286 B
7	1.12 B	.408 B	.259 B	5.97 B	2.34	.228	.175	.165	.072	.084	.267	.262 B
8	2.31 B	.391 B	.294 B	10.2 B	1.85	.201	.169	.135	.073	.276	.284	.242 B
9	2.79 B	.373 B	.278 B	15.3 B	1.54	.168	.194	.083	.063	.389	.283	.228 B
10	2.27 B	.356 B	.269 B	20 B	1.53	.14	.208	.061	.049	.371	.268	.217 B
11	1.91 B	.339 B	.307 B	26.2	1.65	.121	.181	.051	.047	.322	.26	.209 B
12	2.09 B	.314 B	.313 B	27	1.37	.206	.139	.042	.043	.294	.258	.203 B
13	2.27 B	.194 B	.293 B	23.6	1.24	.998	.125	.12	.048	.271	.262	.199 B
14	2.56 B	.251 B	.307 B	20.2	1.13	2.13	.224 E	.379	.07	.257	.261	.197 B
15	2.82 B	.285 B	.458 B	19.5	1	1.27	1.43 E	.361	.087	.149	.245	.201 B
16	2.94 B	.274 B	.425 B	17.8	.959	.739	1.61	.282	.086	.151	.229	.225 B
17	2.7 B	.264 B	.371 B	11.4	2.28	.502	.861	.422	.071	.279	.227	.27 B
18	2.25 B	.267 B	.333 B	5.75	3.05	1.08	.548	.461	.069	.365	.244	.347 B

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
19	1.89 B	.326 B	.337 B	4.09	2.16	1.23	.387	.31	.058	.315	.241	.357 B
20	1.65 B	.349 B	.597 B	3.36	1.53	.724	.318	.245	.048	.257	.236	.309 B
21	1.43 B	.476 B	.69 B	2.88	1.12	.479	.281	.192	.044	.223	.203	.273 B
22	1.25 B	.81 B	.714 B	2.8	.884	.372	.307	.175	.046	.231	.188	.249 B
23	1.1 B	.994 B	.717 B	3.47	.709	.31	.266	.165	.046	.237	.203	.232 B
24	.968 B	1.24 B	.705 B	3.32	.675	.328	.234	.144	.045	.212	.771	.32 B
25	.863 B	.984 B	.656 B	2.53	.754	2.75	.198	.12	.039	.232	1.84	1.3 B
26	.777 B	.706 B	.591 B	2.11	.667	2.83	.162	.105	.031	.288	1.23	3.64
27	.705 B	.599 B	.574 B	2.02	.565	1.27	.149	.095	.025	.327	.953	3.9
28	.645 B	.515 B	.687 B	1.94	.445	.785	.157	.084	.025	.303	.762 B	3.89
29	.595 B		.891 B	1.69	.375	.534	.214	.066	.022	.307	.575 B	3.55
30	.567 B		1.17 B	1.79	.332	.406	.266	.054	.018	.325	.592 B	1.65
31	.581 B		1.38 B		.297		.234	.06		.416		1.56
Mean	1.36	0.487	0.506	8.37	1.93	0.708	0.344	0.174	0.057	0.227	0.413	0.849
Max	2.94	1.24	1.38	27.0	7.65	2.83	1.61	0.461	0.090	0.416	1.84	3.90
Min	0.084	0.194	0.259	1.67	0.297	0.121	0.125	0.042	0.018	0.014	0.188	0.197
Total	42.162	13.63	15.69	251.1	59.842	21.248	10.664	5.404	1.714	7.051	12.39	26.324
Total Dam^3	3640	1180	1360	21700	5170	1840	921	467	148	609	1070	2270

This table provides the annual statistics of daily data.

Overall Mean (m^3/s)	Maximum Daily (m^3/s)	Minimum Daily (m^3/s)	Total Discharge (m^3/s)	Total Discharge in dam^3
1.28	27.0 on Apr 12	0.014 on Oct 1	467.219	40400

Maximum Instantaneous: 27.4 on Apr 11 at 22:55 EST

Minimum Instantaneous: .012 on Oct 01 at 14:00 EST

- A = Partial Day
- D = Dry
- R = Revised within the last two years
- B = Ice Conditions
- E = Estimated
- P = Partial dry

Station Information

Active or discontinued:
Active
Province / Territory:
Ontario

Latitude:
45° 19' 37" N
Longitude:
74° 38' 37" W
Gross drainage area:
84.52 km^2
Effective drainage area:
N/A
Record length:
25 Years
Period of record
1985 - 2016
Regulation type:
Natural
Regulation length:
N/A
Real-time data available:
Yes
Sediment data available:
No
Type of water body:
River
RHBN:
No
EC Regional Office:
BURLINGTON
Data contributed by:
N/A
Datum of published data:
ASSUMED DATUM

Data Collection History

This table contains information pertaining to the historical changes of defined elements in the operation of a station.

Period of operation	Type	Operation schedule	Gauge type
1985 - 1998	Flow	Continuous	Recorder
2006 - 2016	Flow & Level	Continuous	Recorder

Historical Hydrometric Remarks:
STATION ACTIVATED MAY 22, 1985

Click here for further information on remarks.

Date modified: 2014-06-05

Government of Canada | Gouvernement du Canada

Canada

Wateroffice

Daily Discharge Data for RIVIERE DELISLE NEAR ALEXANDRIA (02MC028)

Graph | Table

Station: 02MC028

Data Type: Daily

Parameter Type: Flow

for 2015

Download Apply

2015 Daily Discharge (m^3/s)

This table provides daily data for a station.

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.22 B	.184 B	.149 B	1.66 B	.888	.261	.433	.024	.01	.34	.58	.645
2	.808 B	.182 B	.148 B	1.82 B	.803	.265	1.2	.019	.011	.279	.505	.647
3	.622 B	.18 B	.147 B	4.09 B	.717	.254	.83	.017	.012	.174	.441	1.15
4	.573 B	.177 B	.146 B	8.32 B	.638	.231	.497	.015	.011	.099	.357	1.44
5	.583 B	.176 B	.146 B	9.88	.607	.197	.366	.013	.009	.075	.304	1.25
6	.565 B	.174 B	.145 B	6.21	.599	.175	.316	.013	.008	.062	.273	1.11
7	.492 B	.172 B	.144 B	3.75	.538	.146	.298	.012	.007	.048	.3	.979
8	.394 B	.171 B	.144 B	3.13	.493	.194	.266	.012	.01	.039	.3	.869
9	.372 B	.169 B	.144 B	2.67	.448	.608	.265	.009	.011	.056	.288	.776
10	.352 B	.168 B	.146 B	4.99	.438	.535	.249	.007	.011	.069	.31	.729
11	.334 B	.167 B	.181 B	8.79	.475	.459	.207	.028	.011	.064	.324	.712
12	.318 B	.166 B	.418 B	10.2	.595	.408	.161	.148	.011	.063	.338	.669
13	.304 B	.164 B	.456 B	9.48	.713	.843	.131	.29	.065	.045	.68	.625
14	.291 B	.163 B	.495 B	8.49	.619	.91	.112	.222	.21	.03	1.86	.619
15	.279 B	.162 B	.481 B	7.38	.483	.517	.103	.187	.244	.023	1.69	.779
16	.269 B	.161 B	.454 B	4.29	.407	.603	.089	.149	.173	.044	1.22	1.06
17	.259 B	.16 B	.447 B	2.92	.365	1.6	.075	.115	.11	.13	.996	1.01
18	.251 B	.159 B	.435 B	2.29	.329	.985	.074	.091	.06	.222	.83	1.43
19	.243 B	.158 B	.436 B	1.86	.303	.713	.075	.071	.041	.201	.754	1.48

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
20	.237 B	.157 B	.404 B	1.69	.261	.698	.087	.049	.047	.173	.795	1.15
21	.231 B	.156 B	.391 B	2.98	.221	.427	.094	.045	.056	.154	.806	.974
22	.225 B	.155 B	.414 B	4.04	.188	.343	.086	.042	.052	.13	.726	1.6
23	.219 B	.154 B	.443 B	3.44	.159	.311	.07	.039	.044	.139	.641	2.42
24	.214 B	.153 B	.402 B	2.76	.162	.82	.061	.033	.036	.12	.562	2.3
25	.209 B	.152 B	.371 B	2.08	.141	.563	.049	.034	.029	.199	.469	2.03
26	.205 B	.151 B	.477 B	1.66	.216	.392	.063	.031	.025	.314	.457	1.58
27	.201 B	.151 B	.757 B	1.4	.303	.306	.065	.023	.021	.296	.472	1.42
28	.197 B	.15 B	.986 B	1.32	.286	.269	.052	.017	.018	.28	.81	1.56
29	.193 B		1.04 B	1.17	.265	.297	.056	.013	.025	1.08	1	.889
30	.19 B		1.08 B	1.01	.257	.367	.045	.011	.178	1.34	.849	1.05
31	.187 B		1.34 B		.246		.034	.01		.814		1.16
Mean	0.356	0.164	0.431	4.19	0.425	0.490	0.210	0.058	0.052	0.229	0.665	1.16
Max	1.22	0.184	1.34	10.2	0.888	1.60	1.20	0.290	0.244	1.34	1.86	2.42
Min	0.187	0.150	0.144	1.01	0.141	0.146	0.034	0.007	0.007	0.023	0.273	0.619
Total	11.037	4.592	13.367	125.77	13.163	14.697	6.509	1.789	1.556	7.102	19.937	36.112
Total Dam^3	954	397	1150	10900	1140	1270	562	155	134	614	1720	3120

This table provides the annual statistics of daily data.

Overall Mean (m^3/s)	Maximum Daily (m^3/s)	Minimum Daily (m^3/s)	Total Discharge (m^3/s)	Total Discharge in dam^3
0.700	10.2 on Apr 12	0.007 on Aug 10	255.631	22100

Maximum Instantaneous: 10.4 on Apr 05 at 03:00 EST

Minimum Instantaneous: .006 on Aug 10 at 14:00 EST

- A = Partial Day
- D = Dry
- R = Revised within the last two years
- B = Ice Conditions
- E = Estimated
- P = Partial dry

Station Information

Active or discontinued:
Active
Province / Territory:
Ontario
Latitude:
45° 19' 37" N
Longitude:
74° 38' 37" W
Gross drainage area:
84.52 km^2
Effective drainage area:

N/A
Record length:
25 Years
Period of record
1985 - 2016
Regulation type:
Natural
Regulation length:
N/A
Real-time data available:
Yes
Sediment data available:
No
Type of water body:
River
RHBN:
No
EC Regional Office:
BURLINGTON
Data contributed by:
N/A
Datum of published data:
ASSUMED DATUM

Data Collection History

This table contains information pertaining to the historical changes of defined elements in the operation of a station.

Period of operation	Type	Operation schedule	Gauge type
1985 - 1998	Flow	Continuous	Recorder
2006 - 2016	Flow & Level	Continuous	Recorder

Historical Hydrometric Remarks:
STATION ACTIVATED MAY 22, 1985

Click here for further information on remarks.

Date modified: 2014-06-05

APPENDIX E

SEWAGE FLOW DESIGN CALCULATIONS

Dry Weather Flows

Area Location	Area (ha)	Land Purpose	Housing Density (units)	Population	Average Flow (L/s)	Peaking Factor [2]	Peak Flow (L/s)	Extraneous Flow (L/s)	Peak Flows L/s	Peak Flows m^3/day
1	n/a	Existing Developed Land	-	3300	44.28	2.37	104.95	-[1]	104.95	9,068
2	63.53	Future Residential	953	2573	10.42	3.50	36.46	3.18	39.64	3,425
3	36.22	Future Industrial	-	-	14.67	3.30	48.42	1.81	50.23	4,340
4	1.65	Future Commercial	-	-	0.95	1.50	1.43	0.08	1.51	131

Wet Weather Flows

Area Location	Area (ha)	Land Purpose	Housing Density (units)	Population	Average Flow (L/s)	Peaking Factor [2]	Peak Flow (L/s)	Extraneous Flow (L/s)	Peak Flows L/s	Peak Flows m^3/day
1	n/a	Existing Developed Land	-	3300	44.28	2.37	104.95	-[1]	104.95	9,068
2	63.53	Future Residential	953	2573	10.42	3.50	36.46	17.79	54.25	4,687
3	36.22	Future Industrial	-	-	14.67	3.30	48.42	10.14	58.56	5,060
4	1.65	Future Commercial	-	-	0.95	1.50	1.43	0.46	1.89	164

	Total Average Flow		Total Peak Flow	
	L/s	m^3/day	L/s	m^3/day
Dry Weather Flows	75	6,500	196	16,963
Wet Weather Flows	99	8,530	220	18,978

Potential Residential Growth per year over 20 years = 48 units

Notes

1. Assume average flow incorporates extraneous flow
2. Peaking Factor for residential development was determined using the Harmon Formula and for Industrial (Figure) and Commercial Development using MOE guidelines.

Design Parameters

Lagoons Rated Capacity (m^3/d) =	3237
130% over capacity (m^3/d) =	4208.1

From Statistics Canada:	
Population =	3300
Private dwellings occupied by residents =	2985
Resident Unit Density =	2.7

Parameters	
Existing Residential Average Flow (L/c/day) =	1275
New Residential Average Flow (L/c/day) =	350
Industrial Average Flow (L/gross ha/day) =	35000
Commercial Average Flow (L/gross ha/day) =	50000
Extraneous Flows (L/s/gross ha) =	0.05
Extraneous Flows (L/s/gross ha) =	0.28
Harmon Correction Factor =	1
Official Plan Residential Density (units/ha) =	15

The peak domestic sewage flow is calculated as:

$$Q(d) = \frac{PqM + \ell A}{86.4}$$

where:

- Q (d) = Peak domestic sewage flow (including extraneous flow) in litres per second.
- P = Design Population in thousands
- q = Average daily per capita domestic flow in litres/capita/day (See Table 2.2)
- M = Peaking Factor (as derived from the Harmon Formula)
- ℓ = Unit of peak extraneous flow in litres/hectare/second
- A = Area in hectares

APPENDIX F

GEOTECHNICAL DESKTOP REVIEW

25/05/2015

Township of North Glengarry
90 Main Street, P.O. Box 700
Alexandria, ON K0C 1A0

RE: Geotechnical Desktop Study for the Proposed Expansion of Alexandria Sewage Lagoons, Alexandria, North Glengarry, Ontario.

Introduction

McIntosh Perry Consulting Engineers Ltd. (MPCE) is pleased to submit this geotechnical desktop study to be used for planning and preliminary design of the propose sewage lagoons east of Alexandria, in North Glengarry, Ontario.

The purpose of this report is to provide a broad understanding of the surficial geology of the area in the general vicinity of the existing lagoons. It is understood that the exact location of proposed expansion is yet to be determined. The following desktop study is to provide general guideline for the conceptual and preliminary design. Detailed information can be obtained through site specific geotechnical investigation.

General Physiography

The Glengarry till plain is a region of low relief forming the drainage divide between St. Lawrence River and Ottawa basin from Prescott to the Quebec boundary. The till has a medium texture and contains a high proportion of limestone mixed with materials derived from the Precambrian rocks to the north and from the sandstone of the Nepean Formation. The depth to bedrock is sometimes over 30 m. The porous nature of the till plain strata usually predetermine a supply of well water.

There are however areas that the till is overlain by the water-laid deposits ranging from clay to sand size particles. It is visible that the quiet water deposits are interrupted by coarse grained and stony drumlins and ridges. The clay is sensitive and similar in behaviour to the Champlain Sea Clay of the Ottawa Valley. Clay might by underlain by till or rock. The rock is limestone of Shadow Lake formation. Other sedimentary rocks such as dolostone, shale and sandstone of the same formation are also expected in this area. Clay although grey in color like the underlying limestone but it is only mildly calcareous and it is likely derived from more acidic rocks of Canadian Shield. The clay has deposited either on the Champlain Sea floor or in the floor of the channels eroded.

In areas where the salt is leached clay is expected to be more sensitive. East of Ottawa the clay is interstratified pink and grey, lower in lime and free carbonates are lacking in most of the layers. This clay is found to be less pervious and more acidic. Combination of less pervious clay interrupted by high drumlin crowns of till ridges affects the drainage properties of the general area.

Site Geology and Recommendations

The existing lagoons are located east of the Town of Alexandria in a relatively narrow clay deposit formed on an eroded channel floor surrounded by till. Surficial geology maps are shown in Figure 1. The clay narrow is approximately extended in north-east to south-west direction.

If hydraulic conductivity of the soil is required for preliminary design of the sewage expansion, then the relevant environmental codes and guidelines should be consulted. The clay is expected to be medium to high plasticity with clay content ranging from 50% to 70%. It should be noted that varved clay deposits may demonstrate anisotropic hydraulic behaviour. Interbedded silt and clay layers may appear more permeable horizontally than vertically. Till is expected stone-poor sandy silt to silty sand Paleozoic deposit.

If accurate and site-specific soil permeability values are required, then a more rigorous study accompanied by in-situ hydrogeology and permeability tests is recommended.

Closure

I trust this study meet the requirements of your project at the current stage. Please do not hesitate to contact the undersigned should you have any questions or concerns.

Sincerely,

N'eem Tavakkoli, M.Eng., P.Eng.
Geotechnical Engineer

Ref. H:\01 Project - Proposals\2014 Jobs\0CM-14-0312 Twp North Glengarry - EA - Alex Sewage Works\10 Geotechnical Investigation\0CM-14-0312_Alexandria_Lagoons.docx

N

POWER DAM ROAD

MACDONELL ROAD

MCCORMICK ROAD

MACPHEE ROAD

COUNTY ROAD 10

RIVER ROAD

ALEXANDRIA LAGOONS

19

10a

5b

LEGEND

- Alexandria Lagoon
- Parcel
- Roadway
- Railway
- Watercourse

Surficial Geology

- 5b: Stone-poor, carbonate-derived silty to sandy till
- 10a: Massive-well laminated
- 19: Modern alluvial deposits

REFERENCE

Surficial Geology of Southern Ontario provided by the Ontario Geological Survey, Miscellaneous Release - Data 128 - Revised

250 125 0 250

Scale 1:10,000 Metres

CLIENT: TOWNSHIP OF NORTH GLENGARRY

PROJECT: ALEXANDRIA LAGOON SYSTEM EXPANSION

TITLE: SURFICIAL GEOLOGY

McINTOSH PERRY
115 Walgreen Rd., RR#3, Carp, ON K0A1L0
Tel: 613-836-2184 Fax: 613-836-3742

PROJECT NO: CM14-0312	FIGURE: 1
Date	May 25, 2015
GIS	SK
Checked By	NT

Document Path: H:\01 Project - Proposals\2014 Jobs\0CM-14-0312 Twp North Glengarry - EA - Alex Sewage Works\12 GIS\mxd\KM1140312_NorthGlengarry\EA_SurficialGeology.mxd

BH/MW ID: MW-2 (downgradient)

SHEET 1 of 1

PROJECT No: CM-11-135
SITE: Alexandria Lagoons
CLIENT: Township of North Glengarry

LOGGED BY: JC
DRILLER: Downing Drillings
DATE DRILLED: Tuesday March 5, 2013

Depth (ft / m)	Symbol	DESCRIPTION	Elevation	Soil Headspace CGI ppm (0 100 300 500)	Sample Type	Sample ID	Well Completion Details
0 / 0		Ground Surface	0.000				stick-up steel casing
0 / 0		*Silty Clay* light brown, moist	0.000				bentonite seal
10 / 3		*Silty Clay* dark brown, moist	-3.048 3.048				schedule 40 PVC riser (2.0")
16 / 5		*Silty Clay* dark brown, moist, small stones	-4.877 4.877				silica sand pack water level on March 5, 2013 schdule 40 PVC well screen (10 slot)
20 / 6		End of hole	-6.096 6.096				

NOTES:

Descriptions are based on observations and hand testing of grab samples. Mechanical Tests were not performed unless otherwise

EASTING: 530261.93 m E (approx.)
NORTHING: 5018848.80 m N (approx.)
MAP DATUM: 18 T

ELEVATION - TOP OF PVC RISER:
REVIEWED BY: MP
TEMPLATE: MP - BH&MW w CGI

APPENDIX G

ENVIRONMENTAL EXISTING CONDITIONS REPORT

Alexandria Sewage Lagoon Facility

Existing Conditions Report

Prepared for:

Corporation of the Township of North Glengarry
63 Kenyon Street West
Alexandria, Ontario K0C 1A0

Prepared by:

McIntosh Perry Consulting Engineers Ltd.
115 Walgreen Road
Carp, ON
K0A 1L0

July 2015
Amended January 2017

Table of Contents

FIGURES

TABLES

1.0 INTRODUCTION

McIntosh Perry Consulting Engineers Ltd. (McIntosh Perry) completed a screening of the existing conditions of the Alexandria Swage Lagoon Facility property, to accurately assess the potential environmental constraints that may be associated with the proposed expansion of the Alexandria Sewage Lagoon Facility. This Existing Conditions Report summarizes the findings of the June 1, 2015 site visit, and a background review of the best available information for the subject property. The report includes an outline of existing site conditions, outlines the nature and boundaries of any significant features and ecological functions on or adjacent to the site, and is a compilation of the environmental inventory found on site.

2.0 DESCRIPTION OF THE SITE AND NATURAL ENVIRONMENT

2.1 Existing Land Use

At the time of the field survey, the subject property included a wastewater treatment facility represented by five (5) separate treatment cells (Cell A, Cell B, Cell C, Aeration Cell and Geotube Cell) and an undeveloped cultural meadow and a shallow cattail wetland (**Figure 1**). The subject property was bounded by corn fields and a railway line (**Figure 1**). Access to the property was from McCormick Road, north of the study area. The property is classified as "Waste Disposal" in the Township of North Glengarry's Official Plan (2013), Schedule "A" and as "AG-4" (General Agricultural – special exception) in the Zoning By-Law 39-2000.

2.2 Landforms, Soils & Geology

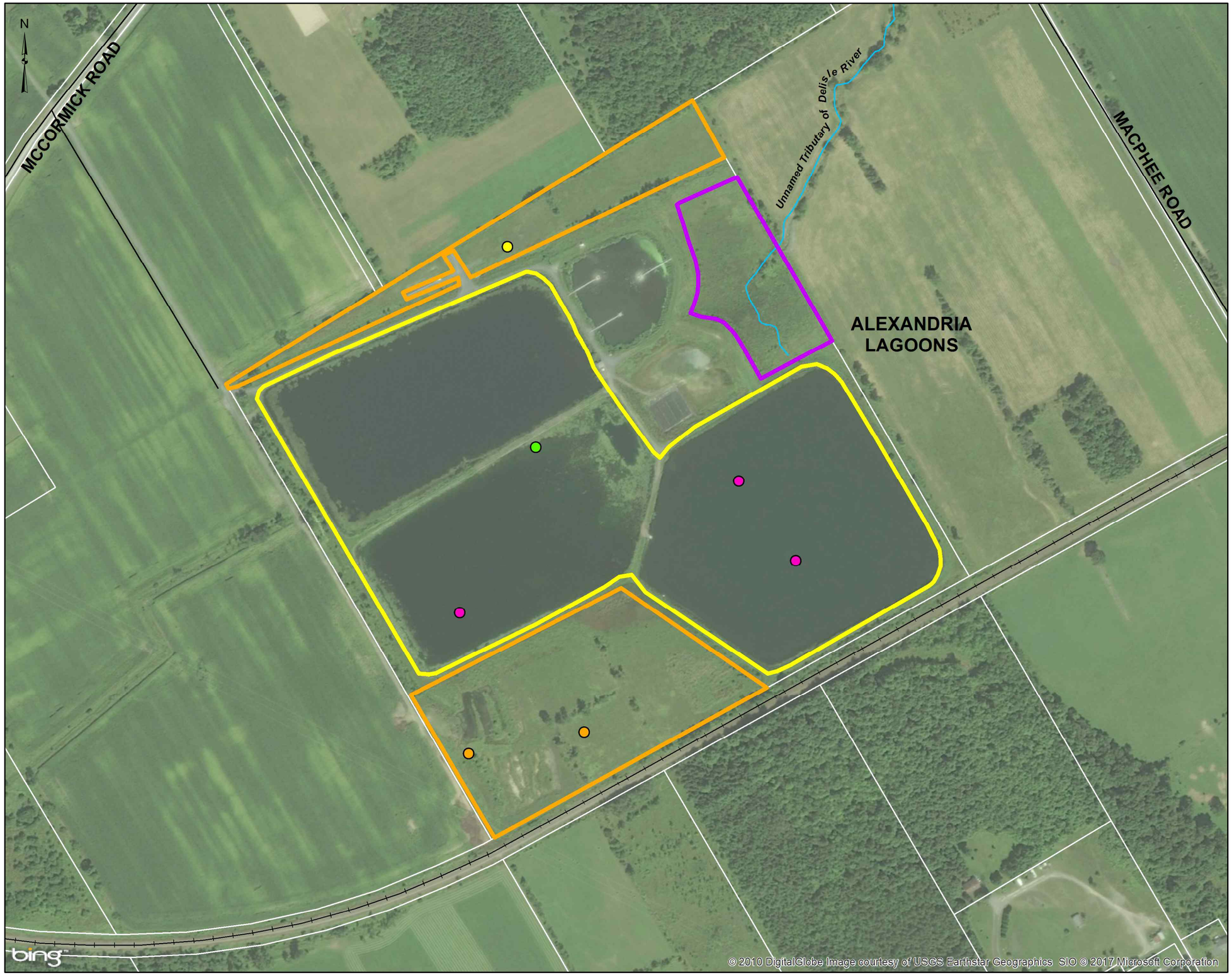
Soils present on the subject property were classified as Bearbrook Clay; a water-laid fine brown and grey varved clay with poor drainage (Matthews, et al., 1957). The topography of the subject property was smooth, level and stonefree.

2.3 Surface Water, Groundwater and Fish Habitat

Surface water present on the subject property included water in the wastewater treatment cells and a shallow cattail wetland on the north corner and northeast side of the subject property (Figure 1). The shallow cattail wetland is seasonally connected to the Delisle River (~330 m north of the subject property) by an intermittent unnamed tributary (municipal drain).

According to background information provided by the MNRF, fish species present within the Delisle River and adjacent watercourses include the following: American Eel (*Anguilla rostrata*), Banded Killifish (*Fundulus diaphanus*), Blackchin Shiner (*Notropis heterodon*), Blacknose Shiner (*Notropis heterolepis*), Bluntnose Minnow (*Pimephales notatus*), Brassy Minnow (*Hybognathus hankinsoni*), Brook Stickleback (*Culaea inconstans*), Brown Bullhead (*Ameiurus nebulosus*), Common Carp (*Cyprinus carpio*), Central Mudminnow (*Umbra limi*), Common Shiner (*Luxilus cornutus*), Creek Chub (*Semotilus atromaculatus*), Emerald Shiner

(*Notropis atherinoides*), Fantail Darter (*Etheostoma flabellare*), Fathead Minnow (*Pimephales promelas*), Finescale Dace (*Phoxinus neogaeus*), Golden Shiner (*Notemigonus crysoleucas*), Iowa Darter (*Etheostoma exile*), Johnny Darter (*Etheostoma nigrum*), Largemouth Bass (*Micropterus salmoides*), Logperch (*Percina caprodes*), Longear Sunfish (*Lepomis megalotis*), Longnose Dace (*Rhinichthys cataractae*), Mimic Shiner (*Notropis volucellus*), Muskellunge (*Esox masquinongy*), Northern Redbelly Dace (*Chrosomus eos*), Pumpkinseed (*Lepomis gibbosus*), Rock Bass (*Ambloplites rupestris*), Rosyface Shiner (*Notropis rubellus*), Sand Shiner (*Notropis stramineus*), Smallmouth Bass (*Micropterus dolomieu*), Spottail Shiner (*Notropis hudsonius*), Stonecat (*Noturus flavus*), Yellow Perch (*Perca flavescens*), Tadpole Madtom (*Noturus gyrinus*) and White Sucker (*Catostomus commersonii*) (MNRF, 2015 & MNRF, 2016).



LEGEND

- Parcel Boundary
- Roadway
- Railway
- Watercourse

Observations

- Bank & Barn Swallow Observation
- Black Tern Observartion
- Bobolink Observation
- Grasshopper Sparrow Observation

Habitat

- Cattail Organic Shallow Marsh Type - Snapping Turtle Foraging Habitat
- Cultural Meadow - Grasshopper Sparrow Bobolink & Eastern Meadowlark Breeding/Nesting/Foraging Habitat
- Snapping Turtle, Barn Swallow and Bank Swallow Foraging Habitat & Black Tern Breeding/Nesting/Foraging Habitat

REFERENCE

Surficial Geology of Southern Ontario provided by the Ontario Geological Survey, Miscellaneous Release - Data 128 - Revised

100 50 0 100
Scale 1:4,000 Metres

CLIENT: TOWNSHIP OF NORTH GLENGARRY

PROJECT: ALEXANDRIA LAGOON SYSTEM EXPANSION

TITLE: NATURAL ENVIRONMENT MAP

McINTOSH PERRY
115 Walgreen Rd., RR#3, Carp, ON K0A1L0
Tel: 613-836-2184 Fax: 613-836-3742

PROJECT NO: CM14-0312	FIGURE: 1
Date	July 23, 2015
GIS	SK
Checked By	HL

Document Path: H:\01 Project - Proposals\2014 Jobs\0CM-14-0312 Twp North Glengarry - EA - Alex Sewage Works\12 GIS\mxd\CM140312_NorthGlengarryEA_EIS.mxd

2.4 Vegetation

The subject property was located in the St-Lawrence Lowlands Ecoregion, within the Mixedwood Plains Ecozone (Ecological Stratification Working Group, 1995). At the time of the field investigation, the subject property contained two main vegetation communities adjacent to the wastewater treatment cells, a Cultural Meadow and a shallow Cattail Shallow Marsh (**Figure 1**). The vegetation survey was completed on June 1, 2015. No nationally, provincially or regionally rare or endangered plant species were observed during the field survey.

The following section outlines the existing vegetation communities located within the study area. For a detailed map of vegetation communities found within the study area, refer to **Figure 1**.

2.4.1 *Community 1: Cultural Meadow (CUM)*

Vegetation Community 1 was located in the south corner of the subject property (**Figure 1**). It was classified under the Ecological Land Classification (ELC) methodology as a Cultural Meadow (CUM) (**Photos 1, 2, 3, & 4**). This community was primarily dominated by various grass species and common meadow-type vegetation species, with sporadic tree saplings and woody shrubs also present. The community was bisected by hedgerows that contained mature bur oak (*Quercus macrocarpa*), American elm (*Ulmus americana*) and hawthorn spp. (*Crataegus* spp.) shrubs. Herbaceous and woody species that characterized Community 1 included: red-osier dogwood (*Cornus sericea*), tartarian honeysuckle (*Lonicera tatarica*), white ash (*Fraxinus americana*), choke cherry (*Prunus virginiana*), nannyberry (*Viburnum lentago*), poison ivy (*Toxicodendron radicans*), red raspberry (*Rubus ideaus*), yarrow (*Achillea millefolium*), Queen Anne's lace (*Daucus carota*), buttercup spp. (*Ranunculus* spp.), grass spp. (*Gaminoid* spp.), goat's beard (*Tragopogon dubius*), red clover (*Trifolium pratense*), white clover (*Trifolium repens*), common burdock (*Arctium minus*), common milkweed (*Asclepias syriaca*), cow vetch (Vicia cracca), yellow hawkweed (*Hieracium* spp.), wild strawberry (*Fragaria vesca*) and ox-eye daisy (*Leucanthemum vulgare*).

2.4.2 *Community 2: Cattail Organic Shallow Marsh Type*

Vegetation Community 2 was located in the north corner of the subject property (**Figure 1**). It was classified under the ELC methodology as a Cattail Organic Shallow Marsh Type (MAS3-1) (**Photos 5, 6, 7 & 8**). This community was seasonally connected to the Delisle River, approximately 330 m north of the site, by an unnamed tributary (municipal drain). At the time of the June 1, 2015 field investigation, there was very little water in this community (<10 cm). However, given the vegetation species present and historical aerial photographs, it is evident that it is a seasonally wet vegetation community. The community was dominated by broad-leaved cattail (*Typha latifolia*). Other vegetation species present in Community 2 included the following: nannyberry, shrub willow spp. (*Salix* spp.) and grass spp.

2.5 Designated Natural Heritage Features

Natural Heritage features identified through background information provided by the MNRF, as present on or within radius of the subject property, include the following: ditch, evaluated wetland (Delisle River – Evaluated – Provincial), Municipal Drain (Delisle River), Municipal Drain (Hamell Municipal Drain), Municipal Drain (Un-named Drain), Delisle River, Unevaluated Wetland, pond (MNRF, 2015 & MNRF 2016). No other Natural Heritage features were identified by background information or during the June 1, 2015 site investigation.

2.6 Wildlife

The following section outlines the existing wildlife observations from the 2015 field investigation on the subject property, in addition to gathered background information. Wildlife species observed within the study area were identified by sight and through direct evidence, including call, footprints and scat.

The subject property is located in the St. Lawrence Lowlands Ecoregion within the Mixed Plains Ecozone (National Ecological Framework for Canada, 1995). Characteristic wildlife within this Ecoregion includes: black bear, moose, deer, wolf, hare, chipmunk, other small mammals, waterfowl, turtles, snakes and various bird species.

Two mammal species were observed during the 2015 field investigation on the subject property; white-tailed deer (*Odocoileus virginianus*) and red squirrel (*Sciurus vulgaris*). Other mammal species known to be common in the area within habitat observed on and directly adjacent to the subject property included: groundhog (*Marmota monax*), striped skunk (*Mephitis mephitis*), chipmunk (*Tamias striatus*) and meadow vole (*Microtus pennsylvanicus*).

No reptile or amphibian species were observed during the field survey on the subject property. Given the available habitat, the main species with the potential to be present on the subject property are the Eastern Garter Snake (*Thamnophis sirtalis*) and Northern Leopard Frog (*Rana pipiens*).

Bird species observed during the field surveys included: Mallard (*Anas platyrhynchos*), American Crow (*Corvus brachyrhychos*), Song Sparrow (*Melospiza melodia*), Yellow Warbler (*Setophaga petechia*), Killdeer (*Charadrius vociferus*), Red-winged Blackbird (*Agelaius phoeniceus*), Grasshopper Sparrow (*Ammodramus savannarum*), Tree Swallow (*Tachycineta bicolor*), Bank Swallow (*Riparia riparia*), Barn Swallow (*Hirundo rustica*), Canada Goose (*Branta canadensis*), Eastern Kingbird (*Tyrannus tyrannus*), Brown Thrasher (*Toxostoma rufum*), Black Tern (*Chlidonias niger*) and Bobolink (*Dolichonyx oryzivorus*). Habitat observed on the subject property represented appropriate breeding/nesting/foraging habitat for the Mallard, American Crow, Song Sparrow, Yellow Warbler, Killdeer, Red-winged Blackbird, Grasshopper Sparrow, Tree Swallow, Canada Goose, Eastern Kingbird, Brown Thrasher, Black Tern and Bobolink. Foraging habitat for the Bank Swallow and Barn Swallow was also present. These bird species, (excluding the American Crow and Red-

winged Blackbird), and their nests are protected under the *Migratory Birds Convention Act*, 1994. In addition, habitat for Bank Swallow, Barn Swallow and Bobolink is afforded protection under the *Endangered Species Act*, 2007 (ESA).

2.7 Species at Risk

Background information obtained from the MNRF Kemptville District Office (Seabert, 2015), the Natural Heritage Information Centre (NHIC) (2015), Ontario Nature Reptiles and Amphibians of Ontario Atlas (ORAA) (2015), the Ontario Breeding Bird Atlas (OBBA) (2008), in addition to the June 1, 2015 field observations, indicated that the species listed below in **Table 1** have the potential to be present in the area of, or on the subject property. **Table 1** also labels what the provincial and federal status of each species is, if habitat for each species was observed on the property or not, and what category of habitat it was (i.e. breeding, nesting, etc.).

Table 1: Species at Risk Potentially Present on the Subject Property

Common Name	Scientific Name	Provincial Status	Federal Status	Habitat Present	Source
Bird Species					
Barn Swallow	*Hirundo rustica*	Threatened	Threatened	Yes (study area represents foraging habitat)	OBBA, MNRF 2015, McIntosh Perry observation, MNRF 2016
Bobolink	*Dolichonyx oryzivorus*	Threatened	Threatened	Yes (study area represents breeding/nesting/foraging habitat)	OBBA, MNRF 2015, McIntosh Perry observation, MNRF 2106
Chimney Swift	*Chaetura pelagica*	Threatened	Threatened	No	MNRF 2016
Eastern Meadowlark	*Sturnella magna*	Threatened	Threatened	Yes (study area represents breeding/nesting/foraging habitat)	OBBA, MNRF 2015
Bank Swallow	*Riparia riparia*	Threatened	Not at Risk (listed as threatened by COSEWIC)	Yes (study area represents foraging habitat)	McIntosh Perry observation
Least Bittern	*Ixobrychus exilis*	Threatened	Threatened	No	MNRF 2015
Grasshopper Sparrow	*Ammodramus savannarum*	Special Concern	Not at Risk (listed as special concern by COSEWIC)	Yes (study area represents breeding/nesting/foraging habitat)	McIntosh Perry observation
Black Tern	*Chlidonias niger*	Special Concern	Not at Risk	Yes (study area represents breeding/nesting/foraging habitat)	MNRF 2015, McIntosh Perry observation, MNRF 2016

Common Name	Scientific Name	Provincial Status	Federal Status	Habitat Present	Source
Wood Thrush	*Hylocichla mustelina*	Special Concern	Special Concern	No	OBBA
Eastern Wood-pewee	*Contopus virens*	Special Concern	Not at Risk (listed as special concern by COSEWIC)	Yes (study area represents breeding/nesting/foraging habitat)	OBBA
Mammal Species					
Little Brown Bat	*Myotis lucifugus*	Endangered	Endangered	No	MNRF 2016
Northern Long-eared Bat	*Myotis septentrionalis*	Endangered	Endangered	No	MNRF 2016
Tri-Colored Bat	*Perimyotis subflavus*	Endangered	Endangered	No	MNRF 2016
Vegetation Species					
Butternut	*Juglans cinerea*	Endangered	Endangered	Yes (none observed)	MNRF 2015, MNRF 2016
Fish Species					
Cutlip Minnow	*Exoglossum maxilingua*	Threatened	Not at Risk (listed as special concern by COSEWIC)	No	MNRF 2015, NHIC, MNRF 2016
American Eel	*Anguilla rostrata*	Endangered	Not at Risk (listed as threatened by COSEWIC)	No	MNRF 2016
Reptile Species					
Blanding's Turtle	*Emydoidea blandingii*	Threatened	Threatened	No	ORAA
Snapping Turtle	*Chelydra serpentina*	Special Concern	Special Concern	Yes (study area represents foraging habitat)	MNRF 2015, ORAA, MNRF 2016

Suitable habitat for the Barn Swallow, Bobolink, Eastern Meadowlark, Bank Swallow, Grasshopper Sparrow, Black Tern, Eastern Wood-pewee, Butternut and Snapping Turtle was observed to be present on the subject property during the 2015 field survey. Five (5) species at risk were observed on the subject property during the 2015 field survey; Barn Swallow, Bobolink, Bank Swallow, Grasshopper Sparrow and Black Tern.

The Barn Swallow prefers to construct its nest on ledges or walls of human-made structures (e.g. barns, other buildings, bridges, large culverts). Foraging habitat includes open farmland, marshes and lakes adjacent to human habitation. The Barn Swallow is a threatened species in Ontario. Therefore, the bird and its habitat are protected under the ESA. During the 2015 field survey, Barn Swallows were observed foraging over the water in Cell 'C' on the east side of the subject property (**Figure 1, Photo 9**).

The Bank Swallow is a colonial nester that utilizes vertical banks on shorelines and within sand and gravel pit sites. Similar to the Barn Swallow, the Bank Swallow can be found foraging over open fields, marshes and lakes. The Bank Swallow is also a threatened species in Ontario, receiving protection for the species and its habitat through the ESA. During the 2015 field survey, Bank Swallows were observed foraging over the water in Cell 'C' on the east side of the subject property (**Figure 1, Photo 9**).

Habitat preferred by the Grasshopper Sparrow includes short treeless grasslands, unimproved pastures or occasionally cultivated hayfields and cereal crops. As a special concern species, the Grasshopper Sparrow is not afforded protection under the ESA. The species, its eggs, nest and nestlings are, however, protected under the Migratory Birds Convention Act, 1994. During the 2015 field survey, evidence for probable breeding effort was observed (singing males) within the cultural meadow on the south corner of the subject property (**Figure 1, Photos 1, 2, 3 & 4**).

Foraging, nesting and breeding habitat preferred by the Black Tern includes 50:50 open water/emergent vegetation marshes, wet meadows and ponds. As a special concern species, the Black Tern is not afforded protection under the ESA. The species, its eggs and nest, are protected under *the Migratory Birds Convention Act,* 1994. During the 2015 field survey, two (2) Black Terns were observed foraging over Cells 'A' and 'B' (**Figure 1, Photo 10**).

The Eastern Wood-pewee prefers habitat of deciduous and mixed forest with open space near the nest (e.g., forest edges). As a special concern species, the Eastern Wood-pewee is not afforded protection under the ESA. The species, its eggs and nest are protected under the *Migratory Birds Convention Act*, 1994. Although this species was not detected during the 2015 field investigation, potential habitat for the Eastern Wood-pewee was observed within the south corner of the subject property (e.g., treed hedgerows) (**Photo 11**).

Appropriate breeding, nesting and foraging habitat for the Bobolink and Eastern Meadowlark includes open areas of tall grass with a certain amount of thatch (e.g. hay fields and regenerating meadows). As threatened species, the Bobolink and Eastern Meadowlark are afforded species and habitat protection under the ESA. One (1) singing male Bobolink was observed within the Cultural Meadow habitat on the north side of the subject property (**Figure 1, Photo 12**). Appropriate habitat for both species was also observed within the cultural meadow located in the south corner of the subject property (**Figure 1, Photos 1, 2, 3 & 4**). If any project works are proposed to encroach within habitat of these species, it is recommended that three (3) presence/absence surveys be completed by a qualified avian biologist between June 1 and the end of the first week in July. If the surveys determine that either species, (or other nesting migratory birds) are *not* using the area for breeding purposes, then work can commence after the surveys have been completed. If the surveys confirm the presence of breeding Bobolink or Eastern Meadowlark, the following is required to occur:

- The project must be registered with the MNRF under Section 23.2 of O. Reg. 242/08. Details on how to register with the MNRF can be found here: https://www.ontario.ca/page/bobolink-and-eastern-meadowlark-habitats-and-land-development;

- Applicable compensation undertaken (i.e., habitat creation and management, minimum of 4 hectares at least 200 metres wide); and
- If the Eastern Meadowlark is determined to be breeding within the habitat, then project works must not commence until after August 1, and after registration has occurred (see above bullet one). If the Bobolink is determined to be breeding within the habitat, then project works must not commence until after July 15, and after registration has occurred (see above bullet one). If a species of migratory bird is identified nesting within the area (e.g., Savannah Sparrow, Grasshopper Sparrow, etc.), then work should not occur until the birds have finished nesting and left the area. This timing will depend on the species observed.

Butternuts often grow in open, well-drained sites. Edge habitat between the cultural meadow and treed areas would have been appropriate for this species. They are intolerant of shade. The Butternut is listed as an endangered species due to the fact that it is susceptible to Butternut canker, a lethal fungal disease (ROM, 2009). Butternut canker causes cracks and cankers to form on the branches and trunk of the butternut tree that eventually girdle the tree and kill it. Butternuts are protected by the ESA. No Butternuts were observed on the subject property during 2015 field investigation.

Habitat preferred by the Snapping Turtle includes large bodies of water as well as smaller ponds. As a species of special concern, the Snapping Turtle is not protected by the ESA. It is protected from harm, however, by the *Fish and Wildlife Act*, 1997. Although no Snapping Turtles were observed during the field survey, the wastewater treatment cells on the subject property and the cattail marsh located in the south corner of the subject property would be considered appropriate habitat for this species (**Figure 1, Photos 5, 6, 7, 8 & 10**).

3.0 REFERENCES

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Appendix A – Photographs

Photo 1: Vegetation Community 1, Cultural Meadow, facing northeast, June 1, 2015.

Photo 2: Vegetation Community 1, Cultural Meadow, facing northwest, June 1, 2015.

Photo 3: Vegetation Community 1, Cultural Meadow, facing east, June 1, 2015.

Photo 4: Vegetation Community 1, Cultural Meadow, facing northeast, June 1, 2015.

Photo 5: Vegetation Community 2, Cattail Marsh, facing east, June 1, 2015.

Photo 6: Vegetation Community 2, Cattail Marsh, facing north, June 1, 2015.

Photo 7: Vegetation Community 2, Cattail Marsh, facing northwest, June 1, 2015.

Photo 8: Vegetation Community 2, Cattail Marsh & Vegetation Community 1, Cultural Meadow, facing west, June 1, 2015.

Photo 9: Barn Swallow & Bank Swallow foraging habitat, facing north, June 1, 2015.

Photo 10: Black Tern observation location, facing southwest, June 1, 2015.

Photo 11: Eastern Wood-pewee habitat, facing east, June 1, 2015.

Photo 12: Bobolink observation location, facing north, June 1, 2015.

Appendix B - Correspondence

Ministry of Natural Resources

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Kemptville, ONK0G 1J0

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Fax.: (613) 258-3920

Ministère des Richesses naturelles

District de Kemptville
CP 2002
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Kemptville, ONK0G 1J0

Tél.: (613) 258-8204
Téléc.: (613) 258-3920

Mon. Jun 22, 2015

Heather Lunn
McIntosh Perry
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Carp, Ontario
K0A 1L0
(613) 836-2184 ext 2277
h.lunn@mcintoshperry.com

Attention: Heather Lunn

Subject: Information Request - Developments
Project Name: Proposed Lagoon Expansion on McCormick Rd., Alexandria
Site Address: McCormick Rd., Approx. 1.2km east of Sandfield Ave. S.
Our File No. 2015_LOC-3094

Natural Heritage Values
The Ministry of Natural Resources (MNR) Kemptville District has carried out a preliminary review of the area in order to identify any potential natural resource and natural heritage values.

The MNR works closely with partner agencies and local municipalities in order to establish concurrent approval process and to achieve streamlined and efficient service delivery. The MNR strongly encourages all proponents to contact partner agencies (e.g. MOE, Conservation Authority, etc.) and appropriate municipalities early on in the planning process. This provides the proponent with early knowledge regarding agency requirements and approval timelines.

Natural heritage features and values contribute to the province's rich biodiversity and provide habitat for a variety of species. The following Natural Heritage values were identified:

- Ditch
- Evaluated Wetland, Delisle River (Evaluated-Provincial)
- Pond
- River, Rivière Delisle

Municipal Official Plans contain additional information related to natural heritage features. Please see the local municipal Official Plan for more information such as specific policies and direction pertaining to activities which may impact natural heritage features. For planning advice or Official Plan interpretation, please contact the local municipality.

Where natural values and natural hazards exist (e.g., floodplains), there may be additional approvals and permitting required from the local Conservation Authority. The MNR strongly recommends contacting the local Conservation Authority for further information and approvals. Please see the MNR Kemptville Information Guide (2012) for contact information pertaining to Conservation Authorities located within the Kemptville District area.

For additional information and online mapping tools, please see the Natural Heritage Information Centre (NHIC), where additional data and files can be downloaded in both list and digital format. In addition sensitive species information can be requested and accessed through the NHIC at NHICrequests@ontario.ca.

In Addition, the following Fish species were identified: bluntnose minnow, brassy minnow, brook stickleback, brown bullhead, Carps and Minnows, central mudminnow, common shiner, creek chub, fathead minnow, finescale dace, northern redbelly dace, pumpkinseed, tadpole madtom, white sucker.

Water

Where the site is adjacent to or contains a watercourses or waterbodies, additional considerations apply. If any in-water works are to occur, there are timing restriction periods for which work in water can take place (see below). Appropriate measures should be taken to minimize and mitigate impact on water quality and fish habitat, including:

- including the installation of sediment and erosion control measures;
- avoiding removal alteration or covering of substrates used for fish spawning, feeding, over-wintering or nursery areas; and
- debris control measures should be put in place to manage falling debris (e.g. spalling).

A work permit from the MNR may be required pending further details regarding the proposed works. No encroachment on the bed or banks of the waterbody (e.g. abutments, embankments, etc.) is permitted until MNR approval and clearance has been issued. In order for MNR staff to determine when a work permit is required, additional information can include:

- Detailed drawings (existing and proposed)
- Location mapping
- Registered Plan survey
- Site photographs
- Public Lands Act Forms - application forms, ownership form and landowner notification form.

The MNR does not have any water quality or quantity data available. We recommend that the Ministry of the Environment be contacted for such data along with the local Conservation Authority. For further information regarding fish habitat and protocols, please refer to the following

interagency, document, *Fish Habitat Referral Protocol for* Ontario at: http://www.mnr.gov.ca/264110.pdf

Timing restriction periods in MNR Kemptville District*:

Warmwater → March 15 – June 30
→ March 15 – July 15 for St. Lawrence River & Ottawa River
Coldwater → October 1 – May 31
Mixed lakes → October 1 – June 30 (Big Rideau & Charleston)

* *Please note: Additional timing restrictions may apply as it relates to Endangered and Threatened Species, including works in both water and wetland areas.*

	FISH SPECIES	TIMING WINDOW
Spring:	Walleye	March 15 to May 31
	Northern Pike	March 15 to May 31
	Lake Sturgeon	May 1 to June 30
	Muskellunge	March 15 to May 31
	Largemouth/Smallmouth Bass	May 1 to July 15
	Rainbow Trout	March 15 to June 15
	Other/Unknown Spring Spawning Species	March 15 to July 15

	FISH SPECIES	TIMING WINDOW
Fall:	Lake Trout	October 1 to May 31
	Brook Trout	October 1 to May 31
	Pacific Salmon	September 15 to May 31
	Lake Whitefish	October 15 to May 31
	Lake Herring	October 15 to May 31
	Other/Unknown Fall Spawning Species	October 1 to May 31

Additional approvals and permits may be required for the proposed works as it relates to the Fisheries Act. Please contact your local Conservation Authority and the Department of Fisheries and Oceans to determine requirements and next steps. Where the Fisheries Act is triggered and habitat compensation, mitigation measures or best management practices are being considered; as the MNR is charged with the management of Provincial fish populations, the MNR requests ongoing involvement in such discussions in order to ensure population conservation. Furthermore, local Conservation Authorities may also have additional approvals for works in and adjacent to water and wetland features. Finally, Transport Canada's Navigable Waters Protection Division may require review and approval of the proposed project. Please contact these local agencies directly for more information.

As per the Natural Heritage Reference Manual (Section 13; OMNR 2010) the MNR strongly recommends that an Ecological Site Assessment be carried out to more thoroughly determine the presence of natural heritage features, and Species at Risk and their habitat located on site. The MNR can provide survey methodology for particular species at risk and their habitats. In addition, the local planning authority may have more details pertaining to the requirements of the assessment process, which will allow for the municipality to make planning decisions which are consistent with the Provincial Policy Statement (2005).

Species at Risk

With the new Endangered Species Act (ESA, 2007) in effect, it is important to understand which species and habitats exist in the area and the implications of the legislation. A review of the Natural Heritage Information Centre (NHIC) and internal records and aerial photograph interpretation indicate that there is a potential for the following Threatened (THR) and/or Endangered (END) species on the site or in proximity to it:

- Barn Swallow (THR)
- Bobolink (THR)
- Butternut (END)
- Cutlip Minnow (THR)
- Eastern Meadowlark (THR)
- Least Bittern (THR)

All Endangered and Threatened species receive individual protection under section 9 of the ESA and receive general habitat protection under Section 10 of the ESA, 2007. Thus any potential works should consider disturbance of possible important habitat (e.g. nesting sites). Please note that as of June 30, 2013 general habitat protection applies to all Threatened and Endangered species. The habitat of these listed species is protected from damage and destruction and certain activities may require authorization(s) under the ESA. Please keep this date in mind when planning any species and habitat surveys

Species receiving General Habitat protection:

- Barn Swallow (THR)
- Bobolink (THR)
- Butternut (END)
- Cutlip Minnow (THR)
- Eastern Meadowlark (THR)
- Least Bittern (THR)

If the proposed activity is known to have an impact on the species mentioned above or any other SAR, an authorization under the Endangered Species Act, 2007 (ESA) may be required. It is recommended that MNR Kemptville be contacted prior to any activities being carried out to discuss potential survey and mitigation measures to avoid contravention of the ESA.

Habitat has been identified within the project area that appears suitable for one or more species listed by SARO as Special Concern (SC). In Addition, one or more Special Concern species has been documented to occur either on the site or nearby. Species listed as Special Concern are not protected under the ESA, 2007. However, please note that some of these species may be protected under the Fish and Wildlife Conservation Act. Species of Special Concern for consideration:

- Black Tern (SC)
- Monarch (SC)
- Snapping Turtle (SC)

If any of these or any other species at risk are discovered throughout the course of the work, and/or should any species at risk or their habitat be potentially impacted by on site activities, MNR

should be contacted immediately and operations be modified to avoid any negative impacts to species at risk or their habitat until further direction is provided by MNR.

Please note that information regarding species at risk is based on documented occurrences only and does not include an interpretation of potential habitat within or in proximity to the site in question. Although this data represents the MNR's best current available information, it is important to note that a lack of information for a site does not mean that additional features and values are not present. i.e.: Species at Risk (SAR) or their habitat could still be present at the location or in the immediate area. It is the responsibility of the proponent to ensure that species at risk are not killed, harmed, or harassed; or their habitat is not damaged or destroyed through the activities carried out on the site. The MNR continues to strongly encourage ecological site assessments to determine the potential for SAR habitat and occurrences. When a SAR or potential habitat for a SAR does occur on a site, it is recommended that the proponent contact the MNR for technical advice and to discuss what activities can occur without contravention of the Act. If an activity is proposed that will contravene the ESA (such as Section 9 or 10), the proponent must contact the MNR to discuss the potential for a permit (Section 17). For specific questions regarding the Endangered Species Act (2007) or SAR, please contact a district Species at Risk Biologist at sar.kemptville@ontario.ca. For more information regarding the ESA (2007), please see attached ESA Information Sheet.

As of July 1, 2013, the approvals processes for a number of activities that have the potential to impact SAR or their habitat were changed in an effort to streamline approvals processes while continuing to protect and sustainably manage Ontario's natural resources. For those activities that require registration with the Ministry, businesses and individuals will be able to do so through a new online system. The online system will also include information to help guide individuals and businesses through the new processes. For further information on which activities are authorized through this new online registration process and how to apply, please refer to the following website: http://www.mnr.gov.on.ca/en/About/2ColumnSubPage/STDPROD_104342.html. General inquiries may be directed towards Kemptville District MNR, while questions and comments involving the new online forms can be directed to the Registry Approvals Service Centre (RASC) at 1-855-613-4256 or mnr.rasc@ontario.ca.

Please note: The advice in this letter may become invalid if:

- The Committee on the Status of Species at Risk in Ontario (COSSARO) re-assesses the status of the above-named species OR adds a species to the SARO List such that the section 9 and/or 10 protection provisions apply to those species.
- Additional occurrences of species are discovered.
- Habitat protection comes into force for one of the above-mentioned species through the creation of a habitat regulation (see general habitat protection above).

This letter is valid until: Tue. Jun 21, 2016

MNR is streamlining and automating its approvals processes for natural resource-related activities. Some activities that may otherwise contravene the ESA may be eligible to proceed without a permit from MNR provided that regulatory conditions are met for the ongoing protection of species at risk and their habitats. There are regulatory provisions for projects that have attained a specified level

of approval prior to, or shortly after, the specified species or its habitat became protected under the ESA. Their requirements include registering the activity with the Ministry of Natural Resources, taking steps to immediately minimize adverse effects on species and habitat, and developing a mitigation plan. Anyone intending to use this regulatory provision is strongly advised to review Ontario Regulation 242/08 under the Endangered Species Act, 2007 for the full legal requirements.

For more information please check out the following link http://www.ontario.ca/environment-and-energy/development-and-infrastructure-projects-and-endangered-or-threatened-species

The MNR would like to advise, by way of this letter, that we continue to be circulated on information with regards to this project. If you have any questions or require clarification please do not hesitate to contact me.

Sincerely,

Erin Seabert
Resource Management Tech
erin.seabert@ontario.ca

Encl.\
-ESA Infosheet
-NHIC/LIO Infosheet

Ministry of Natural Resources and Forestry

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Thu. Dec 8, 2016

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Attention: Lisa Marshall

Subject: Information Request - Developments
Project Name: Expansion of the Alexandria Sewage Lagoon Facility
Our File No. 2016_LOC-3829

Natural Heritage Values

The Ministry of Natural Resources and Forestry (MNRF) Kemptville District has carried out a preliminary review of the above mentioned area in order to identify any potential natural resource and natural heritage values.

The following Natural Heritage values were identified for the general subject area:

- Evaluated Wetland, Delisle River (Evaluated-Provincial)
- Municipal Drain, Delisle River
- Municipal Drain, Hamell Municipal Drain
- Municipal Drain, Un-named Drain
- River, Rivière Delisle
- Unevaluated Wetland

Municipal Official Plans contain information related to natural heritage features. Please see the local municipal Official Plan for more information, such as specific policies and direction pertaining to activities which may impact natural heritage features. For planning advice or Official Plan interpretation, please contact the local municipality. Many municipalities require environmental impact studies and other supporting studies be carried out as part of the development application process to allow the municipality to make planning decisions which are consistent with the Provincial Policy Statement (PPS, 2014).

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The MNRF strongly encourages all proponents to contact partner agencies and appropriate municipalities early on in the planning process. This provides the proponent with early knowledge regarding agency requirements, authorizations and approval timelines; Ministry of the Environment and Climate Change (MOECC) and the local Conservation Authority may require approvals and permitting where natural values and natural hazards (e.g., floodplains) exist.

As per the Natural Heritage Reference Manual (NHRM, 2010) the MNRF strongly recommends that an ecological site assessment be carried out to determine the presence of natural heritage features and species at risk and their habitat on site. The MNRF can provide survey methodology for particular species at risk and their habitats.

The NHRM also recommends that cumulative effects of development projects on the integrity of natural heritage features and areas be given due consideration. This includes the evaluation of the past, present and possible future impacts of development in the surrounding area that may occur as a result of demand created by the presently proposed project.

In Addition, the following Fish species were identified: American eel, banded killifish, blackchin shiner, blacknose shiner, bluntnose minnow, brassy minnow, brook stickleback, brown bullhead, Carps and Minnows, central mudminnow, common carp, common shiner, creek chub, emerald shiner, fantail darter, fathead minnow, finescale dace, golden shiner, Iowa darter, johnny darter, johnny darter/tesselated darter, largemouth bass, logperch, longear sunfish, longnose dace, mimic shiner, muskellunge, North American Catfishes, northern redbelly dace, Notropis sp., Pimephales sp., pumpkinseed, rock bass, rosyface shiner, sand shiner, smallmouth bass, spottail shiner, stonecat, tadpole madtom, white sucker, yellow perch.

Wildland Fire

MNRF woodland data shows that the site contains woodlands. The lands should be assessed for the risk of wildland fire as per PPS 2014, Section 3.1.8 "*Development shall generally be directed to areas outside of lands that are unsafe for development due to the presence of hazardous forest types for wildland fire. Development may however be permitted in lands with hazardous forest types for wildland fire where the risk is mitigated in accordance with wildland fire assessment and mitigation standards".* Further discussion with the local municipality should be carried out to address how the risks associated with wildland fire will be covered for such a development proposal. Please see the Wildland Fire Risk Assessment and Mitigation Guidebook (2016) for more information.

Significant Woodlands

Section 2.1.5 b) of the PPS states: *Development and site alteration shall not be permitted in significant woodlands unless it has been demonstrated that there will be no negative impacts on*

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the natural features or their ecological functions. The 2014 PPS directs that significant woodlands must be identified following criteria established by the Ontario Ministry of Natural Resources and Forestry, i.e. the Natural Heritage Reference Manual (NHRM), 2010. Where the local or County Official Plan has not yet updated significant woodland mapping to reflect the 2014 PPS, all wooded areas should be reviewed on a site specific basis for significance. The MNRF Kemptville District modelled locations of significant woodlands in 2011 based on NHRM criteria. The presence of significant woodland on site or within 120 metres should trigger an assessment of the impacts to the feature and its function from the proposed development. Based on criteria from the NHRM, the site has potential for significant woodlands.

Significant Wildlife Habitat

Section 2.1.5 d) of the PPS states: *Development and site alteration shall not be permitted in significant wildlife habitat unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions.* It is the responsibility of the approval authority to identify significant wildlife habitat or require its identification. The MNRF has several guiding documents which may be useful in identification of significant wildlife habitat and characterization of impacts and mitigation options:

- Significant Wildlife Habitat Technical Guide, 2000
- The Natural Heritage Reference Manual, 2010
- Significant Wildlife Habitat Mitigation Support Tool, 2014
- Significant Wildlife Habitat Criteria Schedule for Ecoregion 5E and 6E, 2015

The habitat of special concern species (as identified by the Species at Risk in Ontario list) and Natural Heritage Information Centre tracked species with a conservation status rank of S1, S2 and S3 may be significant wildlife habitat and should be assessed accordingly.

Water

If any in-water works are to occur, there are timing windows for which work in water should not take place (see below). Appropriate measures should be taken to minimize and mitigate impact on water quality and fish habitat, including:

- installation of sediment and erosion control measures;
- avoiding the removal, alteration, or covering of substrates used for fish spawning, feeding, over-wintering or nursery areas; and
- debris control measures to manage falling debris (e.g. spalling).

Timing windows (no in-water works) in MNRF Kemptville District*:

Warmwater and cool water → March 15 – June 30

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St. Lawrence River & Ottawa River → March 15 – July 15
Coldwater → October 1 – May 31
Big Rideau Lake & Charleston Lake → October 1 – June 30

* *Please note: Additional timing restrictions may apply as they relate to endangered and threatened species for works in both water and wetland areas.*

Timing windows when in-water work is restricted – based on species presence:

	FISH SPECIES	TIMING WINDOW (No in-water works)
Spring:	Walleye	March 15 to May 31
	Northern Pike	March 15 to May 31
	Lake Sturgeon	May 1 to June 30
	Muskellunge	March 15 to May 31
	Largemouth/Smallmouth Bass	May 1 to July 15
	Rainbow Trout	March 15 to June 15
	Other /Unknown Spring Spawning Species	March 15 to July 15

	FISH SPECIES	TIMING WINDOW (No in-water works)
Fall:	Lake Trout	October 1 to May 31
	Brook Trout	October 1 to May 31
	Pacific Salmon	September 15 to May 31
	Lake Whitefish	October 15 to May 31
	Lake Herring	October 15 to May 31
	Other /Unknown Fall Spawning Species	October 1 to May 31

Additional approvals and permits may be required under the Fisheries Act. Please contact Fisheries and Oceans Canada to determine requirements and next steps. There may also be approvals required by the local Conservation Authority or Transport Canada. As the MNRF is responsible for the management of provincial fish populations, we request ongoing involvement in such discussions in order to ensure population conservation.

Species at Risk

A review of the Natural Heritage Information Centre (NHIC) and internal records indicate that there is a potential for the following threatened (THR) and/or endangered (END) species on the site or in proximity to it:

- American Eel (END)
- Barn Swallow (THR)

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- Bobolink (THR)
- Chimney Swift (THR)
- Cutlip Minnow (THR)
- Butternut (END)
- Little Brown Bat (END)
- Northern Long-eared Bat (END)
- Tri-Colored Bat (END)

All endangered and threatened species receive individual protection under section 9 of the ESA and receive general habitat protection under Section 10 of the ESA, 2007. Thus any potential works should consider disturbance to the individuals as well as their habitat (e.g. nesting sites). General habitat protection applies to all threatened and endangered species. Note some species in Kemptville District receive regulated habitat protection. The habitat of these listed species is protected from damage and destruction and certain activities may require authorization(s) under the ESA. For more on how species at risk and their habitat is protected, please see: https://www.ontario.ca/page/how-species-risk-are-protected.

If the proposed activity is known to have an impact on any endangered or threatened species at risk (SAR), or their habitat, an authorization under the ESA may be required. It is recommended that MNRF Kemptville be contacted prior to any activities being carried out to discuss potential survey protocols to follow during the early planning stages of a project, as well as mitigation measures to avoid contravention of the ESA. Where there is potential for species at risk or their habitat on the property, an Information Gathering Form should be submitted to Kemptville MNRF at sar.kemptville@ontario.ca.

The Information Gathering Form may be found here:
http://www.forms.ssb.gov.on.ca/mbs/ssb/forms/ssbforms.nsf/FormDetail?OpenForm&ACT=RDR&TAB=PROFILE&ENV=WWE&NO=018-0180E

For more information on the ESA authorization process, please see:
https://www.ontario.ca/page/how-get-endangered-species-act-permit-or-authorization

One or more special concern species has been documented to occur either on the site or nearby. Species listed as special concern are not protected under the ESA, 2007. However, please note that some of these species may be protected under the Fish and Wildlife Conservation Act and/or Migratory Birds Convention Act. Again, the habitat of special concern species may be significant wildlife habitat and should be assessed accordingly. Species of special concern for consideration:

- Black Tern (SC)

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- Snapping Turtle (SC)

If any of these or any other species at risk are discovered throughout the course of the work, and/or should any species at risk or their habitat be potentially impacted by on site activities, MNRF should be contacted and operations be modified to avoid any negative impacts to species at risk or their habitat until further direction is provided by MNRF.

Please note that information regarding species at risk is based largely on documented occurrences and does not necessarily include an interpretation of potential habitat within or in proximity to the site in question. Although this data represents the MNRF's best current available information, it is important to note that a lack of information for a site does not mean that additional features and values are not present. It is the responsibility of the proponent to ensure that species at risk are not killed, harmed, or harassed, and that their habitat is not damaged or destroyed through the activities carried out on the site.

The MNRF continues to strongly encourage ecological site assessments to determine the potential for SAR habitat and occurrences. When a SAR or potential habitat for a SAR does occur on a site, it is recommended that the proponent contact the MNRF for technical advice and to discuss what activities can occur without contravention of the Act. For specific questions regarding the Endangered Species Act (2007) or SAR, please contact MNRF Kemptville District at sar.kemptville@ontario.ca.

The approvals processes for a number of activities that have the potential to impact SAR or their habitat have recently changed. For information regarding regulatory exemptions and associated online registration of certain activities, please refer to the following website: https://www.ontario.ca/page/how-get-endangered-species-act-permit-or-authorization.

Please note: The advice in this letter may become invalid if:

- The Committee on the Status of Species at Risk in Ontario (COSSARO) re-assesses the status of the above-named species OR adds a species to the SARO List such that the section 9 and/or 10 protection provisions apply to those species; or
- Additional occurrences of species are discovered on or in proximity to the site.

This letter is valid until: Fri. Dec 8, 2017

The MNRF would like to request that we continue to be circulated on information with regards to this project. If you have any questions or require clarification please do not hesitate to contact me.

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Ontario

Sincerely,

Dom Ferland
Management Biologist
dominique.ferland@ontario.ca

Encl.\
-ESA Infosheet
-NHIC/LIO Infosheet

APPENDIX H

ARCHAEOLOGICAL ASSESSMENT AND BUILT HERITAGE

Ministry of Tourism, Culture and Sport

Archaeology Programs Unit
Programs and Services Branch
Culture Division
401 Bay Street, Suite 1700
Toronto ON M7A 0A7
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Ministère du Tourisme, de la Culture et du Sport

Unité des programmes d'archéologie
Direction des programmes et des services
Division de culture
401, rue Bay, bureau 1700
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ArchaeologyReports@ontario.ca

Ontario

Jul 7, 2015

Adam Pollock (P336)
Past Recovery Archaeological Services
4534 Bolingbroke Maberly ON K0H 2B0

RE: RE: Entry into the Ontario Public Register of Archaeological Reports: Archaeological Assessment Report Entitled, "Stage 1 &2 Archaeological Assessments for the Alexandria Lagoon System Class EA, 20596 McCormick Road, Part of Lots 32 and 33, Concession 2, Geographic Township of Lochiel, Now Township of North Glengarry, United Counties of Stormont, Dundas, and Glengarry", Dated Jun 17, 2015, Filed with MTCS Toronto Office on N/A, MTCS Project Information Form Number P336-0080-2015, MTCS File Number 0003209

Dear Mr. Pollock:

The above-mentioned report, which has been submitted to this ministry as a condition of licensing in accordance with Part VI of the Ontario Heritage Act, R.S.O. 1990, c 0.18 has been entered into the Ontario Public Register of Archaeological Reports without technical review.[1]

Please note that the ministry makes no representation or warranty as to the completeness, accuracy or quality of reports in the register.

Should you require further information, please do not hesitate to send your inquiry to ArchaeologyReports@Ontario.ca.

cc. Archaeology Licensing Officer
Ryan Morton,Corporation of the Township of North Glengarry
Ryan Morton,Corporation of the Township of North Glengarry

1In no way will the ministry be liable for any harm, damages, costs, expenses, losses, claims or actions that may result: (a) if the Report(s) or its recommendations are discovered to be inaccurate, incomplete, misleading or fraudulent; or (b) from the issuance of this letter. Further measures may need to be taken in the event that additional artifacts or archaeological sites are identified or the Report(s) is otherwise found to be inaccurate, incomplete, misleading or fraudulent.

STAGE 1 & 2 ARCHAEOLOGICAL ASSESSMENTS
FOR THE ALEXANDRIA LAGOON SYSTEM
CLASS EA
20596 McCORMICK ROAD
PART OF LOTS 32 AND 33, CONCESSION 2
GEOGRAPHIC TOWNSHIP OF LOCHIEL
NOW TOWNSHIP OF NORTH GLENGARRY
UNITED COUNTIES OF STORMONT, DUNDAS AND GLENGARRY

Past Recovery
Archaeological Services Inc.

STAGE 1 & 2 ARCHAEOLOGICAL ASSESSMENTS FOR THE ALEXANDRIA LAGOON SYSTEM CLASS EA, 20596 McCORMICK ROAD, PART OF LOTS 32 AND 33, CONCESSION 2, GEOGRAPHIC TOWNSHIP OF LOCHIEL, NOW TOWNSHIP OF NORTH GLENGARRY, UNITED COUNTIES OF STORMONT, DUNDAS AND GLENGARRY

Prepared for:	Lisa Marshall, P.Eng. Project Engineer McIntosh Perry Consulting Engineers Ltd. 115 Walgreen Road R.R. #3 Carp, ON K0A 1L0 Phone: (613) 836-2184 x2224 E-mail: l.marshall@mcintoshperry.com
Re:	Municipal Class 'C' Environmental Assessment (in progress)
Prepared by:	Adam Pollock, M.A. and Andy Snetsinger, M.A. Staff Archaeologists Past Recovery Archaeological Services Inc. 4534 Bolingbroke Road, R.R. #3 Maberly, ON K0H 2B0 Phone: (613) 267-7028 E-mail: pras@pastrecovery.com
PRAS Project No.:	PR15-08
Licensee:	Adam Pollock, M.A., Licence P336 Past Recovery Archaeological Services Inc.
P.I.F. No.:	P336-0080-2015

Date: June 17, 2015 Original Report

ACKNOWLEDGMENTS

Ms. Lisa Marshall, P.Eng. and Mr. Mark Priddle, P.Geo., with McIntosh Perry Consulting Engineers Ltd., provided direction regarding the study area boundaries and logistical assistance with the Stage 2 property survey.

Mr. Robert von Bitter, Archaeological Data Coordinator, Ontario Ministry of Tourism, Culture and Sport, provided a current listing of archaeological sites in the vicinity of the study area.

PROJECT PERSONNEL

Project Manager	Brenda Kennett, M.A. (P030)
Licence Holder	Adam Pollock, M.A. (P336)
Historical Research	Adam Pollock
Property Inspection	Adam Pollock
Drafting	Adam Pollock Andy Snetsinger, M.A.
Stage 2 Field Crew	Adam Pollock Andy Snetsinger Shyong En Pan, B.Sc. Ed Thierry
Report Writing	Adam Pollock Andy Snetsinger
Report Review	Jeff Earl, M.Soc.Sc. (P031)

EXECUTIVE SUMMARY

Past Recovery Archaeological Services Inc. was retained by McIntosh Perry Consulting Engineers Ltd. on behalf of the Township of North Glengarry, to undertake Stage 1 and 2 archaeological assessments of the Alexandria Lagoon System as part of a Municipal Class 'C' Environmental Assessment. The subject property was located within Part Lots 32 and 33, Concession 2 of the geographic Township of Lochiel, at the municipal address of 20596 McCormick Road, now in the Township of North Glengarry, in the United Counties of Stormont, Dundas, and Glengarry (see Maps 1 and 2). The study area was a square-shaped parcel measuring approximately 34.1 hectares (84.2 acres) in size.

The purpose of the Stage 1 investigation was to evaluate the archaeological potential of the study area and present recommendations for the mitigation of any significant known or potential archaeological resources. To this end, historical, environmental and archaeological background research was conducted in order to make a determination of archaeological potential. As the subject property was found to possess potential for archaeological resources, a Stage 2 assessment was recommended.

The purpose of the Stage 2 assessment was to determine whether archaeological resources, artifacts or sites with cultural heritage value or interest were present on the property and to determine whether these resources required further assessment. The Stage 2 fieldwork was undertaken on May 14th and 15th, 2015 and consisted of a shovel test pit survey at 5 metre intervals across areas determined by the Stage 1 assessment to have archaeological potential. No artifacts or features of cultural heritage value or interest were found.

The results of the Stage 2 property survey documented in this report form the basis for the following recommendation:

1) No further archaeological assessment of the study area is required as all areas of archaeological potential have been assessed with no materials of cultural heritage value or significance found (see Map 16).

The reader is also referred to Section 7.0 below to ensure compliance with relevant provincial legislation as it may relate to this project.

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1.0 INTRODUCTION

Past Recovery Archaeological Services Inc. (Past Recovery) was retained by McIntosh Perry Consulting Engineers Ltd. on behalf of the Township of North Glengarry to undertake Stage 1 and 2 archaeological assessments of the Alexandria Lagoon System as part of a Municipal Class 'C' Environmental Assessment,.

The objectives of the Stage 1 archaeological assessment were as follows:

- To provide information about the geography, history, and current land condition of the study area;
- To describe any previous archaeological fieldwork and evaluate the archaeological potential of the study area; and,
- To recommend appropriate strategies for Stage 2 archaeological assessment in the event further assessment is warranted.

The objectives of the Stage 2 archaeological assessment were as follows:

- To document all archaeological resources on the property;
- To determine whether the property contains archaeological resources requiring further assessment; and,
- In the event that archaeological sites requiring further assessment are discovered, to recommend appropriate Stage 3 assessment strategies.

2.0 PROJECT CONTEXT

This section of the report provides the context for the archaeological work undertaken, including a description of the study area, the related legislation or directives triggering the assessment, and the confirmation of permission to access the subject property.

2.1 Property Description

The subject property was located within Part Lots 32 and 33, Concession 2 of the geographic Township of Lochiel, at the municipal address of 20596 McCormick Road, now in the Township of North Glengarry, in the United Counties of Stormont, Dundas, and Glengarry (Maps 1 and 2). The property was a square-shaped parcel measuring approximately 34.1 hectares (84.2 acres) in size and was defined by the following legal description:

- Property Information Number (PIN) 011101600511000 - Part Lots 32 & 33 Concession 2, Township of North Glengarry.

The limits of the study area were determined using Geographic Information Systems (GIS) shapefile data supplied by the project planners. For the purposes of this assessment, this data was imported into GIS software and the limits of the subject property were overlain on recent high resolution satellite imagery.

2.2 Development Context

The Township of North Glengarry is proposing to upgrade its existing wastewater treatment facility at Alexandria, requiring the completion of a Municipal Class Environmental Assessment, Part II; Municipal Water and Wastewater Projects. Given that the proposed upgrades to the Alexandria Lagoon System may involve the construction of new facilities and/or major expansions to existing facilities (having the potential for significant environmental effects), this project has been identified as a Schedule 'C' Wastewater Project (Municipal Engineers Association 2011). The completion of an archaeological assessment was a requirement under this process, wherein "*archaeological resources and areas of archaeological potential*" are environmental factors to be considered when reviewing existing and future conditions, developing alternatives, and analyzing and evaluating them to determine the preferred alternative for a project. The study is being carried out in accordance with the requirements of Phase 3 of the Municipal Class EA, a component of a larger assessment being carried out by McIntosh Perry Consulting Engineers Ltd., the project planners. Approval authority for the Municipal Class EA planning and design process rests with the project proponent, the Township of North Glengarry.

2.3 Access Permission

Permission to access the study area and complete all aspects of the archaeological assessment activities, including photography, archaeological survey, and the collection of any artifacts encountered, was granted by the project planners on behalf of the project proponent.

3.0 HISTORICAL CONTEXT

This section of the report is comprised of an overview of human settlement in the region using information derived from background historical and archival research. The purpose of this research is to describe the known settlement history of the local area, with the intention of providing a context for the evaluation of known and potential archaeological sites, as well as a review of property-specific information presenting a record of settlement and land use history within the study area.

3.1 Regional Pre-Contact Cultural Overview

It should be noted that our understanding of the pre-Contact sequence of human activity in the area is very incomplete, stemming from a lack of systematic archaeological surveys in the region, as well as from the destruction of archaeological sites caused by development prior to legislated requirements for the completion of archaeological assessments. It is possible, however, to provide a general outline of pre-Contact occupation in the region based on archaeological, historical and environmental research conducted in eastern Ontario.

The earliest human occupation of southern Ontario began approximately 11,000 years ago with the arrival of small groups of hunter-gatherers referred to by archaeologists as Palaeo-Indians (Ellis and Deller 1990:39). Most archaeological evidence for the Palaeo-Indian period has been found in south-western and south-central Ontario at sites located on the former shorelines of glacial Lake Algonquin. First Nations settlement of eastern Ontario was late in comparison to these other parts of the province as a result of the high water levels of the St. Lawrence Marine Embayment of the post-glacial Champlain Sea (Hough 1958:204). The St. Lawrence Valley remained very much on the fringe of the portions of the province occupied by Palaeo-Indian colonizers. The earliest reported finds in the general area are late Paleo-Indian non-fluted lanceolate points from Akwesasne at Thompson Island downriver from Cornwall (Gogo 1961).

During the succeeding Archaic period (c. 7000 to 1000 B.C.), the environment of southern Ontario approached modern conditions and more land became available for occupation as water levels in the glacial lakes dropped (Ellis, Kenyon, and Spence 1990:69). More extensive First Nations settlement of eastern Ontario began during the Archaic period, sometime between 5,500 and 4,500 B.C. (Kennedy 1970:61; Ellis, Kenyon and Spence 1990:93). Artifacts from Archaic sites in this area suggest a close relationship to the Laurentian Archaic stage peoples of New York State. Laurentian peoples occupied the Canadian biotic province transition zone between the deciduous forests to the south and the boreal forests to the north. The first significant evidence for occupation of the St. Lawrence Valley dates to this time. Dailey and Wright (1955a, 1955b) identified a number of Laurentian or Middle Archaic sites in the vicinity of Cornwall. Late Archaic sites have also been identified at Jessups Falls and in the Pendleton area along the South Nation River (Watson 1982; Daechsel 1980).

The introduction of ceramics to Ontario marked the beginning of the Woodland period (c. 1000 B.C. to A.D. 1550). It was in the Middle Woodland period (c. 300 B.C. to A.D. 900) that distinctive trends or ‘traditions’ evolved in different parts of Ontario for the first time. The Middle Woodland tradition found in eastern and south-central Ontario has become known as ‘Point Peninsula’ (Spence, Pihl and Murphy 1990:157). Towards the end of the Woodland

period (circa A.D. 800) domesticated plants were introduced in areas to the south of the Canadian Shield. Along with this shift in subsistence, settlements located adjacent to corn fields began to take on greater permanency as sites with easily tillable farmland became more important. Eventually, semi-permanent and permanent villages were built, many of which were surrounded by palisades, evidence of growing hostilities between neighbouring groups.

The proliferation of Woodland period sites suggests an increase in the population of eastern Ontario, with the general study area falling within a very active region for First Nations populations through this period. A number of Middle Woodland sites, attributed to the Point Peninsula complex, have been identified in this part of eastern Ontario, with Ault Park near Cornwall being one of the most significant in eastern Ontario (Fox 1990:183-186). Other local archaeological sites with occupations dating from this time period include the Long Sault Island Mounds (Ritchie and Dragoo 1959) and the Malcolm Site (BgFp-2) (Daily and Wright 1955a). Slightly further afield, significant Middle Woodland components have been found at the Leamy Lake sites (Laliberté 2000) and at a recently discovered site in Vincent Massey Park which also contains Late Archaic material (FAC 2010, 2012). Fragments of an early ceramic vessel were recovered from the Deep River Site (CaGi-1) on the Quebec side of the Ottawa River across from Chalk River (Mitchell 1963). The Meath Sites (BkGg 1-10), located on Mud Lake in the Muskrat River Basin south of Pembroke, have yielded a range of occupations from the Archaic through to Middle Woodland (Robertson and Croft 1971 and 1976; Croft 1986). The Wilbur Lake sites on the Bonnechere River near Eganville are centered around the Kant Site (BjGg-1), which is primarily related to aspects of the Middle Woodland period, although they also contain elements spanning the Late Archaic to Late Woodland periods (Mitchell 1987, 1988, 1989, 1990; Pendergast 1957). Middle Woodland sites have been noted in the South Nation Drainage Basin and along the Ottawa River including the northwest part of Ottawa at Marshall's and Sawdust Bays (Daechsel 1980, 1981).

There appears to have been a hiatus in the occupation of the St. Lawrence Valley through the early stages of the Late Woodland period. By the end of the period, however, a considerable population belonging to what archaeologists refer to as the St. Lawrence Iroquois had become established in the region. Settlement clusters have been identified near the Spencerville/Prescott area, and lying just north of Lake St. Francis (sometimes identified as the 'Cornwall cluster'; see Adams 2003:43), with a large number reported for Jefferson County in New York State and further east into Quebec. The 'Cornwall cluster' of villages includes Summerstown Station (BgFp-1), Glenbrook (BgFp-5), Berry (BgFo-3), and MacDougald (BgFp-36). In addition to these village sites, numerous special purpose camps (i.e. fishing camps along tributaries of the St. Lawrence River) have been found in the area, including the Salem (BgFp-4), Gray's Creek (BgFp-6), Cooper (BgFp-16), Casgrain Hill (BgFp-20), Sugarbush (BgFp-21), Salem Suburb (BgFp-22), Mice Mucking Hollow (BgFp-24), Kaneb Road (BgFp-27), Big Boulder Camp (BgFp-28), Track (BgFp-29), and Home Property (BgFp-34) sites. The material culture and settlement patterns of the fourteenth and fifteenth century St. Lawrence Iroquoian sites are directly related to the Iroquoian-speaking groups that Jacques Cartier and his crew encountered in 1535 at Stadacona (Quebec City) and Hochelaga (Montreal Island) (Jamieson 1990:386). Following Cartier's initial voyages, subsequent journeys by Europeans found only abandoned settlements along the St. Lawrence River. High mortality from the European diseases introduced by Cartier and continued conflict with neighbours probably accounts for the disappearance of these people. At this time, there was a significant increase of St. Lawrence Iroquoian ceramic

vessel types on Huron sites, and segments of the St. Lawrence Iroquois population may have relocated to the north and west either as captives or refugees (J. Wright 1966:70-71; Sutton 1990:54). Mohawk oral tradition suggests that some of the people from the Hochelaga area joined the Mohawks.

The portions of eastern Ontario lying within the Ottawa River watershed, including the South Nation River, appear to have seen continued use by groups retaining a hunter and gatherer-based subsistence strategy, in some cases incorporating limited horticulture. The hunter/gatherers of this region are primarily regarded as having been Algonkian-speaking populations practicing lifeways with roots in the Archaic period. The origins of these groups and the nature of their relationships with their neighbours remains a matter of debate, which has been hampered by the low intensity of archaeological investigation in the area.

The population shifts of the late sixteenth and early seventeenth centuries were certainly in part a result of the disruption of traditional trade and exchange patterns among all First Nations peoples brought about by the arrival of the French, Dutch and British along the Atlantic seaboard. Control of the lucrative St. Lawrence River trade became a source of contention between neighbouring peoples as the benefits of trading with the Europeans became apparent. While prolonged occupation of the region may have been avoided as a result of hostilities between Iroquoian speaking populations to the south and Algonquin populations to the north, at least the northern reaches of the South Nation River basin were undoubtedly used as hunting territories by the Algonquin at this time. There is virtually no archaeological evidence for contact between Europeans and First Nations populations in this area during this time period, suggesting that the region remained largely abandoned and that any remaining Native groups may have deliberately avoided the newcomers.

3.2 Regional Post-Contact Cultural Overview

The first European to venture deeper into what would become southern Ontario was Étienne de Brûlé, who was entrusted by Samuel de Champlain in 1610 to strengthen relations between the French and First Nations and to learn their language and customs. Champlain himself made two trips into Ontario, initially in 1613 and again in 1615. While he made note of the South Nation River during his 1613 visit to the area, it is difficult to determine what use, if any, was made of the river by the early French traders and missionaries that followed him. At least some travel on the river system during the 17th and early 18th centuries was likely.

The first centuries of contact between First Nations peoples and Europeans contributed to a period of significant change in the region. The endemic warfare of the age and severe smallpox epidemics in 1623-24 and again between 1634 and 1640 brought about drastic population decline among all First Nations peoples in southern Ontario, particularly the Huron, who had become an important ‘middle man’ in the French fur trade (Hessel 1993:63-65). Following the dispersal of the Huron from the present Simcoe County area by the League of Five Nations in 1649, these Iroquoian groups from the later New York State area began to make tentative attempts to settle the northern shore of Lake Ontario and the St. Lawrence River.

In 1673, Fort Frontenac was established at the present site of Kingston, and another fort was constructed at La Presentation (Ogdensburg, New York) in 1700. These forts were erected both

to solidify control of the fur trade and to enhance ties with local Native populations. The French also encouraged the establishment of indigenous villages near their settlements to create closer alliances. This policy had some success; however Haudenosaunee (Iroquois) traders cultivated ties with both the French on the St. Lawrence and the British in the Mohawk Valley, and eventually Oswego, to ensure that they had competing markets for furs. Akwesasne, part of the Haudenosaunee hunting grounds for over a century and a half, became their permanent settlement towards the middle of the eighteenth century. With the Royal Proclamation of 1763 the British acquired all French possessions in North America. The terms of the Proclamation, which included rules for the purchase of Indian land, were communicated to the Mohawk settlement by the Imperial Indian Department and at the Niagara Congress in 1764.

Settlement in the St. Lawrence Valley area was not actively encouraged by the British colonial government until the late eighteenth century. With the end of the American Revolutionary War (1775-1783), an exodus of United Empire Loyalists and disbanded soldiers moving north across the St. Lawrence required the acquisition and settling of new lands. In response, the British Government sought to acquire the rights to lands along the north shore of the St. Lawrence River and Lake Ontario through hurried negotiations with their Mississauga military allies, who were assumed, erroneously, to be the only Native peoples inhabiting eastern Ontario. Captain William Redford Crawford, who enjoyed the trust of the Mississauga chiefs living in the Bay of Quinte region, negotiated on behalf of the British government. In the so-called 'Crawford Purchase,' the Mississauga were cajoled into giving up Native title to most of eastern Ontario, including what would become the counties of Stormont, Dundas, Glengarry, Prescott, Russell, Leeds, Grenville and Prince Edward, as well as the front townships of Frontenac, Lennox, Addington and Hastings and much of what is now the City of Ottawa (Lockwood 1996:24). There were numerous problems with this transaction as it ignored other Native groups' rights to some of the lands it purported to cover, crucial documents were missing, and the extent of compensations was never clear. Nevertheless Major Samuel Holland, Surveyor General for Canada, began laying out these lands in 1784, with such haste that the newly established townships were assigned numbers instead of names. The westernmost surveyed township (Elizabethtown) was originally called Township No. 8, while the easternmost (Charlottenburg) was Township No. 1 (Leavitt 1879:17). Euro-Canadian settlement along the north bank of the St. Lawrence River and the eastern end of Lake Ontario began in earnest about his time.

A government store was constructed in 1784 to anchor the planned settlement of New Johnstown (later Cornwall) which was to become the district headquarters, and settlers who had been moved from Quebec to populate the village subsequently began the work of clearing the forests (Harkness 1946:45). Cornwall soon boasted a canal, the Hodge Mill and various military buildings, and was also noted for its early textile industry (Belden 1879). Arriving at the village, Loyalists drew settlement lots in the district, with each soldier receiving a grant of 100 acres fronting on the St. Lawrence River and an additional 200 acres further inland in the same township. Officers were entitled to much larger grants based on their rank, and the children of Loyalists also obtained free land. As a result, the entire river frontage within the Townships of Charlottenburg, Cornwall, Osnabruck, Williamsburg and Matilda was settled almost simultaneously.

In 1788, Sir Guy Carleton, the Governor General of Quebec, established four administrative districts for Upper Canada and associated land boards to facilitate settlement. Territory along the

St. Lawrence at the eastern end of the later Province of Ontario was initially made part of the Lunenburg or Eastern District with New Johnstown as the district town. This included the later counties of Dundas, Glengarry, Ontario, Prescott, Russell, Stormont, Carleton, Grenville and Leeds. Carleton, Grenville and Leeds became the Johnstown District in 1792, and Prescott and Russell the Ottawa District in 1816. Dundas, Glengarry and Stormont became the United Counties of Stormont, Dundas and Glengarry in 1849. Historic Glengarry County comprised two of the original eight Royal Townships of Upper Canada: Lancaster and Charlottenburg. Each of these townships was then subdivided to create the four townships which defined the county until recently (Archives of Ontario 2009).

Lochiel Township

The initial settlement of the land within what would become Lochiel Township took place in 1794 with the arrival of a group of about forty families from Glenelg in Scotland (Harkness 1946:50)[1]. These new arrivals received grants of land in the neighborhood of Kirkhill, forming the nucleus of a farming community. As with the rest of Glengarry County, the ethnic makeup of the pioneering population was predominantly Scottish.

Lochiel Township did not come into existence until 1818, when it was separated from Lancaster. This administrative change reflected the growing population of the area. By 1842, the population of the township had reached 2,047 (Smith 1846:98). Four years later, Smith's *Canadian Gazetteer* (1846:98) reported that 53,886 acres of land had been taken up, with 8,366 of these under cultivation. Although the pioneering population had been able to supplement the returns of their farms with cash incomes from the timber shanties along the Ottawa and in the valleys of the South Nation and Castor rivers, as these operations moved further upriver, it became increasingly difficult for Glengarrians participate. Disenchanted with declining returns on marginal land, some Scots Catholics were attracted by the promise of better prospects in Western Canada (Cartwright 1977). The area of relatively poor land in Lochiel and Lancaster townships was amongst the earliest to be abandoned.

The corresponding population decline among the Scottish population before World War I was counter-balanced by a wave of migration from neighbouring Quebec, where there were severe land shortages, which led to an increased French-Canadian population in Glengarry County (Bowering 2006:7). This shift in the ethnic makeup of the area was particularly acute in the vicinity of Alexandria, which is still true today. The community was incorporated as a village in 1883, becoming a town in 1902 as the population grew.

The regional rail network arrived in Alexandria with the construction of the Alexandria Subdivision of the Canada Atlantic Railway Company (Andreae 1997). Although plans to construct a line from Ottawa east through Alexandria to Coteau Junction in Quebec had been in the works since the early 1870s, it was not until lumber baron J. R. Booth became involved that work on the line got underway. The Alexandria portion of the line was constructed between

[1] This settlement is commemorated with a plaque erected by the Archaeological and Historic Sites Board of Ontario at the MacLeod Farm, on Dalkeith Road).

1881 and 1882. This railway amalgamated with the Grand Trunk in 1914, which in turn became part of the Canadian National Railway in 1923.

3.3 Property History

Archival research was conducted in order to develop a general picture of the settlement and land use history for the study area through the nineteenth and twentieth centuries, particularly as it relates to the archaeological potential of the property. Information was compiled from a variety of sources, including a Lochiel Township patent plan based on P. McNiff and James McDonell's 1785 survey, an 1862 map prepared by H. F. Walling, an 1880 map made by the H. Belden & Co., twentieth century topographic maps and aerial photographs, as well as the Stormont County Land Registry Office (SCLRO) Abstract Index records for Lots 32 and 33, Concession 2.

Unfortunately, the quality of the scan of the Patent Plan of Lochiel Township (identified as the north part of Lancaster Township at the time) available from the Archives of Ontario is relatively poor. Although the names of the original patentees have been written over each of the lots in the vicinity of the present study area, the handwriting is almost illegible. It appears, however, that the name "Capt John McDonnell" has been inscribed over several of the lots in the 1st and 2nd concessions of Lochiel, including Lots 32 and 33 (Map 3). The reference to "Capt" suggests that McDonnell was a former British soldier, whose land grant consisted of several hundred acres. The land registry abstract index indicates that John McDonnell was granted the patent for Lot 33 Concession 2 in 1796 and that the patent for Lot 32 Concession 2 was granted to Nancy Ross in 1798 (SCLRO).

The 1862 H. F. Walling map of Lochiel provides the names of settlers on the two lots containing the present study area, with the names "C. Chisholm" and "T. Chisholm" shown on Lot 33, and "J. H. McDonald" written on Lot 32 (Map 4). Structures shown in association with each of these men (likely representing the locations of farmsteads) are in close proximity to a forced road (now McCormick Road) lying well to the north of the subject property. The concession road lying to the south of the study area (now Glen Robertson Road), between the 1st and 2nd concessions of the township, is illustrated using solid lines, suggesting that the road had been cleared and was in use at the time. Several structures are illustrated in proximity to this road, though none within the southern portion of the lots containing the subject property. C. Chisholm and T. Chisholm had purchased the east and west halves of Lot 33 in 1837 (SCLRO Instruments 1731 and 1732). No individual by the name of J.H. McDonald appears in the abstract index for Lot 32, at the time of the map the lot would have been owned by Alexander D. McDonald (SCLRO 580).

The 1880 H. Belden & Co. map of Lochiel provides a view of the study area in the latter part of the nineteenth century, showing evidence of the increasing settlement density in the general vicinity. Two names appear on the portions of Lots 32 and 33 containing the subject property, with "Alex McDonald" shown as owning all of Lot 32 (200 acres), and "D. Tombs" shown as owning the south-easternmost quarter of Lot 33 (totalling 50 acres; Map 5). David Tombs had purchased the south half of the east half of Lot 33 in 1878 (SCLRO 2723) and had purchased all of Lot 32 on October 14th, 1880 (SCLRO 3149). No structures are illustrated in the immediate vicinity of the study area. It should be noted, however, that atlases of this type were sold by subscription, where subscribers were given preference with regard to the amount of detail provided on the maps (i.e. name and location of a residence or farmstead). For this reason, the

absence of names and/or structures on individual lots should not be taken as evidence that the lot was vacant, or that all settlement features present at the time are shown. Interestingly, the rail line lying to the south of the study area (labelled "Ottawa Junction R. Y.") is depicted lying much further south than the alignment of the present railway. This discrepancy, however, is likely related to problems of scale associated with the illustration of the map, as there is no other indication that the line was moved.

The next available map providing details regarding the settlement history of the study area dates from 1909, with the publication of the first edition of the one-inch-to-one-mile scale topographic map for this area. The map shows several features of interest, specifically that no residences or substantial outbuildings (e.g. barns) were present within the subject property (Map 6). In addition, a substantial portion of the eastern half of the property is illustrated as having been forested. Given the density of settlement in the surrounding area and local conditions, it is likely that this area was not under cultivation because of wet soil conditions during at least part of the year.

A mosaic of aerial photographs dating from 1954 provides a view of the study area in the middle of the twentieth century. By this time, the entire property appears to have been cleared and was under active cultivation, with several fencelines visible (Map 7). Significantly, the aerial photograph also shows the course of a small stream, draining from the northeastern portion of the subject property off to the northeast into the Delisle River. In addition, the course of a partially channelized stream lying to the southwest of the study area is also visible. The land for the lagoon system was purchased by the Ontario Water Resource Commission in 1962 (SCLRO 7886, 7887 and 7888); the land was then sold to the Town of Alexandria in 1966 (SCLRO 13999).

4.0 ARCHAEOLOGICAL CONTEXT

This section describes the environmental and archaeological context of the study area which, combined with the historical context outlined above, provides the necessary information to assess the archaeological potential of the property.

4.1 Previous Archaeological Research

In order to determine whether any previous archaeological fieldwork has been conducted within or in the immediate vicinity of the present study area, a search of the titles of reports in the *Ontario Public Register of Archaeological Reports* maintained by the Ministry of Tourism, Culture and Sport (MTCS) was undertaken. In addition, in order to augment these results, a search of the Past Recovery corporate library was conducted and a network of professional contacts was consulted, including other licensed archaeologists working in the area. This search revealed that only a limited amount of archaeological research has been conducted within the former Township of Lochiel[2]. Known studies in the vicinity include:

- In the late nineteenth and early twentieth centuries, archaeological work in southern Ontario was conducted by a variety of researchers, such as David Boyle, William Wintemberg, Col. G. E. Laidlaw, and Andrew F. Hunter, as well as by a number of amateur collectors. Records of this research and of the donation of artifacts to the provincial museum (now the Royal Ontario Museum) appeared in the Annual Archaeological Reports included as an appendix in the reports to Ontario's Minister of Education between 1888 and 1928; and
- Stage 1 and 2 archaeological assessments conducted in association with the North Glengarry Regional Water Supply Project Class EA in the geographic townships of Kenyon and Charlottenburg (Past Recovery 2013a, 2013b).

To the knowledge of Past Recovery staff, no archaeological fieldwork has previously been conducted within the limits of the present study area.

4.2 Previously Recorded Archaeological Sites

The primary source for information regarding known archaeological sites in Ontario is the *Archaeological Sites Database* maintained by the Archaeological Data Coordinator at MTCS. The database contains information on all archaeological sites that have been formally registered with the province and is accessible to licenced archaeologists through an online portal (PastPortal). As per MTCS requirements, a search of registered archaeological sites lying within a one kilometre radius of the subject property was completed by Past Recovery staff as part of

[2] In compiling the results, it should be noted that archaeological fieldwork conducted for research purposes should be distinguished from systematic property surveys conducted during archaeological assessments associated with land use development planning (generally after the introduction of the *Ontario Heritage Act* in 1974 and the *Environmental Assessment Act* in 1975), in that only those studies undertaken to current industry standards can be considered to have adequately assessed properties for the presence of archaeological sites with cultural heritage value or interest. In addition, it should be noted that the vast majority of the research work undertaken in the area has been focussed on the identification of Woodland period village sites, while current MTCS requirements minimally require the evaluation of the material remains of occupation and/or land uses pre-dating 1900.

the background research conducted for this study. The search revealed that no archaeological sites have been registered within the one kilometre search area.

In addition, the background research included a review of the Past Recovery corporate library, conducted in order to determine whether there was any evidence of previously recorded archaeological sites in the immediate area, which may have not been formally registered with the province. The search revealed that no archaeological sites have been recorded within the one kilometre search area.

On the basis of this research, to the knowledge of Past Recovery staff no archaeological resources have previously been discovered either within the limits of the present study area or in the immediate vicinity. It should be noted, however, that the relative paucity of known sites in this area is almost certainly a result of the limited amount of systematic archaeological research that has been undertaken in the immediate vicinity.

4.3 Cultural Heritage Resources

The recognition or designation of cultural heritage resources (here referring only to built heritage features and/or cultural heritage landscapes) may provide valuable insight into aspects of local heritage, whether identified at a local, provincial, national, or international level. Of specific relevance to the present study, some of these cultural heritage resources may be associated with significant archaeological features or deposits. Accordingly, the Stage 1 archaeological assessment included the compilation of a list of cultural heritage resources that have previously been identified within or immediately adjacent to the current study area. The following sources were consulted:

- Federal Heritage Buildings Review Office online Directory of Heritage Designations (http://www.pc.gc.ca/eng/progs/beefp-fhbro/index.aspx);
- Canada's Historic Places website (http://www.historicplaces.ca/en/home-accueil.aspx);
- Ontario Heritage Properties Database (http://www.hpd.mcl.gov.on.ca/scripts/hpdsearch/english/default.asp);
- Ministry of Tourism, Culture and Sport's List of Heritage Conservation Districts (http://www.mtc.gov.on.ca/en/heritage/heritage_conserving_list.shtml);
- Ontario Heritage Trust website (www.heritagetrust.on.ca/Resources-and-Learning/Online-Plaque-Guide.aspx); and,
- The Ontario Heritage Bridge List (MTO 2008).

No previously identified cultural heritage resources were found to be located within or immediately adjacent to the present study area.

4.4 Heritage Plaques and/or Monuments

The recognition of a place, person, or event through the erection of a plaque or monument may also provide valuable insight into aspects of local history, given that these markers typically indicate some level of heritage recognition. As with cultural heritage resources (built heritage features and/or cultural heritage landscapes), some of these places, persons, or events may be associated with significant archaeological features or deposits. Accordingly, this study included

the compilation of a list of heritage plaques and/or markers in the vicinity of the study area. The following sources were consulted:

- The Ontario Heritage Trust Online Plaque Guide (http://www.heritagetrust.on.ca/Resources-and-Learning/Online-Plaque-Guide.aspx);
- An extensive listing of Ontario's Heritage Plaques maintained by Alan Brown (http://www.ontarioplaques.com/); and,
- An extensive listing of historical plaques of Ontario maintained by Wayne Cook (http://www.waynecook.com/historiclist.html).

No evidence of plaques or monuments associated with historically-significant places, persons, or events was noted within or immediately adjacent to the study area.

4.5 Cemeteries

The presence of historical cemeteries in proximity to a parcel of land proposed for development can pose archaeological concerns in two respects. First, cemeteries may be associated with related structures or activities that may have become part of the archaeological record, and thus may be considered features indicating archaeological potential. Second, the boundaries of historical cemeteries may have been altered over time, as all or portions may have fallen out of use and been forgotten, leaving potential for the presence of unmarked graves. For these reasons, an archaeological assessment also includes a search of available sources of information regarding historical cemeteries. For this study, the following sources were consulted:

- A complete listing of all registered cemeteries in the province of Ontario maintained by the Consumer Protection Branch of the Ministry of Consumer Services;
- Field of Stones website (http://freepages.history.rootsweb.ancestry.com/~clifford/);
- Ontario Cemetery Locator website maintained by the Ontario Genealogical Society (http://ogs.andornot.com/CemLocat.aspx);
- Ontario Headstones Photo Project website (http://canadianheadstones.com/on/cemeteries.php); and,
- Available historical mapping and aerial photography.

No evidence of a known cemetery within or immediately adjacent to the present study area was found. The closest registered cemetery to the study area is located c. 780 metres to the southwest, in Lot 35, Concession 2 of the geographic Township of Lochiel, along Glen Robertson Road. This cemetery is registered with the Ministry of Government and Consumer Services with the Site Number: 03987.

4.6 Local Environment

The assessment of present and past environmental conditions in the region containing the study area is a necessary component in determining the potential for past occupation as well as providing a context for the analysis of archaeological resources discovered during an assessment. Factors such as local water sources, soil types, vegetation associations, and topography all contribute to the suitability of the land for exploitation and/or settlement. Accordingly,

information from local physiographic, geological, and soils research has been compiled here to create a picture of the environmental context for both past and present land uses.

The study area is located within the Glengarry Till Plain physiographic region identified by Chapman and Putnam (1984:113). This region is characterized by low relief, and forms the drainage divide between the international section of the St. Lawrence River and the Ottawa basin, from Prescott to the Quebec boundary (Chapman and Putnam 1984:201). The surface is typically undulating to rolling, consisting of long morainic ridges and a few well-formed drumlins, together with intervening clay flats and swamps. Glacial deposits in this area are Wisconsinan in age, left behind by glacial ice that occupied this area until approximately 23,000 years ago (Rowell 1997:15). During the final retreat of the ice sheet, glacial lake waters in the Lake Ontario basin expanded into the Ottawa River valley. With the uncovering of the St. Lawrence River valley, approximately 11,700 to 11,500 years ago, water levels in the Lake Ontario Basin dropped, allowing seawater to inundate the isostatically depressed Ottawa and St. Lawrence River valley areas (Rowell 1997:15). This large body of water, known as the Champlain Sea, re-worked the earlier glacial deposits and added marine clays and sands to the inundated lands.

Topographical mapping of the area, prepared at a scale of 1:10,000, shows the subject property is located in a relatively flat area (Map 8). Elevations range from a high of 76 metres to a low of 74 metres, providing c. 2 metres of local relief. Surficial geological mapping of the region, prepared at a scale of 1:50,000, shows the study area lying within fine-textured glaciomarine deposits consisting of silt and clay, with minor sand and gravel (Rowell 1997; Map 9). To the north and south of the study area are deposits of till emerging from the clay flats, identified as stone-poor sandy silt to silty sand-textured till on Paleozoic terrain.

Soil survey mapping of the region, prepared at a scale of 1:50,000, shows the study area containing two distinct soil types (Matthews et al. 1977:map sheet; Map 10), Bearbrook clays and Eamer loams. Bearbrook clays are described as a stonefree Dark Grey Gleysolic soil with poor drainage characteristics. Eamer loams are identified as a moderately stony to boulder brown forest soil with good drainage characteristics. The distribution of these soils appears to mirror the surficial geology of the area, with the Bearbrook clays having formed over the fine-textured glaciomarine deposits of silt and clay, and Eamer loams having formed over the till on Paleozoic terrain.

The study area lies within the Upper St. Lawrence sub-region of the Great Lakes - St. Lawrence Forest Region, a region characterized by a predominantly deciduous forest (Rowe 1972:94). The dominant cover type is composed of sugar maple and beech, with red maple, yellow birch, basswood, white ash, largetooth aspen, and red and burr oaks, with local occurrences of white oak, red ash, grey birch, rock elm, blue beech, and bitternut hickory. Butternut, eastern cottonwood, and slippery elm have a sporadic distribution in river valleys, and some small pure stands of black maple and silver maple are reported on fertile, fine-textured lowland soils. Poorly-drained depressions frequently carry a hardwood swamp type in which black ash is prominent. The general character of the forest cover is broadleaved on the deep calcareous soils, while on shallow, acidic or eroding materials a representation of conifers is usual, particularly the eastern hemlock, eastern white pine, white spruce, and balsam fir. Coarse-textured soils

commonly support stands of eastern white and red pine. Wet sites bear black spruce or eastern white cedar.

The study area is located within the Upper St. Lawrence – Raisin River watershed and the Delisle River subwatershed. Local drainage patterns follow topographic conditions, with a now partially channelized stream draining the study area to the northeast, towards the Delisle River. Although the construction of the sewage lagoons and the cultivation of the surrounding fields (and associated drainage/channelization of pre-existing streams) has heavily modified the drainage patterns in this area, the background research conducted for this study reveals that several water sources were located in close proximity to the subject property prior to the turn of the twentieth century, including:

- The Delisle River comes within c. 300 metres of the northeastern tip of the subject property. Recent provincial base mapping shows that the river and its floodplain have been identified as wetlands.
- An unnamed stream drains the northeastern portion of the study area off to the northeast, into the Delisle River.

5.0 STAGE 1 ARCHAEOLOGICAL ASSESSMENT

This section of the report includes an evaluation of the archaeological potential within the study area, in which the results of the background research described above are synthesized with observations made during a property inspection to determine the likelihood of the area containing significant archaeological resources.

5.1 Property Inspection

A site inspection was conducted on April 17th, 2015, to verify the presence or absence of factors influencing archaeological potential. The weather was clear and provided good visibility. This inspection was conducted according to the archaeological fieldwork standards outlined in *Standards and Guidelines for Consultant Archaeologists* (MTCS 2011), with field conditions and features influencing archaeological potential documented through digital photography. The complete Stage 1 photographic catalogue is included as part of Appendix 1, and the locations and directions of the photographs referred to in this section of this report are shown on Map 11.

The site inspection confirmed what had appeared to be disturbance to the ground in the southwest corner of the property in satellite imagery of the area, as a partially excavated lagoon (Images 1 to 3). Small fields to the east of the partial lagoon along the southern edge of the study area appeared undisturbed, with the exception of mounds of soil along the eastern edge of the fields, likely from the partially excavated lagoon (Images 4 and 5). Areas that appeared low and wet in the satellite imagery were confirmed to be so, including land between the mounds of soil and the eastern dyke of the southern lagoon, land to the northeast of the southern fields, and an area along the eastern edge of the property south of the northeast corner (Images 5, 6 and 7). The two fields in the northeast corner of the study area appeared undisturbed (Images 8 and 9). The northern edge of the lagoons and western edge of the study area had been disturbed by dyke construction, roads and extensive ditching (Images 10 and 11). All of the areas determined to be of low archaeological potential given conditions described above have been marked on Map 12.

Table 1. Inventory of the Stage 1 Documentary Record.

Type of Document	Description	Number of Records	Location
Photographs	Digital photographs documenting the subject property and conditions at the time of the site inspection	32 digital photographs	On PRAS computer network – file PR15-08
Field Notes	Notes on the site inspection	1 page	PRAS office - file PR15-08

5.2 Evaluation of Archeological Potential

Archaeological assessment standards established by MTCS (*Standards and Guidelines for Consultant Archaeologists*, 2011) specify factors to be considered when evaluating archaeological potential. Licensed consultant archaeologists are required to incorporate these

factors into potential determinations and account for all features on the property that can indicate archaeological potential. If this evaluation indicates that any part of the subject property exhibits potential for archaeological resources, the completion of a Stage 2 archaeological assessment is required prior to the issuance of approvals for the planned development.

A number of factors are used to determine archaeological site potential. For pre-Contact sites criteria are principally focused on topographical features such as the distance from the nearest source of water and the nature of that water body or stream, areas of elevated topography including features such as ridges, knolls, and eskers, and the types of soils found within the area being assessed. For post-Contact sites, the assessment of archaeological site potential is more reliant on historical research (land registry records, census, and assessment rolls, etc.), as well as cartographic and aerial photographic evidence, and the inspection of the study area for possible above ground remains or other evidence of a demolished structure. Also considered in determining archaeological potential are known archaeological sites within or in the vicinity of the study area.

Areas that are considered to exhibit potential for the presence of pre-Contact archaeological sites include lands within 300 metres of modern water sources, past water sources, specific resource areas, previously registered archaeological sites, and distinctive land formations. Areas of elevated topography and well-drained sandy soils are also considered features indicative of archaeological potential. Post-Contact archaeological site potential is identified on the basis of the property lying within 300 metres of sites of early Euro-Canadian settlement , identified cultural heritage features, property identified as having the potential for archaeological sites, events, activities, and/or occupations of historical significance, modern water sources, specific resource areas and registered archaeological sites, and/or within 100 metres of historical transportation routes.

Any areas within these archaeological potential zones shown have low or no archaeological potential can be excluded from Stage 2 testing. Criteria for identifying these areas include the presence of steep slopes (greater than 20% gradient), permanently saturated soils and/or exposed bedrock, as well as locations where archaeological potential has clearly been removed through deep and extensive land alterations (eg. former aggregate pits or quarries), where it is clear that this activity would have heavily damaged or removed any archaeological resources present.

The research conducted for this study suggests that the subject property exhibits characteristics that indicate potential for the presence of archaeological resources associated with pre-Contact settlement and/or land uses (Map 13). Specifically:

- Portions of the study area lie within 300 metres of a primary water source, the Delisle River; and,
- Portions of the study area lie within 300 metres of secondary water sources, an unnamed stream draining into the Delisle River and wetlands occupying the Delisle River floodplain.

The study area also exhibits characteristics that indicate potential for the presence of archaeological resources associated with post-Contact settlement and/or land uses (see Map 13). Specifically:

- Portions of the study area lie within 300 metres of a primary water source, the Delisle River;
- Portions of the study area lie within 300 metres of secondary water sources, an unnamed stream draining into the Delisle River and wetlands occupying the Delisle River floodplain;
- Portions of the study area lie within 100 metres of a historical transportation route, being the Canada Atlantic Railway constructed between 1881 and 1882;
- Portions of the study area contain soils that are identified as loams with good drainage characteristics, providing suitable soils for agricultural exploitation.

5.3 Archaeological Potential Mapping

In order to accurately map areas of archaeological potential, Geographic Information Systems (GIS) software was used to geo-reference and plot available environmental, archaeological, and historical features. This data was then used to generate precise archaeological potential buffers, using appropriate MTCS standards (see Map 13). The following data sources were used:

- Water Sources:
  - MNRF Ontario Hydro Network – Waterbody (2010-08-09 revision);
  - MNRF Ontario Hydro Network – Watercourse (2011-09-27 revision);
  - MNRF Wetland Unit (2011-04-02 revision);

- Surficial Geology:
  - MNRF Surficial Geology of Southern Ontario (2010-04-07 revision);

- Topography:
  - MNRF Contours - Five Metre Intervals (2006-05-25 revision);

- Soils:
  - OMAFRA Soil Survey Complex (2003-01-01 revision);

- Satellite/Aerial Imagery:
  - GeoOttawa satellite imagery captured between 1976 and 2014;
  - Digital Raster Acquisition Project East (DRAPE) satellite imagery captured between 01/01/2008 and 01/01/2009.

In addition, GIS software was used to map the current conditions of the property based on the Stage 1 site inspection (see Map 12; see Section 5.1). Using the results of the archaeological potential mapping and the results of the site inspection, a map was generated to show the intersection of these two data sets (Map 14). This map determined which areas of the property required further archaeological assessment and which areas could be considered exempt from Stage 2 testing (see Map 14).

5.4 Stage 1 Recommendations

The results of the background research discussed above indicate that portions of the study area exhibit potential for the presence of significant archaeological resources (see Map 14). Accordingly, it is recommended that:

1) The portions of the study area that have been determined to exhibit archaeological potential should be subject to Stage 2 archaeological assessment prior to the initiation of soil disturbances or other alterations (see Map 14).

2) Any future Stage 2 archaeological assessment should be undertaken by a licensed consultant archaeologist, in compliance with *Standards and Guidelines for Consultant Archaeologists* (MTCS 2011). The preferred methodology for the Stage 2 assessment would be a shovel test pit survey at 5 metre intervals as the sections of the property with archaeological potential are not accessible for ploughing.

The reader is also referred to Section 7.0 below to ensure compliance with relevant provincial legislation and regulations that may relate to this project.

6.0 STAGE 2 ARCHAEOLOGICAL ASSESSMENT

This section of the report describes the methods and results of the Stage 2 property survey, conducted in order to determine whether the subject property contains significant archaeological resources.

6.1 Field Methods

The archaeological fieldwork for the Stage 2 property survey was completed over two days, on May 13th and 14th, 2015 with a crew of up to four archaeologists. Archaeological fieldwork was conducted according to criteria outlined in *Standards and Guidelines for Consultant Archaeologists* (MTCS 2011). The weather for both days consisted of clear skies and temperatures ranged from 10 to 22 °C, permitting good visibility and acceptable conditions for the identification, documentation, and recovery of archaeological resources.

In order to ensure full coverage of the study area during the Stage 2 property survey, overlay maps were printed and used in the field, allowing Past Recovery staff to accurately determine the limits of the study area in relation to fixed reference landmarks, as well as to accurately record field conditions. Where necessary, a handheld Global Positioning System (GPS) receiver was used to record the locations and extent of features of interest.

The handheld GPS unit used in the assessment was a Garmin GPSMAP 60CSx, equipped with a built-in quad helix antenna capable of calculating its position to within ten metres (95% typical). This unit was also capable of receiving Wide Area Augmentation System position correction signals, which can improve the accuracy of the position reporting to within three to five metres under ideal conditions (95% typical). At the time of Stage 2 property survey, the GPS consistently gave estimated probable error readings of less than four metres.

The Stage 2 property survey was conducted by means of a shovel test pit survey carried out at 5 metre intervals (Images 12 and 13). Test pits were excavated by shovel and trowel, and excavated materials were screened through 6 millimetre (1/4 inch) hardware mesh. Shovel test pits were at least 30 centimetres in diameter and excavation continued 5 centimetres into sterile subsoil, where possible. All pits were examined for stratigraphy, cultural features, and/or evidence of deep and intensive disturbance. All test pits were backfilled once completed. In areas where shovel test pit profiles showed conclusive evidence of deep and intensive disturbance, test pits were excavated judgementally in order to determine the limits of the disturbance.

The results of the Stage 2 property survey were documented through field notes, a field map and digital photographs. The complete Stage 2 photographic catalogue is included as part of Appendix 1, and the locations and orientations of all photographs used in this section of the report are shown in Map 15. As per the *Terms and Conditions for Archaeological Licences* in Ontario, curation of all field notes, photographs, and maps generated during the Stage 2 archaeological assessment is being provided by Past Recovery Archaeological Services Inc. pending the identification of a suitable repository. An inventory of the records generated by the assessment is provided below in Table 2.

Table 2. Inventory of the Stage 2 Documentary Record.

Type of Document	Description	Number of Records	Location
Photographs	Digital photographs documenting the subject property and conditions at the time of the property survey	18 digital photographs	On PRAS computer network – file PR15-08
Field Maps	Printed high-resolution satellite image of the subject property	1 page	PRAS office - file PR15-08
Field Notes	Notes on the property survey	2 pages	PRAS office - file PR15-08

6.2 Results

The area of archaeological potential within 100 m of the rail line was shovel test pit surveyed at 5 metre intervals, excluding the locations determined to be disturbed or low-lying and wet during the Stage 1 site inspection (see Map 14). This area was extended beyond the 100 metre buffer from the rail line to include undisturbed fields noted in the Stage 1 site inspection (Map 16). The soil stratigraphy consisted of c. 10 to 25 cm of dark brown loam topsoil above a light brown/grey clay loam subsoil (Image 15).

The northeast portion of the study area within 300 m of the unnamed stream and Delisle River was also shovel test pit surveyed at 5 m intervals (see Map 14). The western part of this area up to a stone field boundary appeared to have been stripped of topsoil with gravel fill placed over the area, and was determined to have been disturbed (Images 16 and 17; see Map 16). The remaining portion of this part of the study area gently sloped to the eastern boundary of the property, where there was a slight incline to a page wire fence line. The general soil stratigraphy of the eastern part consisted of c. 20 cm of dark brown clay loam above a brown/grey clay subsoil (Image 18). The eastern end of this part of the property was determined to be low-lying and wet, with areas of standing surface water observed during the assessment (Images 19, 20 and 21; see Map 16). The typical stratigraphy of the low-lying and wet area consisted of little to no topsoil and water-saturated grey clay (Image 22). The exception was within a slightly raised c. 2 m wide area parallel to eastern page wire fence line. The stratigraphy in this area consisted of c. 30 cm of dark brown clay loam topsoil above a brown/grey clay subsoil (Image 23). No artifacts or features of archaeological significance were found in any of the tested locations.

6.3 Analysis and Conclusions

No artifacts, features, or other cultural deposits of archaeological concern were noted during the Stage 2 assessment.

6.4 Stage 2 Recommendations

This report forms the basis for the following recommendation:

1) No further archaeological assessment of the study area is required as all areas with archaeological potential have been assessed, with no archaeological resources of cultural heritage value or interest found (see Map 16).

The reader is also referred to Section 7.0 below to ensure compliance with relevant provincial legislation and regulations that may relate to this project.

7.0 ADVICE ON COMPLIANCE WITH LEGISLATION

In order to ensure compliance with provincial legislation, the reader is advised of the following:

1) This report is submitted to the Minister of Tourism, Culture and Sport 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 Tourism, Culture and Sport, 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.

2) 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 Archaeological Reports referred to in Section 65.1 of the *Ontario Heritage Act*.

3) 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*.

4) The *Cemeteries Act*, R.S.O. 1990 c. C.4 and the *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 (when proclaimed in force) require that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Consumer Services.

5) 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 LIMITATIONS AND CLOSURE

Past Recovery Archaeological Services Inc. 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 prescribed in the client proposal and subsequent agreed upon changes to the contract. 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.

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, sample and testing program may fail to detect all or certain archaeological resources. The sampling strategies in this study comply with those identified in the Ministry of Tourism, Culture and Sport's *Standards and Guidelines for Consultant Archaeologists* (2011).

The documentation related to this archaeological assessment will be curated by Past Recovery Archaeological Services Inc. until such a time that arrangements for their ultimate transfer to an approved and suitable repository can be made to the satisfaction of the project owner(s), the Ontario Ministry of Tourism, Culture and Sport and any other legitimate interest group.

We trust that this report meets your current needs. If you have any questions of if we may be of further assistance, please do not hesitate to contact the undersigned.

Brenda Kennett, M.A.
Principal
Past Recovery Archaeological Services Inc.

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10.0 IMAGES

Image 1. Photograph of the partially excavated lagoon in the southwest corner of the study area, facing southwest. (PR15-08D020)

Image 2. Photograph of the partially excavated lagoon, facing northeast. (PR15-08D021)

Image 3. Photograph of the partially excavated lagoon, facing northwest. (PR15-08D024)

Image 4. Photograph of what appears to be undisturbed fields in the southern part of the study area, facing northeast. (PR15-08D030)

Image 5. Photograph of the low and wet area between the southern lagoon dyke and mounds of fill on the eastern edge of the southern fields, facing west. (PR15-08D009)

Image 6. Photograph of the low wet area between the southern fields and the lagoon dyke, facing southwest. (PR15-08D007)

Image 7. Photograph of a low-lying and wet area east of the lagoon, facing southeast. (PR15-08D003)

Image 8. Photograph of the field along north edge of study area and the ditch which encircles the lagoons on their west, north and east sides, facing northwest. (PR15-08D001)

Image 9. Photograph of the field in the northeast corner of the study area, facing northeast. (PR15-08D002)

Image 10. Photograph of the dyke and extensive ditching along the northern side of the lagoons, facing east. (PR15-08D015)

Image 11. Photograph of the dyke and extensive ditching along the western side of the study area, facing south. (PR15-08D014)

Image 12. Photograph of field crew performing the shovel test pit survey, facing north. (PR15-08D033)

Image 13. Photograph of field crew performing the shovel test pit survey, facing north. (PR15-08D038)

Image 14. Photograph of soil mounds covered in grass, which were excavated from the partially completed lagoon, facing south. (PR15-08D039)

Image 15. Photograph of the stratigraphy of a representative test pit from the southern fields of the study area, facing west. (PR15-08D034)

Image 16. Photograph of gravel fill on the surface west of the stone field boundary in the northeastern section of the study area, facing west. (PR15-08D040)

Image 17. Photograph of gravel fill on the surface west of the stone field boundary in the northeastern section of the study area, facing north. (PR15-08D041)

Image 18. Photograph of the stratigraphy of a representative test pit from the northeast part of the study area, facing east. (PR15-08D050)

Image 19. Photograph of standing water in the northeast section of the study area, facing west. (PR15-08D043)

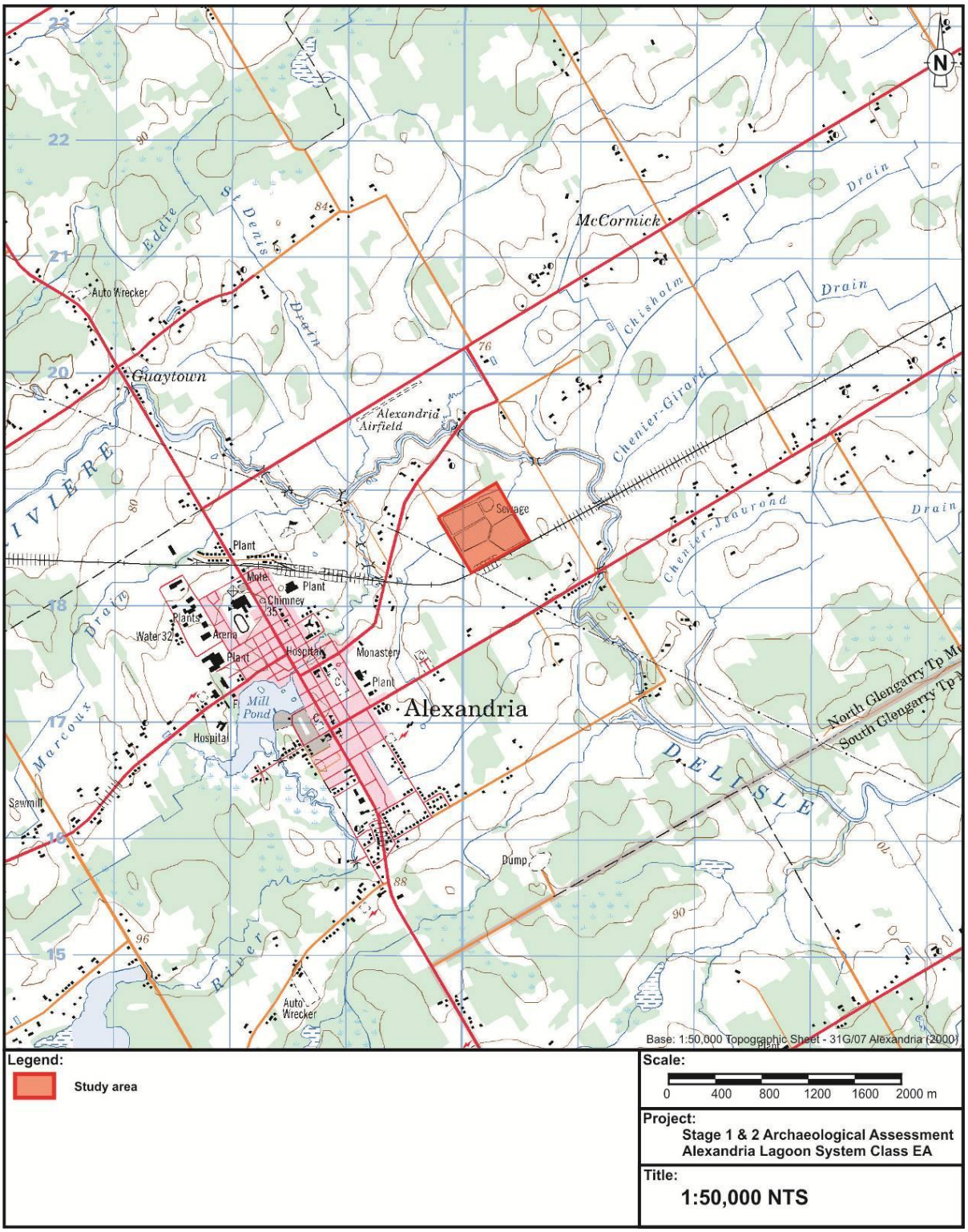
Image 20. Photograph of surface water and mosses in the northeast section of the study area, facing east. (PR15-08D045)

Image 21. Photograph of standing water and mosses in the northeast section of the study area, facing east. (PR15-08D047)

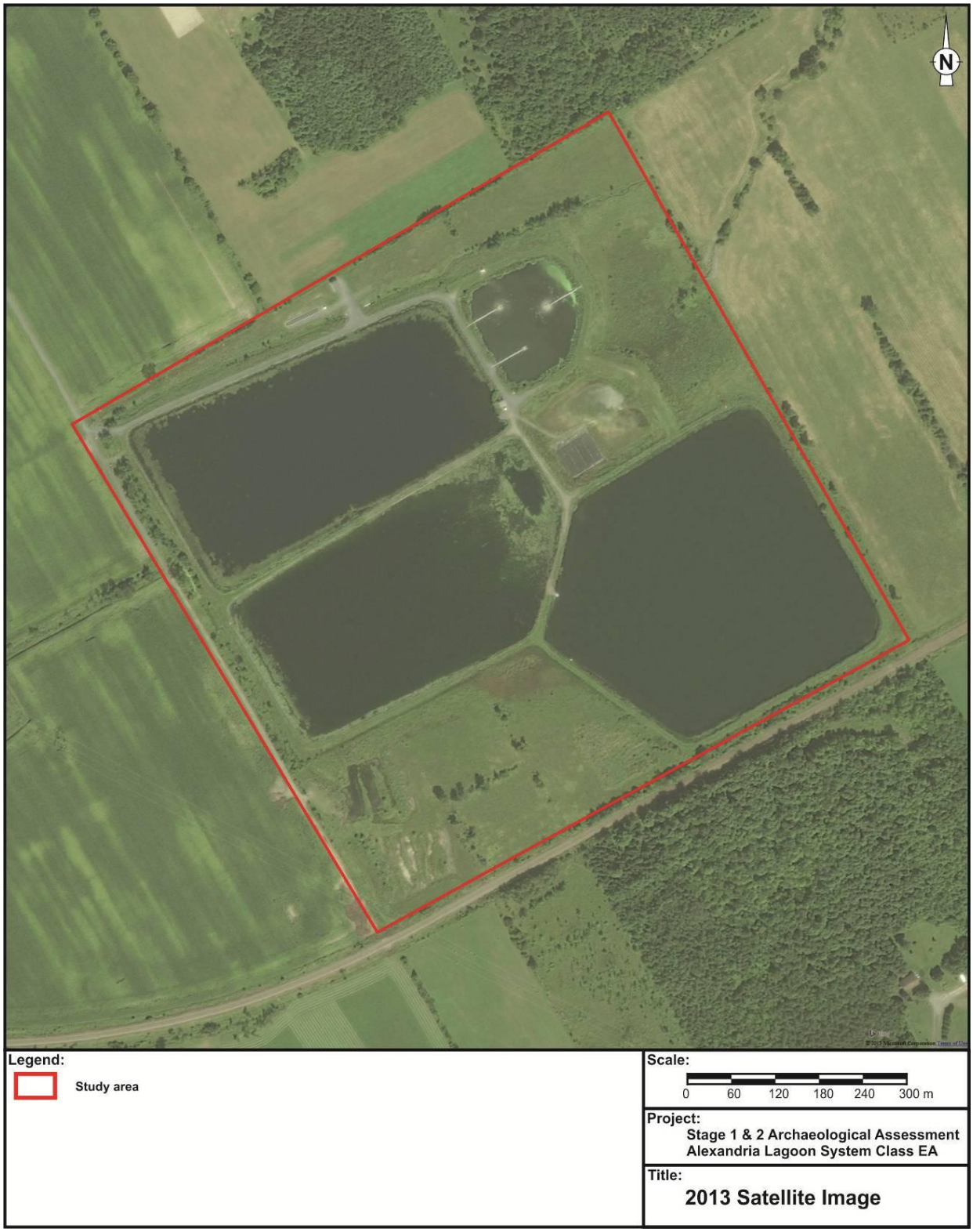
Image 22. Photograph of the stratigraphy of a representative test pit placed in the low wet portion of the study area, facing south. (PR15-08D049)

Image 23. Photograph of the stratigraphy of a representative test pit from the slightly raised area along the eastern boundary fence, facing east. (PR15-08D048)

11.0 MAPS



Map 1. Location of the study area.

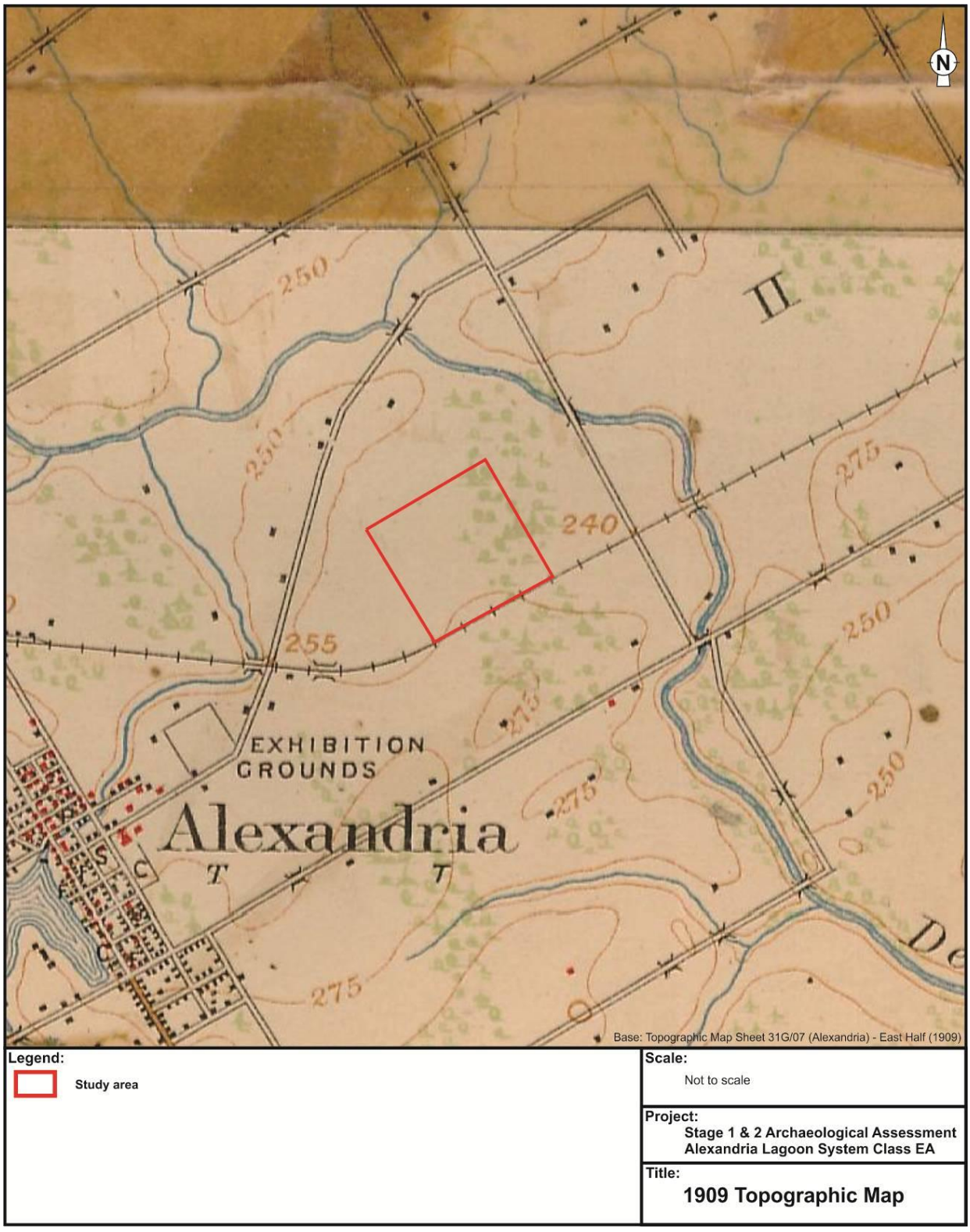


Map 2. Recent (2013) satellite image of the study area showing existing conditions.

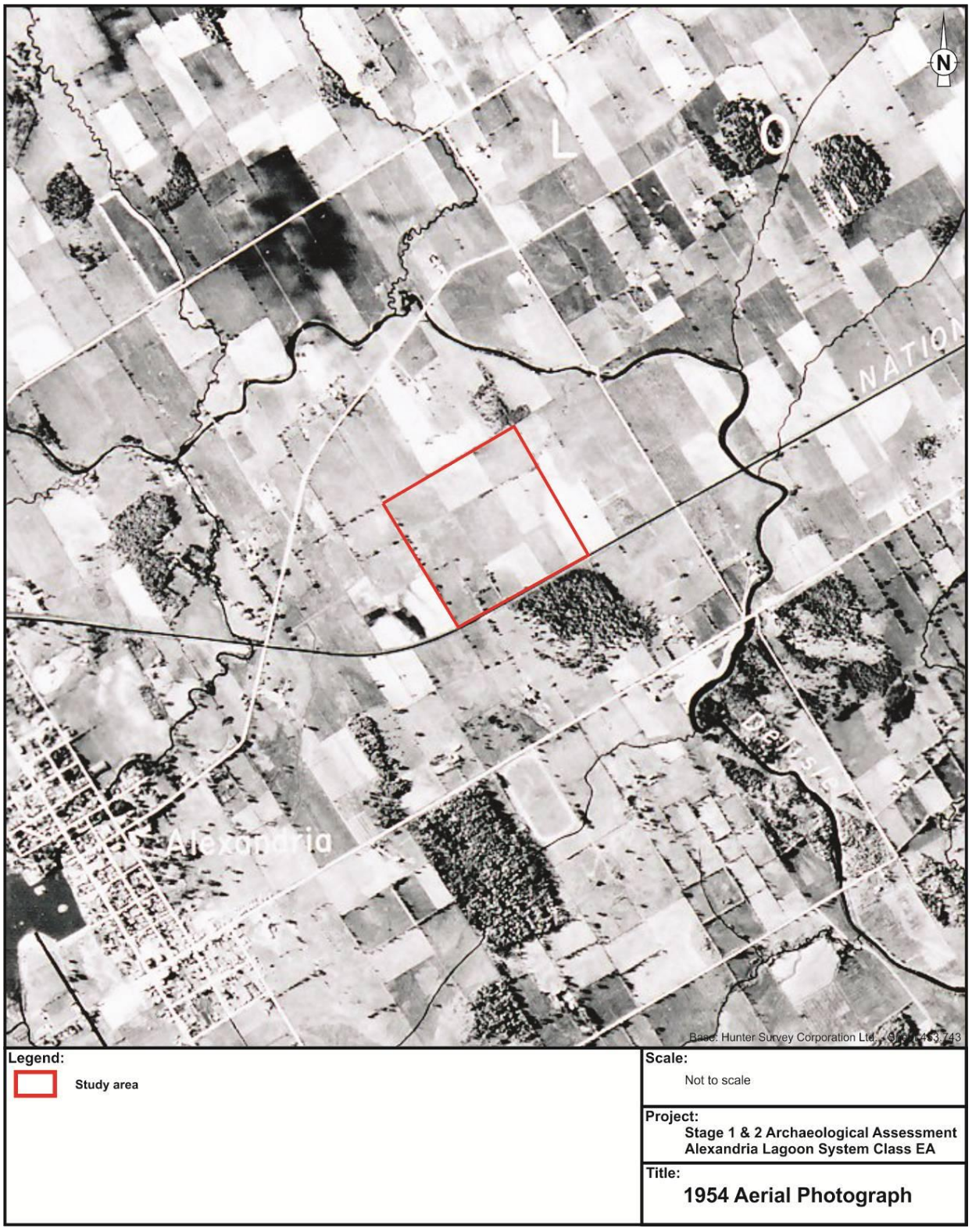
Map 3. Segment of a patent plan for Lochiel Township showing the approximate limits of the study area.

Map 4. Segment of the 1862 H. F. Walling map of Lansdowne Township showing the approximate limits of the study area.

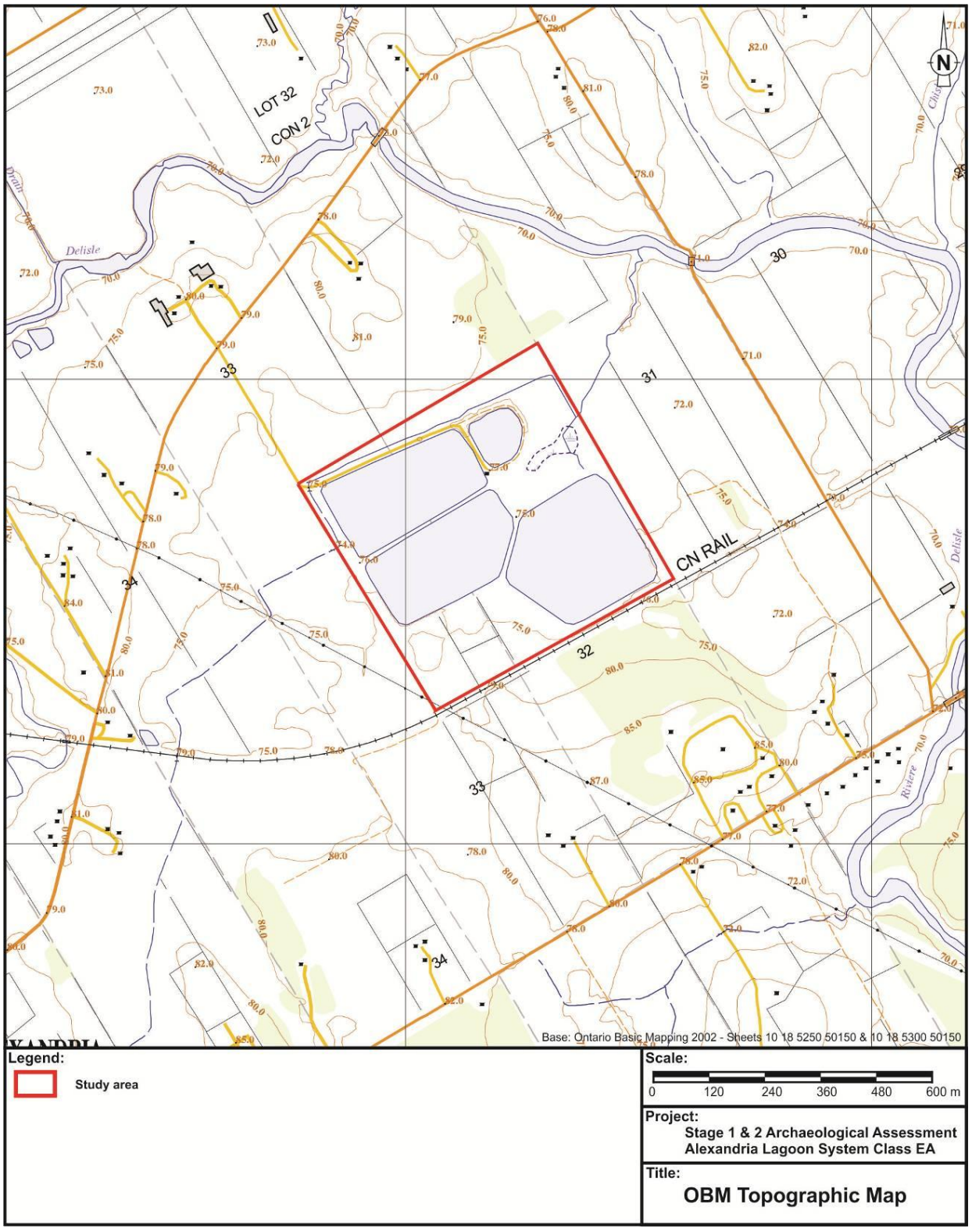
Map 5. Segment of the 1880 H. Belden & Co. map of Lochiel Township showing the approximate limits of the study area.



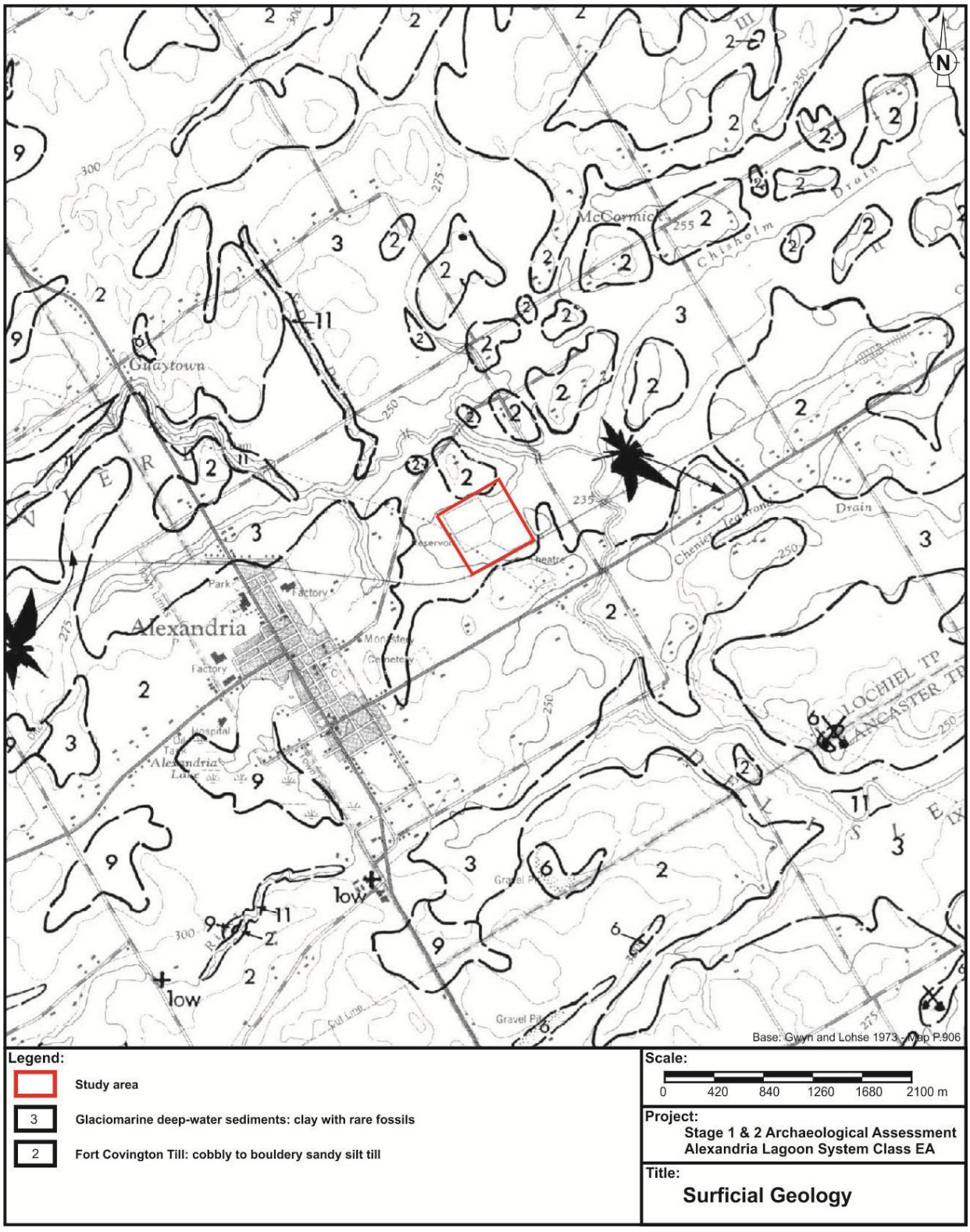
Map 6. Segment of a first edition (1909) one-inch-to-one-mile topographic map of the Alexandria vicinity` showing the approximate limits of the study area.



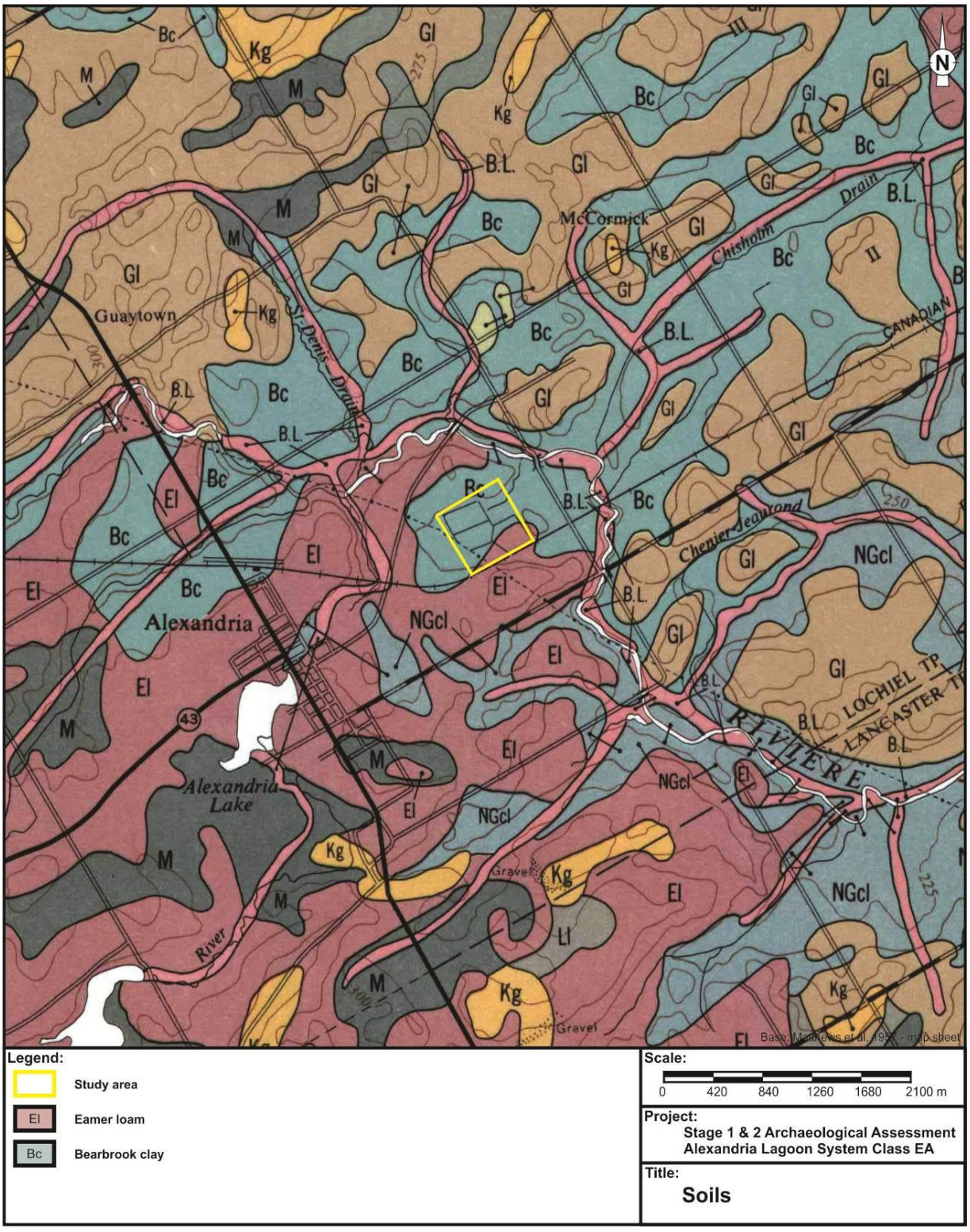
Map 7. Segment of a 1954 aerial photograph mosaic showing the approximate limits of the study area.



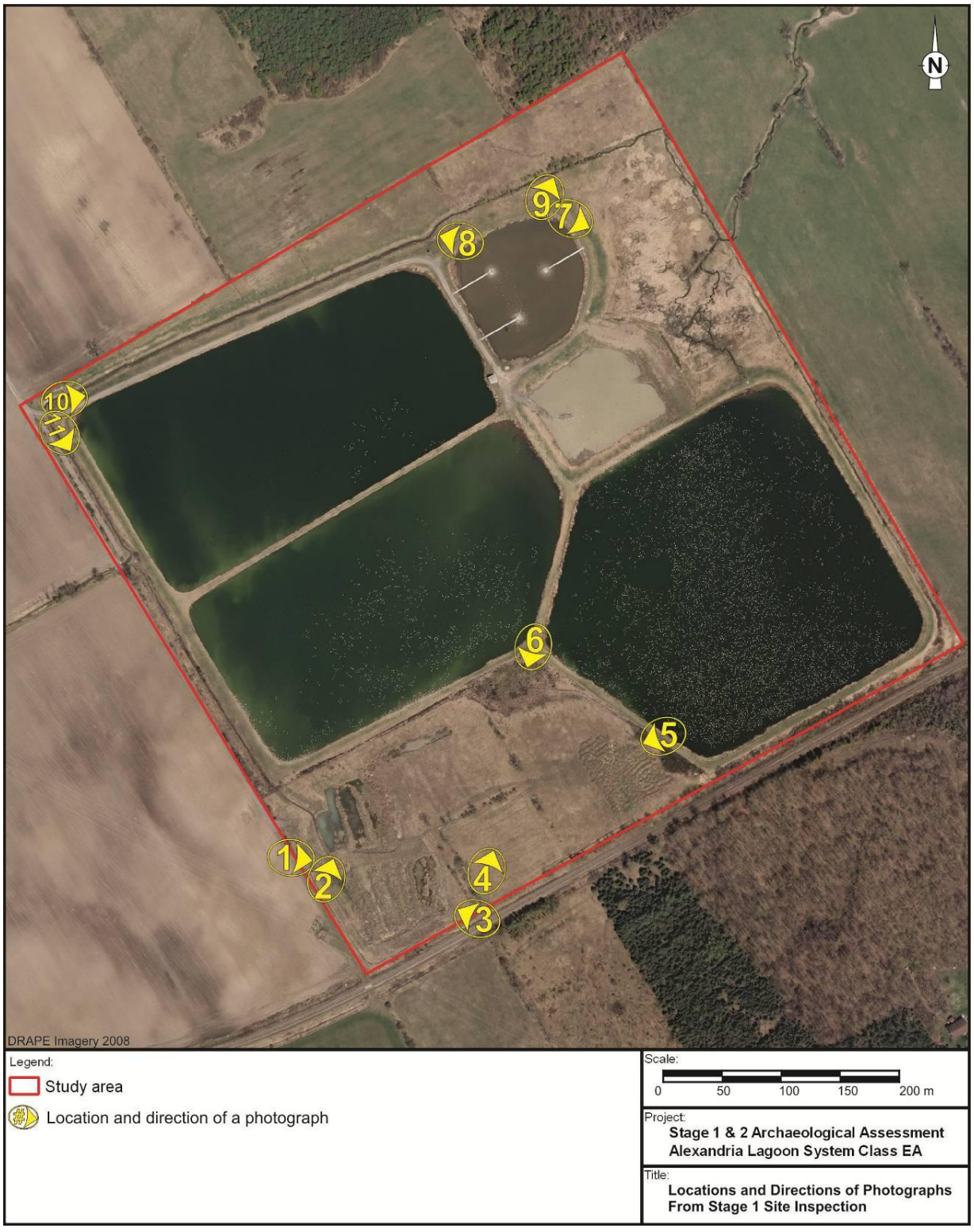
Map 8. Segment of topographical mapping showing the limits of the study area.



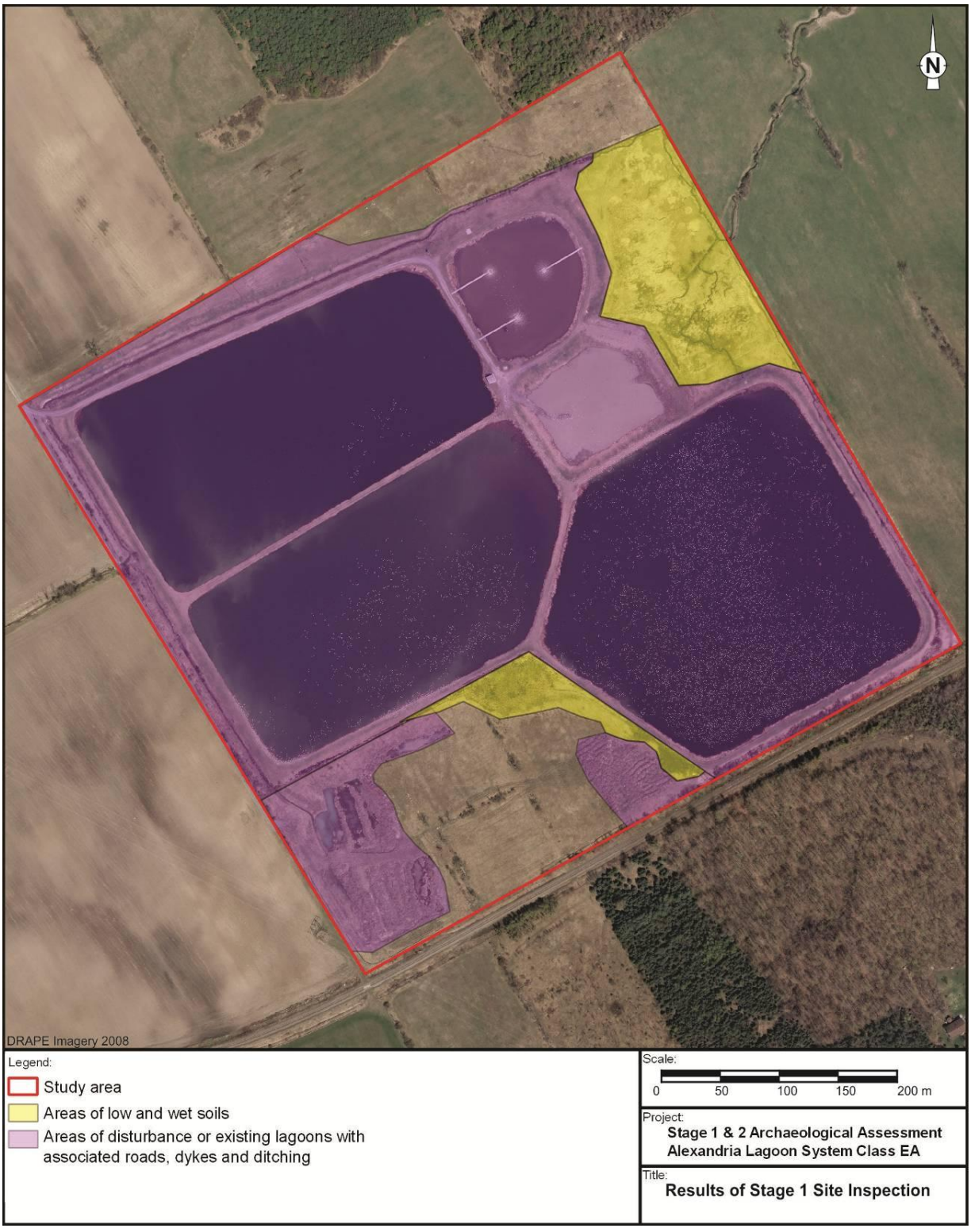
Map 9. Segment of surficial geology mapping showing the limits of the study area.



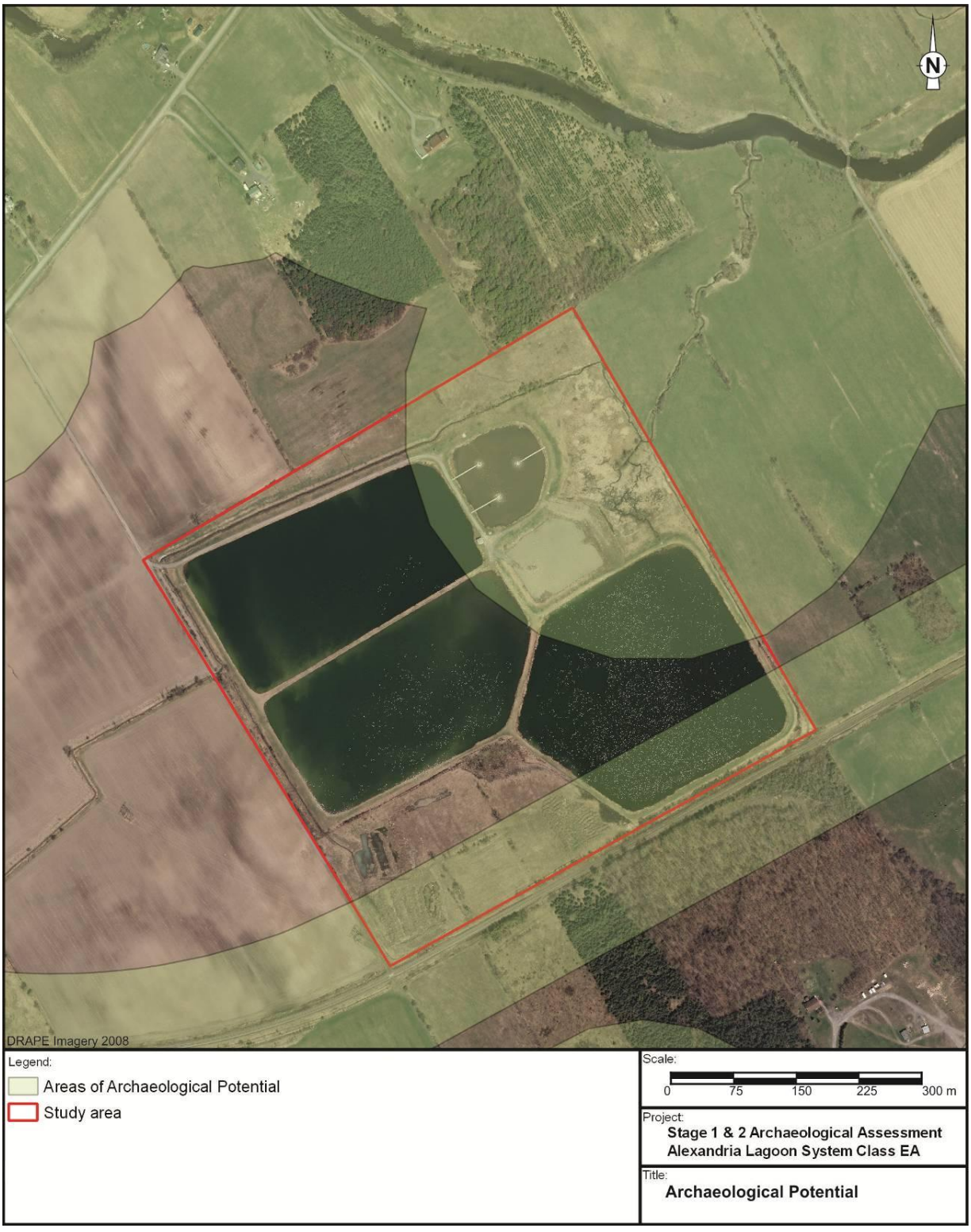
Map 10. Segment of soil survey mapping showing the limits of the study area.



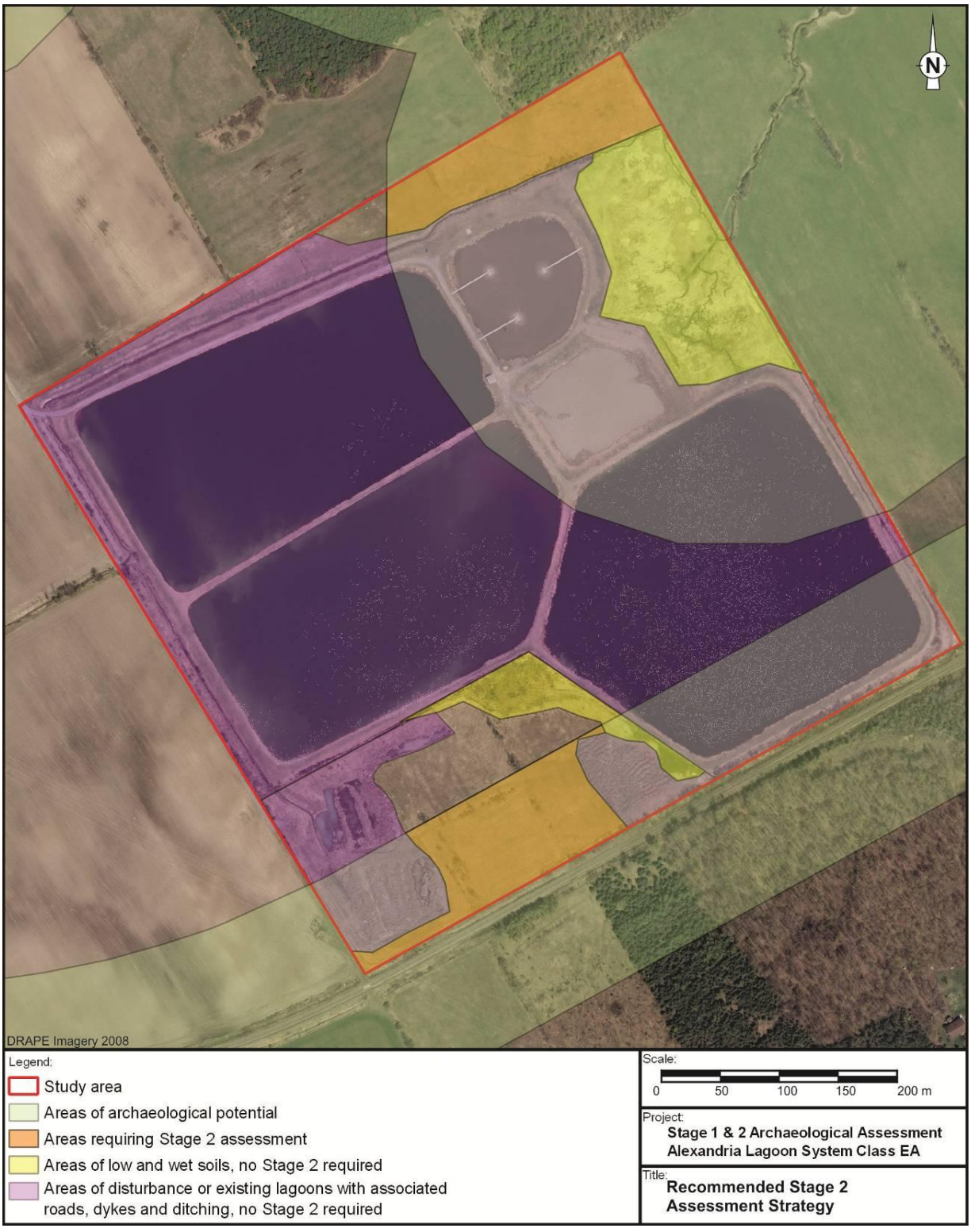
Map 11. Map showing the locations and directions of photographs used in Section 5.0 of this report. Note that photograph numbers correspond to image numbers from this report.



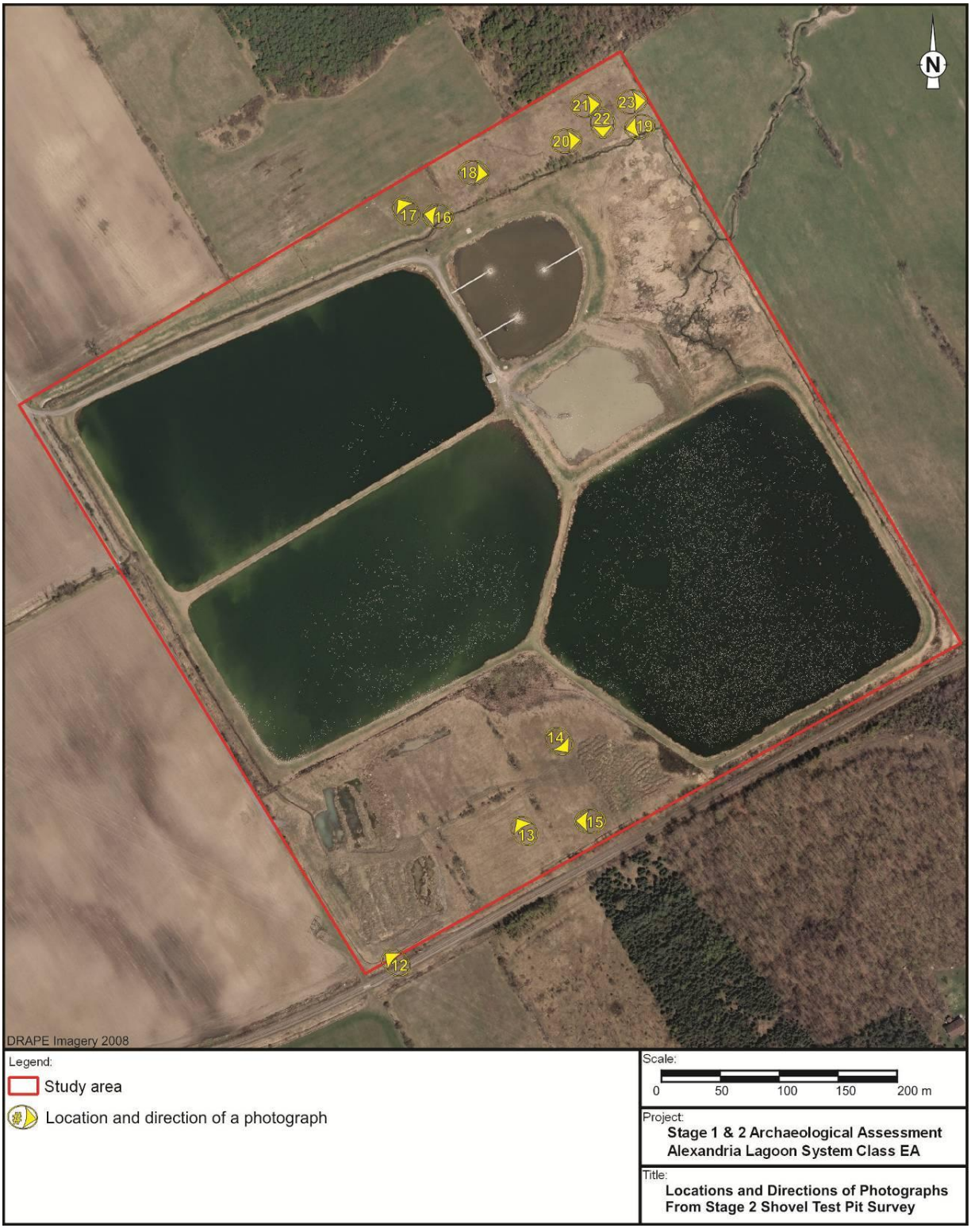
Map 12. Map of the conditions of the study area based on the Stage 1 site inspection.



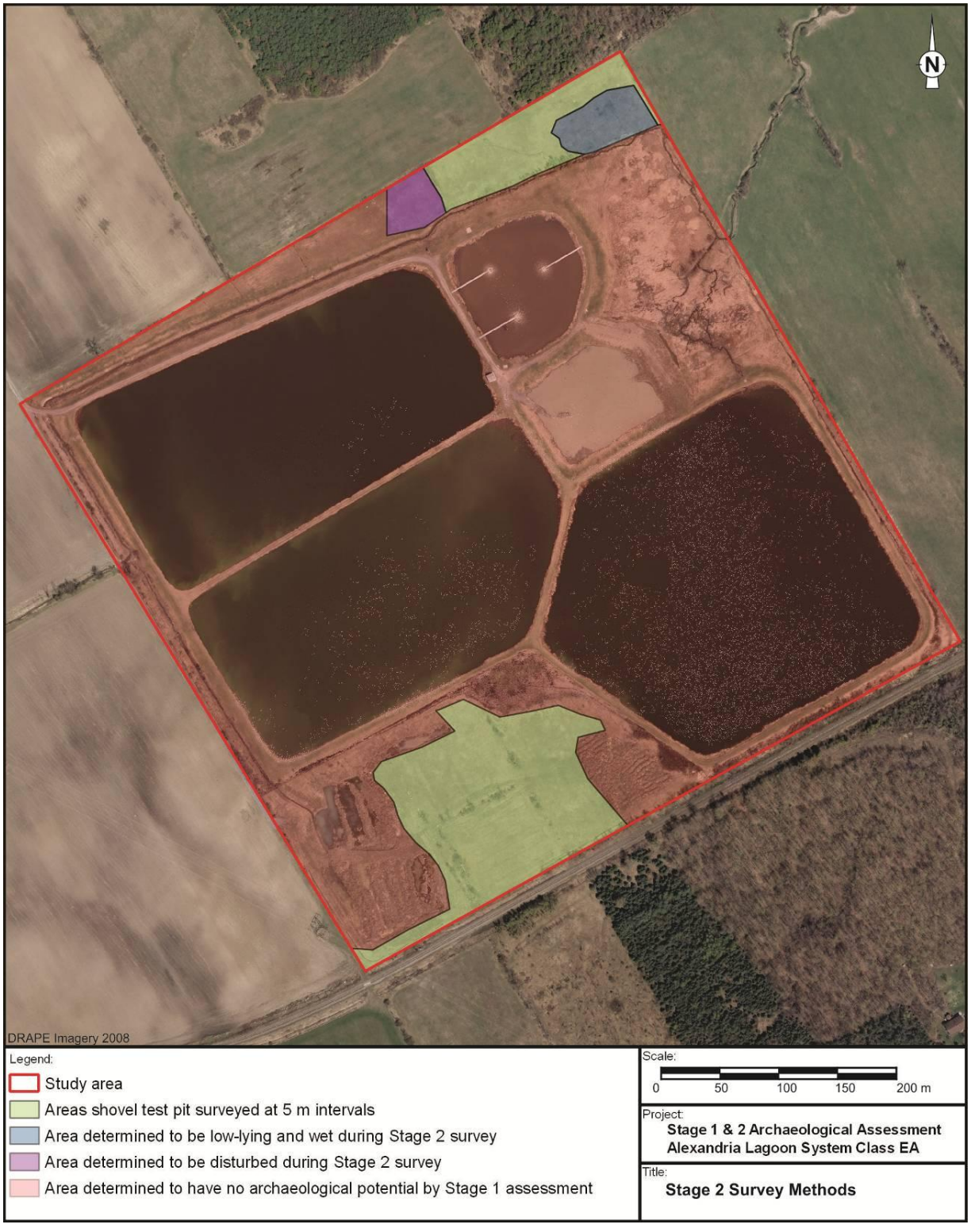
Map 13. Map of the archaeological potential for the study area.



Map 14. Map showing the recommended Stage 2 archaeological assessment methodology.



Map 15. Map showing the locations and directions of photographs used in Section 6.0 of this report. Note that photograph numbers correspond to image numbers from this report.



Map 16. Map showing the Stage 2 property survey methods and results.

APPENDIX 1: Photographic Catalogue

Catalogue No.	Description	Dir.
PR15-08D001	Photograph of field along north edge of study area and the ditch which encircles the lagoons on their west, north and east sides	NW
PR15-08D002	Photograph of field in the northeast corner of the study area	NE
PR15-08D003	Photograph of a low-lying and wet area east of the lagoon	SE
PR15-08D004	Photograph of aerating lagoon	S
PR15-08D005	Photograph of aerating lagoon	SE
PR15-08D006	Photograph of small drainage lagoon	E
PR15-08D007	Photograph of low wet area between the southern fields and the lagoon dyke	SW
PR15-08D008	Photograph of southern lagoon	SE
PR15-08D009	Photograph of low and wet area between the southern lagoon dyke and mounds of fill on the eastern edge of the southern fields	W
PR15-08D010	Photograph of low and wet area between the southern lagoon dyke and mounds of fill on the eastern edge of the southern fields	W
PR15-08D011	Photograph of low and wet area between the southern lagoon dyke and southern fields	N
PR15-08D012	Photograph of western dyke of the southern lagoon	S
PR15-08D013	Photograph of southern lagoon	E
PR15-08D014	Photograph of the dyke and extensive ditching along the western side of the study area	S
PR15-08D015	Photograph of the dyke and extensive ditching along the northern side of the lagoons	E
PR15-08D016	Photograph of western lagoon	S
PR15-08D017	Photograph of western lagoon	SE
PR15-08D018	Photograph of partially excavated lagoon	S
PR15-08D019	Photograph of partially excavated lagoon	E
PR15-08D020	Photograph of partially excavated lagoon on southwest corner of the study area	SW
PR15-08D021	Photograph of partially excavated lagoon	NE
PR15-08D022	Photograph of partially excavated lagoon	N
PR15-08D023	Photograph of partially excavated lagoon	NE
PR15-08D024	Photograph of partially excavated lagoon	NW
PR15-08D025	Photograph of exposed pebbles and cobbles on high point along the southern boundary of the study area	E
PR15-08D026	Photograph of stone field fence, possibly and old laneway of field road in southern portion of the study area.	N
PR15-08D027	Photograph of what appear to be undisturbed fields in the southern part of the study area	NE
PR15-08D028	Photograph of what appear to be undisturbed fields in the southern part of the study area	N
PR15-08D029	Photograph of what appear to be undisturbed fields in the southern part of the study area	E

Catalogue No.	Description	Dir.
PR15-08D030	Photograph of what appear to be undisturbed fields in the southern part of the study area	NW
PR15-08D031	Photograph of what appear to be undisturbed fields in the southern part of the study area	N
PR15-08D032	Photograph of partially excavated lagoon	W
PR15-08D033	Photograph of field crew performing shovel test pit survey	N
PR15-08D034	Photograph of the stratigraphy of a representative test pit from the southern fields of the study area	W
PR15-08D035	Photograph of crew testing near stone field fences in southern section of study area	N
PR15-08D036	Photograph of crew testing near stone field fences in southern section of study area	N
PR15-08D037	Photograph of test pit in southern study area fields	N
PR15-08D038	Photograph of field crew performing shovel test pit survey	N
PR15-08D039	Photograph of soil mound covered in grass, which were excavated from the partially completed lagoon	S
PR15-08D040	Photograph of gravel fill on surface west of stone field fence in the northeastern section of the study area	W
PR15-08D041	Photograph of gravel fill on surface west of the stone field fence in the northeastern section of the study area	N
PR15-08D042	Photograph of standing water in the northeast section of the study area	N
PR15-08D043	Photograph of standing water in the northeast section of the study area	W
PR15-08D044	Photograph of surface water and mosses in the northeast section of the study area	S
PR15-08D045	Photograph of surface water and mosses in the northeast section of the study area	E
PR15-08D046	Photograph of surface water and mosses in the northeast section of the study area	N
PR15-08D047	Photograph of standing water and mosses in the northeast section of the study area	E
PR15-08D048	Photograph of the stratigraphy of a representative test pit from the slightly raised area along the eastern fence boundary of the study area	E
PR15-08D049	Photograph of the stratigraphy of a representative test pit placed in the low wet portion of the study area	S
PR15-08D050	Photograph of the stratigraphy of a representative test pit from the northeast study area	E

APPENDIX 2: Glossary of Archaeological Terms

Archaeology:
The study of human past by excavation of cultural material.

Archaeological Sites:
The physical remains of any building, structure, cultural feature, object, human event or activity which, because of the passage of time, are on or below the surface of the land or water.

Archaic:
A term used by archaeologists to designate a distinctive cultural period dating between 8000 and 1000 B.C. in eastern North America. The period is divided into Early (8000 to 6000 B.C.), Middle (6000 to 2500 B.C.) and Late (2500 to 1000 B.C.). It is characterized by hunting, gathering and fishing.

Artifact:
An object manufactured, modified or used by humans.

B.P.:
Before Present. Often used for archaeological dates instead of B.C. or A.D. Present is taken to be 1951, the date from which radiocarbon assays are calculated.

Backdirt:
The soil excavated from an archaeological site. It is usually removed by shovel or trowel and then screened to ensure maximum recovery of artifacts.

Chert:
A type of silica rich stone often used for making chipped stone tools. A number of chert sources are known from southern Ontario. These sources include outcrops and nodules.

Contact Period:
The period of initial contact between Native and European populations. In Ontario, this generally corresponds to the seventeenth and eighteen centuries depending on the specific area.

Cultural Resource / Heritage Resource:
Any resource (archaeological, historical, architectural, artifactual, archival) that pertains to the development of our cultural past.

Cultural Heritage Landscapes:
Cultural heritage landscapes are groups of features made by people. The arrangement of features illustrate noteworthy relationships between people and their surrounding environment. They can provide information necessary to preserve, interpret or reinforce the understanding of important historical settings and changes to past patterns of land use. Cultural landscapes include neighbourhoods, townscapes and farmscapes.

Diagnostic:
An artifact, decorative technique or feature that is distinctive of a particular culture or time period.

Disturbed:
In an archaeological context, this term is used when the cultural deposit of a certain time period has been intruded upon by a later occupation.

Excavation:
The uncovering or extraction of cultural remains by digging.

Feature:
This term is used to designate modifications to the physical environment by human activity. Archaeological features include the remains of buildings or walls, storage pits, hearths, post moulds and artifact concentrations.

Flake:
A thin piece of stone (usually chert, chalcedony, etc.) detached during the manufacture of a chipped stone tool. A flake can also be modified into another artifact form such as a scraper.

Fluted:
A lanceolate shaped projectile point with a central channel extending from the base approximately one third of the way up the blade. One of the most diagnostic Palaeo-Indian artifacts.

Lithic:
Stone. Lithic artifacts would include projectile points, scrapers, ground stone adzes, gun flints, etc.

Lot:
The smallest provenience designation used to locate an artifact or feature.

Midden:
An archaeological term for a garbage dump.

Mitigation:
To reduce the severity of development impact on an archaeological or other heritage resource through preservation or excavation. The process for minimizing the adverse impacts of an undertaking on identified cultural heritage resources within an affected area of a development project.

Multicomponent:
An archaeological site which has seen repeated occupation over a period of time. Ideally, each occupation layer is separated by a sterile soil deposit that accumulated during a period when the site was not occupied. In other cases, later occupations will be directly on top of earlier ones or will even intrude upon them.

Operation:
The primary division of an archaeological site serving as part of the provenience system. The operation usually represents a culturally or geographically significant unit within the site area.

Paleo-Indian:
The earliest human occupation of Ontario designated by archaeologists. The period dates between 9000 and 8000 B.C. and is characterized by small mobile groups of hunter-gatherers.

Profile:
The profile is the soil stratigraphy that shows up in the cross-section of an archaeological excavation. Profiles are important in understanding the relationship between different occupations of a site.

Projectile Point:
A point used to tip a projectile such as an arrow, spear or harpoon. Projectile points may be made of stone (either chipped or ground), bone, ivory, antler or metal.

Provenience:
Place of origin. In archaeology this refers to the location where an artifact or feature was found. This may be a general location or a very specific horizontal and vertical point.

Salvage:
To rescue an archaeological site or heritage resource from development impact through excavation or recording.

Stratigraphy:
The sequence of layers in an archaeological site. The stratigraphy usually includes natural soil deposits and cultural deposits.

Sub-operation:
A division of an operation unit in the provenience system.

Survey:
To examine the extent and nature of a potential site area. Survey may include surface examination of ploughed or eroded areas and sub-surface testing.

Test Pit:
A small pit, usually excavated by hand, used to determine the stratigraphy and presence of cultural material. Test pits are often used to survey a property and are usually spaced on a grid system.

Woodland:
The most recent major division in the pre-Contact cultural sequence of Ontario. The Woodland period dates from 1000 B.C. to A.D. 1550. The period is characterized by the introduction of ceramics and the beginning of agriculture in southern Ontario. The period is further divided into Early (1000 B.C. to A.D. 0), Middle (A.D. 0 to A.D. 900) and Late (A.D. 900 to A.D.1550).

Ontario

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

Alexandria Sewage Lagoon Treatmetn Facility

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

McCormick Road.

Proponent Name

Township of North Glengarry

Proponent Contact Information

Ryan Morton, Public Works, 613-525-3708

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

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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@mtc.gov.on.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.