

**Beneficial Use Impairment Updates and
Assessments for the St. Lawrence River Area of
Concern**

UPDATE ON THE BEACH CLOSINGS BENEFICIAL USE IMPAIRMENT



Beach Closings Criterion # 1 Assessment for St. Lawrence River (Cornwall) Area of Concern

Report prepared for Environment and Climate Change Canada in support of the St. Lawrence River (Cornwall) Remedial Action Plan and the Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health.



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Executive Summary

The St. Lawrence River (Cornwall) Area of Concern (AOC) 'Beach Closings' beneficial use was originally identified as being 'impaired' in the 1997 Remedial Action Plan (RAP) Stage 2 Report due to persistent, on-going high fecal bacteria counts preventing the public from enjoying the river. Three delisting criteria were subsequently established to assess the status of the St. Lawrence River (Cornwall) AOC Beach Closings impaired beneficial use (BUI). This report assesses delisting criterion #1:

- 1. At public beaches, no more than 20% of weekly tests (i.e., five sample E. coli geometric means) exceed the Provincial Water Quality Objective during an annual swimming season. In addition, the main/predominant sources of fecal pollution are known; most of these exceedances are associated with local events, such as significant rainfall or high wind periods.*

Results of this assessment demonstrate the following:

- Exceedances did not occur more than 20% of tests for Charlottenburgh Park Beach
- Glengarry Beach and a couple of Akwesasne beaches did exceed the 20% of weekly tests; however most of those exceedances were paired with high rainfall events. When exceedances associated with rainfall events were removed from the equation, Glengarry Beach and the Akwesasne beaches meet the delisting criteria.

Overall, the results of this assessment indicate that the delisting criterion #1 has been met for all of the AOC beaches.

Acronyms and Abbreviations

AOC – Area of Concern

BUI – Beneficial Use Impairment

CFU – Colony Forming Units

ECCC – Environment and Climate Change Canada

EOHU – Eastern Ontario Health Unit

E. coli – *Escherichia coli*

GLWQA – Great Lakes Water Quality Agreement

IJC – International Joint Commission

MCA – Mohawk Council of Akwesasne

MECP – Ontario Ministry of Environment, Conservation and Parks

OMHLTC - Ontario Ministry of Health and Long-Term Care

PWQO – Provincial Water Quality Objective

RAP – Remedial Action Plan

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1.0 Introduction

In 1986, the St. Lawrence River at Cornwall was identified as an Area of Concern (AOC) by the International Joint Commission (IJC) under the Great Lakes Water Quality Agreement between Canada and the United States (International Joint Commission, 1987). An Area of Concern is a geographic area along the Great Lakes where water quality and ecosystem health has been severely degraded by human activities to the point that beneficial uses were impaired. In order to address the Beneficial Use impairments (BUIs) resulting from the environmental degradation a Remedial Action Plan (RAP) was developed. The Beach Closing BUI was initially defined by the IJC to occur “when water, which are commonly used for total-body contact or partial-body contact reaction, exceed standards, objectives, or guidelines for such use”. As a result, the Beach Closings BUI (#10) was determined to be “Impaired” for the St. Lawrence River (Cornwall) AOC.

Public beaches in Ontario are monitored by local health units following standards and protocols published by the Ontario Minister of Health and Long-Term Care (OMHLTC). The Eastern Ontario Health Unit (EOHU) is responsible for monitoring water quality at the two (2) public beaches located within the AOC, Charlottenburgh Park Beach and Glengarry Park Beach, and the Mohawk Council of Akwesasne Health Department is responsible for monitoring the 28 beaches located in Akwesasne. Beach monitoring is conducted through a standard protocol that includes a visual assessment of site conditions and evaluation of *E. coli* levels in water samples collected in the beach area (OMHLTC, 2018b). The EOHU issues ‘swimming advisories’ (notices of impaired water quality) for beaches when samples exceed the Provincial Water Quality Objectives (PWQO), based on the geometric mean¹ of five (5) samples, which combined cannot exceed 200cfu/100 mL of water and a single sample cannot exceed 400 cfu/100mL of water. *E. coli* is considered a reliable indicator of fecal inputs that can impair water quality for recreational use.

Delisting criterion #1 was adopted in 2006, and incorporates components that address the following:

- The International Blue Flag Program (www.blueflag.ca) benchmark whereby beaches should be closed for less than 20% of the swimming season due to unsafe levels of *E. coli* as determined by the local health authority;
- Impairments are due to human current or past activity; and
- Impairments are due to persistent, on-going high fecal bacteria counts, not sporadic high counts associated with rainfall events

¹ The **geometric mean** is a calculation used to average the bacterial levels of *E. coli* in samples collected from recreational water. Monitoring public beaches for *E. coli* bacteria and the use of the geometric mean approach permits more meaningful statistical evaluations. Assessment of the bacterial quality of recreational water requires more than a single result. Due to the uneven distribution of bacteria throughout a liquid medium, the count of microorganisms in a single “grab sample” does not represent the average concentration in a particular body of water. A random sample may demonstrate a concentration that is far above or below the average. To obtain an accurate assessment of the quality of recreational water, the results of a number of samples shall be combined in such a way that a random, unrepresentative sample will not unduly influence the average. (OMHLTC, 2018a).

The aim of this report is to assess delisting criterion #1:

1. *At public beaches, no more than 20% of weekly tests (i.e., five sample E. coli geometric means) exceed the Provincial Water Quality Objective during an annual swimming season. In addition, the main/predominant sources of fecal pollution are known; most exceedances are associated with local events, such as significant rainfall or high wind periods.*

E. coli data from Glengarry Park Beach, Charlottenburgh Park Beach and 28 Akwesasne beaches for the years of 2012-2020 will be assessed against the delisting criterion listed above. This report does so by comparing data with the *E. coli* limits adopted by the EOHU (200cfu/100 mL of water, and a single standard maximum of less than 400cfu/100 mL).

2.0 Methods

2.1 Akwesasne Beaches

There were 28 beaches monitored within Akwesasne over the time period from 2012-2020. At the request of the MCA, the names and locations of the sites are kept within the community and data for the sites are listed by numbering in a generic fashion. Results of bacteriological analyses for these beaches were received as scanned reports from EOHU and transferred to Excel spreadsheets. Data was entered by date and then organized by site and sampling event per year.

Historical records of daily rainfall from Environment and Climate Change Canada's weather station in Cornwall, ON and from the National Centers for Environmental Information under the National Oceanic and Atmospheric Administration's weather station in Massena, NY were cross-referenced with dates of exceedances to determine if there were correlations between pertinent weather events and exceedances.

Due to inherent limits in EOHU's methodology for bacteriological analyses of water, it is not possible to establish whether individual samples contain a number of colony-forming units below 10cfu/100mL. Likewise, it is not possible to know the exact number of colony-forming units contained in a sample exceeding 1000cfu/100mL. Therefore, in the calculation of geometric means, results recorded as less than 10 or greater than 1000 cfu/100mL were taken as 10 cfu/100mL and 1000 cfu/100mL respectively.

Geometric means of *E. coli* present at events were plotted against the number of sampling events undertaken at that site, per year, to establish the percentage of events exceeding PWQO regulations during that year. This practice is a close analogy to that of past reports where the percentage of weekly beach postings would serve to meet the delisting criterion that 'no more than 20% of weekly tests during an annual swimming season would surpass PWQO regulations'. Because these geometric mean calculations via *E. coli* analyses are the exact mechanism that would initiate a beach posting, and because there is a lack of data surrounding beach postings in Akwesasne, this method was considered sufficient.

Lastly, the geometric means of sampling events for each site were recorded for each year from 2012-

2020. The aim of this practice was to establish whether exceedances were recurring at particular sites, and to visualize the long-term trends in water quality at these sites.

2.2 Glengarry Park Beach and Charlottenburgh Park Beach

Detailed reports were provided by the EOHU for both Glengarry Park and Charlottenburgh Park beaches between 2012-2020. These reports included the dates of sampling events, the results of the bacteriological analyses corresponding to each sampling event (5 samples per event), the geometric mean of these results, whether the beach was posted on the date of a sampling event or not, weather conditions, and potential sources of pollution such as wildlife present or beach traffic.

Sampling events that exceeded the PWQO standard were referenced against the same historical records of rainfall that were used for Akwesasne beaches, i.e. Environment and Climate Change Canada's weather station in Cornwall, ON, and the National Centers for Environmental Information under the National Oceanic and Atmospheric Administration's weather station in Massena, NY. Since rainfall events, as described in previous RAP reports and identified by microbial source tracking analysis (RAP 2014), are associated with a high percentage of the events that exceed the PWQO due to run off from sources of pollution such as fecal matter, this analysis is valuable in identifying the key factors associated with exceedances.

3.0 Results and Discussion

3.1 Akwesasne Beaches

The results of the 28 Akwesasne recreational areas sampled from 2012 to 2020 indicate that out of the total 1207 sampling events, only 25 (2%) of events exceeded the water quality guidelines (Table 1). Of the 25 exceedances 21 coincided with rainfall events. Rainfall is typically the most important local event to initiate postings at otherwise healthy sites; therefore, the RAP delisting criterion provides an allowance for exceedances that coincide with rain events.

Beach 14 and 19 were the only sites out of the 28 that recorded an annual ratio of exceedances above the RAP delisting criteria of 20%. However, all but one of these exceedances coincided with a rainfall event, allowing them to meet delisting criteria.

3.2 Glengarry Park Beach and Charlottenburgh Park Beach

Glengarry Beach is a site known to have frequent *E. coli* exceedances because of the resident bird population, as well as the influence of a nearby tributary (Raisin River) which is located in an agricultural watershed and therefore is prone to contamination by agricultural run-off (Haley and Ridal, 2010). As a result, both 2014 and 2017 sampling years, had exceedance rates above the 20% RAP delisting criteria benchmark (Figure 2).

In 2014, 15 sampling events, out of 50, recorded geometric means above the water quality guideline (an exceedance rate of 30%). Of the 15 exceedances, 11 coincided with rainfall events, reducing the number

of unexplained exceedances to 8% during the swimming season. Similarly, in 2017, 5 of 24 sampling events recorded geometric means above the water quality guideline (an exceedance rate of 33%). Four of these five events coincided with rainfall events, reducing the number of unexplained exceedances to 4% (Table 2). These adjusted percentages, accounting for explainable exceedances, meet the delisting criterion of 'no more than 20% of tests can exceed the water quality guidelines during an annual swimming season'.

In contrast to Glengarry Park Beach, Charlottenburgh Park Beach is a site that rarely exceeds the water quality guidelines, in no small part due to the consistent upkeep of the beach area provided by the Park's staff. Charlottenburgh Park Beach is sampled less frequently than Glengarry Park Beach because the EOHU notes it as 'low risk' due to historical data. The EOHU does a risk assessment every year before they take samples, to ensure the sampling amount is correct. Charlottenburgh Park Beach only had two exceedances between 2012 and 2020, one was explained by a weather event, and one was an outlier. It did not exceed the delisting criterion of 20% exceedances in the annual swimming season for any of its sampling seasons (Figure 3).

4.0 Conclusions and Recommendations

The Akwesasne beaches had only 2% of total sampling events exceeding the PWQO, contributing to an overall positive assessment for the AOC. Only 4 of 1207 Akwesasne sampling events can be counted as exceedances of the PWQO without a qualified explanation (i.e. rainfall events).

Sampling events recorded at Charlottenburgh Park Beach between 2012 and 2020 also support the conclusion that recreational water quality in the AOC is consistently very good. Charlottenburgh met the delisting criteria each year; none of the sampling years had exceeded the delisting criterion.

Glengarry Park Beach recorded some exceedances above the 20% delisting criterion; however, many of these were paired with high rainfall events, allowing for the delisting criterion to be met. It appears as though weather events are not the only reason for degradation in water quality at the Glengarry Park Beach, as some exceedances occurred in absence of recent precipitation or high winds. The implementation of beach upkeep by park staff along with sustained efforts to understand the effect of the Raisin River tributary on this particular beach are recommended if these outliers are to be mitigated.

Overall, the review of beach water quality data from 2012-2020 has determined that the conditions at public beaches in the AOC meet the delisting criterion #1.

To prevent possible back sliding of existing beach conditions, monitoring and assessments of conditions at AOC beaches should continue to be undertaken, led by in partnership with the EOHU and MCA Health Department. Managers of each beach should continue to review and upgrade, where possible, beach upkeep, and animal traffic should be monitored and mitigated.

5.0 Acknowledgements

The authors are indebted to Idalia Milan and the Eastern Ontario Health Unit for providing the beach data included in this report and Rami Basha of the Health Unit for review of this document. We thank Peggy Pyke, Abraham Francis and Britney Bourdages of the Tehotiiennawakon--Environment Program at the

Mohawk Council of Akwesasne, as well as members of the MCA Health Department for providing review of the document and input on the data for Akwesasne beaches.

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APPENDIX A: Tables

Table 1. Summary of sampling activities and results for Akwesasne beaches by site, including total number of sampling events, total exceeding events, percentage of exceedances, total exceeding events coinciding with rainfall, and exceeding events not explained by rainfall (outliers). Due to number of site samples, this chart demonstrates the average and maximum exceedance per beach, which is different than the tables below, which go by year.

Site Name	# Sampling Events	# of Events Exceeding PWQO	Avg. Annual Exceedance (%)	Max. Annual Exceedance (%)	# Exceedances coinciding with rainfall events (>2mm)	# Exceedances per Year <u>not</u> Associated with Rainfall Events	% Exceedances per Year <u>not</u> Associated with Rainfall Events
Beach 1	54	2	3%	17%	2	0	0%
Beach 2	46	1	2%	12%	1	0	0%
Beach 3	51	0	0%	0%	0	0	0%
Beach 4	9	0	0%	0%	0	0	0%
Beach 5	52	1	2%	8%	1	0	0%
Beach 6	81	2	2%	17%	1	1	1%
Beach 7	78	1	1%	8%	1	0	0%
Beach 8	49	4	5%	11%	4	0	0%
Beach 9	73	0	0%	0%	0	0	0%
Beach 10	15	0	0%	0%	0	0	0%
Beach 11	29	0	0%	0%	0	0	0%
Beach 12	39	2	4%	10%	1	1	2.6%
Beach 13	74	1	1%	9%	1	0	0%
Beach 14	19	2	12%	25%	1	1	5%
Beach 15	22	1	8%	17%	1	0	0%
Beach 16	45	2	5%	17%	1	1	2%
Beach 17	79	0	0%	0%	0	0	0%
Beach 18	77	0	0%	0%	0	0	0%
Beach 19	74	3	4%	50%	3	0	0%
Beach 20	79	1	1%	8%	1	0	0%
Beach 21	74	1	1%	9%	1	0	0%
Beach 22	80	1	1%	8%	1	0	0%
Beach 23	3	0	0%	0%	0	0	0%
Beach 24	1	0	0%	0%	0	0	0%
Beach 25	1	0	0%	0%	0	0	0%
Beach 26	1	0	0%	0%	0	0	0%
Beach 27	1	0	0%	0%	0	0	0%
Beach 28	1	0	0%	0%	0	0	0%
	Total Sampling events: 1207	Total Number of Events Exceeding PWQO: 25			Total Exceedances Coinciding with Rainfall Events (>2mm): 21	# Exceedances per Year <u>not</u> Associated with Rainfall Events: 4	

Table 2. Summary of sampling activities at Glengarry Park Beach by year, including total number of sampling events, total exceeding events, percentage of exceedances, total exceeding events coinciding with rainfall, and the total number of exceeding events not explained by rainfall (outliers).

Year	# of Sampling Events	# of Events Exceeding PWQO	% of Events Exceeding PWQO	# Exceedances Coinciding with Rainfall Events (>2mm)	# Exceedances per Year <u>not</u> Associated with Rainfall Events	% Exceedances per Year <u>not</u> Associated with Rainfall
2012	35	4	11%	3	1	3%
2013	29	4	7%	3	1	3%
2014	50	15	30%	11	4	8%
2015	31	2	6%	2	0	0%
2016	25	1	4%	1	0	0%
2017	24	5	21%	4	1	4%
2018	30	0	0	0	0	0%
2019	16	2	12.5%	2	0	0%
2020	2	0	0	0	0	0%
Years: 2012-2022	Total Sampling Events: 242	Total Number of Events Exceeding PWQO: 33		Total Exceedances Coinciding with Rainfall Events (>2mm): 26	Total number of Exceedances per Year <u>not</u> Associated with Rainfall Events: 7	

Table 3. Summary of sampling activities at Charlottenburgh Park Beach by year, including total number of sampling events, total exceeding events, percentage of exceedances, total exceeding events coinciding with rainfall, and the total number of exceeding events not explained by rainfall (outliers).

Year	# Sampling Events	# Events Exceeding PWQO	% of Events Exceeding PWQO	# Exceedances Coinciding with Rainfall Events (>2mm)	# Exceedances per Year <u>not</u> Associated with Rainfall Events	% Exceedances per Year <u>not</u> Associated with Rainfall
2012	15	0	0	0	0	0%
2013	52	1	2%	1	0	0%
2014	15	0	0	0	0	0%
2015	4	0	0	0	0	0%
2016	4	0	0	0	0	0%
2017	3	0	0	0	0	0%
2018	5	0	0	0	0	0%
2019	6	1	16.7%	0	1	16.7%
2020	10	0	0	0	0	0%
	Total Sampling Events: 114	Total Exceeding: 2		Total Exceedances Coinciding with Rainfall Events (>2mm): 1	Total number of Exceedances per Year <u>not</u> Associated with Rainfall Events: 1	

APPENDIX B: Figures

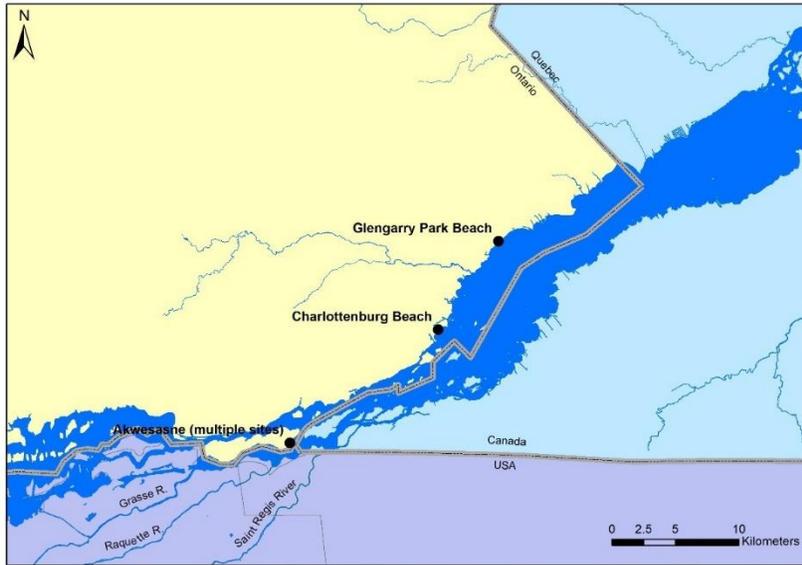


Figure 1. Map showing the locations of Charlottenburg and Glengarry Park Beaches and Akwesasne.

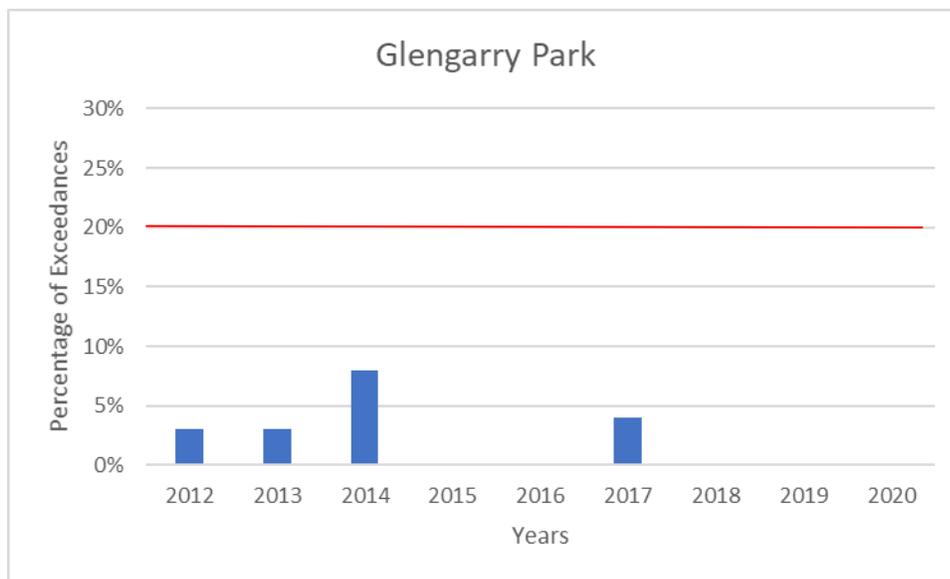


Figure 2. Shows the percent of sampling events that exceeded the PWQO at Glengarry Park beach for the 2012-2020 swimming seasons not associated with rainfall events, compared to the 20% delisting criterion.

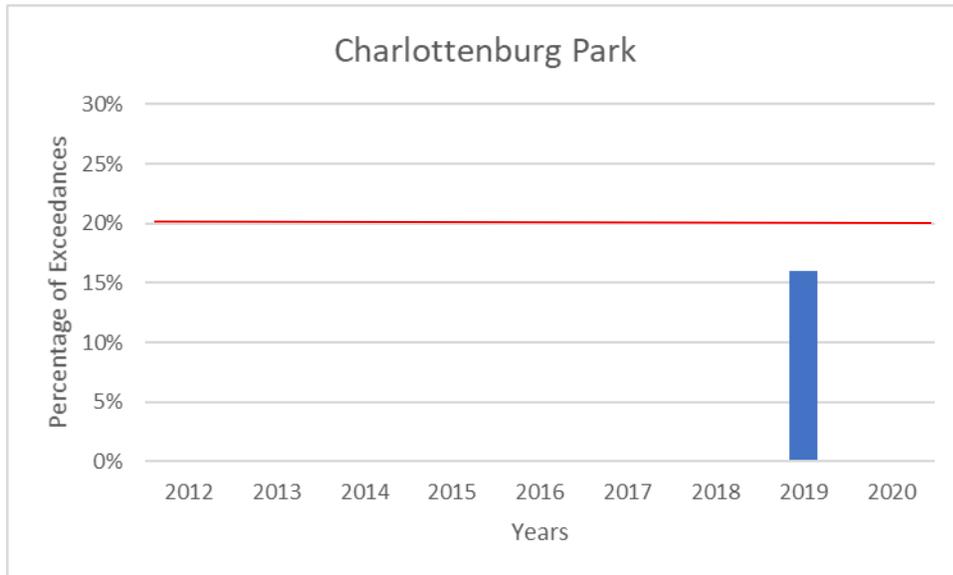


Figure 3. Shows the percent of sampling events that exceeded the PWQO at Charlottenburgh Park beach for the 2012-2020 swimming seasons not associated with rainfall events, compared to the 20% delisting criterion.