Beneficial Use Impairment #10 Assessment Report

Beach Closings

January 22, 2018

VERSION 12

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Acknowledgements

The content of this beneficial use impairment assessment report has been reviewed and approved by the Bay of Quinte Remedial Action Plan Biomonitoring and Water Quality Technical Work Group, Delisting Steering Committee and Restoration Council. The following provides an amalgamated list of everyone who was involved in the discussion and review process:

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The County of Prince Edward
Town of Deseronto
Town of Greater Napanee

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Note: In 1986, the federal/provincial Bay of Quinte Remedial Action Plan (RAP) Coordinating Committee was established to oversee the development of a Bay of Quinte RAP. The Coordinating Committee was charged with developing the RAP through parallel processes of technical evaluation and public participation. A Public Advisory Committee (PAC) was established in 1988 to oversee the Bay of Quinte RAP public participation component. Both committees were dissolved in 1996 and in 1997 the Bay of Quinte RAP Restoration Council was formed to oversee implementation of the RAP.

Executive Summary

The Bay of Quinte Area of Concern 'Beach Closings' beneficial use impairment (BUI) was identified as impaired in 1990 in part because beaches and swimming areas were closed periodically during the swimming season due to fecal coliform counts exceeding 100 **fecal coliforms** per 100mL of water. In 1993, the Bay of Quinte Remedial Action Plan Stage 2 Report supported this impaired status and recommended that the delisting criteria focus on the maximum allowable concentration of 100 **Escherichia coli** (*E. coli)* per 100 ml of water, which is Ontario's maximum allowable concentration for recreational water use.

The delisting target for this BUI is:

> *Demonstrate improved bacteriological water quality conditions for the public beaches at Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial Park (Northport).*

Two criteria have been used to assess achievement of the target for the status of the 'Beach Closings' BUI:

> Criterion 1: Beach postings days should not exceed 20% of the annual swimming season (Victoria Day to Labour Day) due to exceedences of the Provincial Water Quality Objective for *E. coli* (100 *E. coli* per 100 ml of water).
>
> Criterion 2: The main sources of fecal contamination have been identified and no significant source of human fecal contamination is contributing to any identified fecal contamination at the specified beaches.

Four public beaches on or associated with the Bay of Quinte have been monitored for the purpose of this BUI: Frankford (on the Trent River); Kingsford Mill (on the Salmon River); Centennial Park (at Deseronto) and Centennial Park (at Northport) (see Map 1).

Numerous programs were put in place to reduce bacterial inputs prior to and following the preparation of the Remedial Action Plan. Upgrades to municipal sewage treatment facilities and private septic systems, improvements to stormwater management systems and programs to adopt 'best management practices' in the agricultural community have all contributed to reduced nutrient and bacterial inputs and improved water quality over the past 30 years. In addition, there have been specific water quality management actions undertaken at the beaches themselves, including regular *E. coli* monitoring by Hastings Prince Edward Public Health, signage and by-laws to restrict dogs from beaches, use of goose repellants and shoreline naturalization.

This assessment of the status of the BUI by technical experts of the Bay of Quinte RAP Biomonitoring and Water Quality Technical Work Group concludes that the delisting target and criteria related to the 'Beach Closings' BUI have been met for the following reasons:

- Improved bacteriological water quality has been recorded at the four public beaches: Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial (Northport).
- For the five years, 2011 to 2015, there were no years when beach postings exceeded 20% of the swimming season. Therefore, the delisting criterion #1 has been met.
- Microbial source tracking DNA analysis of the waters of the four beaches in 2011, 2012 and 2013 did not detect the presence of indicator bacteria associated with the human gut. Therefore, the delisting criterion #2 has been met.

Based on these findings, this beneficial use should be considered to be restored and the status of this beneficial use should be changed from ‘impaired’ to ‘not impaired’ for the Bay of Quinte Area of Concern.

1.0 Introduction

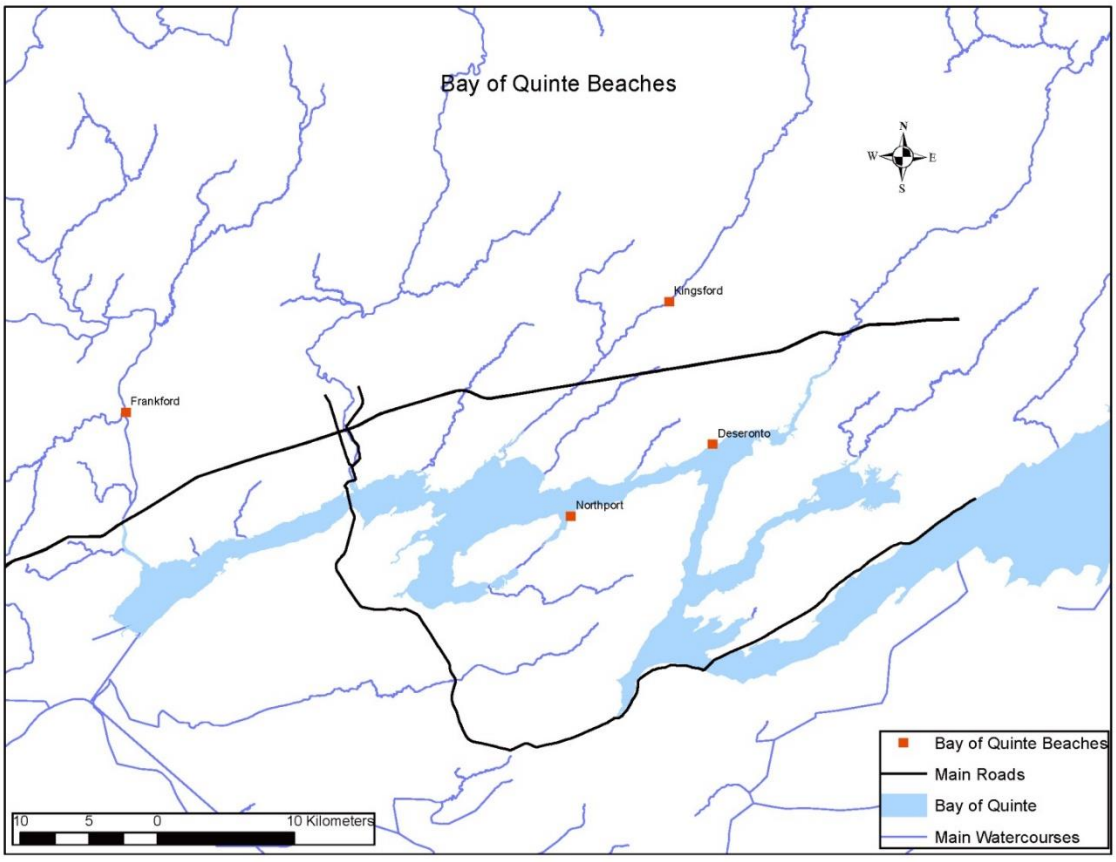
The Bay of Quinte Area of Concern 'Beach Closings' beneficial use impairment (BUI) was identified in the 1990 Bay of Quinte Remedial Action Plan (RAP) Stage 1 Report (prepared by the Bay of Quinte Remedial Action Plan Coordinating Committee). This status was supported by additional scientific evidence presented in the subsequent Stage 2 Report (BQ RAP Coordinating Committee 1993).

Four public beaches on or associated with the Bay of Quinte have been monitored for the purpose of this BUI: Frankford (on the Trent River); Kingsford Mill (on the Salmon River); Centennial Park (at Deseronto) and Centennial Park (at Northport, on the north side of Prince Edward County). Map 1 shows the locations of each of the four beaches.

This report summarizes the work that has been done to assess conditions and determine whether a 'not impaired' status can be applied to the water quality at beaches of the Bay of Quinte. This consists of work undertaken by scientists and RAP partners who have been members of the Bay of Quinte RAP Biomonitoring and Water Quality Technical Work Group. The goal of this group was to:

- establish the targets and criteria needed to measure the status of the BUI; and,
- conduct and document the monitoring and research needed to assess whether those targets and criteria have been met.

The report also notes the management actions that have been taken to address the impaired status of beaches.



Map 1 - Bay of Quinte beaches monitored through the Remedial Action Plan program

2.0 Targets and Criteria for Redesignating the Beneficial Use Impairment 'Beach Closings'

Over the last 20 years, the delisting targets and criteria have gone through several iterations as scientists gained a better understanding of the Bay of Quinte bacteriological sources and management options. Table 2.1 identifies the current delisting target, criteria and status. Appendix D to this report includes the changes to the BUI restoration targets and criteria over time. This section summarizes the changes and rationale for those changes.

Table 2.1 – Current Targets and Status

DELISTING TARGET	CRITERIA	STATUS
1.Improved Bacteriological Water Quality Demonstrate improved bacteriological water quality conditions for the public beaches at Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial (Northport).	**1. *E. coli* Exceedences** At Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial (Northport) beach postings days should not exceed 20% of the annual swimming season (Victoria Day to Labour Day) due to exceedences of the Provincial Water Quality Objective for *E. coli* (100 *E. coli* per 100 ml of water).	**ACHIEVED**
	2. Sources of Fecal Contamination At Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial (Northport) beaches the main sources of fecal contamination have been identified and no significant source of human fecal contaminates is contributing to any identified fecal contamination at the specified beaches.	**ACHIEVED**

2.1 Rationale for Revisions to Targets and Criteria 1993-2014

In 1993, the Bay of Quinte Remedial Action Plan Stage 2 Report included, as a goal for bacterial contamination, the following:

> *"The Bay of Quinte RAP Coordinating and Public Advisory Committees believe a goal of zero beach closures and an objective to restore water quality throughout the bay to bathing beach criteria are desirable and achievable."* (BQ Remedial Action Plan Stage 2 Report, page 87)

As new science emerged, it was determined that the original targets needed to be revised because a goal of zero beach closures was not realistic or achievable due to a variety of issues including natural *E. coli* contamination from wildlife feces. In addition, it was recognized that periodic postings can occur at most Lake Ontario beaches from wave suspension of *E.coli* from beach sands.

The first major changes took place in 2005 and were officially ratified and approved by the Restoration Council in 2007. The rationale for the amendments included:

> **Zero Exceedences:** With increased knowledge about *E. coli* and its ecology, it was considered to be impractical to have zero beach postings through the swimming season.

Time Trends: The revised targets included a base year period (1989-1994) against which improvements to the beach postings could be measured.

Specific Beaches: Instead of a generalized water quality target aimed across the entire area of concern, specific public beach areas were identified under the targets and criteria. In 2005 seven beaches were identified. In 2007, three of the beaches were removed from the criteria due to permanent closures of the beaches or being located geographically outside of the scope of the Remedial Action Plan. This left the four beaches that are part of the current target: Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial Park (Northport).

Blue Flag Swimming Season Targets: The 2007 addition of the delisting criterion referring to beach postings not exceeding 20% of the annual swimming season was based on the standards for the internationally-recognized Blue Flag program, which is being implemented at many beaches around the Great Lakes. The Bay of Quinte beaches should be meeting Ontario's standards for recreational water quality (the most stringent in North America) at least 80% of the swimming season in order to be considered to be 'not impaired'.

Additionally, the phrase 'beach closing' was changed to 'beach posting' when discussing the status of the beaches, at the request of Hastings Prince Edward Public Health. Although a beach is seldom actually closed, 'posting' a beach is a means to communicate advisories and/or place signs in response to a swimming advisory or beach closure (Ontario Ministry of Health and Long-Term Care 2014). Thus, the beach is typically open but swimming is advised against. This revised phrasing was deemed to be more consistent with current beach management practices when discussing the status of the beaches, although the title of this BUI remained 'Beach Closings' as per the Great Lakes Water Quality Agreement.

The Provincial Water Quality Objective for beaches of 100 *E. coli*/100 ml is based upon a geometric mean of levels of *E. coli* determined from a minimum of 5 samples per site taken within a given swimming area. It is recommended that the assessment be made on a minimum of a weekly sampling program during the swimming season.

The samples are to be collected in accordance with the sampling methods described in Ontario Ministry of Health and Long-Term Care Safe Water Program's 'Beach Management Guidance Document, 2014'. The guidance document states that where the depth of water is 1 to 1.5 meters, samples for bacteriological analysis must be obtained 15 to 30 centimeters below the water surface. When the depth of water is less than 1 meter, samples should be obtained as far off shore as possible within the bathing area.

Beaches in Ontario are posted when the geometric mean of 5 samples collected on one day exceeds 100 *E. coli* / 100 ml of water.

In 2007, the importance of distinguishing the sources of fecal contamination was recognized and where any human sewage fecal contamination sources had been identified, the sources should be investigated and control plans pursued. As a result of this, a 3 year study of open waters of the Bay of Quinte was conducted in order to acquire a baseline profile of *E. coli* concentrations during the secondary body contact recreational season. The results of this study were used to assess criterion 2 and are discussed in section 6.2.

In 2012 further refinements of the targets and criteria were proposed, with two additional changes to the 2007 targets and criteria. The rationale for the changes included:

> **Fecal Sources:** Recognizing the importance of the source of fecal contamination and based on the results of studies done since 2007, a specific criterion was established that would require identifying the origins (human or animal) of the *E.coli* found in the beach samples. Contamination of beaches from human sewage is generally regarded to present more health concerns than contamination from wildlife fecal sources.
>
> **Microcystin Target**: A specific target was established for a safe level of microcystins at the four beaches due to a concern about the potential health effects for beach users.

In 2014, the Bay of Quinte Restoration Council approved the 2012 target for improved water quality and the two associated criteria. However, the Council decided that the microcystin target did not need to be met in order to restore the BUI because microcystins were not within the original scope of the problem definition or identified in the remedial actions recommended for the BUI in the Stage 2 RAP; thus the microcystin target was removed as a delisting target for this BUI. To ensure that the issue with microcystins continued to be examined at public beaches, the Restoration Council identified the 2012 microcystin target as a 'Community Objective' and developed a five-year monitoring program to track microcystin presence and levels at the four beaches. See section 2.2 for further information on the microcystin community objective.

2.2 Microcystin Community Objective

In recent years, the issue of cyanobacterial blooms and the potential of the presence of microcystins have been of increased concern to public health agencies. The Restoration Council concurred that cyanobacterial toxins are an important emerging issue in the Bay of Quinte and considered the need for an additional BUI delisting target related to microcystins; however, it was decided that this was not an issue that was to be specifically addressed through the Remedial Action Plan process, as the RAP process was established to address historical issues in the bay as documented in the Stage 1 and Stage 2 reports. Therefore, no formal targets or criteria relating to microcystins are a part of the requirement for restoring the Beach Closings BUI. However, a 'community objective' for microcystins has been established to address the health concerns relating to microcystins at the beaches of the Bay of Quinte. Under this 'community objective', a five-year beach monitoring program for microcystins will be undertaken from 2017-2021 at the four Bay of Quinte beaches that are the focus of this report.

There is no standard in Ontario's Water Quality Guidelines for microcystin levels in recreational waters. The Health Canada Guideline (Provisional) for recreational waters is set at 20 µg/L expressed as MC-LR (Health Canada 2012).

The community objective agreed to by the Restoration Council for the Bay of Quinte beaches, applies Health Canada's recreational water guideline:

> *At Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial (Northport) beaches record no more than one exceedence per year, for a consecutive five-year period of a safe level of microcystins as established under Health Canada's [provisional] recreational water guidelines for microcystins (20 ug/L).*

3.0 Historical Bacterial Sources

Bacterial contamination historically occurred at municipalities throughout the Great Lakes where sewer systems conveyed sanitary wastes to the most convenient surface water source without any form of treatment. This included the Bay of Quinte municipalities. The first sewage treatment plants built in the bay were at Prince Edward Heights in 1945 and at Picton in 1948. During the 1950s, plants were built at Trenton, CFB Trenton and Napanee. The Belleville plant was constructed in 1962 and the Deseronto plant commenced operation in 1973. All plants have since been significantly upgraded to provide more efficient treatment and expanded to handle most of the wet weather flow.

In 1970, bacteria were found at 28 sampling sites within the Bay of Quinte. The highest levels of bacteria were found at the urbanized areas, particularly at Picton and Deseronto. Counts throughout the bay were sufficiently high to caution against swimming and bathing and consuming bay water without adequate treatment.

The main causes of bacteria at beaches were identified as:

Bypassing of Sewage: The release (bypassing) of untreated sewage was occurring from the sewage treatment plants at CFB Trenton, Belleville, Deseronto, Napanee and Picton. Bypassing can occur due to rain events or snow melt causing an over-capacity at the treatment plan, equipment failures, maintenance problems, power outages.

Stormwater Runoff: Typically, urban stormwater contains bacteria from the feces of domestic animals and wildlife. None of the Quinte area municipalities were treating stormwater. Rainwater falling on the beach areas where dogs or waterfowl roam can also wash bacteria-containing feces directly into the waters of those beaches. Additionally, there were a few locations where storm sewers were still combined with sanitary sewers which caused bacterial loads to the rivers and the bay when wet weather flows exceed the sewage treatment plant capacity.

Livestock: Bacterial contamination can be carried in runoff from farmyards (including manure handling facilities) and fields spread with manure. Where cattle are permitted to water in streams, bacteria will enter the streams. Disposal of waste water from milk houses can also contribute to bacterial contamination.

Private Sewage Systems: Faulty septic systems or holding tanks can release bacterial contamination into water courses, or directly to the bay.

Wildlife feces: Goose and gull feces were a major source of bacteria at many of the beaches.

At that time, there were no estimates of loadings from sources to prioritize remedial actions.

Studies In 1981 and 1982 identified:

- zones with greater than 100 fecal coliform/100 mL of water extended up to 2 km out from the mouth of the Trent River into the Bay of Quinte, under dry and wet weather conditions. It was determined that the plumes were not caused by discharges from the local municipal sewage treatment plant; instead the sources were identified as originating from discharges related to operations at Domtar Packaging's pulp and paper mill at Trenton, Ontario (Domtar subsequently partnered with Cascades in 1997 and the plant was re-named Cascades Containerboard Packaging – Trenton).
- at the Belleville waterfront, a zone with fecal coliform counts over 1000 fecal coliform/100 mL of water extended eastwards 3 km along the waterfront following a 15 mm rainfall. Data

suggested that the source was raw sewage being by-passed to the Bay of Quinte at the Belleville municipal sewage treatment plant.

In 1984, the sewage treatment plant at Belleville was expanded to provide improved treatment. Subsequent bacteriological surveys revealed that the wet weather plume of fecal coliform bacteria was similar to the plume observed in the 1981 survey, with the Moira River being the primary source. Under dry weather conditions, most of the Moira River within the limits of the City of Belleville contained high fecal coliform counts, averaging between 100 – 1,000 fecal coliforms per 100 ml of water. Storm sewers discharging into the river were identified as likely sources of this contamination.

A study in 1987 identified the bacterial zone exceeding the Provincial Water Quality Objective extended about 1 km into the bay from the Trent River. The Domtar plant and the Trenton municipal sewage treatment plant were identified as the sources of E. *coli* bacteria. As well, the bacterial levels found in the Trent River, under both dry or wet weather conditions suggest possible illegal cross-connections or inflow/infiltration of sanitary sewage into storm sewers in downtown Trenton.

Based on bacteriological studies at Trenton and Belleville during wet and dry weather conditions, there appeared to be dry weather inputs of human wastes. This suggested the possibility of some household being improperly connected to the storm sewer systems as opposed to the sanitary sewer system.

Continued improvement to treatment facilities that discharge directly into the bay, along with other upstream measures during the latter half of the 20th century, led to a significant reduction of the level of bacteriological contamination in the bay. However, despite this improvement, bacteriological pollution and beach postings continued to be an issue through the 1980s and 1990s.

4.0 Historical Beach Assessments

In describing the beneficial use impairment, the Stage 1 Report states:

> "Beaches throughout the Bay of Quinte periodically are closed because fecal coliform counts exceed 100 in 100 mL of water (the body contact recreation guideline). Recreational opportunities are lost, health risks are increased and tourism revenue is forfeited. Some sources have been identified (e.g., combined sewers, poor livestock practices, inflow and infiltration), and some general corrective actions have been recommended, but more work is needed to define the relative contribution of each source and the exact corrective work." (p. 12)

The 'causes' identified in the previous section (3.2) were contributing to bacterial contamination of beaches around the bay. The Stage II report in 1993 referenced work done through the Tri-Authority Rural Beaches Program Study which clearly identified that most of the beaches in the watershed were experiencing fecal bacterial contamination. The report specifically identified those public swimming areas that had been sampled for *E. coli* from 1989 to 1991: Trent River below Frankford; Moira River at Riverside Park; Salmon River at Kingsford and Forest Mills; North Park beach at Northport; and the Napanee River at Newburgh. In the years 1989, 1990 and 1991, the *E. coli* levels at these beaches exceeded the Provincial Water Quality Objectives (PWQO) and the beaches were posted on average 33-33.5% of the time (Table 4.1, reproduced from Table 16, Stage 2 Report 1993).

Table 4.1 – Number of Days Five Rural Beaches in the Bay of Quinte Watershed Were Posted 1989-1991

Beach	Days Posted					
	1989		1990		1991	
	# days	%	#days	%	#days	%
Frankford Beach (Trent River)	32	**28%**	33	**28%**	28	**23.7%**
Forest Mills (Salmon River)	-	-	11	9.3%	0	0%
Kingsford Beach (Salmon River)	15	12.7%	49	**41.5%**	22	**18.6%**
Newburgh Beach (Napanee River)	-	-	47	39.8%	67	56.8%
East and West Riverside Beach (Moira River)	71	60.2%	67	56.8%	95	80.5%
Total Days Posted	**118**		**207**		**210**	
Total Recreational Days May 24-Sept. 1	118		118		118	
Total Recreational Days X # Beaches Sampled	354		590		590	
% of Time Posted (All Beaches)		33%		35.5%		35.5%

Source: Brunatti, R. 1992. Tri-Authority Rural Beaches Program Study – Year One Summary Report

5.0 Actions Undertaken to Address the Beneficial Use Impairment

Programs to reduce bacterial inputs were put in place prior to and following the preparation of the Remedial Action Plan. Upgrades to municipal and industrial sewage treatment facilities, improvements to stormwater management systems and private septic systems, and programs to establish 'best management practices' in the agricultural community have all contributed to reducing inputs over the past 30 years. In addition, there have been specific management actions at the beaches themselves, including regular *E. coli* monitoring by Hastings Prince Edward Public Health, signage and by-laws to restrict dogs on some of the beaches, limited use of goose repellants, and shoreline naturalization at Centennial Beach (at Deseronto).

5.1 Sewage Effluent and Combined Sewers

There are currently seven (7) municipal sewage treatment plants (Quinte West, CFB Trenton, Belleville, Deseronto, Napanee, Picton and Stonecrest) that discharge directly to the Bay of Quinte. (Note: On January 1, 1998, Trenton was amalgamated with the Village of Frankford and the Townships of Murray and Sidney to form Quinte West). These plants all provide a minimum of secondary treatment (several have tertiary treatment) with mandatory disinfection requirements and criteria that impose strict maximum concentrations for *E. coli* in final effluent. Effluent monitoring data for the plants for recent years indicate that all plants consistently meet the *E. coli* effluent objectives during normal operations.

Belleville and CFB Trenton have combined sewer systems that collect both stormwater and sanitary sewage into one collection pipe. During heavy rain events, combined storm and sewer systems can be a major source of bacteria to the bay. Under normal conditions, it transports all of the wastewater to a sewage treatment plant for treatment prior to discharging to a water body. However, when the volume of wastewater exceeds the capacity of the treatment plant (e.g., during heavy rainfall events or snowmelt), untreated or partially treated stormwater and wastewater is discharged directly into streams, rivers and other receiving water bodies.

In recent years, the City of Belleville has undertaken a number of studies and projects to assist in dealing with the effects of extreme precipitation events on the City's combined sewers. Since the introduction of the federal wastewater regulation reporting in 2013, no overflows have been reported from Belleville CSOs. Belleville recently (2017) initiated a Class Environmental Assessment Study to develop a Wet Weather and Wastewater Servicing Master Plan for the wastewater conveyance and treatment system in accordance with the Municipal Engineers Association (MEA) Class EA master planning process. The end result will be upgrades to Belleville's wet weather flow management, wastewater servicing and treatment, and major collection system conveyance systems. Sewer separation projects are also being undertaken throughout the City, to reduce the possibility of overflows.

Upgrades completed in 2015 at Deseronto have increased the peak capacity to handle extreme wet weather events with the goal of complete elimination of bypassing.

Napanee has completed an environmental assessment to evaluate treatment capacity needs and is developing designs for the future upgrade and expansion of their Wastewater Pollution Control Plant.

The City of Quinte West has been implementing facility and infrastructure upgrades that have been identified in the Long term Capital investment Plan for many years now. Many of these upgrades include new sanitary and storm sewer replacements as part of the urban road reconstruction programs. In addition, the city has refurbished all of the main sewage pumping stations in the last several years and is currently in the process of completing a 25 million dollar upgrade at the Trenton WWTP that includes a new UV disinfection system.

CFB Trenton updated their sewage treatment system in 2006 by building a combined sewer overflow tank which collects the excess unprocessed sewage discharge during combined sewer overflow events. The tank retains the waste until the water levels in the system go down, then releases the water into the sewage treatment facility for full treatment prior to being discharged into the Bay of Quinte.

Process wastewater from Cascades Containerboard Packaging – Trenton (the former Domtar plant) is not discharged into the Trent River from the site, but is utilized by a closed-loop system within the mill. The mill's combined effluent that discharges to the Trent River consists of boiler blowdown water, non-contact cooling water and strainer backwash. Sanitary wastewater (e.g., plant washrooms) from facility operations is discharged to the municipal waste water sewer system. As such, this facility is not considered to be a significant source of bacteriological contamination loading to the Bay of Quinte, and the effluent is not subject to monitoring requirements for bacteriological parameters.

5.2 Stormwater Management

Improving the overall management of stormwater has been considered a priority for the bay for some time. To address this priority, a number of planning and management actions have taken place: the development of Bay of Quinte-focused Stormwater Management Guidelines; Pollution Prevention and Control Plans for urban areas surrounding the Bay of Quinte; four Master Drainage Plans; and the implementation of stormwater management retrofit projects.

Stormwater Management Guidelines

The 1993 Bay of Quinte Remedial Action Plan Stormwater Management Guidelines (updated in 2006) were developed to provide guidance to municipalities around the bay on minimum requirements for planning, design and approvals of stormwater management systems in new urban development areas within the Area of Concern. The guidelines also provide guidance with respect to design and approvals of retrofit stormwater treatment facilities within existing built-up areas. This document provides a consistent and comprehensive approach to stormwater management around the bay. The most important component of the guidelines, in the context of the Beach Closings BUI, is that the guidelines recommend that stormwater discharges must meet the bathing beach criterion of 100 E. *coli* per 100 ml. The current version of the guidelines was updated to align with the Ministry of Environment and Climate Change's Stormwater Management Planning and Design Manual (2003) which recommends Level 1 (Enhanced) stormwater treatment which targets 80% removal of suspended solids. These guidelines have been accepted by the MOECC and municipalities located around the bay and are being uniformly applied.

Pollution Prevention and Control Plans

Pollution Prevention and Control Plans (PPCPs) have been completed through Bay of Quinte RAP efforts for the existing urban areas of Belleville, Trenton, Picton, Deseronto and Napanee. The scope of the PPCPs is to identify opportunities to reduce quantity and pollutant loadings to the bay

emanating from the urban areas due to stormwater runoff. The PPCPs provide an analysis of dry-weather and wet-weather discharges in these urban areas, reviews current stormwater management plans and identifies opportunities for action that would reduce the loading of pollutants into the Bay of Quinte. Implementation of the PPCPs is long-term, based on need and the resources available.

Master Drainage Plans

Master Drainage Plans for Potter Creek, Hospital Creek, Mayhew Creek, Selby Creek and Norbelle Creek were developed through Bay of Quinte RAP efforts to provide a more regional drainage management design that would see stormwater management facilities located strategically to reduce the numbers of facilities and costs of maintenance. The Master Drainage Plan forms a supporting document for a Secondary Plan and guides future development so as to minimize the impact of stormwater on the bay.

Retrofit Stormwater Management Implementation

To deal with retrofitting stormwater facilities, project management services have been provided through the Bay of Quinte RAP to the City of Belleville, Quinte West, Deseronto and Prince Edward County for the design, approvals and construction of remedial stormwater management facilities in existing, built-up urban areas as identified in the Pollution Prevention and Control Plans. Four projects are currently being implemented:

Centennial Park, Deseronto: Centennial Park is close to stormwater outfalls draining the Town of Deseronto and as a result may carry some risk of bacterial contamination. An Environmental Assessment has been completed for stormwater retrofit of these outfalls and construction of one outfall is currently being planned.

Herchimer Avenue, Belleville: Facilities to treat stormwater before being discharged into the Bay of Quinte are scheduled for construction in 2018. This includes new stormwater sewers and water quality treatment technologies.

Delhi Park, Picton: An Environmental Assessment was completed with a focus is to improve water quality using conventional approaches to treat the stormwater - which currently drains untreated, directly into Marsh Creek and ultimately to Picton Bay and the Bay of Quinte. Detailed designs of the retrofit are currently being developed.

Foster Avenue, Belleville: An Environmental Assessment is currently being undertaken to review options for retrofitting this large catchment area to improve water quality draining into the Bay of Quinte.

The City of Quinte West is also pushing new residential developments to include a storm water connection for each home in efforts to reduce the possibility of home owners directing storm water the sanitary sewer system.

5.3 Best Management Practices – Agriculture

Since 1991, funding programs have been in place to assist rural and agricultural landowners in Bay of Quinte watersheds to implement land use Best Management Practices in order to reduce nutrient and bacterial loadings to Bay of Quinte waterways. Examples of the programs include the following:

A Rural Beaches Program began in 1991, initiated by the Napanee, Moira and Lower Trent conservation authorities (the Moira and Napanee conservation authorities were subsequently combined with the Prince Edward Region Conservation Authority in 1995 to form Quinte Conservation

Association). The program was set up to 'eliminate or substantially reduce the number of public beach closures by encouraging improved rural land management practices in order to reduce the impact of upstream pollution sources' on beaches (Ontario Ministry of Environment and Energy 1996). The program included an outreach component to rural property owners and the implementation of specific projects including livestock access restriction to waterways, improving manure storage facilities, improving milk house washwater disposal practices, and undertaking septic system inspections, pump-outs and repairs.

In the 'Land Stewardship II' program of the Ontario Ministry of Agriculture and Food, ten landowners completed projects on Cold Creek, which is a tributary of the Trent River. They applied best management practices for manure management and cattle access control. There were also 18 landowners who completed 30 additional projects in the Napanee and Wilton Creek watersheds.

Since 2011 the Bay of Quinte Remedial Action Plan has offered a Habitat Enhancement Program through which landowners complete projects such as shoreline naturalization and plantings, installing fencing to restrict livestock access to waterways and establishing alternative water sources for livestock (e.g. windmill pumps).

In 2015 a Healthy Soils Check Up program was piloted in the South Sidney subwatershed. This program provided agricultural landowners with free soil testing, mapping showing erosion prone areas and technical support/advice on best management practices for fertilizer application and reducing sediment runoff from agricultural lands. In 2016 this program was expanded to the entire Bay of Quinte watershed below Highway 7 and targeted landowners in the South Sidney, lower Napanee and Hay Bay areas which are areas that contribute high loadings of phosphorus to the bay. An incentive to establish cover crops was also implemented through this program.

5.4 Private Septic Systems

There are currently approximately 2,000 private septic systems located on the Bay of Quinte. Poorly maintained or failing septic systems can contribute to the bacterial loading to the bay. To address this potential source of bacteria, several key initiatives have been undertaken.

The Deseronto Sewage Treatment Plant recently expanded due to a partnership between the federal and provincial governments, the Town of Deseronto and the Mohawks of the Bay of Quinte. This expansion will allow for the development of 400+ new homes that will be serviced by municipal sewers rather than septic systems.

In 2013, a septic stewardship program was initiated by the Bay of Quinte RAP Office for landowners on the Bay of Quinte and in lower portions of the bay's tributaries. This program offers landowners a free educational site visit, septic system pump out and inspection. Between 2013 and 2016, 154 landowners participated in the program.

5.5 Management Actions at Beaches

In 2010, BQRAP staff prepared a report recording the wildlife management regime at each of the four beaches. At Frankford, maintenance included use of a goose repellant, with some success. There were no specific actions identified for the other beaches, however it was noted that for each of the beach locations, the municipality had a by-law requiring dog owners to pick up their pet feces.

Centennial Park Beach at Deseronto was identified as an ideal demonstration site for shoreline naturalization. Conditions prior to 2011 included mowed grass to the water's edge, a deteriorating gabion basket shoreline and two culverts draining into the bay. A naturalization project was completed by the town and the BQ RAP staff to reduce surface runoff and, with it, the amount of bacterial contamination entering the water. The project included the removal of the gabion baskets, native plantings, a walking path designed to link to the Waterfront Trail, signage and various shoreline naturalization techniques that would allow waterfront access.

Hastings Prince Edward Public Health undertakes a beach monitoring program each summer, which includes routine beach surveillance and water quality sampling on a weekly or bi-weekly basis. This takes place at the four beaches: Frankford (weekly), Kingsford Mill (bi-weekly), Centennial Park (Deseronto) (weekly), and Centennial Park (Northport) (bi-weekly). Water quality results are posted on their website and if a beach exceeds the PWQO of 100 *E. coli* per 100ml, signs are displayed to 'post' the beach.

In addition, permanent signs are already posted at Frankford, Kingsford Mill and Centennial Park (Deseronto) that say: "This beach may have high levels of bacteria for up to 48 hours after heavy rainfall and/or strong winds which may pose a risk to the health of swimmers. Avoid swimming during these periods."

6.0 Assessment of Beneficial Use Impairment: Results and Conclusions

To assess the current condition of the beneficial use impairment 'Beach Closings' and to determine whether the beneficial use restoration targets and criteria has been met, members of the Biomonitoring and Water Quality Technical Work Group conducted monitoring and research studies. In addition, a 5-year monitoring plan (2017-2021) has been developed to monitor the levels of microcystins at the four beaches to ensure that the community objective described in section 2.2 for microcystins is met (see details in section 6.3).

6.1 Assessment of Criterion 1: *E. coli* Exceedences

> Criterion 1: At Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial (Northport) beach postings days should not exceed 20% of the annual swimming season (Victoria Day to Labour Day) due to exceedences of the Provincial Water Quality Objective for E. coli (100 E. coli per 100 ml of water).

The four beaches are continually sampled and tested for *E. coli* by the Hastings Prince Edward Public Health either weekly or bi-weekly over the annual swimming season (Victoria Day to Labour Day). Of the four beaches, only Frankford and Kingsford Mill beaches have continuous annual data from 1989-1991 (Table 4.1). The bacteriological water quality at the four beaches has improved from the general conditions recorded in 1989-1991. During that time period, Frankford beach postings consistently exceeded the target; Kingsford met the target in 1989, but exceeded the target in 1990 and 1991.

The frequency of beach postings over the period 2009-2015 (Table 6.1) show a marked improvement from the postings recorded in 1989 -1991 (see Table 4.1). Over the years 2009 to 2015 there was only one instance when the number of postings exceeded 20% of the number of days sampled. This

took place at Kingsford Mill, in 2010; for the five most recent years, 2011 to 2015, there were no years when postings exceeded 20% of the swimming season at Kingsford.

Thus Criterion #1 has been met for the period 2011 to 2015.

Table 6.1 – Beach Closings 2009-2015

YEAR	Frankford			Kingsford Mill			Centennial (Deseronto)			Centennial (Northport)		
	# WEEKS SAMPLED	POSTINGS		# WEEKS SAMPLED	POSTINGS		# WEEKS SAMPLED	POSTINGS		# WEEKS SAMPLED	POSTINGS	
		#	%		#	%		#	%		#	%
2009	17	3	17.6	3	0	0	17	1	5.9	17	0	0
2010	15	2	13.3	6	3	**50**	16	0	0	9	0	0
2011	16	3	18.7	10	2	20	16	1	6.2	8	0	0
2012	16	1	6.2	7	0	0	15	2	13.3	8	0	0
2013	17	1	5.9	9	0	0	17	2	11.8	9	0	0
2014	15	0	0	8	1	12.5	15	2	13.3	8	0	0
2015	18	2	11.1	9	0	0	16	0	0	8	0	0

Source: Hastings Prince Edward Public Health

6.2 Assessment of Criterion 2: Sources of Fecal Contamination

> Criterion 2: At Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial (Northport) beaches the main sources of fecal contamination have been identified and no significant source of human fecal contaminates is contributing to any identified fecal contamination at the specified beaches.

The second criterion to be tested against in addition to *E. coli* counts required microbial source tracking analyses. DNA was extracted from the water samples that were used to measure *E. coli* levels. The DNA analysis was used to detect the presence of host-specific *Bacteroidales* bacteria, associated with the human gut (Edge et. al., 2010). Bacteria that are sourced to humans generally indicate a much greater risk of disease and therefore a greater concern than elevated *E. coli* counts from a source such as bird fecal droppings. Human-sourced bacteria could come from sewage treatment facilities, combined sewer overflows, illegal sewage cross-connections to stormwater drains, faulty private sub-surface sewage systems, or pleasure boat discharge of black water.

In the 2014 report which summarized microbial source tracking data from 2011, 2012 and 2013, Edge et al. (2014) conclude:

> "Over three sampling years, the human *Bacteroidales* DNA marker has not been detected in about 500 water samples from the four Bay of Quinte beaches."

The microbial source tracking results showed no measurable human sewage contamination. These results indicate that the beaches were not impaired by human sewage contamination. Similarly, Edge et al. (2014) did not detect evidence of sewage contamination from two stormwater pipes discharging near the Deseronto and Frankford beaches.

Thus Criterion #2 has been met.

6.3 Microcystin Community Objective

The established 'community objective' for microcystins at beaches is "*beaches record no more than one exceedence per year, for a consecutive five-year period of a safe level of microcystins".* Health Canada's [provisional] recreational water guideline for microcystins is 20 ug/L.

To assess current conditions, a five-year sampling program will be undertaken from 2017-2021 in partnership by Hastings Prince Edward Public Health and Quinte Conservation Association. Results from this assessment will be reported following completion of the program.

There were also previous monitoring programs for microcystins at beaches, in 2009 and 2015.

In 2009, 3 sets of samples were taken, September to November from the four specified beaches. All samples were lower than Health Canada's provisional guideline of 20 ug/L for microcystins.

In 2015, bi-weekly sampling took place at the four beaches from late May to late August. In none of the samples did total microcystin levels exceed 1.0 ug/L, which is well below the guideline of 20 ug/L established under Health Canada's [provisional] recreational water guidelines for microcystins (email correspondence, July 26, 2016. (A. Zastepa, Environment and Climate Change Canada to K Geater, Environment and Climate Change Canada).

7.0 Post-delisting Monitoring

Continued monitoring of the bacterial conditions at the beaches of the Bay of Quinte is needed to protect the health of those using the water for recreation. Public safety is enhanced with routine monitoring for *E. coli* during the swimming season and posting beaches as necessary. Hastings Prince Edward Public Health will continue annual routine sampling for *E.coli* at the four Bay of Quinte beaches that were specified in the Beach Closings impaired beneficial use delisting criteria. In addition, Quinte Conservation Association is undertaking a 5-year microcystin monitoring program (2017-2021) at the four Bay of Quinte beaches to evaluate the status of the community objective established for microcystins at public beaches.

Table 7.1 - Post-delisting Monitoring Programs

Metric	Monitoring Program	Beneficial Use Criteria #	Responsible Agency and Contact
E. coli	Continue annual sampling for *E. coli* at the four Bay of Quinte area beaches.	1, 2	Hastings Prince Edward Public Health
Microcystin	5-year microcystin monitoring program (2017-2021)	Community objective	Quinte Conservation Association; Hastings Prince Edward Public Health

8.0 Conclusions and Recommendation

The assessment of the status of the beneficial use by technical experts of the Biomonitoring and Water Quality Technical Work Group indicates that the redesignation target and criteria related to the 'Beach Closings' beneficial use impairment have been met. Improved bacteriological water quality has been recorded at the four public beaches, Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial (Northport). For the five years, 2011 to 2015, there were no years when beach postings exceeded 20% of the swimming season, meeting criterion #1. Microbial source tracking DNA analysis of bacteria found in the waters of the four beaches in 2011, 2012 and 2013 did not detect the presence of bacteria associated with the human gut, meeting criterion #2.

The recommendation based on this assessment report is that the 'Beach Closings' impaired beneficial use has been restored and should be redesignated to 'not impaired'.

9.0 References

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APPENDICES

- **A. Acronyms**
- **B. Contributors, Technical Reviewers, Approvals**
- **C. Communications**
- **D. Changes to Delisting Criteria over Time**
- **E. Background Reports**

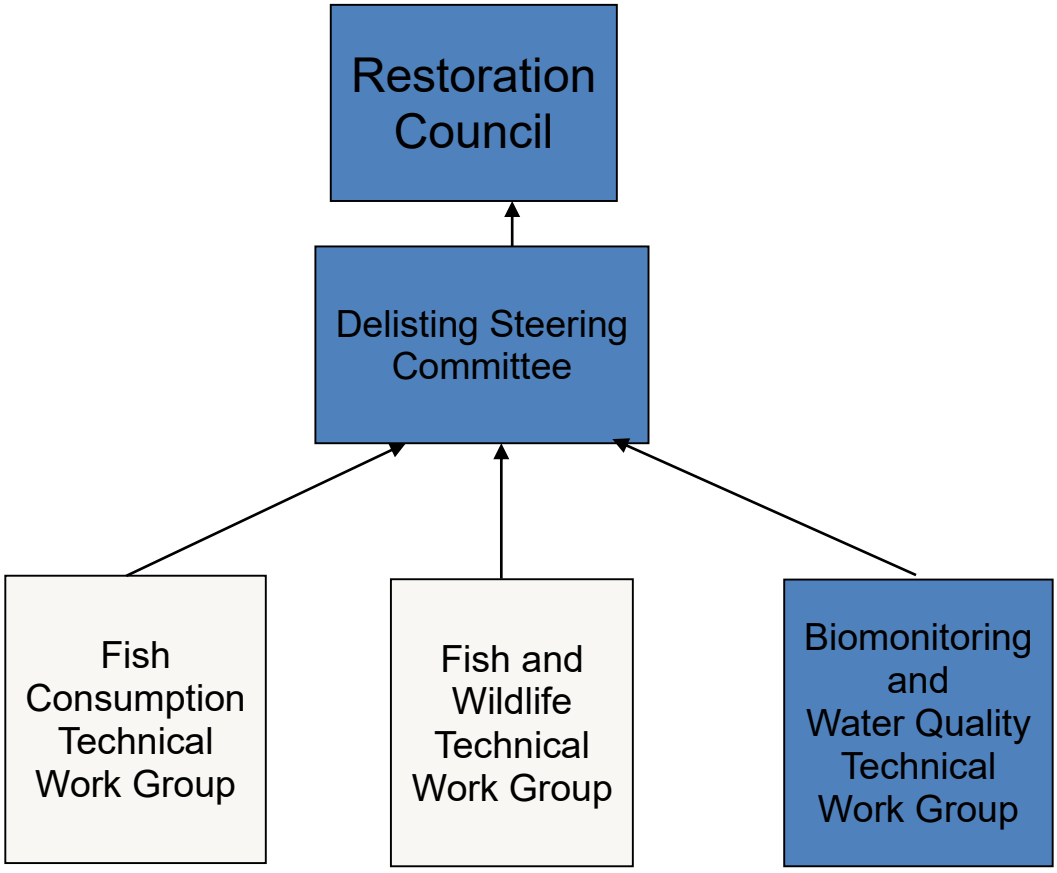
APPENDIX A: Acronyms

AOC	Area of Concern
BQ	Bay of Quinte
BQ RAP	Bay of Quinte Remedial Action Plan
BU	Beneficial Use
BUI	Beneficial Use Impairment
HPEH	Hastings Prince Edward Public Health
PWQO	Provincial Water Quality Objectives

APPENDIX B: Contributors, Technical Reviewers, Approvals

The Bay of Quinte 'Beach Closings' BUI Assessment Report is a synthesis of assessments undertaken by scientists to determine whether the Bay of Quinte is meeting the delisting target and criteria. Each of these scientists belong to the Bay of Quinte Biomonitoring and Water Quality Technical Work Group, who review all data that measure achievement of the target and criteria and then provide their expert recommendations to the Delisting Steering Committee. The Delisting Steering Committee provides an additional layer of accountability, ensuring that the appropriate documentation and data substantiate recommendations to the Bay of Quinte Restoration Council that the delisting target and criteria have been met. The Restoration Council is the body which oversees implementation of the Bay of Quinte Remedial Action Plan, and which ultimately recommends delisting.

Bay of Quinte Remedial Action Plan Governance Structure



Reviewers

The 'Beach Closings' beneficial use impairment assessment report has been reviewed and approved by the Bay of Quinte Remedial Action Plan Biomonitoring and Water Quality Technical Work Group, Delisting Steering Committee and Restoration Council.

Voting Members and Alternates on the Restoration Council

Agency	Member	Alternate
Lower Trent Conservation	Glenda Rodgers, Co-chair RAP Restoration Council CAO and Secretary Treasurer, Lower Trent Conservation	Anne Anderson Special Projects Coordinator Coordinator
Quinte Conservation Association	Terry Murphy, Co-chair RAP Restoration Council, and General Manager, Quinte Conservation	Brad McNevin Watershed Science and Monitoring Manager
Environment Canada	Kristin Geater Remedial Action Plan Program Officer, Great Lakes Areas of Concern Section	Sandra Kok Program Head, Great Lakes Areas of Concern Section
Ontario Ministry of the Environment and Climate Change	Andrew Morley Great Lakes Advisor Eastern Region	Cathy Chisholm Area Supervisor Belleville Area Office
Ontario Ministry of Natural Resources and Forestry	Alastair Mathers Lake Ontario COA Basin Coordinator Lake Ontario Management Unit Glenora Fisheries Station	Jim Hoyle Assessment Biologist Lake Ontario Management Unit Glenora Fisheries Station
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Fisheries and Oceans Canada	Gavin Christie Division Manager Great Lakes Laboratory for Fisheries and Aquatic Sciences	Christine Boston Aquatic Science Biologist
Mohawks of the Bay of Quinte	Todd Kring Director of Community Infrastructure	Nicole Storms Environmental Services Officer
CFB Trenton	Andrew Tam Environmental Officer 8 Wing CFB Trenton	

Formal Approvals

Final approval of BUI assessment report by Biomonitoring and Water Quality Technical Work Group: DATE

Final approval of BUI assessment report by Delisting Steering Committee: DATE

Final approval of BUI assessment report by Restoration Council: DATE

APPENDIX C: Communications

To be inserted (Sarah/Kristin)

APPENDIX D: Changes to the Delisting Targets and Criteria over Time

Year	Change & Rationale	Target	Criteria
1993	Original Target from 1993 Stage I report	Restore bacteriological water quality throughout the Area of Concern to achieve the objectives of zero beach closures and *E.coli* densities of 100 organisms per 100ml of water throughout the bay	
2000	Amended to show time trends in water quality at specific beaches and to allow periodic exceedences	Target 1. Using 1989 – 1994 as the base year period, demonstrate progress toward improving bacteriological water quality conditions for the beaches at Forest Mills, Frankford, Kingsford and Newburgh. Target 2. Using 1989 – 1994 as the base year period, demonstrate progress toward improving bacteriological water quality conditions for the beaches at Riverside Park and Zwick's Island (Belleville).	
2007	i. Removal of Forest Mills and Newburgh; locations no longer promoted or maintained as public beaches by Quinte Conservation ii. Removal of Zwicks Island and Riverside Park after they were formally closed by the City of Belleville iii. Target and criterion were re-written to be more measurable. **Changes approved by Restoration Council on June 19, 2007**	Demonstrate progress toward improving bacteriological water quality conditions for the beaches at Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial Park (Northport).	At Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial Park (Northport) beach postings do not exceed 20% of the annual swimming season (Victoria Day to Labour Day) due to exceedences of the Provincial Water Quality Objective (100 *E. coli* per 100 ml.).
2012	i. Human-based fecal contamination was specifically	Target 1. Demonstrate improved bacteriological water	Criterion 1: At Frankford, Kingsford Mill, Centennial Park (Deseronto) and

Year	Change & Rationale	Target	Criteria
	identified (Criterion 2) because it is a legacy pollution concern, and more likely to carry pathogens that can impact humans, rather than fecal contaminations originating from pets or birds. The Restoration Council wanted to ensure that if fecal contamination in stormwater was impacting a beach, any human source would be identified and a management plan developed to address the source.	quality conditions for the public beaches at Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial Park (Northport).	Centennial Park (Northport) beach postings days should not exceed 20% of the annual swimming season (Victoria Day to Labour Day) due to exceedences of the Provincial Water Quality Objective for *E. coli* (100 *E. coli* per 100 ml of water). Criterion 2: At Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial Park (Northport) beaches the main sources of fecal contamination have been identified and no significant source of human fecal contaminates is contributing to any identified fecal contamination at the specified beaches
	ii. At the time it was considered important to include the presence of microcystins as a new target (Target 2) **Target and Criteria were approved by Restoration Council on July 17, 2012**	Target 2: At Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial Park (Northport) beaches record no more than one exceedence per year, for a consecutive five-year period of a safe level of microcystins as established under Health Canada's provisional recreational water guidelines for microcystins.	
2014	i. The Restoration Council removed the target for microcystin; microcystins were not an original target for this BUI and there is on-going microcystin monitoring within another BUI (Eutrophication). A microcystin 'Community Objective' remains in place. **Target and Criteria were approved by Restoration Council on October 16, 2014 (Current Target and Criteria)**	Target 1: Demonstrate improved bacteriological water quality conditions for the public beaches at Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial Park (Northport).	Criterion 1: At Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial Park (Northport) beach postings days should not exceed 20% of the annual swimming season (Victoria Day to Labour Day) due to exceedences of the Provincial Water Quality Objective for *E. coli* (100 *E. coli* per 100 ml of water). Criterion 2: At Frankford, Kingsford Mill, Centennial Park (Deseronto) and Centennial Park (Northport) beaches the main sources of fecal contamination have been identified and no significant source of human fecal contaminates is contributing to

Year	Change & Rationale	Target	Criteria
			any identified fecal contamination at the specified beaches.

APPENDIX E: Background Reports