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Item No. 12.1.1
Environment and Sustainability Standing Committee
February 1, 2018

TO: Chair and Members of Environment and Sustainability Standing Committee

Original Signed

SUBMITTED BY: _____
Kelly Denty, Acting Director, Planning & Development

DATE: November 28, 2017

SUBJECT: Pollution Control Study for Lake Banook

ORIGIN

On September 19, 2017, the following motion of Regional Council regarding item 14.3.4 was put and passed:

“THAT Halifax Regional Council request a staff report for a pollution control study of Lake Banook and Lake Micmac. “

LEGISLATIVE AUTHORITY

Halifax Regional Municipality Charter, Part IV, c. 79 (1) (k). Power to Spend Money. The Council may expend money required by the Municipality for: recreational programs; c. 228, Purpose of municipal planning strategy.

Subclause 79(1)(aw)(iii) of the *Halifax Regional Municipality Charter* provides that “The Council may expend money required by the Municipality for ... all other expenditures ... incurred in the due execution of the duties, powers and responsibilities by law vested in, or imposed upon, the Municipality, the Mayor, Council or officers.”

RECOMMENDATION

It is recommended that Halifax Regional Council consider including \$150,000 for a Pollution Control Study of Lake Banook and Lake Micmac in Planning and Development’s 2018/19 operating budget.

BACKGROUND

There has been an upward trend of beach closures at Birch Cove Beach at Lake Banook over the last three years, with a record 33 days of closures in 2017 due to high bacteria counts (Table 1). A lake pollution control study can assess the health of the two lakes to identify the source and spread of bacteria through testing, and can identify potential solutions through land-use planning, infrastructure, and public education.

Table 1: Beach closures at Birch Cove Beach at Lake Banook

Year	2012	2013	2014	2015	2016	2017
# of Days Closed	5	0	6	17	17	33

Lake Banook and Lake Micmac are integral regional recreational assets for the municipality, serving the paddling and rowing communities for recreational and competitive purposes, as well as swimming and fishing. These activities depend on adequate lake water quality, which may be summarily described as high clarity, with contaminant levels low enough to avoid impacts to human and fish health. Increasingly high bacteria levels observed at Birch Cove since 2015 suggest that water quality conditions in Lake Banook are degrading. If true, and if these conditions persist, the viability of continued use of these lakes for current user groups may be threatened.

Lake Micmac and Lake Banook are in a subwatershed of the Shubenacadie river system that originates with Lake Charles and is shared with Red Bridge Pond and Sullivan's Pond. Three control structures (locks) regulate the water levels of these lakes. Lock 1 is located at the outlet of Lake Banook, and Locks 2 and 3 are located between the outlet of Lake Charles and the inlet of Lake Micmac. Lands within the subwatershed are developed with a mix of high density residential, medium density residential, commercial and institutional uses.

Weed Growth

Lake Micmac and Lake Banook are presently experiencing nuisance weed growth, first observed in 2009. Commissioned by HRM, Stantec Consulting Ltd. (Stantec) studied the weed growth, assessed the likely cause of that growth, and recommended approaches to manage the situation. In 2014, Stantec reported that the mostly likely cause of the nuisance weed growth was the convergence of two conditions: 1) a prolonged water level reduction in Lake Banook from winter-spring 2009 to accommodate installation of the North Dartmouth Trunk Sewer, and 2) the presence of dormant seeds for the nuisance weeds, and a significant nutrient resource in the sediments of Lake Banook. The low, over-winter water level may have disrupted the local species ecology, favoring hearty species that can withstand stressed conditions better than existing dominant species. Lakebed sediment exposure to higher light, oxygen, and wind stresses may also have played a role in plant survival and in opening new areas for colonization by hearty species, such as native pondweeds. Stantec's assessment suggested that one of the likely causes of the weed growth is the result of sediment enrichment because of non-point source sediment loading to the lake.

Following this assessment, HRM hired Natural Ocean Products Inc., and Stantec for weed harvesting and weed harvesting monitoring services, respectively, from 2016 through 2018. The goal of this project is to minimize the impact of aquatic weeds on recreational and competitive boating in the lakes.

Pollution Control Studies in HRM

Several pollution control studies have been conducted in HRM since the 1960s and 1970s. Most of these studies have related to point source pollution to establish sewage treatment facilities in the region and to mitigate water pollution due to on-site septic failures. One study of relevance is the Shubenacadie Lakes Planning/Pollution Control Study of 1993, which focused on managing water quality in the Shubenacadie Headwaters. The growth of suburban developments has long been recognized as adversely affecting water quality in the surrounding area. Although this study focussed on protection of the headwaters during development pressures, it provides guidance on a general approach to a pollution control study.

Objectives for the Shubenacadie Pollution Control Study were as follows:

1. Determine the desired end uses from a community perspective;
2. Propose an achievable water quality target based on the desired end uses;
3. Assess the current situation with respect to how different pollutants contribute to the overall issue and recommended actions to reduce the inputs;
4. Assess the impact of future development within the watershed and recommended actions to minimize these impacts; and,
5. Prepare recommendations for planning and management strategies which make use of existing legislation and regulatory tools, amended as necessary to match pollution control requirements and outline next steps to be taken in the overall Watershed Management Program.

Current Work

In addition to the beach monitoring program, two water quality monitoring projects were recently completed for the Municipality. One of these, a three-year contract collecting surface water quality data from 33 sites, included data collection from the Shubenacadie subwatershed including Lake Banook and Lake Micmac in 2015 and 2017. The other, a four-year contract to collect surface water quality data from Russell Lake, concluded the Municipality's obligations with respect to development agreements for the Morris-Russell Lake subdivision.

HRM plans to conduct a water quality monitoring & watershed study program review, commencing April 2018, contingent on funding approval through reserves. The overall intent of the proposed review is to assess our current and former water quality monitoring activities and watershed studies for use and effectiveness, to provide a strategic, evidence-based approach to advance Regional Planning outcomes and enable effective responses to emerging watershed management issues.

Water Resource Jurisdiction and Responsibilities

The responsibility for ownership and protection of watercourses in Nova Scotia is assigned to the Province, with Nova Scotia Environment (NSE) as the lead agency, as per the Nova Scotia Environment Act (1998, amended to 2013). This authority applies to all forms of water – *i.e.*, drinking water, wastewater, stormwater, groundwater, surface water, & wetlands - and is exercised through applicable regulations, policies, management strategies, licences, certifications, standards, and guidelines. To fulfill these obligations, NSE imposes requirements and restrictions on watercourse alterations to protect surface water resources, aquatic habitat, and to ensure sustainable use for drinking water, recreational, agricultural, industrial, and other purposes. Although NSE regulates water quality standards for drinking water and wastewater, no such standards have been established for stormwater, which is consequently managed exclusively for flow (quantity), and not quality. Based on this stormwater management framework, there is no long-term historical data for stormwater quality in the municipality.

Through regulatory and permitting processes, Nova Scotia Environment assigns additional responsibilities to protect water quality to organizations conducting approved works – including but not limited to industrial operations and municipal water utilities, such as the Halifax Regional Water Commission (Halifax Water). As the owner and operator of public infrastructure for drinking water, wastewater, and stormwater systems in HRM, Halifax Water has several facilities operating within the Shubenacadie River subwatershed, including wastewater pumping stations at the shores of Red Bridge Pond and Oathill Lake, the Dartmouth North Trunk Sewer running along the western shoreline of Lake Banook, and 14 storm sewer outlets draining into Lake Banook and immediate tributaries.

The Municipality's role is principally to set service boundaries for water, wastewater, and stormwater services, manage stormwater within the public right of way, assess the impact of overland flow during development, and to ensure that land use planning policies conform to provincial policies respecting wetlands and floodplains. Despite the lack of formal responsibility to protect watercourses, the Municipality requires riparian buffers along watercourses for all new developments. In most cases, the required buffer

ranges from 65 to 100 ft. measured from the ordinary high water mark of every watercourse. Building permits for new structures within this watercourse buffer will not be granted. Regulations for watercourse setbacks and the maintenance of buffers within the setback have been implemented consistently across all land use bylaws since 2006. Structures constructed before 2006 may be within the watercourse buffer as they were not subject to the same requirements when they were built.

DISCUSSION

Fecal Pollution, Pollution Sources, and Source Tracking

The Guidelines for Canadian Recreational Water Quality (Health Canada, 2012) indicate that contact with fecal pollution represents a significant concern for swimming-based recreation, and that *Escherichia coli* (*E. coli*) is currently considered the best indicator of fecal contamination in freshwater recreational environments. Its abundance is used to indicate the microbiological quality of recreational waters and the possibility of the presence of other fecal bacterial pathogens.

Fecal pollution in recreational waters may originate from specific, identifiable sources such as discharge pipes from factories, wastewater (sewage) treatment facilities, vehicles, buildings, etc., - known as point sources – or from numerous indeterminate sources spread over a large area – known as nonpoint sources. Typical examples of nonpoint pollution sources include stormwater runoff, wild or domesticated animals including birds, and even by swimmers themselves. Contributors to nonpoint source pollution may include agricultural lands, malfunctioning septic systems, residential areas, roadways, parklands, and improperly managed construction sites, among others. While point source pollution and their solutions have long been recognized and are typically regulated, nonpoint source pollution is more difficult to identify and mitigate.

To determine the underlying source of *E. coli*, Microbial Source Tracking (MST) techniques can be used to identify whether the contributions are human or animal origin. Further discrimination may also be made, for species specific results (e.g., humans vs. dogs vs. birds), group comparisons (e.g., humans vs. wildlife vs. livestock), and specific individual hosts (e.g., cows from a specific farm), to determine which source is the main contributor. The MST approach can be either through a known-source library (i.e. matching “fingerprints” of bacterial strains from the water to specific hosts) or through a library-independent approach. Currently, Nova Scotia does not have a library of species available. Therefore, if an MST approach is selected, it requires a library-independent approach.

In 2015, an article was published in the *Journal of Environmental Quality* investigating library-independent microbial source tracking markers in urban (Lake Fletcher) and rural (Middle Musquodoboit) watersheds in HRM¹. In this research, a multi-faceted approach using a variety of techniques (environmental bacteria and DNA-based MST together with pathogen detection, turbidity, and *E. coli* quantification) was used to identify sources of fecal pollution. The study found that these tools were valuable for monitoring water quality management. Results showed that the chances of detecting intestinal pathogens increased in surface water samples when levels of *E. coli* and turbidity reached a certain threshold. The study’s research noted that storm events “were associated with higher pathogen and fecal marker concentrations in the waterways, possibly due to problems with runoff and stormwater management.”

Regardless of the approach, MST techniques have limitations in their ability to identify the sources of pollution and require specialized expertise in population genetics, population biology, host-microbe interactions, microbial physiology, and microbial ecology. The U.S. Environmental Protection Agency (EPA) notes that “protection from fecal microbial contamination is one of the most important and difficult challenges facing environmental scientists trying to safeguard waters used for recreation (primary and secondary contact), public water supplies, and propagation of fish and shellfish.”² They also noted that

¹ Stea, E., Truelstrup Hansen, L., Jamieson, R., and Yost, C (September 16, 2015). Fecal Contamination in the Surface Waters of a Rural- and an Urban-Source Watershed. *Journal of Environmental Quality*.

² U.S. Environmental Protection Agency, Office of Research and Development (June, 2005). Microbial Source Tracking Guide Document, p. 11.

fecal source identification is a challenge due to the variety of potential fecal sources impacting watersheds, and that it must be accomplished prior to implementing remediation measures.

Recent Fecal Contamination Study at HRM Beaches

During 2014, a graduate student at Dalhousie University conducted a focused study of fecal contamination at four HRM beaches, including Birch Cove Beach. The study enumerated *E. coli*, assessed the presence of pathogens, and used a library-independent MST approach that compared human markers against those of dogs and birds. Although the summer of 2014 had comparatively few beach closures and *E. coli* counts for most HRM beaches, the study generated a few interesting findings.

Those findings relevant to Birch Cove Beach include:

- *E. coli* levels were higher before and after the beach season;
- Human markers were prevalent before and after the season but not during the beach season, likely due to hydrological conditions (elevated water tables); and,
- Dog markers were detected most often during the beach season.

Perhaps most usefully, this study demonstrated the viability of library-independent MST methodologies in the local environment.

Proposed Study

A pollution source control study is an appropriate means by which to understand the locations and sources of fecal contamination affecting Lake Banook and Lake Micmac. Such a study requires the collection of environmental samples before, during, and after the beach season to properly characterize when, and from where, bacterial loads into the lakes are coming, and for this reason such a study cannot be completed during the remainder of the 2017-18 fiscal year.

A properly scoped study will consist of three interrelated parts:

1. Conduct a bacterial loading analysis of the Lake Banook and Lake Micmac subwatersheds to determine total *E. coli* loading, the principal locations from which loads originate, and timing of loading;
2. Conduct MST analysis study to determine the principal sources, and discriminate among non-human sources (e.g., dog, avian, wildlife); and
3. Develop recommendations to manage bacteria loads in the watersheds and/or the lakes to reduce future beach closures and enable safe ongoing use of Lake Banook and Lake Micmac for swimming, boating, and other recreational purposes.

A library-independent MST technique will be required, given the absence of a DNA library for Nova Scotia. Local expertise in associated techniques has been developed and demonstrated over the past several years by Dalhousie University's Centre for Water Resource Studies.

The activities associated with a pollution control study are not expected to impact municipal operations, including beach use and aquatic weed harvesting/monitoring, or recreational / competitive activities in Lake Banook or Lake Micmac. Should this study proceed, it would not be expected to conclude until after the end of the 2018 beach season.

The estimated budget required to support the study scope identified above is \$150,000. This estimate was developed by staff and validated by independent environmental professionals. As with the weed harvesting project, this amount can be added to the Energy & Environment operating budget for 2018/19.

FINANCIAL IMPLICATIONS

There are no financial implications for the current 2017/18 operating budget.

Funding in the amount of \$150,000 for the Pollution Control Study is not included in the approved-in-principle 2018/19 operating budget and would need to be incorporated as part of the on-going 2018/19 budget development process.

The Budget Committee, on January 19, 2018, moved and passed a motion directing a \$150,000 increase to the Planning and Development budget for the Lake Banook Study be added to the Parking Lot for future consideration in the 2018/2019 Budget.

Furthermore, any subsequent decisions related to pollution source control actions, to meet Council's environmental objectives or service delivery priorities, could have additional financial implications beyond the initial \$150,000 study.

RISK CONSIDERATION

The Municipality recognizes that land development and land use practices impose risks to water quality. Further, it recognizes that a water pollution control study represents a way to identify the status of these risks, and options by which they may be mitigated by the Municipality or other responsible parties.

COMMUNITY ENGAGEMENT

Community engagement was not required for the development of this report.

ENVIRONMENTAL IMPLICATIONS

There are no environmental implications directly associated with this report. Should Council approve funding a pollution control study, that study may locate, quantify and identify sources of fecal pollution affecting Lake Banook and Lake Micmac and identify possible remediation opportunities to address principal sources. Future projects undertaken to implement approved remediation strategies will, if successful, result in improved environmental conditions and reduced environmental risks to beach and lake users.

ALTERNATIVES

No alternatives are recommended.

ATTACHMENTS

None.

A copy of this report can be obtained online at <http://www.halifax.ca/council/agendasc/cagenda.php> then choose the appropriate meeting date, or by contacting the Office of the Municipal Clerk at 902.490.4210, or Fax 902.490.4208.

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