

# Shadow Lake and Silver Lake Management Plan

2019



**KAWARTHA  
CONSERVATION**

Discover • Protect • Restore

# About Kawartha Conservation

A plentiful supply of clean water is a key component of our natural infrastructure. Our surface and groundwater resources supply our drinking water, maintain property values, sustain an agricultural industry, and support tourism.

Kawartha Conservation is the local environmental agency that helps protect our water and other natural resources. Our mandate is to ensure the conservation, restoration, and responsible management of water, land, and natural habitats through programs and services that balance human, environmental, and economic needs.

We are a non-profit environmental organization, established in 1979 under the Ontario *Conservation Authorities Act* (1946). We are governed by the six municipalities that overlap the natural boundaries of our watershed and who voted to form the Kawartha Region Conservation Authority. These municipalities include the City of Kawartha Lakes, Township of Scugog (Region of Durham), Township of Brock (Region of Durham), Municipality of Clarington (Region of Durham), Township of Cavan Monaghan, and Municipality of Trent Lakes.

Cover photo: Entrance to Shadow Lake from Gull River

# Acknowledgements

This plan was facilitated by Kawartha Conservation and developed with significant input from local communities, stakeholders, and agencies, including: local shoreline and watershed residents, members of the Shadow Lakes Association, members of the Community Advisory Panel, and members of the Science and Technical Committee

Funding for this project was provided by the municipality of the City of Kawartha Lakes



# Shadow Lake and Silver Lake Management Plan

## Executive Summary

Shadow Lake and Silver Lake are small-to-medium sized lakes within the municipality of City of Kawartha Lakes. They are connected and exist along the Gull River system, and are highly valued by local residents and other users for their excellent water quality and natural scenery. The *Shadow Lake and Silver Lake Management Plan* was developed by Kawartha Conservation, under contract from City of Kawartha Lakes, to provide several suggested actions for local individuals and groups to undertake to maintain, and wherever possible enhance, lake health.

What constitutes a healthy lake? How do we know we are sustaining lake resources? To help steer us, a vision statement has been developed as the guiding principle for the plan:

“Ensure the long-term sustainability of Shadow Lake and Silver Lake to maintain a safe, peaceful and natural setting for living, boating, swimming, fishing, and access to water for household uses.”

Lake ecosystems are complex, with many interrelated components. They also change through time, mirroring changes in land use practices and naturally occurring processes in its drainage basin. Shadow Lake and Silver Lake are considered to be in a relatively healthy state, but there remain several challenges facing the lakes. Water level management, intense shoreline development, invasive species, and other stressors if not responsibly managed do pose a legitimate threat to the future state of the lakes.

The content of the *Shadow Lake and Silver Lake Management Plan* includes a summary of science-based information relevant to the lake health (Chapter 1), key management objectives and issues related to maintaining healthy lakes (Chapter 2), and several management recommendations to maintain or enhance lake health that can be undertaken by the various parties that are active on the lakes (Chapter 3). The Plan is the culmination of a four-year planning project, initiated in 2014, whereby the City of Kawartha Lakes provided funding to Kawartha Conservation to lead its development. This included studying various components of the lake, for example water quality, water quantity, land use, aquatic and terrestrial resources, and consulting with community members, organizations, and other stakeholders to document and address their values and concerns with respect to lake health. Members of the Community Advisory Panel, the Science and Technical Committee, and local stakeholders, agencies, and organizations have been instrumental in providing guidance and review of the *Shadow Lake and Silver Lake Management Plan* and associated materials.

### Goals:

To ensure the *Shadow Lake and Silver Lake Management Plan* addresses land use pressures and other community-based concerns, the following strategic goals were developed at the project onset:

- **Maintain excellent water quality in the lake and its tributaries for human use and ecological needs.**
- **Promote sustainable human and natural resources management activities that protect and enhance overall watershed and lake health.**

- Use science-based findings to guide *Official Plan* policies, by-laws, and other strategic planning documents to ensure a supportive planning policy framework with a primary goal of protecting the lakes and their watersheds.

### State of the Lakes

Water quality within Shadow Lake and Silver Lake, and their connecting watercourses is considered to be in an excellent state. Data on Silver Lake is limited compared to Shadow Lake, however important water quality parameters such as nutrient concentrations, dissolved oxygen, and clarity indicate no significant water quality deterioration of the lakes from human use. This is important given a significant amount of the shoreline is occupied by developments. Exceptional amounts of natural vegetative cover remain on lands and along watercourses draining into the lakes, which helps to prevent water quality impacts from the minimal residential, business, and agricultural activities that do exist within the watershed. Any water quality issues are likely to be localized and exist in nearshore areas adjacent to shoreline developments. One identified area of water quality deterioration and management concern is the occasional high bacterial levels at the public beach.

The lakes exist along the downstream sections of the Gull River, and are the drainage end-point from a significantly large watershed from north. The Gull River upstream of Shadow Lake is beyond the geographic scope of the study area, but its water quality and quantity significantly influence the state of Shadow Lake and Silver Lake. These upstream waters are considered part of the ‘Haliburton Lakes’ area and are also referred to as ‘Reservoir Lakes’, which encompasses a watershed of numerous lakes and rivers whose water levels are actively managed to support local shoreline developments and operation of the Trent-Severn Waterway National Historic Site. Almost all of the waters of Shadow Lake and Silver Lake come from the Gull River through the hamlet of Norland. These inputs consist of exceptionally clean waters, but because of the large drainage area can cause extreme water flow and level variability on Shadow Lake and Silver Lake.

The aquatic ecology within the lake and its connecting watercourses is considered to be in a fair state. There has been no apparent and significant deterioration of aquatic habitats within the lake. Resident fish communities are dominated by native species which include several top native predators that contribute to a recreational fishery for walleye, smallmouth bass, and muskellunge. The biodiversity of the lake is under threat from invasive species, as several non-native fishes, invertebrates, and plants have proliferated throughout the lakes.

The water and natural resources of Shadow Lake and Silver Lake watershed are influenced by various stressors that are expected to remain ongoing and perhaps even intensify into the future, including: the intensification of existing shoreline development, climate change, the threat of additional non-native aquatic and terrestrial organisms, among others. The cumulative impacts of these stressors could deteriorate water quality and aquatic ecology within the lake if responsible management is not undertaken in a collaborative manner.

### Objectives:

The project management team further defined our management vision and approach through six objectives. These were formed by considering all of the science-based and agency, community, and lake stakeholder-based issues facing the lake and reorganizing them in a positive form to assist with framing management actions.

Objectives	Issues Addressed
1. Reduce extreme water levels affecting shoreline properties	<ul style="list-style-type: none"> <li>• Variability in water levels, and extreme high and low water events</li> </ul>

<b>2. Maintain excellent water quality conditions</b>	<ul style="list-style-type: none"> <li>• Occasional posting of Shadow Lake public beach as unsafe due to <i>E.coli</i></li> <li>• Pollutants from local shoreline development and activities</li> <li>• Potential contamination from other sources, including the Gull River Watershed</li> </ul>
<b>3. Maintain the biodiversity of the lake ecosystem</b>	<ul style="list-style-type: none"> <li>• Proliferation of non-native invasive species</li> <li>• Wildlife species of conservation concern</li> </ul>
<b>4. Maintain the natural integrity of the shoreline</b>	<ul style="list-style-type: none"> <li>• Significant residential development along the lake shoreline</li> <li>• Impacts to shoreline waterfronts resulting from high water levels</li> </ul>
<b>5. Improve our understanding of how the lake will respond to emerging pressures</b>	<ul style="list-style-type: none"> <li>• Limited monitoring programs and data on lakes ecosystem</li> </ul>

**Management Actions:**

Upon synthesizing and analysing all available science-based information, as well as through extensive stakeholder consultations, 17 "best bet" management actions were identified and grouped under five strategic themes:

- Stewardship,
- Strategic Planning,
- Urban and Rural Infrastructure,
- Research and Monitoring, and
- Communications and Outreach.

We have tried to develop actions as specific to the lakes as possible by identifying priority areas for our management actions. Given the similar management pressures on lakes in south-central Ontario (e.g., intense shoreline development, invasive species, climate change, etc.), many of these management actions are transferable to other lakes in the region as well.

For each recommended action, these details are provided: level of priority, rationale, priority areas, agent responsible for implementation, and deliverables. The following provides a summary of key actions contained in the plan.

***Stewardship Strategy:***

Actions tailored to shoreline landowners and lake users for voluntarily implementing best management practices on their properties for the benefit of all and the future health of the lake.

Actions	Priority
<b>A1:</b> Undertake responsible management of septic systems, including routine inspections, along shoreline properties.	High
<b>A2:</b> Undertake measures to reduce the risk of transferring aquatic and terrestrial invasive species into the lakes and their watersheds.	High
<b>A3:</b> Manage stormwater runoff by increasing the filtering and absorbing capacity of shoreline properties.	High

<b>A4:</b> Maintain the natural features along the shoreline.	High
<b>A5:</b> Undertake responsible recreational boating within the lake, including routine equipment inspection and minimizing disturbance to sensitive habitats.	Medium
<b>A6:</b> Implement measures such as vegetated buffer strips along streams, conservation tillage, and other practices that reduce nutrient and soil loss from farms, with assistance from cost–share programs.	Low

**Strategic Planning Strategy:**

Actions that give profile to pro-active land use policy and natural resource planning initiatives.

Actions	Priority
<b>B1:</b> Continue efforts to identify opportunities to mitigate impacts of fluctuating and extreme water level events, in particular high and low water flows, on shoreline properties.	High
<b>B2:</b> Undertake responsible development planning within the watershed, and particularly along the shoreline.	High
<b>B3:</b> Undertake actions within the Fisheries Management Plan for Fisheries Management Zone 17, and the Trent Source Protection Plan.	Medium

**Urban and Rural Infrastructure Strategy:**

Actions that focus on voluntarily maintaining sustainable public areas and construction works including lake-access areas, roads, and all construction sites.

Actions	Priority
<b>C1:</b> Maintain safe and accessible public lake-access locations by improving water quality at the beach and addressing erosion issues at the boat launch.	High
<b>C2:</b> Ensure that construction projects, particularly road maintenance works, are conducted in a manner that does not degrade water quality or sensitive habitats.	Medium

**Research and Monitoring Strategy:**

Actions focused on addressing, through collaboration, science-based information gaps to better understand the response of the lake to emerging pressures, and tracking environmental health and plan effectiveness through time.

Actions	Priority
<b>D1:</b> Increase community participation in the routine monitoring of key indicators of lake health, including water quality and invasive species.	High
<b>D2:</b> Undertake routine monitoring of, and establish a relationship between, water levels and flows in Shadow Lake and Silver Lake to better characterize their hydrological regime.	High
<b>D3:</b> Undertake an inventory of existing septic systems, water use, and occupancy status on shoreline properties to better inform nutrient loading estimations.	Medium

<b>D4:</b> Conduct research to identify how the lake ecosystem responds to stressors such as cumulative development, climate change, and invasive species.	Medium
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**Communications and Outreach Strategy:**

Actions that encourage dialogue and information sharing among all communities, agencies, and stakeholders and promote sustainable practices to maintain a healthy lake environment

Actions	Priority
<b>E1:</b> Communicate the science, solutions, and outcomes of plan implementation among all active stakeholders in the Shadow Lake and Silver Lake watershed.	High
<b>E2:</b> Communicate on a regular basis the water management activities along the Gull River, including early warning of high, low, and variable water level events.	High

**Effective Implementation**

Even though Kawartha Conservation is responsible for leading the development of this Plan, the undertaking of the recommended action items is a shared responsibility among all Shadow Lake and Silver Lake watershed stakeholders. Watershed residents, shoreline residents, local businesses, agencies, and organizations have a role to play, and as such have been identified wherever possible within the *Shadow Lake and Silver Lake Management Plan* as most appropriate to lead, or partner, on one or more of the recommended actions. All of the actions recommended in the Plan are voluntary and not mandated to be undertaken by watershed stakeholders. A healthy Shadow Lake and Silver Lake watershed will likely only be maintained in perpetuity if reasonable efforts are made among all watershed stakeholders towards successful collaboration, communication, and accountability.



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# Acronyms and Unit Conversions

**ug/L:** Micrograms per litre

**m:** Metres (1 m = approx. 3.3 feet)

**km:** Kilometres (1 km = approx. 0.6 miles)

**km<sup>2</sup>:** Square kilometres (1 km<sup>2</sup> = approx. 0.386 miles<sup>2</sup> = 100 hectares = approx. 250 acres)

**ha:** Hectares (1 ha = 0.01 km<sup>2</sup> = approx. 2.47 acres)

**kg:** Kilograms (1 kg = approx. 2.2 pounds)

**m<sup>3</sup>:** Cubic metres (1 m<sup>3</sup> = approx. 35 cubic feet)

# 1.0 Setting the Context



Typical granite rock islands and yellow buoys to mark in-water navigation hazards  
(Central Shadow Lake, August 2016)

# 1.1 Introduction

Shadow Lake and Silver Lake are situated within the municipality of the City of Kawartha Lakes, located between the Villages of Norland and Coboconk. The lakes exist along and near the outlet of the Gull River. Waters from Shadow Lake and Silver Lake flow through the lower portions of the Gull River into Balsam Lake, and eventually through the Kawartha Lakes and into Lake Ontario through the Trent River and Bay of Quinte (Figure 1.1). The main focus area of this Plan (i.e., the Planning Area) is defined as all lands and waters downstream of Norland (Gull River inflow into the northern part of Shadow Lake) and upstream of Coboconk (before Gull River empties into Balsam Lake, just south of Silver Lake) (Figure 1.2). This area, also referred to as the Shadow Lake and Silver Lake subwatershed, is approximately 63 km<sup>2</sup> and represents approximately 5% of the total Gull River watershed. The planning area encompasses two municipalities, City of Kawartha Lakes and Township of Minden Hills.

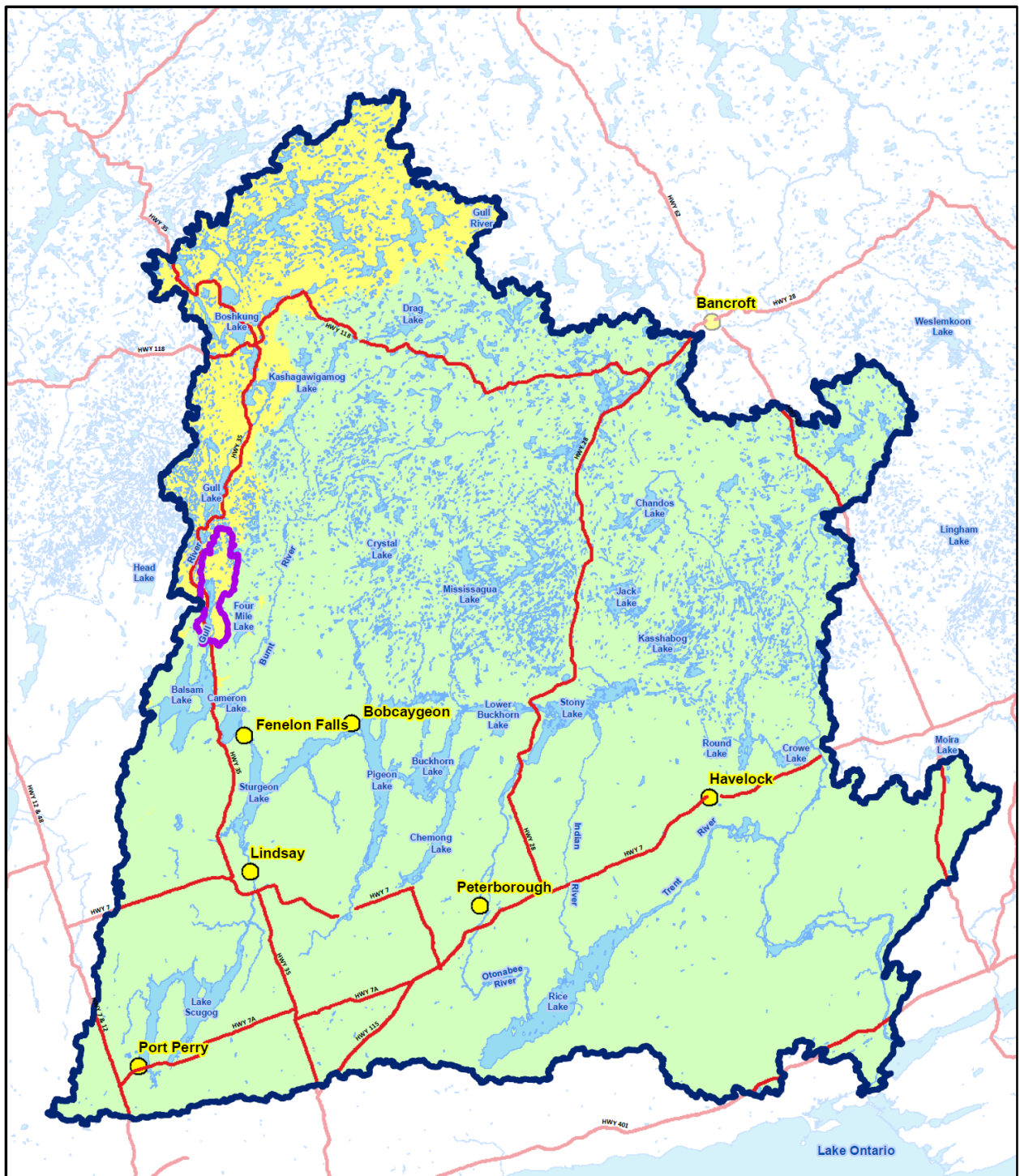
The *Shadow Lake and Silver Lake Management Plan* is the culmination of a four-year study (2014-2017) coordinated by Kawartha Conservation and funded by the municipality of the City of Kawartha Lakes. The Plan is a community-driven endeavour, providing a framework for the voluntary implementation of collaborative strategies for maintaining the health of Shadow Lake and Silver Lake and its watershed for all uses. Kawartha Conservation's role in the development of the *Shadow Lake and Silver Lake Management Plan* is one of a facilitator and lead author. Their focus is to build consensus among a broad spectrum of watershed partners, organizations, and residents whom will ultimately share responsibility (on a voluntary basis), for undertaking the recommended management actions.

## **Document Layout**

*Chapter 1* provides the foundation upon which the *Shadow Lake and Silver Lake Management Plan* is developed and includes a summary of lake management drivers, stakeholder values and concerns, management vision and goals, and background characterization.

*Chapter 2* provides a summary of management objectives. These include the aspirations of lake-based stakeholders, agencies, and organizations and ultimately provide the foundation for the Implementation Plan. Within each objective, a number of issues hindering their achievement have been presented.

*Chapter 3* presents the preferred lake management actions that address the key points and issues identified in the previous chapter. These actions are categorized into five strategies focused on sector-based action items. The strategies include Stewardship, Strategic Planning, Urban and Rural Infrastructure, Research and Monitoring, and Communications and Outreach.



## Trent River Watershed

- Gull River Watershed
- Core Shadow Lake and Silver Lake Management Planning Area
- Trent River Watershed

0 5 10 20 30 40 Kilometres


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 Additional Data Sources



**Figure 1.1: Map showing the Shadow Lake and Silver Lake Planning Area, in relation to the entire Trent River drainage basin**

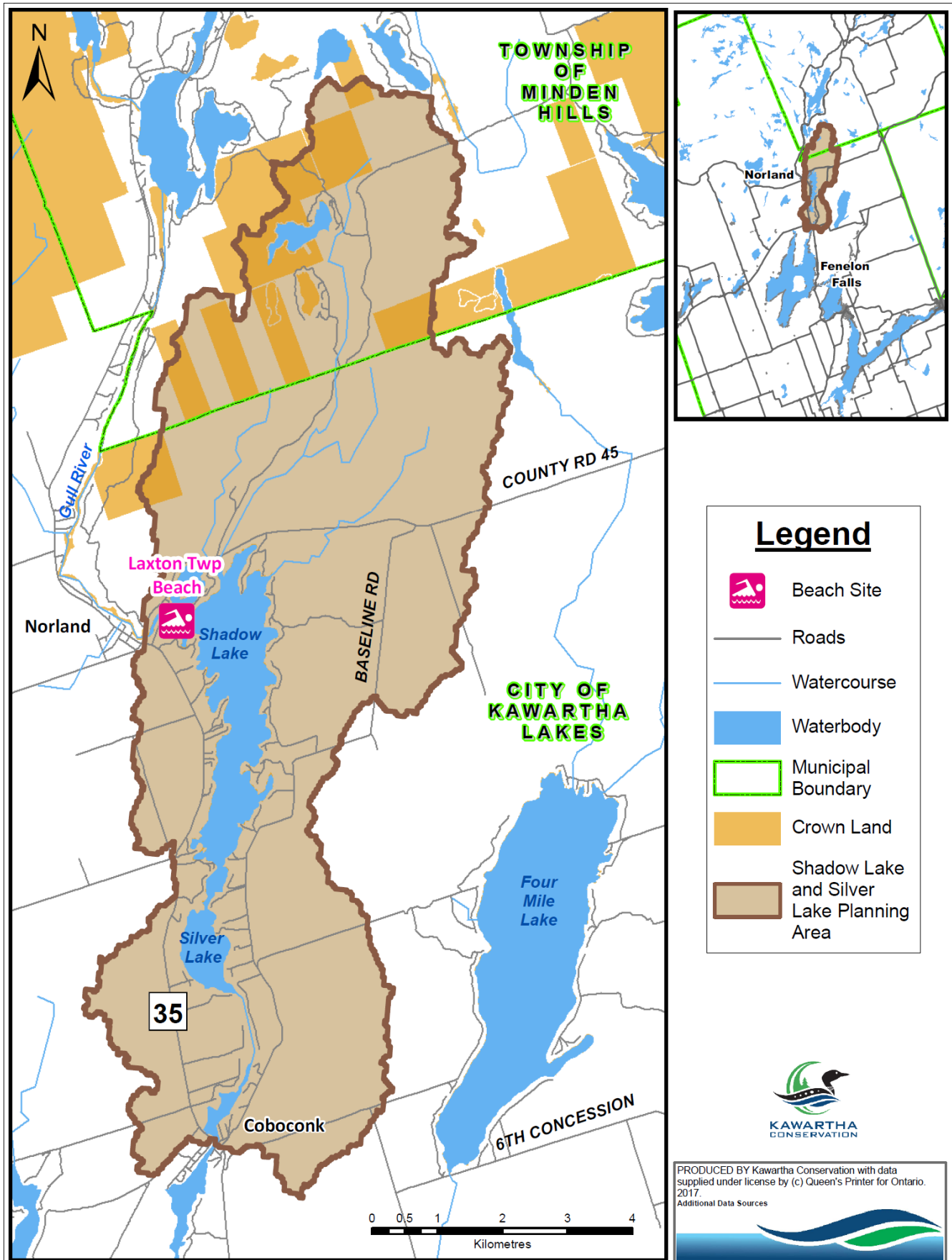


Figure 1.2: Map showing the Shadow Lake and Silver Lake Planning area

## 1.2 Lake Management Drivers, Values, and Concerns

Shadow Lake and Silver Lake are water resources of the utmost value to the local municipalities, the federal government, First Nations, shoreline residents, seasonal visitors, and local businesses. Surrounding communities benefit from its economic, environmental, and recreational enjoyment opportunities. For many people, particularly shoreline residents and seasonal visitors, the lake is an integral part of their identity and livelihood.

The following reports, studies, and recent developments demonstrate the imperative for lake management plans for the Kawartha Lakes, including Shadow Lake and Silver Lake:

- In the early 1970's, hydrological conditions and water level management opportunities were studied for the Trent Basin by consultants (Acres Consulting Services, 1973). This report was the first comprehensive examination of the operations and procedures for water control in the Shadow Lake and Silver Lake Watershed. The system was identified in this report as high vulnerability for extreme and variable water flows and levels given they exist along the downstream sections of the Gull River, and have limited natural capacity to moderate water levels. To assist in managing the complex water regime, the report outlined in detail 5 distinct zones of reservoir operation: Spill Zone, Food Control Zone, Conservation Zone, Buffer Zone, and Inactive Zone.
- In 2002, a report commissioned by the City of Kawartha Lakes, titled *Shoreline Environmental Studies in Support of Official Plan Policies for the City of Kawartha Lakes* (Gartner Lee and French Planning Services, 2002), recommended that the municipality encourage the development of individual lake management plans as a cooperative process among lake residents, the municipality, businesses, and provincial and federal agencies.
- In 2008 and 2009, the City of Kawartha Lakes Environmental Advisory Committee hosted a series of Environmental Roundtables, inviting various community representatives to put forward initiatives to help realize their goals of protecting the environment. Twenty-two local associations and organizations with an interest or role in water quality participated. By a wide margin, lake management planning was selected as the number one priority.
- In 2009, a municipal staff report was presented to council, outlining support for lake management plans that aim to sustain healthy lakes. Council supported recommendations that lake management planning actions be coordinated by the local conservation authority. Kawartha Conservation entered into a four-year partnership (2014 to 2018) with the City of Kawartha Lakes to lead the development of the *Shadow Lake and Silver Lake Management Plan*.
- In 2011, a water management study was undertaken by AECOM (AECOM, 2011) in which several reports were published that summarized and evaluated the current water management approach within the Trent-Severn Waterway and presented several recommendations for operations.
- In 2013, the Our Kawartha Lakes Integrated Community Sustainability Plan (City of Kawartha Lakes. Draft, 2013) identified numerous water sustainability goals, and the municipality now seeks to achieve many of these through a lake management planning process.
- Beginning in 2014, several lake-specific management plans have been developed by Kawartha Conservation, including *Sturgeon Lake Management Plan*, *Balsam Lake and Cameron Lake Management Plan*, and *Canal Lake and Mitchell Lake Management Plan*. These plans helped to guide the development of the *Shadow Lake and Silver Lake Management Plan*.

### **Community-Based Values and Concerns**

Throughout the development of the *Shadow Lake and Silver Lake Management Plan*, significant effort was placed on gathering input from local stakeholders, agencies, and organizations. Particularly, guidance was received from members of the local lake association (Shadow Lakes Association) who provided insight into “what the community wants for their lake”, and the Community Advisory Panel, a group of committed individuals that met on a routine basis and provided invaluable project support.

The following provides a list of key values (Table 1.1) and concerns (Table 1.2) identified by the lake community as priorities for lake management. These were obtained from consultations with public and lake-specific stakeholders, agencies, and organizations primarily through the Strategic Visioning process undertaken by the City of Kawartha Lakes in support of their Official Plan, as well as Kawartha Conservation Blue Canoe shoreline communication program (summers of 2013 to 2016), a series of public open houses (summer 2016 and 2017), several Community Advisory Panel meetings and Science and Technical Committee meetings, and conversations at Shadow Lake and Silver Lake Annual General Meetings.

To ensure the lake-based values remain, and lake-based concerns are addressed, a coordinated management approach by all local stakeholders, agencies, organizations (see Appendix A) is required. Open house events provided a clear indication that the lake community is well aware of the issues and will work together with partners who provide effective leadership and a sound action plan.



**Table 1.1: Lake values identified by community stakeholders**

Values	Details
<b>Excellent Water Quality</b>	Of utmost importance for lake stakeholders is to maintain excellent water quality, particularly to support recreational use and aquatic communities within the lake. Further, there are numerous private water intakes along the shoreline that provide water for domestic purposes.
<b>Unique Scenery and Wildlife Habitat</b>	Shadow Lake and Silver Lake are located in an ecologically significant area known as "The Land Between," which supports a high diversity of environmental, geologic, and cultural elements. Functioning and abundant habitat support healthy populations of fish and wildlife that provide ample viewing and fishing opportunities.
<b>Good Fishing and Recreational Opportunities</b>	Recreational fishing is particularly popular and the lake supports several desirable sportfish such as: Smallmouth Bass, Walleye, and Muskellunge. Boating and water sports are popular activities on the lakes. Shadow Lake Association manages 75 buoys that mark in-water hazards to navigation.

**Table 1.2: Lake concerns identified by community stakeholders**

Concerns	Details
<b>Water Level regime, in particular extreme fluctuations and high water situations</b>	Flow management into Shadow Lakes is of significant concern to shoreline residents. There are routinely spring high water events that lead to property flooding and damage. Water level variability throughout the summer season is also a concern, as residents note experiencing rapid fluctuations that impact navigation and shoreline activities. Residents have been actively communicating with Parks Canada to try and mitigate issues associated with water level management.
<b>Poorly Functioning Septic Systems</b>	Potential for faulty or inadequate septic systems/tanks from aging shoreline dwellings, resulting in high nutrient inputs and/or contamination. Residents are particularly concerned of potential of systems leaching wastes when inundated during high water levels.
<b>Increased growth of aquatic plants and algae</b>	Residents have noted lake-wide increases in submerged aquatic plant growth in small bays, particularly within last 5 years. Residents along the north shoreline have noted increases in filamentous green algae.
<b>Invasive Species</b>	The introduction and potential proliferation of non-native species (plants, fishes, and invertebrates) that could outcompete or displace native species and impair recreational use of the lake. Northern pike and potential impacts to native muskellunge, and zebra mussel monitoring are important issues.

## 1.3 Management Vision and Goals

The *Shadow Lake and Silver Lake Management Plan* seeks to solidify a common respect for the lakes and their watersheds, maintain a healthy resource for our current generation, and sustain healthy conditions for future generations. The issues facing the lakes will not be addressed overnight. As such, the plan should be considered a long-term endeavour, one that will be achieved only through ongoing collaboration.

The Vision of Shadow Lake and Silver Lake is to:

“Ensure the long-term sustainability of Shadow Lake and Silver Lake through ongoing stewardship to maintain a safe and natural setting for living, boating, swimming, fishing, and access to water for household uses.”

The Goals of the *Shadow Lake and Silver Lake Management Plan* are as follows:

- Maintain excellent water quality in Shadow Lake and Silver Lake and its tributaries for human use and ecological needs.
- Promote sustainable human and natural resources management activities that protect and enhance overall watershed and lake health.
- Use science-based findings to guide *City of Kawartha Lakes Official Plan* (and those of other local municipalities) policies, by-laws, and other strategic planning documents to ensure a supportive planning policy framework with a primary goal of protecting the lakes and their subwatersheds.

Management actions are guided by the following principles:

- Promote an ecological approach to the use of land and water as a fundamental perspective to a healthy lake and as the foundation for effective land use planning within the lake’s watersheds.
- Recognize the links between human health and environmental health, while supporting a healthy economy.
- Maintain a watershed-scale perspective and consider the implications of cumulative actions on the lake basin as a whole.
- Recognize that management is a shared responsibility and requires a shared approach to coordination and implementation of actions.
- Utilize lessons learned from management planning exercises conducted on other local lakes to help better inform management recommendations.

## 1.4 Roles and Responsibilities

The Plan was authored by Kawartha Conservation and submitted to City of Kawartha Lakes as fulfillment of a key funding deliverable: to develop individual Lake Management Plans for all major lakes (Shadow Lake and Silver Lake included) within the City of Kawartha Lakes. Ownership of the Plan therefore lies with the City of Kawartha Lakes. However, responsibility for undertaking the various management recommendations is presented in the Plan as shared amongst all major parties active in and around the Planning Area (Table 1.3). These parties (including local residents, Shadow Lakes Association, Kawartha Conservation, City of Kawartha Lakes, Ontario Ministry of Natural Resources and Forestry, among others), are listed for each recommendation in Chapter 3 of this Plan as being the most appropriate entity that should be responsible to lead, co-lead, or partner on implementation activities. The plan is not legally binding, therefore implementation is expected to occur on a voluntary basis as willingness, opportunity, and resources become available to the various parties.

**Table 1.3: Definition of the roles of various key players in the management of Shadow Lake and Silver Lake.**

Partner	Typical Role	Role in Plan Development	Role in Plan Implementation
<b>Kawartha Conservation</b>	<ul style="list-style-type: none"> <li>Note Kawartha Conservation does not regulate development within the Shadow Lake and Silver Lake Planning Area, as it is outside the Regulated Areas of any conservation authority.</li> <li>Review Planning Act proposals (e.g., minor variances, severances, Plans of Subdivision, etc.) as per Service Agreement with City of Kawartha Lakes, and provide recommendations to ensure conformity with Provincial Policy Statement for Natural Hazards, Natural Heritage Features, and Water Resources.</li> <li>Partner in Source Protection Planning, including addressing threats to Norland Municipal Drinking Water System.</li> </ul>	<ul style="list-style-type: none"> <li>Hired by City of Kawartha Lakes to study the lake, meet with local stakeholders, and produce a Plan in 2018 that provides several recommendations towards maintaining a healthy lake.</li> <li>Undertake a multi-year (2014-2017) science-based study of water resources in lake and its watershed.</li> <li>Organize and facilitate public consultation and communication (e.g., local open houses, stakeholder meetings, media releases, etc.).</li> <li>Lead writer of Management Plan and Characterization Report.</li> </ul>	<ul style="list-style-type: none"> <li>Partner on undertaking recommendations within Stewardship, Strategic Planning, Research and Monitoring, and Communications and Outreach strategies.</li> <li>Implementation role after 2018 to be determined on an annual basis.</li> </ul>
<b>City of Kawartha Lakes</b>	<ul style="list-style-type: none"> <li>Administer land use policies and bylaws as per Official Plan.</li> <li>Undertake public infrastructure works (e.g., maintenance on local and county roads and ditches, etc.).</li> <li>Approve septic system works as per Ontario Building Code.</li> </ul>	<ul style="list-style-type: none"> <li>Hired Kawartha Conservation on a 4-year project basis to study the lake, meet with local stakeholders, and produce a Plan in 2018 that provides several recommendations towards maintaining a healthy lake.</li> <li>Provide input into the process and review key documents.</li> </ul>	<ul style="list-style-type: none"> <li>Lead on undertaking some recommendations within Strategic Planning strategy.</li> <li>Co-lead on undertaking recommendations within Strategic Planning, and Urban and Rural Infrastructure strategies.</li> <li>Partner on undertaking recommendations within Stewardship, Strategic Planning, Communications and Outreach, and Research and Monitoring strategies.</li> </ul>
<b>Parks Canada</b>	<ul style="list-style-type: none"> <li>Manage infrastructure related to water level management regime, including dam facilities at Norland and Coboconk, and throughout the Gull River watershed in partnership with the Ontario Ministry of Natural Resources and Forestry.</li> <li>Monitor and report on water flows and levels into Shadow Lake at Norland in partnership with Environment Canada.</li> </ul>	<ul style="list-style-type: none"> <li>Provide input into the process and review key documents.</li> <li>Co-present at public information sessions.</li> <li>Active participant on the Community Advisory Panel during lake studies and plan preparation.</li> </ul>	<ul style="list-style-type: none"> <li>Co-lead on undertaking recommendations within the Strategic Planning, Research and Monitoring, and Communications and Outreach strategies.</li> </ul>
<b>Shadow Lakes Association, and community members</b>	<ul style="list-style-type: none"> <li>Manage network of 75 buoys that mark in-water navigation hazards.</li> <li>Occasional sampling of Shadow Lake</li> </ul>	<ul style="list-style-type: none"> <li>Provide input into the process and review key documents.</li> <li>Active participation of Shadow Lake</li> </ul>	<ul style="list-style-type: none"> <li>Lead on undertaking recommendations within Stewardship strategy.</li> </ul>

Partner	Typical Role	Role in Plan Development	Role in Plan Implementation
residing along shoreline and in planning area	<p>and Silver Lake water quality as per volunteer-based Lake Partner Program.</p> <ul style="list-style-type: none"> <li>• Routine, in last 10 years, invasive species sampling as per volunteer-based Invading Species Watch Program.</li> <li>• Host the Shadow Lake Association website, including links to water level information.</li> <li>• Live, work, socialize, and recreate.</li> </ul>	<p>Association on the Community Advisory Panel, while others provided one on one input upon request between 2014-2018.</p>	<ul style="list-style-type: none"> <li>• Co-lead on undertaking recommendations within Stewardship, Strategic Planning, Urban and Rural Infrastructure, Research and Monitoring, and Communications and Outreach strategies.</li> <li>• Partner on undertaking recommendations within Stewardship, Strategic Planning, Research and Monitoring, and Communications and Outreach strategies.</li> </ul>
Ontario Ministry of Natural Resources and Forestry	<ul style="list-style-type: none"> <li>• Administer land use policies as per <i>Public Lands Act</i> and <i>Lakes and Rivers Improvement Act</i>, which includes reviewing and approving most development proposals along the shoreline and in the lake.</li> <li>• Administer policies as per Endangered Species Act (e.g., ensuring species and habitats of Endangered or Threatened species are protected), and Fish and Wildlife Conservation Act (e.g., fishing and hunting regulations).</li> <li>• Support invasive species management, including Invading Species Awareness Program.</li> <li>• Monitor recreational fishery on Shadow Lake and Silver Lake as per Broad Scale Monitoring program.</li> <li>• Partner with Parks Canada to manage numerous dam facilities in the Gull River Watershed.</li> </ul>	<ul style="list-style-type: none"> <li>• Provide input into the process and review key documents.</li> <li>• Co-present at public information sessions.</li> <li>• Active participant on the Community Advisory Panel during lake studies and plan preparation.</li> </ul>	<ul style="list-style-type: none"> <li>• Co-lead on undertaking recommendations within Strategic Planning, and Research and Monitoring strategies.</li> <li>• Partner on undertaking recommendations within Stewardship, Research and Monitoring, and Communications and Outreach strategies.</li> </ul>
Haliburton Kawartha Pine Ridge District Health Unit	<ul style="list-style-type: none"> <li>• Monitor water quality at the public beach during the swimming season for safe swimming.</li> </ul>	<ul style="list-style-type: none"> <li>• Provide input into the process and review key documents.</li> </ul>	<ul style="list-style-type: none"> <li>• Co-lead on undertaking recommendations within Stewardship strategy.</li> <li>• Partner on undertaking recommendations within Urban and Rural Infrastructure strategy.</li> </ul>
Fisheries and Oceans Canada	<ul style="list-style-type: none"> <li>• Administering policies as per the Fisheries Act, including reviewing and approving proposals that have potential to cause serious harm to fish habitat that supports the local fishery.</li> </ul>	<ul style="list-style-type: none"> <li>• Minimal, provide input into the process and review key documents.</li> </ul>	<ul style="list-style-type: none"> <li>• Not listed as lead, co-lead, or partner.</li> </ul>

## 1.5 Lake Background Characterization

To provide background information on the current environmental state of Shadow Lake and Silver Lake and its subwatersheds a companion report was developed alongside the *Shadow Lake and Silver Lake Management Plan* that characterizes current lake conditions. This report, the *Shadow Lake and Silver Lake Watershed Characterization Report* (Kawartha Conservation, 2018), presents current information on lake resources (such as land use trends, water quality trends, etc.) as well as their functions, linkages, key issues, and information gaps.

In characterizing Shadow Lake and Silver Lake, the project team has drawn upon all available data, studies, and sampling results and combined this information into a report for review and update as required. This background information, compiled primarily by specialist staff of Kawartha Conservation and vetted through science-minded peers, and other community groups helped to inform management decisions and actions developed through the planning process.

The following is a summary of the report findings, presented in five key themes: Land and Lake Use, Water Levels and Flows, Water Quality, Aquatic Ecosystems, and Terrestrial Natural Heritage.

### 1.5.1 Land and Lake Use

The history of human activities on the landscape around Shadow Lake and Silver Lake is linked to the progression of events occurring in other areas in south-central Ontario. Prior to European settlement, First Nations Peoples have been documented as residing in the area in and around the Kawartha Lakes for thousands of years, owing in large part to the abundance of lakes and connecting corridors for hunting, fishing, and transportation routes. Three different First Nation communities were present in the region: the Huron, the Iroquois and the Mississauga First Nations (Kirkconnell, 1921).

European settlement expanded into the area in the early-to-mid 1800's, with the surveying of the local townships. Over the years there was a gradual but steady shift from exploiting the lakes' watershed resources for commercial purposes to non-intensive agricultural use and using the lake for recreational purposes. In the mid-to-late 1880's numerous dams and timber slides were built along the Gull River to assist with the transportation of logs downstream (LeCraw, 1967). Supported by the lumber industry thanks to the regions vast forests, and access to markets through running logs along the Trent-Severn Waterway and later the Victoria Railway, the landscape was exploited for its forests resources until the end of the century (LeCraw, 1967). The present day natural lands are thus typically regrowth areas that were cleared for logging, succumbed to wildfires, too wet or rocky to farm productively, or abandoned as non-productive farmland.

In terms of control structures immediately adjacent to the planning areas, two dams were constructed on the Gull River upstream of Shadow Lake (Moore Lake Dam also known as Elliot Falls, and Norland Dam), on the Gull river downstream of Silver Lake (Coboconk Dam). In 1903 the Moore Lake Dam (Elliot Falls) became a hydroelectric dam that supplied electricity to nearby Norland, Kirkfield, and to Raven Lake (LeCraw, 1967). Today, little logging occurs in the Shadow Lake region and the dams serve to store water in the lakes, mitigate flooding where possible, and allowing boat traffic to transverse along the Gull River.

Shadow Lake has gone by several names in the past. It is believed that Shadow Lake was originally named Inaskingquash by First Nations in the area, and was named Lac Des Isles by early French settlers in the area (LeCraw, 1967). In the late 1800s what is now Shadow Lake was once known as Mud Turtle Lake and was later named Shadow Lake between the 1920s to the 1940s to improve the image of the lake to tourists.

The Shadow Lake region has little mining, agricultural, or forestry activities, and the area contains a high proportion of natural forests, wetlands, and open rock barrens. Today, the major land use types in the planning area draining into Shadow Lake and Silver Lake are: natural areas (66%), development (25%), and agriculture (8%) (**Figure 1.3**). The

majority of the watershed is natural cover, mostly forests and marsh, owing in large part to large expanses of crown lands in the northern sections and the general sparsity of development outside of shoreline areas. Developments within the watershed are mostly concentrated along the waters edge, and also exist in small areas as rural developments and a small land area of aggregate operations. Agriculture is most prominent in the central portion of the planning area. Due to the relatively shallow soils, farmland occurs sparingly and is dominated by pasture lands.

The lakes have been part of multiple municipalities. Prior to the amalgamation of the City of Kawartha Lakes in 2001 the lakes bordered the townships of Somerville (to the west), Bexley (to the southeast), and Laxton (to the northeast), and was entirely in Victoria County. Norland (population of 600) and Coboconk (population of 800) are the largest communities located near Shadow Lake and Silver Lake.

Census information from 2011 (ESRI, 2016) indicates a permanent human population of 270 people within the Shadow Lake and Silver Lake planning area, the majority of whom reside in Norland, Coboconk, and along the shorelines of Shadow Lake and Silver Lake and their connecting channels. There is a significant summer influx of seasonal residents along the shoreline due to cottage, tourism, and recreational opportunities.

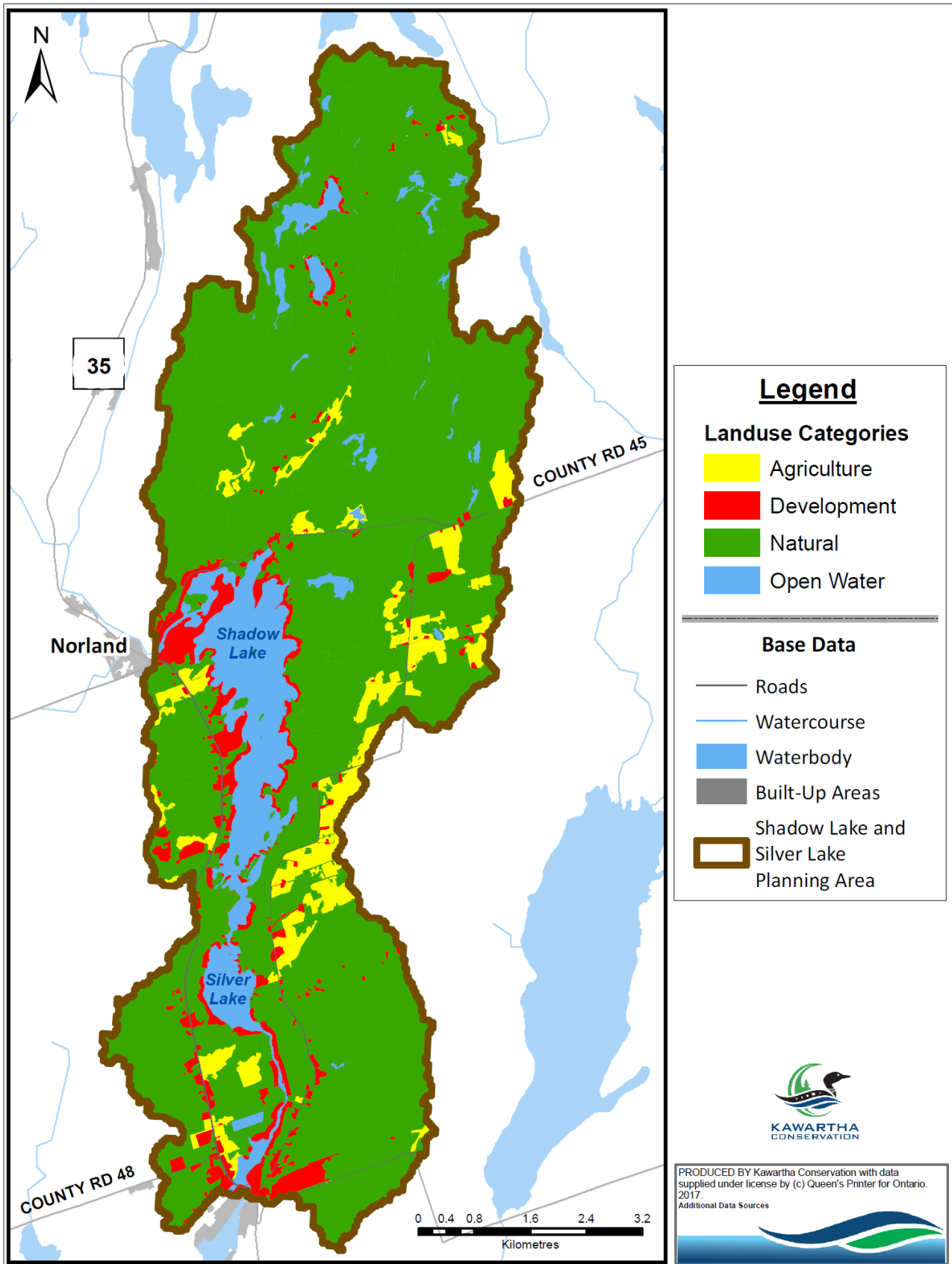


Figure 1.3: Map showing major land use types within the Shadow Lake and Silver Lake planning area

*Shoreline*

The shoreline of Shadow Lake and Silver Lake, combined, is approximately 22 km in length. As shown in Figure 1.3, and Table 1.4, development within the planning area is heavily concentrated along the shoreline of Shadow Lake, Silver Lake, and along the Gull River. As of 2013, approximately 54% of the shorelines on Shadow Lake and Silver Lake (including the Gull River shoreline within the Planning Area), has been developed within a 30-metre distance from shore. Natural shoreline vegetation within this settled area in many cases has been altered and/or cleared to accommodate cottage or residential property development.

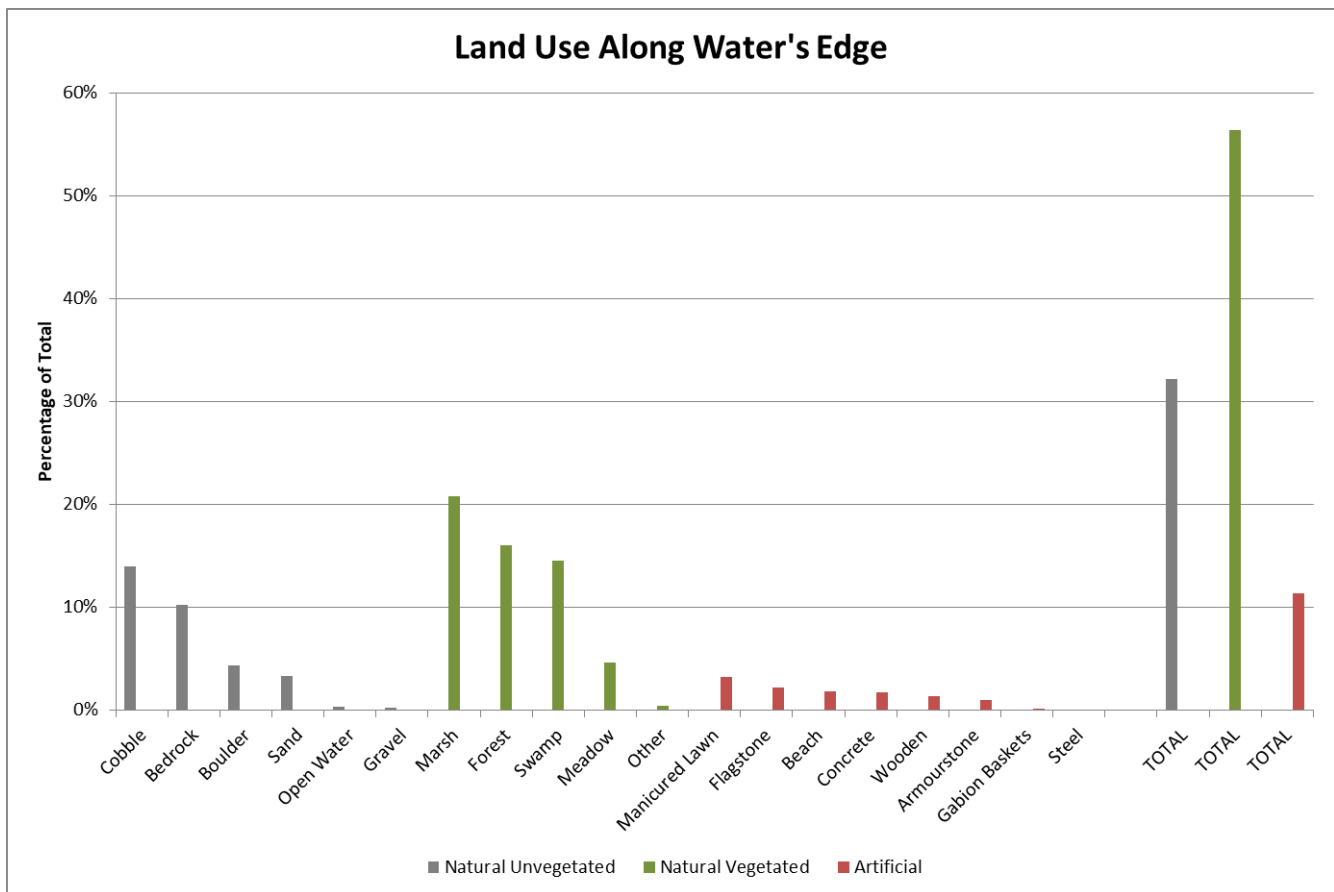
Numerous cottages and homes, and some businesses are located along the shorelines of the lakes. Population densities surrounding the villages are low, though the shoreline of Shadow Lake is host to 600 homes and cottages, with home density the highest on the western side of the lake. Of these 600 waterfront houses, approximately 100 houses are for permanent residence (with a population of approximately 200 residents), while 5/6 of these homes are seasonal cottages. In recent years, the shoreline has supported a more permanent population through conversions of seasonal to year-round residences, and it has steadily become more attractive as a retirement destination.

As a consequence of increased development intensity, several sections of the shoreline have been significantly altered at the water's edge (that is, the shore/water interface). In Shadow Lake and Silver Lake, as of 2017, it is estimated that 11.4%, or 4.5km in length of the water's edge consists of artificial land use including manicured lawn, flagstone, beachsand, concrete, wooden, armourstone, gabion baskets, and other materials (Figure 1.4).

**Table 1.4: Table showing major land use types along the Shadow Lake and Silver Lake shoreline, within varying distances from shore.**

<b>Distance from Shore:</b>		15m	<b>30m</b>	100m	500m	1km
Shadow Lake and Silver Lake	Developed (%)	56%	<b>54%</b>	46%	36%	31%
	Natural (%)	44%	<b>45%</b>	53%	54%	56%
	Agricultural (%)	0%	<b>1%</b>	1%	11%	14%





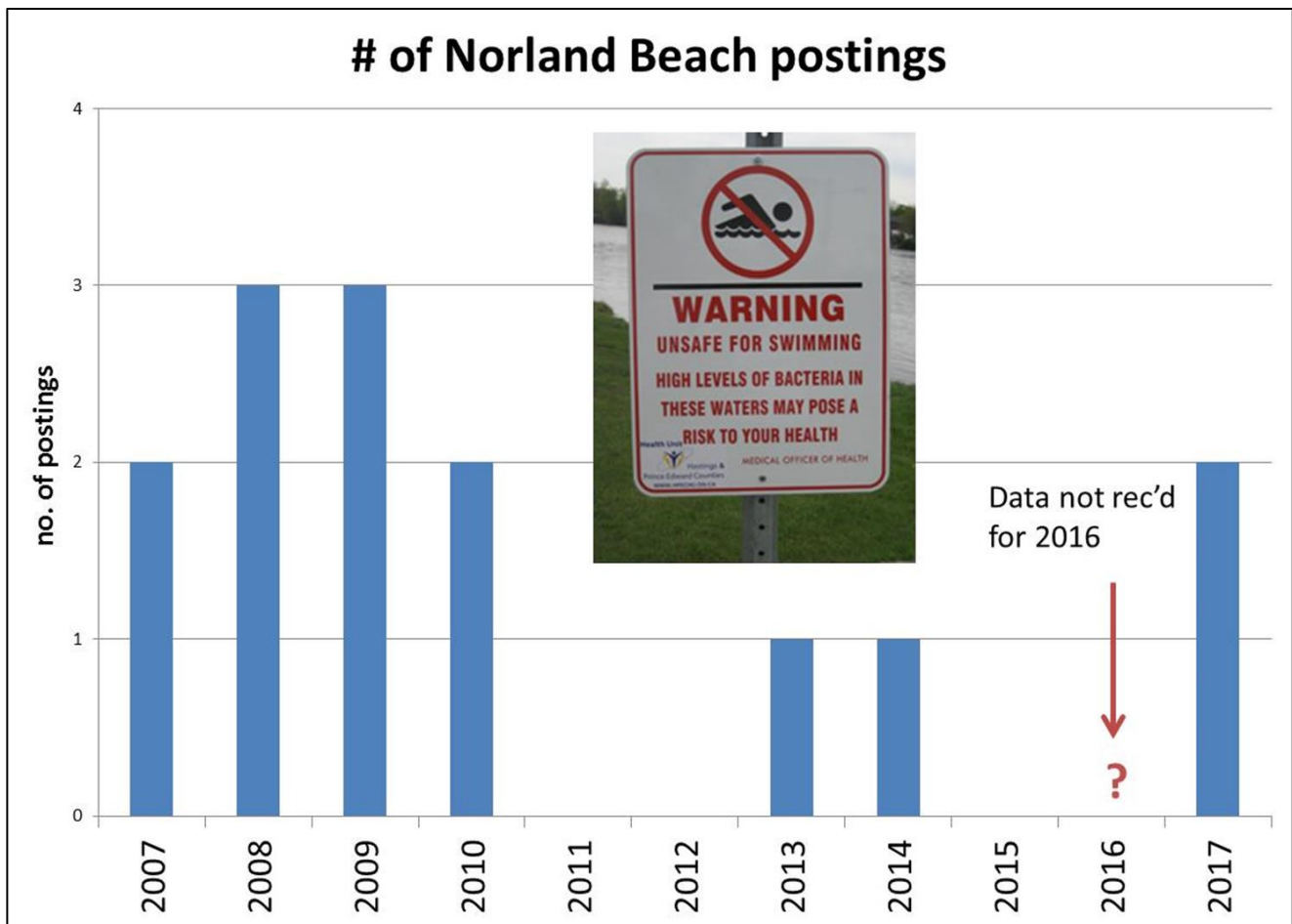
**Figure 1.4: Major land use characteristics at the water's edge of the Shadow Lake and Silver Lake shoreline.**

### Tourism and Recreation

Although Shadow Lake and Silver Lake are hydrologically connected to the Kawartha Lakes via Gull River to Balsam Lake, there is no uninterrupted boating access beyond Norland or Coboconk. Boating between the lakes is possible through the connecting channel known locally as ‘the chute’ although does become dangerous in high or low flow situations. The lake provides ample opportunities, particularly for local shoreline residents and local tourists, for swimming, boating (power, canoe, and sailboat), and fishing, all of which are key recreational activities on the lake.

Historically, lakes within the Kawartha Lakes region have attracted significant numbers of anglers because of highly desired fish stocks (especially walleye) and high natural productivity of the lakes. Within Fisheries Management Zone 17 (i.e., the Kawartha Lakes region and coldwater streams along Lake Ontario, including Shadow Lake and Silver Lake), it is estimated that investment expenditures related directly or indirectly to fishing totaled approximately \$114 million in 2005 alone (Ontario Ministry of Natural Resources, 2010).

There is one active public beach in the planning area, located on Shadow Lake along the north-west shore. Compared to many other beaches within the municipality, this beach has relatively good water quality although within the last ten years it is usually posted as potentially unsafe for swimming due to high *E.coli* levels at least once per year, and in some years as many as 3 times (Figure 1.5).



**Figure 1.5: The amount of time (in percent) the public beach has been posted during the swimming season (June, July, and August), between 2007 and 2017.**

The seasonal influx of vacationers in the City of Kawartha Lakes in the summer months is approximately 17,500 (which equals an increase of 25% of the population), who mostly visit cottages and lakeside communities including Shadow Lake and Silver Lake. The total seasonal population within the municipality is forecast to grow from 31,000 (as of 2006) to approximately 37,500 by 2031. In 2008, an estimated total of 1,263,000 personal visits were made to the City of Kawartha Lakes, 56% of which were made for pleasure, making it the seventh most visited destination in Ontario.

*Drinking Water and Wastewater*

There are no municipal intake systems that draw water from Shadow Lake and Silver Lake. The Village of Norland is serviced by a municipal drinking water system, drawing water from the Gull River upstream of the dam. Private residences along the shoreline obtain their water from groundwater wells and personal or communal surface water intakes. In terms of wastewater, all residents along both lakes are on private septic systems.

**1.5.2 Water Levels and Flows**

Shadow Lake and Silver Lake (also known as the Shadow Lakes system) are flow-through lakes at the lower portion of the Gull River system, created by a natural bedrock constriction at the river's channel. The Gull River flows through the rugged landscape of the Canadian Shield in a southwesterly direction for more than 120 km before it enters Balsam Lake at Coboconk. The Gull River watershed drains 1356 km<sup>2</sup> and includes 17 lakes controlled by 21 dams. These numerous man-made lakes within the watershed are managed as reservoirs, collecting spring runoff and discharging it during the low-water periods in order to provide sufficient recreational navigation levels along the Trent-Severn Waterway.

Shadow Lake and Silver Lake combined (i.e., the Shadow Lakes system) are moderate-sized lakes within the region, having a surface area of approximately 3.2 km<sup>2</sup>, and an average depth of 11.5m. Shadow Lake is hydrologically connected to Silver Lake along the Gull River through a natural narrowing of the watercourse valley, referred to locally as 'the chute'. The deepest section of Shadow Lake (22 m) exists in the north central-basin of the lake, south of the Gull River inflow, and a deep section (20 m) also exists in the south-central basin of the lake. The deepest section of Silver Lake (16m) exists in the south-central section of the lake.

Water levels of Shadow Lake and Silver Lake are prone to the wide-ranging and sometimes sudden fluctuation of inflows from the upstream portion of watershed, the Gull River, which is highly regulated. This is a significant cause for concern for shoreline residents of lake, many of which expect a more stable water level regime and not sharp changes in water levels or extremely high or low levels. The management of water levels in the reservoir lakes including lakes located upstream of the Shadow Lakes system, is a balancing act undertaken by Parks Canada. For example, water must be released from the lakes over the dry summer season to maintain navigation within the Trent-Severn Waterway, and to maintain appropriate water levels to supply various water intake systems (e.g., drinking water supply for Norland). Furthermore, point-source wastewater discharges require appropriate water levels to function properly, and certain valued fishes (e.g., lake trout and walleye) have required water levels during spawning periods. Table 1.X provides a summary of the relationship between water flows entering Shadow Lake through Norland, and the perceived or realized socio-economic and environmental impacts as indicated by the Shadow Lakes Association.

Shadow Lake and Silver Lake, on average, receive 786 million m<sup>3</sup> of water per year. The lakes receive almost all of their water (98%) from the Gull River, which inflows into Shadow Lake at its north end (Figure 1.6). The remaining water inputs are minor in terms of volume, and include drainage from the Shadow Lake Northwest subwatershed (0.6%), direct precipitation onto the surface area of the lake (0.5%), drainage from Shadow Lake North subwatershed (0.5%), Shadow Lake North-east subwatershed (0.3%), and from the land area in and around Shadow Lake and Silver Lake (0.1%) referred to as the Shadow Lake Central subwatershed. Water exits through the southern end of Shadow Lake into the northern part of Silver Lake, and into the north east end of Balsam Lake at Coboconk. Waters eventually continues in a general south-easterly direction through the Kawartha Lakes, eventually draining into Lake Ontario through the Trent River into Bay of Quinte. The locations of all defined subwatershed areas of Shadow Lake and Silver Lake are shown in Figure 1.8. Groundwater inputs into the lake are not well understood. However, due to the thin overburden and highly fractured nature of the near surface bedrock surrounding Shadow Lake, groundwater inputs may be a significant fraction of the Shadow Lake water budget.

Given the high percentage of the total water volumes entering the lakes comes from the Gull River, water levels in both lakes are directly correlated to the flow volumes through the Norland dam. Figure 1.7 demonstrates the long-term monthly flow for the Gull River before entering Shadow Lake, and is considered a relative representation of water level fluctuations in both lakes as well. This pattern reflects seasonal variations of water inflow that is typical of all watercourses in the region, despite the fact that water flows within the Gull River watershed are highly regulated. The highest water levels and flows on the Gull River (and subsequently Shadow Lake and Silver Lake) are observed in May in response to the spring freshet, often combined with rain events. After peaking, river's water level recedes and stays low through the summer and fall's months, reaching the lowest mark of the season in October. In November and December increase in water level is observed, that is followed by decline during the winter season, when rivers and lakes do not receive surface run-off and flow is supported by the groundwater inflow only. As a result, yearly lowest water levels and flows are observed in February-March. Within the last 5 years there have been two high flow

events (spring of 2013 and 2017) that have led to significant flooding of shoreline properties. Analysis of the long-term (1963-2017) maximum and minimum water levels reveals maximum daily and instantaneous discharges are becoming higher and minimum discharges - lower.

Lake flushing rate is an average rate at which water enters and leaves a lake relative to lake volume. It is usually expressed as time needed to replace the lake volume with inflowing water. Using inflow volumes, calculated as part of the lake water budget the flushing rate of Shadow Lake and Silver Lake is 24 times per year. Therefore, on average, the water mass in Shadow Lake and Silver Lake changes approximately every 15 days. This rate of water passage through the lakes is relative quick and indicates that any water management activities within the local subwatersheds will have minimal effect on overall lake water flows and levels.

The local tributaries entering Shadow Lake and Silver Lake are not regulated and thus tend to exhibit well-defined seasonal flow patterns, more typical of a natural flow regime. High flows typically occur during early spring, associated with snowmelt, and throughout the year following high precipitation events. Low flows are usually observed in the summer and winter months.

**Table 1.X: Relationship between water flows entering Shadow Lake and potential or realized impacts.**

<b>Impact of different Gull river flow rate ranges at Norland dam on Shadow Lakes and Gull river</b> for real time flow rate information go to : <a href="https://wateroffice.ec.gc.ca/search/real_time_e.html">https://wateroffice.ec.gc.ca/search/real_time_e.html</a> enter 'Norland' as station name		
Flow rate at Norland dam (cubic metres per second)	Overall condition	Impacts on safety, property, navigation and habitat
70+	Flooding	Some property access roads underwater EMS and municipal services compromised Widespread basement and crawl space flooding Property loss of unsecured items such as docks and sheds Boat houses inaccessible and platforms submerged Debris clogging channels and waterfronts Severe shoreline erosion Some septic tank inundation Dangerous currents in narrow river sections
50 to 70	Extremely high water level for summer months, high water level for spring freshet	Permanent docks underwater Seasonal docks require securing or sandbagging Boathouse platforms submerged Navigation and hazard marker placement delayed Sandbagging required for some properties to control shoreline erosion Disruption of fish spawning habitat Waterfowl nesting disrupted
25 to 50	High water level for summer months, normal water level for spring freshet	Beach areas significantly reduced in size or underwater Nutrient loading from flooded ground producing green algae as waters warm during summer Navigation and hazard marker placement can proceed All river channels are navigable with moderate current
10 to 25	Historically normal water levels during summer months	Ideal flow range for recreational use of all waterbodies Sufficient depth for water intakes Sufficient depth on lower Gull river for watercraft with jet drives or outboards to 90 HP.
5 to 10	Lower than historical minimum during conservation period	Some water intakes pulling surface water Shallow water at many docks requires beaching of watercraft Navigation of lower Gull river limited to outboards up to 10HP
less than 5	Extremely lower than historical minimum during conservation period	Many water intakes exposed Water level in sections of lower Gull river less than 12 inches Many permanent and seasonal docks high and dry

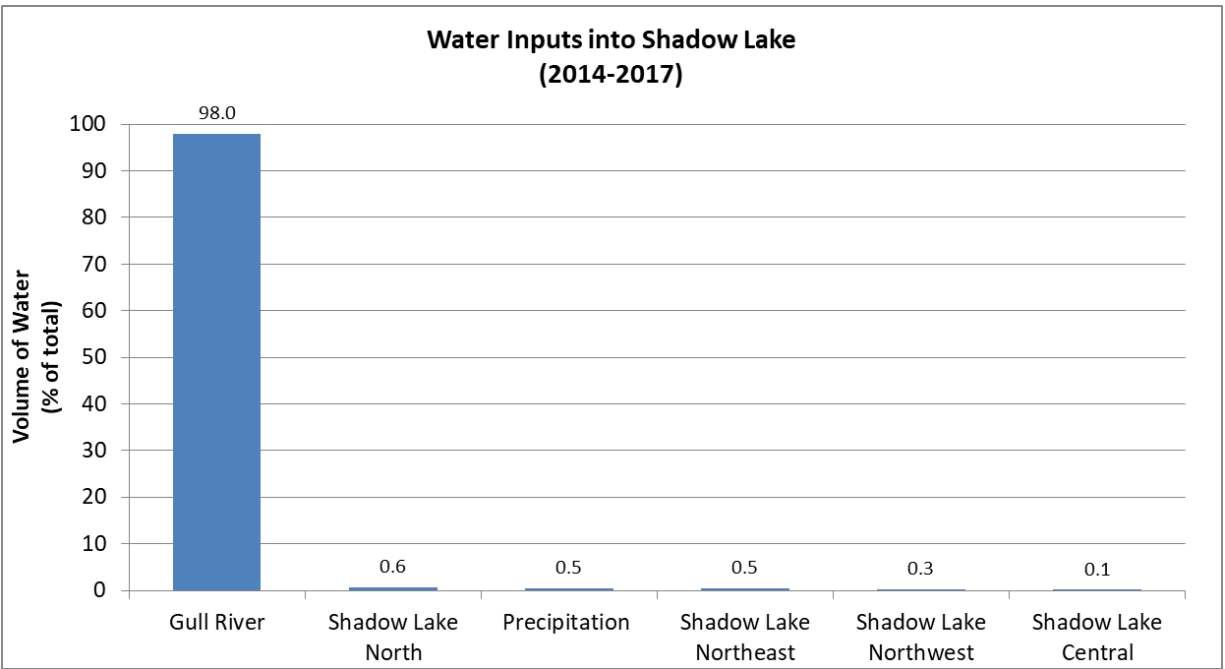


Figure 1.6: The major sources of water, by volume, entering Shadow Lake and Silver Lake on an average yearly basis (2014-2017)

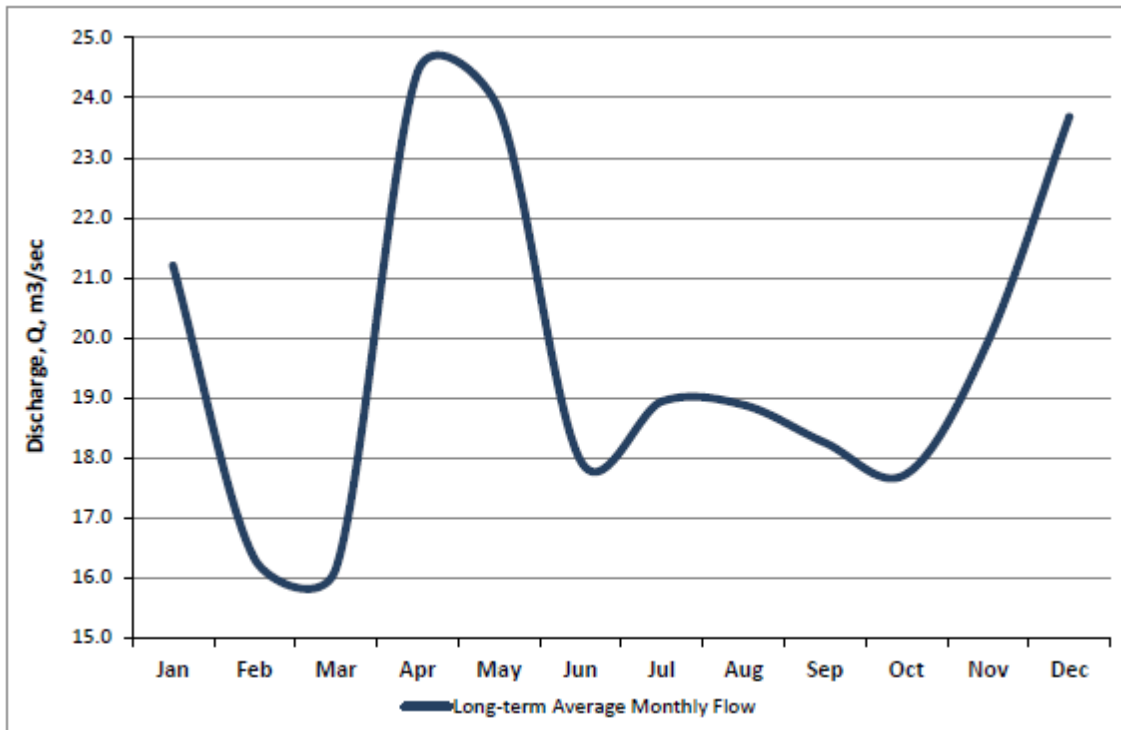


Figure 1.7: Long-term Average Monthly Flow Observed at the Gull River at Norland Hydrometric Station, 1962-2017

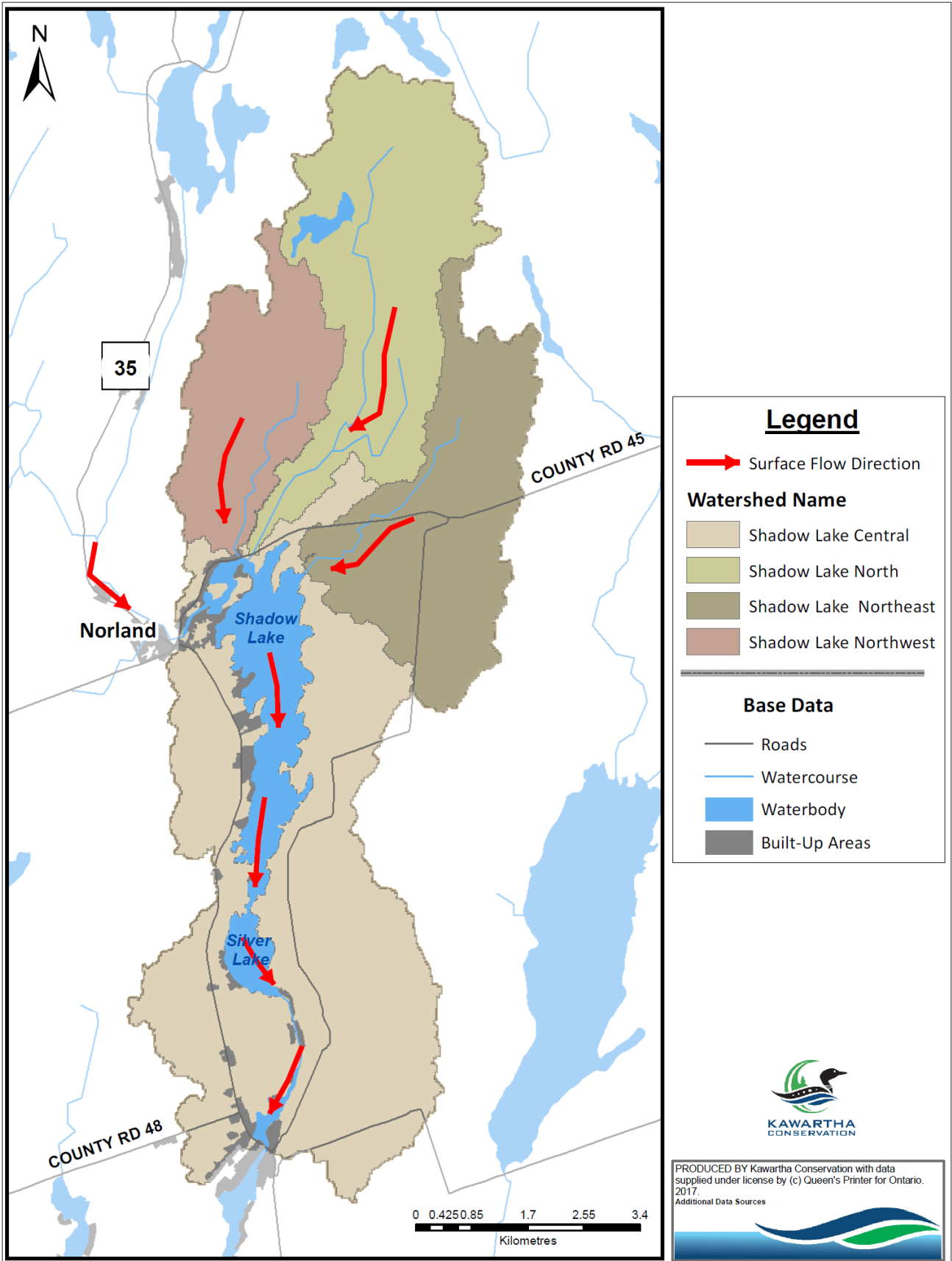


Figure 1.8: Major subwatersheds and their flow direction within the Shadow Lake and Silver Lake Planning area

### **1.5.3 Water Quality**

The need to maintain excellent water quality conditions in Shadow Lake and Silver Lake a major trigger for development of the *Shadow Lake and Silver Lake Management Plan*. Exceptional water quality is important to maintaining the environmental, economic, and socio-cultural benefits provided by the lake.

Shadow Lake and Silver Lake can be characterized as oligotrophic (low productivity, or unenriched) water bodies having excellent water quality. Average phosphorus concentrations in the lakes are well within the *Provincial Water Quality Objectives* (Ontario Ministry of Environment and Energy, 1994) of 10 ug/L thus are not prone to nuisance concentrations of algae (Figure 1.9). Similarly, water quality within the tributaries draining into and out of Shadow Lake and Silver Lake is also considered to be in an excellent state. As stated in the *Provincial Water Quality Objectives* (Ontario Ministry of Environment and Energy, 1994), excessive plant growth in rivers and streams should not be evident at a total phosphorus concentration below 30 ug/L. Recent sampling indicates all watercourses have phosphorus concentrations that meet this objective. Long term trends in water quality as represented by conditions at the outlet of the lakes (Coboconk) indicate better quality conditions since the 1970's and a period of relative stability over the past 20 years (7-9 ug/L) (Figure 1.10).

The fact that Shadow Lake and Silver Lake are not nutrient enriched is not unexpected, given that their major water source (the Gull River), has low concentrations of phosphorus owing to its position on the granite rocks of the Canadian Shield and general lack of wide-spread development and human activity. Waters entering the lake from the Gull River thus tend to be nutrient poor and slightly acidic. Shadow Lake and Silver Lake is partially underlain by limestone bedrock, and therefore has a greater buffering capacity than other lakes in the Canadian Shield and is more resilient to impacts associated with acid rain. However, calcium concentrations in the lakes remain relatively low (approximately 10 mg/L) and therefore limit the production of zebra mussels, an invasive aquatic invertebrate that has spread significantly in neighbouring lakes having relatively higher calcium and less acidity (e.g., Four Mile Lake, Balsam Lake).

A significant concern among local residents was the potential for contamination of the lake from shoreline septic systems that are inundated during high water level events. Sampling for *E.coli* during these periods indicated no water quality impairments. Elevated *E.coli* values were only recorded in the public beach area.

#### *Phosphorus Loading by Water Source*

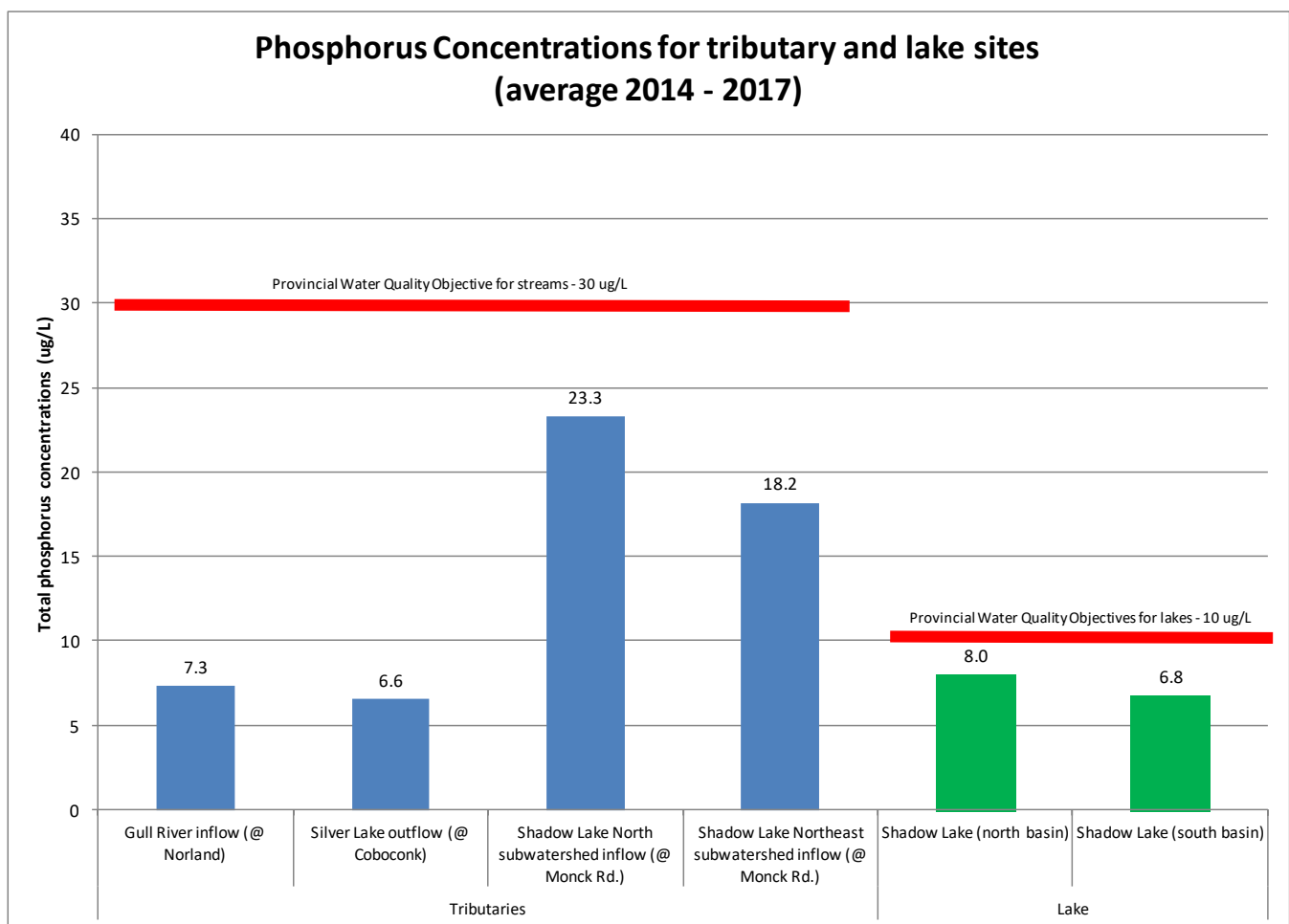
Another way of summarizing phosphorus information is to convert concentrations to loading amounts. Loading is the amount of phosphorus, by weight, that enters the lake on a yearly basis.

For Shadow Lake and Silver Lake, the phosphorus loading data from 2014 to 2017 indicate that approximately 5849 kg of phosphorus enters the lake every year. The majority of phosphorus enters the lake during the spring, when elevated runoff caused by snowmelt and precipitation carries large quantities of nutrients into the lake. Figure 1.11 provides a breakdown of current phosphorus inputs into the lake by water input source. The categories represent inputs from the catchment areas identified in Figure 1.8. The following provides a summary of current phosphorus loadings into Shadow Lake and Silver Lake each year by water source.

- Gull River accounts for 87% (5063 kg) of the total. This value is relatively high compared to the other subwatersheds and is due to its significantly higher annual flow contribution to the lake (approximately 98% of total flow entering Shadow Lake and Silver Lake).
- Local Subwatersheds accounts for 12% (706 kg), which includes inputs from the following:



- Shadow Lake Central accounts for 6.6% (384 kg) of the total. This total includes estimated loadings from surface water runoff from several unnamed tributaries flowing into the lakes, as well as all of the estimated inputs from shoreline septic systems around the lakes.
- Shadow Lake Northwest accounts for 2.5% (148 kg) of the total.
- Shadow Lake North accounts for 1.8% (107 kg) of the total.
- Shadow Lake Northeast accounts for 1.2% (67 kg) of the total.
- Atmospheric deposition accounts for 1.4% (80 kg) of the total. This category was measured from rain and snow sampling and includes inputs from wet deposition such as rain, snow, and dew, as well as from dry deposition from dust. Due to the extremely small surface area of the lake compared with its upstream drainage areas, the contribution from atmospheric deposition is relatively miniscule.



**Figure 1.9: Average phosphorus concentrations (2014-2017) in Shadow Lake and connecting tributaries during the ice-free period, in relation to provincial water quality objectives**

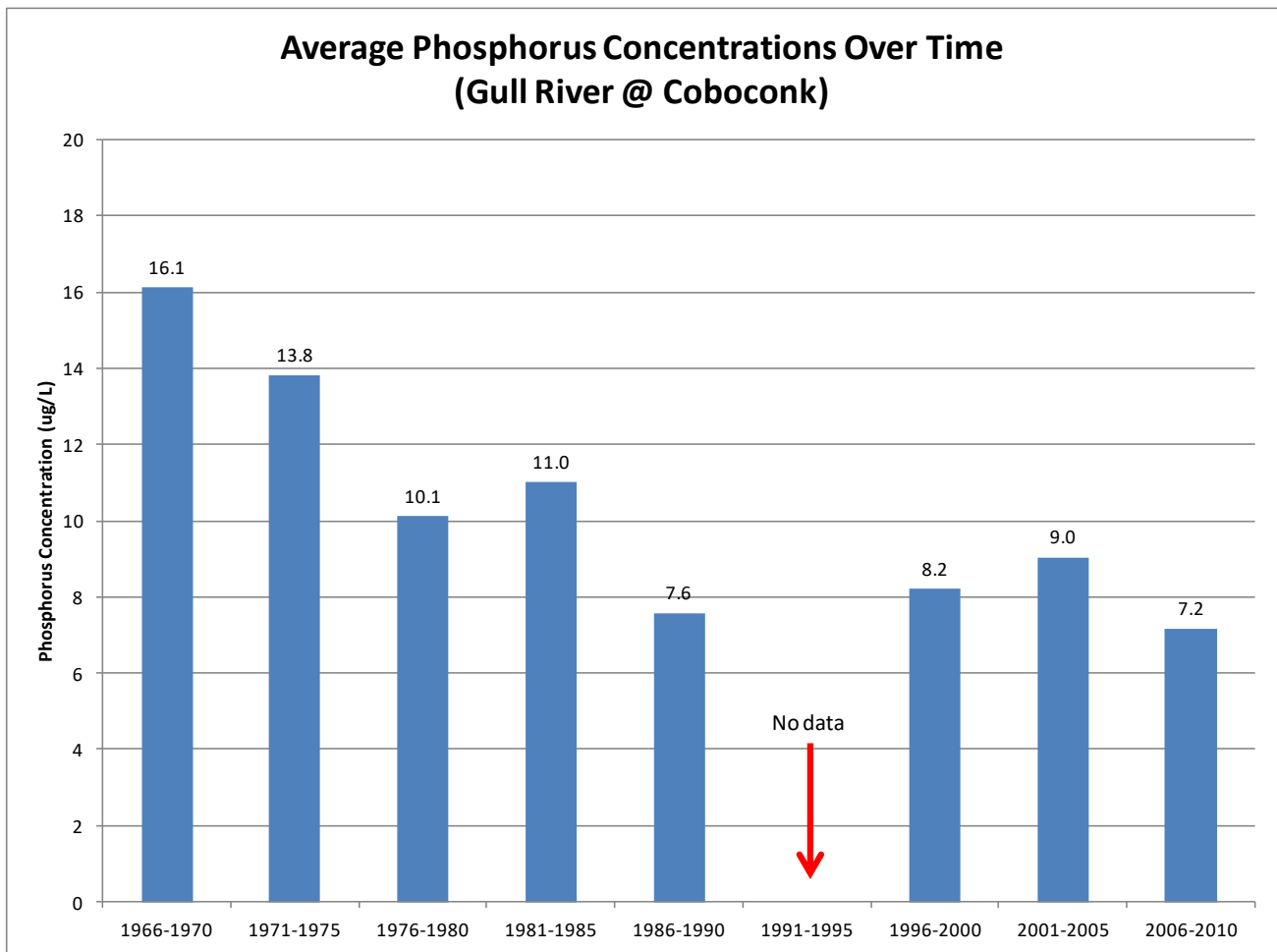


Figure 1.10: Long term average phosphorus concentrations at the outlet of Silver Lake, in Coboconk at Highway 35

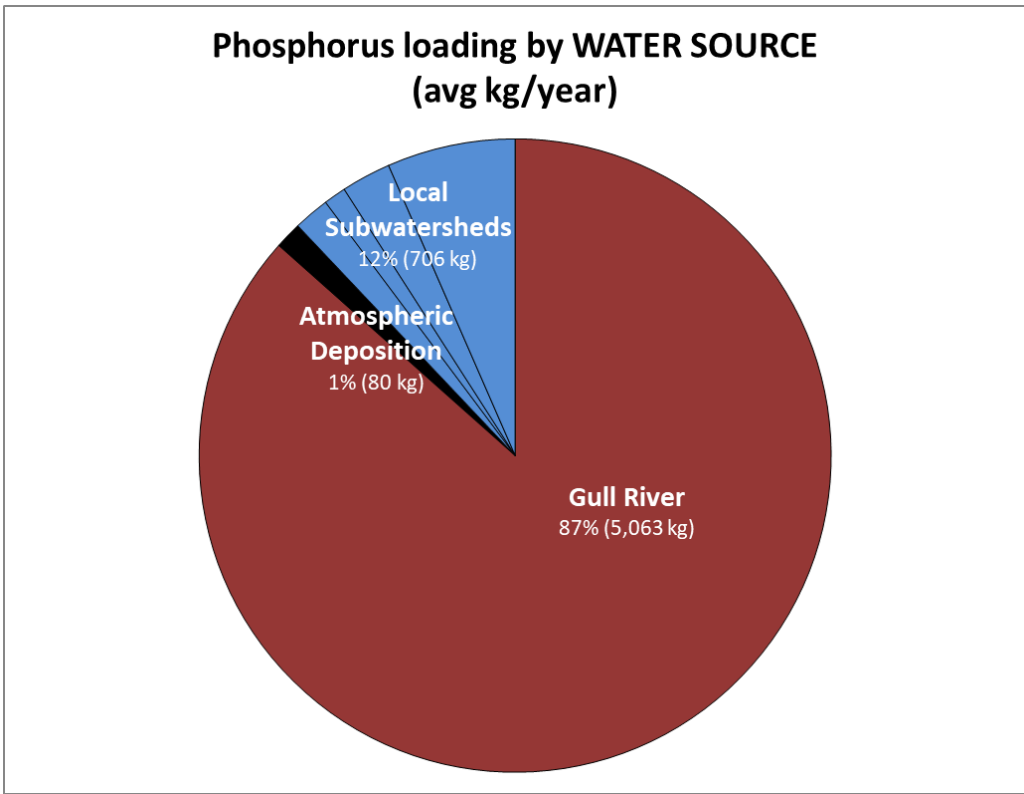


Figure 1.11: Average annual phosphorus loadings into Shadow Lake and Silver Lake, by major water source (2014-2017)

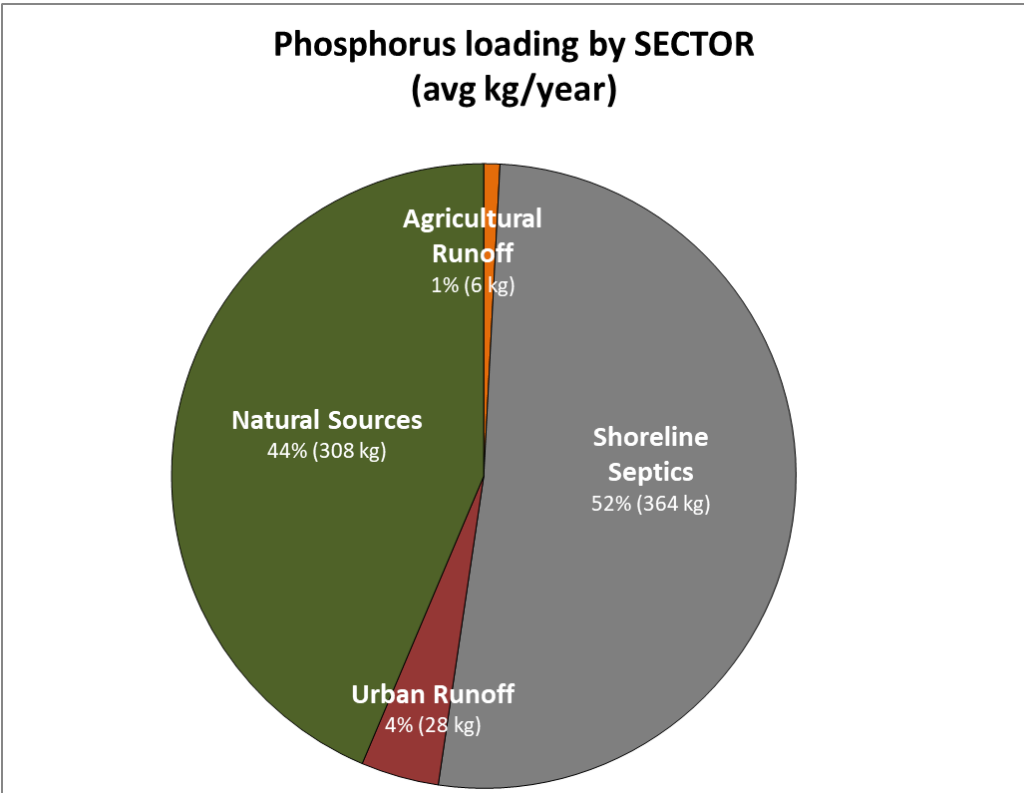


Figure 1.12: Average annual phosphorus loadings into Shadow Lake and Silver Lake, by sector (2014-2017)

To determine the amount of phosphorus loadings into the lake by sector, inputs from all local subwatersheds of Shadow Lake Northwest, Shadow Lake North, Shadow Lake Northeast, and Shadow Lake Central (i.e., the blue pie slices of Figures 1.10) have been broken out into the estimated inputs generated from Natural Sources, Agricultural Runoff, Urban Runoff, and Shoreline Septic Systems. This approach assists in identifying human-derived sources of nutrients that could have management potential.

The following provides a summary of current phosphorus loadings into Shadow Lake and Silver Lake, by sector, in the four local subwatersheds that drain into the lake (Figure 1.11). These account for 12% (706 kg) of the total inputs into the lake from the subwatersheds of Shadow Lake Northwest, Shadow Lake North, Shadow Lake Northeast, and Shadow Lake Central water sources.

- Shoreline Septic Systems account for an estimated 52% (364 kg) of the total phosphorus entering Shadow Lake and Silver Lake from the local subwatersheds, which represents 6% of the total entering the lake from all sources. This value includes estimated inputs from systems (e.g., holding tanks, tile beds, etc.) in close proximity to the Shadow Lake and Silver Lake shoreline. There are approximately 538 residences with private septic systems within 75m of the lake. To calculate phosphorus loading from septic systems, it was estimated that 100% of the phosphorus leaving each septic tank eventually reaches the lake. The phosphorus entering the lake from septic systems is of particular concern because it is orthophosphate, a form of phosphorus that is readily available for instantaneous algae growth.
- Natural Sources account for an estimated 44% (308 kg) of the total phosphorus entering Shadow Lake and Silver Lake from the local subwatersheds, which represents 5% of the total entering the lake from all sources. This source represents phosphorus that is deemed to enter the lake naturally (that is, without human origin) through stream and river flow within the core planning area. Examples of these inputs include wetlands and forests.
- Urban Runoff accounts for an estimated 4% (28 kg) of the total phosphorus entering Shadow Lake and Silver Lake from the local subwatersheds, which represents less than 1% of the total entering the lake from all sources. This represents the phosphorus generated from developed areas around the lake shoreline and within its watershed that enters the lake through stream overland flow. Examples of phosphorus inputs from shoreline development and activities include lawn fertilizers and pet wastes.
- Agricultural Runoff accounts for an estimated 1% (6 kg) of the total phosphorus entering Shadow Lake and Silver Lake from the local subwatersheds, which represents less than 1% of the total entering the lake from all sources. This represents the farm-generated phosphorus estimated to come from crop lands (rare) and pasture fields (more common) that enters the lake through stream and river flow within the core planning area. Examples of these inputs include fertilizer applications, field erosion, and livestock manure.

### *Phosphorus Benchmarks*

All subwatersheds have phosphorus concentrations that meet the *Provincial Water Quality Objectives* (Ontario Ministry of Environment and Energy, 1994). In striving to maintain, and where possible enhance, the existing healthy water quality conditions, there is a need to maintain or reduce these levels to buffer impacts from future cumulative pressures. Thus, management benchmarks have been developed for phosphorus loading amounts based on their estimated contributions by sector.

As illustrated, there are 4 major water sources that load phosphorus into Shadow Lake and Silver Lake: Shadow Lake Northwest, Shadow Lake North, Shadow Lake Northeast, and Shadow Lake Central (Figure 1.11). Sector-specific

benchmarks have been developed for the sources of phosphorus considered manageable within the Local Subwatersheds category. Atmospheric Deposition is excluded because it is considered an unmanageable source.

As shown in Figure 1.12, the Local Subwatershed category has been further broken down into four sector-specific phosphorus contributions: Natural Sources, Agricultural Runoff, Urban Runoff, and Shoreline Septic Systems. The sector-based benchmarks only apply to Agricultural Runoff, Urban Runoff, and Shoreline Septic Systems categories. These three sources are considered manageable, whereas Natural Sources are not.

Benchmarks for urban runoff were developed by estimating that the existing loading from developed areas could be reduced by approximately 15% with the uptake of lot-level water quality improvement practices. Estimates are based on current research (e.g., Steinman et al., 2015) that suggests that implementation of various best management practices such as infiltration swales, permeable pavement, and rain gardens can reduce phosphorus loading by approximately 15%. Benchmarks for shoreline septic systems were developed by estimating that approximately 5% of existing systems are "failing" (i.e., not functioning properly, which in the worst case equates to direct pollution into the lake). Estimates are based on recent septic inspection findings from lakes within Ontario (e.g., B.M. Ross Associates and Township of Huron-Kinloss, 2014) that suggest that approximately 5% of inspected septic systems were deemed to be either an environmental hazard or structurally unsafe. Therefore, the benchmark expresses how much reduction is needed to offset the "failing" loadings. Benchmarks for agricultural runoff were developed by estimating that the existing loading from farmlands could be reduced by approximately 25% with the uptake of water quality improvement practices. Estimates are based on current research (e.g., Makarewicz et al., 2015) that suggest that implementation of various best management practices such as grassed waterways, cover crops, and streambank stabilization can reduce phosphorus loading by approximately 25%.

- The phosphorus benchmark for Shadow Lake and Silver Lake is a maximum loading rate of approximately 374 kg per year from manageable sources. This equals a reduction of existing average annual phosphorous loadings by approximately 24 kg, or minus 15% of current loading from manageable sources. Manageable sources include the subwatersheds that drain into Shadow Lake and Silver Lake (Table 1.5). Sector-specific phosphorus benchmarks are
  - 24 kg/year (minus 15% of current loading) or less, from Urban Runoff;
  - 4 kg/year (minus 25% of current loading) or less, from Agricultural Runoff; and
  - 374 kg/year (minus 5% of current loading) or less, from Shoreline Septic Systems.

**Table 1.5: Phosphorus benchmarks on a sector basis**

Major Input Source		Existing Phosphorus Inputs (kg/year)	Benchmark Water Quality Objectives (kg/year)	Overall Reduction Needed (kg/year)
Gull River		5063	-	-
Local Subwatersheds	Urban Runoff	28	24	4 (15%)*
	Agricultural Runoff	6	4	2 (25%)**
	Shoreline Septic Systems	364	346	18 (5%***)
	<b>Subtotal: Manageable Sectors</b>	398	374	24 (6%)
	Natural Sources	308	308	0 (0%****)
Atmospheric Deposition		80	80	0 (0%****)
<b>Total: All phosphorus inputs</b>		<b>5849</b>	-	-

\*Benchmarks for urban runoff are based on recent research from other areas (e.g., Steinman et al., 2015) that suggests by implementing various best-management practices, it is reasonable to expect a 15% decrease in phosphorous inputs from shoreline development areas.

\*\*Benchmarks for agricultural runoff are based on recent research from other areas (e.g., Makarewicz et al., 2015) that suggests by implementing various best-management practices, it is reasonable to expect a 25% decrease in phosphorus inputs from agricultural areas.

\*\*\* Benchmarks for shoreline septic systems are based on recent system inspection findings from lakes within Ontario (e.g., B.M. Ross Associates and Township of Huron-Kinloss, 2014) that suggests that approximately 5% of existing shoreline septic systems are considered high risk of failing (i.e., an environmental hazard or structurally unsafe), which equals approximately 18.2 kg per year of phosphorus going into Shadow Lake and Silver Lake. Therefore, a 5% reduction from existing loading values is needed to make up this difference.

\*\*\*\* Benchmarks for natural sources and atmospheric deposition are not applicable, and thus are not included in the overall reduction needed values.

### **1.5.4 Aquatic Ecosystems**

Aquatic ecosystems refer to the water-related components that support life in and around Shadow Lake and Silver Lake. Healthy aquatic life provides significant benefits such as economic revenue (e.g., a high quality fishery that attracts anglers to the area), social significance (e.g., a picturesque cottage-country setting with abundant wildlife), and ecological integrity (e.g., a self-perpetuating food web). As our lake-based communities continue to grow, so does the pressures placed on its ecosystem. The cumulative effects of pressures such as incremental habitat loss, pollution, and introductions of non-native species can cause dramatic shifts in the lake food web. Responsible management is needed not just at a property level, but also in recognizing that life in lakes is dependent upon multiple components connected at a broader ecosystem level.

Shadow Lake and Silver Lake support diverse fish communities that contribute to a functioning warmwater recreational fishery. Approximately 20 fish species have been documented within Shadow Lake and Silver Lake, many of which are important (e.g., walleye, smallmouth bass, muskellunge) in supporting a small recreational fishery. According to the most recent available data (2009), the fish community in Shadow Lake and Silver Lake consists of warm- and cool-water species dominated by yellow perch, smallmouth bass, rock bass, white sucker, walleye, bluegill, muskellunge, and cisco. Shadow Lake supports sensitive, coldwater fishes including cisco, mottled sculpin, and trout-

perch. These fishes are able to persist likely because of deep basins which thermally stratify during the summer months. Thermal regime sampling suggests that coldwater stream communities are likely present in the middle reaches of Shadow Lake Northeast Subwatershed (in the vicinity of Shadow Lakes Road 10). No known fish species listed as Special Concern, Threatened or Endangered have been documented.

Shadow Lake and Silver Lake have been exposed to a variety of non-native aquatic species, particularly fishes (common carp, walleye, bluegill, black crappie, rainbow smelt). There is limited data available for the lakes and subwatersheds draining directly into the lake, but yellow iris has been confirmed in 2017. Northern pike have been recently observed (2016) in Shadow Lake. This non-native fish is expanding its range into the Kawartha Lakes and connecting waters and are of concern considering they have the potential to outcompete muskellunge. Within the larger Gull River watershed, the following have been reported at present: Chinese mystery snail, rusty crayfish, common reed, and European frog-bit. In addition to these existing non-native species, there are others that are at immediate risk of becoming established (e.g., round goby). Zebra mussels, a filter feeding organism found in many neighbouring lakes (e.g., Balsam Lake, Four Mile Lake), are not likely to proliferate in Shadow Lake and Silver Lake given calcium concentrations are considered too low to sustain local populations. Proliferations of non-native species are considered invasive when they have negative ecological and economic impacts. The hydrological interconnectedness, and close proximity of Shadow Lake to the Gull River and Kawartha Lakes are likely contributing factors in the spread of invasive species.

Lake tributaries provide important ecological pathways to and from the lake. The Gull River inlet, for example, provides habitat for spawning walleye populations. The other main tributaries entering the lake likely provide habitat for lake dwelling organisms but are under-studied. Access to aquatic habitat can be fragmented by man-made obstructions including dams, weirs, and perched or blocked culverts, as well as by natural obstructions such as steep river channels and fast flowing waters. Not only do such features impede migration, but they can also isolate populations and limit their access to suitable resident habitat. The two main obstructions include the Norland dam which restricts access to the Gull River, and the Coboconk dam which restricts access to Balsam Lake. In addition, there are three identified perched culverts that restrict access at least during the summer months, including two that are near the outlets of medium-sized tributaries (Shadow Lake North and Northeast subwatersheds at Monck Rd.) and one that exists in the mid-reaches of the sensitive coldwater stream (Shadow Lakes Northeast subwatershed at Shadow Lake Road 10).

Aquatic habitat conditions along the creeks draining directly into Shadow and Silver Lakes are of excellent quality, owing to the lack of human disturbance. Subwatersheds that drain directly into the Shadow Lake planning area have exceptional coverage of natural areas, particularly forests and wetlands. Along creek corridors, natural riparian areas comprise over 95% of their entire length, and are within acceptable guidelines for maintaining aquatic ecosystem health. This is substantiated by exiting benthic macroinvertebrate communities.

**Table 1.6: Fish species present or recorded historically in Shadow Lake and Silver Lake.**

<b>Fish by Common Names</b>		
Black Crappie	Largemouth Bass	<b>Smallmouth Bass</b>
Blacknose Shiner	Logperch	Spottail Shiner
Bluegill	Mottled Sculpin	Sunfish Sp.
Bullhead Sp.	<b>Muskellunge</b>	Trout-perch
Cisco	Northern Pike	<b>Walleye</b>

Common Carp	Pumpkinseed	White Sucker
Fathead Minnow	Rainbow Smelt	Yellow Perch
Golden Shiner	Rock Bass	

**Bold** indicates important species to the recreational fishery

### **1.5.5 Terrestrial Natural Heritage**

Shadow Lake and Silver Lake lies within in an area known as “The Land Between,” a transitional zone between two distinct ecological units: the Canadian Shield and the St. Lawrence Lowlands. This overlap in area is significant on a provincial scale as it provides a unique concentration and diversity of natural heritage features that occur within both of these distinct land-form types.

Natural cover on the landscape (that is, forests, wetlands, meadows, and vegetative corridors along water courses and shorelines) is essential to maintaining healthy lakes and their watersheds. The services provided by these natural features include the following:

- Filter and utilize nutrients, absorbing sediments and other pollutants from surface water runoff.
- Improve air quality through filtration and oxygen release.
- Provide natural aesthetic vistas.
- Provide wildlife habitat, including habitat for species we are just starting to understand (e.g., a wide range of pollinators).
- Provide the first line of defense in flood attenuation by absorbing high water levels.
- Provide recreational opportunities such as hunting, hiking, and wildlife watching.
- Reduce shoreline erosion.
- Sequester carbon to reduce atmospheric carbon dioxide levels, thus contributing to the mitigation of the effects of climate change.
- Moderate summer temperature extremes through shade and transpiration.

Approximately 45% of the shoreline area around Shadow Lake and Silver Lake remains in a natural state, with forests being the dominant natural cover type. The subwatersheds, on the other hand, contain large tracts of natural lands most of which is upland forests (Figure 1.13). Several of these forested areas, particularly in the western and eastern sections of Shadow Lake Central subwatershed are classified as provincially significant woodlands. These large tracts of natural areas are considered ‘core natural areas’, important natural heritage habitats that are important on a regional basis for sustaining populations of wildlife.

According to a research document titled *How Much Habitat is Enough?* (Environment Canada, 2013), a certain minimum amount of natural cover types are needed on the landscape to maintain healthy ecosystems. These benchmarks exist for forest, wetland, and streamside vegetation amounts. We can compare existing natural cover values in the core planning area against these benchmarks to provide insight into the condition of our terrestrial natural heritage. Table 1.7 provides a summary of management benchmarks calculated for each subwatershed and the core planning area. Where the existing natural cover level is below the benchmark, the additional cover required to meet the benchmark has been presented. Owing to the extensive areas of natural cover, the subwatersheds of Shadow Lake and Silver Lake meet all guidelines except for Shadow Lake and Silver Lake Central, which is slightly lacking in wetland cover. However, due to the physiography within this area (i.e., shallow soils over well-drained limestone bedrock) this subwatershed is not naturally conducive to extensive wetland formation.

The Shadow Lake and Silver Lake planning area is known to provide natural habitat that supports the following species of conservation concern (i.e., listed as Special Concern, Endangered, or Threatened), including: five reptiles



(milk snake, snapping turtle, Blanding’s turtle, common five-lined skink, Eastern hog-nosed snake), one plant (butternut), one bird (Eastern meadowlark), and one insect (rusty-patched bumblebee).

**Table 1.7: Table summarizing existing forest, wetland, and streamside vegetation cover within the Shadow Lake and Silver Lake Planning area, in relation to ecosystem health benchmarks**

<b>Subwatershed</b>	<b><u>Forests</u></b> Benchmark = >50%	<b><u>Wetlands</u></b> Benchmark = >10%	<b><u>Streamside Vegetation</u></b> Benchmark = >75%
SL_Northwest	67.8	10.4	98
SL_North	73.8	12.9	98
SL_Northeast	77.9	16.5	97
SL_Central	65.5	1.3	71
<b>Total Shadow Lake and Silver Lake Planning Area</b>	<b>69.3</b>	<b>7.5</b>	<b>93</b>

Red highlight: existing amount does not meet benchmark

Green highlight: existing amount meets benchmark

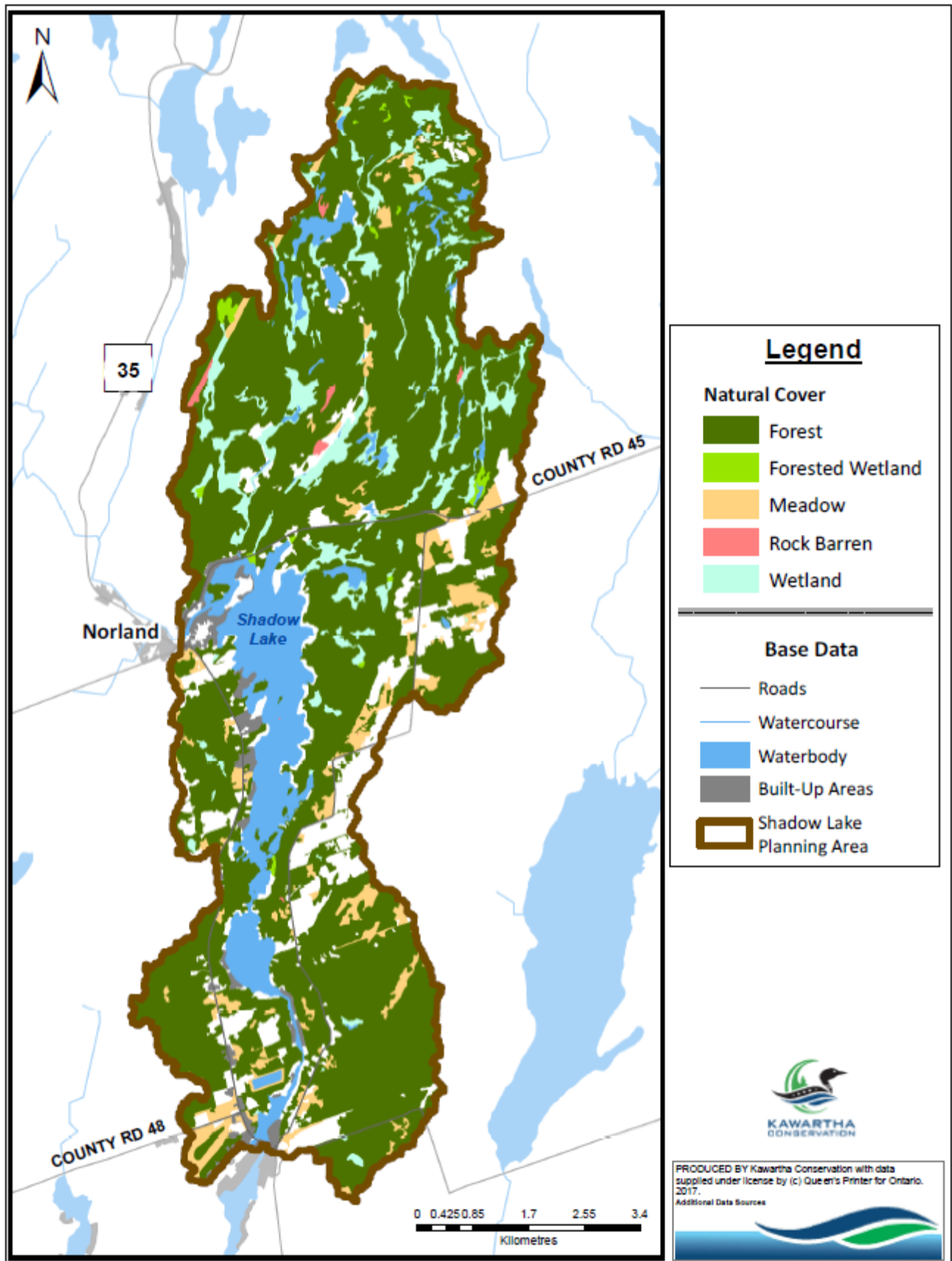


Figure 1.13: Map showing natural cover types within the Shadow Lake and Silver Lake Planning area

## 2.0 Management Objectives



*Aerial view of northern section of Shadow Lake  
(Photo courtesy of Lou Wise)*

## 2.1 Introduction

This chapter provides a summary of the management objectives of the *Shadow Lake and Silver Lake Management Plan*. Objectives are "what we want to achieve" through a coordinated approach to managing the lake. The objectives form the basis of the Implementation Strategies and were developed through community consultation. Each management objective is organized into the following: Background, Issues, and Implementation Approach. There are six objectives in total.

*Background* provides a summary of the objective, including its origin and why it's important. Key points are highlighted, such as valued components, current state, and apparent trends that are relevant in implementing the *Shadow Lake and Silver Lake Management Plan*.

*Issues* are barriers that prevent us from realizing the objective. Issues have been identified by two means: (1) technical studies, science-based research, and anticipated relevance and (2) concerns expressed through the lake-stakeholder consultation process.

*Implementation Approach* is a summary of how we intend to address issues and fully realize our objectives. Actions are presented under each strategy in Chapter 3: Implementation Strategies. For specific details related to each action, please refer to Implementation Strategies.

### Strategies

- **Stewardship:** Actions that are tailored to shoreline landowners and lake users to voluntarily undertake best management practices on their properties for the benefit of all and the future health of the lake
- **Strategic Planning:** Actions that give profile to pro-active land use policy and natural resource planning initiatives.
- **Urban and Rural Infrastructure:** Actions that focus on voluntarily maintaining sustainable public areas and construction works including lake-access areas, roads, and all construction sites.
- **Research and Monitoring:** Actions focused on addressing, through collaboration, science-based information gaps to better understand the response of the lake to emerging pressures, and tracking environmental health and plan effectiveness through time.
- **Communications and Outreach:** Actions that encourage dialogue and information-sharing among all stakeholders and promote sustainable practices to maintain healthy lake environments. In this chapter, there are no specific Communications and Outreach actions identified under each Management Objective because effective communication is crucial to implementing all aspects of the management plan. Please refer to the Communications and Outreach Strategy in Chapter 3 for all Communication and Outreach actions.

## 2.2 Management Objective #1:

### Reduce extreme water levels affecting shoreline properties

#### BACKGROUND:

- Water levels on Shadow Lake and Silver Lake are influenced by the water management operations of the Trent-Severn Waterway. Shadow Lake and Silver Lake exist at the bottom end of the Gull River Watershed, which is a significantly large drainage system that is managed as a series of reservoir lakes and rivers to supply water volumes as required to the Trent-Severn Waterway navigational system. Thus these lakes are considered ‘flow-through’ lakes that experience more variable water levels than compared to other large lakes within the municipality (e.g., Balsam Lake, Four Mile Lake, etc.), as a result of both natural hydrological and geography conditions, as well as water management decisions affecting Gull River flows entering Shadow Lake. Shoreline residents frequently experience high water levels during spring months, leading to sometimes (and apparently more frequent) extensive flooding of shoreline properties.

#### ISSUES:

- Variability in water levels, and extreme high and low water events. During exceptionally high precipitation and/or snow melt events within the Gull River Watershed there is so much runoff flowing downwards through the system that by the time it accumulates and flows through Shadow Lake and Silver Lake, the water bodies are not large enough, and there is not enough storage in upstream reservoirs, to freely pass the water thus water levels rise. These events lead to flooding conditions in the spring along shoreline properties, an occurrence that has happened twice (2015 and 2017) within the past five years. Throughout the summer months water level variability (approximately 1.5m in difference) is a concern among shoreline residents, as Gull River inputs are manipulated through dams to either increase or decrease flows to maintain stable conditions along the Trent-Severn Waterway navigable system. There have been several studies into the operations of Parks Canada which identify these lakes as high risk for variable and extreme events. Waterfront residents are actively communicating with Parks Canada to investigate opportunities to achieve acceptable water level conditions. The potential impacts to the natural environment (e.g., wetlands, sensitive habitats, etc.) resulting from water level manipulations are not well understood.

## IMPLEMENTATION ACTIONS (Objective #1):

### Strategic Planning

- Continue efforts to identify opportunities to mitigate impacts of fluctuating and extreme water level events, in particular high and low water flows, on shoreline properties [Action B1 – page 56].
- Undertake responsible development planning within the watershed, and particularly along the shoreline [Action B2 – page 57].

### Research and Monitoring

- Undertake routine monitoring of, and establish a relationship between, water levels and flows in Shadow Lake and Silver Lake to better characterize their hydrological regime [Action D2 – page 64].

### Communications and Outreach

- Communicate on a regular basis the water management activities along the Gull River, including early warning of high, low, and variable water level events [Action E2 – page 69].

## 2.3 Management Objective #2:

### Maintain excellent water quality conditions

#### BACKGROUND:

- Shadow Lake, Silver Lake, and their connecting tributaries have excellent water quality. There is overwhelming community support for maintaining excellent water quality conditions. Data indicate that waters in Shadow Lake and Silver Lake are considered clear and clean, and do not impair fish and wildlife populations. This is due in large part to the exceptionally clean water entering Shadow Lake from the Gull River, which is also the most significant source of flow volumes of both lakes. Further, water moves through these lakes relatively rapidly (i.e., high flushing rate) which replenishes the lakes with clean water on a regular basis. Water quality in Shadow Lake and Silver Lake, as indicated by nutrient concentrations, has improved since the mid-1960's, and from the mid-1980's to the present has remained relatively stable. Nutrient concentrations within Shadow Lake and Silver Lake and all its local subwatersheds meet provincial water quality guidelines.
- Life in and around the lake needs clean water. Several lakeside residents draw water along shorelines for personal use, and thus need access to clean water. Aquatic ecosystems also need clean water to thrive. Excessive inputs of sewage, nutrients, sediments, toxic chemicals, and other elements can negatively impact the quality of the lake water for human use and ecosystem needs.

#### ISSUES:

- Occasional posting of Shadow Lake public beach as unsafe due to *E.coli*. Over the past ten years the public beach on Shadow Lake has been posted as potentially unsafe for swimming on average once a year, and on several instances 2-3 times per year, due to elevated *E.coli* levels. The reason for high *E. coli* remains unclear but are likely the result of a combination of factors including feces from birds, stormwater runoff over developed areas containing contaminants following storm events and/or shallow, warm waters with limited water circulation.
- Pollutants from shoreline development and activities. The shoreline is heavily developed around Shadow Lake and Silver Lake, and consists of mostly residential properties. Developed shoreline properties tend to contain significant amounts of hardened surfaces such as concrete, asphalt, and patio stones where pollutants (such as pet feces, oil, fertilizers, salt, etc.) accumulate. After a rain, these harmful substances tend to be washed directly into the lake instead of being purified by gradually filtering through vegetation into the ground. Furthermore, all shoreline properties are on private septic systems. Research suggests that in areas of shallow soil depths (as is the case along Shadow Lake and Silver Lake), there is a greater risk for leaching of contaminants into the lake if septic systems are not functioning optimally. Frequent high water situations that lead to inundated septic systems is of particular concern for these lakes. High nutrient and bacteriological loadings into the nearshore can deteriorate water quality and lead to increased aquatic plant growth. Given the high replenishment rate of Shadow Lake and Silver Lake with clean waters from the Gull River, these lakes are less susceptible than other lakes (e.g., those with high retention times, for example Four Mile Lake) to lake-wide water quality deterioration from local subwatersheds or shoreline areas.
- Potential contamination from other sources, including the Gull River Watershed. The potential for oil and/or gas spills from power boats, oil spills from shoreline properties, and other disturbances are areas of concern. In addition, given that water quality within the lakes is primarily influenced by water quality within the Gull River, shoreline development and intensification around the reservoir lakes is an issue of interest.

## IMPLEMENTATION ACTIONS (Objective #2):

### Stewardship

- Undertake responsible management of septic systems, including routine inspections, along shoreline properties [Action A1 - page 49].
- Manage stormwater runoff by increasing the filtering and absorbing capacity of shoreline properties [Action A3 - page 51].
- Maintain the natural features along the shoreline [Action A4 – page 52].
- Undertake responsible recreational boating within the lake, including routine equipment inspection and minimizing disturbance to sensitive habitats [Action A5 – page 53].
- Implement measures such as vegetated buffer strips along streams, conservation tillage, and other practices that reduce nutrient and soil loss from farms, with assistance from cost-share programs [Action A6 – page 54].

### Strategic Planning

- Continue efforts to identify opportunities to mitigate impacts of fluctuating and extreme water level events, in particular high and low water flows, on shoreline properties [Action B1 – page 56].
- Undertake responsible development planning within the watershed, and particularly along the shoreline [Action B2 - page 57].
- Undertake actions within the Fisheries Management Plan for Fisheries Management Zone 17, and the Trent Source Protection Plan [Action B3 – page 58].

### Urban and Rural Infrastructure

- Maintain safe and accessible public lake-access locations by improving water quality at the beach, addressing flooding along Baker Rd., and managing parking near the boat launch [Action C1 – page 60].
- Ensure that construction projects, particularly road maintenance works, are conducted in a manner that does not degrade water quality or sensitive habitats [Action C2 – page 61].

### Research and Monitoring

- Increase community participation in the routine monitoring of key indicators of lake health, including water quality and invasive species [Action D1 – page 63].
- Undertake an inventory of existing septic systems, water use, and occupancy status on shoreline properties to better inform nutrient loading estimations [Action D3 – page 65].



## 2.4 Management Objective #3:

### Maintain the biodiversity of the lake ecosystem

#### BACKGROUND:

- Biodiversity is what sustains healthy aquatic and terrestrial ecosystems. It includes all varieties of life and all habitats of Shadow Lake and Silver Lake and its subwatersheds. Biodiversity helps sustain the goods and services provided by the Shadow Lake and Silver Lake ecosystem, such as provisioning services (e.g., food and fresh water), regulating services (e.g., air quality regulation, erosion regulation, and pollination), and cultural services (e.g., educational values, inspiration, and sense of place). Native biodiversity, or life that is naturally occurring in an area, provides greater benefits to the lake ecosystem than non-native biodiversity. Shadow Lake and Silver Lake are located within a distinct ecoregion known as “The Land Between,” which is known for supporting high levels of biodiversity.

#### ISSUES:

- Proliferation of non-native invasive species. Shadow Lake and Silver Lake are prone to the introduction and spread of non-native species, in large part because: its shorelines have significant development, it is a popular vacation and angling destination, and its hydrological connection to the Trent-Severn Waterway. Several non-native species have been documented in their watershed, including European Common Reed, European frog-bit, rusty crayfish, among several others. Invasive species have been demonstrated to impact native biodiversity in Ontario lakes, and can have the potential to cause lake-wide ecosystem changes (e.g., the clearing of the water column from zebra mussel filter-feeding results in a deeper sunlight penetration depth, which in turn results in an increase in aquatic plants). The recent documentation of Northern Pike is of concern as they can negatively impact muskellunge, a native top predator and a keystone species supporting their recreational fishery.
- Wildlife species of conservation concern. Within the planning area, there are several documented wildlife species that are considered at risk on a provincial level. These species rely on functioning aquatic and terrestrial habitat for persistence, and the following have been noted as occurring in the planning area: milk snake, snapping turtle, Blanding’s turtle, common five-lined skink, Eastern hog-nosed snake, butternut, Eastern meadowlark, and rusty-patched bumblebee. Major threats to species of conservation concern include loss of habitat (e.g., removal of nearshore vegetation), increased disturbance from development activities and boating, direct mortality and injury by road vehicles and boat propellers.

## IMPLEMENTATION ACTIONS (Objective #3):

### Stewardship

- Undertake measures to reduce the risk of transferring aquatic and terrestrial invasive species into the lake and its watershed [Action A2 – page 50].
- Maintain the natural features along the shoreline [Action A4 – page 52].
- Undertake responsible recreational boating within the lake, including routine equipment inspection and minimizing disturbance to sensitive habitats [Action A5 – page 53].

### Strategic Planning

- Undertake responsible development planning within the watershed, and particularly along the shoreline [Action B2 – page 57].
- Undertake actions within the Fisheries Management Plan for Fisheries Management Zone 17, and the Trent Source Protection Plan [Action B3 – page 58].

### Urban and Rural Infrastructure

- Ensure that construction projects, particularly road maintenance works, are conducted in a manner that does not degrade water quality or sensitive habitats [Action C2 – page 61].

### Research and Monitoring

- Increase community participation in the routine monitoring of key indicators of lake health, including water quality and invasive species [Action D1 – page 63].
- Conduct research to identify how the lake ecosystem responds to stressors such as cumulative development, climate change, and invasive species [Action D4 – page 66].

## 2.5 Management Objective #4:

### Enhance and maintain the natural integrity of the shoreline

#### BACKGROUND:

- The zone between land and water is often referred to as the 'Ribbon of Life'. Shoreline areas are extremely rich in biodiversity and provide multiple benefits to the lake ecosystem including filtering contaminants, preventing erosion, and providing fish and wildlife habitat. The shoreline around Shadow Lake and Silver Lake is approximately 22 km in length and contains significant residential development.
- The lake shoreline is a dynamic system. Natural forces such as water currents, wave action, and ice movement can be a source of shoreline accumulation (e.g., gaining land) or shoreline erosion (e.g., losing land). A natural shoreline provides a stable waterfront in most instances, due to its ability to stabilize soil, absorb wave energy, and slow lot-level surface water runoff. Shoreline degradation is often accelerated by waterfront modifications such as removal of natural cover, hardening, infilling, and dredging.

#### ISSUES:

- Significant residential development along the lake shoreline. The shorelines of Shadow Lake and Silver Lake, including their connecting channels, are heavily developed. This development is mostly consisting of individual residential or cottage properties that occupy approximately 54% of land area adjacent to both lakes. Developed shorelines can cause reduced aquatic habitat potential, less water quality buffering capacity, greater wave action, land/water isolation, and other negative implications for the lake. The land/water interface along the shoreline, as well as shallow nearshore areas (less than 2m deep) are particularly prone to alterations from development and other activities associated within shoreline living. Data from a recent shoreline survey indicate that approximately 11.4% (4.5 km) of the land/water interface along the entire shoreline consists of artificial materials (e.g., manicured lawn, armourstone, etc.).
- Impacts to shoreline waterfronts resulting from high water levels. The relatively frequent high water levels experienced during the spring on Shadow Lake and Silver Lake means their shorelines are more susceptible to changes associated with flooding events. This can accelerate shoreline degradation (e.g., erosion, flooded septic systems, etc.) particularly along sections where natural vegetation has been removed to accommodate artificial structures and manicured lawns. High water events can also undermine efforts to naturalize shorelines, for example by washing away plantings and shallow soils.

## IMPLEMENTATION ACTIONS (Objective #4):

### Stewardship

- Undertake responsible management of septic systems, including routine inspections, along shoreline properties [Action A1 - page 49].
- Undertake measures to reduce the risk of transferring aquatic and terrestrial invasive species into the lake and its watershed [Action A2 – page 50].
- Manage stormwater runoff by increasing the filtering and absorbing capacity of shoreline properties [Action A3 - page 51].
- Maintain the natural features along the shoreline [Action A4 – page 52].
- Undertake responsible recreational boating within the lake, including routine equipment inspection and minimizing disturbance to sensitive habitats [Action A5 – page 53]

### Strategic Planning

- Continue efforts to identify opportunities to mitigate impacts of fluctuating and extreme water level events, in particular high and low water flows, on shoreline properties [Action B1 – page 56].
- Undertake responsible development planning within the watershed, and particularly along the shoreline [Action B2 – page 57].

### Research and Monitoring

- Undertake an inventory of existing septic systems, water use, and occupancy status on shoreline properties to better inform nutrient loading estimations [Action D3 – page 65].
- Conduct research to identify how the lake ecosystem responds to stressors such as cumulative development, climate change, and invasive species [Action D4 – page 66].

## 2.7 Management Objective #5:

### Improve our understanding of how the lake will respond to emerging pressures

#### BACKGROUND:

- Solid scientific understanding of lake-based pressures and how the lake ecosystem will respond to them are key elements in directing management decisions. Some of the important emerging pressures include:
  - Climate change. It is generally agreed that climate change is predicted to increase water temperatures and alter natural hydrological processes (e.g., more extreme weather events and changes to rainfall patterns). This will likely have impacts on multiple facets of the lake ecosystem including water quality, aquatic ecosystems including aquatic plant growth, and water levels and flows. This is of particular concern to Shadow Lake and Silver Lake residents, given they already experience relatively high number of extreme and variable water level events.
  - Cumulative development. It is unknown at what point development in the watershed/shoreline can cause serious negative implications for the lake aquatic ecosystem. Shoreline areas, in particular, are at risk of increasing development and urbanization. There is a need to improve scientific understanding about the interactions of these stressors within the lake to better manage the resource. Cumulative development along lakes within the Gull River reservoir lakes is also of concern, given that water quality within Shadow Lake and Silver Lake mirrors water quality entering the lake from Gull River.
  - Non-point sources of pollution. These are diffuse sources of pollution that are not easily measured because there is no single "outlet." A particular area of focus should be quantifying nutrient inputs into the nearshore areas of the lake (e.g., from septic systems, and shoreline development and activities) because these values are not well understood at this time.
  - Invasive species. Species introductions into areas outside their naturally occurring range can have profound impacts on lake dynamics. Zebra mussel proliferation in the Kawartha Lakes, resulting in increasing water clarity and leading to the proliferation of aquatic plants, is an example of the ecosystem-level impact of invasive species.

#### ISSUES:

- Limited monitoring programs and data on lakes ecosystem. There is a general lack of data for Shadow Lake, and in particular Silver Lake, compared to other large lakes within the City of Kawartha Lakes. Further, there is limited routine monitoring of key indicators of lake(s) health, such as invasive species, water quality, and biodiversity.

## IMPLEMENTATION ACTIONS (Objective #6):

### Research and Monitoring

- Increase community participation in the routine monitoring of key indicators of lake health, including water quality and invasive species [*Action D1 – page 63*].
- Undertake routine monitoring of, and establish a relationship between, water levels and flows in Shadow Lake and Silver Lake to better characterize their hydrological regime [*Action D2 – page 64*].
- Undertake an inventory of existing septic systems, water use, and occupancy status on shoreline properties to better inform nutrient loading estimations [*Action D3 – page 65*].
- Conduct research to identify how the lake ecosystem responds to stressors such as cumulative development, climate change, and invasive species [*Action D4 – page 66*].

## 3.0 Implementation Strategies



Shoreline properties inundated during high water event on Shadow Lake  
(North shore of Shadow Lake, Monck Rd., Spring 2017)

## 3.1 Introduction

The following Implementation Strategies provide a framework for a coordinated approach to maintaining a healthy Shadow Lake and Silver Lake. Integrated efforts are fundamental to improving the environment in and around the lake. Everyone in the watershed shares a responsibility for the current state of the lake, so everyone is needed to participate in management efforts. A broad spectrum of partners and residents are required to voluntarily undertake actions for the benefit of the lake. Working simultaneously, they can accomplish tasks in different areas. The more actions and strategies accomplished, the more likely that the objectives for a healthy lake environment will be met.

Implementation Strategies provide a suite of actions to help achieve the management objectives outlined in the previous chapter. For greater on-the-ground applicability, actions are presented under the following strategies:

- Stewardship Strategy,
- Strategic Planning Strategy,
- Urban and Rural Infrastructure Strategy,
- Research and Monitoring Strategy, and
- Communications and Outreach Strategy.

Within each strategy, an introductory context is provided for approaches to implementation along with detailed actions. The format for each management action is as follows:

**Action:** A brief description of the recommended management approach.

**Priority:** The level of priority for undertaking the particular action. A value was assigned for each action based on the five criteria listed below, and it was averaged to determine the overall priority level for the action. Please refer to Appendix C for more detail.

CRITERIA	Level	Value	Details
#1. Action meets multiple objectives?	High	3	Meets many (over half of) objectives
	Medium	2	Meets a few objectives
	Low	1	Meets a single objective
#2. Action is affordable?	High	3	Cost < \$5,000; easy to acquire local funding
	Medium	2	Cost >\$5,000 and <\$50,000; typical medium project proposal
	Low	1	Cost >\$50,000; must acquire significant funding
#3. Action has support from community?	High	3	Overwhelming support
	Medium	2	Majority support
	Low	1	Localized support
#4. Action builds public support for implementation?	High	3	High profile; includes a large number of stakeholders
	Medium	2	Medium profile; includes a medium number of stakeholders
	Low	1	Low profile; includes a small number of stakeholders
#5. Action has timely environmental benefit?	High	3	Short term (5 years or less) improvement
	Medium	2	Long term (5 years or more) improvement
	Low	1	Maintain status quo



**Rationale**: A description of why the action is important and how it supports the level of priority.

**Priority Areas**: A description of where the action is needed the most. It is most often geography based (e.g., specific subwatersheds or areas of the lake), but it is also based on other contexts (e.g., a specific threat).

**Lead and (Partner) Implementers**: Organizations, groups, or individuals who have been identified during the planning process as potentially leading or partnering in the implementation of actions. Partners are in parentheses.

**Deliverables**: A description of specific details and/or project measurables leading to successful implementation of an action. In some cases, a specific numeric target is identified.

## 3.2 Stewardship Strategy

Stewardship refers to the voluntary care of resources. In the context of this strategy, stewardship refers to the voluntary care by lakeshore property owners and lake users in a collective effort to meet the goals and objectives of the *Shadow Lake and Silver Lake Management Plan*.

We must all understand that our individual actions contribute to a collective impact on the health of the lakes and their watershed. With this knowledge, associated shoreline and lake users can take actions that contribute to sustaining the health of this valuable resource.

The actions outlined in this strategy contribute to maintaining excellent water quality and enhancing natural habitats. Emphasis is on privately-owned shoreline property, with a primary focus of creating awareness about and undertaking effective land and water stewardship practices. A second major focus is to provide technical assistance and other resources to private landowners in order to initiate positive stewardship actions.

The stewardship strategy works in conjunction with the Communications and Outreach Strategy.



Outlet valley of an unnamed watercourse that drains Shadow Lake North Subwatershed (upstream of Monck Rd., Summer 2017)

## **Action A1: Septic system maintenance**

Undertake responsible management of septic systems, including routine inspections, along shoreline properties.

### **Priority**

- High

### **Rationale**

- Septic systems at shoreline residences on the strip of land around the lake are estimated to contribute almost 364 kg/year, or 6% of the phosphorus load from all sources. This is the largest manageable source of phosphorus that enters the lake. A 5% reduction in septic system loading is needed to achieve the water quality benchmarks for the lake. This source of phosphorus has a potentially significant influence on nearshore water quality and aquatic plant proliferation, because it is readily available for uptake (orthophosphate). In addition, bacteria from sewage is often ineffectively treated or contained by faulty septic systems. Human health should be a major consideration when faulty systems are in the vicinity of residential wells and swimming areas. In addition, several waterfront properties along Shadow Lake and Silver Lake are prone to flooding and water inundating septic systems. Although no lake-wide impacts have been detected through sampling, there is a legitimate concern that flooded systems could leach contaminants into the lake and locally affect waters. Individual septic systems should be responsibly maintained.

### **Priority areas**

- Densely populated shoreline areas; older septic systems
- Septic systems that are prone to water inundation during high water levels.
- Septic systems in close proximity to the public beach

### **Lead and (partner) implementers**

- Shadow Lake and Silver Lake residents; City of Kawartha Lakes; Haliburton, Kawartha, Pine Ridge District Health Unit; (Shadow Lakes Association; septic system businesses; Federation of Ontario Cottagers' Associations)

### **Deliverables**

- Conduct periodic inspections of septic system to determine if functioning as designed or if pump-outs, repairs, or replacement is needed.
  - Require the septic system to be inspected by a licenced installer as a condition of property sale/purchase.
- Conduct regular pump-outs, every 3 to 5 years depending on use or when scum and sludge occupy more than one-third of capacity, to ensure septic system is functioning as designed.
- Take advantage, if necessary, of the recently approved City of Kawartha Lakes "Septic Rehabilitation Loan Program." This allows owners to enter into a longer-term payback agreement to access funds to repair or improve their system.
- Host periodic "dock talk" extension services and local workshops with a focus on helping homeowners understand, inspect, and manage septic systems.
- Continue investigating official complaints of potentially malfunctioning systems to address potential health hazards and determine corrective actions as required.
- Identify whether high water events inundate septic system and consider means (e.g., upgrading, moving, etc.) to prevent potential leaching of septage into lake.

## Action A2: Invasive species management

Undertake measures to reduce the risk of transferring aquatic and terrestrial invasive species into the lakes and their watersheds.

### Priority

- High

### Rationale

- The introduction and spread of non-native species throughout the aquatic and terrestrial environment is generating profound implications for ecosystem health throughout North America. Although documented invasive species within Shadow Lake and Silver Lake are limited, several have established populations within their drainage area including: European common reed, European frog-bit, rusty crayfish, among others, and are near impossible to eradicate once established to the detriment of biodiversity and lake-based values. Northern Pike, a non-native fish that has shown to compete with the native muskellunge, has recently been reported within Shadow Lake. Due to its hydrological connection with the popular Kawartha Lakes region, and intense shoreline usage, Shadow Lake and Silver Lake is susceptible to the introduction and spread of more aquatic species (e.g., round goby, zebra mussels) and terrestrial species (e.g., emerald ash borer, dog strangling vine). Probable pathways for spreading are through recreational activities (e.g., boating, hiking) and natural dispersal through the Gull River watershed and Balsam Lake.

### Priority areas:

- Vessels and in-water equipment that travels to and from Shadow Lake and Silver Lake
- Primary public boat launch in Norland (Gull River), on Government Dock Rd.
- Secondary public boat launch (Silver Lake), on Kelvin Rock Rd.
- Public access locations along Gull River.

### Lead and (partner) implementers

- Watershed residents; Invading Species Awareness Program - Ontario Ministry of Natural Resources and Forestry and Ontario Federation of Anglers and Hunters; (Federation of Ontario Cottagers' Associations; Shadow Lakes Association; recreational boaters and anglers; City of Kawartha Lakes; Ontario Nature; Kawartha Field Naturalists; Ontario Invasive Plants Council; Kawartha Conservation; construction industry)

### Deliverables

- Implement best management practices to reduce the risk of introducing and spreading invasive species, for example:
  - Inspect boats, trailers, boating equipment, fishing tackle and nets, and remove any visible plants or animals before leaving any water body.
  - Drain water from the motor, live well, and bilge and transom wells while on land, before leaving the water body.
  - Empty bait buckets on land before leaving the water body; avoid releasing live bait into a water body or transferring from one water body into another.
  - Wash and dry fishing tackle, nets, boat, and equipment to kill harmful species that may not be visible to the eye.
- Consider the feasibility of installing a voluntary boat and trailer wash station near the public boat launch. Appropriate runoff controls should be put in place at wash stations to prevent entry of potential exotic species into the lake.
- Report invasive species sightings through the Invading Species Hotline: 1-800-563-7711 and/or the Early Detection and Distribution Mapping System (EDD MapS Ontario): [www.eddmaps.org/ontario](http://www.eddmaps.org/ontario)
- Promote the use of existing "monitoring tool-kits" (e.g., <https://foca.on.ca/ais-monitoring-toolkit/>) to facilitate public education, with an emphasis to:
  - Learn how to prevent the spread of invasive species.
  - Learn how to identify existing invasive species and species that could potentially threaten watershed health.
  - Access information from organizations such as the Invading Species Awareness Program and the Invasive Plants Council to gain access and disseminate information to lake stakeholders.
  - Use best-bet control and management approaches.
- Host workshops and on emerging invasive species (e.g., emerald ash borer, *Phragmites*, etc.).

## Action A3: Stormwater runoff management

Manage stormwater runoff by increasing the filtering and absorbing capacity of shoreline properties.

### Priority

- High

### Rationale

- Although developed areas only account for approximately 25% of the lands immediately draining into Shadow Lake and Silver Lake, they are concentrated along the shoreline. More than half (45%) of the shoreline length has been developed within 30m of the lake. These areas contribute disproportionately high amounts of sediments, nutrients, and other contaminants typically through increased surface water runoff over fertilized lawns and hardened surfaces (e.g., concrete, pavement, etc.) running into the lake. In terms of phosphorus loading into the lake, it is estimated that surface water runoff flowing over developed areas (most of which exist along the shoreline), contribute less than 1% from all sources.

### Priority areas

- Village of Norland
- Areas of dense urban shoreline development

### Lead and (partner) implementers

- Shadow Lake and Silver Lake residents; Norland residents; (Shadow Lake Association; City of Kawartha Lakes; Kawartha Conservation)

### Deliverables

- Develop a program that provides educational and project management assistance, as well as financial assistance where possible, to waterfront residents to support the uptake of lot-level measures for water stewardship action including:
  - Maintain a buffer strip of natural vegetation along urban waterfronts and stream banks to filter runoff, prevent erosion, and provide wildlife habitat.
  - Capture and store and diffuse storm runoff via rain barrels, grassed swales, vegetated depressions, rain gardens, splash blocks or “roll up” attachments to downspouts, and private stormwater management ponds as applicable.
  - Maintain trees and other landscape plants that help slow surface water runoff and reduce soil erosion; replace at-risk, dying, or storm-damaged trees with trees and shrubs of appropriate species.
  - Mow lawns to no less than three inches in height to encourage healthier root development and help absorb more moisture.
  - Transition to the use of a low-or zero-phosphorus fertilizer or to the reduction and elimination of chemical fertilizers on lawns. Instead leave mulched clippings to decompose and use yard compost for soil amendments; do not discard of clippings in waterways.
  - Conduct soil testing to determine actual nutrient deficiencies, and adjust soil amendments accordingly.
  - Maintain permeable surfaces, such as porous asphalt or vegetated swales, as alternatives to hardened driveways, walkways, and parking lots.
  - Dispose of pet wastes in the garbage and discourage feeding of waterfowl.
-

## Action A4: Naturalization along shorelines

Maintain the natural features along the shoreline.

### Priority

- High

### Rationale

- Shorelines are transitional areas from water to land, and are often referred to as the 'Ribbon of Life' around a lake because they are the most important areas in lakes for fish and wildlife production. Within the Shadow Lake and Silver Lake Planning Area, development is concentrated along the shoreline through mostly single residential lots, and as such this area around the lake is particularly vulnerable to human disturbance. At present approximately 11.4% of the shoreline, or 4.5 km, has been modified into artificial structures (e.g., concrete, armourstone, manicured lawn, etc.) that do not provide optimum fish and wildlife habitat nor the runoff filtering capacity that are otherwise provided by natural features (e.g., trees, rocks, stumps, aquatic plants, etc.). There are numerous opportunities along existing waterfront properties as well as during property upgrade developments to maintain or increase fish and wildlife habitat. Shoreline improvements should consider the high variability of water levels, and in particular be able to withstand being inundated during spring high water events.

### Priority areas

- Areas immediately adjacent to the shoreline along residential properties

### Lead and (partner) implementers

- Shadow Lake and Silver Lake residents; (Ontario Ministry of Natural Resources and Forestry; Shadow Lakes Associations; Federation of Ontario Cottagers' Associations; Kawartha Conservation; City of Kawartha Lakes; local nurseries)

### Deliverables

- Provide more education and marketing to shoreline residents on what to consider when undertaking shoreline improvements (i.e., who to contact for support, what options are available, etc.) that protect or enhance the integrity of the shoreline including:
  - Maintain a buffer strip of natural vegetation along the shoreline, the wider the better; establish a "no-mow" zone along the shoreline.
  - Minimize waterfront development of artificial structures (excluding erosion protection) to 25% or less of total frontage.
  - Select dock or boathouses sites where the least amount of vegetation currently exists, keeping safety in mind at all times.
  - Re-vegetate disturbed soil areas as soon as possible to stabilize loose soils.
  - Retain fallen trees and large rocks in the nearshore zone, unless they are a hazard to boats or swimmers.
- Produce and distribute a non-technical guidance document that clearly illustrates practical approaches for improving existing non-natural shorelines.
- Provide/obtain advice on the best naturalization options that will withstand high water events.

## Action A5: Responsible boating

Undertake responsible recreational boating within the lake, including routine equipment inspection and minimizing disturbance to sensitive habitats.

### Priority

- Medium

### Rationale

- Shadow Lake and Silver Lake is an important body of water for recreation, particularly for private pleasure craft. Due to the potential for lake contamination by chemicals (e.g., gas, oil, etc.), there is a need to educate people about properly maintaining equipment and what actions to take in an emergency spill situation. Further, there are several areas of the lake (e.g., marsh wetlands, etc.) where boating disturbance should be avoided during periods of increased sensitivity (e.g., fish spawning and bird nesting areas).

### Priority areas

- Sensitive shoreline habitats (e.g., marsh wetlands, fish spawning habitats)

### Lead and (partner) implementers

- Recreational boaters; (Shadow Lake and Silver Lake residents; Shadow Lakes Association; Boating Ontario)

### Deliverables

- Implement a Clean Boater campaign, to ensure a proactive approach to reducing risk of water contamination, through measures such as the following:
  - Practise preventative maintenance, including regular engine and equipment inspection and servicing.
  - Keep oil absorbent pads and containment pans or trays under the engine when it is not in water.
  - Know the fuel capacity prior to filling tanks; when possible, fill away from water over a spill containment system.
  - Store petroleum products carefully to reduce risk of spillage.
  - Minimize the use of harsh cleaners by rinsing boats regularly, or if a boat needs cleaning beyond the soft cleaning, first remove the boat from the water.
  - Whenever possible, use low-impact recreational practices (e.g., canoeing, kayaking, sailing, etc.) and technologies.
- Minimize disturbance to sensitive ecological features with measures such as the following:
  - Reduce your wake and ensure the boat is an appropriate distance from shore; this minimizes the turbidity (soil and sediment disturbance) and damage to nearshore areas.
- Minimize noise and speed levels when operating near populated waterfront areas.
- Continue to deploy and retrieve buoys that mark in-water navigational hazards.

## Action A6: Nutrient and soil loss from farms

Implement measures such as vegetated buffer strips along streams, conservation tillage, and other practices that reduce nutrient and soil loss from farms, with assistance from cost-share programs.

### Priority

- Low

### Rationale

- At 8% of the total land use, agriculture occupies a small, but significant portion of lands within the Shadow Lake and Silver Lake planning area. The proper management of farmlands is essential in maintaining the environmental health of the watershed, in decreasing phosphorus and nitrogen loads, and in reducing sediment loss into the lake via drainage ditches and other small tributaries. Over the past 20 years, farmers have made significant gains in applying enhanced water quality protection measures through the Environmental Farm Plan. In terms of phosphorus loadings, it is estimated that local rural areas contribute less than 1% into Shadow Lake and Silver Lake from all input sources. Slight reductions in agricultural phosphorus loading are needed to achieve the water quality benchmark.

### Priority areas

- Shadow Lake Central subwatershed

### Lead and (partner) implementers

- Ontario Soil and Crop Improvement Association: delivery agent for the Environmental Farm Plan; farmers; (Ontario Ministry of Agriculture, Food and Rural Affairs; Kawartha Conservation; City of Kawartha Lakes)

### Deliverables

- Conduct agricultural improvement projects, through the Environmental Farm Plan in priority subwatershed such as:
  - Grassy waterways on erodible crop land sites;
  - Vegetated buffer strips adjacent to watercourses;
  - Grazing land management: fencing, crossings, alternative watering systems;
  - Improved manure storage;
  - Livestock yards/feedlot operation runoff management and diversion of upslope water;
  - Conservation tillage and cover crops that stabilize soils and reduce erosion;
  - Nutrient management planning: implementation of precision agricultural practices including the use of GPS and satellite navigation technology for more accurate application of nutrients; and
  - Wetland restoration and protection.



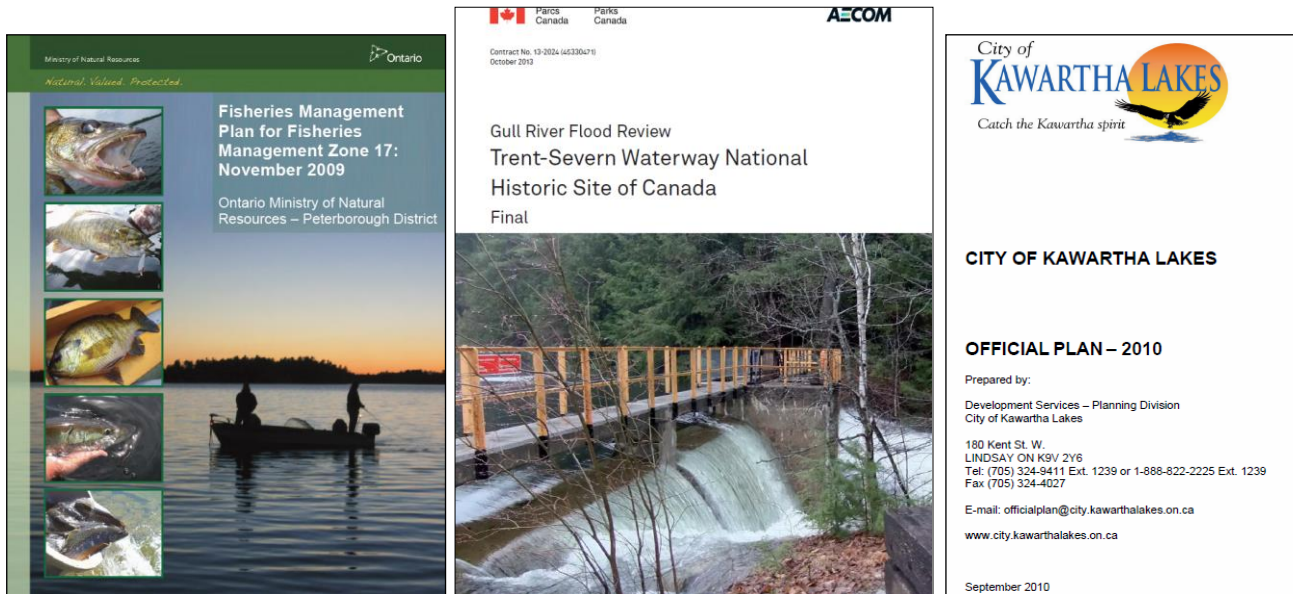
### 3.3 Strategic Planning Strategy

The primary focus of this strategy is to undertake proactive approaches for lake health and environmental protection measures within land use policy and natural resource planning.

The existing provincial and municipal regulatory tools that apply to lands and waters within the Shadow Lake and Silver Lake planning area provide some degree of protection in maintaining good water quality and natural heritage, however there are several opportunities to consider. Some lakes within the municipality, Four Mile Lake for example, have extended protection measures that provides more stringent rules for new developments put in place through Special Policy Area designations within the City of Kawartha Lakes Official Plan. Another enhancement to consider in terms of the municipal planning approach is to explore mechanisms through which the large-scale removal of shoreline forested areas can be regulated.

Further, given a significant number of shoreline properties are affected by fluctuating water levels, and high water levels in particular, emphasis is placed on working with Parks Canada to continuously review their water management regime to mitigate impacts.

Strategic natural resources planning and management is also emphasized within this strategy, through profiling the several actions within the Fisheries Management Plan for Fisheries Zone 17 and Source Protection Planning for Norland municipal drinking water system.



*Examples of recently developed planning initiatives that contribute to the objectives of the Shadow Lake and Silver Lake Management Plan*

## Action B1: Lake level management planning

Continue efforts to identify opportunities to mitigate impacts of fluctuating and extreme water level events, in particular high and low water flows, on shoreline properties.

### Priority

- High

### Rationale

- Water levels on Shadow Lake and Silver Lake are influenced overwhelmingly by Gull River inflows to Shadow Lake through Norland. The Gull River system is managed as a series of 'reservoir lakes' by Parks Canada, to accommodate various socio-economic and ecological needs of all Gull River stakeholders and in particular the operation of the Trent-Severn Waterway. Shadow Lake and Silver Lake are considered 'flow-through lakes' as they are the receiving waters of a large drainage area before emptying into Balsam Lake. Because of certain factors (e.g., geological pinch-points, significant rains and snowmelts, etc.), the lakes are naturally prone to fluctuations and especially extreme high water events. Local residents are being impacted by the water management regime, for example they have experienced two significant spring flooding events within the last five years and lake level fluctuations on an ongoing basis. Parks Canada in partnership with the Shadow Lakes Association have made significant progress towards communicating to local residents before, during, and after extreme water situations. These efforts should continue alongside identifying any opportunities that could mitigate flooding and strive to meet conditions of acceptable water levels that meets the needs of all (or most) shoreline residents, other stakeholders, and the lake ecosystem.

### Priority areas:

- Shoreline properties along Shadow Lake, Silver Lake, and Gull River Watershed.

### Lead and (partner) implementers

- Parks Canada – Trent-Severn Waterway; Shadow Lakes Association; Ontario Ministry of Natural Resources and Forestry; (shoreline residents; City of Kawartha Lakes)

### Deliverables

- Investigate opportunities in the operations of the water management infrastructure to reduce extreme water situations for shoreline properties.
- Establish thresholds/criteria for acceptable water levels and identify ecological and socio-economic impacts associated with water level management.
  - Establish a range of water levels that suits the needs and interests of the majority of the users. For example,
    - Acres (1973) identified 12.7 cubic metres per second through Norland Dam as acceptable flows to accommodate shoreline residents;
    - recent conversations with Shadow Lakes Association indicates: more than 60 m<sup>3</sup>/sec is too high, less than 10 m<sup>3</sup>/sec is too low, and somewhere in the 10-40 m<sup>3</sup>/sec range (preferably 20m<sup>3</sup>/sec) is optimal for shoreline residents.
  - Establish a range of water levels that are optimal for fish and wildlife habitats, and to maximize lake resilience to water quality pollution.

## Action B2: Responsible shoreline and watershed development

Undertake responsible development planning within the watershed, and particularly along the shoreline.

### Priority

- High

### Rationale

- Municipal Official Plans provide the structure for land use planning and development in the Shadow Lake and Silver Lake planning area. A significant section of the shoreline around Shadow Lake and Silver Lake are considered in a developed state, many of which are seasonal dwellings. Therefore the potential exists not only for new development proposals on existing natural lands, but also the intensification (i.e., re-development and/or upgrading into more permanent residences) of existing developed areas. The intent of this action is to consider regulatory tools that would be best applicable to afford enhanced protection to large tracts of natural lands in the watershed and along the shoreline. These areas along the lake shoreline maintain the integrity of the lake ecosystem by stabilizing soils, moderating temperature, providing fish and wildlife habitat, reducing surface water runoff, utilizing nutrients, among other functions. Shadow Lake and Silver Lake residents are particularly concerned about the clear-cutting of forested areas along the shoreline, inundation of properties during high water levels, and recent applications for aggregate operations. Further, given that both Shadow Lake and Silver Lake, along with Cameron Lake, have been identified as having the most 'crowded shorelines' of all lakes within the municipality (Gartner Lee and French Planning 2002), opportunities to reduce impacts to shoreline visual aesthetics from shoreline modifications should also be considered.

### Priority areas:

- Shoreline lands within 1km around the lake
- Large forested areas along the Shadow Lake and Silver Lake shoreline
- Aggregate proposals in watershed

### Lead and (partner) implementers

- City of Kawartha Lakes

### Deliverables

- Ensure all new major structures (e.g., recreational dwellings, commercial properties, etc.) and infrastructure (e.g., cottage roads, etc.) are built above high water levels, and away from sensitive fish and wildlife habitats (e.g., wetlands, muskellunge spawning areas, etc.).
- Continue to administer flood plain regulations to ensure protection from flood damages to future infrastructure development and effective measures for reducing flood damages for existing development, including flood preparedness and resilience.
- Consider updating land use policies specific to Shadow Lake and Silver Lake, for example by applying restrictions similar to Four Mile Lake Special policy area. These may include: requiring minimum lot frontages, restricting cluster developments, restricting aggregate operations, requiring minimum setbacks from roads, etc.
- Review various regulatory approaches to preventing the clear-cutting of large forested areas along the Shadow Lake and Silver Lake shoreline. The scope and criteria of the by-law (e.g., to which projects it applies) would be determined through the municipal process, which should emphasize public consultation. Potential tools to consider include:
  - Official Plan policies;
  - Municipal bylaws (e.g., Forest Conservation, Site Alteration, etc.);
  - Shoreline Secondary Planning; and,
  - Other regulatory approaches.
- Review and integrate where applicable guidance from the document Shoreline Environmental Studies in Support of Official Plan Policies for the City of Kawartha Lakes (Gartner Lee and French Planning Services, 2002).

## Action B3: Fisheries and Source Protection Management Planning

Undertake actions within the *Fisheries Management Plan for Fisheries Management Zone 17*, and the *Trent Source Protection Plan*.

### Priority

- Medium

### Rationale

- The Fisheries Management Plan for Fisheries Management Zone 17 was released in 2009 by the Ontario Ministry of Natural Resources and Forestry. The Plan outlines several challenges in maintaining healthy fisheries resources and provides several management strategies that apply to local watercourses, including Shadow Lake and Silver Lake. Strategies within the Plan include: Walleye, Largemouth and Smallmouth Bass, Panfish, Muskellunge and Northern Pike, Coldwater Streams Fisheries, Additional Species (forage fish and species at risk), Invasive Species and Fish Pathogens, Fisheries Awareness and Education, and Monitoring and Assessment. A Fisheries Advisory Council comprised of several key stakeholders including angling clubs, First Nations, tourist associations, academia, and stewardship groups, played a large role in developing the Plan by identifying goals, objectives, and management actions. Implementation of several action items in the Plan would benefit the fishery within Shadow Lake and Silver Lake.
- The community of Norland is serviced by a municipal drinking water system thus is subject to policies and activities within scope of the Trent Source Protection Plan. This Plan identifies various drinking water threats to the Norland intake system, and given that it draws surface waters from Gull River upstream of Shadow Lake, actions undertaken for this Plan will benefit downstream waters of Shadow Lake and Silver Lake.

### Priority areas

- Fishes that important to the recreational fishery (walleye, smallmouth bass, and muskellunge), and invasive fish species (northern pike).
- Addressing water quality threats to Norland municipal drinking water system.

### Lead and (partner) implementers

- Ontario Ministry of Natural Resources and Forestry; City of Kawartha Lakes; (local anglers; local residents; Kawartha Conservation; Ontario Ministry of Environment and Climate Change)

### Deliverables

- Implement the *Fisheries Management Plan for Fisheries Management Zone 17* on Shadow Lake and Silver Lake, specifically the actions listed below:
  - Identification of critical spawning locations for Walleye, Muskellunge, and Smallmouth Bass.
  - Monitor the fisheries and aquatic ecosystems as they continue to change in response to environment variables.
  - Monitor angler harvest and effort through creel surveys or other means.
  - Monitor for the presence of aquatic invasive species and pathogens as a component of the Broad-scale monitoring program.
  - Report on the State of the Resource based on results of the Broad-scale Monitoring program and other monitoring initiatives.
  - Develop plain-language information materials associated with management actions that can be taken and their potential effectiveness.
- Address the drinking water quality threats within the Intake Protection Zone for Norland (includes most of Norland along Gull River upstream of dam) municipal drinking water system, as identified in the *Trent Source Protection Plan*.
  -

### 3.4 Urban and Rural Infrastructure Strategy

A significant focus of this strategy is the ongoing management of public lake-access areas and minimizing the potential impacts associated with construction projects, including road maintenance. These are primarily municipal responsibilities, with emphasis on enhanced control of stormwater, water quality and quantity, soil erosion, and maintenance of public spaces. Shoreline residents involved in construction projects (e.g., undertaking home and property upgrades) are similarly responsible for ensuring that their activities are not detrimental to the health of the lake.



Public boat launch on the Gull River, immediately upstream of Shadow Lake and downstream of the Norland Dam (August 2016)

## **Action C1: Management of public lake-access areas**

Maintain safe and accessible public lake-access locations by improving water quality at the beach and addressing erosion issues at the boat launch.

### **Priority**

- High

### **Rationale**

- Public access to Shadow Lake and Silver Lake provides a primary connection to the lake. There are relatively limited designated public access areas. The primary public access for Shadow Lake is through the boat launch along the Gull River (Government Dock Rd. in Norland) and the public beach along its north-west shore. The primary access to Silver Lake is a boat launch at the end of Kelvin Beach Rd. The public beach is, on average within the past 10 years, posted as unsafe for swimming approximately once every year and in many years 2-3 times, due to high *E.coli* levels. The specific cause of occasional high *E.coli* levels are not well understood, but likely include a combination of factors including bird feces, pet feces, stormwater runoff over developed areas, and warm, shallow waters. Active management of this public space is needed to increase public safety and enjoyment. Further, the public launch in Norland could benefit from maintenance including erosion control and re-grading launch area.

### **Priority areas:**

- Public beach along north-west shore of Shadow Lake (Shadow Lake Rd. 3)
- Public boat launch in Norland (Government Dock Rd.)

### **Lead and (partner) implementers**

- City of Kawartha Lakes; local residents (Haliburton, Kawartha, Pine Ridge District Health Unit)

### **Deliverables**

- Within a five-year period, achieve a target of 100% (no postings in any given year) reduction in the amount of time that public beach is posted as unsafe for swimming.
  - Conduct routine maintenance such as regular garbage pick-up, clean-up of pet and bird feces, and provision of adequate feces disposal facilities.
  - Investigate the potential to implement higher levels of urban storm runoff management for waters that drain into the swimming area.
  - Implement ways to deter birds in the beach vicinity, such as creating and maintaining tall vegetation or wider buffers.
- Improve the boat launch, through re-grading and design, to ensure safe launch platform and to reduce erosion of area into Gull River.
- Continue to deploy navigation aids on Shadow Lake and Silver Lake that are intended to mark in-water hazards in accordance with Transport Canada policy standards.

## Action C2: Responsible construction practices

Ensure that construction projects, particularly road maintenance works, are conducted in a manner that does not degrade water quality or sensitive habitats.

### Priority

- Medium

### Rationale

- Routine maintenance of drainage ditches along road networks is often needed to remove the build-up of silt and sediments and to upgrade aging culverts. In the case of roadside ditches, the accumulation of sediments over time may impede the ability of the ditch to drain water efficiently during precipitation events and high-water periods. This is similar to agricultural drainage corridors, where it is also necessary to maintain unimpeded water conveyance during crop growth periods. These practices can potentially involve dredging or altering the channel for increased through-flow. This can damage the aquatic ecosystem, including the harmful alteration of in-stream habitat, destabilization of banks, introduction of excessive sediments into our lake, etc. A number of cost-effective options incorporate the natural environment (e.g., vegetation and its root systems), which will help minimize maintenance costs while protecting the environment. In the case of roadside ditches and construction sites, the focus should be on reducing sediment loading into nearby (downslope) watercourses.

### Priority areas:

- Roads with steep slopes and highly erodible soils,
- Roads that drain immediately into lake-connecting watercourses, and
- All construction worksites.
- Perched culverts along streams.

### Lead and (partner) implementers

- City of Kawartha Lakes; watershed residents; (construction industry)

### Deliverables

- Avoid conducting construction projects during sensitive periods for fish and wildlife, where this is appropriate.
- Identify and install effective measures to prevent disturbed soils and sediments from migrating into the watercourses. Use standards outlined in the document, *Erosion and Sediment Control Guideline for Urban Construction* (Toronto and Region Conservation Authority, 2006). For example:
  - Focus on site-level containment of sediments, recognizing that advanced controls are often required to protect sensitive natural heritage features.
  - Plant disturbed areas with soil-stabilizing vegetation, preferably native species.
  - Use sediment blankets or matting for disturbed banks.
  - Work in low-flow periods; develop a back-up plan in case of heavy rains/melt.
- Host periodic workshops for contractors, consultants, project managers, and developers to ensure effective communications and knowledge of the most up-to-date measures for controlling the movement of sediments off-site.
- Address perched culverts at road-stream crossings to ensure that resident and migratory aquatic organisms fishes have unimpeded access up and down tributaries on a year-round basis. For example the following locations have perched culverts: Shadow Lake North subwatershed at Monck Rd., Shadow Lake Northeast subwatershed at Monck Rd. and at Shadow Lake Road 10.

### 3.5 Research and Monitoring Strategy

All management decisions, as well as remedial and restorative actions, depend on sound scientific data and knowledge. Further lake-based research will shed light on the many information gaps identified by this planning process, including emerging 21st-century pressures. Further monitoring is crucial for determining the effectiveness of current lake-based programming and for identifying new opportunities to engage stakeholders. This adaptive management approach ensures that priorities remain relevant as new information becomes available.

A key component of this strategy is collaboration among groups and institutions already active on the lake. There is great value in using the expertise of local community members, volunteers, and citizen scientists. We promote the sharing of local knowledge and expertise that, in some cases, spans generations. This will help build plan interest and lead to the increased “buy-in” of local people. As project partners create the momentum, the community is more likely to come on board.



*A colony-forming aquatic invertebrate known as Bryozoa  
(east shore of Shadow Lake August 2017)*



## **Action D1: Citizen science and volunteer-based lake monitoring**

Increase community participation in the routine monitoring of key indicators of lake health, including water quality and invasive species.

### **Priority**

- High

### **Rationale**

- Routine collection of lake and watershed data provides critical information about the ongoing state of Shadow Lake and Silver Lake, and also helps to monitor progress on achieving the planning objectives while allowing early detection of water quality or aquatic health improvements and/or deterioration. Citizen science refers to the collection of lake data by members of the general public, typically as part of a collaborative project with professional scientists. Two programs are particularly relevant in tracking lake health over time including the Lake Partner Program (administered by Ontario Ministry of Environment and Climate Change), and Invading Species Watch Program (administered by Ontario Federation of Anglers and Hunters and Ontario Ministry of Natural Resources and Forestry). Another opportunity is to establish a nearshore water chemistry monitoring program in partnership with Kawartha Conservation to track nutrients and other important parameters closer to shore. These programs are no charge, or low-cost, and are valuable in terms of providing public engagement opportunities while obtaining meaningful data on lake health. Long-term information on water quality within Shadow Lake and in particular Silver Lake is lacking.

### **Priority areas**

- The open waters of Shadow Lake and Silver Lake
- Waters of Shadow Lake and Silver Lake that are adjacent to public access points and developed areas

### **Lead and (partner) implementers**

- Shadow Lakes Association; Shadow Lake and Silver Lake residents; (Ontario Federation of Anglers and Hunters; Ontario Ministry of Natural Resources and Forestry; Federation of Ontario Cotters' Associations; Ontario Ministry of Environment and Climate Change)

### **Deliverables**

- Undertake routine sampling of key water quality parameters (e.g., nutrients and water clarity) by participating in the Lake Partner Program.
  - Enhance Lake Partner Program sampling on Shadow Lake. There is currently active sampling for *E.coli* only, other important parameters have not been sampled within approximately 10 years.
  - Establish Lake Partner Program sampling on Silver Lake. There is currently no active sampling and limited water quality data exists.
- Undertake routine sampling of aquatic invasive species (e.g., zebra mussels, spiny water flea, etc.) by participating in the Invading Species Watch Program.
  - Establish multiple sampling locations on Shadow Lake and Silver Lake, particularly in waters adjacent to public access locations and developed shorelines.
    - Invasive species monitoring as per Invading Species Awareness Programs (program administered by Ontario Federation of Anglers and Hunters).
- Establish a monitoring program to sample water quality (e.g., nutrients, productivity, etc.) in the nearshore waters adjacent to developed shorelines along Shadow Lake and Silver Lake.

## Action D2: Flow and water level monitoring

Undertake routine monitoring of, and establish a relationship between, water levels and flows in Shadow Lake and Silver Lake to better characterize their hydrological regime.

### Priority

- High

### Rationale

- Water levels in Shadow Lake and Silver Lake are of primary interest to shoreline residents and the Shadow Lakes Association, given they experience the direct consequences of variable, high, or low water scenarios. Water flows are actively monitored along the Gull River (since early 1960's, immediately upstream of Shadow Lake), as well as in several locations within the Gull River watershed to inform the water management operations of Parks Canada and the Trent-Severn Waterway. A preliminary relationship between water flows entering Norland and corresponding water levels experienced in Shadow Lake and Silver Lake has been established, but could be better refined and be more practical through the installation and routine monitoring of water level devices directly within Shadow Lake and/or Silver Lake. More data is needed to better characterize water level regime (e.g., high/low water levels, amount of time in acceptable water levels, etc.) to inform management approaches including: determining whether acceptable water level thresholds are being met, keeping development away from flood-prone shorelines, and climate change vulnerability assessments.

### Priority areas

- Shadow Lake and Silver Lake

### Lead and (partner) implementers

- Shadow Lakes Association; Shadow Lake and Silver Lake residents; Parks Canada – Trent-Severn Waterway; Ontario Ministry of Natural Resources and Forestry

### Deliverables

- Maintain routine monitoring of water flows of the Gull River at Norland.
- Maintain Flood Forecasting and Warning Systems programming.
- Establish a monitoring program to routinely collect data on water levels in Shadow Lake and Silver Lake, for example:
  - Install a fixed water level monitoring device (e.g., staff gauge, level logger, etc.) with a known benchmark along public property, for example near public beach on Shadow Lake (northwest shore) and public launch on Silver Lake (Kelvin Rock Rd.);
  - Record water levels continuously or during various hydro-periods of interest (e.g., high levels, low levels, average levels, etc.) into a secure database that has some QA/QC;
- Establish relationships between water levels and water flows (also known as a rating curve) by comparing flows through Norland to water levels on Shadow Lake and Silver Lake, during various hydro-periods of interest (e.g., high flows, low flows, average flows, etc.).
- Use water level and flow data to characterize acceptable water level and flow conditions, and to inform management thresholds.
- Refine existing maps showing flood-prone areas along Shadow Lake and Silver Lake; consider refining digital elevation mapping to better estimate extent of inundated areas.
- Refine existing digital bathymetry (i.e., water depth) mapping for Shadow Lake and Silver Lake, given that existing depth contour information available in public domain through Land Information Ontario is inaccurate.

## **Action D3: Septic system questionnaires**

Undertake an inventory of existing septic systems, water use, and occupancy status on shoreline properties to better inform nutrient loading estimations.

### **Priority**

- Medium

### **Rationale**

- Septic systems around the lake are estimated to contribute approximately X%, or X kg/year, of the total nutrient (phosphorus) loading into Shadow Lake and Silver Lake, and is considered a manageable source of pollution. This value is estimated based on generalized values from research undertaken in Ontario on key inputs such as: number and type of dwellings along the shore, age and type of septic system, average dwelling occupancy and water usage per year, among others. Local data is lacking and is needed to refine these estimates to obtain more accurate loading estimates that are specific to Shadow Lake and Silver Lake.

### **Priority areas**

- All septic systems within 100m of Shadow Lake and Silver Lake, and their connecting channel

### **Lead and (partner) implementers**

- Shadow Lakes Association; Shadow Lake and Silver Lake residents; (City of Kawartha Lakes; Kawartha Conservation)

### **Deliverables**

- Distribute a questionnaire to all property owners around Shadow Lake and Silver Lake, to obtain information specific to septic systems, including detailing:
  - Septic system type, proximity to lake, year of construction, and other information related to the functioning of the structures.
  - Water use rates, dwelling occupancy, and other information related to wastewater usage.
  - Soil composition, soil depth, property slopes, and other information related to nutrient pathways to the water.
- Use the results of the questionnaire to refine nutrient loading calculations to obtain a better estimation of nutrient inputs from shoreline septic systems.

## **Action D4: Understanding lake ecosystem stressors**

Conduct research to identify how the lake ecosystem responds to stressors such as cumulative development, climate change, and invasive species.

### **Priority**

- Medium

### **Rationale**

- The key driver for the proposed research is the already at capacity, and anticipated increase of intensification, of development along the shorelines of Shadow Lake and Silver Lake and the consequent pressures on the lake ecosystem. There is an urgent need to improve scientific understanding about the influence of shoreline development on lake health - particularly within the context of other stressors such as climate change and invasive species - so that appropriate management responses may be developed.

### **Priority areas:**

- Potential impacts of expanding cormorant colonies
- Cumulative development along shorelines,
- Climate change, and
- Invasive species in aquatic ecosystems.

### **Lead and (partner) implementers**

- (Colleges and universities; Ontario Ministry of Natural Resources and Forestry; Ontario Ministry of Environment and Climate Change; (watershed residents; City of Kawartha Lakes; Kawartha Conservation; First Nations; watershed residents)

### **Deliverables**

- Conduct research on potential lake ecosystem changes resulting from climate change, invasive species, and cumulative shoreline development.
  - Investigate options for predictive modeling tools and decision-support systems to guide management efforts to mitigate any negative impacts of emerging pressures.
- Conduct a climate change vulnerability assessment.
- Conduct research to identify lake and watershed health thresholds and carrying capacity.
  - An example is the Lakeshore Capacity Handbook (Province of Ontario, 2010), a modelling tool applicable to Ontario lakes on the Canadian Shield that predicts lake water quality based on the amount of shoreline development. This tool was tested on Shadow Lake and Silver Lake, but unfortunately it was not successful in predicting existing water quality conditions based on existing shoreline development.
- Utilize traditional ecological knowledge from local First Nations communities.
- Identify various, minimally impacted “reference lakes” the data from which can be used to better understand the range of natural variability expected in healthy aquatic ecosystems.

## 3.6 Communications and Outreach Strategy

Communication and outreach help set the *Shadow Lake and Silver Lake Management Plan* in motion and provide the mechanisms for Plan updates and adjustments to meet changing community needs and environmental conditions. This involves communicating information about the lake and its subwatersheds; providing actions to sustain a healthy environment, community, and economy; receiving feedback from stakeholders about implementation of the Plan (including Plan updates and adjustments); and assisting collaboration on the Plan and related projects.

Many people have a stake in the implementation of the *Shadow Lake and Silver Lake Management Plan*. They are grouped into target audiences by the different forms of communication and outreach required for implementing the Plan. Audience groups include shoreline property owners, lake associations, road monitors, First Nations communities, agricultural and rural landowners, urban residents, businesses, tourists and other visitors, municipal councillors and staff, lake associations, agencies and related organizations, developers, funders, and Kawartha Conservation staff and Board of Directors.



*Shadow Lakes Association Annual General Meeting  
(July, 2017)*

## **Action E1: Keeping stakeholders informed and engaged**

Communicate the science, solutions, and outcomes of plan implementation among all active stakeholders in the Shadow Lake and Silver Lake watershed.

### **Priority**

- High

### **Rationale**

- A large amount of information and analysis has been generated through Plan development, providing a baseline for setting environmental targets. It enables informed decision-making and actions that contribute to the goal of the Plan. Through information sharing it will be possible to track any improvement or decline in conditions, measure the effectiveness of actions, and respond to emerging issues in a changing environment. Extreme water level events are of particular interest to shoreline residents, given Transparency and accountability to stakeholders are necessary for ongoing funding and support for Plan implementation.

### **Priority areas**

- Watershed residents, and groups active around/on the lake

### **Lead and (partner) implementers**

- Shadow Lake and Silver Lake residents; Shadow Lake and Silver Lake Associations; (watershed Residents; Kawartha Conservation; City of Kawartha Lakes; Ontario Ministry of Natural Resources and Forestry; developers and contractors; Federation of Ontario Cottagers' Associations)

### **Deliverables**

- Ongoing liaising with all active stakeholders on lake (e.g., Shadow Lakes Association, shoreline and watershed residents, Parks Canada, OMNRF Bancroft – Minden, City of Kawartha Lakes, among others).
- Ongoing liaising with active lake-based organizations within Gull River watershed (e.g., Coalition of Haliburton Property Owners Association, Coalition for Equitable Water Flow, County of Haliburton, Federation of Ontario Cottagers' Associations, among others).
- Maintain ongoing communications with Parks Canada and Shadow Lakes Association in regards to the Gull River water management regime, in particular early warning of extreme water levels on Shadow Lake and Silver Lake.
  - Post links, resources, and other pertinent information on Shadow Lakes Association website.
- Make available all relevant report and studies that are related to Shadow Lake and Silver Lake to local residents; consider digitally compiling reports and posting online within a central location (e.g., Shadow Lakes Association website).
- Distribute reports, through Shadow Lakes Association meetings, newsletters, and local road monitors, on monitoring results, implementation of stewardship actions, impacts of actions, and other changes in the watershed.
- Provide updates via newsletters, social media, local media, and budgets.
- Maintain a web page for lake management planning to host reports, updates, and related resources.
- Host periodic workshops, with subject experts, on specific areas of focus that are of significant interest to local residents, for example:
  - Invasive species management.
  - Septic system management.
  - Water well and water intake management.
  - Shoreline protection for high water events.
- Use annual meetings of local organizations (e.g., meeting of Shadow Lakes Association) to review lake monitoring programs and discuss regional projects of interest to their membership.
- Maintain representation from Shadow Lake and Silver Lake on the Community Advisory Panel membership.
- Facilitate signage at the boat dock and public beach to communicate basic best practices for lake use.

## **Action E2: Maintain routine communication regarding water level management decisions**

Communicate on a regular basis the water management activities along the Gull River, including early warning of high, low, and variable water level events.

### **Priority**

- High

### **Rationale**

- Parks Canada in partnership with the Shadow Lakes Association, Ontario Ministry of Natural Resources, City of Kawartha Lakes, among others have made significant progress towards communicating to local residents before, during, and after extreme water situations. The active water quantity monitoring program undertaken by local authorities is termed the Flood Forecasting and Warning System. Effective communication in all aspects of the water management operations along the Gull River, in addition during extreme events, is paramount in ensuring shoreline residents and others impacted by fluctuating and extreme levels are engaged and can respond to situations accordingly. There are several means to ensure information sharing takes place on a routine basis, for example through annual general meetings of lake residents, website materials, newsletters, among other strategies.

### **Priority areas**

- Watershed residents, and groups active around/on the lake

### **Lead and (partner) implementers**

- Shadow Lakes Association; Parks Canada – Trent-Severn Waterway; (watershed residents; Kawartha Conservation; City of Kawartha Lakes; Ontario Ministry of Natural Resources and Forestry)

### **Deliverables**

- Actively involve and communicate to local residents, through the Shadow Lakes Association, the water management decision making process before, during, and after extreme and/or highly variable water events.
  - Receive presentations by water management staff regarding previous year's events, and future year's forecasts, at Shadow Lakes Annual General Meeting.
  - Post water management related links, resources, and other pertinent information on Shadow Lakes Association website.
  - Distribute reports, through Shadow Lakes Association meetings, newsletters, and local road monitors, on communication efforts and outcomes.
- Make available all relevant water management report and studies that are related to Shadow Lake and Silver Lake to local residents; consider digitally compiling reports and posting online within a central location (e.g., Shadow Lakes Association website).

## 3.7 Moving To Implementation

The *Shadow Lake and Silver Lake Management Plan* provides a solid framework for a coordinated approach to maintaining a healthy lake and subwatersheds for all uses. However, successful implementation will require ongoing commitments (financial and otherwise) from all identified partners to fully realize and sustain a healthy lake environment. Fortunately Shadow Lake and Silver Lake Associations' are well-coordinated group of individuals that have a keen interest in taking an active role in managing their lake resources.

Creating and maintaining effective partnerships is essential to the success of this management plan. The more stakeholders, resources, and knowledge applied to each action item, the better the result. Everyone around the lake is accountable for responsible lake management. Early implementation efforts should highlight small successful projects from individuals and groups to build momentum.

Specific costs of action item deliverables were intentionally omitted from the *Shadow Lake and Silver Lake Management Plan*. At early stages of implementation, it is essential to develop a solid business plan to attract potential funders, sponsorships, and commitments from many sectors. Efforts should also emphasize the assembly of relevant expertise, even if those partners have not yet been identified in the plan implementation.

Many of the strategies and actions developed in this plan can be applied to other lakes as well. However, we have focused primarily on the priorities of stakeholders and ecosystem-based issues specific to Shadow Lake and Silver Lake. Careful consideration is needed in applying management approaches from this plan to other lakes, as each lake is unique with its own set of issues and community-based values.

To assess progress and remain accountable, the *Shadow Lake and Silver Lake Management Plan* should be reviewed and updated, if necessary, in a five- to 10-year time period. Reporting and evaluating the progress of project deliverables should be conducted more often, for example, on an annual basis. This will allow stakeholders to adjust priorities and assess targets and deliverables using an adaptive management approach.





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# Appendix A: Key Communities and Stakeholders

Everyone has a role to play in maintaining a healthy Shadow Lake and Silver Lake. A wide range of communities, organizations, and individuals depends on healthy lake conditions to sustain their livelihoods. Successful implementation of the management actions identified in Chapter 3 relies heavily on a cooperative approach among these stakeholders for their support and direction. Table A provides a working list of key lake-based communities, stakeholders, and agencies.

**Table A: Key lake management communities, stakeholders, and agencies**

<b>First Nations</b>	Williams Treaty First Nations
<b>Federal Government</b>	Parks Canada – Trent-Severn Waterway; Fisheries and Oceans Canada; Transport Canada
<b>Provincial Government</b>	Ministry of Natural Resources and Forestry (Bancroft District, Science and Research Branch); Ministry of the Environment and Climate Change (Eastern Region); Ministry of Municipal Affairs and Housing; Ministry of Transportation; Ministry of Agriculture, Food and Rural Affairs
<b>Municipal Government</b>	City of Kawartha Lakes; Haliburton, Kawartha, Pine Ridge District Health Unit; County of Haliburton; Township of Minden Hills
<b>Stewardship Groups</b>	Kawartha Lake Stewards Association; Soil and Crop Improvement Association (Environmental Farm Plan); Ontario Nature; Kawartha Field Naturalists; Ontario Federation of Anglers and Hunters; Ducks Unlimited; Kawartha Land Trust; Kawartha Conservation; City of Kawartha Lakes Environmental Advisory Committee; Friends of the Osprey;
<b>Agriculture</b>	City of Kawartha Lakes Agricultural Development Advisory Board; Victoria County Soil and Crop Improvement Association; Victoria-Haliburton Federation of Agriculture; Victoria Cattlemen's Association; and others
<b>Lakeside Communities</b>	Shadow Lake and Silver Lake residents; Shadow Lakes Association; several Road Monitors; Federation of Ontario Cottagers' Associations
<b>Academia</b>	Trillium Lakelands District School Board; Kawartha Pine Ridge District School Board; Peterborough Victoria Northumberland and Clarington Catholic District School Board; Fleming College; Trent University and other academic institutions
<b>Lake-related Businesses and Clubs</b>	Coboconk Norland and Area Chamber of Commerce, Scouts Canada, Lindsay Bassmasters, Muskies Canada, Boys & Girls Clubs of Kawartha Lakes, and others

# Appendix B: Existing Planning Initiatives

A number of current management planning initiatives relate to the *Shadow Lake and Silver Lake Management Plan* goal of maintaining a healthy and sustainable Shadow Lake and Silver Lake. To realize this goal, support for these initiatives is crucial. For maximum leverage, efforts should be integrated wherever possible. The following initiatives are particularly relevant:

- Our Kawartha Lakes Integrated Community Sustainability Plan (City of Kawartha Lakes, Draft, 2013). This plan, led by the local municipality, provides a framework for sustainable management for 10 key themes: Water, Agriculture, Natural Systems, Resource Consumption, Health and Education, Economy, Culture and Heritage, Active Communities, Accessibility, and Financial Filter. The plan recognizes lake management planning as a key step in achieving a sustainable municipality. As such, they should be integrated when seeking funding for implementation efforts.
- Shoreline Environmental Studies in Support of Official Plan Policies for the City of Kawartha Lakes (Gartner Lee and French Planning Services, 2002). This initiative resulted in a thorough list of shoreline-based planning advice and approaches, which were recommended to the City of Kawartha Lakes for integration into their Official Plan. Many of these were considered in the development of the Strategic Planning Strategy outlined in Chapter 3.
- Official Plans for City of Kawartha Lakes. The Official Plan is a policy document containing a statement of Council's commitments to guide development and land use within the municipality. The Official Plan contains a number of policies that address protection of water resources including lakes and water quality. It allows implementation for a number of planning tools including Secondary Plans (more detailed plans of a specific area), Zoning and other by-laws, Subdivision Control, Consent Applications (to sever land into a limited number of parcels), and Site Plan Control.
- Kawarthas, Naturally Connected Natural Heritage Systems Strategy (Ontario Ministry of Natural Resources, Draft, 2013). This strategy identifies significant landscape features and functions in the Kawartha Lakes region that help maintain functioning ecosystems. Using a base set of ecosystem-based targets (e.g., maintaining 30% forest cover on the landscape), the strategy will determine which landscape-level features are priority areas for protection and/or restoration. All of the Shadow Lake and Silver Lake planning area is within the scope of this initiative. Accordingly, the completed strategy will be a valuable tool for the implementation of many action items outlined in Chapter 3.
- Trent Source Protection Plan. (Trent Conservation Coalition Source Protection Committee, 2014). This plan provides a framework for addressing drinking water threats to municipal drinking water systems. Norland is serviced by a municipal drinking water system, drawing water from the Gull River immediately upstream of Shadow Lake. Several policies within this plan apply to land use and activities within the intake protection zone.
- Fisheries Management Plan for Fisheries Management Zone 17 (Ontario Ministry of Natural Resources, 2009). This plan provides provincial direction for the management of fisheries resources within the Kawartha Lakes management zone, including recreational use as well as science and monitoring aspects. The plan presents management strategies for the following themes: Walleye, Largemouth and Smallmouth Bass, Panfish, Muskellunge and Northern Pike, Coldwater Stream Fisheries, Other Fish Species, Invasive Species and Disease Management, Awareness and Education, and Monitoring and Assessment. Successful implementation of this plan will be crucial for achieving objectives identified in Chapter 2.
- Relevant Provincial and Federal Legislation. Various pieces of legislation provide the foundation for planning, policy, and/or plan implementation. The federal statutes of most relevance include: the *Historic Canals*

*Regulations, Fisheries Act, Navigation Protection Act, Species at Risk Act, Migratory Birds Convention Act, Canadian Environmental Assessment Act, and Canadian Environmental Protection Act. The provincial statutes of most relevance include: the Planning Act, Clean Water Act, Conservation Authorities Act, Endangered Species Act, Environmental Assessment Act, Fish and Wildlife Conservation Act, Green Energy Act, Lakes and Rivers Improvement Act, Oak Ridges Moraine Conservation Act, Public Lands Act, Ontario Water Resources Act, Nutrient Management Act, Drainage Act, Pesticides Act, and Environmental Protection Act.*

# Appendix C: Assessment of Action Priority

The following provides more details with respect to the outcomes of evaluating each management action, contained within Chapter 3: Implementation Strategies, against five criteria.

CRITERIA	Level	Value	Details
<b>#1. Action meets multiple objectives?</b>	High	3	Meets many (over half of) objectives
	Medium	2	Meets a few objectives
	Low	1	Meets a single objective
<b>#2. Action is affordable?</b>	High	3	Cost < \$5,000; easy to acquire local funding
	Medium	2	Cost >\$5,000 and <\$50,000; typical medium project proposal
	Low	1	Cost >\$50,000; must acquire significant funding
<b>#3. Action has support from community?</b>	High	3	Overwhelming support
	Medium	2	Majority support
	Low	1	Localized support
<b>#4. Action builds public support for implementation?</b>	High	3	High profile; includes a large number of stakeholders
	Medium	2	Medium profile; includes a medium number of stakeholders
	Low	1	Low profile; includes a small number of stakeholders
<b>#5. Action has timely environmental benefit?</b>	High	3	Short term (5 years or less) improvement
	Medium	2	Long term (5 years or more) improvement
	Low	1	Maintain status quo

ACTIONS	Criteria Number					Summed	Average	Priority
	#1	#2	#3	#4	#5			
<b>STEWARDSHIP STRATEGY</b>								
<b>A1:</b> Undertake responsible management of septic systems, including routine inspections, along shoreline properties.	2	3	3	3	2	13	2.6	High
<b>A2:</b> Undertake measures to reduce the risk of transferring aquatic and terrestrial invasive species into the lakes and their watersheds.	2	3	3	3	3	14	2.8	High
<b>A3:</b> Manage stormwater runoff by increasing the filtering and absorbing capacity of shoreline properties.	2	3	3	3	2	13	2.6	High
<b>A4:</b> Maintain the natural features along the shoreline.	3	3	3	3	2	14	2.8	High
<b>A5:</b> Undertake responsible recreational boating within the lake, including routine equipment inspection and minimizing disturbance to sensitive habitats.	2	3	2	1	1	9	1.8	Medium
<b>A6:</b> Implement measures such as vegetated buffer strips along streams, conservation tillage, and other practices that reduce nutrient and soil loss from farms, with assistance from cost-share programs.	2	2	1	1	1	7	1.4	Low
<b>STRATEGIC PLANNING STRATEGY</b>								
<b>B1:</b> Continue efforts to identify opportunities to mitigate impacts of fluctuating and extreme water level events, in particular high and low water flows, on shoreline properties.	2	3	3	3	3	14	2.8	High

<b>B2:</b> Undertake responsible development planning within the watershed, and particularly along the shoreline.	2	3	3	3	3	14	2.8	High
<b>B3:</b> Undertake actions within the Fisheries Management Plan for Fisheries Management Zone 17, and the Trent Source Protection Plan.	2	1	2	2	3	10	2	Medium
<b>URBAN AND RURAL INFRASTRUCTURE STRATEGY</b>								
<b>C1:</b> Maintain safe and accessible public lake-access locations by improving water quality at the beach and addressing erosion issues at the boat launch.	2	2	3	3	3	13	2.6	High
<b>C2:</b> Ensure that construction projects, particularly road maintenance works, are conducted in a manner that does not degrade water quality or sensitive habitats.	2	3	2	2	2	11	2.2	Medium
<b>RESEARCH AND MONITORING STRATEGY</b>								
<b>D1:</b> Increase community participation in the routine monitoring of key indicators of lake health, including water quality and invasive species.	2	3	3	3	2	13	2.6	High
<b>D2:</b> Undertake routine monitoring of, and establish a relationship between, water levels and flows in Shadow Lake and Silver Lake to better characterize their hydrological regime.	2	3	3	3	2	13	2.6	High
<b>D3:</b> Undertake an inventory of existing septic systems, water use, and occupancy status on shoreline properties to better inform nutrient loading estimations.	2	3	1	3	3	12	2.4	Medium
<b>D4:</b> Conduct research to identify how the lake ecosystem responds to stressors such as cumulative development, climate change, and invasive species.	2	3	1	3	3	12	2.4	Medium
<b>COMMUNICATIONS AND OUTREACH STRATEGY</b>								
<b>E1:</b> Communicate the science, solutions, and outcomes of plan implementation among all active stakeholders in the Shadow Lake and Silver Lake watershed.	3	3	3	3	3	15	3	High
<b>E2:</b> Communicate on a regular basis the water management activities along the Gull River, including early warning of high, low, and variable water level events.	3	3	3	3	3	15	3	High