REPORT ON THE STATE OF

DRAFT PIKE LAKE

AND ITS WATERSHED




July 2009

Pike Lake Community Association and Volunteers
With Assistance from the Lake Management Planning Program

Pike Lake Community Association
Rideau Valley Conservation Authority
Friends of the Tay Watershed
Tay Valley Township
TD Friends of the Environment Foundation
Fisheries and Oceans Canada / Pêches et Océans Canada
Rideau Lakes Environmental Foundation
Lanark
The Ontario Trillium Foundation / La Fondation Trillium de l'Ontario

Draft Report on the State of Pike Lake and its Watershed 2009 — Executive Summary

An Overview

Property owners, cottagers, business owners and day-users of Pike Lake all have an interest in the current and future health of the lake and surrounding environment. In a watershed, we all live downstream. This means the activities carried out by ourselves and neighbours determine the quality and health of the lake ecosystem available to all of us. The cumulative impact of unsustainable human activity around the lake can cause deterioration in water quality, reduction in fish and wildlife habitat, and an overall decline in the quality of life in the watershed. Since 2005, the Pike Lake Community Association and its volunteers have been encouraging discussion, feedback, and input from the lake community to learn more about what individuals value about the lake and its watershed. Our hope is to find consensus on the major issues facing the health of our lake, and solutions on how those issues can be addressed.

However, Pike Lake community members, users, and partner groups (government and non-government agencies) need to understand the current health and condition of the Pike Lake watershed before they can develop recommendations to protect its long-term health. Through the 2005 lake survey, community meetings and open houses, the Pike Lake community identified nine main pressures and issues facing the lake and its watershed (see list on page 5). Lake Association volunteers and various organizations including the Ministry of Natural Resources, Rideau Valley Conservation Authority, Tay Valley Township, and the Township of Rideau Lakes collected and compiled information and data about the lake to produce the *Report on the State of Pike Lake and its Watershed.*

The intent of this report is to improve the knowledge and understanding of Pike Lake and its watershed by outlining its history, changes and trends over time, and examining the interactions and relationships of the lake environment relative to the pressures and issues facing the lake. While the pressures and issues identified by the lake community can have an impact on the entire Pike Lake watershed, the majority of the information presented in this report is specific to Pike Lake.

Based on the information provided in this report, property owners, cottagers, business owners, day users and decision-makers will work together to develop land use recommendations and stewardship actions aimed at addressing the issues and protecting the long-term health and special character of Pike Lake and its surrounding environment. Lake volunteers will gather these community-supported recommendations and actions into a second document, the *Pike Lake Stewardship Plan.* This plan will help guide the Pike Lake Community to address the issues facing Pike Lake through education, communication, stewardship actions, monitoring activities and the implementation of sustainable approaches to land use development.

The intent of the *Report on the State of Pike Lake and its Watershed* is to provide a summary of what is currently known about the Pike Lake watershed, and to describe how that information relates to the issues that are important to people who enjoy the lake. Members of the Pike Lake community will use this information to develop actions and recommendations that help ensure the long-term health of Pike Lake and its watershed.

The Pike Lake Stewardship Planning Process — *An Inclusive and Participatory Process*

The lake stewardship planning process provides an opportunity for everyone with an interest in Pike Lake to come together to discuss concerns and solutions relating to the health of the lake and its surrounding environment. This process works to improve the lake community's understanding of the lake, its watershed, its unique natural features; and how human activity is impacting the lake ecosystem. The process also provides an opportunity to strengthen relationships and encourage communication among the lake community members and its partner agencies.

The Pike Lake community is made up of everyone who works, lives and plays within the lake's watershed, including:

- permanent and seasonal property owners on Grants Creek, Crosby, Little Crosby and Pike Lakes. (Note: there has been no data collected for Crosby and Little Crosby Lakes);
- residents, cottagers, and farmers within the watershed;
- commercial operators including the Pike Lake Trailer Park, bait shop and rental cottages;
- day users including anglers, boaters, campers and picnickers; and
- Community Partners including government (municipal and provincial), non-government groups and other organizations such as: Community Stewardship Council of Lanark County, Fisheries and Oceans Canada (DFO), Friends of the Tay Watershed Association, Lake Networking Group, Leeds, Grenville and Lanark District Health Unit, Ministry of Natural Resources (Kemptville District) (MNR), Ministry of Environment (MOE), Ontario Provincial Police — Lanark County, Township of Rideau Lakes, Lanark County, County of Leeds and Grenville, Rideau Valley Conservation Authority (RVCA), and Tay Valley Township.

Working together, the community can develop a plan that outlines the issues and actions that address them in order to protect the long-term health and character of the lake and its watershed. **The Pike Lake Community Includes You! Your involvement and feedback is important!**

The Pike Lake Stewardship Planning Process — *A Long History of Involvement*

As early as 2001, when the first water quality data report from the Rideau Valley Conservation Authority's Watershed Watch Program resulted in a "D grade" for the lake, the idea of creating a lake plan was met with interest and curiosity. The creation of the Rideau Valley Conservation Authority Lake Management Planning Program (LMPP) and a presentation from the Program Manager at the 2005 Annual General Meeting stimulated further involvement by the lake community. At this AGM, driven by the wishes of the Pike Lake residents and property owners to protect the natural environment of the lake, the Pike Lake Community Association (PLCA) made the decision to undertake the lake planning process.

The first step in the lake planning process was to recruit volunteers from the lake community to form the Pike Lake Planning Steering Committee (Steering Committee), which was established in July 2005. Seven lake residents and property owners attended the first steering committee meeting to discuss the lake planning process and project plan. In the early days of the lake planning work, the committee began engaging members of the lake community in the lake planning process, gathering the needed historical information, and building sound working relationships with the Tay Valley and Rideau Lakes Townships. In subsequent meetings, with the assistance of LMPP representatives, the Steering Committee developed a complete project plan. During this period, lake volunteers attended several LMPP workshops and disseminated information to the lake community.

In the summer of 2006, the Steering Committee circulated a survey to lake residents and property owners to gain a better understanding about what the community valued about the lake. Based on the three primary values identified in the survey, the Steering Committee developed a Vision Statement for the lake stewardship planning process: *"The Pike Lake community's vision is to protect and improve the water quality, natural environment, and tranquility of the Pike Lake Watershed for present and future generations."*

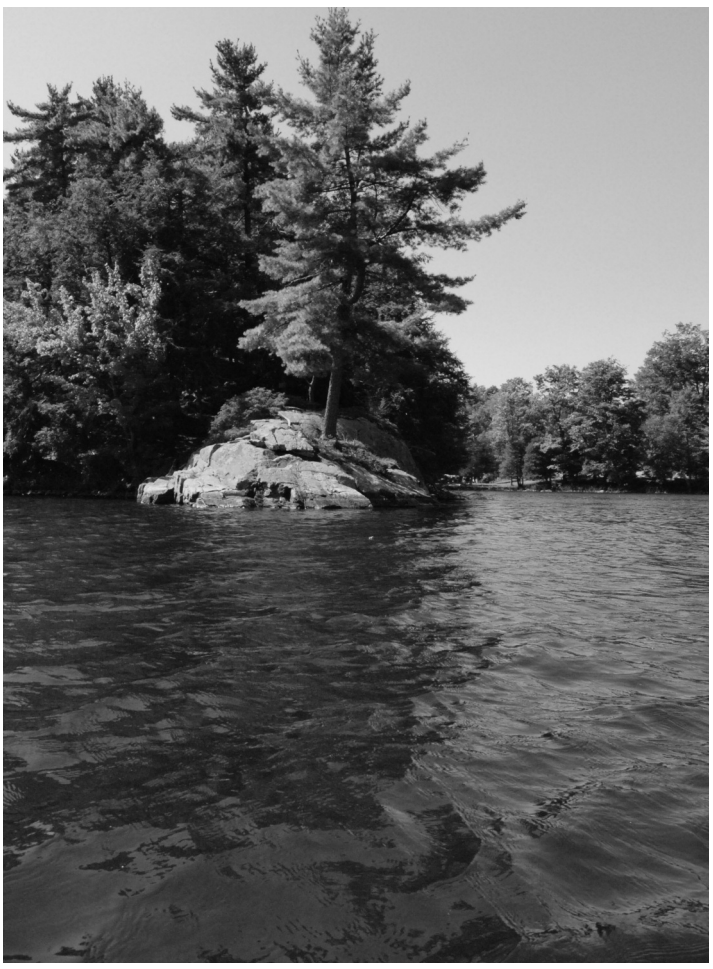
In addition to gathering information about what the community valued about the lake, the survey focused on identifying the issues the lake community wanted addressed on the lake. Through subsequent discussions and feedback gathered at community meetings and open houses, the Pike Lake Community identified nine main issues facing the health of the lake and its watershed.

In 2007, the Steering Committee was excited to learn that the RVCA Lake Management Planning Program accepted the Pike Lake Community Association's application to receive support throughout the Pike Lake planning process. This was a great step for the PLCA, because Pike Lake was one of the first lakes (second only to the Otty Lake Association) to be selected to receive support from this program.

Since that time, the Steering Committee has worked hard to collect information to develop the draft *Report on the State of Pike Lake and its Watershed* in order to provide an overview of what is currently known about each of these issues.

Once the lake community reviews this draft report, the Steering Committee will work towards completion of the *Pike Lake Stewardship Plan* based on feedback and direction of the lake community to address each of the nine issues identified in this report. This plan will help guide the Pike Lake Community in the implementation of stewardship actions, recommend and support sustainable land use policies and outline education and monitoring activities that will work to protect, preserve and maintain what the community values about the lake and its surrounding environment.

By involving everyone in the protection of Pike Lake and its watershed, individuals will have the opportunity to learn more about how their activities enhance or harm the lake. A better understanding of these relationships leads to better stewardship. **We need your involvement and participation for the Pike Lake Stewardship Process to succeed!**



The Pike Lake Watershed at a Glance

The Pike Lake Watershed

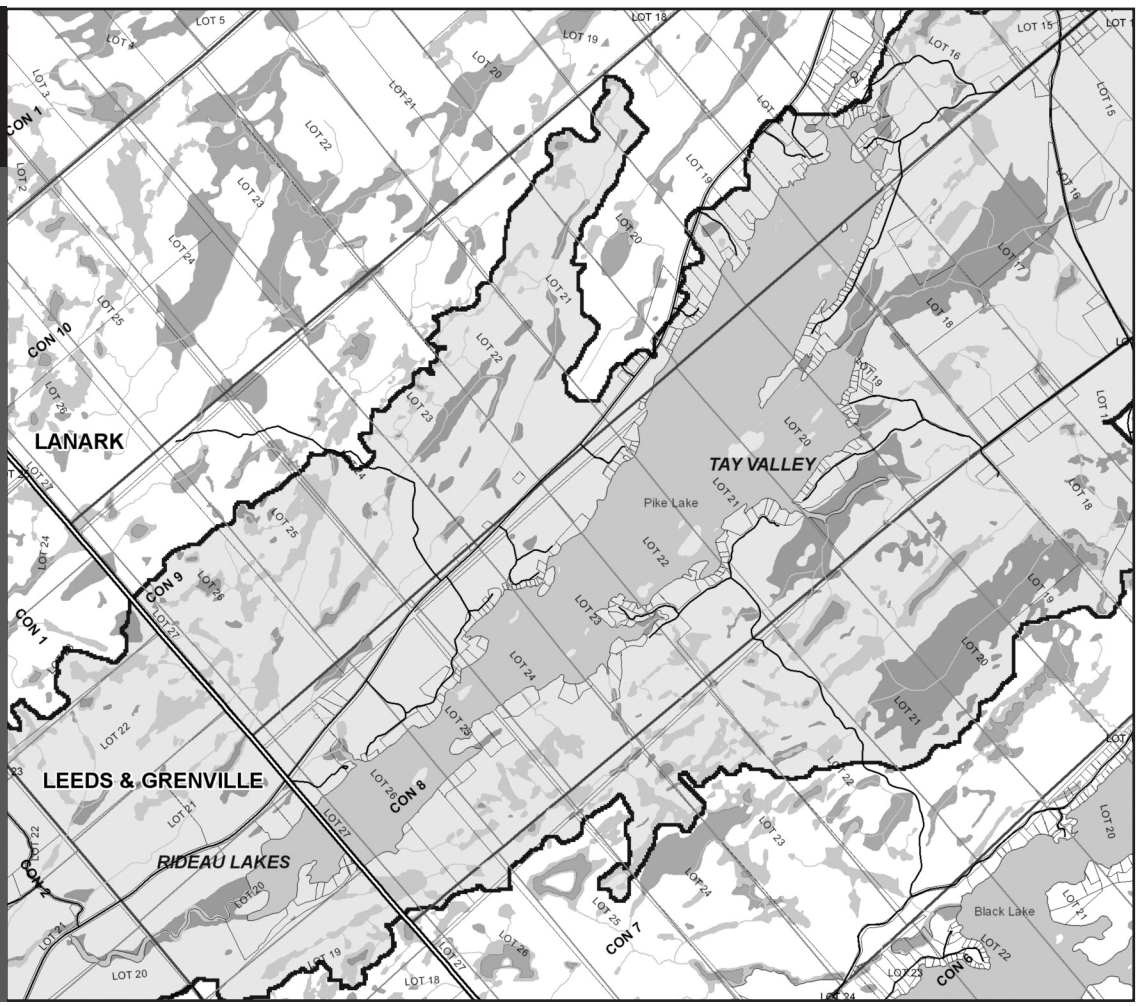
- Is one of 14 sub-watersheds in the Tay River Watershed
- Encompasses all the land and waterbodies that drain into Pike Lake including Crosby and Little Crosby Lakes, permanent and intermittent streams, many wetlands, and a large portion of the provincially significant Crosby Lake Creek Complex
- Total area: 66.6 km^2 (25.7 mi.^{2})
- Land cover is dominated by forest, with some agricultural land
- Includes the municipal Stanleyville Waste Disposal Site (currently a transfer station)

Pike Lake

- Total area: 3.16 km^2 (1.22 mi.^{2}), maximum depth: 32.6 m (107 ft), mean depth: 8.2 m (27 ft)
- Spans the boundary of two counties (Lanark and Leeds and Grenville) and two townships (Tay Valley Township and Rideau Lakes Township)
- Shoreline is typical of a Canadian Shield lake; generally steep and rocky
- The lake has 25 Crown land islands and one private island
- Tributaries: upper Grants Creek, two unnamed tributaries, and several smaller intermittent/seasonal streams, including a wetland area situated next to the Stanleyville Waste Disposal Site
- A stop-log dam on the lake's outlet (lower Grants Creek) is controlled by the Ministry of Natural Resources which maintains water levels on the lake

Pike Lake's Top Nine Issues

1. **Water Quality (both lake water and groundwater)**
2. **Development Pressures**
3. **Conservation and Protection of the Natural Environment**
4. **Impacts of Motor Vehicles**
5. **Crown Land**
6. **Mining Concerns**
7. **Aquatic Vegetation**
8. **Water Levels**
9. **Fisheries Health**



Water Quality (Surface & Groundwater)

- Water quality data from 2001 to 2008 indicates the lake has generally high concentrations of nutrients (phosphorus and nitrogen).
- The lake's average phosphorus concentration is 14 micrograms per litre (μg/L). The Provincal Water Quality Objective for phosphorus is 20 μg/L (a concentration above which excessive or presistent algae and aquatic plant growth is likely to occur).
- The lake's average nitrogen concentration is 472 μg/L. RVCA uses 500 μg/L as a guideline to indicate when concentrations of nitrogen are excessive in a lake.
- High nutrients in the lake can deteriorate water quality and contribute to excessive aquatic plant growth and algae blooms.
- The lake has had algae blooms.
- Analysis for bacterial contamination show bacterial counts do not pose a health concern for recreational and other water uses.
- The lake's watershed has thin soil cover. Consequently, groundwater within the watershed is susceptible to surface contamination from land use activities, improperly sealed abandoned wells, or faulty septic systems.
- Based on the Ministry of the Environment's (MOE) 2006 Water Well Information System, there are an estimated 193 drilled wells within the watershed. It is unclear how many wells are around Pike Lake.

Development Pressures

- Based on a survey completed in 2007, there are 266 properties within 300 m (984 ft) of the lake including:
  - 155 seasonal properties; 58 permanent residential, 5 farm properties and 31 vacant lots;
  - Moodie's Cottage Rentals, Pike Lake Bait Shop, and the Pike Lake Trailer Park (50 campsites).
- The conversion of cottages to permanent homes is increasing around the lake. Unsustainable development within the watershed may impact the lake's natural landscape, water quality, and overall health.
- Although the Pike Lake watershed falls within the jurisdiction of two municipalities, the planning policies that guide waterfront property development in the Tay Valley and Rideau Lakes Townships are similar. These policies promote the principles of sustainable development and the preservation and enhancement of waterfront areas. Increased setback requirements, larger waterfront lot sizes, "Floor Space Index" provisions, and Site Plan Controls are in place in order to limit the scale of development on smaller waterfront properties, while accommodating a modest proportion of new development around the lake.

Conservation and the Protection of the Natural Environment

- Based on land classification mapping, the lake's watershed is dominated by deciduous forest (36 percent), mixed forest (32 percent), and coniferous forest (2 percent)
- There are many permanent wetlands throughout the watershed adjacent to the lakes, streams and creeks. Wetlands make up 10 percent of the watershed's land cover, including a portion of the provincially significant Crosby Lake Creek Complex.
- Pastureland and abandoned fields make up 3 percent of the watershed's land cover.
- Pike Lake's watershed has several identified Species at Risk including the Eastern ratsnake, least bittern, and bald eagle. These species are at risk primarily because of habitat destruction.
- Little is known/recorded about wildlife populations (birds, furbearers, amphibians and reptiles) and their habitat conditions in the Pike Lake watershed.
- Habitat loss through residential development, the removal of natural shoreline vegetation, and declines in water quality threaten the fish and wildlife species found throughout the lake's watershed.

Impacts of Motor Vehicles

- Multi-season and multi-use recreation occurs around Pike Lake. While the vast majority of recreationists are responsible, respectful and safe in the way they pursue their interests, some conflict of use of this shared resource can occur.
- It is vital that the various recreational activities undertaken by the lake community are carried out in a sustainable way. Respectful use of the natural landscape and supporting infrastructure; protection of the lake's water quality, and wildlife habitat; limiting air pollution; and ensuring encroachment on private property does not occur will protect Pike Lake and its watershed.
- Boating is a popular pastime on the lake. Potential impacts of boating include shoreline erosion from boat wake, water, noise and air pollution, impacts on nesting waterfowl and introduction of invasive species to the lake ecosystem.
- Testing for invasive species on the lake is ongoing. As of September 2007, zebra mussel veligers (a mobile, juvenile form of the zebra mussel) or spiny waterflea have not been detected on the lake. However, in 2008 observations of zebra mussels have been made on Crosby Lake.

Crown Land

- The lake has 25 Crown land islands. The largest islands are frequently used by the public for day use, weekend and long-term camping activities. Activities and the use of public lands are governed by polices outlined in the Ministry of Natural Resources *Public Lands Act.*
- Concerns from lake residents and users

have been raised about the unsustainable use of the islands for camping activity (specifically: littering of the natural space, noise, denuding of vegetation, improper disposal of septic waste and the impact of fire damage from unattended fires (i.e., fire of May 2008).
- Working with all stakeholders that enjoy the islands, a sustainable solution for the continued shared use of the lake's public lands should be explored by the Pike Lake community.

Mining Concerns

- Although a significant portion of the lands within the Pike Lake watershed are fully patented (meaning the mining rights are privately owned, including all of the lands within the Township of Rideau Lakes); the mining rights of an estimated 10 to15 percent of the land directly surrounding Pike Lake rests with the Crown.
- According to Ministry of Northern Development and Mines (MNDM) mapping, property owners within Lot 19, Concession 8, Lot 20, Concession 9, and Lot 21, Concession 9 around the lake own only the surface rights to their property.
- On April 30 2009 the *Mining Amendment Act,* Bill 173 was introduced to modernize the *Mining Act*. It has been through first and second reading.
- As of April 30, 2009 all surface rights only land has been WITHDRAWN from mining in southern Ontario. The government does not plan to return mineral rights to the owners of surface rights only land
- On presently claimed surface right only land the rights will not be withdrawn until the mining company relinquishes the claim in the future (There are 14 of these claims at the south end of Black Lake).
- There are currently no active mining claims within the Pike Lake watershed.

Aquatic Vegetation

- Based on observations by lake property owners and users, the density of Eurasian watermilfoil has increased in shallow bays on the lake making recreational activities such as swimming and boating less enjoyable. High nutrient levels on the lake contributed by human activity (faulty septic system runoff, use of fertilizers, and removal of shoreline vegetation) leads to excessive aquatic plant growth.
- Monitoring on the lake to show if the types of aquatic plant and growth patterns have changed over time has not been completed.
- Algal blooms have been documented on the lake. Such blooms and increasingly excessive weed growth can be expected in shallow areas of Pike Lake and are likely the result of changes in weather and ice cover patterns, nutrient inputs and temperature variations throughout the year.

Water Levels

- The Ministry of Natural Resources (MNR) has operated a dam at the outlet of Pike Lake (on lower Grants Creek) since 1970.
- The MNR's objective for water level management is to maintain water levels that are suitable for recreational activities and ecological requirements on Crosby, Little Crosby and Pike Lake, while meeting downstream water flow requirements.

Fisheries Health

- Pike Lake is a cool water fishery that supports walleye, smallmouth and largemouth bass, northern pike, yellow perch and pan fish.
- The lake was historically stocked with largemouth and smallmouth bass and walleye from 1930 to 1979. However, the sport fish populations, specifically walleye, appear to be naturally reproducing and sustaining their populations, and therefore, the MNR does not currently stock the lake.
- According to the 1998 MNR Pike Lake Fisheries Report, dam operations on the lake may have negatively affected the fish populations in the past. Recorded impacts include the restricted movement of fish populations from suitable habitat areas needed for spawning or feeding; the flooding of northern pike spawning areas during spring incubation and nursery areas; and a rapid water level drawdown in the spring of 1982 believed to have impacted walleye spawning activity for that year.
- In 2008, the MNR reviewed the Pike Lake water level operations. Current research has shown that fish populations are adaptive to fluctuations in water levels as long as changes in water levels occur before the spawning period. Based on the water level data and operations at the Pike Lake Dam, it is likely fish populations, specifically pike and walleye are not being affected at this time.
- Loss of fish habitat through shoreline development, and the removal of natural shoreline vegetation, increased boating activity, decreased water quality, and over-harvesting threaten the health of the lake's fish populations.
- Information about fish populations on Pike Lake was last reported in 2003.

Where do we go from here?

Over the last several years we have accomplished a lot in documenting the history and current state of the Pike Lake ecosystem. Based on the information provided in this report, the community will develop recommendations and stewardship actions aimed at addressing the issues to protect the long-term health and special character of Pike Lake and its watershed. These community-supported recommendations and actions will be included in the *Pike Lake Stewardship Plan*. Want to know more? For a copy of the full draft *Report on the State of Pike Lake and its Watershed,* please contact the Pike Lake Community Association, Bart Poulter, bart.poulter@sympatico.ca or visit www.pikelake.ca.

Intent - Draft Report on the State of Pike Lake and its Watershed

Property owners, cottagers, business owners, watershed residents, and day-users of Pike Lake all have an interest in the current and future health of the lake and surrounding environment. Since 2005, the Pike Lake Community Association and its volunteers have carrying out the lake stewardship planning process to encourage discussion, feedback and input from the lake community to learn more about what individuals value about the lake and its watershed, to find consensus on the major issues facing the health of the lake, and to address those issues.

Through the 2005 lake survey, community meetings, and open houses, the Pike Lake community identified nine main pressures and issues facing the lake and its watershed. Lake Association volunteers and various organizations including the Ministry of Natural Resources, Rideau Valley Conservation Authority, Tay Valley Township, and the Township of Rideau Lakes collected and compiled information and data about the lake to produce the *Report on the State of Pike Lake and its Watershed* (the report).

The intent of this report is to improve the knowledge and understanding of Pike Lake and its watershed by outlining its history, changes, and trends over time, and examining the interactions and relationships of the lake environment relative to the pressures and issues facing the lake.

Based on the information provided in this report, property owners, cottagers, business owners, watershed residents, day users and decision-makers will work together to develop land use recommendations and stewardship actions aimed at addressing the issues and protect the long-term health and special character of Pike Lake and its watershed. Lake volunteers will gather these community-supported recommendations and actions into a second document, the *Pike Lake Stewardship Plan*.

Acknowledgments

The Pike Lake Community Association would like to thank the many dedicated Pike Lake volunteers that have contributed hundreds of hours to the Pike Lake Stewardship Planning process to date. The Association would also like to thank our Community Partners and the Lake Management Planning Program for the support and help in the development of this report. The Ontario Trillium Foundation, Community Stewardship Council of Lanark County, Fisheries and Oceans Canada, TD Friends of the Environment Foundation, Rideau Lakes Environmental Foundation and the Rideau Valley Conservation Authority have provided funding support for the Pike Lake Stewardship Planning process.

Special thanks to:

Mandy Bjerkelund
Mark Campbell
Lisa Campbell
Audrey Cook
Rick Cormier
Adrienne Fowlie
Wendy Hassard
Karen Hunt
Kay Rogers
Jeff Kohl, Ontario Healthy Communities Coalition
Jane Lindsay
Anne and Gordon McCallum
Bart and Dale Poulter
Denise Poley
Orest Roscoe
Cathy Squires
Maureen Towaij
Current and past members of the Pike Lake Planning Steering Committee
- Geoff Mace
- Cathy Cameron
- Victor Conrad
- Adrienne Fowlie
- Andrea Klymko (RVCA)
- Aili Kurtis
- Gordon McCallum
- Bart Poulter
- Pat Shore
- John Wilson

Bird Studies Canada
CGIS Spatial Solutions
Community Stewardship Council of Lanark County
Department of Fisheries and Oceans
Friends of the Tay Watershed Association
Jacques Whitford
Ministry of Environment
Ministry of Natural Resources
- Anne Bendig
- Sarah MacHardy
- Dale McLenaghan

Ministry of Northern Development and Mines
Mississippi Valley Conservation
Ontario Provincial Police – Lanark County
Otty Lake Association
Rideau Valley Conservation Authority
- Andrea Klymko

Township of Rideau Lakes
Tay Valley Township
- Kathy Coulthart-Dewey
- Joanna Reed

The Fowlie family

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Part 1: Pike Lake and its Watershed Description

The Pike Lake watershed encompasses the area of land that drains into Pike Lake, including Crosby and Little Crosby Lakes, as well as all the wetlands and permanent and intermittent streams that drain into those lakes. The watershed spans the boundary of two counties (Lanark, Leeds and Grenville) and two townships (Tay Valley Township and Rideau Lakes Township) (Refer to Map 1).

The Pike Lake watershed is one of fourteen subwatersheds that make up the larger Tay River watershed. From Crosby Lake, the water flows into Little Crosby Lake, through upper Grants Creek to Pike Lake. Lower Grants Creek, the lake's only outlet, drains Pike Lake. Grants Creek flows to the Tay River, west of Perth. The Tay River eventually drains into Lower Rideau Lake. Refer to Table 1 for key features and physical characteristics of Pike Lake and its watershed.

Table 1: Physical Characteristics of Pike Lake and its Watershed

Lake Watershed Area	66 km^2 (25.7 mi^2)
Watershed Orientation	Northeast to southwest direction
Located	Approximately 10 km (6.2 mi) southwest of the Town of Perth
Latitude	44^o 47' north
Longitude	76^o 21' east
Lake Surface Area	3.16 km^2 (1.22 mi^2)
Lake Height Above Sea Level	145.1 m (475.7 ft)
Length	6 km (3.7 mi)
Width	0.5 km (0.3 mi)
Shoreline Length	22.5 km (14 mi)
Average Depth	8.2 m (27 ft)
Maximum Depth	32.6 m (107 ft)
Flushing Rate of Lake (times per year)	0.8
Lake Volume	26.58 x 10^6 m^3
Annual lake inflow/outflow (from all stream inputs as well as surface runoff and precipitation)	21.16 x 10^6 m^3
Number of Islands	25 Crown Land islands, 1 private - range in size from very small outcrops; approximately 3 m^2 (32 ft^2), to the largest; approximately 1.21 ha (3 ac)

1. Pike Lake

Pike Lake is long and narrow with a steep and rocky shoreline. The northwestern shoreline (Perth end of the lake) is steep. Populated with several islands, the southeastern section of the lake (Westport end of the lake) has a more gradually sloping shoreline. The lake has an average depth of 8.2 m (27 ft). The northeast end of the lake, including the large eastern bay, has an average of depth of 12 m (40 ft) with progressive drop offs. Mixed forest cover with outcroppings of exposed bedrock characterizes the backshore area of the lake.

The littoral zone makes up about 35% of the lake's area. The littoral zone is the shallow transition zone between dry land and the open water area of the lake. The shallow water, abundant light, and nutrient-rich sediment in this area provides ideal conditions for the growth of aquatic plants, which in turn provide food and habitat for many animals such as frogs, birds, muskrats, turtles, insects, and snails. This part of the lake also provides the essential spawning habitat for many fish species. Protecting the littoral zone is important for the health of the lake, as well as the health of fish and wildlife populations.

The majority of the shoreline around the lake is privately owned. There is one privately owned island on the lake with a cottage. The remaining 25 islands are Crown Land (provincially owned) islands. Other public lands within the watershed include the Bard Conservation Area; owned and managed by the Rideau Valley Conservation Authority (RVCA) (Refer to Map 1).

The lake has a developed shoreline, with most permanent residences on the northwest shoreline. Comparatively, the south and southwest shores are least developed. Owned by the MNR, there is one public boat launch at the northwest end of the lake. There are several other privately owned boat launches around the lake including one at Moodie's Rental Cottages. Commercial operations on the lake (all located on the northwest shore) include the Pike Lake Trailer Park, Moodie's Rental Cottages, a bait shop, and other home-based businesses.

1.1 Hydrology

Crosby and Little Crosby Lakes drain into Pike Lake via upper Grants Creek at the southwest end of the lake. Two other tributaries drain into the lake. Several other smaller, intermittent, and seasonal streams drain into the lake depending on the amount of annual rainfall and snow pack. A lake volunteer has observed several underwater springs at the north end of the lake.

Pike Lake's outlet (lower Grants Creek) is at the northeast end of the lake. Water levels are managed by the MNR. A stop-log dam is used to maintain levels suitable for recreational activities and ecological requirements on Crosby, Little Crosby, and Pike Lakes, and to meet downstream water flow requirements. For more information about the Pike Lake Dam operations, see Section 8 Water Levels. Upstream of the dam, beaver dams are occasionally present, but do not appear to affect the lake water level.

The turnover time for the lake, or the length of time it takes for all the lake's water to be replaced with new water, is estimated to be less than once per year (0.8 years) depending on precipitation and obstacles to

outflow (Kerr 1998). Because the turnover time of the lake is fairly short, the observed water quality condition of the lake in a given year (algal blooms, excessive growth of aquatic plants, etc) is in part a function of the quality of the water that drains into the lake from upstream lakes and streams, surface water runoff, groundwater discharge, and precipitation over the previous year (Michalski, 1992).

1.2 Bedrock Geology

The Pike Lake watershed lies in a transition area between the **Canadian Shield** and the Smith's Falls Limestone Plain. The topography in the area has steep slopes, thin soil cover, many exposed rock outcroppings, and poor drainage, creating localized wetland areas.

The majority of the watershed area is underlain with Precambrian rock (older than 590 million years) which is part of the "Frontenac axis" that extends south to the St. Lawrence River. The rock is composed of paragneiss, quartzofeldpatic gneiss, quartz arenite, calcite, and dolomite marbles (Esseltine, 2001). These rocks are highly folded and faulted.

A small portion of the watershed's northeastern tip is composed of sedimentary rocks from the Paleozoic age (590 to 240 million years old). These rocks consist of gently sloping, unmetamorphosed limestone, dolomites, shales, and sandstones (Esseltine, 2003).

1.3 Soils

Much of the soil layer along the west side of the lake is made up of **glacial till** (accumulations of unsorted, un-stratified mixtures of clay, silt, sand, gravel, and boulders) called 'till vaneer' and 'till blanket' with sandy pockets. The east side of the lake is also primarily composed of glacial till but has pockets of organic soils. **Organic soils** dominate the low areas along the upper Grants Creek area at the south end of the lake (Kettles, 1992).

1.4 Climate

The Pike Lake region experiences a **temperate climate** with cold winters and hot summers. Data collected at Drummond Centre (45° 01' N, 76° 15'W) weather station between 1984 and 2008 was used to outline the climatic conditions in the lake's watershed.

Over the past 24 years, the monthly temperatures have remained relatively constant with average temperatures in January and February of -8.6 °C (16.5 °F) and -8.5 °C (16.7 °F) respectively. Average temperatures in July and August were 20.2 °C (68.4 °F) and 19.1 °C (66.4 °F) respectively.

Over 24 years, the average amount of precipitation (snow and rain) is 869 mm (34 in) with about 27% falling during the summer months (June, July and August). The wettest year was 2008, with 1082 mm of total average precipitation, while 2001 was the driest year with 695 mm (27 in) of precipitation).

April 2001 was the driest month in this time span, with less than 10 mm (0.4 in) of rain while September 1986 was the wettest month with close to 180 mm (7 in). Average snowfall for the area (December, January, and

February) is approximately 184 cm (72 in) per year. The frost-free period in the watershed ranges between 117 and 134 days with an average growing season of 190 days (Kerr 1998).

2. Landcover

2.1 Forest

Based on land classification mapping, the lake's watershed made up of 36% deciduous, 32% mixed, and 2% coniferous forest cover (refer to Map 2 and 2b). Tree species found around the lake include Eastern butternut (endangered species), Eastern hemlock, hard maples, ironwood, red oak, trembling aspen, white ash, white birch, white cedar, white elm, white oak, and white pine.

2.2 Agriculture

Land classification mapping indicates pastureland and abandoned fields make up 3% of the watershed's land cover. Croplands make up another 3% of the watershed's land cover. The majority of the land used for agriculture is found at the northeastern portion of the watershed, with the remainder located along the Scotch Line Road and County Road 36 (refer to Map 2 and 2b).

2.3 Wetlands

There are many permanent wetlands throughout the watershed adjacent to the lakes, streams, and creeks and in areas where the groundwater table is close to the surface. Wetlands make up 10% of the watershed's land cover, which includes a portion of the provincially significant Crosby Lake Creek Complex, found in Rideau Lakes Township. Refer to Map 1 for locations of these significant areas. For more information about the watershed's wetlands, refer to Section 3 Conservation and Protection of the Natural Environment.

3. Land Use

3.1 Development History

Prior to European settlement, First Nations people likely moved through the region to fish and hunt, however, their impact on the land and water was minimal.

European settlers began arriving in the Perth region of Lanark County in the early part of the 1800s. Most of the early settlement in the area was done by pensioned, discharged British military personnel who were given land grants of 40 – 80 ha (100 - 200 ac) by the Crown during the construction of the Rideau Canal. The majority of the early settlers in the Pike Lake area were of Scottish and Irish descent (McGill, 1979). In 1812, Pike Lake was named by a local land surveyor (R. Sherwood) because of the abundance of northern pike in the lake at that time (Kerr, 1998).

Much of the area around the nearby village of Stanleyville (named after Michael Stanley) was settled in the 1840s, and became well developed, boasting a church and a store. By 1863, Stanleyville had a town hall, a schoolhouse, and a few houses. Land in North Burgess Township (now part of Tay Valley Township) and

North Crosby (now part of Rideau Lake Township) was relinquished by the First Nations people to the Crown by Crawford's Purchase on October 9, 1873.

For more information about development around the lake, refer to Section 2 Development Pressures.

3.2 Forestry and Agriculture

Many small farms emerged on the limited tillable farmland in portions of the lake's watershed in the early 1800s. The early form of commerce in the area was farming, mining, logging, and maple syrup production. Pioneers hauled these products to Perth for distribution. Currently, there are five farms around the lake, and one privately managed forest within the watershed.

3.3 Mining, Pits and Quarries

Some 19th century settlers quickly learned that the rocky and stone-ridden land was, at best, marginal for farming. They turned to mining mica and apatite, and producing potash to sustain their livelihood in the former North Burgess Township. The Pike Lake area proved to be an important source of mica with significant mining activity throughout the 1800's. A New York company opened the Pike Lake Mine (Lots 16 and 17, Con 9 of North Burgess Township – east end of Pike Lake) in 1860. The mine closed in 1880 and reopened in 1892.

In 1886, a mining boom pushed the importance of mica to an all-time high, leading to 30 mica mines operating in former North Burgess Township. Stanleyville was known as 'Micaville" during that time. Mica mining ended in the area around 1912.

In 1950, a mining company prospected vermiculite (a mica-like mineral) near Stanleyville (Lot 17, Con 8 of old North Burgess Township). Surface and near surface sampling using pits and trenches, and subsequent mapping of the property was completed. However, the deposit was not considered economically viable and work was ended in 1951. Once sold, the property operated as an open pit aggregate mine. Activity on the property ended in 1961.

Today, several abandoned mica mines and pits exist throughout the northeast section of Pike Lake near Stanleyville. There is one active aggregate operation located across from the Stanleyville Waste Disposal Site. For detailed information about current mining issues in the area, refer to Section 6 Mining Concerns.

3.4 Kevan Drain

To provide quality agricultural products, a farmer depends on the natural environment, good weather, and workable soil. However, farmers sometimes need to modify the environment in order to grow crops. One of these changes may require the drainage of surface and subsurface water from low areas in their land by constructing or converting existing natural watercourses into open drains. There are three different types of drains – municipal, private, and mutual agreement drains (Ontario Federation of Agriculture, 2006).

The Kevan Drain is an open channel municipal drain, found east of Stanleyville, south of Stanleyville Road in Tay Valley Township. This drain flows into a natural watercourse that eventually empties into Pike Lake (refer

to Map 4). Created under the authority of the *Drainage Act*, municipal drains require review under various pieces of legislation including, Section 35 of the federal *Fisheries Act*, Section 28 of the *Conservation Authorities Act*, environmental assessment legislations and the *Endangered Species Act*. Once approved, drains are part of the municipality's infrastructure and are the municipality's responsibility to repair and maintain.

Classified as a Type F Municipal Drain, the Kevan Drain is dry at least 3 months of the year (intermittent water flow). As a result, the fish spawning and nursery habitat that may be important for various species is available only for a limited time in the spring and early summer. Because fish habitat is present in this drain during periods of elevated water levels in the spring, and during important spawning and nursery times, any proposed work and maintenance carried out on this municipal drain requires review and approval by the Rideau Valley Conservation Authority under their level II agreement with Fisheries and Oceans Canada. This review and approval of proposed work and maintenance ensures fish and fish habitat are protected during and after the proposed work period.

In the summer of 2008, the Kevan Drain underwent a full clean out to maintain its effectiveness in draining surface water. In order to avoid harmful impacts to fish habitat in the drain and downstream, work was carried out during dry conditions, with sediment and erosion control measures put in place throughout the construction period. These mitigation measures will be in place until the area disturbed by the work has completely re-stabilized with vegetation.

3.5 Stanleyville Waste Disposal Site

The Stanleyville Waste Disposal Site is located on Stanleyville Road just south of Stanleyville in Burgess Ward, Tay Valley Township. It is one of three active waste disposal/transfer sites in the municipality. The Amended Provisional Certificate of Approval (No. A450801) issued by the Ministry of the Environment (MOE) defines the extent of the site, the types of waste to be accepted, and any necessary or specific conditions for design and operation of the site. The Certificate of Approval also describes how the site is to be maintained and monitored for the long-term protection of the environment. The MOE requires the municipality to test surface and groundwater quality twice annually through testing wells on the site's property.

The total site area is 13.17 ha (32.54 ac), with a landfill area of 2.56 ha (6.33 ac). The site is approximately 120 m (394 ft) from an unnamed stream that flows through a culvert just south of the landfill into a large wetland area. This wetland eventually drains into the large bay on the east side of the lake (about 1.7 km/ 1 mile away from the landfill site) and provides valuable breeding habitat for many birds, fish, and mammals. A water quality sampling site is monitored at the mouth of this tributary. Refer to Map 3 for water quality mapping sites.

In order to conserve the Stanleyville site landfill capacity, and reduce the costs of applying and compacting cover material at the site, the Tay Valley Township converted the site into a waste transfer station, with waste and recyclables being sent to the Glen Tay Waste Disposal Site. Once the Glen Tay site has reached capacity,

the Stanleyville site will be re-opened to accept waste. The remaining capacity of the Stanleyville site is estimated to be about 153,800 m^3 with an expected site life in excess of 20 years.

In Ontario, landfill sites are subject to Part V of the *Environmental Protection Act* and its regulations. Regulation 347 is the general waste management regulation under Part V of the *Environmental Protection Act* and provides definitions of waste management terms, defines different classes of waste, and provides standards for the design and operation of landfill sites. For new or expanding landfill sites, these regulatory requirements are superseded by Regulation 232/98.

In the Stanleyville Waste Disposal Site 2007 Annual Report, prepared by the municipality's consulting engineers, stated the total amount of household waste deposited at the site was 24,760 bags, an increase of approximately 6.6% over the previous year. During the year, Tay Valley Township recycled 751 tonnes of material. Using data collected in topographical surveys in 2006 and 2007, the engineers calculated that a volume of 510 m^3 (cubic metres) of waste, berm and cover materials were placed in the landfill during a nine-month period of operation.

In order to conserve the Stanleyville site landfill capacity, and reduce the costs of applying and compacting cover material at the site, the MOE permitted the municipality to operate the site as a waste transfer station. Since September 2007, scrap metal and electronic waste, compacted household waste, and blue box recyclables received at the site are compacted and trucked to the Glen Tay Waste Disposal Site on a routine basis. Once the Glen Tay site has reached capacity, the Stanleyville or the Maberly landfill sites will be re-opened to accept waste.

Utilizing capacity data available for the past seven years, engineers have calculated the capacity and site life for the Stanleyville site. Considering the current site's use as a transfer station, and that population growth, consumption patterns, recycling program costs, revenues, and diversion rates can fluctuate considerably over time, it is difficult to project a site closure date. However, it has been estimated, with a calculated average fill rate of 0.74 m^3 per capita per year, the remaining capacity of the site is about 153,800 m^3 with an expected site life in excess of 20 years. Refer to Appendix 1 for the Stanleyville Waste Disposal Site Profile and Capacity Analysis.

3.5.1 Surface Water Testing at the Stanleyville Waste Disposal Site

Both operating and closed landfills can produce **leachate** (contaminated water that contains metals, organic chemicals, bacteria, and other toxic chemicals). The effect each landfill site has on the surrounding environment and surface and groundwater quality depends on the site's characteristics, including the **attenuation capacity** of the overburden soils, the type of waste stored in the landfill, the age and size of the landfill, and the distance traveled by leachate plumes (MOE 2008, RVCA, 2000).

Tay Valley Township's Certificate of Approval, issued by the MOE, guides the operation of the Stanleyville Waste Disposal Site. The guidelines require an annual hydrogeological assessment to measure the impact of the waste disposal site on the local surface water and groundwater sources.

For many years, the municipality has engaged the services of a consulting engineering firm to review the operation and development of the site, to provide surface water and groundwater monitoring programs, and to report the results to the MOE and the municipality on an annual basis. The following will discuss the surface water monitoring and water quality results for the waste disposal site in 2007. Information has been referenced from the *Stanleyville Waste Disposal Site 2007 Annual Report, Tay Valley Township,* prepared by McIntosh Perry Consulting Engineers Ltd, and the *2007 Annual Hydrogeological Assessment Report*, prepared by Jacques Whitford.

In monitoring surface water quality at the site, the consulting engineers are governed by the Provincial Water Quality Objectives (PWQO). The PWQO are 'criteria, which serve as chemical and physical indicators that represent a satisfactory level for surface water quality, which is protective of all forms and aspects of aquatic life and its cycles during indefinite exposure to the water'. The PWQO for protection of recreational water use are based on public health and aesthetic considerations. The municipality is required to conduct surface water monitoring two times per year in the spring and summer at two specified stations, with samples analyzed for the following water quality parameters (refer to Appendix 3) at detection limits low enough to allow for comparison with the PWQO.

Surface water samples were collected from three surface water stations [SW-1, SW-2 and SW-3] on May 22, 2007 (Refer to Appendix 2 for the Stanleyville Waste Disposal Site Existing Conditions and Sampling Stations). All surface monitoring stations were dry during the October sampling period. A second attempt at the fall sampling was completed on December 13, 2007. A sample was collected from station SW-2 but surface water stations SW-1 and SW-03 were either dry or frozen.

The 2007 surface water samples results were similar to the results from 2006. A few parameters slightly exceeded PWQO during the sampling process. Appendix 3 outlines the surface water samples taken in 2007 that had parameters exceeding the PWQO.

The MOE Certificate of Approval and its orders of compliance also include Trigger Mechanisms and Contingency Plans for both surface and groundwater. The testing station SW-2 is designated as the compliance station for the surface water sampling. If the identified trigger parameters for water quality at this station (specifically boron and un-ionized ammonia) exceeds PWQO levels, the station is tested again within 45 days. Two additional parameters, chloride and total phosphorus, have been identified to supplement the basic parameters but no decision making will be based on them. If the selected trigger parameter exceeds the PWQO in two or three consecutive sampling events, then a variety of prescribed contingency measures are applied as circumstances dictate. The main objective of the surface water trigger mechanism is to ensure that measures are carried out to prevent leachate-impacted surface water that exceeds the PWQO from migrating beyond the waste disposal site boundaries.

At compliance station SW-2 in 2007, the trigger parameter boron met the PWQO limit but total phosphorous exceeded its limit. However, it has been recognized that total phosphorous is naturally elevated in this area, as indicated by historical high concentrations observed at the background station (SW-1). The current surface water-monitoring program is to be reviewed with the MOE.

3.5.2 Groundwater Testing at the Stanleyville Waste Disposal Site

The Renfrew County – Mississippi – Rideau Groundwater Study identified the Stanleyville Waste Disposal Site as a potential or existing contaminant source to groundwater quality. Ongoing monitoring programs and hydrogeological studies will continue to define the degree of groundwater impacts to this area.

The MOE Certificate of Approval requires the Tay Valley Township to complete an annual hydrogeological assessment to measure the impact of the Stanleyville Waste Disposal Site on the local groundwater and surface water sources. A consulting engineering firm reviews the operation and development of the site, carries out surface and groundwater monitoring programs, and reports the results to the MOE and the municipality on an annual basis.

According to the 2007 Annual Hydrogeological Assessment Report, Stanleyville Waste Disposal Site has a soil, sediment, and rock overlay that is made up of three layers: peat, permeable sand and gravel overburden (with some clay and silt seams), and underlying Precambrian granite/gneisses bedrock with a few fractures. The upper peat layer is generally located in the floodplain of the unnamed creek and marshy lands located to the south and downgradient of the landfill site. The sand/gravel overburden is located underlying the peat in the marshy areas. The bedrock layer encompasses the area (which is a buried valley). A number of bedrock outcrops are found to the north and south of the site.

The overburden groundwater generally flows from the site in a southward direction to the low-lying marshy areas, following the long axis of the buried valley and then travels west along the wetland. This overburden aquifer is considered to be the critical aquifer at this site. The bedrock groundwater generally flows southward.

In monitoring groundwater quality at the site, consulting engineers are governed by the Reasonable Use Guidelines and the Ontario Drinking Water Quality Standards (ODWQS). Reasonable Use Guidelines are designed to protect the groundwater quality in consideration of current and potential land use in the area. The ODWQS provide a province-wide standard to protect the quality of groundwater that is, or may be used, as a potable water source.

The municipality is required to conduct groundwater monitoring two times per year in the spring and fall from six designated wells, with samples analyzed for the following water quality parameters (refer to Table 5) at detection limits low enough to allow for comparison with the ODWQS.

The consultants collected groundwater samples from six overburden monitoring stations [BH-1, BH-2, GA-1, BH05-01, BH06-01, and BH06-02] and two bedrock monitoring stations [BR-2 and BR-3] on May 22 and October 9 and 29, 2007. Refer to Appendix 2 for location of sampling stations. The 2007 groundwater samples indicated continued leachate impact to the immediate down gradient area of the landfill site. The sampled parameter concentrations were comparable with data from 2006. Appendix 3 outlines the groundwater samples taken in 2007 that had parameters exceeding the ODWQS.

The MOE Certificate of Approval and its orders of compliance also include Trigger Mechanisms and Contingency Plans for both groundwater and surface water exceedances. According to the 2007 Stanleyville Waste Disposal Site Annual Report the objective of the groundwater trigger mechanism is to implement a contingency plan to control leachate-impacted groundwater that exceeds the Reasonable Use Guideline from migrating beyond the site boundaries.

The overburden aquifer well BH-1 has been designated as the compliant station for the contingency plan. Chloride, sodium, and boron are the three leachate trigger parameters. If a selected trigger parameter exceeds RUC levels, the station should be tested again within 30 days. If the selected trigger parameter exceeds RUC levels in two or three consecutive sampling events, then prescribed contingency measures must be implemented.

In 2007, several monitoring stations revealed parameters, which exceeded the calculated 2007 RUC. However, none of the selected trigger parameters (chlorine, sodium, boron) exceeded the RUC at compliance station BH-1. The consultant engineers concluded that the site is compliant with RUC conditions as stipulated in the Certificate of Approval.

The consultants have recommended the municipality should continue to investigate the extension of the existing Contaminant Attenuation Zone.

3.6 County Road 10

The majority of the lake's northwest shore runs along County Road 10. The County of Lanark's Public Works Department repairs and maintains this road. In order to maintain safe driving conditions during the winter, the Public Works Department applies road salt to this road.

Heavy use of road salts can damage vegetation found along the roadside and nearby areas. Road salt runoff can also damage organisms in soils, and can affect birds and other wildlife. Chloride ions from road salts eventually enter nearby waterbodies (wetlands, streams, and lakes) and harm freshwater plants, fish, and other organisms not adapted to waters with high salt content (saline). Surface runoff containing road salt can also move through soils and eventually enter groundwater.

After a five-year scientific assessment of the impacts on terrestrial and aquatic environments, the Federal government declared road salts containing inorganic chloride salts as 'toxic' under the *Environmental Protection Act* 1999 (Novakowski, et al 2006).

Environment Canada released a 'Code of Practice for Environmental Management of Road Salts' in April 2004 to help municipalities and other road authorities manage their use of road salts in a way that reduces the harm they cause to the environment, while maintaining road safety. By April 2005, organizations that use more than 500 tonnes of salt per year were required to develop management plans outlining goals and strategies to reduce impacts of salt released to the environment. Environment Canada also outlined ways for effective salt application through use of equipment upgrades, pre-wetting, and anti-icing techniques, as well as best management practices for proper salt storage etc. The Code of Practice also encourages monitoring of application rates and water quality sampling (Novakowski, et al 2006).

Lanark County applies more than 500 tonnes of road salt per year on county roads. Public Works minimizes the use of road salt by pre-wetting roads with salt brine. As much as possible, Lanark County's Public Works Department applies Environment Canada's Best Management Practices for road salt application to their operations.

Stanleyville Waste Disposal Site Information was referenced from the Stanleyville Waste Disposal Site 2007 Annual Report, Tay Valley Township, prepared by McIntosh Perry Consulting Engineers Ltd, and the 2007 Annual Hydrogeological Assessment Report, prepared by Jacques Whitford Ltd.

Part 2: Nine Key Issues

1.1. Surface Water Quality

According to the survey conducted by the Pike Lake Community Association in 2005, the quality of Pike Lake's water was the most important concern to people around the lake. Seasonal and permanent residents, campers, anglers, visitors, and municipalities all depend on clean lake water to sustain economic uses, recreational enjoyment, and overall quality of life.

Many things affect a lake's health. Unsustainable recreational use and shoreline development, surface water runoff carrying excess nutrients, chemicals, and fertilizers, faulty septic systems, excessive aquatic vegetation growth, algae blooms, invasive species, sedimentation from soil erosion, and the removal of shoreline vegetation all impact and degrade the lake's water quality.

The area along the lake's shoreline, if vegetated with native shrubs, trees, grasses, and other plants, acts as a natural buffer or filter that slows down surface runoff and absorbs excess nutrients and contaminants before they reach the lake. Removing or preventing the growth of vegetation along the shoreline greatly reduces any buffering capacity this critical area of land can provide in protecting the lake's water quality.

Lake water quality can be improved by limiting or reducing hardened surfaces near the lake (such as retaining walls and manicured lawns), maintaining or upgrading septic systems, properly handling greywater, limiting the use of fertilizers, and protecting and enhancing shoreline buffer areas with native vegetation.

1.1.1. How a Lake's Surface Water Quality is Measured

Measurements of water clarity (light penetration), Chlorophyll *a*, oxygen levels, temperature, and concentration or availability of nutrients (phosphorus and nitrogen) in a lake are indicators of a lake's biological productivity. A lake's productivity is classified in three ways:

Oligotrophic lakes have high water clarity, low nutrient levels, and minimal plant growth. These lakes typically do not support large fish populations.

Mesotrophic lakes have sufficient oxygen and nutrient levels to support a variety of habitats and diversity of fish and other aquatic species.

Eutrophic lakes typically have low water clarity, high nutrient levels, and are susceptible to low oxygen levels and support warm water fish species. Because of high nutrient levels, these lakes are subject to excessive aquatic vegetation growth (algae blooms and dense aquatic plant growth).

The natural aging of a lake, or eutrophication, follows a slow, natural progression or evolution from a nutrient poor (oligotrophic) condition, to an intermediate (mesotrophic) stage of nutrient availability and biological productivity, to a nutrient rich, eutrophic state. This process however, can be greatly accelerated by human activities that increase nutrient and sediment loading into a lake – this is called **anthropogenic** or cultural eutrophication. A lake that has reached the eutrophic state will have water

quality conditions that are degraded, leading to excessive aquatic plant growth and algae blooms, which, negatively affect fish and wildlife populations and limit recreation use.

1.1.2. Current State of Surface Water Quality

Pike Lake is classified as a mesotrophic lake, which means it is capable of producing and supporting moderate populations of living organisms. Excess nutrients entering the lake from faulty septic systems, lawn fertilizers, and other human activities on shore have the potential to increase the lake's productivity, and the potential for increased algae blooms and excessive aquatic vegetation growth.

Various agencies and groups have collected water quality data on the lake since 1970. Between 1975 and 2000, volunteers have collected water clarity and nutrient data from the deepest point in the lake through the MOE's Self-Help Program and Lake Partner Program. Under the MOE's Recreational Lakes Survey Program water quality samples were collected in 1975 and 1983. Since 2001, volunteers have been collecting water quality data in partnership with the RVCA's Watershed Watch Program (refer to Map 3 for Watershed Watch Sampling Sites).

The types of parameters and techniques used to collect the water quality data on the lake have changed over time. These challenges, in addition to differences in period and frequency of sampling over the years, make it difficult to compare data from year to year. However, the data presented in this section does provide an indication of the condition of the lake's historical water quality.

1.1.2.1. Water Clarity

Water clarity is one measurement that can help indicate the quality of a lake's water. Water clarity measurements indicate the amount of light penetrating into a lake, and provide an indirect measure of the amount of suspended material in the water, which is an indication of the amount of phytoplankton (algae), suspended soil sediment, and other organic material present in the water.

Shoreline erosion, the stirring up of bottom sediments through boating and dredging activity, and nutrient pollution from surface water runoff and faulty septic systems can increase the amount of particles suspended in water, reducing water clarity.

Algae are critical to the life in our lakes, and use available nutrients in the lake to grow, but too much algae can cause problems. High nutrient levels in the lake can increase the growth rates of algae. A higher amount of algae in the water reduces water clarity, limiting the ability for light to penetrate into the water column. This affects the aquatic plants and algae that need light for photosynthesis. Lower photosynthesis rates, coupled with the decomposition of aquatic plants and algae, depletes the amount of available oxygen in the water. Aquatic plants, fish, and other aquatic organisms need oxygen to survive. In areas with low oxygen levels, these organisms can be stressed or die.

Since 1975, water clarity has been measured at the deep point of the lake by lowering a black and white disk (Secchi disk) into the water until it is no longer visible.

Water clarity measurements have ranged from 2.4 m (8 ft) to 6.5 m (21 ft). Average water clarity over 31 years of data is 4.0 m (13 ft). This reading supports a mesotrophic classification (Secchi disk readings between 2 – 5 m) (Refer to Figure 1).

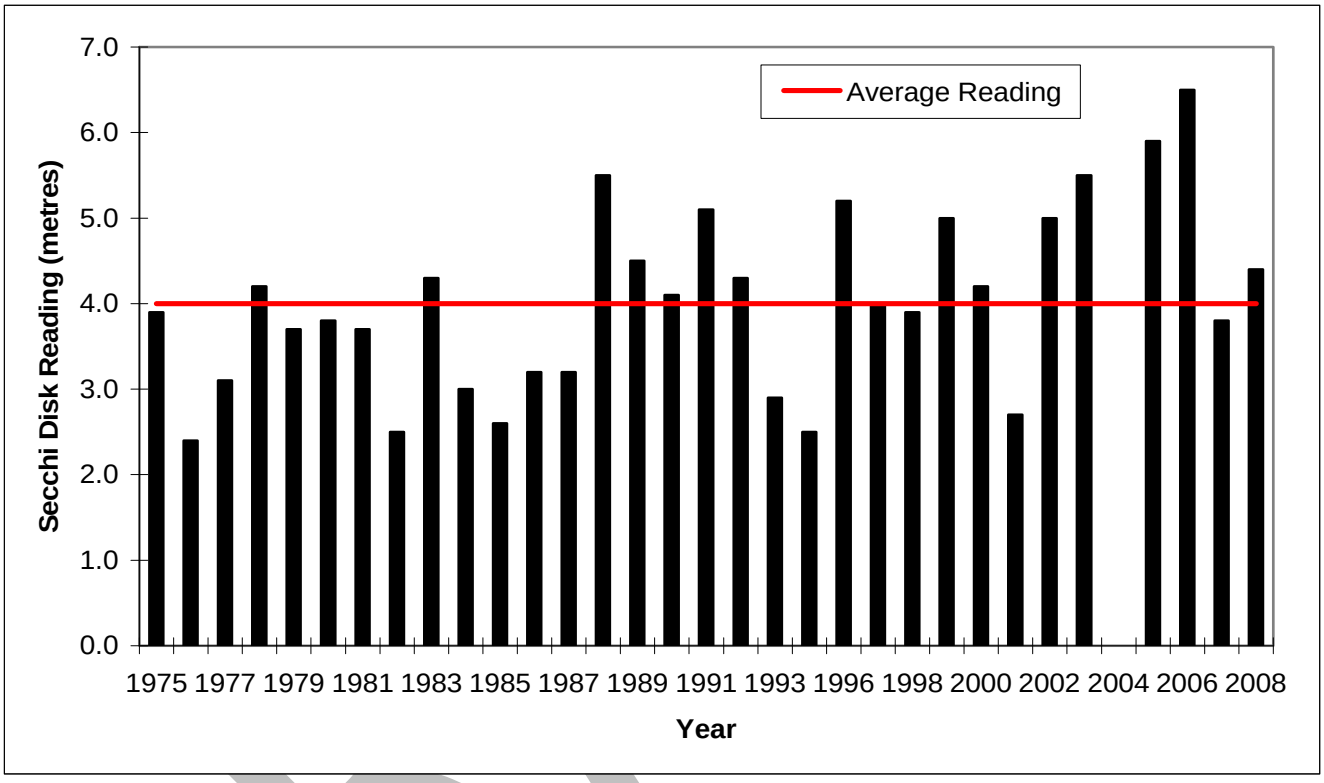


Figure 1: Pike Lake Average Annual Water Clarity Based on Secchi Disk Depth

1.1.2.2. Chlorophyll *a*

Chlorophyll *a* is a pigment that makes plants and algae green. Plants and algae use this pigment to trap the energy from the sun so they can grow. Samples of chlorophyll *a* collected at the deepest point on the lake from 1975 to 1994 were used as an estimate of potential plant growth and of the abundance of algae in the water. As discussed earlier, too much algae can cause problems. As algae die, bacteria eat them. This activity uses up the available oxygen in the water which reduces the ability of aquatic plants, fish and other aquatic organisms to survive.

The **Provincial Water Quality Objective** (PWQO) for chlorophyll *a* was a maximum of 5 micrograms per litre (µg/L). In 1994, total phosphorus became the standard for assessing the biological productivity of a lake. In the 19 years of sampling up to 1994, 65% of the annual averages exceeded the PWQO (refer to Figure 2 for sampling results). For those years, samples

indicated an excessive quantity of algae in the lake, which has negatively affected water clarity and oxygen levels on the lake.

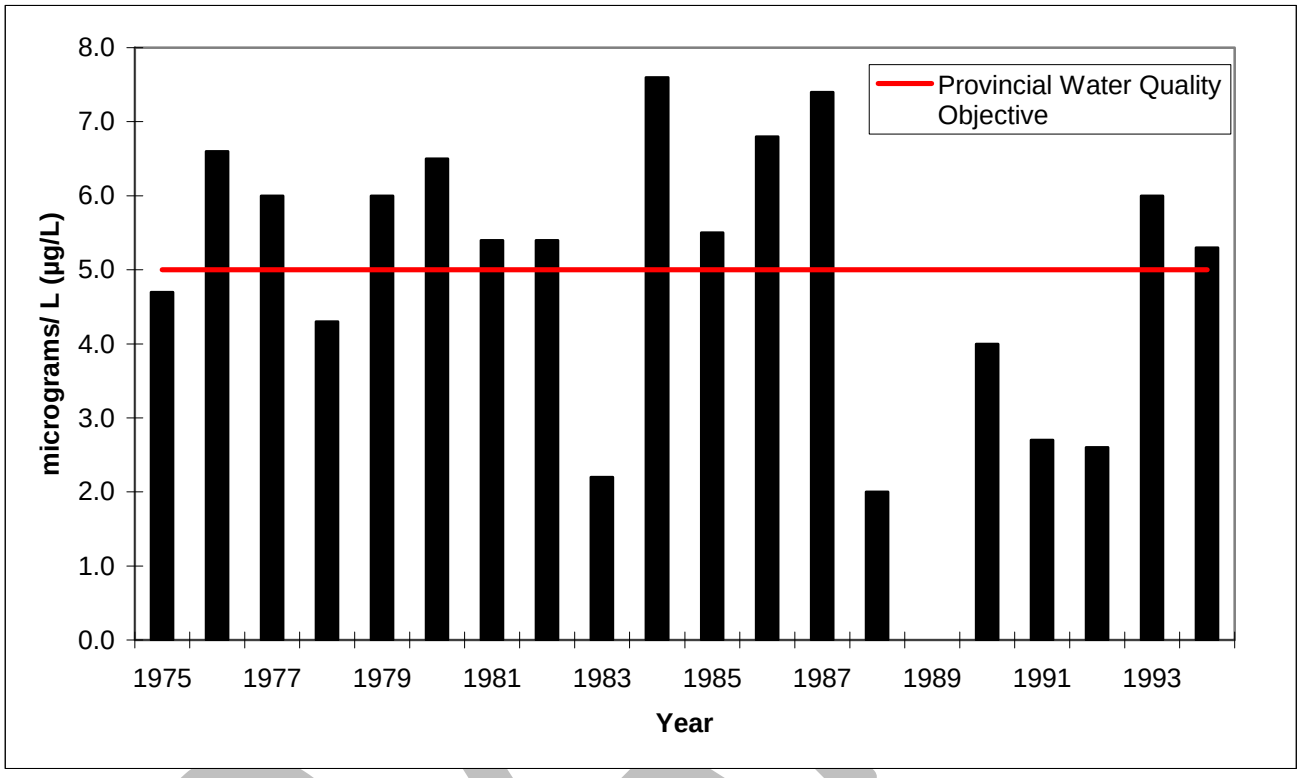


Figure 2: Average Annual Chlorophyll *a* samples taken on Pike Lake (1975- 2001)

1.1.2.3. Dissolved Oxygen and Temperature

Dissolved Oxygen (DO) and temperature measurements taken throughout the lake's water column provides an indication of how much of the lake's depth is habitable for fish and other aquatic plant and animal species. The amount of DO is dependent on many factors, including temperature, nutrient levels, and water depth.

Typically, each year, the lake warms to about 25 °C (77 °F). Dissolved oxygen content declines so that by August, only the top 8 to 10 m (26 to 33 ft) have sufficient oxygen for fish. Figure 3 outlines the decline in DO concentrations and temperature changes in the water column throughout the summer season.

High concentrations of nutrients, such as phosphorus, promote the growth of algae and aquatic plants. When these aquatic plants die, oxygen is consumed during bacterial decomposition, which can greatly reduce the oxygen concentration at depths where photosynthesis is light-limited. Under low oxygen conditions, or **anoxic,** or no oxygen conditions, phosphorus can be released from the bottom sediments, in a process known as "internal phosphorus loading".

Depending on the wind and temperatures each year, the extra phosphorus in the anoxic zone can re-enter the water column and become mixed with the surface water, which can lead to even further aquatic vegetation growth and algae blooms.

The Watershed Watch Program collected dissolved oxygen and temperature profiles three times in 2007 and once in 2008. The relatively short winter with very late ice formation on the lake in 2006/2007 may have been the reason for slightly higher oxygen concentrations at ice-out in May. When the second profile was done in July, there was still close to 10 mg/L of oxygen in the upper 5 m (16 ft) and sufficient oxygen for most fish species to 25 m (82 ft) depth.

In 2008, when the DO and temperature profile was completed in September, conditions were anoxic in the water column at a depth of approximately 14 m (46 ft). Figure 3 outlines the dissolved oxygen and temperature profiles measured in 2007 and 2008 on the lake.

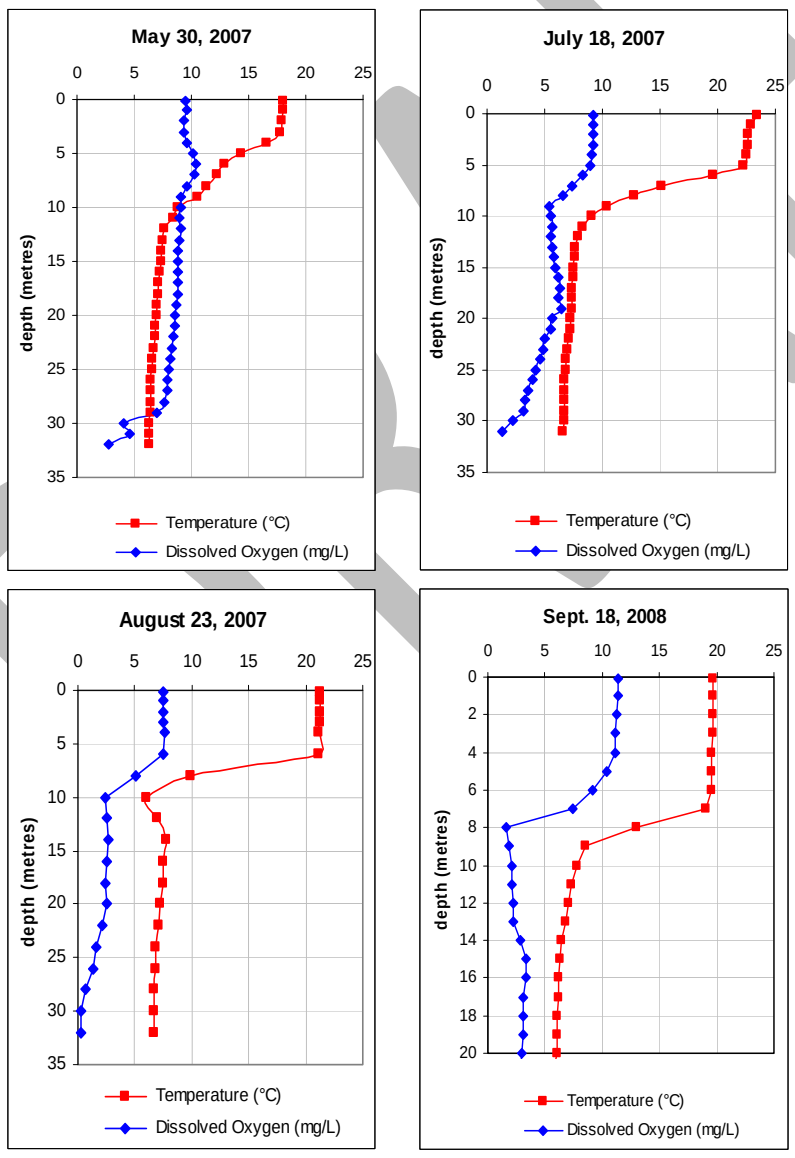


Figure 3: Temperature and Dissolved Oxygen Profiles taken on Pike Lake in 2007 and 2008

1.1.2.4. Phosphorus (Total Phosphorus)

Phosphorus is an essential nutrient for aquatic plant growth (both algae and rooted plants). Phosphorus sources in a lake come from upstream lakes, streams, and wetlands that drain into the lake, from precipitation, and from lake bottom sediments. Human sources of phosphorus that enter the lake come from soaps, fertilizers, eroded soils from development, yard wastes, and untreated effluent from faulty septic systems.

In a lake, elevated levels of phosphorus increase aquatic plant growth. When the aquatic plants and algae decompose, they deplete the available dissolved oxygen in the water and return phosphorus to the water. Continued high concentrations of nutrients inputs into the lake can lead to long-term water quality problems, also known as eutrophication, which affects fish and wildlife, as well as the overall health of the lake.

In 1983 and 1991, the MOE estimated the phosphorus inputs to the lake. Natural sources of phosphorus inputs from upstream lakes, land runoff, and the atmosphere were estimated to be contributing 543 kg in 1983 and 608 kg in 1991.

Phosphorus loading from shoreline development was also calculated. In 1983, 211 cottages, 31 trailer sites (Pike Lake Trailer Park), 7 rental cottages (McNamees Cottages), and 31 vacant lots were estimated to be supplying 147 kg of phosphorus to the lake. In 1991, 26 permanent homes, 176 cottages and 40 trailer sites, 40 vacant lots and 8 farm properties were supplying 169.2 kg of phosphorus to the lake.

For water quality sampling, total phosphorus (TP) is measured in micrograms per litre (µg/L), which include the measurement of both soluble and particulate forms of phosphorus, are used to estimate the amount of nutrients available in the lake for plant growth.

Sampling results of TP measurements gathered from the lake as part of the MOE Recreational Lakes Program in 1975 and 1983 showed high average loadings of 20 and 47 µg/L of phosphorus, which exceeded the PWQO of 20µg/L (a phosphorus concentration above which excessive or persistent algae and plant growth is likely to occur). There did not appear to have been a corresponding impact on plant or algae growth, as measured by chlorophyll *a* concentration measurements taken in those years (refer to Figure 2). However, the water clarity measurements for those years did show some correlation to the high phosphorus measurements (refer to Figure 1).

Elevated average loadings of TP were recorded in 1993 and 1996. Sampling from the deepest point of the lake has exceeded the PWQO every year since 2001 to 2006 but not in 2007 and 2008. Recent years (2007 and 2008) did not have phosphorus exceedances (Refer to Figure 4). The average phosphorus concentration measured from 2001 to present is 14µg/L., which puts Pike Lake in the mesotrophic category as also indicated by the previous parameters discussed.

Figure 4 below shows the Watershed Watch Program total phosphorus results measured at all of the independent sample sites around the lake from 2001 to 2008. The figure shows that, on average, the phosphorus concentration measured on the lake falls within 8 – 15 µg/L. Many of the samples shown above the PWQO of 20 µg/L are taken from Watershed Watch Site D. Found at the eastern bay of the lake, this sampling site is at the mouth of the wetland area that drains the area next to the Stanleyville Waste Disposal Site. Since 2001, results from the sampling site (Site D) at the stream near the disposal site show there are higher concentrations of TP and TKN flowing toward the lake (Refer to Table 2). Although it is likely the results at site D on the lake are a product of inflow from the stream, specific investigative sampling on the stream would be needed to definitively demonstrate what the source is of the higher nutrient concentrations measured at the lake site.

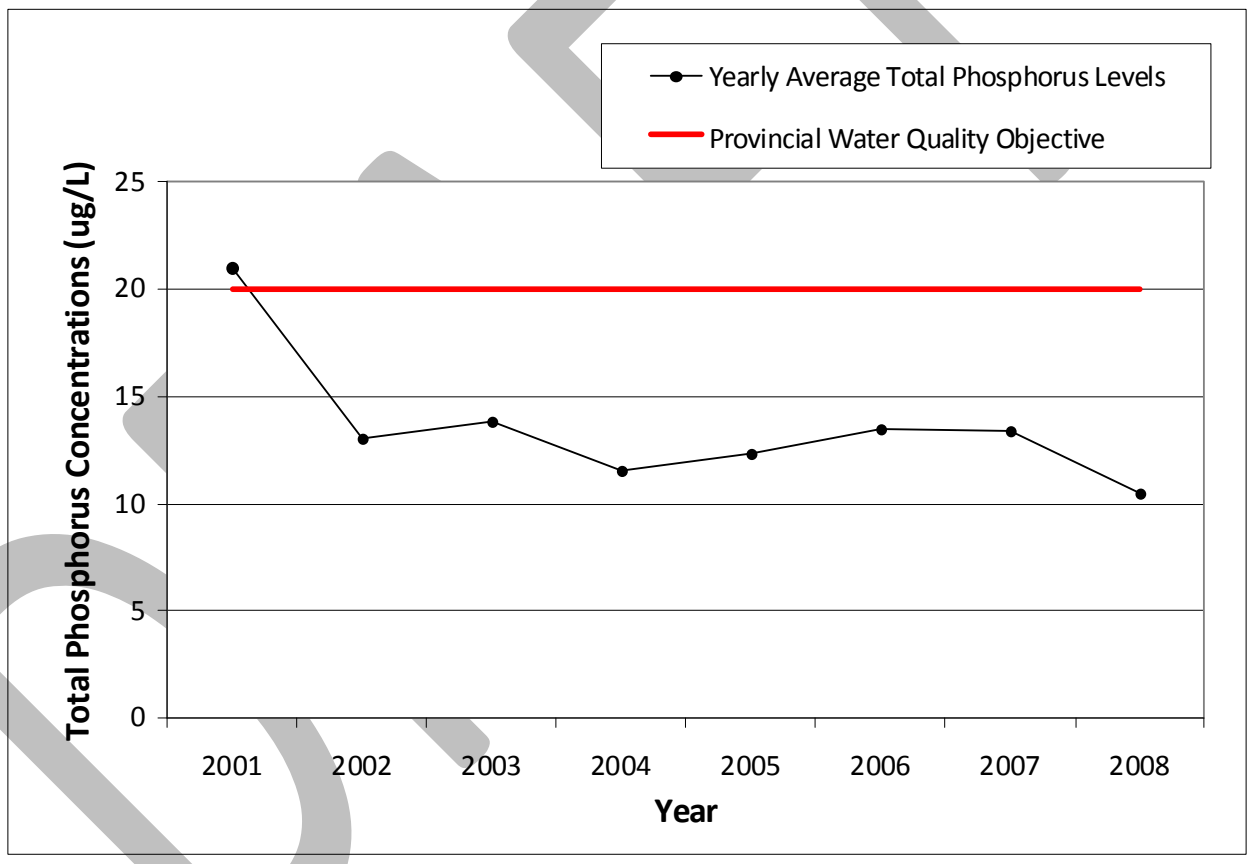


Figure 4: Yearly Average Total Phosphorus on Pike Lake (2001 - 2008)

1.1.2.5. Nitrogen (Total Kjeldahl Nitrogen)

Nitrogen is another significant nutrient in all lakes. Measured as Total Kjeldahl Nitrogen (TKN) micrograms per litre (µg/L), it includes all organic nitrogen and ammonia found in a water body. High concentrations may be indicative of excessive nitrogen entering the lake. Naturally occurring sources of nitrogen include the atmosphere, animal and human waste, decaying

organic matter, and live organic material including algae. High nitrogen concentration can cause organic nitrogen enrichment of lake water.

There is presently no PWQO guideline for TKN. However, literature cites that lakes with nitrogen concentrations less than 500 µg/L are not influenced by excessive organic inputs. RVCA uses 500 µg/L as a guideline to indicate when concentrations of nitrogen are excessive in a lake.

Figure 5 below shows the Watershed Watch Program TKN results measured at all of the independent sample sites around the lake from 2001 to 2008. In 2001, a particularly dry year, nearly all the TKN results were above the guideline. In the samples taken in years since, the exceedances have dropped significantly. In 2008, there was one exceedance in TKN measurements (Site D) and the average TKN measurement was 405 µg/L. The average TKN measurement for the lake from 2001 to present is 472 µg/L.

Since 2001, Site D continues to have higher concentrations of both total phosphorus and total Kjeldahl nitrogen (Refer to Table 2). It is likely the results at site D are a product of inflow from the stream. TP and TKN sampling on the stream is needed to definitively demonstrate what the contributing source of the higher nutrient concentrations measured at the lake site.

Table 2: Average Concentrations of Total Phosphorus and Total Kjeldahl Nitrogen from each Watershed Watch Site on Pike Lake from 2001 to 2008

	Total Phosphorus (µg/L)	Total Kjeldahl Nitrogen (µg/L)
Site A	13	460
Site B	12	455
Site C	14	461
Site D	20	581
Site E	16	474
Site F	14	481
Site G	14	463
Site H	11	436
Deep Point	12	430

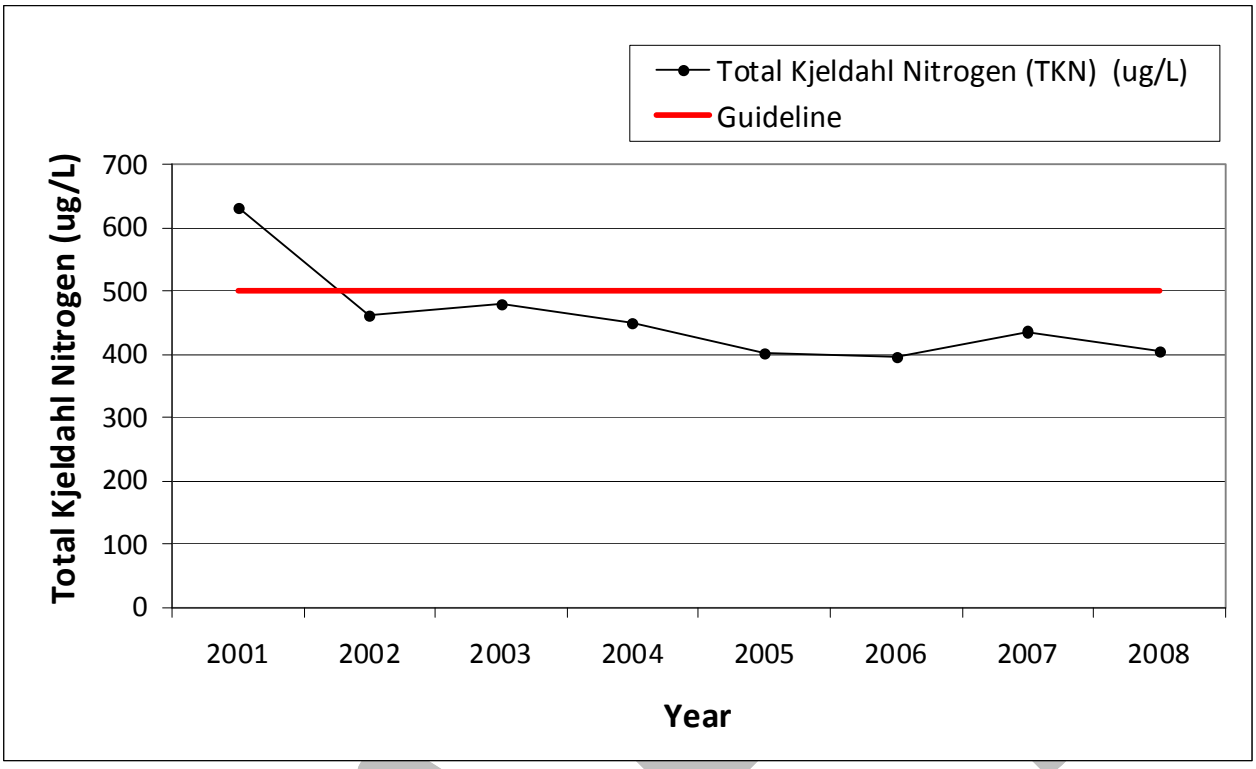


Figure 5: Yearly Average Total Kjeldahl Nitrogen on Pike Lake (2001 - 2008)

1.1.2.6. Algal Blooms

As discussed throughout this section, high nutrient levels encourage the growth of algae and aquatic vegetation. Excessive growth of algae can lead to blooms. Even with relatively low concentrations of nutrients, algal blooms can occur because of other variables such as weather conditions that may be favourable to a particular species of alga, as occurred in some bays on the lake in 2007 and 2009. Blooms in 2001 were a result of very dry conditions, which lead to a low water level in the lake, but about the same amount of nutrients in that decreased volume. Blooms and increasing aquatic vegetation growth can be expected in shallow areas of Pike Lake and are likely the result in changes in weather patterns, ice cover, nutrient inputs (from land use and human activity), and erratic temperatures throughout the year. Long-term monitoring is needed to better understand these trends.

1.1.2.7. Dissolved Organic Carbon

Dissolved organic carbon (DOC), are dissolved compounds found in water derived from organic materials such as plant matter. DOC is important for the aquatic food chain. DOC gives lake water a deep amber or 'tea' colour. These dissolved compounds reduce the penetration of visible and ultra-violet light into the lower, darker areas of the lake. High DOC can slow the decay processes in a lake so that branches or other debris that fall into the water will accumulate on the bottom in much the same condition as when they fell.

Research has shown that DOC can interfere with nutrient uptake processes by aquatic plants in Canadian Shield lakes if there is enough of it from the "right" source i.e. exogenous, or outside DOC, rather than naturally occurring, or resident, DOC, in the lake. Because research is ongoing into the effects of DOC, the main purpose in measuring DOC concentrations now is to build a dataset that can be compared to research results. No firm conclusion can be drawn at this time on the lake's DOC concentrations.

1.1.2.8. Bacteria

One of the many variants of *Escherichia coli* (E. coli) is used as an indicator of the possible presence of other harmful bacteria and pathogens in water. The main sources of these harmful bacteria are warm-blooded animals (decay of dead animals and defecation near and in the water) and human waste (septic systems and grey water).

The PWQO for E. coli in surface water sources is 100 counts/100 mL. Counts above this objective can mean the lake water is unsafe for swimming. For drinking water, there should be no E. coli counts, as a general precaution, untreated lake water should not be used for drinking water and its use for washing and cooking should be limited.

In 2001, the Watershed Watch Program began sampling for bacterial pollution (E. coli) close to the developed areas to see if there was a problem with septic and grey water entering the lake. Extremely high levels of E. coli counts (over 1000 counts) may indicate a point source of sewage pollution in surface water.

The RVCA Watershed Watch Program uses E. coli sample results persistently above 10 counts/100 mL as an early warning guide for excessive bacteria in lakes for recreational use. Counts on the lake have fluctuated over the years, with up to 25% of samples in excess of the early warning guide, but only one sample exceeded the PWQO (Site E, 198 counts) in 2003.

Although not all parts of the lake were sampled, the results in recent years (2004 to 2008) indicate the water in the lake does not pose a health concern for cottagers and residents for swimming and other water contact recreational use. Many of the relatively elevated counts have occurred at both the inflow and outflow of the lake.

1.1.2.9. Benthic Invertebrates

Sampling of **benthic invertebrate** communities (water bugs that live on the bottom of streams, lakes, and other waterbodies) provides an indication of overall water quality, condition, and health of a waterbody.

Currently, there is no sampling for benthic invertebrates on Pike Lake. Sampling has been carried out downstream of the lake at three different sites on Grants Creek over the past several years. RVCA has maintained one sample location on Grants Creek at Glen Tay Road

since 2003. The Ontario Benthos Biomonitoring Network (OBBN) is the provincial protocol used.

Benthic invertebrate samples once collected, counted and identified can be used to determine **species diversity**. Species diversity will increase with increasing habitat diversity, suitability, and water quality. The healthier the community, the greater the number of species found. The **Family Biotic Index (Hilsenhoff Index)** is also used to analyze the species and number of organisms present to give the site a score that identifies the potential degree of organic pollution found in the water quality.

Results of the benthic invertebrate sampling site on Grants Creek since 2003 show species richness to be average, however, species that are more tolerant of poorer water quality conditions have been found in the samples over the years. The Family Biotic Index samples have fluctuated from the 'fairly poor' category indicating there is substantial pollution likely in the area, to the 'good' category indicating that organic pollution is probable in the area (RVCA, 2008).

The latest trend appears to be poorer water quality for the downstream sample location. RVCA will continue to monitor conditions on order to determine trends over time (RVCA, 2008).

1.1.2.10. Invasive Species

The Ontario Federation of Anglers and Hunters and the Watershed Watch Program sampled for the presence of zebra mussel **veligers** and spiny waterfleas in 2006 and 2007 on the lake. It appears the lake is currently free of these species. However, tests of Crosby Lake indicated that veligers were present.

Watershed Watch samples for calcium (Ca) in the lake, a mineral that zebra mussels need to build their shells, in order to measure how habitable the lake is for zebra mussel populations. Research estimated the threshold calcium levels in lakes below which zebra mussel populations cannot succeed. The estimated thresholds are as low as 8mg/L and as high as 28 mg/L.

Cohen and Weinstein's 2001 literature review identified that zebra mussel populations are unlikely to be established in lakes with a calcium concentration below 20 mg/L. Research found that lakes with zebra mussel populations where calcium concentrations were below 20 mg/L might be the result of recruitment of larvae or juveniles drifting from upstream populations established in higher calcium waters. Experimental data suggest that populations cannot be sustained where calcium levels are below 15 mg/L, although there a few reports of zebra mussel veligers from inland lakes with calcium measurements in this range. Pike Lake's average calcium concentration is 19 mg/L.

1.1.3. Who Regulates Surface Water Quality?

The MOE is responsible for enforcing regulations as they pertain to surface water quality under the following legislation: the *Environmental Protection Act*, the *Nutrient Management Act*, the *Ontario Water Resources Act*, and the *Environmental Assessment Act*. The MNR is responsible for enforcing the *Lakes and Rivers Improvement Act*.

Thanks to the template provided by the Report on the State of Otty Lake and its Watershed. Specific water quality information was referenced from the (MOE) Self-Help Program, Lake Partner Program, MOE's Recreational Lakes Survey Program and RVCA's Watershed Watch Program and Stream Assessment Program.

1.2. Groundwater - Quality and Quantity

Some waterfront cottages and homes on Pike Lake draw water from the lake for drinking and other domestic uses. Many cottages and residents however, draw their drinking water from groundwater sources through private wells.

Water is continuously moving from one location to another and can take several paths and forms. The water from rain or melting snow evaporates, transpires by vegetation, moves to wetlands, streams and lakes, or seeps into the ground to become groundwater. The precipitation that seeps into the ground percolates through sediments (such as clay, gravel, or sand) and through pores and fractures in bedrock. This layer of sediment and bedrock, called a **formation**, eventually collects water and becomes saturated. This collection of water, also known as an **aquifer**, is where drilled wells draw their water. Eventually, groundwater flows back to the surface, or **discharges** through wells, springs, streams, or areas with shallow water tables (such as wetlands).

1.2.1 Current State of Groundwater Quality and Quantity

According to the 2003 Renfrew County – Mississippi – Rideau Groundwater Study, aquifers within the study area, including the Pike Lake watershed, are primarily Precambrian **bedrock aquifers.** The study identified that in areas with Precambrian bedrock aquifers, groundwater flow occurs along vertical **fractures**. These aquifers are capable of providing good quality water, although naturally have levels of sodium at concentrations in excess of the recommended advisory limit of the Ontario Drinking Water Standard for individuals on salt restricted diets. These aquifers typically provide adequate water yields for residential use.

Ground and surface water are often interconnected. Activities above the ground may introduce or provide sources of contamination that can affect the quality and quantity of groundwater (OMAFRA Factsheet, 2006). The risk of contamination (or vulnerability) of a groundwater source is linked to several factors, including:

- the make-up of the area's geology (type and thickness of soil, sediment and bedrock);
- how close an aquifer is to the surface (high or low water table);
- the time of year (most precipitation and infiltration to groundwater occurs during late spring to early summer, and late fall); and
- the types of land use practices carried out in the area.

Sources of potential contaminants and land use activities commonly found in rural areas that can threaten groundwater quality and quantity include:

- pathogens (surface application of manure, faulty septic system effluent);
- nitrates (lawn fertilizers, septic systems, manure and fertilizer application);

- pesticides;
- solvents and fuels (hazardous household or farm wastes discharged to septic systems or onto the ground, leaking or abandoned fuel storage tanks);
- salts (naturally occurring sources, road de-icing, water softeners, septic systems);
- landfills, pits, and quarries; and
- high-yield water taking operations.

The Renfrew County – Mississippi – Rideau Groundwater Study identified areas where aquifers were vulnerable or susceptible to contamination in the study area. To do that, the depth of aquifers and the thickness and permeability of the soil or rock material overlaying the aquifers within the study area were analyzed. The study identified that over 90% of the study area, including the Pike Lake watershed, had highly vulnerable aquifers due to the area's thin soil cover, which provides minimal protection to the underlying bedrock aquifer. However, a more localized study of the area geology and hydrogeology is always required to establish the degree of vulnerability and to determine whether an aquifer in use in the areas is at risk from land use activities.

The watershed includes a few abandoned quarries, pits, and trenches from past mining and aggregate activities. There are also areas in the watershed once used as local dumps until the mid-1950s. Some of these sites can potentially provide contaminant sources that can impact groundwater used for drinking water.

Best management practices on farm and rural properties can minimize the impact of potential threats to groundwater quality. Properly stored and applied pesticides, fertilizers, and other chemicals will reduce the risk of impacting groundwater quality. Proper construction, use, and maintenance of wells and septic systems will also limit potential contamination of drinking water sources.

Due to the lack of local groundwater studies in the area, it is difficult to comment with certainty on the overall quality, quantity, or vulnerability of the groundwater sources within Pike Lake's watershed. The Queen's University Civil Engineering Department continues to carry out groundwater studies at a site near Perth. Summarized below are some recent preliminary findings.

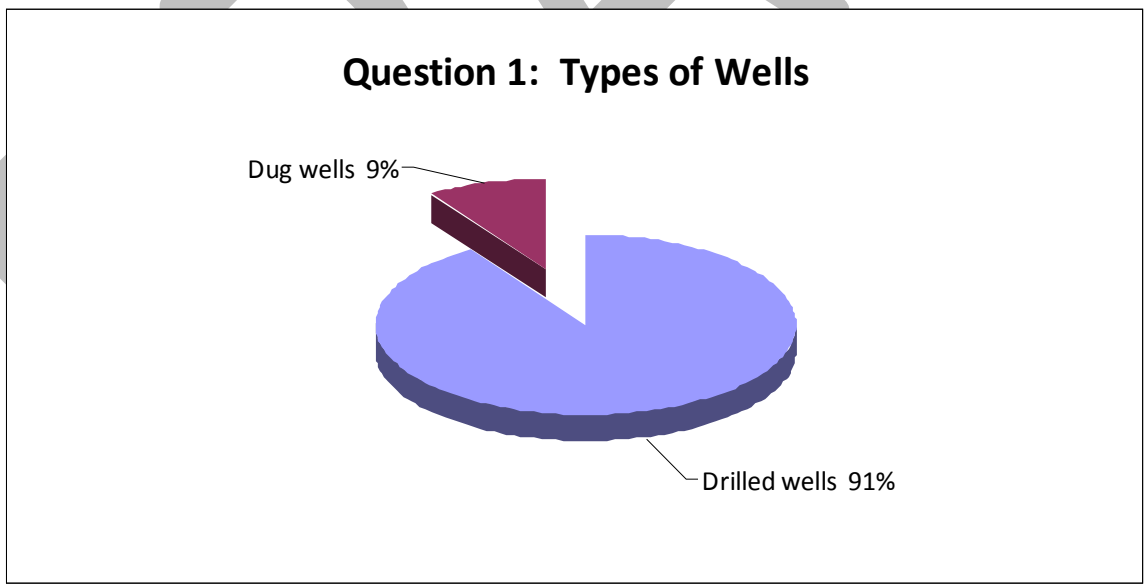
- Research at the study site has found there is much less recharge of the aquifer from precipitation, compared to areas with similar types of aquifers (2-3% recharge of precipitation vs. 20-30% of precipitation contributing to groundwater recharge). Considering the relatively unknown permeability of the material (soil and rock) above aquifers in the Tay Watershed and its affect on the rate of groundwater recharge, the predicted changes in timing and amount of precipitation to eastern Ontario will likely leave groundwater quantities sensitive to climate change.
- The groundwater aquifer at the study site was found to be very sensitive to agricultural impacts. More research on the mechanisms for bacterial transport in the bedrock is required.

- Results of the preliminary studies need to be expanded to the full watershed.

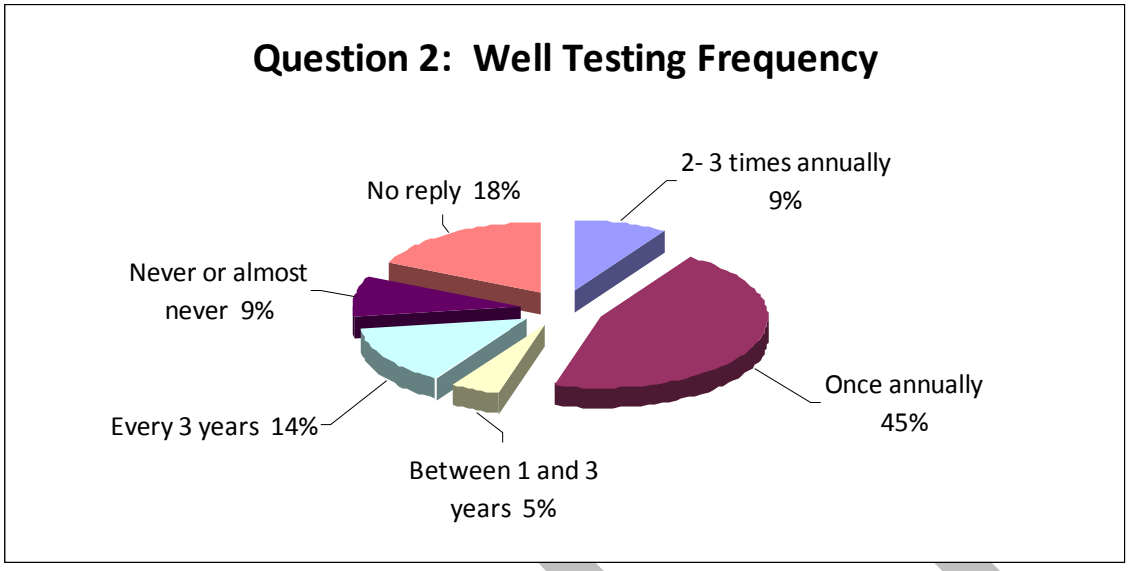
It is uncertain how climate change will affect the lake. However, an increase in extreme weather events including drought, heavy rainfall, and high temperatures is expected, which may affect the water balance of the watershed. A better understanding of seasonal groundwater quality and quantity fluctuations, the contributions that precipitation lends to groundwater recharge, effects of anthropogenic activities and the overall use or pressure we place on aquifers in the area is required to better predict long-term trends and the effects that climate change may have on groundwater quality and quantity.

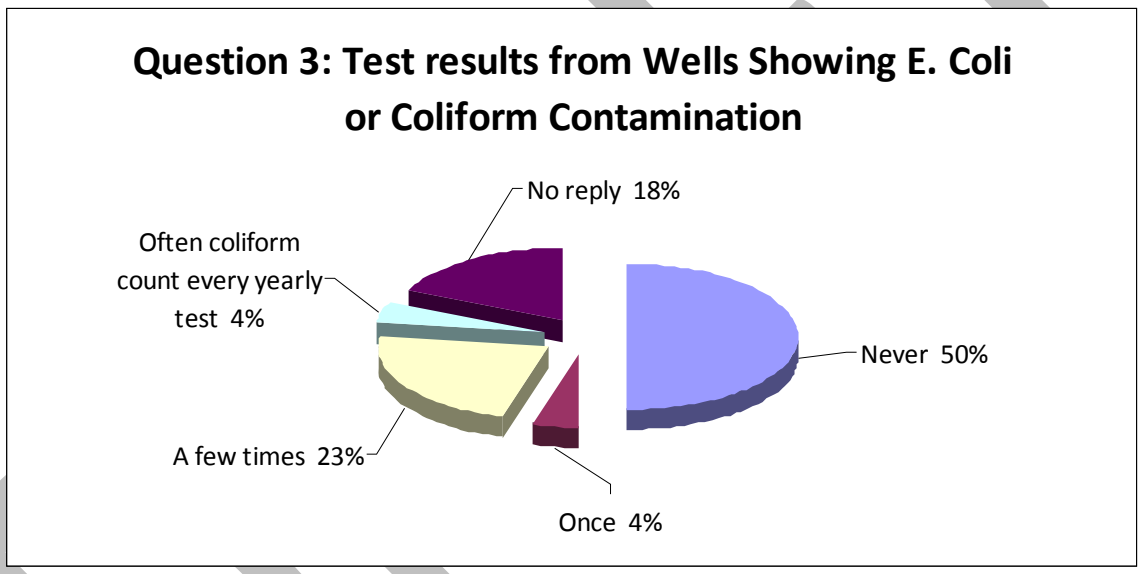
1.2.1.1. Drinking Water Wells in the Pike Lake Watershed

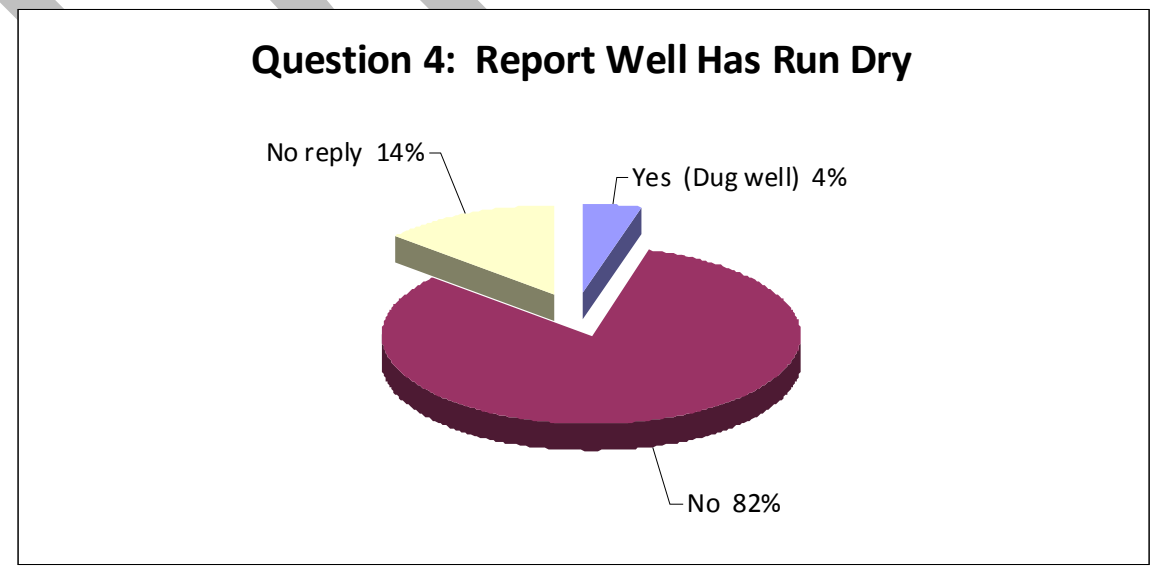
Based on the Ontario Ministry of the Environment's 2006 Water Well Information System, there are approximately 193 drilled wells within the Pike Lake watershed. In order to establish a more accurate baseline of drinking water sources and well information around the lake, a Pike Lake volunteer carried out a questionnaire in the summer of 2008. To review the questionnaire, refer to Appendix 4. Of the 290 surveys sent out, 69 property owners from around the lake responded. There are still many gaps in the information about drinking water wells around the lake; however, the five questions asked about wells received responses from 22 property owners. The results are outlined in the following charts.

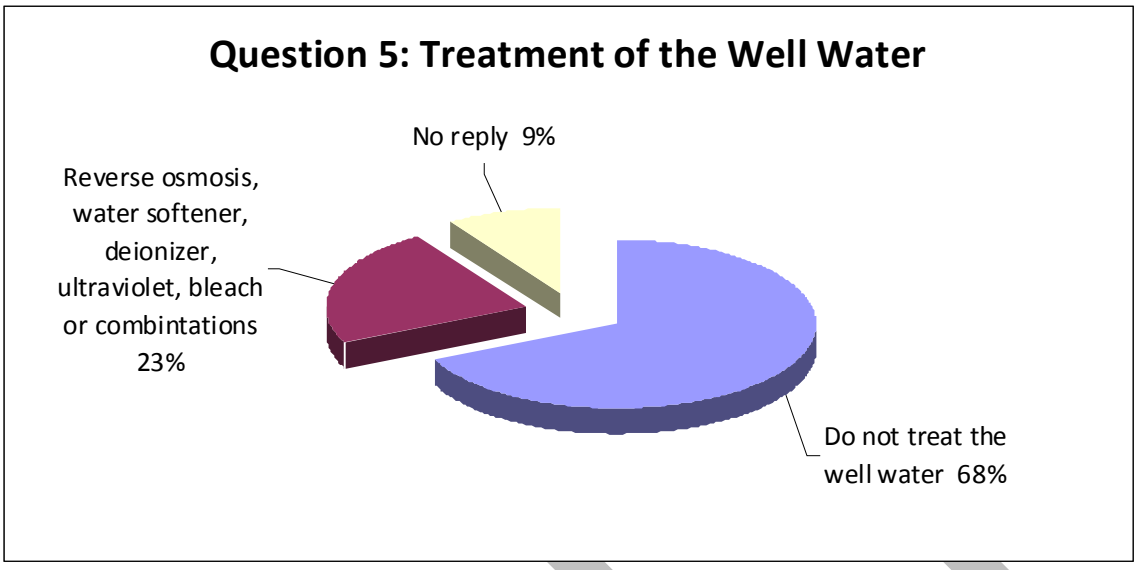


Note: Of the drilled wells (20), one was unused, and 12 had caps above ground


Question 2: Well Testing Frequency
No reply 18%
2- 3 times annually 9%
Never or almost never 9%
Once annually 45%
Every 3 years 14%
Between 1 and 3 years 5%


Question 3: Test results from Wells Showing E. Coli or Coliform Contamination
No reply 18%
Often coliform count every yearly test 4%
Never 50%
A few times 23%
Once 4%


Question 4: Report Well Has Run Dry
No reply 14%
Yes (Dug well) 4%
No 82%



The *Ontario Well Regulation* (Regulation 903 – under the *Ontario Water Resources Act)* outlines standards, rules, and responsibilities for well construction and maintenance. Drilled wells that are properly constructed and maintained should prevent contaminants and surface water from entering the well. However, well water can be vulnerable to contamination from nearby threats if a well's casing is not properly sealed. If not properly de-commissioned and sealed, abandoned wells can also provide direct pathways for contaminants to reach groundwater.

The Leeds, Grenville and Lanark District Health Unit and the Ottawa Public Health Branch provide a free well testing program to monitor private well water for the presence of *Escherichia coli* (E.*coli*) and total coliforms. The presence of these bacteria in private well water is an indication of recent contamination from sewage or animal waste. According to the Leeds, Grenville and Lanark District Health Unit, although this free service is available, many people do not test their drinking water regularly. The Health Unit recommends that a residential property owner test their water three times a year, each time submitting three separate samples one week apart. For a seasonal property, it is recommended only two tests are carried out, each time submitting three separate samples. The Ontario Ministry of Health maintains a confidential database of water test results.

For more information about private well water testing, refer to the Ontario Ministry of Health and Long-term Care Factsheet – Water Safety: Putting Your Well Water to the Test.

Analysis of drinking water for metals and other chemicals of concern can be carried out by accredited laboratories (contact the MOE at 1-800-565-4923). For more information on how to maintain and protect private wells, contact the Well Aware Program.

1.2.2 Who Regulates Groundwater?

There are a number of federal and provincial acts and regulations that guide the management and protection of groundwater resources in Ontario. The *Planning Act*, *Municipal Act*, *Safe Drinking Water Act*, *Ontario Water Resources Act*, *Nutrient Management Act, Environmental Assessment Act, Environmental Protection Act* and the *Clean Water Act* each has a role to play in protecting groundwater.

The *Clean Water Act* sets out a framework to protect municipal drinking water sources on a watershed basis. Source protection areas are delineated based on existing watershed boundaries. The Pike Lake Watershed is within the Mississippi-Rideau Source Protection Region. While the Act does not apply specifically to private well water systems, the Pike Lake community will be able to benefit from work that will identify and assess threats to water quality in the region. These threats will be addressed in the region's source protection plan that ensures risks to drinking water are managed through monitoring and best management practices and that further contamination of surface and groundwater from land use activity are prevented before it poses a risk to human health.

Utilizing a hydrogeological model will help to illustrate how groundwater moves and is influenced by surface human activities.

Monitoring of groundwater quality and quantity is essential to evaluate changes over time and to assess the effects of climate change, impacts of human activities, changes in land uses and effectiveness of best management practices. A comprehensive groundwater-monitoring program can help to assess these changes over time.

Participating in programs such as the Environmental Farm Program and the Rideau Valley Rural Clean Water Program etc., that provide incentive grants for well abandonment, nutrient management, and septic upgrades will help to reduce the contaminant movement into the groundwater.

Protecting groundwater recharge areas ensures groundwater quality and quality. An area specific groundwater study is required to identify such areas. Recharge areas will need to be protected on federal or provincial level legislation, or through relevant municipal planning policies.

Thanks to the template provided by the Report on the State of Otty Lake and its Watershed. Specific groundwater information was referenced from the 2003 Renfrew County – Mississippi – Rideau Groundwater Study, the 2008 Pike Lake Drinking Water survey and the interim report on research in the Tay watershed presented by Dr. Kent Novakowski Civil Engineering Department, Queen's University at the Tay Watershed Stakeholders' Meeting on May 6, 2008,

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2. Development Pressures

Responses in the 2005 Pike Lake survey identified the lake's water quality, natural environment, and tranquility as the three most valued aspects of the lake. The landscapes and recreational opportunities found on the lake are important to the people that use the lake and to the commercial operators that rely on the lake to provide great fishing, swimming, boating, vacationing, or winter recreation opportunities.

Investment in lake property is both emotional and financial; but the equity is in the health of the lake. The number of people living around and using the lake can have a direct effect on its water quality and its rural character. As development intensifies around the lake, natural landscapes become fragmented, outdoor light levels increase, and noise and pollution from recreation and boating activity can increase. It is vital that we recognize how our activity is impacting the health of the lake and its surrounding ecosystem.

Unless municipal agencies guide and regulate development around the lake in a way that supports growth, but preserves the environment and landscapes for the future use and enjoyment, the growing population around the lake's watershed will cause irreversible changes to the landscape and stress the environment. This in turn will diminish the quality of life and overall character of the lake that is important to so many.

The use of waterfront properties continues to shift from seasonal to a more intensive, multi-season basis throughout the region. This trend has seen the improvement and enlargement of existing dwellings, septic and well system upgrades, the creation of new lots, building of larger new homes, and changes in occupancy from secondary or seasonal use to principal or permanent use.

As undeveloped waterfront property becomes increasingly limited, existing properties become more intensively used (accessory buildings, gazebos, and decks) and manicured landscapes along the shoreline increase. A balance is needed between permitting higher density development, and protecting the lake's unique rural character, natural landscapes, and recreational and economic opportunities.

2.1. Development on Pike Lake

Between 1970 and 1976, there was a large increase in cottage development around the lake. An estimate of cottage, commercial and permanent housing development trends around the lake from 1970 to 2007 is outlined in Table 3 below.

Currently, development is spread over the entire lake, with the exception of the south and southwest portions. Most permanent residences are on the northwest shoreline. The lake's three commercial operations are also located in this part of the lake: the Pike Lake Trailer Park (50 campsites); Moodie's Cottage Rentals; and a bait shop. There are five farm properties around the lake and one privately managed forest. Overall, there is little development in the backshore areas of the lake.

In 2007, 58% of the residential waterfront properties on the lake were seasonal, 22% were permanent, and 12% were vacant lots. Of those properties, 147 in Tay Valley and 2 in Rideau Lakes are less than 1 acre in size. In 2006 Pike Lake development had one site plan application, 1 minor variance and 1 Zoning By-law

amendment. In 2007, no development applications were received. In 2008, 2 site plan applications, 2 minor variances and 3 Zoning By-law amendments were received.

Table 3: Development on Pike Lake between 1970 and 2007

Year	Cottages	Permanent Homes	Vacant Lots	Farm Properties	Commercial
1970	99				Pike Lake Trailer Park (10 sites) McNamee's Cottages (7 cabins)
1973-75	147		31		Pike Lake Trailer Park Moodie's Store and Marina
1976	167				Pike Lake Trailer Park (26 sites)
1983	211	5	31		Pike Lake Trailer Park (38 sites) McNamee's Cottages (7 cabins)
1989	242 buildings				Pike Lake Trailer Park McNamee's Cottages
1991	176	26	40	8	Pike Lake Trailer Park (40 sites)
Mid 1990s	230	30			2 resorts
2007	155	58	31	5	Moodie's Cottage Rentals Pike Lake Bait Shop Pike Lake Trailer Park (50 campsites)

Information in the Table was compiled from Ministry of Environment and Ministry of Natural Resources Lake Survey reports (1970 – 2007)

2.2. Municipalities

The municipal governments of Tay Valley Township and the Rideau Lakes Township are responsible for regulating land development within the lake's watershed. The majority of the Pike Lake shoreline and watershed falls within Tay Valley Township's jurisdiction. Each municipality has its own Official Plan and Zoning By-laws that govern development within its jurisdiction. Guided by the Provincial Policy Statement and public input, Official Plans provide general policy goals and objectives that describe how land can be used, and how the character of waterbodies will be protected (i.e. limiting overcrowding and hardened surfaces, integrating new development into the existing landscape with minimal disturbance, and protecting buffers and natural heritage features). Zoning By-laws set out specific requirements that include minimum setbacks from water, lot coverage and maximum building height to ensure the broad policies set out in the Official Plan are met.

Although Pike Lake falls within the jurisdiction of two municipalities, the planning policies that guide waterfront development in the Tay Valley and Rideau Lakes Townships are similar, promoting the principles of sustainable development and the preservation and enhancement of waterfront areas. Increased setback requirements, larger waterfront lot sizes, 'Floor Space Index' provisions, and Site Plan Controls are in place to limit the scale of development on smaller waterfront properties, while accommodating modest amounts of additional development. Table 4 below outlines the current Zoning By-law provisions relating to single

dwelling and accessory structures on residential waterfront lots in Tay Valley Township and Township of Rideau Lakes.

2.2.1. Conversion of Seasonal Cottages and Development

In Tay Valley Township, in order to convert a property that is zoned seasonal residential (RS) to permanent use, a Zoning By-law Amendment is required to have the property zoned Limited Services Residential. If the lot is currently vacant, and has private road access, a re-zoning to Limited Services Residential will be required. Council reviews these applications and considers the suitability of development on the site with advice from other agencies as required (i.e. RVCA and MNR).

For both municipalities, all commercial and residential development within 100 m (328 ft) of a waterbody, regardless of whether the development meets all zoning regulations, is subject to Site Plan Control. This involves the submission of a plan that addresses issues of the development such as drainage, septic system location, erosion potential, visual impact, and mitigation measures such as protection of natural features, slope stability, and preservation of shoreline vegetation.

The alteration to shorelines along the lake requires permission under the RVCA administered *Ontario Regulation 174/06 – Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*. The MNR's *Public Lands Act,* requires permission for work over or on the bed of the lake (boathouses, docks) and along the shoreline. Development along the shoreline might also be subject to provisions under the Federal *Fisheries Act* and screening through the MNR's *Endangered Species Act.*

The municipalities of Tay Valley and Rideau Lakes recognize the 1992 *Rideau Lakes Basin Carrying Capacities and Proposed Shoreland Development Policies* report. This report states that, where site specific conditions exist, greater setbacks for development may be warranted based on slope, soil type and depth, and vegetation cover. These policies for increased setbacks have been incorporated within municipal planning documents and are used to asses the potential impacts of new development.

Other agencies must be contacted before beginning any projects along the shoreline. Appendix 5 lists the different types of projects and the appropriate agencies to contact to ensure proper permits are acquired (if necessary), and impacts to the environment have been minimized for the project.

2.2.2. Re-development, Minor Variances and Zoning By-law Amendments

Minor variances or Zoning By-Law amendments are required where land development proposals do not meet the requirements set out in municipal planning policies (i.e. additions, reconstruction closer than 30 m to the water). The municipality is the approval authority for these types of applications. Generally, applications are reviewed so that any approval results in minimal impact to the aquatic and terrestrial environment. Site suitability and the potential for mitigating impacts are important factors in the approval process. The RVCA and other agencies are circulated all planning applications and provides technical advice and recommendations to the municipalities. All properties within 100m of

Pike Lake are subject to Site Plan Control. Site Plan Control is a planning tool that ensures conditions of approval are included to mitigate environmental impacts of the development.

Table 4: Tay Valley Township and Township of Rideau Lakes Zoning By-law Provisions Relating to Dwellings and Accessory Structures on Residential Waterfront Lots

	Tay Valley Township (Zoning By-law No. 02-121)	**Rideau Lakes Township (Zoning By-law No. 2005-6)**
Zone	Seasonal Residential (RS)/Limited Services Residential (RLS)	Waterfront Residential (RW)
Lot Area	4050 m^2 (1 acre)	
Water Frontage	60 m (197 ft)	
Lot Coverage	10%	
Front Yard	10 m (33 ft)	
Exterior Side	10 m (33 ft)	6 m (20 ft)
Interior Side	6 m (20 ft)	
Rear Yard	7.5 m (25 ft)	
Setback from High-water Mark	Dwelling, Septic System, Accessory Structures: 30m but excluding: - pump houses, marine facilities and stairs - decks and gazebos having combined area of less than 14 m^2	Dwelling, Septic System, Accessory Structures: 30m but excluding: - pump houses, marine facilities and stairs - decks and gazebos unattached to a main building having combined area of less than 14 m^2
Shoreline Occupancy Provisions	Yes. Maximum of 25% or 15m of shoreline, whichever is lesser, shall be occupied by marine facilities, pump houses, stairs, deck, patios, gazebos and other accessory buildings and structures.	
Building Height	9 m (30 ft)	10 m (33 ft)
Floor Space Index	12%	10%
Dwelling unit area	75 m^2 (807 ft^2)	
Decks	- > 30m water setback, 2m deck encroachment is permitted - 15-30m water setback, 2m deck encroachment up to total of 28m^2 is permitted - 6-15m water setback, 1.25m deck encroachment up to total of 14m^2 - < 6m water setback, no deck permitted	- > 30m water setback, 3m deck encroachment is permitted - 15-30m water setback, 2m deck encroachment up to total of 14 m^2 is permitted - 6-15m water setback, 1.2m deck encroachment is permitted - < 6m water setback, no deck permitted
Sleeping Cabins	Not permitted	Permitted. One cabin, floor area not to exceed 25m^2. Minimum water setback shall be 30m or setback of existing dwelling, whichever is greater. No kitchen facilities, may contain washroom facilities
Marine Facilities	Permitted. No water setback, 3m side yard requirement	Permitted. No water setback, 4.5m side yard requirement
Private ROW Setback	No provision	6m from edge of ROW
Swimming Pools	Not permitted to encroach into 30m required water setback	Not permitted to encroach into 30m required water setback unless setback is greater than any existing non-complying dwelling

Repair/Restoration of Non-Complying Single Dwelling on Waterfront Lot	Repair/restoration permitted provided height, size, volume & extent of non-conformity not increased	
Reconstruction (incl. Rebuilding) of Non-Complying Single Dwelling on Waterfront Lot	Reconstruction permitted where dwelling destruction was involuntary, height, size, volume & extent of non-conformity is not increased, & work is commenced within 12 months	Reconstruction permitted where dwelling destruction was involuntary, height, size, volume & extent of non-conformity is not increased, & work is commenced within 24 months
Enlargements/ Additions to Non-Complying Single Dwelling on Waterfront Lot	1. Vertical addition permitted for dwellings with water setback of 15m or more 2. Horizontal addition permitted only where addition complies with all By-law provisions	1. Vertical addition permitted for dwellings with water setback of 15m or more 2. Horizontal additions: a) rear addition permitted where addition has water setback of 15m or more, is less than 4.5m wide or 25% (for portion parallel to water), whichever is lesser, b) side addition permitted where addition has water setback of 15m or more, and is less than 6m wide (for portion perpendicular to water) Only 1 of 3 enlargements are permitted.
Water Setback for Replacement of Non-Complying Class 4 (Septic) Sewage System	30m, alternatively go through site plan process for approval of a lesser (existing) distance, subject to Building Code minimum of 15m	30m. If lot is <45m in depth, replacement system must be greater than 15m or at same location, whichever is greater.
Site Plan Control	Development within 100 m	Development within 100 m

Information in table was complied from the "Zoning By-law Provisions Relating to Single Dwellings and Accessory Structures on Residential Waterfront Lots" S. Pentz, 2008 Novotech Engineering Consultants Ltd.[1]

2.2.3. Land Division

Additional lots can be created on the lake in two ways: by consent (severance) or by plan of subdivision. Between 2000 and 2006, there were 12 severances on the lake. Any proposal with greater than three residential lots within the Tay Valley and Rideau Lakes Township generally requires the submission of technical reports outlining the potential environmental impacts on the lake. Applications must address potential increases in nutrient loading, lake capacity, storm water hydrogeology through a completion of a Hydrological Assessment, and may require an Environmental Impact Study (EIS). These studies would be reviewed by the municipality and other regulating agencies. The proposal would need to undergo a public approval process. There are currently no

[1] In December 2008, Tay Valley Township initiated an Inter-municipal Zoning By-law Harmonization Project to promote discussion amongst the municipalities of Lanark Highlands, Drummond North-Elmsley, Rideau Lakes, and Central and South Frontenac about the harmonization of shoreline development provisions in Zoning By-laws. Through initial discussion between the neighbouring municipalities, the group concluded that differences in zoning provisions naturally exist between municipalities due to differences in political interest, public participation, and planning fundamentals. However, the group also concluded that where similar Zoning By-law provisions exist, efforts should be made to ensure consistency in the interpretation, implementation, and approvals process of those provisions.

subdivisions on Pike Lake. To date, no proposals for the development of a subdivision around the lake have been submitted to either Tay Valley Township or the Township of Rideau Lakes. It has been noted that other lakes in the region have experienced an increase in the conversion of existing properties zoned commercial tourism to Multiple Ownership or fractional ownership. Often this does not require *Planning Act* approval except site plan control.

2.2.4. Wetlands

Several wetlands, including the provincially significant Crosby Lake Creek Complex make up about 10%, or 5 km^2 of the watershed's land cover. Wetlands are important to the local ecology because they provide important habitats to a variety of wildlife species, including species at risk; they moderate flood impacts; and they filter water by trapping sediments and taking up nutrients like phosphorus.

Wetlands also offer social and economic benefits providing recreational opportunities such as boating and canoeing, fishing, trapping, and wildlife viewing. Threats to the health and ecological function of wetlands include alteration through development, draining, dredging, and filling; introduction and spread of invasive species; climate change; and air and water pollution.

If the community identifies a wetland that is not currently evaluated and designated by the MNR as provincially or locally significant, the lake community can work with the municipality and RVCA to have the wetland considered in the municipal Official Plan and Zoning By-law and included under RVCA's *Ontario Regulation 174/06*.

The RVCA's *Ontario Regulation 174/06 – Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*, regulates development in areas within 120m (394ft) of provincially significant wetlands (Crosby Lake Creek Complex). Any activity that could interfere with the hydrological function of the wetland (for example site grading, vegetation removal, impacts to fish habitat) requires permission from the RVCA. If a Planning Act application is submitted for development with a provincially significant wetland, or within 120 m of adjacent lands, an Environmental Impact Study (EIS) is required and must demonstrate the proposed activities will not result in any negative impacts on the natural features or ecological functions of the wetland. Development applications may also be subject to review under Section 35 of the federal *Fisheries Act* and the MNR's *Endangered Species Act*.

The Provincial Policy Statement and RVCA's *Ontario Regulation 174/06* do not provide similar protection for wetlands that are of regional or local significance. However, if development occurs within these wetland areas, development applications may be subject to an EIS, and review under Section 35 of the federal *Fisheries Act* and the MNR's *Endangered Species Act*. The RVCA has a work plan that will expand protection of wetlands with phasing starting in 2010.

2.3. Lake Carrying Capacity

In 1991, 1992, and 2008 different models were used to estimate the **carrying capacity** (the level of shoreline development that can be sustained before water quality, overall health, and character of a lake is degraded) of Pike Lake. The following paragraphs outline some of the methods used to estimate the carrying capacity of the lake, and the limitations or assumptions of those models.

First developed in 1975, the MOE applied the Ontario Lakeshore Capacity Study (OLCS) water quality model in 1991 to Pike Lake to determine the potential effect a proposed 30-site tent and trailer park development at the outlet of Crosby Lake could have on the water quality and future development capacity of Pike Lake. The carrying capacity model, was based on chlorophyll *a* measurements (the parameter used at that time to measure a lake's biological productivity), and phosphorus supply to the lake (conservative assumptions of phosphorus loading from shoreline development, upland lakes and rivers, atmospheric deposition etc). The carrying capacity measurement was also based on the lake's state of development at that time, which included 26 permanent residences, 176 cottages, the Pike Lake Trailer Park (40 sites), 40 vacant lots, and 8 farm properties.

Based on these input parameters, model results indicated the proposed development on Little Crosby Lake would not have exceeded the development capacity of Pike Lake, and that sufficient development capacity would remain for the additional existing 40 vacant lots for seasonal residential use.

The carrying capacity of the lake was also outlined in the 1992 *Rideau Lakes Basin Carrying Capacities and Proposed Shoreland Development Policies* report. This model required estimates of a lake's net phosphorus supply (determined by atmospheric deposition, the hydrology of a lake, level of land use and development, and phosphorus loading from upstream lakes) and data on the lake's chlorophyll *a* concentrations and Secchi disk depths to predict the lake's carrying capacity. Using this data, the model predicted the results of six development scenarios for the lake that ranged from pre-development to high-density development.

The MOE, MNR, and Ministry of Municipal Affairs and Housing (MMAH) used the 1975 model to develop the current Lakeshore Capacity Assessment Model. Using a number of assumptions about phosphorus loading, this most recent model quantifies linkages between natural sources of phosphorus to a lake, human inputs from shoreline development, and the current phosphorus concentration of the lake. The model predicts several important indicators of water quality: total phosphorus, algal density (chlorophyll *a* concentration), water clarity, oxygen concentration in bottom waters at the critical end-of-summer period, and volume of fish habitat. The model can be used to back-calculate 'pre-development' conditions in a lake; calculate how much development can be added to a lake without altering water quality beyond a given point; and calculate the difference between existing conditions and that predicted carrying capacity. The model can also be used to predict the expected impact of a proposed new development.

The capacity assessment model incorporates the concept of ecosystem sustainability and protection of natural character of a waterbody into the municipal planning process and encourages land use decisions that maintain

or enhance water quality. There are many assumptions used in this nutrient-based capacity assessment model that require further scientific evidence before the model can be defended with confidence. Until that time, guiding development with protective municipal policies to ensure adequate setback specifications and minimum lot sizes, and encouraging individual waterfront property owners to implement best management practices such as maintaining natural vegetation buffers along the shoreline and the installation of proper septic and well systems, can help limit the negative impact of development on the lake.

2.4. Septic Systems

The improper maintenance and use of sewage treatment systems around the lake can have detrimental effects on drinking water sources, which can lead to potential human health concerns and impacts to overall lake health. Older septic systems, privies, and grey water pits often do not meet current health and building codes and are prone to malfunction, thereby releasing untreated sewage that contains both harmful bacteria and nutrients directly into the lake or groundwater aquifers. Bacterial contamination can affect drinking water quality. High nutrient levels in surface water sources can cause excess plant growth (weeds and algae blooms) which contribute to the eutrophication of the lake, leading to a decline in water quality, impacts on fish and wildlife populations and reduces recreational property value on the lake.

Growing awareness of the importance of properly functioning septic systems has evolved over the last 40 years, and is reflected in current industry standards and government regulations.

A voluntary, targeted septic re-inspection program, initiated in 2000 by Tay Valley Township, educates the public about the importance of septic system maintenance and protecting surface and groundwater quality. The program helps to ensure individuals are accountable for the proper functioning of their septic system so that it is not a health or environmental risk to the community (Saunders, 2007). At the start of each season, the Tay Valley Re-Inspection Program staff mail out a questionnaire to selected property owners. Once the questionnaires have been returned, homeowners are encouraged to make an appointment for re-inspection. A similar voluntary septic re-inspection program is currently available in the Township of Rideau Lakes; however, properties around Pike Lake have not been included in the program to date.

In Ontario, the *Building Code* contains five classes of sewage treatment systems:
Class 1: All forms of privies, composting toilets, chemical toilets etc, and self-contained portable toilets
Class 2: Grey water system
Class 3: Cesspool
Class 4: Leaching bed system
Class 5: Holding tank

Pike Lake was part of the Tay Valley Septic Re-Inspection Program in 2002 to 2005 and 2007. A total of 83 septic systems have been inspected on the lake. Below, Table 5 outlines the results of the septic re-inspections carried out on the lake. Septic re-inspections are planned for Pike Lake in 2010.

Based on re-inspection activities on the lake, it is assumed the primary sewage systems used on the lake is the Class 4 system (leaching bed systems) with many properties still maintaining a Class 1 system (privy/composting toilets). Some Class 5 systems (holding tanks) are still in use around the lake. New holding

tanks will only be approved as a last resort. Class 2 systems (grey water pits) are still common, particularly on sites serviced by Class 1 and Class 5 systems.

Since 2005, the Mississippi-Rideau Septic System Office has been contributing data on the locations and dates of sewage system permits issued within the region to the Tay Valley Township's Geographic Information System database. Septic re-inspection data is also entered. This mapping and data management system is a valuable tool that will help gain a better understanding of the age and types of septic systems around the lake, track the progress of the re-inspection program and mitigation measures carried out, and prioritize future inspection efforts.

Table 5: Results of Septic Re-Inspections Carried out on Pike Lake from 2002-2005 and 2007

Year	Number of Re-Inspections	Concern
2007	40	More Information Required (2)
		No Concern (18)
		Remedial Work Required (20)
2005	2	Remedial Work Required (1)
		No Concern (1)
2004	19	No Info
2003	8	No Info
2002	14	No Info

Note:
"No Info" = information was not available in the database
"Remedial Work Required" = anything from cutting grass over distribution field - replacing baffles in the tank.
"No Concern" = at the time of inspection, the system appeared to be functioning properly.
"More Information Required" = unable to locate specific parts of the system or unable to determine type of system.

As previously stated, property owners are responsible for maintaining and upgrading septic systems to meet requirement of the *Building Code Act* (1992). The *Building Code* now requires the installation of effluent filters in the outlet flow path of every system and that effluent filters are accessible at grade using access risers. Refer to Appendix 6 for the *Building Code Act*'s General Requirements for Operation and Maintenance.

If property owners or renters become aware of septic system problems on the lake, concerns can be reported confidentially to the Mississippi Rideau Septic System Office. If there is a concern for water quality, section 15.9 Inspection of Unsafe Building, under the *Building Code Act* gives Septic Inspectors the ability to enter a property (Refer to Appendix 6).

Thanks to the template provided by the Report on the State of Otty Lake and its Watershed. Thanks also to the following volunteers and community partners that provided information for the Development Pressures section of this report: Bart Poulter, Rideau valley Conservation Authority, Mississippi-Rideau Septic System Office, Township of Rideau Lakes, and Tay Valley Township.

3. Conservation and Protection of the Natural Environment

3.1. Shoreline (Ribbon of Life)

The shoreline habitat extends from the area along the water's edge to the upland areas along the shoreline. This area is commonly referred to as the "ribbon of life" because of the important role it plays in keeping the lake's water clean and healthy, protecting against erosion, and providing important habitat to many plants and animals.

Unfortunately, shoreline vegetation is frequently removed and replaced with lawns and hardened (rock or concrete) shorelines. Many people have grown accustomed to the "tidy" look of urban homes and parks and don't realize that by bringing those aesthetic concepts to the lake, they are putting everything they value about the lake at risk, including their privacy, the rural character, clean drinking and lake water, fish and wildlife health, as well as property values.

The protection and maintenance of a healthy shoreline with native trees and shrubs is important to every person that enjoys swimming, fishing, or spending time at Pike Lake. When the natural shoreline vegetation is removed, the buffering capacity and ecological benefits of the shoreline are reduced.

Trees around the lake provide shade and help regulate the temperature during the hot summer months. Cool water holds more oxygen than warm water and provides a better environment for spawning and survival of fish species sensitive to water temperature. If shading is removed, temperatures in the littoral zone increases and oxygen is lost from the water. Warmed water also helps aquatic plants to grow more vigorously, thereby producing weedy shorelines.

Tree and shrub roots, fallen leaves, branches, dead trees, and native aquatic vegetation are all important habitat for the fish and wildlife in the lake, providing a variety of places for aquatic organisms to hide, breed, and feed.

Properties that slope towards the lake or have manicured lawns provide a direct route for contaminants and nutrients from soaps, lawn fertilizer, pesticides and herbicides, car and boat wash soap products, faulty septic runoff, and pet and wildlife waste to enter the lake and can result in excessive aquatic plant and algae growth. A buffer of trees and shrubs between homes or cottages and the lake will filter many of the chemicals, nutrients, and sediments out of the runoff. The plants on the shoreline use the nutrients in runoff for growth rather than the plants in the lake.

A good buffer along the shoreline protects against increased erosion and sedimentation along the shoreline, which can harm fish and wildlife habitat and can increase aquatic weed and algae growth in the lake. The root system in the buffer works to hold together soil that would otherwise be washed away by heavy precipitation events, overland runoff, wave action, and boat wake.

3.1.1. Current State of the Pike Lake Shoreline

In the summer of 2008, the Pike Lake Community Association, in partnership with its volunteers and Jacques Whitford Ltd. carried out a shoreline survey, using the M.A.P.L.E (Mutual Association for the Protection of Lake Environments) Shoreland Classification and Inventory protocol.

The purpose of the survey was to identify the present state of the lake's shoreline and outline the restoration action that could be carried out to enhance or rehabilitate the shoreline on a property by property basis. This was achieved by mapping and photographing the shoreline, classifying it into a certain category based on the definitions outlined below (definition excerpts from the M.A.P.L.E. Shoreline Classification Survey Manual, 1994), and listing recommended restorative action for each property. At the time of publication of this report, the 2008 MAPLE survey results were not available.

3.2. Wildlife

Many respondents of the Pike Lake 2005 survey and participants from subsequent community meetings identified the need to protect existing fish and wildlife populations and their habitat within the Pike Lake watershed. The true health of a lake is reflected by the presence or absence of wildlife, whether it is insects, birds, mammals, reptiles and amphibians, or fish. Each organism plays an important role and is an essential part of the lake's ecosystem. The protection of biodiversity (the number of different species within the watershed) is important to the lake's health.

3.2.1. Current State of the Pike Lake Watershed Wildlife

Little is known about the current health of wildlife populations in the watershed. Following the 2008 AGM, Dale Poulter, a Pike Lake volunteer, cottager, nature enthusiast, and photographer, emailed and mailed out a request to the community to gather information about observed wildlife around the lake. From personally collected material and information provided by residents and cottagers, the following outlines wildlife observations made in the watershed throughout 2008.

3.2.1.1. Insects

Table 6 below outlines insects identified at Pike Lake in 2008. Listed insects have been personally observed, and are only a sample of existing insect populations. Species marked with an asterisk (*) indicates a species of Special Concern. In 2008, two interesting observations were made at the lake:

- A swarm of thousands of honey bees stayed high up in a cedar tree on the point at the north end of the lake for about two weeks in the summer
- Gypsy moth infestation occurred about 1998, some still present but in small numbers

3.2.1.2. Birds

In 2008, Pike Lake volunteers identified various bird and waterfowl throughout the watershed. Active nesting sites for both common and rare species were identified in the lake area including loon nests, a great blue heron rookery, eastern bluebird nest boxes along Scotch Line, and a red-tailed hawk nest at the north end of the lake. Interesting species of note found in wetland and creek areas (specifically Rte 1 and Rte 17) include wood duck, green heron, and bald eagle. In upland forested areas, a wild turkey flock and a scarlet tanager were identified.

Categories used in the Table 7 below are based on the ROM Field Guide to Birds of Ontario. There were additional reports of bird sightings, but the specific species were not identified. Species marked with an asterisk (*) indicates **Endangered, Threatened** or species of **Special Concern**. For an extensive birding identification resource, refer to the National Audubon Society's *The Sibley Guide to Birds: David Allen Sibley.*

Table 6: Insects identified at Pike Lake in 2008

Ants	**Caterpillars** Tent caterpillars Wooly Bear caterpillar (see moths)	**Earwigs** **Fleas** Springtails (snow fleas)
Aquatic Insects Caddisfly larva Damselfly larva Dragonfly larva Mayfly larva (shad flies) Giant water bug Mid-sized diving beetle Waterstriders Whirligig beetle	**Centipedes** Round Millipedes	**Flies** Black flies Crane Fly Deerflies Fireflies Fruit flies Horse flies House flies Mosquitoes
Bees Bumble bees Honey bees	**Cicadas** Dog Day Cicadas	**Hornets** Yellow Jackets Stump Stabbers **Wasps** Paper wasps
Beetles June Beetle Long Horned Sawyer Beetle and Larvae Ladybugs Swamp Milkweed Leaf Beetle	**Crickets** Field crickets **Grasshoppers**	**Moths** Eastern Tent Caterpillar Moth Gypsy moth Geometer Moths (Inchworms) Laurel Sphinx Moth Milkweed Tussock Moth Tiger Moth Tolype Moth Isabella Tiger Moth (Wooly Bear Caterpillar)
Butterflies Eastern Tiger Swallowtail ***Monarch**** Milbert's Tortoise Shell White Admiral	**Damselflies** Northern Bluet **Dragonflies** Common Green Darner	**Spiders** Dock spiders Small jumping black spiders

Mourning Cloak Question Mark Skippers Pearly Eye	Calico Pennant Eastern Pondhawk Halloween Pennant Widow Skimmer Slaty Skimmer	
		Stink Bugs **Harvestmen (Daddy long legs)**

Table 7: Birds Observed Around Pike Lake; surveyed 2008

WATERFOWL

Ducks, Geese, and Swans

Blue-Winged Teal
Canada Goose Common Merganser
Hooded Merganser
Mallard
Wood Duck

SHORE BIRDS

Gulls, Terns, and Allies

Herring Gull
Ring-Billed Gull

Plovers

Killdeer

Sandpipers and Phalaropes:

Spotted Sandpiper

SWIMMING BIRDS

Common Loon

WETLAND BIRDS

Herons and Bitterns

Black-Crowned Night Heron
Great Blue Heron
Green Heron
Least Bittern*

Vultures

Turkey Vulture

BIRDS OF PREY

Caracaras and Falcons

American Kestrel

Hawks, Kites and Eagles

Bald Eagle*
Broad-Winged Hawk
Cooper's Hawk
Northern Goshawk
Osprey
Red-Tailed Hawk

NOCTURNAL BIRDS OF PREY

Owls

Great Horned Owl
Northern Saw-Whet Owl

NOCTURNAL

Nightjars

Common Nighthawk
Whip-Poor-Will

FOWL-LIKE BIRDS

Partridges, Grouse, and Turkeys

Ring-Necked Pheasant
Ruffed Grouse
Wild Turkey

DISTINCTIVE COOING CALLS

Pigeons and Doves

Mourning dove

HUMMINGBIRDS AND SWIFTS

Hummingbirds

Ruby-Throated Hummingbird

Swifts

Chimney Swift

KINGFISHERS

Belted Kingfisher

WOODPECKERS

Black-Backed Woodpecker
Downy Woodpecker Hairy Woodpecker
Northern Flicker
Pileated Woodpecker
Red-Headed Woodpecker *
Three-Toed Woodpecker
Yellow-Bellied Sapsucker

PERCHING BIRDS

Blackbirds

Baltimore Oriole
Bobolink
Brown-Headed Cowbird
Common Grackle
Eastern Meadowlark
Red-Winged Blackbird

Cardinals and allies

Indigo Bunting
Northern Cardinal
Rose-Breasted Grosbeak

Chickadees and Titmice

Black-Capped Chickadee

Creepers

Brown Creeper

Crows and Jays

American Crow
Blue Jay
Common Raven

Finches

American Goldfinch
Evening Grosbeak
House Finch
Pine Siskin
Purple Finch

Flycatchers

Alder Flycatcher
Eastern Phoebe
Willow Flycatcher
Yellow-Bellied Flycatcher

Nuthatches

Red-Breasted Nuthatch
White-Breasted Nuthatch

Sparrows and allies

Chipping Sparrow
Clay-Colored Sparrow
Dark-Eyed Junco
Field Sparrow
House Sparrow
Song Sparrow

Swallows

Bank Swallow
Barn Swallow
Cliff Swallow
Purple Martin
Tree Swallow

Tanagers

Scarlet Tanager

Thrushes

American Robin
Eastern Bluebird

Waxwings

Cedar Waxwing

Wood-Warblers

Black + White Warbler
Pine Warbler
Yellow Warbler

Wrens

Carolina Wren
House Wren
Marsh Wren

3.2.1.3. Mammals

Table 8 outlines mammals observed from 2006 to 2008. Species marked with an asterisk (*) indicates a species of Special Concern. Many observations of mammal activity were also noted during this period and are noted below:

- Several active beaver lodges;
- Evidence and sightings of a Black Bear;
- Coyote sighted near Stanleyville and heard on many occasions;
- Grey Wolf heard during 2007-08 winter;
- Muskrat feeding activity;
- Yearly sightings of Northern River Otter feeding in swamp area;
- Raccoon - nocturnal visits to compost and garbage cans;
- Red Fox with pups; and
- Noticeable decline in Mink since 1990 generally seen along the shoreline

Table 8: Mammals Observed within the Pike Lake Watershed 2006 - 2008

Beaver	***Grey Wolf ****	Red Fox
Black Bear	Groundhog	Red Squirrel
Coyote	House Mouse	Shrew
Deer Mouse	Mink	Star-Nosed Mole
Eastern Chipmunk	Muskrat	Striped Skunk
Eastern Cottontail	Northern River Otter	Vole
Eastern Black Squirrel	Porcupine	White-Tailed Deer
Eastern Pipistrelle Bat	Raccoon	

3.2.1.4. Reptiles and Amphibians

Table 9 outlines the reptiles and amphibians observed around the watershed in 2008. Species marked with an asterisk (*) indicates a Threatened Species or Species of Special Concern.

Cottagers have noted there has been a vast decline in the number of bullfrogs in the past 20 years. The distribution of many amphibians and reptiles is directly linked to the vegetation structure of aquatic habitats (wetlands, lakes, streams etc), food availability, and types of escape cover. Emergent and submerged vegetation supports invertebrate populations that provide an important food source for amphibians and reptiles. During the breeding season, some species of frogs call from emergent vegetation at the water's edge and their egg masses are often attached to aquatic plants. Aquatic turtles often eat submerged vegetation, an important food source.

Protecting native aquatic vegetation beds and wetland areas is an important way to support reptile and amphibian populations throughout the watershed.

Table 9: Reptiles and Amphibians Observed within the Pike Lake Watershed

Reptiles	Amphibians
Eastern Ratsnake*	Spring peeper
Northern Red-bellied Snake	Chorus frog
Eastern Garter Snake	Gray tree frog
Eastern Ribbonsnake*	Green frog
Northern Water Snake	Bullfrog
Snapping Turtle	Northern Leopard Frogs
Painted Turtle	Spotted salamander

3.2.1.5. Invertebrates

Species of crayfish, snails, clams, mussels, and leeches have been identified around Pike Lake.

3.2.1.6. Species at Risk

Species at Risk (SAR) are animals, plants, and insects that have experienced population declines, primarily due to loss of habitat (NHIC, 2008). Pike Lake's watershed has several species identified as **Species at Risk** including the eastern ratsnake, least bittern, and bald eagle. These species are at risk primarily because of the destruction of habitat.

Information about Ontario's species of concern, and their associated vegetation communities and natural areas is tracked, updated, and made available to the public on the Species at Risk Ontario List (SARO List) and at the Natural Heritage Information Centre (NHIC). The Committee on the Status of Species at Risk in Ontario (COSSARO) is responsible for assessing the status of wildlife species believed to be at risk in Ontario. The list is updated when a species is added, removed, or its designation changes. The MNR works with many partners at local, provincial and national levels to protect and recover species at risk.

Lake Residents, cottagers, and visitors can help protect and recover species at risk and their habitats by:

- assisting the Pike Lake Community Association with species recovery projects (shoreline enhancement and fish rehabilitation projects);
- reporting sightings of species at risk to the Kemptville District Ministry of Natural Resources; and
- learning about threats to our lake's wildlife and habitats and to help to minimize these threats.

3.2.1.7. Invasive Species

Originating from other regions of the world, invasive species are one of the greatest threats to the biodiversity of Ontario's lakes, rivers, wetlands, and woodlands. In the absence of their natural predators or controls, invading species can easily establish and out-compete with native fish and wildlife, creating unbalanced natural ecosystems. Usually adaptable and equipped with high reproduction rates, these favourable characteristics for survival, along with assistance in movement by human activity, help invasive species spread easily through different ecosystems (OFAH, 2008). Common aquatic invasive species include:

Common European Reed: a tall perennial grass that ranges from 1.5 to 5 m (5 – 16 ft) in height that builds up dense monoculture stands that out-compete native wetland plants, alter water levels, decrease the size of open water habitats within wetlands and block sunlight to the underlying plant community.

Eurasian watermilfoil: an aggressive submerged aquatic plant native to Europe, Asia and North Africa.

European Frog-bit: a free-floating aquatic plant that resembles a miniature water lily. First introduced as a horticultural species to the Ottawa region in 1938 and then spread to the nearby Rideau Canal.

Purple Loosestrife: a beautiful but aggressive invader native to Europe. A hardy perennial which can form dense monocultures in wetlands and agricultural lands, replacing native plant species and the habitat.

Rusty Crayfish: although native to North America, the rusty crayfish has been introduced to many northern lakes and streams where they cause a variety of problems. It is on average 10 cm (3.9 inches) in length, not including the claws, have a brown body, and greenish-rusty coloured claws with dark black bands near the tip, and more robust claws and is larger than other native species. They feed on aquatic plants, benthic invertebrates (which include aquatic worms, snails, leeches and aquatic insects), decaying plants and animals, fish eggs, and small fish. They have a more aggressive nature than the native species in areas they are introduced to.

Spiny waterflea: a microscopic invertebrate (zooplankton) introduced from northern Europe and Asia by ships.

Zebra mussels: a freshwater mollusk native to the Black and Caspian Sea region of Asia.

The aquatic invasive species currently identified on the lake include Eurasian watermilfoil, European frog-bit, and purple loosestrife. While zebra mussel veligers have not been identified on the lake, the 2008 water quality monitoring report for Crosby Lake has identified veligers. The Pike Lake Community Association has focused on proactive education (i.e. passing out literature at the AGM, placed signs at the boat launch and gates entering into the various roads around the Lake) to help prevent further spread of these species. Continued efforts are needed by the Pike Lake community to ensure additional species are not spread to the lake. For more information

about invasive species in Eastern Ontario and the current prevention campaigns, go to the Ontario Federation of Anglers and Hunters Invading Species Awareness Program.

3.3. Wetlands, Forests, and Successional Lands

The first European settlers in the watershed cleared some of the land for agriculture and harvested the timber for fuel and building material. Although the landscape was altered and wildlife habitat became more fragmented, the density of development was low and likely did not result in significant changes to wildlife populations.

Today, wildlife habitat becomes increasingly fragmented from the development of homes and roads. This can reduce the value of wildlife habitat and make it unsuitable for successful feeding and breeding. When numbers are already low, as is the case with Species at Risk, the connectivity of habitat is particularly important to the continued survival of wildlife within the landscape.

Pike Lake, its shoreline, and various wetlands within the watershed provide crucial habitat, feeding, and breeding grounds for many species of insects, reptiles and amphibians, birds, and mammals. Continuing to have a rich diversity of wildlife in the watershed will require protecting and enhancing habitats in the upland forested areas as well as the wetlands and shorelines.

3.3.1. Current State of Wetlands, Forests, and Successional Lands

3.3.1.1. Wetlands

Wetlands throughout the watershed contribute to the improvement of water quality. Wetlands help to neutralize a number of different contaminants that can be carried into waterbodies from overland runoff, and remove nutrients like phosphorus and nitrogen from water that flows into the lake, its tributaries, and groundwater. Wetlands also recharge groundwater aquifers and help regulate water levels during flooding events. When wetlands are fragmented or disturbed through land use activities, their capability to filter surface water, recharge groundwater, and so is their ability to regulate floodwater is reduced (Ducks Unlimited, 2006).

A wetland's ability to store water is important. These shallow depressions on the landscape collect runoff from rainfall or snowmelt and store it either in the pore spaces within the sediments and organic matter or in open water areas within the wetland.

This storage of runoff results in an overall reduction in runoff volume following a rainfall or snowmelt event, and lowers the overall duration of the runoff event. A study was undertaken at RVCA to quantify the hydrological functions of wetlands within the context of Rideau River watershed. Using numerical modeling techniques, the potential cumulative effect of the loss of Non-Provincially Significant Wetlands (locally significant wetlands and un-evaluated wetlands) on peak flood discharges and minimum dry weather flows at selected locations within the watershed was completed.

The knowledge gained from this analysis will form the basis of future decisions by RVCA with respect to the application of Ontario Regulation 174/06 – *Development, Interference with Wetlands and Alterations to Shorelines and Watercourses* on wetlands that are not designated provincially significant.

Results from this modeling exercise showed the un-evaluated wetlands within the Pike Lake Watershed were identified to attenuate flood waters in the 1 in 100 years flooding event by 7.03m3/sec. If the un-evaluated wetlands were removed, it was predicted that the watershed would be able to help absorb flood waters at 6.99 m3/sec. Overall, the study found the un-evaluated wetlands in the Pike Lake watershed provided little impact to diminishing flows during major flooding events. This is likely due to the large capacity the lakes within the watershed have to help absorb flooding waters.

The provincially significant wetland, the Crosby Lake Creek Complex, found in Rideau Lakes Township was evaluated and designated by the MNR in 1985. The wetland evaluation system was primarily designed to serve the needs of Ontario's planning process. Based on scientific criteria, the evaluation system recognizes the critical role of wetlands in maintaining healthy ecosystems. The system identifies and inventories the biophysical features or values of a wetland, and provides a way of rating wetlands using a point system that quantifies wetland values.

The Crosby Lake Creek Complex wetland complex is located on private land, about 8 km southwest from Pike Lake and is 393 ha (971 ac) in size. The largest wetland is 324 ha (800 ac). The complex is comprised of seven individual wetlands; including three different wetland types: 61% swamp, 29% marsh, and 10% bog. Soil types in this complex include 80% organic, and 20% clays, loams, or silts (McIntyre and Mills, 1985). The complex has a diverse vegetation community. Refer to Appendix 7 for an outline of the different vegetation types in the complex.

At the time of the evaluation survey, the surrounding habitat around the complex consisted mainly of deciduous forest, with some pasture and abandoned agricultural land. The report noted that roads, a utility corridor, and residential buildings contributed to the fragmentation of the wetland complex habitat.

Permanent wetlands provide valuable nesting and feeding habitat for wildlife and water birds. Muskrat, raccoon, bullfrogs, and beaver were sighted in the Crosby Lake Creek Complex during the evaluation. Observation of minnows provided evidence of fish spawning and rearing in the area. The wetland was identified as a locally significant waterfowl staging area, providing nesting habitat for great blue herons and the regionally significant osprey. The survey documented the wetlands also provide breeding and feeding habitat for provincially significant birds such as the pied-billed grebe and sedge wren, which were both sighted.

Further mapping and monitoring efforts could be undertaken to better understand the value contributed from area wetlands, and to support the protection of all local wetlands through local Zoning By-laws.

3.3.1.2. Forests

Based on land classification mapping, the land cover of the lake's watershed is dominated (approximately 70%) by deciduous, mixed, and coniferous forest, although the landscape is fragmented by roads and encroaching development, farms, and fields (refer to Map 2).

Wildlife populations are often healthier in regions with more forest cover and where forest fragments are either grouped closely together or connected by corridors of natural habitat. Many bird species observed in the watershed do have habitat preferences for larger woodlands, including pileated woodpecker, hairy woodpecker, scarlet tanager, black and white warbler, Canada warbler, and mourning warbler. Other identified bird species around that lake prefer larger woodlands, but may also nest near more fragmented forested areas including ruffed grouse, wild turkey, red-bellied woodpecker, house wren, and black-capped chickadee (Freemark, 1999). The presence of these bird species may indicate that forest cover around the watershed is fairly connected.

Individuals should consider when developing properties to keep buildings at a distance from woodlands and maintain buffers around smaller woodlands, especially in areas that are highly fragmented from human development. Larger woodlands should be identified in the watershed and afforded long-term protection for connectivity and wildlife habitat purposes.

3.3.1.3. Successional Lands

Farming and other land uses have altered most of the original forested landscape throughout the region. While most fields cleared for agriculture are still being farmed, many have been abandoned over the past 50 years, however, due to changing agricultural practices. Abandoned fields or areas used as pastureland currently make up 3% of the watershed's land cover (refer to Map 2).

Many of these fields, if left alone, can eventually become forests again through the natural process of succession (i.e. the slow growth of shrubs and trees into areas currently dominated by grasses and herbaceous plants). Many wildlife species depend on old-field habitat. Birds that use old fields include upland sandpipers, northern harriers, bobolinks, eastern meadowlarks, and a variety of sparrows.

Mammals that use old fields include voles, mice, skunks, foxes, and deer. Old fields also provide habitat for many species of butterflies, moths, and grasshoppers, as well as snakes, turtles, and frogs. Some species use old fields for all or part of their lives, while others rely on them for

particular seasons or parts of the day. Deer, for example, often feed in old fields in the evening but spend the rest of the time in nearby forests.

Old fields are important habitat for two endangered bird species in southern Ontario, the Henslow's and the eastern loggerhead shrike. These species continue to use abandoned pasturelands, specifically old fields with short plants and hawthorn shrubs.

The value of an old field as important wildlife habitat depends on the surrounding landscape. An old field in an area surrounded by forested areas, or a field planted with trees to connect larger forested areas may be more important to wildlife than one in an area dominated by old fields. There are different management options for old fields that can be used to support different types of wildlife communities. By preserving and maintaining old fields in their existing state, this could provide habitat for rare, threatened, or endangered plant and animal species that rely on old field habitat for survival, or preserve sensitive habitats such as alvars or savannahs. Alternatively, enhancing the field by planting trees can create new wildlife habitat, improve landscape diversity, link forested areas creating wildlife corridors, and increase forest interiors that support reproductive success of forest interior bird species such as thrushes and veerys. Old fields planted with conifers and hardwoods can sometimes generate income for landowners as managed Christmas tree, fuelwood, sawlog, or pulp plantations while also providing wildlife habitat.

Contacting the Kemptville District MNR can guide long-term management decisions such as determining whether an old field should be restored to a woodland, or whether the old field lies within the historic range of rare communities such as an alvar or savannah.

3.4. Who Conserves and Protects the Natural Environment?

Environment Canada's How Much Habitat Is Enough? Fact Sheet provides valuable guidelines for protection and habitat restoration activities that can be adapted for to local watersheds. It provides information on how much habitat is needed to support a natural, functioning ecosystem as well as guidance in selecting priority areas for effective wetland, riparian, and forest habitat restoration. This important tool can be used to set stewardship actions in future wildlife habitat enhancement projects or activities set out in the Pike Lake Stewardship Plan. For more information about this fact sheet, refer to www.on.ec.gc.ca/wildlife.

3.4.1. Shoreline

Although the RVCA and municipalities encourage everyone to maintain or restore their shoreline to a natural state, individual property owners are responsible for maintaining their own shoreline. Prior to completing any work near or in the water, including shoreline stabilization and docks, the MNR and RVCA must both be contacted to ensure fish habitat is not altered, disrupted, or destroyed (see Appendix 5 for more information about which agencies to contact).

Alteration to shorelines along the lake requires permission under the RVCA's Ontario Regulation 174/06 – *Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*. Under the MNR's *Public Lands Act*, construction or work on boathouses over the bed of the lake and any work on the bed of the lake requires permission. Development along the shoreline might also be subject to the federal Fisheries Act and screening through the *Endangered Species Act*.

3.4.2. Wildlife

The new Endangered Species Act 2007 takes a "stewardship first" approach to the protection of species and their habitats. For more information about the 2007 Endangered Species Act, refer to Service Ontario's e-laws.

There are a number of monitoring programs through NatureWatch that have been developed for individuals to observe wildlife populations. Monitoring not only helps promote interest and knowledge around the lake, information generated by volunteers about wildlife can provide insight into the changes in wildlife populations and abundance over time. Monitoring can also help identify areas for habitat protection or enhancement. Protecting natural areas, especially wetlands, and creating or restoring other important habitat areas such as shorelines, can help to support wildlife populations around our lake. For more information about citizen science monitoring programs refer to Nature Canada's NatureWatch Program.

3.4.3. Wetlands

The RVCA's Ontario Regulation 174/06 – *Development, Interference with Wetlands and Alterations to Shorelines and Watercourses,* regulates development of areas within 120m (394ft) of provincially significant wetlands. An Environmental Impact Study (EIS) must demonstrate the proposed activities will not result in any negative impacts on the natural features or ecological functions of the wetland. Development applications may also be subject to review under Section 35 of the federal *Fisheries Act* and the MNR's *Endangered Species Act*.

The Ontario Regulation 174/06 does not provide similar protection for wetlands that are of regional or local significance. However, if development occurs within these wetland areas, development applications may be subject to an EIS, and review under Section 35 of the federal *Fisheries Act* and the MNR's *Endangered Species Act.*

Many thanks to Dale Poulter for gathering together wildlife observations for inclusion into this report. Thanks also to the Otty Lake Association for the template provided in the Report on the State of Otty Lake and its Watershed.

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4. Impacts of Motor Vehicles

Results of the Pike Lake survey and discussions at community meetings confirmed that the lake community most values the natural landscape, tranquility of the area, and recreational opportunities the lake and the watershed provides for everyone's personal use and enjoyment.

The lake's community is as diverse as the number of ways the lake and its surrounding landscape is enjoyed and utilized. The community includes day-trippers, renters, campers, cottagers, full time residents, and businesses that all enjoy and use the lake in different ways. Activities enjoyed by community members include fishing, boating, hunting, snowmobiling, ATV'ing, camping, canoeing/kayaking, sailing, swimming, waterskiing, scuba diving, cross-country skiing, picnicking, reading by the lake, photography, painting, hiking, and wildlife viewing.

4.1. Boats and Other Recreational Vehicles

Boating is one of the most important and predominant activities carried out on the lake. Boat launch access to the lake includes one public boat launch owned by the MNR, and privately owned launches at Moodie's Rental Cottages and resident cottages around the lake. These launches provide access for watercraft of varying sizes, including sailboats, fishing boats, powerboats, and Personal Watercraft (PWC) or "jet skis".

Recreational boating, whether one likes to fish, water ski, knee board, wake board, tube, sail, canoe or simply enjoy relaxing and cruising on the water to visit friends or explore crown land islands, provides a great opportunity to enjoy quality family time, reduce stress, and to explore and enjoy the lake. There are several concerns with the increase in recreational boating that are common to many lake communities. These concerns relate to the implications for safety, noise, and nuisance traffic; disturbance of wildlife; boat wake; pollution of waterways; and the introduction of invasive species.

Some community members also identified the issue of trespassing on private property for the use of snowmobiles and all - terrain vehicles (ATVs).

On many lakes, there is a general desire to seek a balanced approach to dealing with these concerns. Multi-season and multi-use recreation occurs around Pike Lake. The vast majority of recreationists are responsible, respectful, and safe in the way they pursue their interests, however, some conflict of use of the lake and its watershed can occur.

It is vital that the various recreational activities undertaken by the lake community are carried out in a sustainable way. Respectful use of the natural landscape and supporting infrastructure; protection of the lake's water quality and wildlife habitat; limiting air pollution and noise; and ensuring encroachment on private property does not occur ensures the long-term health and enjoyment of the Pike Lake and its watershed.

4.2. Current State of Motor Vehicle Activity on the Lake

4.2.1. Safety, Noise, and 'Nuisance Traffic'

Although boating is one of the most important and predominant activities on Pike Lake, some community members have expressed concerns with the implications that certain boating practices may have for their safety and enjoyment of the lake. Specifically, the community has expressed concerns regarding unsafe speeds, reckless operation, and the proximity of PWCs, boats, and water-skiers to swimmers, loons, small vessels (i.e., canoes and kayaks), and shorelines.

Cottagers and property owners may be impacted by increased noise from boating activity (sound of boat motors, as well as music and loud conversations taking place on boats) that resonate across open water. Such noise is disturbing to some users of the lake who seek a tranquil setting in which to relax.

Concerns around the use of ATVs and snowmobiles on private property have also been raised.

4.2.2. Boat Wake

The environmental impacts of inappropriate boat and personal watercraft (PWC) speeds and wakes can have negative long-term effects on shorelines. The wake created by a watercraft will travel outward from the boat until it reaches shore where it is either absorbed or reflected outward again towards the opposite shore. Depending on the condition of the shoreline, the impact of the wake can cause erosion or accelerate the erosion process. In addition, there is the potential for wake damage to property, docks, and docked boats.

Boat wake can impact wildlife by flooding nest sites of various waterfowl (including loons). Loons spend most of the time on water. Awkward on land, they nest close to the water's edge either on islands or on aquatic vegetation mats. Because loons nest so close to water, nests are susceptible to flooding from fluctuating water levels and boat wake. If flooding is consistent, this may lead to abandoned nesting sites which can result in unsuccessful brooding efforts.

The operation of boats in shallow waters increases turbidity. The rotation of propellers in shallow water can stir up the sediment in these areas and smother fish spawning areas.

4.2.3. Pollution

The majority of older boat motors used on the lake today are made up of two-stroke engines. Test results by Environment Canada's Environmental Technology Centre show that older conventional two-stroke outboards produce 12 times as much benzene, toluene, ethyl benzene, and xylenes, and five times as much oil and grease as four-stroke outboards.

Since the late 1990s, new technology for two-stroke and the mass production of the four-stroke engines to comply with tough emission standards has resulted in a switch to the much cleaner and very fuel-efficient outboard motors. The very high cost of fuel in 2008 may have helped with the

conversion. To reduce the impact of air and water pollution, the use of 4-stroke engines should be considered.

4.2.4. Invasive Species

One of the most topical issues related to boating is the spread of invasive species. According the Ontario Federation of Anglers and Hunters, the most common invasive species to watch for in eastern Ontario are zebra mussels, Eurasian watermilfoil, and spiny waterflea.

Watercraft, and any toys or equipment including scuba or snorkeling gear, pool noodles, pumps, etc., that may still have water droplets on or moisture in them can carry invasive species from one waterbody to another. Thorough cleaning of boat, trailer, bilge, other equipment, and toys prior to visiting other waterbodies is necessary to prevent the introduction of foreign water species.

Motorized boats and Personal Water Crafts can inadvertently help the spread invasive plant species like Eurasian watermilfoil throughout the lake. When a boat travels through a patch of Eurasian watermilfoil, the propeller either becomes clogged or it cuts the plant into smaller fragments. Each one of those fragments has the potential to spread to new locations and develop into a new plant.

To date, Pike Lake has been invaded by Eurasian watermilfoil, purple loosestrife, rusty crayfish, and European frog-bit. As of September 2007, neither Zebra mussel veligers (a mobile, juvenile form of the mussel) nor Spiny waterflea has been detected on Pike Lake. However, in 2008, sporadic observations of the adult zebra mussels have been made on Big Crosby Lake. Introduction of this species may still be prevented if the community works together to educate and carry out preventative actions that guard against the invasion.

For more information about invasive species, refer Section 3 Conservation and Protection of the Natural Environment.

4.3. Who Regulates Motor Vehicle Activities?

4.3.1. Wildlife

The MNR administers *the Endangered Species Act*, *Fish and Wildlife Conservation Act*, *Lakes and Rivers Improvement Act* and the *Public Lands A*ct, which all govern what can and cannot be done to fish, wildlife, and their habitat within the Pike Lake Watershed. Environment Canada is responsible for administering the *Migratory Birds Convention Act*. The *Canada Wildlife Act* also serves to protect the fish and wildlife and their habitat.

4.3.2. Boating

The Ontario Provincial Police (OPP) administers the regulations under the *Canada Shipping Act*. For more about the Acts and Regulations that regulate boating activity on the lake, go to Transport

Canada's Marine Safety website, or refer to the Safe Boating Guide. An Owner's Guide to Private Aids to Navigation, developed by the Canadian Coast Guard, offers information about proper buoy marking.

4.3.3. Snowmobiles and All-Terrain Vehicles

The *Motorized Snow Vehicles Act*, governs snowmobile activity. The *Off-Road Vehicles Act* and *Highway Traffic Act* govern off-road vehicle use. Municipalities have the authority to determine whether or not off-road vehicles (ORVs) should be allowed access to roads under their authority. Municipalities must put a By-Law in place for ORVs to be allowed access to their roads and can determine which roads, where on the road, which time of day, and what season that ORVs are allowed access. They can also set speed limits that are lower than those set out in the regulation. If a By-Law does not exist, ORVs are not allowed access to that municipality's roads.

More information specific to these acts and regulations, refer to Service Ontario's e-laws.

Thanks to the Otty Lake Association for the template provided in the Report on the State of Otty Lake and its Watershed for this section.

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5. Crown Land

The Crown Land islands found on the lake are one of the watershed's greatest natural assets. These undeveloped areas add beauty to the landscape, and are an integral part of the character and natural features of the lake. These areas are also important in that they provide public access to the lake for the enjoyment of all. Traditionally, people have enjoyed visiting these islands for a variety of activities, such as picnicking, swimming, enjoying nature, taking a break during a canoe-trip, camping, meeting friends, and finding solitude.

The term public land is sometimes used to mean any land that is controlled or owned by a public agency – whether it is provincial, federal or municipal. The Ministry of Natural Resources (MNR) is responsible for managing Ontario's Crown land in a way that balances social, economic and environmental interests. Most of the Crown land in Ontario is owned and managed by the province. However, some Crown land including national parks, some harbours and canal systems fall under the control of the federal government. Public ownership of Crown land allows a wide range of economic, recreational and social activities to take place side by side. The "rules" governing the administration of Crown land are laid out in a provincial law known as the *Public Lands Act* (PLA). In this legislation, the term "public land" means Crown land. For more information about the laws and policies governing Crown Land, refer to http://www.mnr.gov.on.ca/en/Business/CrownLand/index.html.

5.1. Current State of Crown Land Islands

Lake residents and users have raised concerns about the unsustainable use of the unofficial campsites on the lake's islands, which has resulted in littering of the natural spaces, noise pollution, denuding of vegetation, improper disposal of septic waste, and fire damage from unattended fires. It is important the lake community engage in careful stewardship of these areas and consider the delicate balance of social and environmental needs.

The MNR's Crown Land Management Policies identify permissible recreational activities and uses of public lands under the control of the province. -Residents of Canada may camp free of charge on Crown Land for up to 21 days at any one site, except where posted otherwise as per Policy No. PL 3.03.01 (Free Use Policy). Permissible free use however, carries with it the responsibility of all users of public lands to undertake their activities in an ecologically and responsible manner, and the acceptance of risks associated with their activities.

5.2. Protecting the Crown Land Islands for Future Enjoyment

It is recommended that the Pike Lake community work in association with the MNR, the users of the Crown Land islands, and local emergency services to carry out a pro-active approach to protect, preserve, and ensure the sustainable use and enjoyment of these islands in accordance with sound stewardship principles.

Some of the uses that may be addressed in these cooperative efforts could include:

- the use of designated fire pits (the threat of forest fire is much higher in non-designated fire pits and typically stems from tree root underground fires);
- the establishment and maintenance of appropriate public use structures and/or facilities in accordance with applicable approval requirements;
- a noise limit policy which considers the disturbance to neighbouring cottagers;
- the implementation of approved community rehabilitation and restoration projects; and
- the installation of approved signage to advise users of sustainable use and stewardship guidelines.

Working with all parties and stakeholders, the Pike Lake community should explore a sustainable solution for the shared use of public lands.

Thanks to the Kemptville District MNR for the information provided in this section.

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6. Mining Concerns

6.1. History

There have been a number of different practices with respect to mining in Canada over the past 300 years. In Ontario, regulation of mining began in 1845 when the province was still known as Upper Canada. The *Constitution Act*, 1867 gave the then existing provinces ownership of the public property within their boundaries (i.e. to the provincial Crown). The provinces then issued grants of land known as "Crown Patents" (MNDM, 2008).

In 1913, Ontario amended its *Public Lands Act* which reunified all surface and mineral rights for all private landowners on land granted by the Crown prior to 1913. Any parcels of land granted by the Crown after May 6, 1913 may or may not include the mining rights depending on how the property title is worded. This means if you bought Crown Land, or a previous owner did, it's likely you only own the **surface rights** to the land.

Ontario's current *Public Lands Act* authorizes the Minister of Natural Resources to sell or lease land. Today, the province's policy is to reserve mining rights to the Crown in the majority of land grants (MNDM, 2008).

6.1.1. Mining Act

Ontario's *Mining Act* provides for the acquisition of land for mineral exploration and development. Administered by Ontario's Ministry of Northern Development and Mines (MNDM), the purpose of the *Mining Act* is to encourage prospecting, staking, and exploration for the development of mineral resources. Put simply, mining rights are the rights to the minerals located in, on, or under the land.

Staking involves marking a section of land to claim the sole right to prospect for minerals and the statutory privilege to apply for a lease. Under the "free entry system", prospectors can stake lands to acquire mineral rights without the prior consent of the surface rights owner to the land. Although there are laws that prohibit trespass, these same laws also contain exemptions that effectively state that individuals with legal right to enter a property are not trespassing. A prospector may enter and stake a claim on a property with surface rights without notification, prior or afterwards, to the surface landowner.

Preliminary exploration work on Crown Land or on privately-owned surface-rights-only land can include clear cutting an area up to 10,000 m^2 (1 ha/2.3 ac); excavation up to 1,000 tonnes (metric tons) of material; surface stripping of overburden over an area up to 10,000 m^2 or a volume up to 10,000 m^3. It also includes surface stripping of overburden up to 2,500 m^2 or a volume of up to 2,500 m^3 within 100 m of a water body, as well as drilling, trenching, and blasting. Up to 1,000 tonnes (metric tones) of rock can be removed without a requirement to restore the land.

These exploration activities can occur on the claimed lands without any requirement for an environmental assessment, or for conservation authority or municipal approval. Although Ontario's *Environmental Assessment Act* requires that an environmental assessment be undertaken for every

major commercial or business enterprise, activity, or proposal, *mining is exempted from this requirement*. Although Ontario's *Planning Act* requires municipalities to prepare an official plan to establish the long-term vision for how the land will be used, municipalities do not have the authority to prohibit mining. On page 64 of the Environmental Commissioner of Ontario's Annual Report (2007), his concerns about mining in Ontario were conveyed as follows "MNDM's strategy revolves entirely around the promotion of mining in Ontario, with little consideration given to the larger responsibilities of the Ontario government, such as land use planning or environmental protection."

6.2. Current Mining Activities in the Pike Lake Area

In March 2001, Graphite Mountain Inc. staked 64 prospecting claims for graphite in North Burgess Ward of Tay Valley Township, around Black, Pike, Adams, Otty, and Long lakes (Sherwin, 2003). This staking raised an alarm amongst cottagers and other landowners, many of whom were unaware that they did not own the mineral rights to their properties. In response to the staking activity, the Citizens' Mining Advisory Group formed (the Pike Lake Community Association is a member) to help landowners dispute these claims and to challenge the company to have all the claims cancelled. Tay Valley landowners initiated multiple legal disputes. By 2003, Graphite Mountain Inc. abandoned a majority of claims throughout Tay Valley Township. The 14 active claims dating from the 1980's remaining in the Merkley Road area of Tay Valley Township near the south end of Black Lake will not be withdrawn until the mining company holding them relinquishes the claims anytime in the future.

There are no active mining claims on Pike Lake. A significant portion of the lands within the Pike Lake watershed are fully patented (meaning the landowner owns the surface and mineral rights, including all of the lands within the Township of Rideau Lakes); however an estimated 10-15% of the land directly surrounding Pike Lake rests with the Crown (refer to Map 4). Surface rights only areas around Pike Lake include:

- LOT 19 CON 8: southern part of Route #1, all of Route 1E, Route 17 and 17C
- LOT 20 CON 9: Pike Lake Route 6 and 7, Two Brothers Lane
- LOT 21 CON 9: Trailer park, and possibly a few properties on Pike Lake Route 8

In addition to mica and apatite, which were actively mined in the past, the Nepean sandstone formation along the southeast shore of the lake has potential for building stone and is a possible source of glass sand because of its high silica content.

Mining exploration and activity around lake environments could have substantial negative impacts on the health of the lake including:

- the impact on wetlands, ground water, private wells, and the lake itself;
- environmental issues related to open pit mining e.g. toxic materials released into the watershed; there is no protection under the Clean Water Act for rural water sources;

- noise, dust, and dirt from earth moving equipment;
- the increased heavy truck traffic on local roads;
- the lack of remediation as prospectors are not required to remediate or restore the land; and
- the negative impact of the above mining activities on property values.

Twenty-two of the 25 lakes in Tay Valley Township include surface-rights only properties; many have Crown Land. Therefore, many of the lakes in Tay Valley Township remain vulnerable to mining claims.

6.3. Modernizing Ontario's Mining Act

In August 2008, MNDM launched a review of the *Mining Act*. The discussion paper *Modernizing Ontario's Mining Act: Finding a Balance* notes that the *Mining Act*, originally passed in 1868 and revised in 1906, had few amendments until the early 1990's when requirements for mine closure and reclamation were introduced.

The paper states "Ontario is modernizing its *Mining Act* to ensure that this legislation promotes fair and balanced development that benefits all Ontarians in a sustainable, socially appropriate way, while supporting a vibrant, safe, environmentally sound mining industry. Modernization will bring the *Mining Act* into harmony with the values of today's society while maintaining a framework that supports the mineral industry's contribution to Ontario's economy…"

The five key elements of the review are:

- Mineral Tenure System and Security of Investment;
- Aboriginal Rights and Interests related to mining development;
- Introducing regulatory processes for exploration activities on Crown Land;
- Land use planning in Ontario's Far North; and
- Private rights and interests (surface eights/mining rights conflicts).

Public consultations were held between August 11 and September 8, 2008 in Timmins, Sudbury, Thunder Bay, Kingston, and Toronto to discuss the modernization of the act. Additional consultations were held with First Nations and Métis leaders and organizations. Focused meetings for mineral sector and other stakeholders were also held.

The Citizens' Mining Advisory Group joined with a number of like-minded organizations under the umbrella name of the Coalition for Balanced Mining Act Reform. The Coalition calls for adoption of the following Three Modest Proposals:

<u>1: Single Ownership / Re-unification of Minerals with the Land</u>

The Coalition calls for the Government of Ontario to re-unite all provincially owned mining rights with privately owned surface rights on municipally taxed land. This step will ensure that the 2% of Ontario property owners

who do not own the minerals under their property have the same rights as the other 98% of property owners. This will permanently resolve the problems of "two owners to one property".

This proposal is consistent with the resolution passed by the Association of Municipalities of Ontario (AMO) on June 22, 2007.

2: Strengthen Municipal Planning Powers

The Coalition calls for the Government of Ontario to give municipal governments the authority to include or exclude mineral land use designation in their official plans and the subsequent authority to zone lands so as to restrict the locations in which mining activities can be undertaken, in accordance with municipal needs.

This step will result in a better balancing of the importance of mining, agriculture, recreation, and tourism to the economy of Ontario, and ensure more open and transparent governance that respects the different realities in different regions of the province.

3: Require a Review and Analysis of Impacts

The Coalition calls for the Government of Ontario to require a comprehensive public review of the impacts of proposed mineral exploration and mining activities before such activities can be undertaken by anyone. This step will ensure that mineral exploration and mining activities cause no adverse environmental, health, legal and property impacts.

Lake associations, including Pike Lake, as well as individuals in eastern Ontario, the Kawarthas and Haliburton wrote letters to the Premier and the Minister of Northern Development and Mining supporting the Three Modest Proposals. Municipalities also played an active role. For example, the Reeve and Deputy Reeve for Tay Valley Township, and the Mayors of Perth, Smiths Falls and Merrickville were among the political leaders who participated in the consultations in Kingston. They conveyed their support for the Three Modest Proposals. In addition, Ottawa, Kingston, and Peterborough councils passed resolutions supporting the Three Modest Proposals.

A number of environmental organizations and other non-governmental organizations have also provided input. Their focus has been more on the environmental impacts, but their input complements that of the Coalition for Balanced Mining Act Reform.

Media coverage included two feature articles in Cottage Life Magazine, a special on W-Five, and interviews on Ontario Today, as well as articles in numerous newspapers.

6.3.1. The Mining Amendment Act

The Minister of Northern Development and Mines introduced the *Mining Amendment Act,* Bill 173*,* on April 30, 2009. The Minister expects that the Bill, which has passed first and second reading, will receive royal assent by the end of the year. Under the new legislation, and effective April 30, 2009, all surface rights only land that is not presently staked is withdrawn from mining in Southern Ontario

(south of Lake Nipissing and the French and Mattawa Rivers). Further, when claims lapse on surface rights only land in Southern Ontario, the mineral rights will be withdrawn. The new legislation does not address the role of municipalities in land use planning, including mineral land use designation. The section on the purpose of the *Mining Act* references minimal environmental impact; however, it is silent on how this purpose would be achieved. For more information on Bill 173 go to www.ontario.ca/mines-news.

6.4. How to Determine if You Have the Mineral Rights to your Property

To find out if you own the mining rights to your land, refer to the MNDM website at www.mndm.gov.on.ca/mndm/mines/LANDS/mlsmnpge.htm. Navigating through the website to the "Mining Lands CLAIMaps" will enable a property search to see if the Crown retains the mining rights. Directions to navigate the site are included in Appendix 7. It is important to note if a claim is older than 30 years old, it may not show on this system. To carry out a title search, contact the Lanark or Leeds and Grenville Land Registry Offices (contact information in Appendix 7). Title searches must be done in person and may require a small fee. For more information, visit the Friends of the Tay Watershed website www.tayriver.org/documents/mining_rights.htm.

6.4.1. Further Information

To review the background on issues and political actions by Tay Valley Council covering the period from 2001 to the present and commonly asked questions by Tay Valley Township rate-payers, as well as to view *Modernizing Ontario's Mining Act - Finding a Balance Discussion Paper* dated August 2008, refer to: www.tayvalleytwp.ca/INDEX/Mining%20Concerns%20Committee/mining_act_of_ontario.htm. To obtain a copy of the current *Mining Act* check online at www.e-laws.gov.on.ca

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Thanks to the template provided by the Report on the State of Otty Lake and its Watershed. Specific information collected by Bart Poulter with help from Dale Messenger from MNDM and Kay Rogers. The mining history in the Tay Valley Watershed has been referenced from "*Geology, Mineral Deposits and History of Mining in the Tay River Watershed"*, written by Donald F. Sherwin, produced by the Friends of the Tay http://www.tayriver.org/documents/geology_report/geology_report.htm.

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7. Aquatic Vegetation

Although present in the lake naturally, phosphorus enters the lake through a variety of ways including seepage from older or faulty septic systems, and runoff from detergents, fertilizers, and other sources. These nutrients are taken up by aquatic vegetation. High amounts of phosphorus increases growth rates leading to algae blooms and dense growth of aquatic vascular plants in bays and shallow areas around the lake. In excessive amounts, aquatic vegetation can be detrimental to the lake system.

The overgrowth of aquatic plants or "weeds" in Pike Lake, particularly in shallow bays found in the north and southeast of the lake, is of concern to many individuals around the lake. When plant growth becomes excessive, the lake looks unappealing and spoils recreational activities such as swimming, boating, and fishing.

7.1. Importance of Aquatic Vegetation

Aquatic vegetation includes algae and vascular plants (emergent plants with floating leaves or leaves that grow out of the water such as cattails, reeds, and wild rice; submergent plants that live for the most part under water such as water milfoil and bladderwort; and floating plants such as duckweed and lily pads) are important in maintaining a healthy lake system.

Aquatic vegetation serves many important functions for the lake. It takes up nutrients, provides oxygen to water, acts as a filter to remove contaminants and stabilizes the lake bottom preventing suspension of sediments, which all help to maintain water quality. Aquatic plants limit erosion of shorelines by moderating the effects of wave and ice erosion, provide shade along the shoreline area, and decrease water temperatures. A healthy native aquatic plant community is also important in preventing the establishment of non-native invasive aquatic plants.

Aquatic vegetation is also important in providing food and habitat for many aquatic organisms including fish, mammals, numerous bird species including waterfowl, amphibians, reptiles, and insects. Yellow perch, northern pike, panfish, and bass all depend on aquatic vegetation to provide food, spawning habitat, and nursery areas. Juvenile fish of most species feed on small crustaceans and insects that are abundant in stands of aquatic vegetation. Even species that may not require vegetation for spawning depend on the cover and forage found in aquatic vegetation.

Many species of wildlife are dependent on aquatic plants for food and nesting sites. The seeds and tubers produced by various water plants are an important source of food for migratory birds and their young. Aquatic plants also support many insects and other aquatic invertebrates that are prey for reptiles and amphibians.

Aquatic vegetation will grow wherever adequate sunlight, nutrients, temperatures, and water quality exist. Other physical factors also influence the distribution of plants within a lake. For example, aquatic plants generally thrive in shallow, calm water protected from heavy wind, wave, or ice action. However, if the littoral zone is exposed to the frequent pounding of waves, plants may be scarce. In a windy location, the bottom

may be sand, gravel, or boulders, none of which provides a good place for plants to take root. In areas where a stream or river enters a lake, plant growth can be variable. Nutrients carried by the stream may enrich the sediments and promote plant growth, or suspended sediments may cloud the water and inhibit growth. Where aquatic plants grow and how abundant they are may vary greatly from lake to lake, and even within a lake itself.

7.1.1. Algae

Algae (also known as phytoplankton) are tiny organisms that use photosynthesis to make their own food. Algae are diverse in form, colour, and habitat and are critical to the life of our lakes. They are the base of the food chain by converting nutrients to organic matter, and oxygenating the water (MOE 2002).

An increase in available nutrients, introduced into a lake from human activity (surface runoff including fertilizer, detergent, and untreated septic system effluent from faulty septic systems) can elevate naturally occurring phosphorus and nitrogen levels in a lake. Coupled with higher temperatures and light levels, an increase in algal growth or a bloom in a lake can result. Filamentous and colonial algae can mass together and form as a scum in the water column or as mats on the lake surface. This dense scum layer can reduce water clarity, blocking out light needed for other plants and animals. Algae blooms can affect the colour of the lake and produce unpleasant odours. Blooms can also ruin recreation activities and clog water intakes.

Excessive growth of algae also reduces oxygen levels in the lake. Algae produce oxygen as a byproduct of photosynthesis, but also take in oxygen for respiration. If there are high algae populations in the lake, great fluctuations in dissolved oxygen can occur. Extreme changes in dissolved oxygen levels in a lake can stress fish and other wildlife. When algae die, the decay uses up oxygen available in the water. If large amounts of algae die off, dissolved oxygen levels can reach very low levels. When this happens, phosphorus that is in the sediments is released into the water column and is then available for even more algal growth. Continued excessive growth speeds up the eutrophication and degradation of a lake and its water quality.

Algae blooms can also pose health risks as some algae (specifically blue green algae) are capable of producing toxins that may be a health hazard to humans, pets, and wildlife drinking the water. If a blue-green algae bloom is suspected, assume toxins are present and call the MOE's Spills Action Centre.

7.1.2. Vascular Plants

Although there are many native species of vascular aquatic plants that grow in the lake, one aggressive aquatic plant that clogs the shallow bays of Pike Lake is an invasive species called Eurasian watermilfoil. Once established, this plant is difficult to eliminate. The most effective way to slow its growth is to limit nutrients from entering the lake.

Eurasian watermilfoil spreads largely by fragmentation. When parts of this plant break off, they are able to settle and grow an entirely new plant. Boating activity can propagate the spread of this plant around the lake because plants are cut or tangled in boat propellers.

Eurasian watermilfoil can begin growing in low water temperatures early in the season, forming a thick canopy that shades the surrounding native plants that would otherwise provide a good food source for ducks and other waterfowl, the canopy also impedes the movement of wildlife. Although the canopy does allow for high survival rates of young fish, Eurasian watermilfoil supports fewer numbers and kinds of aquatic invertebrates that serve as food for fish.

With dense mat growth around the lake, Eurasian watermilfoil also has the potential to ruin recreation, and degrade water quality by lowering oxygen levels in the water, impacting fish and wildlife. Excessive growth speeds up the eutrophication and degradation of a lake and its water quality.

7.2. Current State of Aquatic Vegetation on Pike Lake

No recent surveying or monitoring of the aquatic vegetation in Pike Lake has been carried out. Overall trends in aquatic vegetation types (including other invasive species) and growth patterns cannot be identified.

7.3. Who Regulates the Control of Aquatic Vegetation?

The best way to restrict the spread of excessive aquatic plant growth is prevention; identify the source of excess nutrients on your property and limit their input into the lake. By maintaining a natural shoreline, using phosphate-free soaps and detergents (keep shampoos and soaps out of the lake), avoiding the use of fertilizers, and maintaining septic system with regular pump outs and inspections by a licensed contractor, can help reduce the amount of nutrients entering the lake.

If residents or cottagers notice a persistent problem with aquatic vegetation in front of their property, contact the MNR or RVCA. Staff can recommend methods for dealing with the problem that will help to ensure the health of the lake is protected. If, in consultation, removal of the aquatic vegetation is determined to be the most effective course of action, a proposal must be submitted to the MNR. Approval or permits from the MNR and RVCA is required before aquatic vegetation removal begins. The application may be referred to the MOE for review and approval if the application requests the use of chemicals. Aquatic plant removal can harm fish populations that depend on the presence of plants. The federal *Fisheries Act* provides protection of fish habitat and ensures that no work is carried out that result in the harmful alteration, disruption or destruction of fish habitat (HADD). Fisheries and Oceans Canada has a referral protocol with Parks Canada, and Conservation Authorities for the review of proposed work around water. Methods of control preferred from a fish habitat perspective, include:

- hand pulling (hard to carry out if the patch of plants is well-established);
- hand cutting and raking (only effective early in the season and since the roots are not removed the weeds will grow again). Harvested plant fragments (especially from Eurasian Milfoil plants) must be removed; and

All forms of removal are generally labour intensive and require long-term follow-up as harvesting the plant does not destroy the plant roots. Removal may have to be repeated during the season if the growing conditions are favourable. For more information about the different ways of controlling excessive aquatic plants and permitting process, refer to the MOE's *Permits for Aquatic Plant Control Applicant Information Guide.*

It is important to remember that no in-water work is permitted on Pike Lake between March 15th and July 1st. Avoiding any disturbance of the lake bottom at this critical time of year helps to protect the many fish species that are spawning and rearing young.

Thanks to the information and template provided by the Report on the State of Otty Lake and its Watershed for the Aquatic Vegetation section of this report.

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8. Water Levels

A small dam on the lake's outlet has been used to control water levels on the lake for many years. Water levels fluctuate through the seasons, and according to the Pike Lake 2005 survey, while some individuals would prefer the water levels to be lowered, others would like higher levels be maintained throughout the year. Still others simply want water level to be consistent and reliable throughout the year.

8.1. History of the Dam

Prior to 1945, the original dam was built by Mr. W. Allan (on Lot 12 Con. 10) to provide a storage reservoir for a private saw and gristmill located downstream on lower Grants Creek. The landowners on Pike Lake were paid annually for flooding rights. The dam was later sold to Mr. W. Cameron who purchased the mill in 1945 and operated the dam for a year, later selling it to a Mr. Ritchie. Water rights and payments for flooding were discontinued over this period.

Property owners from Crosby, Little Crosby, and Pike Lakes submitted a petition in 1966 to the provincial government to erect a permanent structure to stabilize water levels on the three lakes. At that time, Mr. H. Byrne owned the property on which the dam was located, and had operated the dam for several years, maintaining the lake level to provide steady water flow for farming operations downstream. The dam was rebuilt on the original site in 1970 (Kerr, 1998).

8.2. Current Operations

Since 1970, the Pike Lake Dam has been operated and maintained by the Kemptville District MNR. The objective of the water level operation is to maintain water levels that are suitable for recreational activities and ecological requirements on Crosby, Little Crosby, and Pike Lakes, and to fulfill downstream water flow requirements.

The concrete dam with steel decking consists of three stop log sluiceways with four wooden logs in each sluiceway. The bottom three logs in each sluiceway are 0.3 m (0.98 ft) high. The top log (4^{th} log) in the outside sluiceways is 0.15 m (0.49 in) and the top log in the centre sluiceway is 0.10 m (0.33 ft) high. The bottom log in the middle sluiceway is designed to provide continuous base flow through the dam into Grants Creek to support ecological needs.

An operating guideline is used to meet target water levels required at specific times of the year. Most log manipulation occurs during the spring runoff and the fall drawdown. Details on how operations are typically managed throughout the year to meet target water levels are outlined below. Refer to Figure 6 for the Pike Lake operating guideline for water levels.

- In the spring, after the ice is out, logs are manipulated to maintain water levels below the upper target level 0.975 m (3.2 ft). During this time, flows may be strong though the dam depending on the intensity of the **spring freshet** (snowmelt) and the amount of precipitation. If the spring water level approaches 1.04m (3.41 ft), logs are removed to prevent flooding of lake properties.

- As the spring melt slows down, logs are added back to the dam to achieve the summer water levels for the lakes (0.975 m (3.2 ft)), and downstream water flow requirements (minimum of 0.14 cubic metres/sec (5 cubic feet/sec) continually except for an increase to 0.28 cubic metres/sec (10 cubic feet/sec) from July 1 to September 15). If there are three logs in each of the sluiceways, and if the water is level with those logs, the water level is 0.91 m (3 ft).
- The water level will typically decline above the dam slowly over the summer months as minimum downstream flow and evaporation generally exceeds the volume of water entering the lake. To compensate for this, from July 1st to September 15th base flow through the bottom log in the middle sluiceway is increased to 10 cubic feet/second. The increased flow is accomplished by removing the plate in the low flow opening. Under normal precipitation and evaporation rates during the summer, target water levels are achieved without log manipulation
- If there is a significant precipitation event during any part of the season, log manipulation may occur to reduce water levels on the lakes above the dam.
- Around September 15th, the logs are adjusted to winter operating conditions (with 2 logs remaining in each sluiceway) lowering the lake's water level to 0.61 m (2 ft). This lower water level helps water level management during the upcoming spring melt (McLenaghan, 2007, Kemptville MNR). Refer to Appendix 10 for the rule curve water target levels.

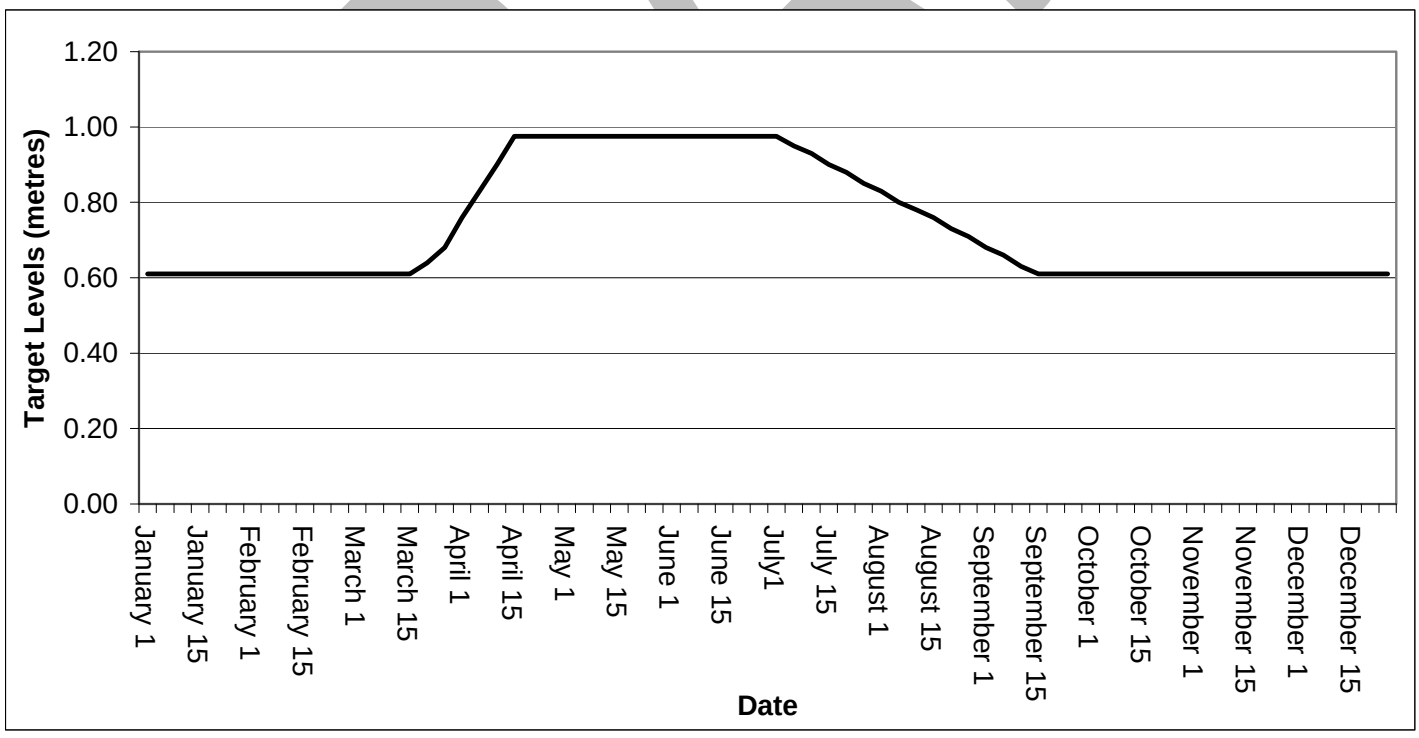

Figure 6: **Kemptville MNR Water Level Targets for Pike Lake**

Although target water levels have been established for this system, lake levels can be off-target. Higher or lower water levels can be the result of significant weather and precipitation events. Spring run-off (spring freshet) increases flows into the lake system; hot, dry, and windy weather can result in lower lake levels due to increased evaporation from the lake surface and reduced water input. When the weather is cool, overcast, and rainy, lake levels are typically higher. Initial log adjustments during these events may not correctly match the results of these weather conditions or events since the number of logs removed or replaced is an estimate to the effects of the amount of precipitation; further adjustments may be necessary (McLenaghan, 2007).

The dam is regularly inspected to ensure water levels and flows are being managed within target levels; equipment is in good working order; and safety for the public and workers is maintained. Water levels have been recorded by the MNR since construction of the dam in 1970. Water level readings are recorded from a staff gauge adjacent to the dam that corresponds to the water levels on the logs in the dam (a new metric gauge was installed in 2008). A lake volunteer began monitoring water levels in 2006.

8.3. Current State of Water Levels

8.3.1. Shoreline Properties, Recreation, and Downstream Water Flows

When water levels are high, older homes or cottages and their septic systems that were built close to the lake and on low-lying ground may be susceptible to flooding. Prolonged flooding of septic systems can also result in septic failure and contamination of the surface water with untreated sewage.

Although not likely to cause property damage, low water levels can make boating and other recreational activities difficult or even unsafe. Low water levels can beach floating docks and make launching or accessing a boat difficult. Rocks and shoals normally submerged become hazardous to boats while shallow bays and channels are inaccessible. Residents living downstream of the dam have expressed concern with insufficient flows downstream.

Further monitoring and discussion with community residents, cottagers, and the MNR is needed to better understand whether current dam operations are affecting shoreline properties, downstream water flows, and recreation activity.

8.3.2. Fisheries

According to Kerr 1998, Pike Lake water level manipulation has shown northern pike spawning areas have been flooded with deeper, colder water during spring incubation and nursery period. The dam has also prevents fish movements and requires constant manipulation to ensure the best water levels for fish productions and recreational activities (Kerr 1998). There are also private dams downstream on Grants Creek that may impede fish movement within the system (McLenaghan, 2009). A rapid water level drawdown in the spring of 1982 was believed to have impacted walleye spawning activity for that year (Kerr 1998).

Further monitoring and a review of current water level operations is needed in order to identify if walleye and pike spawning habitats are being protected during critical spawning times on the three upstream lakes.

8.3.3. Water Quality

Changes in water level are not believed to be negatively impacting the lake's water quality. The cumulative impact of poor shoreline and groundcover condition, faulty septic systems, and nutrient input to the lake through poor land use practices have a much greater impact on water quality than fluctuating water levels.

In 2008, the MNR reviewed the Pike Lake water level operations. Current research has shown that fish populations are adaptive to fluctuations in water levels as long as changes occur before the spawning period. Based on the water level data and operations at the Pike Lake Dam, it is likely fish populations, specifically pike and walleye, are not being negatively affected at this time.

8.3.4. Beaver Activity

According to beaver dam surveys done by residents on the lake, there can be up to three beaver dams on upper Grants Creek from time to time; however, this activity does not appear to affect lake levels. Property owners on Grants Creek are responsible for the removal of the dams if water levels threaten to flood neighbouring properties, although only licensed trappers and farmers can legally trap beaver.

The MNR is responsible for issuing trapping permits and should be consulted before hunting or trapping beaver. For more information on how to control beavers on private land, see the MNR Extension Note on beaver at http://www.lrconline.com/Extension_Notes_English/pdf/bvr.pdf. RVCA and MNR staff are also available for consultation for beaver management.

8.3.5. Other Wildlife

Although some wildlife species benefit from the development of dams, (dams can produce wetland areas, which can provide feeding and breeding areas for many types of waterfowl); most studies have reported habitat loss to be a major concern for wildlife. Flooding of areas can result in extensive loss of shoreline habitats.

Because of their abundant food supplies and available shelter, shoreline habitats often support a much higher diversity of wildlife species for breeding, feeding, and over wintering. Further changes in the flow regimes of rivers or creeks regulated by dams can change the natural succession in vegetation communities and affect the suitability of these habitats for wildlife.

Water level fluctuations can also impact nesting sites for waterfowl, including loons. Because a loon's feet are set so far back on its heavy body, it moves awkwardly on land, so for ease of movement, loons generally build their nests at the water's edge. In late May or early June, loons are on the nest

incubating their eggs. A 15 cm (5.9 in) increase in water level during a loon's 28-day incubation period can flood a loon's nest; a 30 cm (11.8 in) drop can strand a loon nest too far inland.

The current water level operations on the three lakes and downstream flow regulation should be reviewed to identify if habitat requirements for wildlife populations dependant on the watershed's ecosystem are being met. However, the long-term effects of water level fluctuations and flow regulation on downstream ecosystems are often complex and may be difficult to predict.

Thanks to Bart Poulter and Dale McLenaghan with the Kemptville Ministry of Natural Resources for the information provided in the Water Levels section of this report.

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9. Fisheries Health

Pike Lake's fish populations are an important source of enjoyment for the lake's residents and users. Maintaining, protecting, and enhancing the habitat that sustains fish populations are essential to support the long-term health and diversity of the lake's fish community. Fish habitat is any area that provides spawning, nursery, and rearing grounds; provides reliable cover and migration routes; and offers good food supply for fish.

Through a better understanding of the lake's fish populations, their habitat requirements, and how they can be positively or negatively affected by human activity, the Pike Lake community can work to protect and enhance the lake's fish populations to ensure future enjoyment.

9.1. History

Pike Lake was named in 1812 for its abundance of northern pike and has maintained a popular recreational fishery for more than a century. The recreational fishery was so important, that fisheries management efforts began as early as 1922. The following provides a brief review of fisheries management activities on the lake.

9.1.1. Fish Stocking

Lake trout stocking began on the lake in 1922. Although discontinued in 1936, other stocking programs for large and smallmouth bass and walleye fisheries continued in an attempt to establish these populations. Walleye was the only stocking effort being carried out from 1965 onwards. It was concluded the walleye stocking efforts were not contributing significantly to the resident populations, so stocking was stopped in 1979.

9.1.2. Coarse Fish Removal

Fisheries management efforts also included the removal of coarse fish, specifically burbot, a species which had been considered to compete with and predate on lake trout and walleye. Early settlers had reported lake trout ranging from 8 to 20 lbs prior to the arrival of burbot in the 1880's. In an attempt to control the number of burbot and prevent any further loss of sport fish, netting programs were carried out between 1935 and 1963. Fish caught through the netting program were sold to commercial fishermen. No other coarse fish removal projects have taken place since 1963.

9.1.3. Lake Inventories

Lake inventories first took place in 1959 and 1960. In 1970, the lake received a complete aquatic habitat inventory survey and was updated in 1974.

9.1.4. Creel Surveys

To help determine the population status of particular species, a combination of **casual** and **intensive** seasonal **creel surveys** were completed (between 1961 and 1997). In 1997, data from the creel surveys was compared to 1973 data. The mean age of walleye, bass, and perch appeared to have increased

indicating that these species were not being overexploited (a declining trend in mean age often indicates overexploitation). This conclusion was supported by the **catch-per-unit-effort** (CUE) of the intensive index netting programs (CUE is calculated by dividing the number of fish caught by amount of index netting effort). Between 1982 and 1996 there was little change in the catch rates of the major sport fish (including walleye, northern pike, and smallmouth bass) suggesting the populations were relatively stable (Kerr 1998).

Creel surveys for angling effort do not necessarily cover late evening when many walleye are caught. The trends drawn from the CUE data should be considered with caution.

9.1.5. Angling Effort

In 1988, estimates of angling effort during the summer (late May-Labour Day) were completed for Pike Lake. The results suggest that anglers spent approximately 15000 rod hours on the lake (one person fishing for one hour) during these months. Results of another survey completed during the summer of 1997 suggested that angling effort had declined substantially to 7500 rod hours. Estimates for the winter fishing activity in 1978 was 5700 rod hours, and 1983, 2000 rod hours. Based on information gathered from 1973 to 1997, it was estimated that on an annual basis, Pike Lake supported an average of 10000 to 12000 rod hours of angling pressure. This angling intensity was considered to be moderately heavy. The number of rod hours by anglers on Pike Lake has not been surveyed since 1997.

The 1998 MNR fisheries report for Pike Lake suggested that approximately 40% of anglers using the lake in the summer were non-residents; while the winter fishery was almost exclusively local residents. While the majority of angling effort took place in the summer, there were 14 to 16 ice-fishing huts on the lake most winters.

Walleye was the most sought after species during the open water fishery although panfish were also popular. An increased interest in bass fishing was noted in the late 1990's. In the winter, northern pike, walleye and yellow perch were the most heavily harvested species.

The noted rebound of these species may have been due, in large part, to a decline in the number of fish harvested. This decline may have been because of the noted reduction in angling effort, particularly during the summer months, as well as the implementation of MNR's slot-size limit regulations on walleye (Kerr, 1998).

9.1.6. Index Netting Surveys

Index netting programs (1982, 1992, 1996, 1999, 2002) were carried out on Pike Lake to establish a trend through time database to monitor the health status of the lake's fish populations. The initial index netting survey completed in 1982 found the growth rates of walleye were greater than compared to walleye sizes in other lakes in Lanark County (von Rosen, 1985). Growth rates are a parameter

which can provide an indication of available food and the overall status of the fish population. A fish population's common response to overfishing is an increase in the natural rate in growth (Kerr 1998). Von Rosen (1985) reported that growth rates of walleye from the lake were greater than most other Lanark County lakes and attributed this to a heavy rate of exploitation (Kerr, 1998).

9.1.7. Potential Yield

The **potential yield** is the estimated amount of fish that can be harvested annually on a sustained basis from an unstressed population (based on estimated harvest and mean weights). The yield of fish from a waterbody is reflective of latitude, growing season, local soils, topography, and lake nutrient status (Kerr, 1998). The potential yield was calculated to be 1337.5 kg of fish per year on the lake. Individual species yields were divided up based on an approximation of the fish species composition in the lake as follows: panfish 30%, coarse fish 25% (includes suckers, burbot and bullheads), walleye 17%, northern pike 10%, smallmouth bass 10%, largemouth bass 5% and yellow perch 3%.

When harvest and potential yield estimates were compared in various years from 1973 to 1997, some species, notably walleye and northern pike showed signs of overexploitation. This trend had appeared to reverse in the late 1990s to the point where harvests were within acceptable levels for all fish species on the lake (Kerr 1998).

9.2. Current State of the Pike Lake Fishery and Fish Habitat

Pike Lake is a **cool water fishery** with sport fish species and forage fish populations. Based on the most recent survey completed in 1994, an estimated 21 species of fish can be found in the lake including walleye, northern pike, smallmouth and largemouth bass, yellow perch, rock bass, pumpkinseed, bluegill, cisco (lake herring), burbot (ling), white sucker, northern sucker, and numerous species of baitfish and minnows including blacknose shiner, and bluntnose minnow. These populations appear naturally self-sustaining.

The Crosby Lakes support warm water fisheries made up of walleye, smallmouth bass, largemouth bass, northern pike, panfish, and coarse fish.

As mentioned previously, lake trout can no longer be found in the lake, and although historical reports suggested that burbot were responsible for the trout population decline, their disappearance has been attributed to other factors including shoreline development, over harvesting, water quality degradation and shifts in habitat (Esseltine, 2003).

A detailed study of the diseases and parasites affecting aquatic fauna has never been done on the lake. There is one property owner with a license to remove and sell bait from the lake. This is done using netting techniques. There is no data available on the status of the lake's fishery after 2002.

9.2.1. Fish Habitat

Fish habitat includes any area or type of environment that a fish needs to directly or indirectly carry out its life processes. Fish habitat, as defined by the federal *Fisheries Act*, includes all areas a fish uses for

spawning, nursery, and rearing, and areas that provide food supply and migration routes. Fish habitat also includes the plants and other life forms a fish interacts with to survive. The area along the shoreline or 'ribbon of life' provides fish with this important habitat. The productivity of an aquatic habitat depends on many factors including water quality (temperature, dissolved oxygen, turbidity, and nutrients), water quantity (depth and velocity), and cover (aquatic and riparian vegetation, woody debris, and substrate). A diverse fish community like the one found in Pike Lake requires a variety of habitat types to support the fish species present within the lake in order for them to carry out their life processes.

The lake has a relatively deep basin with steep shoreline and narrow littoral zone. The lake bottom and shoreline is comprised largely of cobble, boulders, sand, and gravel.

Bass nests can be found along the northeastern shoreline and around many of the small islands in the lake. Walleye, on the other hand, are believed to spawn on shoals along the shoreline, and around islands in the southeastern portion of lake and the northeast section near the outflow into Grants Creek. Northern pike tend to spawn in the seasonal tributaries and the marshy areas in various parts of lake. Pike are also believed to spawn alongside largemouth bass in upper Grants Creek at the extreme west end of the lake, as well as several creeks and bays along eastern shoreline.

The main walleye spawning habitat exists at the mouth of the outlet to Grants Creek at the northeast portion of the lake. Existing spawning habitat consists of broken gravel to rubble size rock located around and in close proximity to the small island in the middle of the mouth of Grants Creek (Essletine, 2003).

In terms of feeding habitat, walleye tend to feed on the northwest shoreline as well as along the southeast end of lake with the northern pike. Bass, northern pike, and walleye also feed along the islands near the east shore of the lake.

9.2.2. Contaminants in Fish

Based on information from the MOE's Guide to Eating Sport Fish in Ontario 2009-2010, the following consumption restrictions (meals/month) are recommended for Pike and Walleye when fishing at Pike Lake. Restrictions on northern pike, walleye, and smallmouth bass are recommended based on tests for mercury, other metals, PCBs, mirex/photomirex, and pesticides. Rock bass were tested for mercury only.

For more information refer to the Guide to Eating Ontario Sport Fish 2009-2010 Edition.

Northern pike:

- Pike between 40 to 70 cm (16 to 28 in) – restriction of 8 meals/ month.
- Pike over 70cm (28in) - restriction to 4 meals/onth.
- For women of child-bearing age or children under 15:

- Pike between 40 – 45 cm (16 -18 in) – restriction to 8 meals/month.
- Pike between 45 -65 cm (16- 26 in) – restriction to 4 meals/month.
- Pike over 65 cm (26 in) should not be eaten

Walleye:

- walleye between 25 – 55 cm (10-22 in) – restriction of 8 meals/month
- Walleye between 55 – 60 cm (22- 24 in) - restriction to 4 meals/month
- Over 60 cm (24 in) - restriction to 2 meals/month
- For women of child-bearing age or children under 15:
    - Walleye between 25-35 cm (10- 14 in) – restriction of 8 meals/month
    - Walleye between 35 -50 cm (14 - 20in) – restriction of 4 meals/month
    - Walleye 50 cm (20 in) should not be eaten

9.3. Problems and Issues

The following fisheries issues and recommendations were identified in the 1998 MNR Pike Lake Fishery Report (Kerr) and the Fish Habitat of the Tay River Watershed: Existing Conditions and Opportunities for Enhancement report (Esseltine, 2003). These reports provide a number of recommendations that could be considered by the Pike Lake community and for inclusion in the *Pike Lake Stewardship Plan*.

Research is needed to determine if the trends listed below are still applicable and if adaptive management approaches have mitigated some of the water level manipulation problems. An updated snapshot of the health and composition of the lake's fish populations using relevant protocols and working in partnership with local agencies and organizations is required to ensure better understanding of current populations and that efforts are in place to continue to monitor the status of the Pike Lake fishery on a regular basis.

9.3.1. Water Level Manipulation

The water levels on the lake are artificially controlled by a dam at the lake's outlet (Grants Creek). Manipulation of water levels may be impacting fish populations during critical life stages. For example, higher water levels can result in back flooding of important northern pike spawning areas with deeper, colder water during the spring incubation and nursery period. Changing water levels may also negatively affect walleye, bass, and sunfish spawning habitat.

The dam is a barrier to fish that might migrate from Grants Creek into Pike Lake. The dam also likely restricts movement of fish from Pike Lake into Grants Creek, potentially isolating fish populations from areas of suitable habitat for spawning or nursery. Typically when water control structures are evaluated today measures are incorporated into the design to mitigate and provide migration that has been historically altered by past dam installations.

In 2008, the MNR reviewed the Pike Lake water level operations. Current research has shown that fish populations are adaptive to fluctuations in water levels as long as changes occur before the spawning period. Based on the water level data and operations at the Pike Lake Dam, it is likely that fish

populations, specifically pike and walleye, are not being negatively affected at this time. For more information about water level issues on Pike Lake, refer to Section 8 Water Levels.

9.3.2. Shoreline Development and Habitat Alteration

Alterations to the shoreline and the littoral zone from land use practices such as agriculture as well as residential and commercial development, use of fertilizers, poorly maintained septic systems, removal of shoreline vegetation, dredging, filling, development of beaches, and construction of boathouses can damage or remove critical fish habitat.

These types of projects around the water's edge can make soil unstable and vulnerable to erosion from rain, wind, or wave action. Sediments in water body can make prey less visible, damage fish gills reducing the ability for fish to consume oxygen, fill important areas needed for benthic productivity (i.e. habitat for benthic invertebrates and aquatic vegetation), and smother spawning and nursery areas, killing fish eggs and young fish. The quality of fish habitat may become unsuitable and a shift in the fish community structure could result on the lake.

Shoreline rehabilitation projects have not been initiated by the lake community to date but could be initiated at many sites around the lake.

9.3.3. Walleye Spawning Bed Enhancement

To date, no fisheries enhancement or protection projects (nutrient reduction projects, spawning shoal surveys, shoreline rehabilitation) have been conducted on the lake. The walleye spawning shoal surveys should be conducted to identify spawning sites and to confirm areas in need of enhancement and protection on Crosby, Little Crosby, and Pike Lakes.

9.3.4. Legal Overharvest

According to Kerr 1998, both walleye and northern pike were overharvested in the past, although data suggested these populations were recovering. Fish regulations such as fish sanctuaries, catch limits, seasons, or other protective management approaches are used by the MNR to sustain fisheries resources and protect against overexploitation. The Pike Lake watershed falls within the MNR's Fisheries Management Zone 18. These zones are based on ecological factors and angler use patterns (climate zones, watersheds, fishing pressures, accessibility). According to the 2008-2009 Zone 18 Fishing Regulations Summary, Pike Lake has a catch size limit on walleye (no walleye kept between 35-50 cm (13.8 – 19.7 in). This regulation also specifies open fishing seasons. Walleye are open January 1st to March 1st, the 2nd Saturday in May to December 31st. Pike are open January 1st to March 31st, the 2nd Saturday in May to December 31st. Catch limits for walleye for Sport Fish Licence holders is four fish. Catch limits for pike is six fish for Sport Fish Licence holders. For more information about seasons and catch limits for other fish species found on Pike Lake, refer to Zone 18 Recreational Fishing Regulations document http://www.mnr.gov.on.ca/MNR_E001337.pdf.

9.3.5. Stocking

Some residents feel the lake should be stocked with sports fish to improve the quality of recreational fishing on the lake. However, the sport fish populations appear to be naturally reproducing and sustaining, and therefore the lake is currently not stocked with sport fish.

9.3.6. Water Quality Deterioration

Late summer oxygen deficiencies in the lower depths of the lake, or **hypolimnion**, may impact fish distribution and production. Practices that decrease nutrient and sediment loading would improve the water quality on the lake (i.e. not mowing to the waters edge, maintaining a vegetated shoreline buffer, properly maintaining septic systems) and help to increase dissolved oxygen levels in the lake.

9.3.7. Climate Change

Since small changes in water temperatures translate into big impacts in water ecosystems, fish populations are excellent indicators of big-picture trends. Recently, an extensive study funded by Natural Resources Canada, and Mississippi Valley Conservation, through Queen's University was undertaken to find out what effect climate change has had or will have on the region's aquatic systems. Scientists reviewed comprehensive water temperature records for the St. Lawrence River, the Great Lakes Basin, the Bay of Quinte, and eastern Ontario's Mississippi Valley watershed to analyze temperature changes over the last 20 to 40 years. Using this data, they examined the effects on fish populations and made projections the changes these effects may have for the next 100 years.

Several key findings have emerged:

- water temperatures have changed significantly in the last 20 years and there has been a significant shift in fish communities;
- warm-water fish populations have increased by 60% in the last 20 years, while cold-water populations have decreased by the same amount;
- while the rise in the average water temperature has not been great — 1.5°C in the last 30 years — this change has produced a 3 to 4-fold increase in warm-water fish populations;
- detailed modeling suggests that lake water temperatures in the study are will rise 4.5°C within the next 100 years; and
- these transformations are the result of a number of climate change factors, including:
    - warmer seasons: Cold-water fish populations are decreasing since optimal spawning conditions require cold autumns and winters; temperatures during these seasons have been increasing;
    - less spring water flow: Spring freshets — the rapid melting of snow — will be 28% lower and 6 to 7 weeks earlier in the years between 2070 and 2099. Since the reproduction of some cool-water species closely depends upon the strength of freshets, these changes together with the

corresponding reduction in wetland flooding mean that important walleye and northern pike populations will decrease.

In addition to collecting data, the study surveyed anglers to see what changes they have noticed in the last two decades. Results from these surveys have reflected what the science is showing. Anglers have noticed the change in fish populations and many have changed their angling efforts towards warm water species.

The "Water Resources, Fish and Fisheries: Sensitivities, Impacts, and Adaptation to a Changing Climate" study was funded by Natural Resources Canada (NRCan) and Mississippi Valley Conservation through Queens University. The final report "*From Impacts Towards Adaptation: Mississippi Watershed in a Changing Climate"* is available on the Mississippi Valley Conservation website at: http://www.mvc.on.ca/program/ccreport2009.pdf.

9.4. Who Regulates the Fishery Resources and Fish Habitat?

Pike Lake is situated in the MNR's Fisheries Management Zone 18. This management zone has a series of regulations governing open seasons, daily catch, possession limits and size regulations. For more information about the Recreational Fishing Regulations Summary for Pike Lake, refer to http://www.mnr.gov.on.ca/198808.pdf

Any project that involves work in or around the lake requires a fisheries review by the RVCA under Section 35 of the federal *Fisheries Act*. This review involves identifying potential impacts to fish habitat. The goal is to ensure all proposals in and around water avoid a HADD (the Harmful Alteration, Disruption, or Destruction of fish habitat). Section 35 of the federal *Fisheries Act* states:

"No person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat." If an application is made and the project has the potential to result in HADD, mitigation measures to avoid impacting fish habitat will be given to the applying proponent. Advice will be given to the proponent on how to redesign, relocate, or mitigate the project, so that HADD can be avoided. If the project cannot be redesigned or mitigation measures cannot avoid a HADD, the application will be referred to Fisheries and Oceans Canada for review.

The Ministry of Natural Resources administers the *Endangered Species Act*, *Fish and Wildlife Conservation Act*, *Lakes and Rivers Improvement Act* and the *Public Lands Act,* which all govern what can and cannot be done to fish and wildlife and their habitat within the watershed. Permits may be required from the MNR for work around water in addition to permits from RVCA and application review under the Federal *Fisheries Act.*

The majority of the information used for the Fisheries Health section came from the 1998 MNR Pike Lake Fishery Report (Kerr) and the 2003 Fish Habitat of the Tay River Watershed: Existing Conditions and Opportunities for Enhancement report (Esseltine). Thanks to Jackie Oblack, Mississippi Conservation for the Climate Change information included in this section.

Next Steps

The *Report on the State of Pike Lake and its Watershed* is a milestone in the Pike Lake stewardship planning process. Information about the Pike Lake community's concerns and issues facing the health of Pike Lake have been compiled in this report. This information has helped to identify the current state of Pike Lake, and outlined the gaps in the information and data specific to Pike Lake.

Property owners, cottagers, business owners, and day-users of Pike Lake, as well as our community partners are invited to review this draft report to provide comment. In the interim, the Pike Lake Planning Steering Committee will be calling on the Pike Lake community to begin developing specific, measurable, and achievable stewardship actions and land use recommendations to address each of the identified issues of concern. These actions and recommendations to protect the long-term health of the lake will be compiled into the *Pike Lake Stewardship Plan*.

The Pike Lake Community Association will be holding meetings and workshops, and carrying out door-to-door efforts throughout the summer of 2009 to ensure everyone with an interest in the lake continues to have the opportunity to participate in our lake stewardship planning process. The involvement of all community members is important to ensure continued support for the plan and its implementation. For more information about the lake stewardship planning process, or to provide feedback on the Report on the State of Pike Lake and its Watershed, contact the Pike Lake Planning Steering Committee at bart.poulter@sympatico.ca., or www.pikelake.ca.

Glossary of Terms

Anoxic: without oxygen.

Anthropogenic: caused by human activity.

Attenuation capacity: the capacity of an area to diminish contaminant concentrations due to filtration, biodegradation, dilution, or other processes.

Aquifer: an underground layer of permeable rock, gravel, sand, silt, or clay containing large amounts of water from which groundwater can be extracted using a well.

Bedrock Aquifer, Fractured: an aquifer composed of solid rock, but where most water flows through cracks and fractures in the rock instead of through pore spaces. Flow through fractured rock is typically relatively fast.

Benthic invertebrates: animals without backbones that live in stream and lake bottom habitats. Their diversity and abundance are indicators of water quality.

Biodiversity: the variety and variability among living organisms and the ecosystems in which they occur. Biodiversity can be divided into three hierarchical categories -- genes, species, and ecosystems -- that describe quite different aspects of living systems and that scientists measure in different ways.

Canadian Shield: an area of granite rock dating to the Precambrian Era with thin-soil cover found in eastern and central Canada and adjacent portions of the United States.

Carrying capacity: the level of shoreline development that can be sustained before the water quality, health, and character of a lake is degraded.

Casual creel surveys: fishing activity surveys where information is collected during unscheduled MNR enforcement patrols.

Catch-per-Unit- Effort: an estimate of fish population that is calculated by dividing the number of fish caught by amount of index netting effort.

Discharge: the flow of water in a stream, or from a spring, ditch, or flowing artesian well.

Downgradient: the direction that groundwater flows (similar to "downstream' for surface water flows.)

Endangered Species: a wildlife species that is facing imminent extirpation or extinction (see below).

Eutrophic: a condition of lakes typically with low water clarity, high nutrient levels, low oxygen levels, and warm water fish species. Eutrophic lakes are subject to excessive aquatic vegetation growth (algae blooms and weedy) resulting in poor water quality.

Extinct Species: a wildlife species that no longer exists.

Extirpated Species: a wildlife species that no longer exists in an area, but exists elsewhere.

Family Biotic Index (Hilsenhoff Index): an index that identifies the potential degree of organic pollution in a body of water through analyses of the species and numbers of benthic invertebrates present.

Fecal coliform bacteria: a group of bacteria that aid in the digestion of food and are passed through the fecal excrement of humans, livestock, and wildlife. *E. coli* are a subgroup of these bacteria.

Formation: a layer of bedrock or sediment that consists primarily of a certain type (or combination of types) of geological material.

Groundwater: water that flows or seeps downward and saturates soil or rock, supplying springs and wells. The upper layer of the saturate zone is called the water table.

Glacial Till: un-stratified glacial drift deposited directly by the ice and consisting of clay, sand, gravel, and boulders intermingled in any proportion.

Hypolimnion: the bottom and most dense layer of water in a thermally-stratified lake. It is the layer that lies below the thermocline. Typically, it is non-circulatory and remains cold throughout the year.

Intensive creel survey: fishing activity counts and angler interviews carried out by MNR staff based on a random interviewing schedule over a predetermined survey period.

Leachate: moisture and water that filters through the waste in a landfill site, picking up metals, minerals, organic chemicals, bacteria, viruses, and other toxic materials. This contaminated water, if not contained, can travel from a landfill site and contaminate local ground and surface water.

Littoral zone: the shallow transition zone between dry land and the open water area of the lake where sunlight penetrates all the way to the sediment. The shallow water, abundant light, and nutrient-rich sediment in this area provides ideal conditions for the growth of aquatic plants which in turn provide food and habitat for many animals such as frogs, birds, muskrats, turtles, minnows, fish, insects, and snails.

Mesotrophic: a term applied to clear water lakes and ponds with beds of submerged aquatic plants and medium levels of nutrients. These lakes are also of intermediate clarity, depth, and temperature.

Oligotrophic: waters with relatively low nutrients levels which cannot support a large amount of plant life.

Organic soils: soil which contains a high percentage of organic matter.

Potential Yield: an estimate of the theoretical amount of fish which can be harvested annually on a sustained basis from an unstressed population.

Provincial Water Quality Objectives (PWQO): chemical and physical indicators representing a level of water quality, which is protective of all forms of aquatic life and all aspects of aquatic life cycles.

Species at Risk: any native plant or animal that is at risk of disappearing or extinction from the province.

Special Concern: a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.

Species diversity: the number of different species and abundance of different types of organisms which inhabit an area.

Spring freshet: flooding from snow pack and ice melt resulting from the spring thaw.

Staging area: an area where a wildlife species rests during migration.

Succession: the gradual process of replacement of vegetation and wildlife communities with time. Once an area is matured, an event like fire or flood starts the process over again.

Surface Rights: "every right in land other than mining and mineral rights."

Temperate climate: climates without extremes of temperatures and precipitation

Threatened Species: a wildlife species likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.

Veligers: a mobile, juvenile form of the invasive zebra mussel.

Watershed: an area of land, including forests, wetlands, etc. from which surface runoff, including water, sediments, nutrients, and contaminants, drains into a common water body such as a lake, river, stream, or creek.

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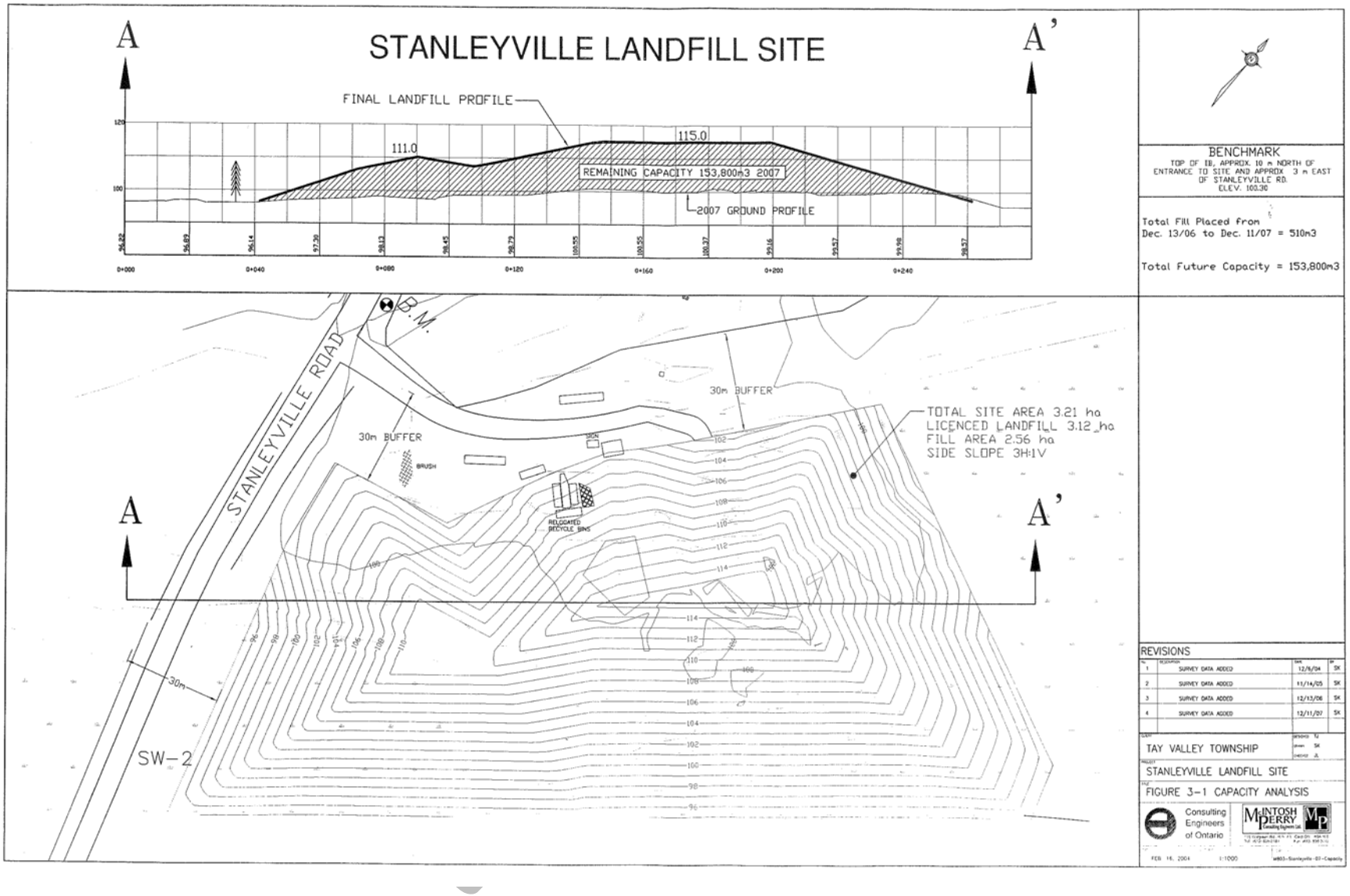
Acronyms

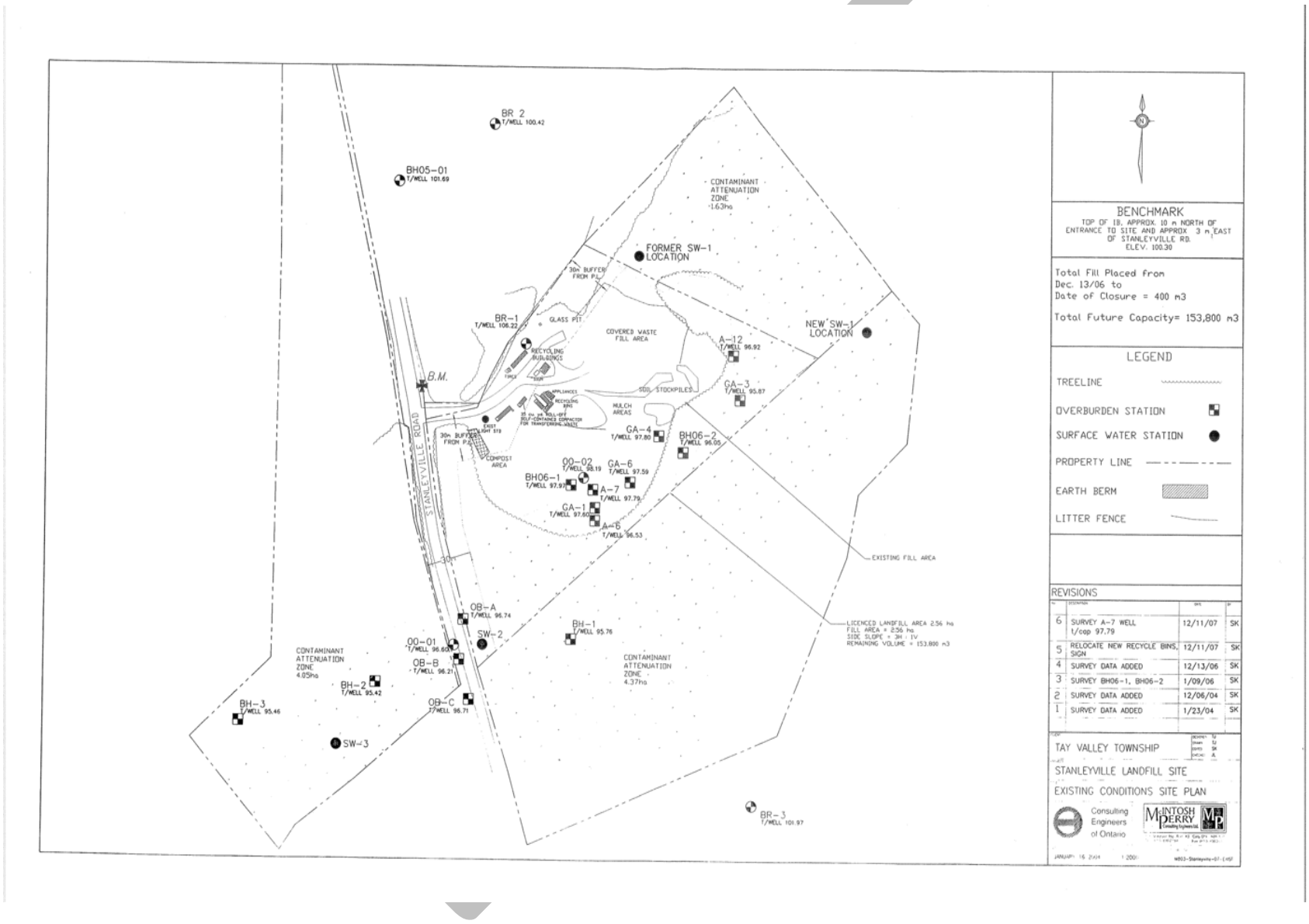
CMAG	Citizens Mining Advisory Group
DFO	Department of Fisheries and Oceans
DOC	Dissolved Organic Carbon
FC	Fecal Coliform
E.Coli	*Escherichia coliform*
LMPP	Lake Management Planning Program
LSP	Lake Stewardship Plan
MOE	Ministry of the Environment
MNDM	Ministry of Northern Development and Mines
MMAH	Ministry of Municipal Affairs and Housing
MNR	Ministry of Natural Resources
NRCan	Natural Resources Canada
OBC	Ontario Building Code
OFAH	Ontario Federation of Anglers and Hunters
OPP	Ontario Provincial Police
PLPSC	Pike Lake Planning Steering Committee
PLCO	Pike Lake Community Association
PWQO	Provincial Water Quality Objective
REAL	Rideau Environmental Action League
RVCA	Rideau Valley Conservation Authority
TKN	Total Kjeldahl Nitrogen
TP	Total Phosphorus
TRL	Township of Rideau Lakes

Appendices

Appendix 1: The Stanleyville Waste Disposal Site Profile and Capacity Analysis



Appendix 2: The Stanleyville Waste Disposal Site Existing Conditions and Sampling Stations



Appendix 3: Surface and Groundwater Parameters Measured at the Stanleyville Waste Disposal Site

Table 1: Surface Water Parameters Measured at the Stanleyville Waste Disposal Site			
Alkalinity	Conductivity	Molybdenum	Thallium
Aluminum	Copper	Nickel	Tin
Antimony	Chloride	Nitrate	Titanium
Arsenic	Chromium	Nitrite	Total kjeldahl nitrogen
Barium	Hardness	pH	Total phosphorous
Beryllium	Ion balance	Phenols	Total suspended solids
Boron	Iron	Potassium	Tungsten
Cadmium	Lead	Selenium	Un-ionized ammonia
Calcium	Manganese	Silver	Uranium
Cobalt	Magnesium	Sodium	Vanadium
		Sulphate	Zinc

Table 2: Summary of 2007 Surface Water Sample Parameters that Exceeded Provincial Water Quality Objectives			
Parameter	**Provincial Water Quality Objective (mg/L)**	**Monitoring Wells Exceeding PWQO**	
		May	**October**
Iron	0.3	SW-1 (4.6)	SW-2 (0.52)
Phenols	0.001	SW-1 (0.016)	SW-2 (0.014)
		SW-2 (0.008)	
Total Phosphorus	0.03	No exceedance	SW-2 (0.06)
Aluminum	0.075	SW-1 (1.5)	No exceedance

Notes: SW-2 is surface water compliant station. Total phosphorous – Recognized Elevated Concentrations of TP are naturally occurring

Table 3: Surface Water Parameters Measured at the Stanleyville Waste Disposal Site			
Alkalinity	Cobalt	Magnesium	Sodium
Aluminum	Conductivity	Molybdenum	Sulphate
Ammonia	Copper	Mercury	Thallium
Antimony	Chloride	Nickel	Tin
Arsenic	Chromium	Nitrate	Total kjeldahl nitrogen
Barium	Hardness	Nitrite	Total phosphorous
Beryllium	Ion balance	pH	Total suspended solids
Boron	Iron	Potassium	Vanadium
Cadmium	Lead	Selenium	Zinc
Calcium	Manganese	Silver	

Table 4: Summary of 2007 Groundwater Sample Parameters that Exceeded the Ontario Drinking Water Quality Standards

Parameter	ODWQS (mg/L)	Monitoring Wells Exceeding ODWQS	
		May 2007	October 2007
Iron	0.3	GA-1, BH-2, BR-3, BH06-2	GA-1, BH-2, BH06-1, BH06-2
Manganese	0.05	GA-1, BH-1, BH-2, BH06-1, BH06-2, BR-3	No exceedance
Sulphate	500	BH-1, BR-3	BH-1
Lead	0.01	BH06-1	No exceedance
Antimony	0.006	BH-2	No exceedance
Alkalinity	500	GA-1, BH06-1, BH06-2	BH06-1, BH06-2
Total Dissolved Solids	500	GA-1, BH06-1, BH06-2, BR-3	GA-1, BH06-1, BH06-2, BH-1, BH-2, BR-3
Boron	5	BH-1, BH06-2	BH06-2
Sodium	200	No exceedance	BR-2
Hardness	100	GA-1, BH-1, BH06-1, BH06-2, BR-2, BH-2	No exceedance
Conductivity	RUC	BR-3	No exceedance

Appendix 4: Pike Lake Drinking Water Sources Information Survey (Conducted by Dale Poulter 2008)

Survey Responses (51) No answers (18)

There is a huge lack of information concerning sources of drinking water at Pike Lake.
Please take a minute to complete this brief questionnaire concerning drinking water used at Pike Lake. There are 2 questions. The information will be summarized in the Pike Lake State of the Lake Report.

1. What do you use for drinking water at Pike Lake?

____ well water
_____bottled water from elsewhere
_____lake water filtered
_____Other (If there is something else)

2) If you have a well:

a) What type of well do you have? (Please Circle)

Drilled well
Dug well

b) If you have a drilled well, is the well cap above ground or below ground? _____
c) How often do you test your water? (Please Circle) Every month Every year Every 3 yrs Never
d) How often has there been evidence of E. Coli or coliform? (Please circle) Never Once A few times Often
e) Has your well ever run dry? _ Yes _ No

DID YOU KNOW…? The Rideau Valley Rural Clean Water Program (RVRCWP) provides financial and technical assistance to farmers and rural landowners to decommission upgrade or replace wells? Cost-share grants are available up to $2,000 (PST and GST are not included for payment). Check out http://www.rideauvalley.on.ca/programs/rcwp/rvca_rcwp.html or call the LandOwner Resource Centre (613-692-3571 or 1-800-267-3504) for more information.

Thank you for your reply. The results will add to our State of the Lake Report
Sincerely, Mrs. Dale Poulter

Appendix 5: Agencies to Contact Prior to Starting Projects in and around the Lake

Governing Bodies for Specific Shoreline Development Activity							
Project Type	**RVCA**	**Lanark County**	**TVT or RLT**	**MOE**	**MNR**	**DFO**	**MMA**
Planning Applications/ Minor Variance Site Plan Zoning	√		√				
Septic Permit Approval			√				
Severance	√	√	√				
Subdivision Approval		√		√			
Shoreline Stabilization	√				√		
Dock	√				√	√	
Boathouse	√		√		√	√	
Aquatic Plant Harvest	√				√	√	
Dredging	√				√	√	
Floating Raft / Mooring Buoy	√					√	
Spills and Water Contamination				√			
Official Plan Amendments							√

Appendix 6: Applicable Act and Regulations for Regulatory Agencies

Agency	Acts	Material Covered Under Acts
Rideau Valley Conservation Authority	• Conservation Authorities Act, 1990	• Regulates development in proximity to floodplains, wetlands and watercourses. Acts as a screening agent for the Department of Fisheries and Oceans. Ensures setbacks are respected, habitat is preserved, any shoreline work is done properly and that no new development takes place in the floodplain.
Ministry of Natural Resources	• Public Lands Act, 1990 • Fish and Wildlife Conservation Act, 1997	• Grants Ministry authority to make regulations, as well as land classification powers. Regulations are extensive and cover work permits, road development, acceptable work taking place on public lands, land occupation and land acquisition. • Protects fish and wildlife from illegal consumption, as well as preserving and furthering habitat.
Municipality	• Planning Act, 1990	• Approval authority for development.
Department of Fisheries and Oceans	• Fisheries Act, 1985	• Orderly management of commercial and recreational fisheries in Canadian fishery waters, the protection of fish habitat.
Ministry of the Environment	• Environmental Protection Act, 1990 • Nutrient Management Act, 2002 • Ontario Water Resources Act, 1990 • Environmental Assessment Act,	• Broad act providing for the protection and conservation of the natural environment. • Regulates preservation and management of nutrients during development. • Promotes sustainable and efficient use of Ontario water to

	1992 • Safe Drinking Water Act, 2002 • Clean Water Act, 2005	ensure future health. • Ensures that projects are carefully considered before federal authorities take action in connection with them, in order to ensure that such projects do not cause significant adverse environmental effects • Provides for the protection of human health and the prevention of drinking water health hazards through the regulation of drinking water systems and drinking water testing • Protects future and present municipal residential drinking water sources, as well as implementing measures for significant risks.
Environment Canada	• Canadian Environmental Protection Act, 1999 • Migratory Birds Convention Act, 1994 • Canada Wildlife Act, 1985	• Focuses on controlling waste, pollution and toxic substances that are products of development to minimize adverse effects on the environment. • Protecting and conserving migratory birds and their nests. • Protects wildlife from illegal consumption, with strict legal penalties as consequence.
Ministry of Northern Development and Mines	• Ontario Mining Act, 1990	• Regulates the development of mineral resources and to minimize the impact of these activities on the environment through rehabilitation of Ontario mining lands.

Appendix 7: Specific Sections of the *Building Code Act*, relevant to Septic Systems and their inspection

***Building Code Act* S. 8.9.1.2. General Requirements for Operation and Maintenance**

(1) Every *sewage system* shall be operated and maintained so that,

(a) the *sewage system* or any part of it shall not emit, discharge or deposit *sanitary sewage* or *effluent* onto the surface of the ground,

(b) *sanitary sewage* or *effluent* shall not emit, discharge, seep, leak or otherwise escape from the *sewage system* or any part of it other than from a place or part of the *sewage system* where the system is designed or intended to discharge the *sanitary sewage* or *effluent* , and

(c) except as provided in Sentence (2), *sanitary sewage* or *effluent* shall not emit, discharge, seep, leak or otherwise escape from the *sewage system* or any part of it into a piped water supply, well water supply, a watercourse, *ground water* or *surface water* .

(2) Clause (1)(c) does not apply to the use of a *sewage system* designed and operated such that properly treated *effluent* is discharged into *soil*.

***Building Code Act* Section 15.9: Inspection of Unsafe Buildings**

(1) An inspector may enter upon land and into buildings at any reasonable time without a warrant for the purpose of inspecting a building to determine, whether the building is unsafe; or whether an order made under subsection (4) has been complied with. 2002, c. 9, s. 26.

Interpretation

(2) A building is unsafe if the building is, structurally inadequate or faulty for the purpose for which it is used; or in a condition that could be hazardous to the health or safety of persons in the normal use of the building, persons outside the building or persons whose access to the building has not been reasonably prevented. 2002, c. 9, s. 26.

Sewage systems

(3) In addition to the criteria set out in subsection (2), a sewage system is unsafe if it is not maintained or operated in accordance with this Act and the building code. 2002, c. 9, s. 26.

(4) An inspector who finds that a building is unsafe may make an order setting out the reasons why the building is unsafe and the remedial steps necessary to render the building safe and may require the order to be carried out within the time specified in the order. 2002, c. 9, s. 26.

Appendix 8: Natural Heritage Information System – Natural Area Report - CROSBY LAKE CREEK COMPLEX- WETLAND

Area Id: 8324 **Area Type:** WET

Alias(es):

Size (ha): 393.0 **Significance Level:** Provincial

Site District:	Counties:	Topographic Maps:
	LEEDS & GRENVILLE	31C/9

UTM Centroid: 18 384200 4953500

Decimal Latitude/Longitude: 44.7275322804793 -76.4620011236751

Description: A Provincially significant wetland complex, made up of seven individual wetlands, composed of three wetland types (10% bog, 61% swamp and 29% marsh) (McIntyre and Mills, 1985).

Vegetation: Vegetation Communities (McIntyre and Mills, 1985): One form M3: narrow-leaved emergents- sedges, grasses; Two forms M1: narrow-leaved emergents- sedges, grasses; willow; W1: floating plants- water shield, lily; milfoil; M4: robust emergents- cattails; sedges, grasses; S4: low shrubs- spirea, Sweet Gale; swamp loosestrife; Three forms M2: robust emergents- cattails; ferns; sedges, grasses; B2: low shrubs- Leatherleaf; sedges; Sphagnum sp.; S2: tall shrubs- willow; spirea; grass; S3: tall shrubs- alder, willow; grass; broad-leaved emergents; Four forms S9: dead deciduous trees; willow; grass; submergents; B3: narrow-leaved emergents- sedges; Leatherleaf; Water Arum; Sphagnum sp.; B4: narrow-leaved emergents- sedges; Leatherleaf; alder; Sphagnum sp.; S6: dead deciduous trees; lily; duckweed; coontail; S8: deciduous trees- Red Maple; saplings; grass; ferns; Five forms M5: narrow-leaved emergents- grass; cattail; ferns; duckweed; submergents; S1: dead deciduous trees; willow; grass; duckweed; spirea; S5: dead deciduous trees; spirea; loosestrife; duckweed; coontail; S7: dead deciduous trees; grass; ferns; duckweed; submergents; B1: tall shrubs- alder; sedges; Water Arum; ferns; Sphagnum sp.;

Landform: Soils (McIntyre and Mills, 1985): 20% clays, loams or silts, and 80% organic; Site Type (McIntyre and Mills, 1985): 86% palustrine (permanent or intermittent outflow), 10% riverine, and 4% lacustrine (at rivermouth);

Representation:

Management Agency:

Minimum Elevation: **Maximum Elevation:**

References

Id	Citation
33889	McIntyre, P., and M. Mills. 1985. Wetland Data Record and Evaluation- Crosby Lake Creek Complex. Second Edition. June 18, 20 & 25, 1985. Ontario Ministry of Natural Resources. Manuscript. 22 pp + 2 maps + 12 pp supplement.

Appendix 9: Species at Risk found in the Kemptville MNR district. (SC= Special Concern, THR= Threatened, NAR= Not at Risk, END= Endangered)

Common Name	Scientific Name	MNR	COSEWIC
VASCULAR PLANTS			
Butternut	Juglans cinerea	END	END
American Ginseng	Panax quinquefolius	END	END
Eastern Prairie Fringed-orchid	Platanthera leucophaea	END	END
Blunt-lobed Woodsia	Woodsia obtusa	END	THR
Deerberry	Vaccinium stamineum	THR	THR
Broad Beech Fern	Phegopteris hexagonoptera	SC	SC
Ogden's Pondweed	Potamogeton ogdenii	END	END
MOSSES and LICHENS			
Flooded Jellyskin	Leptogium rivulare	THR	THR
REPTILES			
Spotted Turtle	Clemmys guttata	END	END
Wood Turtle	Glyptemys insculpta	END	SC
Spiny Softshell	Apalone spinifera	THR	THR
Eastern Ratsnake	Elaphe obsoleta	THR	END
Blanding's Turtle	Emydoidea blandingii	THR	THR
Stinkpot	Sternotherus odoratus	THR	THR
Northern Map Turtle	Graptemys geographica	SC	SC
Milksnake	Lampropeltis triangulum	SC	SC
Five-lined Skink	Eumeces fasciatus	SC	SC
Eastern Ribbonsnake	Thamnophis sauritus	SC	SC
BIRDS **(data is not recorded for fall or spring migrants)**			
Piping Plover	Charadrius melodus	END	END
Henslow's Sparrow	Ammodramus henslowii	END	END
King Rail	Rallus elegans	END	END
Loggerhead Shrike	Lanius ludovicianus	END	END
Bald Eagle	Haliaeetus leucocephalus	END	NAR
Least Bittern	Ixobrychus exilis	THR	THR
Peregrine Falcon	Falco peregrinus	THR	SC
Red-headed Woodpecker	Melanerpes erythrocephalus	SC	THR
Golden-winged Warbler	Vermivora chrysoptera	SC	THR
Short-eared Owl	Asio flammeus	SC	SC
Yellow Rail	Coturnicops noveboracensis	SC	SC

Cerulean Warbler	Dendroica cerulea	SC	SC
Louisiana Waterthrush	Seiurus motacilla	SC	SC
Black Tern	Chlidonias niger	SC	NAR
MAMMALS			
Eastern Cougar	Puma concolor	END	DD
Common Gray Fox	Urocyon cinereoargenteus	THR	THR
Eastern Canadian Wolf	Canis lycaon	SC	SC
Southern Flying Squirrel	Glaucomys volans	NAR	NAR
FISHES			
Pugnose Shiner	Notropis anogenus	END	END
American Eel	Anguilla rostrata	END	SC
Channel Darter	Percina copelandi	THR	THR
Cutlip Minnow	Exoglossum maxillingua	THR	NAR
Northern Brook Lamprey	Ichthyomyzon fossor	SC	SC
River Redhorse	Moxostoma carinatum	SC	SC
Lake Sturgeon	Acipenser fulvescens	SC	END
Grass Pickerel	Esox americanus	SC	SC
Bridle Shiner	Notropis bifrenatus	SC	SC
Eastern Silvery Minnow	Hybognathus regius	NAR	NAR
Brindled Madtom	Noturus miurus	NAR	NAR
INSECTS			
Monarch	Danaus plexippus	SC	SC
West Virginia White	Pieris virginiensis	SC	--

Appendix 10: Mining Information – How to find Mineral Rights/Mining Claims on your Property

(CMAG) lobbies for changes to the Ontario *Mining Act* to give landowners greater protection against claim staking. Pike Lake property owners with Internet access can look at the Mining Claims map at www.claimaps.mndm.gov.on.ca and search by Municipality. Here is how to proceed:

1. go to the above site, & see Mines & Minerals page; click on "map search"
2. click "yes" for disclaimer; map then loads
3. select "search by township"
4. enter "Burgess" it won't recognize Tay Valley
5. click on "go" & wait for map to load (slow)
6. use zoom tool, upper left corner, to get down to Farren Lake (about 3 or 4 clicks)
7. look for full black dots in various concessions.

Any lots with a *full black dot* are NOT open to claims, as the mineral rights are already owned. However, as to who owns these mineral rights, this must be researched at the land registry office in Almonte, if your deed is unclear on the matter.

Any mining activity on the lake could pose a serious threat to water quality, so it would be helpful, once you find out, to inform the association on the ownership of mineral rights on your property: whether they belong to you or a mining company or someone else. This information will help the executive to assess whether a threat exists.

Appendix 11: MNR Rule Curve Targets for Pike Lake Water Levels

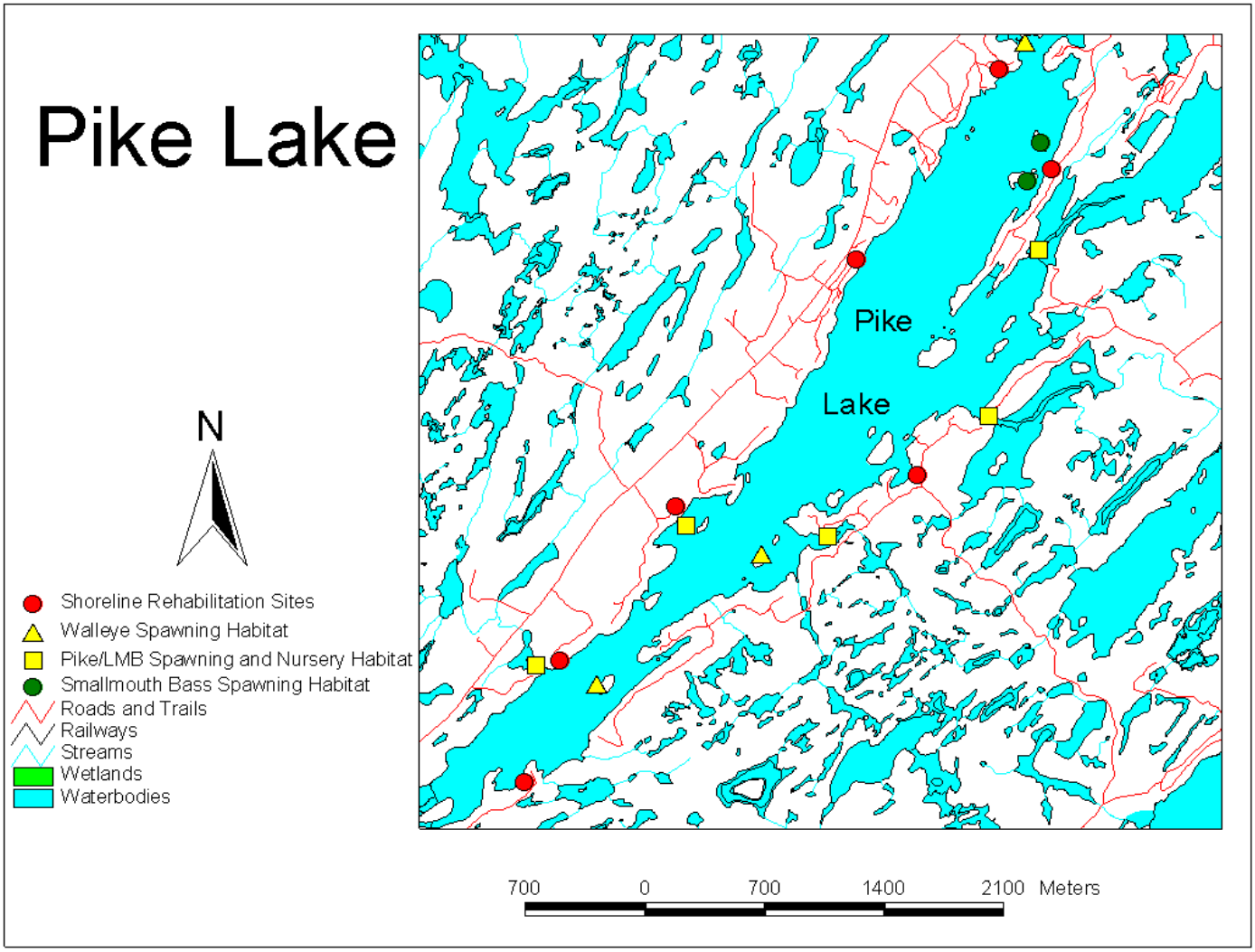
PIKE LAKE RULE CURVE

DATES	TARGET LEVEL	
	Feet	**Metres**
January 1 to March 15	2.00	0.61
March 15 to April 15 manage water levels to achieve target	3.20	0.975
April 15 to July 1	3.20	0.975
July 5	3.12	0.95
July 10	3.04	0.93
July 15	2.96	0.90
July 20	2.88	0.88
July 25	2.80	0.85
August 1	2.72	0.83
August 5	2.64	0.80
August 10	2.56	0.78
August 15	2.48	0.76
August 20	2.40	0.73
August 25	2.32	0.71
September 1	2.24	0.68
September 5	2.16	0.66
September 10	2.08	0.63
September 15 – December 31	2.00	0.61

There is a designed opening in the bottom log in sluiceway # 2. This is to allow 0.4 cubic metres/sec (5 cubic feet/sec) of flow all year except when the flow is increased to 0.28 cubic metres/sec (10 cubic feet/sec during the period of July 1st to September 15th. The increased flow is accomplished by removing the plate in the low flow opening. Flooding occurs on lake properties when the lake level exceeds 1.04m (3.4 ft).

Appendix 12: Map Illustrating Rehabilitation and Critical Fish Habitat Sites of Pike Lake

(from Fish Habitat of the Tay River Watershed: Existing Conditions and Opportunities for Enhancement Esseltine 2003)



Appendix 13: Historic Fish Management Activities on Pike Lake (From Kerr 1998)

APPENDIX 3. Fisheries management activities (excluding stocking) on Pike Lake.

Year	Project/Activity	Reference(s)
1959	• partial lake inventory completed.	File data
1960	• partial lake inventory completed.	File data
1962	• winter creel survey conducted.	Gawley (1962)
1968	• public access to Pike Lake purchased by Ontario Department of Lands and Forests.	File data
1969	• winter creel survey conducted.	File data
1970	• lake inventory completed.	File data
	• winter creel survey conducted.	Raine (1970a)
	• summer creel survey conducted.	Raine (1970b)
	• public access point developed.	File data
1971	• winter creel survey conducted.	File data
	• summer creel survey conducted.	Baldwin (1971)
1972	• winter creel survey conducted.	Anonymous (1972)
1973	• winter creel survey conducted.	File data
	• summer creel survey conducted.	Pratt (1973)
1974	• lake inventory updated.	File data
1975	• Ministry of Environment lake assessment.	File data
1976	• summer creel survey conducted.	Bond (1977)
1977	• aerial activity survey completed.	Mulholland and Kehoe (1977)
1978	• winter creel survey and aerial creel survey conducted.	Hamilton (1979)
	• summer aerial survey conducted.	Gopsill and Mulholland (1979)
	• fall aerial survey conducted.	Gopsill (undated)
1979	• spring aerial survey conducted.	Lashley (1979a)
	• summer creel survey conducted.	Lashley (1979b)
1980	• winter water chemical analysis	File data
1981	• summer aerial activity survey conducted.	Macey (1982)
1982	• summer water chemical analysis.	File data
	• PCB analysis of fish samples.	File data
	• index trap netting program initiated.	von Rosen (1985)
	• summer creel survey conducted.	Dolan (1982)
1983	• winter water chemical analysis.	File data
	• winter aerial creel survey conducted.	File data
	• winter creel survey conducted.	Dolan et al. (1983)
	• Ministry of Environment lake assessment.	File data
1985	• summer creel survey conducted.	File data
	• spring and summer water chemical analysis.	File data
1987	• winter creel survey conducted.	Noonan and Witwicky (1987)
1988	• summer water chemical analysis.	File data
	• summer creel survey conducted.	File data
	• bass nesting survey.	File data
1992	• spring index trap netting conducted.	Von Rosen (1985)
1994	• University of Ottawa forage fish study.	File data
	• summer creel survey conducted	File data
1996	• spring index netting conducted.	File data
1997	• summer creel survey conducted.	File data

Maps

Map 1: Pike Lake Watershed Natural Heritage Features

Map 2: Pike Lake Watershed Landcover Features

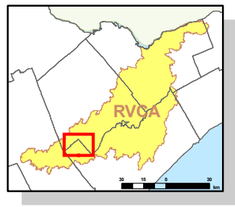
Map 2b: Pike Lake Landcover Features

Map 3: Pike Lake Environmental Monitoring Sites

Map 4: Pike Lake Watershed Structures

Map 5: Surface and Mining Rights

Map 1: Plke Lake Watershed Natural Heritage Features



Legend

- Crown Land
- Municipal Boundary
- Upper Tier Municipality, County
- ANSI
- Deer Yard
- Waterfowl Staging Area
- Conservation Areas

Nesting Sites (verified 1998 - 2004)

- Great Blue Heron
- Osprey

Transportation

- County/Local Road
- Railway

Spawning Areas (verified 1997 - 2002)

- Smallmouth Bass
- Walleye

Water Features

- Permanent Waterbody
- Permanent Wetland
- Pike Lake Watershed
- Intermittent Stream
- Permanent Stream

Evaluated Wetlands

- Other
- Provincial

RIDEAU VALLEY CONSERVATION AUTHORITY

Map Scale: 1:55,000

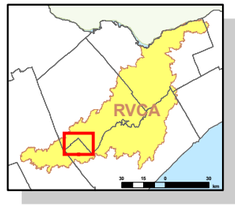
Projection note: U.T.M. Zone 18 - NAD 83 Datum

File Location: Z:\Mapping\MXD\WSSS\MXD\Pike-Lake\PikeLake_NaturalFeatures_11x17_landscape.mxd

Created by: asoutar	
Modified by: asoutar	Date Modified: 6/11/2009 4:18:54 PM
Published by: asoutar	Date Published: 7/23/2009

1 0.5 0 1 2 Kilometers

Map 2: Pike Lake Watershed Landcover Features



Legend

- Intermittent Stream
- Permanent Stream
- Pike Lake Watershed

Transportation

- County/Local Road
- Railway

Provincial Landcover 2000

- Water
- Bedrock
- Forest - sparse
- Forest - dense deciduous
- Forest - dense mixed
- Forest - dense coniferous
- Fen - open
- Bog - treed
- Agriculture - pasture/abandoned fields

RIDEAU VALLEY CONSERVATION AUTHORITY

Map Scale: 1:55,000

Projection note: U.T.M. Zone 18 - NAD 83 Datum

File Location: Z:\Mapping\MXDs\WSED\LM\PIKE-Lake\PikeLake_Landcover_11x17_landscape.mxd

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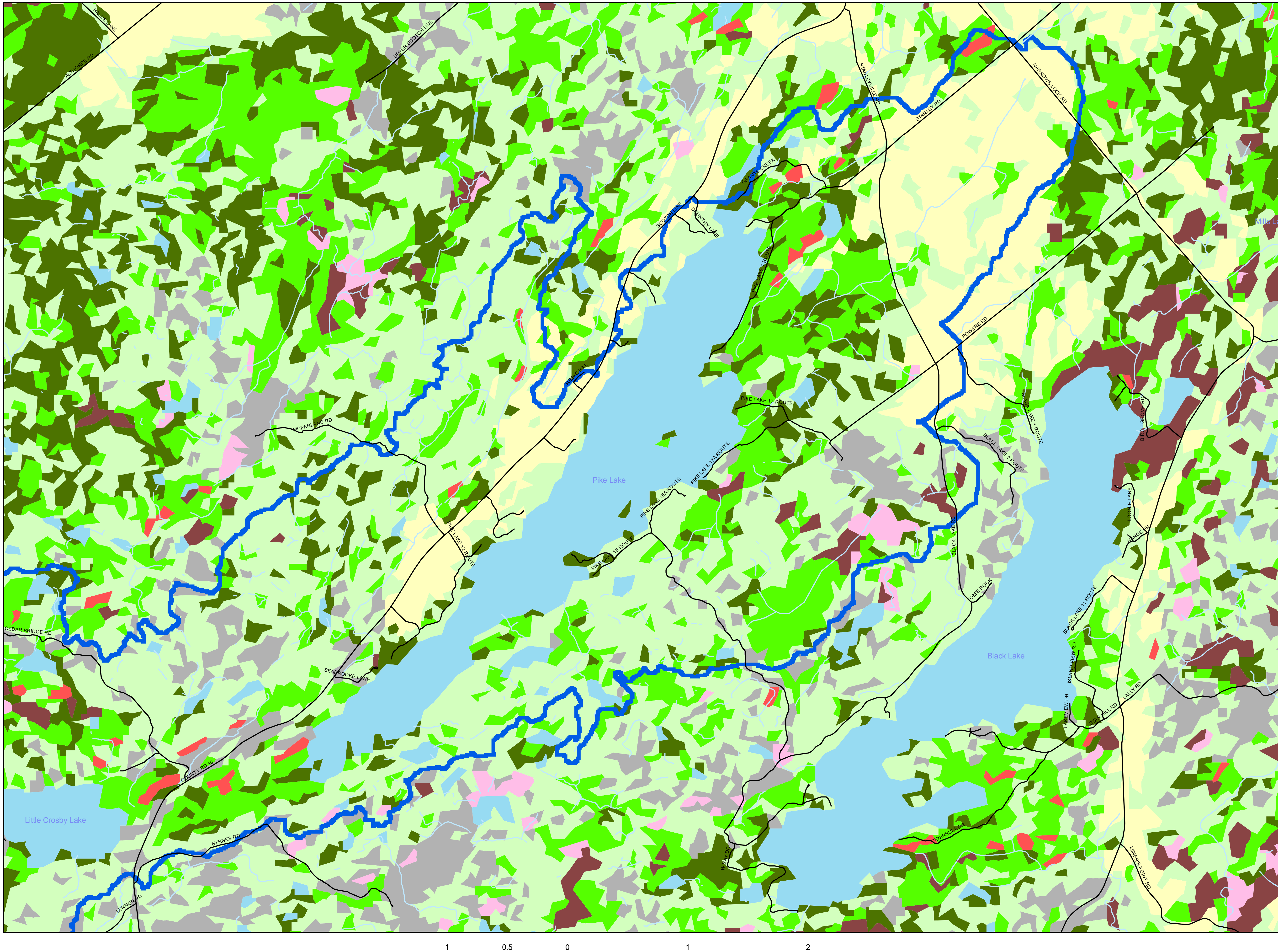
Modified by: asoutar	Date Modified: 6/10/2009 12:02:00 PM
Published by: asoutar	Date Published: 6/11/2009

1 0.5 0 1 2 Kilometers

Map 2b: Pike Lake Watershed Landcover Features



Legend

- Intermittent Stream
- Permanent Stream
- Pike Lake Watershed

Transportation

- County/Local Road
- Railway

Provincial Landcover 2000

- Water
- Bedrock
- Forest - sparse
- Forest - dense deciduous
- Forest - dense mixed
- Forest - dense coniferous
- Fen - open
- Bog - treed
- Agriculture - pasture/abandoned fields

RIDEAU VALLEY CONSERVATION AUTHORITY

Map Scale: 1:30,000

N W E S

Projection note: U.T.M. Zone 18 - NAD 83 Datum

File Location: Z:\Mapping\MXDs\WSES\LMP\Pike Lake\PikeLake_Landcover_11x17_landscape.mxd

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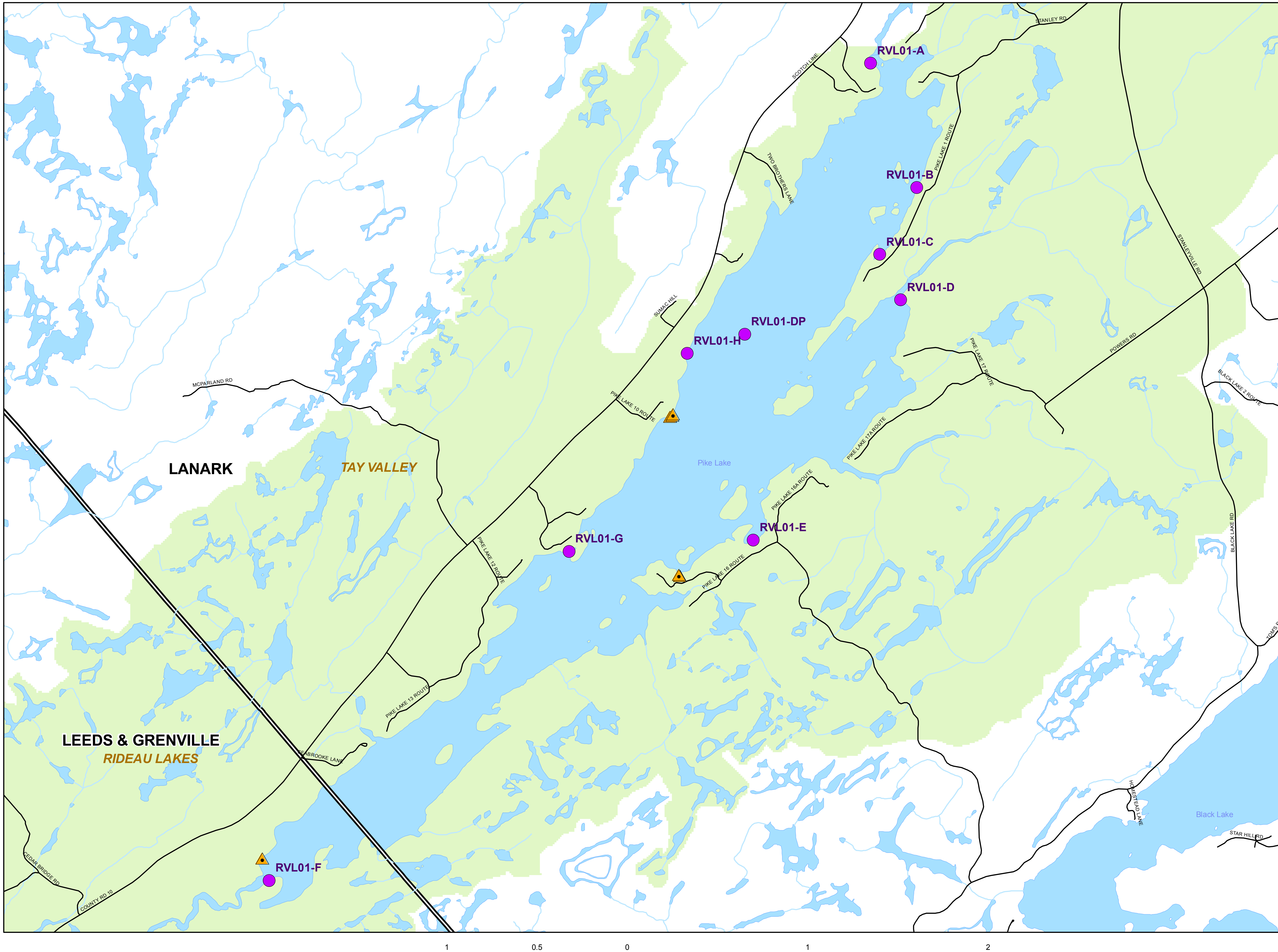
Published by: asoutar	Date Published: 6/11/2009

Map 3: Pike Lake Environmental Monitoring Sites



Legend

- Upper Tier Municipality, County
- Municipal Boundary
- Ontario Benthos Biomonitoring Network
- Pike Lake Watershed

Transportation

- County Road
- Railway

Water Features

- Permanent Waterbody
- Intermittent Stream
- Permanent Stream

RIDEAU VALLEY CONSERVATION AUTHORITY

Map Scale: 1:20,000

Projection note: U.T.M. Zone 18 - NAD 83 Datum

File Location: Z:\Mapping\MXDs\WSES\LMP\Pike Lake\PikeLake_MonitoringSites_11x17_landscape.mxd

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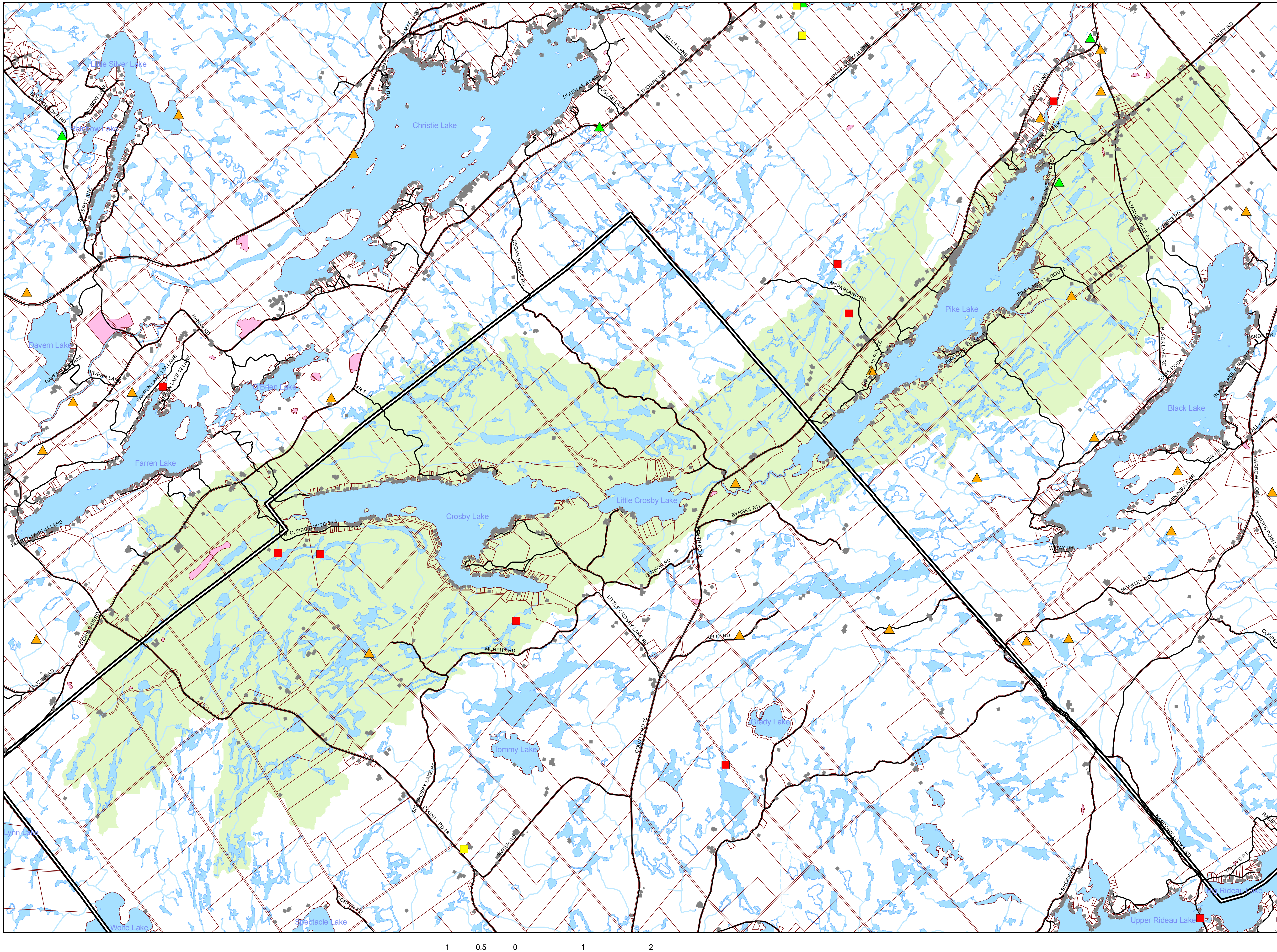
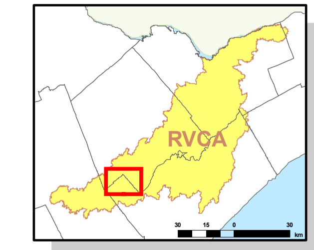
Published by: asoutar	Date Published: 6/11/2009

Map 4: Pike Lake Watershed Structures





Legend

- Dam
- Liquids Depot/Dump
- Buildings - Symbolized
- Buildings - To Scale
- Upper Tier Municipality, County
- Municipal Boundary
- Assessment Parcel

Abandoned Mines/Quarries

- Aggregate Resource Quarry/Pit
- Mine

Pit or Quarry

- Pile
- Pit
- Quarry

Transportation

- County/Local Road
- Railway

Water Features

- Permanent Waterbody
- Pike Lake Watershed
- Intermittent Stream
- Permanent Stream

RIDEAU VALLEY CONSERVATION AUTHORITY

Map Scale: 1:53,241

Projection note: U.T.M. Zone 18 - NAD 83 Datum

File Location: Z:\Mapping\MXDs\WSES\LMP\Pike Lake\PikeLake_Structures_11x17_landscape.mxd

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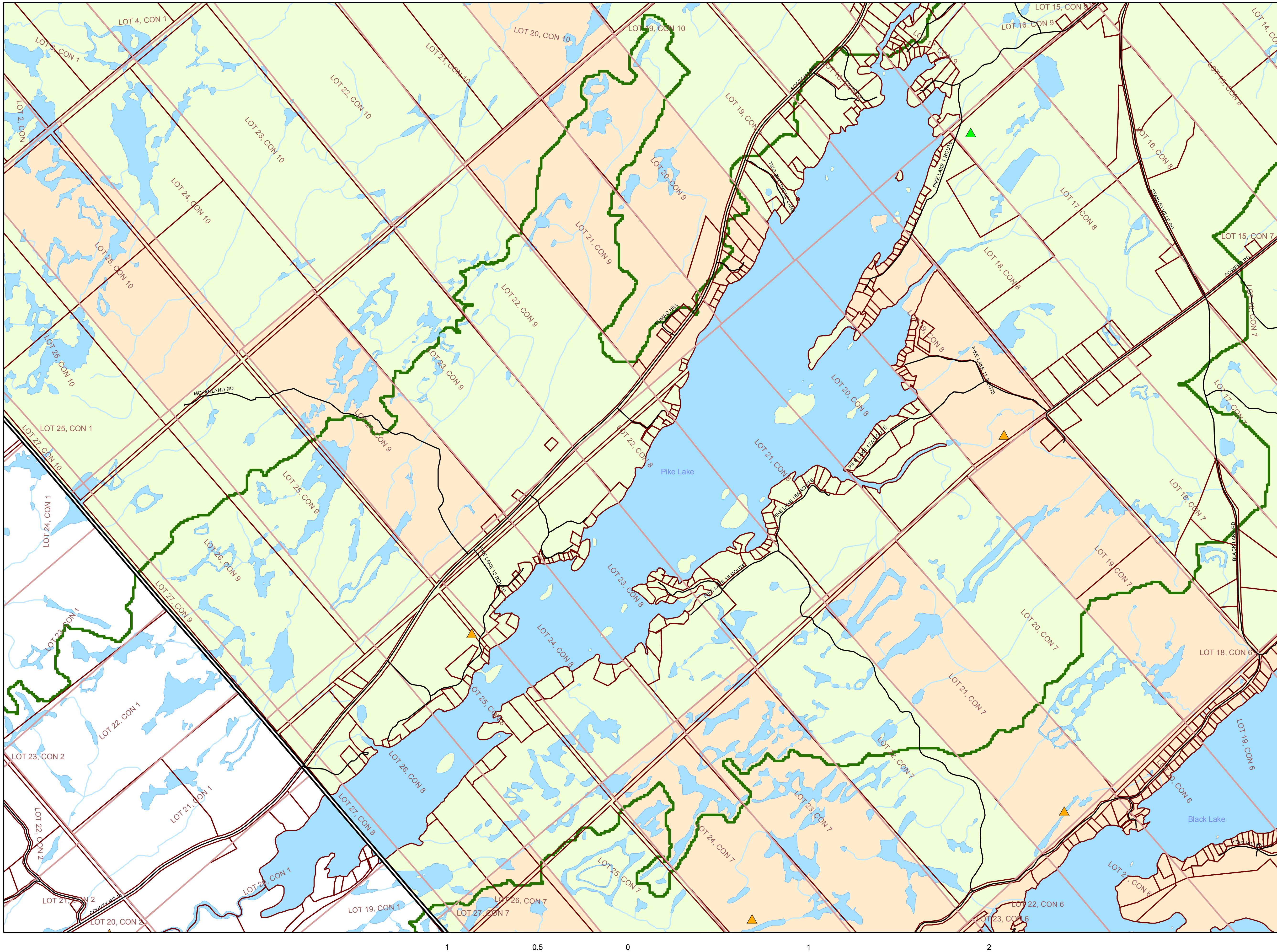
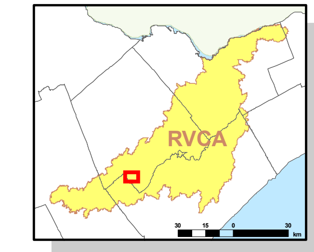
Published by: asoutar	Date Published: 6/12/2009

Map 5: Surface and Mining Rights





Legend

- Upper Tier Municipality, County
- Pike Lake Watershed
- Municipal Boundary
- Lots and Concessions
- Assessment Parcel

Transportation

- County/Local Road
- Railway

Water Features

- Permanent Waterbody
- Intermittent Stream
- Permanent Stream

Surface and Mining Rights

- Patent, surface rights only
- Patent, surface and mineral rights

Abandoned Mines/Quarries

- Aggregate Resource Quarry/Pit
- Mine

RIDEAU VALLEY CONSERVATION AUTHORITY

Map Scale: 1:20,000

N W E S

Projection note: U.T.M. Zone 18 - NAD 83 Datum

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