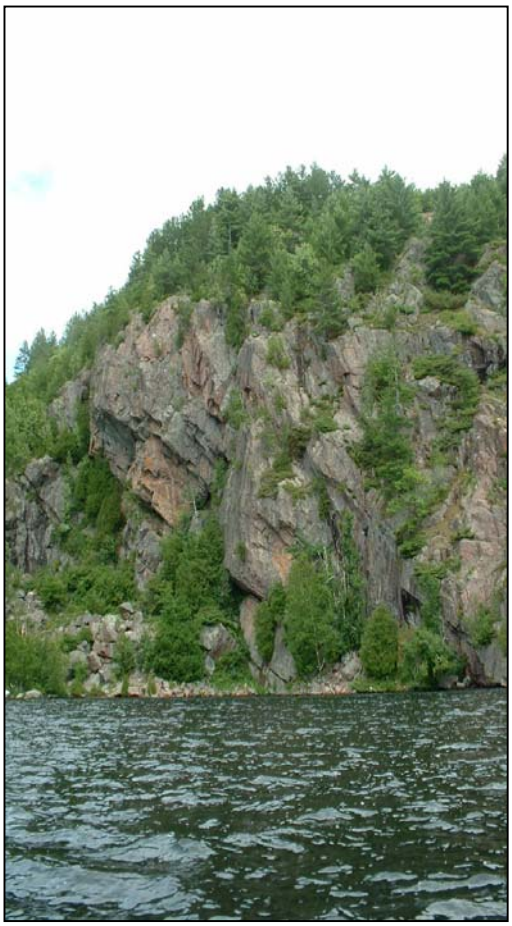
Paudash Lake Management Plan



Prepared by:

Lake Management Plan Committee
Paudash Lake Conservation Association
French Planning Services Inc.

August 14, 2004

Dedication

“This work is dedicated to Gerry and Valerie Hunnius, who have provided, and continue to provide, strong stewardship for Paudash Lake through their unwavering contribution of leadership, time and knowledge. They truly are conservers of its future”.

Preface

Paudash Lake is situated on the Canadian Shield and has picturesque expanses of clear deep waters cradled between steep, rolling hills. The lake has an element of ruggedness from islands and shorelines that thrust rocky, pine clad summits high above the water. The rolling landscape, natural shorelines and pristine water quality has attracted many people to the lake over the past century. These elements continue to be the reason why many people have made this area their permanent or seasonal home.

The purpose of the Paudash Lake Management Plan (referred to as the Lake Plan) is to identify the significant social, natural and physical features that make the lake and its surrounding area a desirable place for people to live and visit. The plan recommends a series of actions that will ensure the long-term sustainability and healthy existence of the lake for future generations. These actions encompass the lake's health, beauty, wildlife habitat, recreational opportunities, as well as opportunities for residential and commercial development.

The Paudash Lake Management Plan is intended to be a living document that will continue to evolve over time as individual circumstances and issues occur and new information becomes available. The observations and recommendations that are presented in this document are based on the background information that has been collected to date and should be reviewed every 5 years to establish new direction to meet current issues.

The Plan was prepared by French Planning Services Inc., under the direction of the Paudash Lake Conservation Association. A Lake Planning Committee was established to coordinate the collection of background information and to coordinate the preparation of the plan. Committee members included Valerie Hunnius, Gerry Hunnius, Lawrie Crump, John Fisher, David Reid and Jim Sangster. Randy French, MCIP RPP, of French Planning Services Inc., facilitated the process and provided technical support.

The Committee extends its gratitude to the following agencies that helped by providing material, advice, assistance and encouragement:

The Municipality of Highlands East
Township of Faraday
County of Haliburton
County of Hastings
Crowe Valley Conservation Authority
Department of Fisheries and Oceans
Ministry of the Environment
Ministry of Natural Resources
Ministry of Northern Development and Mines

THE ONTARIO TRILLIUM FOUNDATION
LA FONDATION TRILLIUM DE L'ONTARIO

The Committee is deeply grateful to the Ontario Trillium Foundation for providing funding to assist in preparation of this Lake Management Plan.

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Section 1 Introduction

Over the years the watershed surrounding Paudash Lake has had many changes: highway improvements, property development, an increasing population, and demand for recreational opportunities. The days of the small family cottage and boats with small horsepower have been replaced with permanent homes, urban landscapes, large cottages, high-speed boats and personal watercraft. The traditional way of life on the lake has changed substantially. However, the lake still remains a highly desirable place to live, and this is evident by the rising property values of today's market.

Why did people want to live on Paudash Lake? In the past, the lake was simply the most practical place to live as it provided the essential elements for existence: fresh water for consumption, cooking and cleaning, a source of food, and a medium for transportation. Today, these essentials are obtained without direct access to the lake and the reasons for living on or near the lake have changed.

Why do people now want to visit or live beside Paudash Lake? This was the question that the Lake Plan Committee needed to answer, and that led to an examination of the values of present lake users. The intent of the Lake Management Plan is to identify important natural habitat, physical elements, and social values that support the current quality of life on the lake and to recommend ways to protect and rehabilitate them.

The Paudash Lake Conservation Association was formed on October 7, 1973 as a result of ongoing negotiations, with the Ministry of Natural Resources (MNR) and the Crowe Valley Conservation Authority (CVCA), about management of the Paudash Lake Dam for the purpose of maintaining the water level of Paudash Lake. The mandate of the Association also includes communication with shoreline residents and with all levels of government on matters concerning the quality of life on Paudash Lake with respect to pollution, development activity and safety.

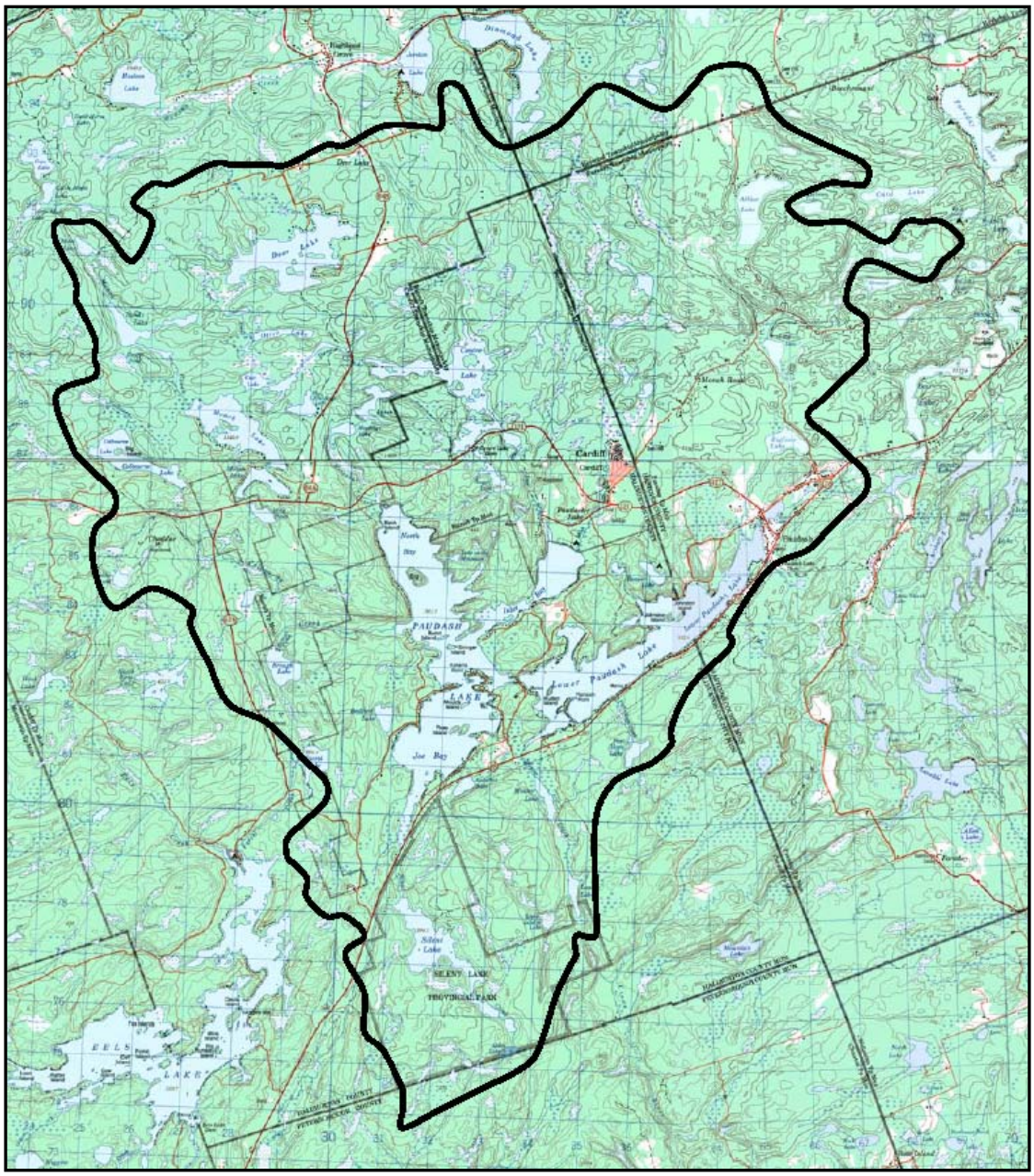
The Paudash Lake Conservation Association is the first association in the Crowe watershed to undertake the development of a Lake Management Plan. The Belmont Lake Association has also recently initiated the process, and it is hoped that both of these associations will have an opportunity to work together on common issues in the future. There are many benefits to having multiple lakes in a watershed working together. Some of these benefits include an increased awareness of upstream and downstream impacts, the sharing of common financial and human resources, and increased support on common issues.

1.1 The Purpose and Scope of the Lake Management Plan

The purpose of this plan is to recognize and protect the unique character of the lake, to develop specific objectives for long-term protection, maintenance and restoration of the lake, and to identify land use and stewardship actions to protect these values for the future.

The broad scope of the Paudash Lake Management Plan applies to all upstream watersheds that flow into Paudash Lake. This area includes the following lakes: Deer, Sandy, Otter, Cup, Monck, Colbourne, Brough, Farrel, Silent, Centre, Albion, Big Fools and many other smaller lakes as shown on Maps 1 and 2; (Map 1 is found in the insert at the back of the Plan and Map 2 is a compilation topographic maps). While background information has been collected on the entire watershed, the specific scope of the plan comprises the immediate area adjacent to Paudash Lake.

Map 2 –Study Area



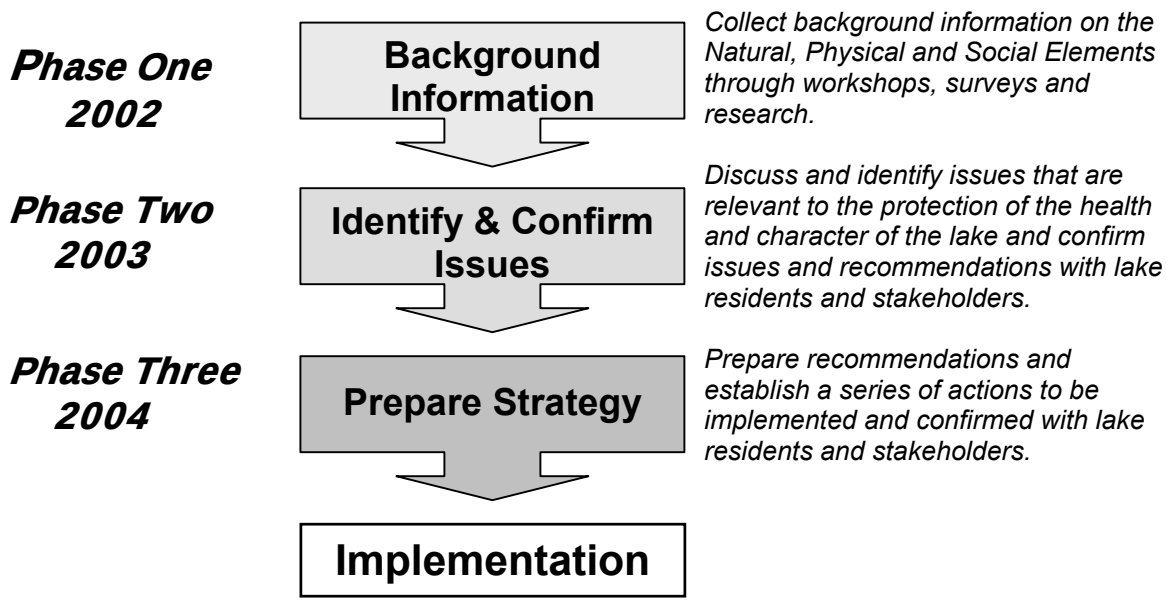
1.2 Planning Approach

In mid-2002, the Paudash Lake Conservation Association initiated a planning process similar to that used by other lake associations in Muskoka, Parry Sound, Haliburton and Peterborough. The Association engaged French Planning Services Inc., and carried out surveys and workshops to obtain the views of local residents, commercial operators, and other stakeholders, and collected and analyzed background information.

The intent of the process was to engage residential and commercial community members in discussions about the values that support their quality of life, the issues and concerns that impact these values, and to prepare a strategy of actions to protect the elements that support this quality of life.

The preparation of the Lake Management Plan took place in three phases, starting in 2002, as described in Figure 1.1:

Figure 1.1 – Lake Planning Process



1.3 Information Sources and Support

There were many agencies that were supportive of the process and involved in the collection of background information: The Municipality of Highlands East, Township of Faraday, County of Haliburton, County of Hastings, Crowe Valley Conservation Authority, Ministry of Natural Resources (MNR) Bancroft Area Office, the Ministry of the Environment (MOE), the Ministry of Northern Development and Mines (MNDM), and the Department of Fisheries and Oceans (DFO).

A Work List of required information was prepared and members of the Planning Committee contacted agencies, collected information and prepared summaries of their findings.

Natural Elements:	Water quality and quantity, wetlands, wildlife habitat, fish habitat, nesting sites, streams, vegetation, and rare species and species at risk.
Physical Elements:	Narrow water bodies, steep slopes, floodplains, access, watershed considerations, mineral and aggregate resources, and forestry.
Social Elements:	Aesthetics, ambience, historical development, cultural sites, recreation and boating.
Land Use Information:	Official Plans, Zoning By-laws, Site Plan Control By-laws, Crown Land Policy and Legislation.

There were many existing documents that provided detailed information on Paudash Lake and some of these excellent resources included (additional sources and web sites are listed in the References section):

- *A Study of the Biology and Ecology of Paudash Lake,* Haliburton/Hastings Counties, Ontario, with Proposals for Management and Restoration, T. Mosquin, J. Atkinson and R. Huizer, Mosquin Bio-Information Limited, Lanark, Ontario (April 1992)
- *Paudash Lake Shoreland Restoration Project,* Doug Brown (October 1997)
- *Evaluation of the Inlet Bay-Eastern, Lower Paudash Lake Wetland,* Biota Environmental Contractors (August 1994)
- *Evaluation of the North Bay, Paudash Lake Wetland,* Biota Environmental Contractors (February 1994)
- *Evaluation of the Joe Bay, Paudash Lake Wetland,* Biota Environmental Contractors (1994)
- *Evaluation of the Moxley Lake Wetland,* Biota Environmental Contractors (February 1994)
- *Evaluation of the Central Paudash Lake Wetland,* Biota Environmental Contractors (1994)
- *MOE Water Quality Report on Paudash Lake,* Gemza, (1997)
- *MOE Water Quality Report on Paudash Lake,* Phillips and Castro, (2004)

The collection of new information focused on obtaining the opinions and comments of lake residents, commercial operators, federal and provincial officials, and municipal councilors and staff.

A Stakeholder's Workshop was held on November 22, 2002, and was attended by municipal politicians, federal, provincial and municipal employees, a representative of the Crowe Valley Conservation Authority, and local commercial operators. The purpose of the Stakeholder's Workshop was to gather thoughts and ideas about the planning process, discuss values and concerns, identify sources of information, and determine the level of interest in participating in the preparation of the plan. The workshop proceedings are included in Appendix 1 (in a separate document).

The Paudash Lake Resident's Workshop was held on July 19, 2003 at the Highlands East Fire Hall (on Highway #28), and 47 people attended. The purpose of this workshop was to promote discussion among permanent and seasonal residents, and to identify the important features and values on Paudash Lake that support their high quality of life. Discussions were also facilitated on the issues that impact the values and features of the lake. The Resident's Workshop proceedings are in Appendix 2 (in a separate document).

A Residential and Commercial Survey (Appendices 3 and 4) was mailed to every shoreline resident and commercial operator during the summer of 2003. The purpose of the survey was to identify the ideas, perspectives, issues, concerns and aspirations of the Paudash Lake waterfront residents and commercial operators. The survey obtained information on: property size, buildings, features and use; residential occupancy; activities; and observations, perceptions and concerns. One hundred and fifty three (153) residential surveys were completed and returned and, based on a total of 729 shoreline properties, this represents a 21% return. Twenty-three (23) commercial surveys were distributed and fifteen (15) were completed and returned, which represents a 65% return.

Two Boating Surveys were conducted on Sunday, August 3 and Thursday, August 21, 2003 by members of the Paudash Lake Plan Committee at the Anchorage Dock within the channel that connects Upper and Lower Paudash lakes. The purpose of the survey was to assess the frequency and style of boating that occurs in the channel. The results from this survey are presented in Section 4.1 Boating.

A Night Light Survey was conducted on August 23, 2003 to gain a better understanding of the scale and scope of light pollution on Paudash Lake.

1.4 Report Structure

The Introduction, Section 1, identifies the purpose and scope of the Paudash Lake Management Plan, the process that was implemented, and the type of information that was collected. Section 2 identifies the community vision, goals and targets. Sections 3 to 7 provides a description of the natural, social, and physical elements, the land use regulations, and contains a summary of

observations and recommendations. Section 8 provides a Summary of Values, Issues and Concerns, and Section 9 contains the Action Plan.

Major observations and recommendations are provided throughout the document. These observations are based on the information that has been collected and French Planning Services Inc. provided the recommendations for consideration by the PLCA.

A glossary of scientific and planning terms has been provided at the end of this document.

Section 2 Vision, Principles and Targets

2.1 Vision and Mandate

A vision statement provides guidance for what the lake should be and look like in the future. It describes a common objective that is important to all community members. The following Vision Statement reflects the values and vision that residents, commercial operators, and government stakeholders share (Figure 2.1).

Figure 2.1 – Vision for Paudash Lake

Our vision for the future of Paudash Lake is…

A place where water quality, wildlife habitat, natural beauty, recreational opportunities, and peace and tranquility are maintained and improved for present and future generations to enjoy.

The Objectives of the Paudash Lake Conservation Association, as listed in their Constitution, are identified in Figure 2.2:

Figure 2.2 – Objectives of the Paudash Lake Conservation Association

1. To promote the water quality and quantity, and maintain reasonable water levels in Paudash Lake.
2. To protect and encourage the preservation and conservation of all natural resources, the natural environment, and wildlife in and around Paudash Lake and vicinity.
3. To promote safe and responsible operation of all watercraft and other recreational vehicles on and in the vicinity of Paudash Lake.
4. To advocate in pursuit of the Association's environmental purposes.
5. To cooperate with other local, regional, national and international organizations which have goals similar to those of the Association.
6. To do such things as may be deemed necessary or advisable to further and promote the interests of the Association.

The Paudash Lake Conservation Association also prepared a Statement of Environmental Principles (Figure 2.3).

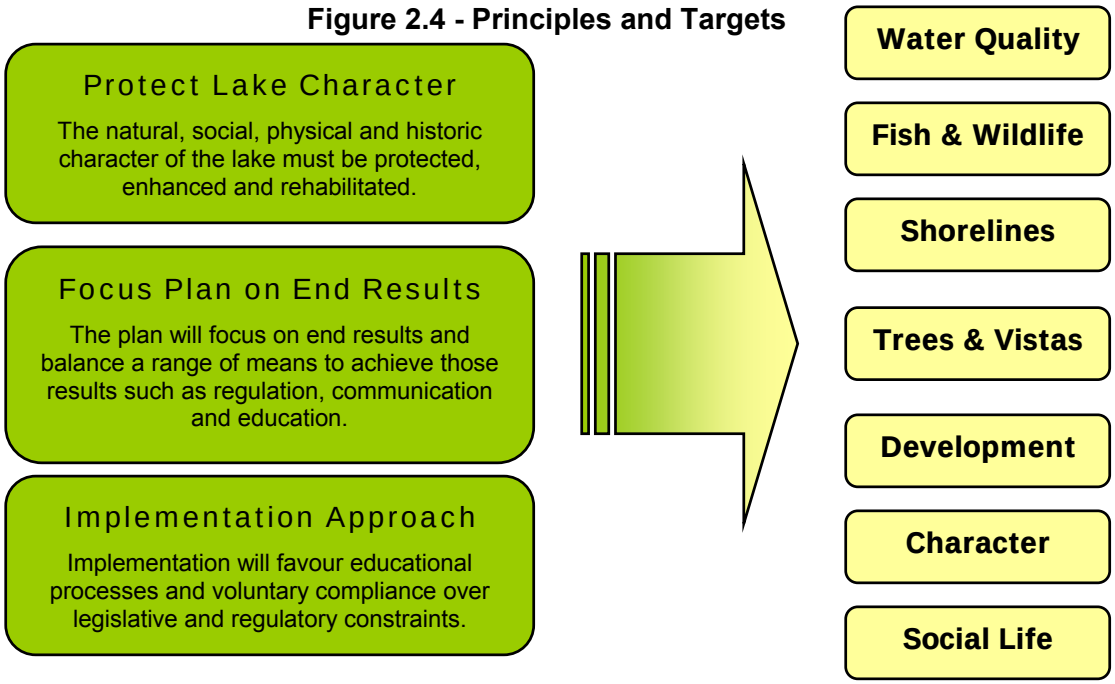
Figure 2.3 – Statement of Environmental Principles

- *The Paudash Lake Conservation Association is committed to protecting the habitat of all species through monitoring, evaluating, protecting and restoring the ecosystems of the natural environment, which support them.*
- *We recognize the environment as a complex living entity, which should have protection in law from destructive actions of individuals and corporations.*
- *Learning to live and work without degrading the environment is the key challenge and opportunity of the global ecological revolution.*
- *Integrating biological conservation with economic development will require partnerships between private and public interests in order to produce results, which are in harmony with nature.*
- *The Paudash Lake Conservation Association believes these large goals can be obtained by empowering individuals to take responsibility for their actions.*
- *We encourage our members to think globally and act locally.*

2.2 Principles and Targets

The Paudash Lake Plan Committee confirmed a series of principles for the preparation of the Lake Management Plan and identified seven potential targets to be addressed (Figure 2.4).

Figure 2.4 - Principles and Targets



These principles and targets helped to identify important features on the lake, and provided the Association with a method for measuring their efforts in the preparation of the plan and the protection of these features. The targets shown in Figure 2.4 are further described as follows:

1. Water Quality - The water of Paudash Lake should not contain contaminants in excess of the natural historic levels (i.e., the level of contaminants that would occur in nature prior to human habitation), or standards specified by qualified official bodies. Significant contaminants to be considered should include phosphorus, nitrogen, toxins and e-coli, and other contaminants that may be identified in the planning process.

2. Fish and Wildlife - Paudash Lake should support a sustainable fish population, including optimum habitat for its naturally reproducing lake trout, and maintain stability in the biodiversity of wildlife species and their habitat. The introduction of "invasive species", such as zebra mussels and purple loosestrife, must be prevented.

3. Natural Shorelines and Riparian Areas - The shoreline can be described as the "ribbon of life" that supports a diverse range of fish and wildlife species. The protection and rehabilitation of the shoreline (littoral, riparian and upland areas) should be promoted to increase the amount of natural shoreline.

4. Natural Appearance and Vistas - The natural vista should be maintained. Buildings and structures should have a minimal impact on the natural appearance of the shoreline and the landscape.

5. Economic and Property Development - The competitiveness and viability of existing resorts and commercial operations are to be supported. A cooperative working relationship has to be fostered between residential and commercial members of the Paudash Lake community to ensure that proposed commercial and residential developments and activities respect the environment and character of the lake, as well as maintain property values.

6. Historical, Cultural and Natural Character - The historical, cultural and natural character of the lake is to be recognized, protected and restored, where appropriate. Future public, commercial and residential development must complement and be compatible with the historical, cultural and natural character of the lake.

7. Social Life - A range of social and recreational activities should be promoted that are consistent with the natural character of the lake, preserves the health and ambience of the lake, and fosters a sense of community around the lake.

Section 3 Lake Description

3.1 Historical Development

There are conflicting reports on the origin of the name Paudash. The book North of 7 and Proud of It: A Parade of Memories from North Hastings indicates that, “Paudash Lake was named by its first inhabitants in honour of Chief George Paudash, leader of a Mississauga Indian Band”. In Bob Lyons’ book Touring the Past, Paudash was named after Chief Johnson Paudash (or Pahtosh) of the Crane Tribe. The word “Paudash” in the language of the Chippewa means “Crane”. The Chippewa Indians of Rice Lake resided on Paudash Lake and remnants of their camps were found off Wolf Point, Joe’s Bay. Even after “white” settlers came to farm the lands, the Aboriginals would come to hunt and pick ginseng.

“Paudash” in the language of the Chippewa means “Crane”.

Although the building of the Burleigh Colonization Road opened the region for agriculture in the mid 1850s, poor soil and an abundance of rocks discouraged the establishment of farming communities here. The lumber business flourished here until the turn of the century. Pine logs from the surrounding forests were floated through Paudash Lake on their way to market. The area didn't experience another surge in its economy until the late 1940s when uranium was discovered. By 1956, Dyno mines had established Cardiff, a Town site of 200 homes for the miners. There was another smaller group of houses built on the Dyno Road about two miles south of the mine itself and called, naturally enough, "Dyno Estates". Close to the Bicroft Mines and closer to Paudash Lake, another settlement called "Bicroft Heights" came to life.

The following information is taken directly from The History of Cardiff, a paper prepared by Linda Mumford for the Open House held by the Township of Cardiff on September 16th, 2000. We acknowledge the Open House Committee members comprised of Paul Slighte (Chair), Linda Mumford (Secretary), Des Noblett (Council) and Joanne Burroughs (Librarian). They in turn acknowledged the following resources: In Quest of Yesterday, Cardiff and Cardiff Township, and Touring the Past, Malcolm McGillivray and Cecil Mumford.

The following quotes provide a favour of the community surrounding Paudash Lake, because it’s mainly about people who live near the lake and have affected its history:

“Cardiff Township was surveyed in 1862, and was named for the seaport capital of Wales, which is also the county town Glamorganshire. Haliburton’s Cardiff was originally part of the United Townships of Glamorgan, Monmouth and Cardiff, whose reeves from 1874 until 1880 included Philip Harding, who was the municipality’s first representative to Minden’s County Council when the Provisional County of Haliburton was established in 1874, and was followed by John J. Hunter. Reeves from the time Cardiff was established as a separate municipality in 1880 until 1940, included

Thomas McInroy, William Ogilvie, Benjamin Wood, Robert Dixon, Isaac Austin, Walter Kidd, H. McGillivray, Nathan Bates, W.J. Watson, Cyrus Toms, A. Mumford, J.J. Mumford, Angus Toms, T.A. Bamford and E.F. Laundry."

"Weatherald, Land Surveyor at the time, had this to say of the district: "I look upon the Country traversed by my survey as almost unfit for settlement on account of its exceeding hillyness and poorness of the soil, even when soil does exist it is so stony that it cannot be ploughed – I deem it best adapted (after being cleared) to raise sheep, and for grazing purposes. There is considerable good pine both red and white but the lumber men are fast thinning it out."

"Coniferous swamps occupy large tracts of land, one in the south-eastern sector covers 500 acres, and a deposit of hornblende schist is sandwiched between granite and gneiss outcrops in the northeast and southwest. Sanford Baker, 1863 and Gilmours, 1864, held early timber licenses, and consequent firms included Parge, Stricklands and Rathbuns."

"The Monck Road, built to link Orillia with the Ottawa Valley, intersected the Burleigh Road to Cheddar Corners, while the Peterson, the first of the Colonization Roads, roughly followed Cardiff's northern boundary. These Colonization Roads, especially in stretches, which had no settlers for miles, tended to fall into disrepair. There are many such historic trails and Colonization Roads scattered all through Cardiff, but these land sites are slowly disappearing for lack of use and forest overgrowth."

"The early days of Cardiff Township are still a subject of controversy", was pioneer Walter Kidd a "Robin Hood" outlaw or just a storyteller who loved a good tale? Just how early did the whiteman see the shores of Paudash Lake? It seems like the stories of adventure go to Cardiff Township before the pioneers did. There are legends of Hudson Bay posts, educated trappers, and Champlain himself wandering the bush west of Bancroft. We have very few government records of Cardiff before 1890. But if you want an educated guess, the sturdiest voice of authority comes from an early schoolteacher in the Township, Ethel Ogilvie, the daughter of early settlers William Ogilvie and Catherine Clark. Ethel taught at the first Cardiff schools before marrying into another prominent Cardiff family, the McGillivray, of Paudash Lake."

"It is thought that the first settler on Paudash Lake was John Anderson followed by Joe Dunlop, a remittance man, on Joe's Bay. Within a few years, Malcolm McGillivray Sr. arrived, taking a free grant of 300 acres at Lot 26 and 27, Concession VIII – a point of land jutting into Paudash Lake. His next-door neighbour, also patenting in 1875, was John McEachern. McGillivray Sr. cut trails over to the Monck Road, to get his wheat to Bancroft Mills, and made another road to the Burleigh Road near Silent Lake. He built the first bridge over the narrows at Paudash Lake. Indians were still coming to Paudash Lake in pioneer days to hunt and pick ginseng. Remains of their camp were found on Joes Bay off Wolf Point and the old Portage. The name "Paudash" means "crane" and was given to the lake by the people in honour of an Indian Chief, George Paudash of the Chippewa Indians of Rice Lake. Strangely enough, there were no fish in Paudash at this time. Paudash Lake ended at Towel's cottage, where there was a sand bar that you could walk on. In fact the Smiths, Edwards, etc., often walked across it to attend the church at S.S.- 7 School. From the sand bar a small stream flowed down to the dam."

“As for the dam at the base of Paudash Lake, former Reeve Mac McGillivray says the original lumberman’s dam “wasn’t as good as a beaver dam.” Starting in 1929, Bill Davis Sr. of Maple Leaf built a new dam, which raised the water levels of Paudash Lake by 5 or 6 feet. There have been property disputes ever since, as cottagers find part of their surveyed lots are under water. Logs, which were mostly pine at that time, were brought down from Center Lake through Center Creek to Inlet Bay. Sliders were built over the rapids and the creek dammed to provide enough water. The logs were out on booms in the lake and towed by a capstan, two horses on a raft like the horsepower they used to drive thrashing machines. The capstan was attached to the boom and to an anchor on a long rope wrapped around the post in the capstan, and this pulled the logs toward the anchor. When the rope was wound up, two men in a punt took up the anchor and carried it further down Paudash Creek and finally into Crow Lake where it stayed all winter and then onto Desoronto. A man called Hubbel had a mill on Paudash Creek and towed the boom with a small stream boat they called a “two-wheeler”. He cut timber down the Burleigh Road and dumped it in at Pine Creek. Hubbel moved away about 1942 and that ended towing logs down the lake.”

Figure 3.1 - Hubbel Mill

“And the first cottagers had already arrived on Paudash shores. Mac McGillivray Jr. recalls the first cottage being built on the big island by a Mr. Johnson. Then his father Hugh built the second for Jack Wilson, a blacksmith shop owner from Bancroft; that was in 1923, and the place was later called Birch Acres. Another early cottage was John Ross on Joe’s Bay; Ross was a banker manager in Bancroft.”

“Cardiff had a number of settlement areas. Some of the families to locate there at an early date were: the Pattersons, Wheelers, Dixons, Dunlops, Andersons, Burnoors, McGillivrays, and Gannons around Paudash Lake; the Broughs, Mooneys, Campbells, Hugheys and Frazers along the Burleigh Road, the Drunkwaters, Edwards, and Smiths around South Paudash, the Southworths, Thompson, Gandiers, Bates, Woods, McIlvenas, Barns and Hatches at Cheddar Corners; the Ogilvies, Willises, Ragans, Pollys, Mitchells, Houstons, Toms, Ennises, Drurys, Lacroixes, and Watsons about Deer Lake; and the Peters, Wilsons, Mackinerys, Sucees, Coverts, Lewises and Peels at Highland Grove, and the Mumfords at Mumford Station in the western end of the township.”

“The I.B. and O. Railway brought prosperity to Highland Grove, which soon boasted a thriving cheese factory and two stores, one of them owned by William Ogilvie, who also kept the post office and had a blacksmith shop. Highland Grove gradually absorbed the business from Deer Lake and Leafield. A Highland Grove man, who served on both council and school board, was Roland John Peel, who, for many years, was a storekeeper until his 1954 retirement to Bancroft.”

“The I.B. and O. Railway ran from York River through Hughes, Baptiste, Highland Grove, Mumford, Wilberforce, Tory Hill, Gooderham, Irondale, Furnace Falls, and Howland. To the railway it was

Mumford Station, today it is Harcourt, but strangely both names still appear on some maps. Although it was the next station stop east of Wilberforce, it retains little to evoke the signs of rail and the right of way is now a playground."

"Since 1985, Pat and Don Furneaux have been the proud owners of the historic Highland Grove General Store. Originally built in 1895, an addition was constructed nearby and moved by horse to join the store; supported by hand hewn wooden beams, 14 to 16 inches across, the building sits upon a hand constructed two-foot thick stone foundation. The General Store was a centre point of the village. A farmer could pick up his mail, buy food, seed, feed for his animals, boots, clothing, sewing supplies, sundries and more, all under one roof. Though the years have brought some changes, the original oak counters and shelving units remain, and you can still pick up your mail and groceries."

"Cardiff old-timers seem to have been history conscience. The Bancroft Times have printed human-interest items over the years. In September of 1897, Cardiff held a fair, probably at Deer Lake; "One of the attractions will be two football matches, one between Leafield and Deer Lake Juniors, the second between Deer Lake and Monmouth Seniors." However, there was a story printed with a little romantic flare when R. Hudson of Highland Grove invested in a cutter and was stated to announce that there was still room in it for another passenger."

"Cardiff also had its tragedies; one of the saddest took the life of a popular young man in July 1899: 'During Tuesday evening's storm, Donald, the eldest son of Alex McGillivray was struck and instantly killed by lightening.' Young McGillivray, in his 24th year, had left the house to look for a cow when the storm broke. From the position in which he was lying when discovered, he was about to seek shelter in the sheep pen when struck. When his father found him a few minutes later, he was already dead and his clothing was still burning. The calamity has cast a pall of gloom over the whole community."

"One of Cardiff's young people to attend Minden's Model School, and graduate to teach both in Minden and at S.S. No 1 and No.2 Cardiff, was Ethel Annabel Ogilvie, a daughter of William Ogilvie and Catherine Clark. In 1910, she married Hugh McGillivray and, after raising two sons and four daughters, she returned to teaching until 1960 when she retired."

"The first school in Cardiff Township was built near what is now called "Dyno Estates", and its teacher was Matilda Huston (Mrs. David Hughey). Early Cardiff school drivers included Jim Paterson, Burt Patterson, Tommy Evans and Bill Sarginson. Probably the first school in the Township was Cardiff S.S.–1. The builder of S.S.-1 Cardiff was a legend named Walter Kidd, who some said has been trained as a lawyer at Queen's University. Kidd moved up to clear a patch of bush in Cardiff. At one time the township had seven school sections. S.S. No 1 built by Water R Kidd, which was Cardiff's first log school on the Dyno location, which was a tourist information booth on Highway 28 South until 1997; S.S. No 2 was at Cheddar Corners; S.S. No 3 at Highland Grove is the present location of the Highland Grove Library and the recent home of the Municipal Office; S.S. No 4 is unknown; and S.S. No 5 was built at White Pines Motor Hotel. S.S. No 7 was located on the McGillivray Road, and when it burned in the early 1930's, the new school was built on the next lot and was used as the Municipal Office until 1998 when it was sold and turned into a home. The

ratepayers of Cardiff were suspicious when the schools were consolidated. In pioneer days, the parents had to pay the teacher and the operating costs of local schools, with little interference or help from the Province. There were plenty of public meetings about consolidation. Mr. Pentlen, the School Inspector at the time, said that consolidation and school buses were the coming thing. Since teachers were no longer willing to work for a few dollars and a basket of eggs a month, the rural families has to gather together and make a bigger school. The same needs developed for secondary education. When North Hastings District High School opened in 1947, the Cardiff School Board purchased space for their students and began busing to Bancroft. None of the original buildings are in use as schools since all students are taken by bus to schools outside the township."

"As soon as the pioneers were established, churches were built, and one of the first was the Anglican Church at Highland Grove. There was a log Church at Cheddar; later demolished and some of the logs used in the Wilberforce Church. There was a Presbyterian Mission formed, which include the School Sections one to five. A church was planned for the present location of the McGillivray Cemetery, but it was built at the foot of Paudash Lake instead after the former church a few miles from McGillivray Cemetery was closed and sold. There are only two active cemeteries in Cardiff Township, the McGillivray and the Deer Lake Cemeteries. There are two active churches in Highland Grove, the Catholic Church and the Reform Church."

"Both Paudash and Highland Grove had a cheese factory but both were closed before World War I. Farmers had a hard time wrestling a living from their stubborn acres. After the labour of clearing the land of trees and stumps was done, there was still the never-ending task of "stone picking". However, in the early 1950's, a diamond driller began drilling for uranium around Paudash, and in no time construction crews were everywhere and new families moving in filled S.S. No. 7 until a temporary school had to be found. With the establishment of the Dyno Mine and Bicroft Mines, houses were built for their staff at Dyno Estates, Bicroft Heights, and the Town site of Cardiff."

"Silent Lake got that name around 1927 when Alfred Greene and his wife Lilian set up the Six Point Lodge. Before that time it was called "Pine Lake; and some of Cardiff Township's oldest residents still call it that." What the Indians called it we may never know. The Ministry of Natural Resources did an archeological study of the lake in 1973. They found bits of evidence that Indians had been camping at the north end of Silent Lake for thousands of years. However, an inspection by expert James Burn in 1972 suggested that none of the Indians made permanent campsites there. Burn did find three lines of stones underwater, running from the shore, which Bill Sarginson suggests, "may have been used to catch fish or launch canoes". However, very few verified Indian relics have been found at Silent Lake."

"Before the creation of Haliburton Provisional County in 1858, the land in Cardiff Township was attached to Peterborough County. Although there are stories of French trappers arriving at Paudash Lake in the 1700's, so far no historical proof has come to light. It seems more likely that the first white settlers were loggers who made clearings to provide food for the camps. Silent Lake was part of the Paudash cutting grounds in the days when timber licenses were issued on the basis of watersheds rather than by lot and concession."

"As early as 1917 and 1918, Paudash Lake's scenic charms and abundance of fish had been discovered by city dwellers, and lakeside families began to accept summer lodgers. Some lodges

and fish camps were built, especially after the construction of Highway 28 from Apsley to Bancroft. Since Crown Land on accessible lakes has been sold for cottages, summer business depends on their trade and, in recent years, both municipal and provincial governments have been promoting winter tourism, and a hundred miles of groomed snowmobile trails offer endless challenges for the adventurous. Today Cardiff has many Marinas, Tent and Trailer sites, Restaurants, Motels, Housekeeping Cottages, and Country Stores to attract visitors from all over the globe."

"As things have changed over the years, since the conception of Cardiff, so has things changed recently. Restructuring is not a new theme, but in the last couple of years the Provincial Government have encouraged and also demanded that smaller municipalities amalgamate with their bordering partners. Haliburton Council is not alone in their decision to restructure from ten municipalities to four. A proposal was sent into the Ministry of Municipal Affairs and Housing from the County of Haliburton on December 31, 1999 and was signed by the Honourable Tony Clement on March 6th, 2000 authorizing the Municipalities of Bicroft, Cardiff, Glamorgan and Monmouth to become one municipality. A Transition Board was established consisting of all members of Council of the existing four municipalities; they have a challenging and time consuming job of organizing, restructuring and naming the new municipality. Some very difficult decisions have been made and others are yet to be made."

"We should all look at this venture not as an inconvenience nor Government bureaucracy, but as making of history and a future for our children, so that when our children are older they can look back at this exact time and say, as we once said, "Those were the good old days!"

Figure 3.2 provides a summary of the origin of local names:

Figure 3.2 – Origins of Local Names

Paudash	Either named after Chief Johnson Paudash (Pahtosh) of the Crane Tribe; or Chief George Paudash, leader of a Mississauga Indian Band
Cardiff	Cardiff was named after the capital of Wales in 1862
Faraday	Faraday Township was named in 1857 after the British Scientist, Michael Faraday
Hastings	Hastings County was named in 1792 for Francis Rawdon-Hastings, Baron Rawdon, Earl of Moira
Lower Paudash Lake	Also known as Lower Switch and Outlet Lake "by the locals" (MNR Lake Map 1970)

Some other interesting notes and memories:

- The first bridge over the narrows at Paudash Lake was constructed by Malcolm MacGilvery Sr. (no date) (Lyons);
- "Paudash Lake ended at Towel's cottage, where there was a sand bar that you could walk across". "In fact the Smiths, Edwards, etc. often walked across it to attend church at S.S.-7 School". From the sand bar a small stream flowed down to the dam (Lyon); and
- The legend of Palashe's Cave is said to be in the vicinity of Paudash Lake. Chief Paudash used to get silver and lead in its pure state from this cave before it was concealed, which is said to be "between three lakes, near the place where the water runs under the rocks" (Reynolds)".

Observations

- *The area around Paudash Lake has a rich history of First Nation use.*
- *Over the past century, Paudash Lake has had a significant increase in development.*
- *The preceding section is viewed by the Lake Plan Committee as the beginning of a growing and on-going saga about Paudash Lake. More local information is needed.*
- *The economic base of the area has changed over the years. The economic influence of the original logging, mining and farming industries has been largely supplanted by a residential and commercial tourist industry and its associated services.*

Recommendations – Historical Development

1. **Further investigate the history of the area and prepare articles for the association newsletter and other media.**

2. **Residents and stakeholders on the lake should be encouraged to contribute their memories, anecdotes and photographs to an up-dated history.**

3.2 General Location and Characteristics

Paudash Lake is a relatively large body of water located about 15 km southwest of Bancroft, in the geographic townships of Cardiff and Bicroft, which are now part of the Municipality of Highlands East, and the Township of Faraday and the Counties of Haliburton and Hastings. Paudash Lake is divided into two lakes named Upper and Lower Paudash lakes. Upper Paudash Lake is further divided into North Bay, Inlet Bay and Joe Bay (Maps 1, 2 and 3).

Combined, the lake has a total surface area of 1,216 hectares (ha), a mean depth of 9.3 metres (m), at the regulated level, and a total shoreline length of 59.7 kilometres (km). Figure 3.3 and 3.4 provide details on the physical characteristics of Upper and Lower Paudash Lake.

Figure 3.3 – Upper Paudash Lake Physical Characteristics

Latitude	44^0 58’	Mean Depth	12.0 m
Longitude	78^0 03’	Maximum Depth	46.4 m
Drainage Area	193.0 sq km	Island Shoreline Length	7.4 km
Surface Area	754.7 ha	Perimeter	35.7 km
Length	7.0 km	Height Above Sea Level	343.0 m

Source: Mosquin et al. (1992)

Figure 3.4 – Lower Paudash Lake Physical Characteristics

Latitude	44^0 58’	Mean Depth	6.6 m
Longitude	78^0 01’	Maximum Depth	21.3 m
Drainage Area	193.0 sq. km	Island Shoreline Length	2.3 km
Surface Area	461.3 ha	Perimeter	24.0 km
Length	6.0 km	Height Above Sea Level	343.0 m

Source: Mosquin et al. (1992)

Water depths in the lake are shown on Map 3, Bathymetry. There are 26 streams flowing year-round into Paudash Lake (see Map 1). The only outlet is the Crowe River, which flows south past Chandos Lake, to Belmont Lake and Crowe Lake, and eventually to the Trent River. Streams that are considered as having year round or intermittent water flow are shown in Map 8 (See Section 5.4). There are also many natural depressions or swales that pass storm water into the lake.

3.3 Watershed

The Crowe River watershed has a total drainage area of 2,006 square kilometres (775 square miles) (Map 4). The boundary of the watershed is the boundary of the Crowe Valley Conservation Authority. The Conservation Authority is responsible for fifteen (15) dams located on the river system, including the Paudash Lake dam. There are two main tributaries connected to the Crowe River located downstream of Paudash Lake: the North River, which converges at Belmont Lake, and Beaver Creek, which converges at Crowe Lake near the village of Marmora. The Crowe River flows into the Trent River system, which empties into the Bay of Quinte at Lake Ontario.

Paudash Lake is one headwater lake for the Crowe River watershed. The Paudash Lake sub-watershed has a total drainage area of 193 sq. km., which represents about 10% of the total area within the entire Crowe River watershed. Paudash Lake's watershed encompasses a number of large lakes including: Deer, Sandy, Otter, Cup, Monck, Colbourne, Brough, Farrel, Silent, Centre, Albion and Big Fools lakes (Maps 1 and 2).

Observations

- *Although Paudash Lake constitutes a small fraction of the Crowe River watershed, its health and well-being has an immediate impact on those bodies of water downstream of it, as it is a headwater lake for the watershed.*
- *There are numerous smaller lakes and rivers that flow into Paudash Lake, and their health will impact the future health of Paudash Lake.*

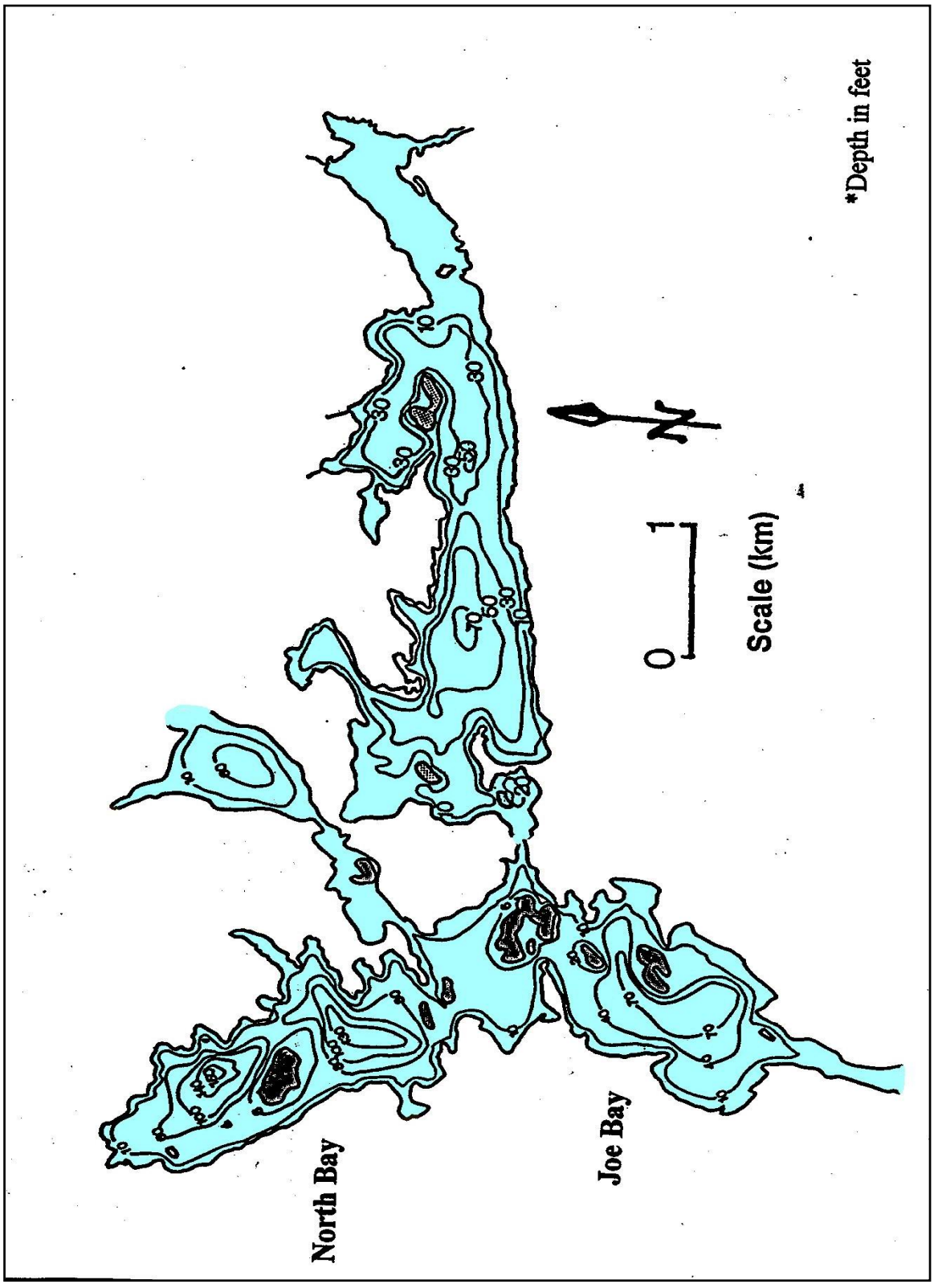
Recommendations – Watershed

3. ***All major water bodies in the Crowe River Watershed should be encouraged to develop lake plans and collaborate on matters having mutual benefits including communication and education opportunities.***

4. ***Local official plans should provide policy that recognizes watershed impacts and requires the consideration of upstream and downstream impacts when reviewing new development proposals.***

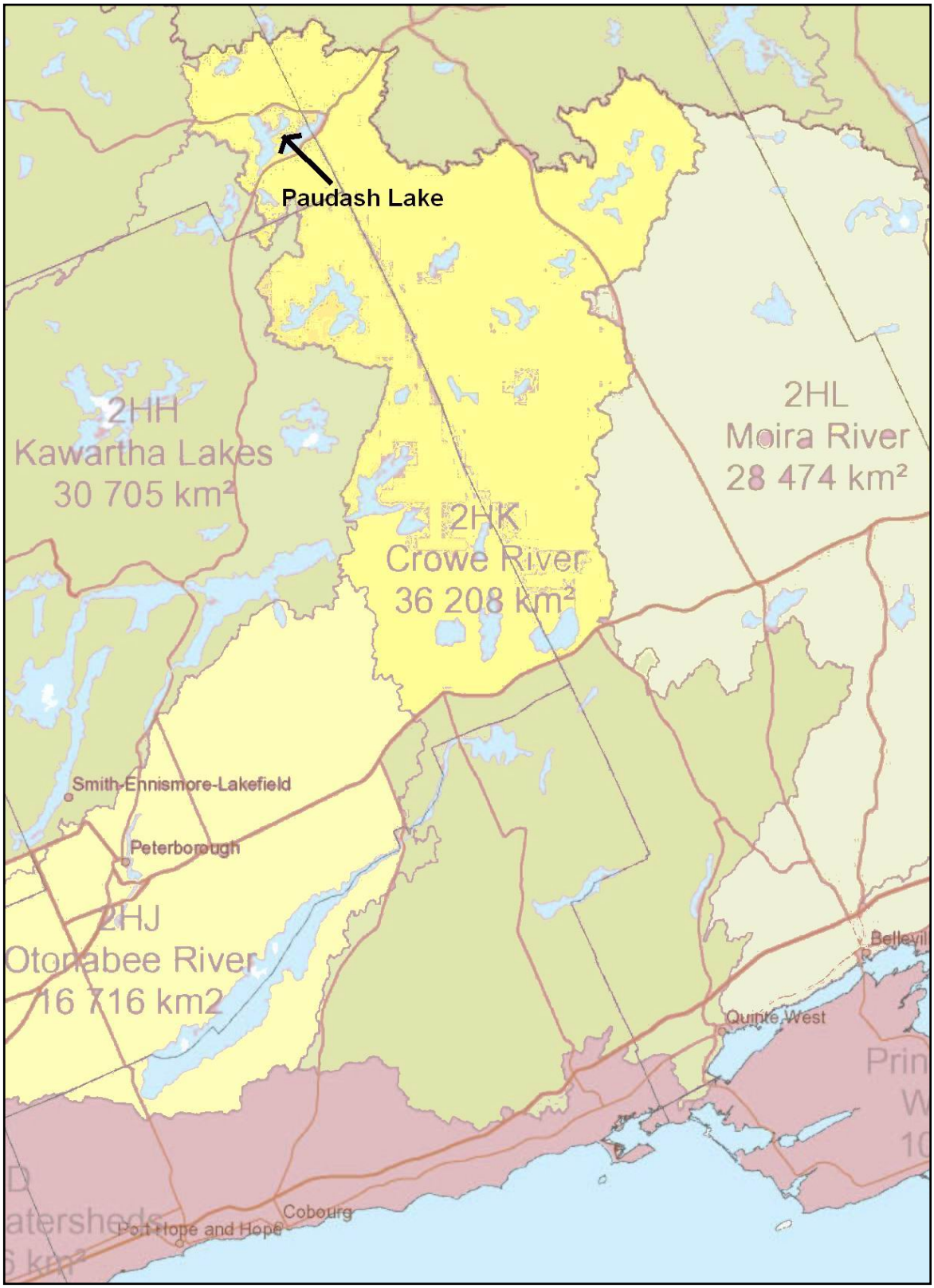
5. ***The PLCA should request that local municipalities provide information on major development applications within the drainage area of the Paudash Lake.***

Map 3 – Bathymetry



Source - MOE Water Quality Report (1999)

Map 4 – Crowe River Watershed



Source: Tertiary Watersheds – Georgian Bay to Ottawa River (MNR)

3.4 Water Levels

A concrete dam was originally constructed, in 1928, at the outlet of Lower Paudash Lake, and rebuilt, in 1958, to control the water level of Paudash Lake. The summer water level is estimated to be 342.31 metres, the winter water level is 342.02 metres, and the 100-year flood level is 342.80 metres (Figure 3.5).

Figure 3.5 – Water Levels

	Water Level	Difference in Water Level
100 Year Flood	342.80 m	0.49 m (19.29“) 0.29 m (11.42“)
Summer Operating Level	342.31 m	
Winter Operating Level	342.02 m	

Source: CVCA (2004)

The dam is owned and maintained by the MNR (Bancroft District) and operated in cooperation with the Crowe Valley Conservation Authority (CVCA), which has flood prevention as its core mandate. The MNR establishes the parameters for the operation of the dam to ensure fish and wildlife requirements are met, and the CVCA determines the day-to-day operation of the dam to ensure optimum flood control through the watershed. The adjustment of water levels also results in ensuring adequate supply of water for municipal and private systems, and enhances recreational boating opportunities.

During the past three decades, the PLCA, MNR and the Conservation Authority have discussed the water level management regime for the Paudash Lake Dam. The PLCA has requested consideration of a fixed weir to maintain more naturally regulated water levels throughout the year, but the CVCA has expressed concerns that the fixed weir will diminish their ability to manage the dam for flood control purposes.

In 1992, a study was completed for the Paudash Lake Conservation Association (PLCA) by Ted Mosquin, Jann Atkinson and Ron Huizer entitled: A Study of the Biology and Ecology of Paudash Lake. The purpose of the study was to examine the natural values of the lake and its associated wetlands, in light of impacts of human settlement, to identify management concerns and to suggest preventative, ameliorative, or restorative actions that would contribute to securing the long-term productivity, biodiversity and ecological health of the lake. A series of recommendations resulted from the study and the following recommendation, taken from Mosquin et al. (1992) report, was related to the operation of the dam.

> “*Restoration of a Natural Seasonal Flow Rhythm for Paudash Lake* - Artificial manipulation of lake water levels, to meet human needs, negatively affects littoral zone (near shore) function, shoreline habitat, aquatic species migration, and normal annual flushing of the lake. The fall drawdown exposes the littoral zone to freezing, which kills many species essential to freshwater food chains. The higher summer water levels keep the area, normally between high and low water levels, submerged, thus, eliminating valuable habitat for many shoreline plants and animals. The normal continual flushing of the lake is

prevented during the maintained summer levels causing nutrients and pollutants to accumulate rather than being allowed to flow through the system. The dam prevents the required movement of aquatic life between the Crowe River and Paudash Lake. The lake should be self regulating, with perhaps a fixed structure dam, and be allowed to rise and fall with the seasons".

The maintenance of the fall and spring water levels may have a negative impact on Lake Trout spawning behaviour and success (see Section 5.5) as well as on other aquatic life including turtles and frogs. At present there are no studies to determine the impact of water management activities on Paudash Lake.

Observations

- *Water levels in Paudash Lake are controlled by the CVCA through a dam (owned by MNR) on the Crowe River.*
- *Artificial water level management may result in a detrimental effect on the natural ecosystem, including disruption of spawning and incubation of some fish species, especially lake trout and bass. According to recent studies by Dr. D.O. Evans in Haliburton lakes, the consequences of water level drawdown is dependent upon the specific circumstances in each lake, and the timing and extent of the drawdown, which are the key variables both for juvenile habitat and survival of embryos.*

Recommendations – Water Levels

6. The MNR should prepare an assessment of the impact of fall and winter water level drawdown on Lake Trout spawning success and the natural environment.

7. The CVCA should re-consider the impacts of replacing the existing operating dam structure with a fixed structure to allow natural water level fluctuations.

3.5 Access

Vehicle access to Paudash Lake is gained from secondary roads off Highway #28 to the south and Highway #118 (formerly 121) to the north. McGillivray Road (County Road 9) provides the main north/south access between Upper and Lower Paudash Lake, and is maintained by the municipality of Highlands East. Public and private road networks around the lake are shown on Map 6 – Land Use Map (insert at back of report). As well as the islands, there are several mainland properties on or near Blueberry Hill on North Bay that are only accessible by water through the local marinas.

There are two public recreational boat access points to Upper Paudash Lake:

North Paudash Beach – picnic tables, parking, outhouses, swimming beach and boat launch—accessed from Hwy 118, between County Rd. 648 and the Village of Cardiff.

Rogers Landing – cement pad boat launch—end of Lewis Dr., off south end of Dyno Rd. (extension County Rd. 648 south).

There are three private commercial boat access points:

The Anchorage – Upper Paudash at the Narrows
Paudash Lake Marine – Lower Paudash near Narrows
Wil-Lou Marina – Lower Paudash near Crowe River outlet

Observations

- *There are two (2) public boat launch ramps and three (3) commercial ramps.*
- *Almost all mainland properties are accessible by road. There are only a few mainland properties on or near Blueberry Hill in North Bay that are accessible by water only.*

Recommendations – Access

8. Local municipalities should retain and improve existing public access sites.

3.6 Ownership

Land along the shoreline of Upper Paudash Lake is approximately 85% privately owned with the remaining 15% being Crown land. Burnt Island and a large portion of the backlands surrounding North Bay are Crown land. The area surrounding Lake on the Mountain is partly private and partly Crown land. There is also a 200 ft strip of shoreline retained by the Crown on the east side of North Bay, just north of the mouth to Inlet Bay; the MNR has indicated that they will not sell it to private interests (Vermeersch, MNR Bancroft, 2004). A 66 ft shoreline road allowance located around Upper and Lower Paudash Lake was transferred to the municipalities and many property owners have purchased the portion in front of their properties.

Most of the shoreline of Lower Paudash Lake is in private ownership, excluding about 5% located along the north shore; Map 6 – Land Use 2003 (insert at back of report), indicates the location of Crown land and patented (private) land.

Silent Lake Provincial Park is located in the southwest corner of the watershed. An addition of 169 hectares to the Park was recently approved through the Ontario Living Legacy Land Use Strategy, and the total area of the park is approximately 1,450 hectares (See section 7.2.2 and Map 8).

Observations

- *15% of the shoreline on Upper Paudash Lake and 5% of the shoreline on Lower Paudash Lake is in Crown Ownership. A substantial amount of the backlands surrounding North Bay is in Crown ownership.*
- *About 90% of the shoreline of Paudash Lake is in private ownership and these property owners will play a significant role in the maintenance of natural shorelines.*

<u>Recommendations</u> – Ownership

9. ***A stewardship program to encourage and educate property owners on the maintenance and restoration of shorelines should be introduced. The PLCA has already conducted a 2 year Shoreline Restoration Project of 100 properties and should consider the implementation of Phase 2 of the project.***

10. ***The MNR should be encouraged to retain the remaining Crown shorelines on Upper and Lower Paudash Lake.***

Section 4 Social Elements

Social elements enhance the quality of life on Paudash Lake. According to many shoreline residents, "a lake environment is a place where you can relax, recreate and get away from it all". For a growing number of people, it is a natural environment in which to enjoy retirement and, for others, it is a place to open new businesses and create recreational opportunities such as marinas, restaurants and bed and breakfasts. Social values are some of the most important elements that contribute to one's experience on the lake, but their diversity makes them difficult to identify and protect. On Paudash Lake these social elements include recreational activities, cultural and historic sites, landscape and aesthetics, and noise and lighting.

4.1 Recreational Boating

Boating is the second most popular recreational activity on Paudash Lake, next to swimming, with over 86% of resident survey respondents citing it as a preferred recreational activity. All types of vessels are present on the lake from non-motorized boats, such as kayaks and canoes, to large inboard motorboats. Figure 4.1 indicates the total number of boats per household of those who participated in the Residential Survey 2003; each household on the lake has about 2.93 boats, with a higher number of non-motorized boats than motorized.

Figure 4.1 – Total Boats on Paudash Lake

Type of Boat (152)	# of Boats	% of Boats	Boats per Household
Non-motorized	248	56	1.63
Motorized	198	44	1.30
Total	446	100	2.93

Source: Paudash Lake Resident Survey (2003)

Figure 4.2 indicates the percentage of households with non-motorized boats; 76% of all households have a canoe and 24% have paddleboats.

Figure 4.2 – Households with Non Motorized Boats

Type of Non-Motorized Boats (152)	# of Households	%
Canoes	116	76.3
Paddleboats	36	23.7
Sailboats	28	18.4
Kayaks	23	15.1
Windsurfers	20	13.2
Other Non-Motorized Boats	25	16.5

Source: Paudash Lake Resident Survey (2003)

Figure 4.3 indicates the percentage of households with motorized boats; 84% of all boats have two (2) stroke motors and 16% have four (4) stroke motors. There is a very low percentage of boats (2%), on the lake, with greater than 200 horse-powered motors.

Figure 4.3 – Households with Motorized Boats

	2 Stroke		4 Stroke	
Horsepower / Type of Motorized Boat (152)	**# of Households**	**%**	**# of Households**	**%**
Less than 10 hp	65	33.0	1	0.5
11 - 100 hp	64	32.0	9	5.0
101- 199 hp	24	12.0	15	8.0
More than 200 hp	1	0.5	3	2.0
PWC	11	6.0	1	0.5
Pontoon Boats	2	1.0	2	1.0
Subtotal	167	84.0	31	16.0

Source: Residents Survey (2003)

Boating is a very popular activity and there are several issues, such as safety, speed, reckless operation, and closeness of boats and water-skiers to swimmers and small vessels (e.g. canoes and kayaks), which could potentially impact Paudash Lake and its residents. There are also potential environmental concerns, which include damage to shorelines and wildlife habitat, particularly bird nesting areas and fish spawning grounds. There is also the potential of wake damage to property, docks and docked boats, and increased noise from the vessel's engines and occupants of the boats.

In August of 2003, Paudash Lake Conservation Association conducted two boating surveys at the Anchorage dock. The purpose of these surveys, results of which are described further in this Section, was to gather information on the frequency and style of boating that occurs along the channel that connects Upper and Lower Paudash Lake.

Personal Water Craft (PWC)

The operation of Personal Water Craft (PWC) is the greatest boating concern of shoreline residents. In the Resident Survey (Appendix 3), about 75% of the respondents indicated that PWCs had a moderate to significant impact on their personal enjoyment of the lake. PWC's are very unpopular, not only on Paudash Lake, but on many waterbodies across North America; some states in the United States have banned them. The main concern with PWCs appears to be with the uncaring attitude of a limited number of PWC operators, which causes all of them to be branded as "irresponsible".

In 2001, Senator Mira Spivak introduced Bill S-26 (now Bill S-8), The Personal Watercraft Act, which was passed by the Senate and introduced to the House of Commons where it waits for a final decision. Bill S-8 would require the Minister of Transportation to restrict PWC's wherever local authorities find that they cause excessive problems; restrictions could take the form of limiting hours, setting speed limits, or outright bans. The Federation of Ontario Cottagers Associations Inc. (FOCA) has given its endorsement "in principle" to the Bill.

Speed

Speed along the channel between the Lower and Upper Paudash Lakes appears to be a concern to residents, and signs are posted (through the PLCA in partnership with Jerry Luczynski of *The Anchorage*, and the late Ken Rupert) on each side of the Narrows, restricting speed to 10 km/hr. There is also a 10 km/hr speed restriction for all vessels within 30 metres of the shoreline. The environmental impacts of inappropriate boat speeds and wakes can be large and can have long-term or permanent negative effects on wildlife and vegetation. Erosion of the shoreline negatively impacts the visual aesthetics and propeller driven boats venturing into shallow waters, increases turbidity and damages weed beds, resulting in the loss of fish habitat. Disturbance of nesting waterfowl is also a problem, which results in brood loss. The long-term effects are a reduction in fish production because of loss of habitat, which means reduced food supply for waterfowl. Eventually this may result in a reduction of the local wildlife population.

In most cases, speeders are long gone by the time the police are on the scene, so it is necessary to educate the public about how to assist with community-based policing. It is important that boat registration numbers and descriptions of the drivers of the offending vessels are recorded. Also, video surveillance recordings are extremely useful as evidence and eyewitnesses would have to be willing to testify in court.

Navigation Aids (Buoys)

While the Ministry of Natural Resources has produced a bathymetry (lake bottom contour) map (Map 3), there is no Canadian Hydrographic Service nautical chart for Paudash Lake. For safe navigation on the lake, boaters are dependent on the general depth contours shown on the contour map and their own familiarity with the lake's features and navigation aids. Shoals and other hazards must be learned through word of mouth or direct experience.

In the past the PLCA has placed buoys on the rocks in Joe Bay; subsequently, this has been taken over by residents of Joe Bay.

Enforcement and Regulations

Over the next several years, implementation of the new Operator Competency Regulations should help to remind boaters of speed and safety restrictions. Until recently, there were no training requirements or certification programs for boat operators, so boaters were uneducated about safety regulations and even the meaning of signage.

Operator Competency Regulations are now in effect for powered recreational vessel operators. Since 1999, any operator under the age of 16 was required to have an Operator Efficiency Card. As of September 15, 2002, all operators of powered recreational vessels under 4 metres (13.1 ft), regardless of age, must be certified. The final phase of this legislation comes into effect September 15, 2009, at which time all powered recreational vessel operators must have a competency card.

There are courses available through the Canadian Power and Sail Squadron and the Canadian Coast Guard. For the past 3 years, Des Noblett of Paudash Lake Marina has hosted courses.

Information is available on the web sites http://www.ccg-gcc.gc.ca and http://www.cps-ecp.ca, or by calling the Boating Safety Information line at 1-800-267-6687.

Boat Traffic Survey

The purpose of the boat traffic study was to gather information about the frequency and style of boating that occurs along the channel connecting Lower and Upper Paudash lakes. The survey was carried out on the Anchorage docks. At this location, volunteers used score sheets to track the boating activity moving east and west within fifteen-minute intervals. The results of these information sheets were compiled and examined to determine the frequency and character of the boating activity in the channel.

The score sheets used to record the sighting of boats allowed for recording of information every fifteen minutes from 9:00 a.m. to 9:00 p.m., inclusive. Each time a boat crossed the observation line, a tick mark in the appropriate box was added. After fifteen minutes, the surveyor would move across to the next column on the form and continue recording boat traffic. Surveyors recorded their name for each time period they surveyed, and weather related information was collected five times during the twelve-hour observation period.

Best judgment was used to determine which category each observed vessel fell under, using the definitions below. The only boats not included in the survey are those beached, docked or unoccupied.

Skiff:	Small vessel with an outboard motor controlled by a throttle grip at the rear of the boat, which includes a discretional rating of being under 10 horsepower (hp).
Runabout:	Inboard or outboard boats having no sleeping cabins, and are controlled by a steering wheel at or near the centre of the boat. Two categories of runabouts are provided: one for outboards less than 100 hp and one for motors greater than 100 hp with the assumption that all inboard-outboard motorized boats are greater than 100 hp.
Cruiser:	A motorboat with covered sleeping quarters.
Houseboat:	A flat-bottomed pontoon motorboat with covered sleeping quarters; resembles a floating motor home.
Pontoon Boat:	A flat-bottomed pontoon boat with an open deck and railings.
Personal Watercraft:	Also known as a jet ski or jet boat.
Slow:	Obeying the speed limit.
Fast:	Exceeding the speed limit.

Boating Survey Results

The results of the boating traffic survey on Sunday, August 3rd, 2003 on the Civic Holiday weekend, and Thursday, August 21st, 2003 have been collated and summarized as follows. August 3rd was more then 80% cloudy with rain and was a steady 24 °C throughout the day and the winds were calm. August 21st was sunny for ¾ of the day with cloud cover in the evening. The temperature was 18 °C at 9:00 am, 26 °C throughout the day, and cooled to 24 °C in the evening. Winds were light to

moderate throughout the day. Generally, August 21 was considered a better day for recreational boating and this was reflected in higher boating activity.

Figures 4.4, 4.5, and 4.6 indicate the type and speed of boats passing through the channel.

Figure 4.4 - Boat Traffic Time Profile for August 3, 2003

		Morning 09:00 – 12:00		**Early Afternoon** 12:00 – 15:00		**Late Afternoon** 15:00 – 18:00		**Evening** 18:00 – 21:00	
		East	West	East	West	East	West	East	West
Motorized Boats									
Skiffs	Slow	11	12	13	13	5	7	10	7
	Fast			1	1	5	1		2
Runabouts < 100 hp	Slow	16	12	34	22	14	10	7	8
	Fast			4	9	19	15		
Runabouts > 101 hp	Slow	17	15	22	25	11	21	25	23
	Fast			7	10	10	12	9	5
Cruisers	Slow						2		
	Fast								
Houseboats	Slow								
	Fast								
Pontoon Boats	Slow	1	1	1	2	6	1	3	2
	Fast						1		2
PWC	Slow	5	2	12	9	4	6		2
	Fast				2		2		
Barges	Slow								
	Fast								
Motorized Subtotal		**50**	**42**	**94**	**93**	**74**	**78**	**54**	**51**
Non-Motorized Boats									
Windsurfer									
Sailboat									
Canoe				1	1				
Kayak			1						
Paddleboat		1					1		
Non-Motorized Subtotal		**1**	**1**	**1**	**1**		**1**		
Total		**51**	**43**	**95**	**94**	**74**	**79**	**54**	**51**

Figure 4.5 – Boat Traffic Time Profile for August 21, 2003

		Morning 09:00 – 12:00		Early Afternoon 12:00 – 15:00		Late Afternoon 15:00 – 18:00		Evening 18:00 – 21:00	
		East	West	East	West	East	West	East	West
Motorized Boats									
Skiffs	Slow	2	4	5	3	4	4	2	1
	Fast					1	2		
Runabouts < 100 hp	Slow	2	5	7	3	5	9	6	4
	Fast	1		2	1	1		1	2
Runabouts > 101 hp	Slow	4	3	9	5	10	11	4	3
	Fast			5	7	4	3		1
Cruisers	Slow			1		1	1		
	Fast								
Houseboats	Slow								
	Fast								
Pontoon Boats	Slow		1					1	1
	Fast								
PWC	Slow					1	1		
	Fast					1	1		
Barges	Slow								
	Fast								
Motorized Subtotal		**9**	**13**	**29**	**19**	**27**	**32**	**14**	**12**
Non-Motorized Boats									
Windsurfer									
Sailboat									
Canoe			1						
Kayak		1							
Paddleboat		2	1		2			1	1
Non-Motorized Subtotal		**3**	**2**		**2**			**1**	**1**
Total		**12**	**15**	**29**	**21**	**27**	**32**	**15**	**13**

Figure 4.6 – Boat Traffic By Boat Type, 2003

		August 3, 2003		August 21, 2003	
		East	West	East	West
Motorized Boats					
Skiffs	Slow	39	39	13	12
	Fast	6	4	1	2
Runabouts < 100 hp	Slow	71	52	20	21
	Fast	23	24	5	3
Runabouts > 101 hp	Slow	75	84	27	22
	Fast	26	27	9	11
Cruisers	Slow		2	2	1
	Fast				
Houseboats	Slow				
	Fast				
Pontoon Boats	Slow	11	6	1	2
	Fast		3		
PWC	Slow	21	19	1	1
	Fast		4	1	1
Barges	Slow				
	Fast				
Motorized Subtotal		**272**	**264**	**80**	**76**
Non-Motorized Boats					
Windsurfer					
Sailboat					
Canoe		1	1		1
Kayak		1		1	
Paddle Boat		1	1	3	4
Non-Motorized Subtotal		**3**	**2**	**4**	**5**
Total		**541**		**165**	

The results of the survey lead to many observations.

Observations

From the Boat Traffic Survey (Figures 4.4, 4.5, and 4.6):

- *The most active time of day for boating is in the afternoon between 12:00 and 6:00 pm*
- *Only one runabout exceeded the speed limit in the morning on both observation days. Most speeding took place in the afternoon; the use of non-motorized boats took place in the morning and early afternoon.*
- *Clearly, runabouts were the most popular boat on the water, followed by skiffs, PWCs, pontoon boats, and then cruisers.*
- *There were no houseboats or barges observed, and this can be attributed to the size of the lake and its accessibility by road.*

- *The number of boats traveling east and west is similar, and this makes sense as the observations took place in the channel connecting Lower and Upper Paudash lakes and there is no alternative route.*
- *A greater percentage of runabouts were exceeding the speed than all other boats.*
- *Only about 10% of skiffs, pontoon boats, and PWCs exceeded the speed limit.*
- *A higher percentage of speeding occurred during early to late afternoon.*

From the Residents Survey (Appendix 3)

- *Eighty-six percent (86%) of all residents state that boating is a preferred recreational activity.*
- *Every household has about three (3) boats, and there are more non-power boats (56%) than power boats (44%). Seventy-five percent (75%) of all households have at least one canoe.*
- *Eighty-four percent (84%) of all motorized boats have 2 stroke engines.*
- *Twenty-two percent (22%) of all boats have greater than 101 hp engines.*
- *Approximately seven percent (6.5 %) of all boats are personal watercraft.*

<u>Recommendations</u> - Boating

11. ***The PLCA should continue to support community-based policing, to enforce speed and wake control, in order to minimize boat wakes in the channels. Safe boating practices should be encouraged by all of those who use the lake, including non-residents and visitors; this can be promoted through signage at boat ramps, newsletters and other means of communication.***

12. ***Signage should be posted in order to raise awareness of wildlife habitat. Boaters may be encouraged to reduce speed and noise levels in the waterways if they have prior warning of nesting areas.***

13. ***The PLCA should encourage all boaters to become certified operators by notifying members of the dates and times of the programs available, and by making members aware of the information web site and telephone line.***

14. ***In order to educate boat owners about safety requirements, the Paudash Lake Conservation Association (PLCA) should encourage and assist the O.P.P. to continue to operate courtesy vessel inspections on an annual basis. A program could be offered where boaters could go to a determined location for a free inspection of safety equipment without the risk of being charged for infractions.***

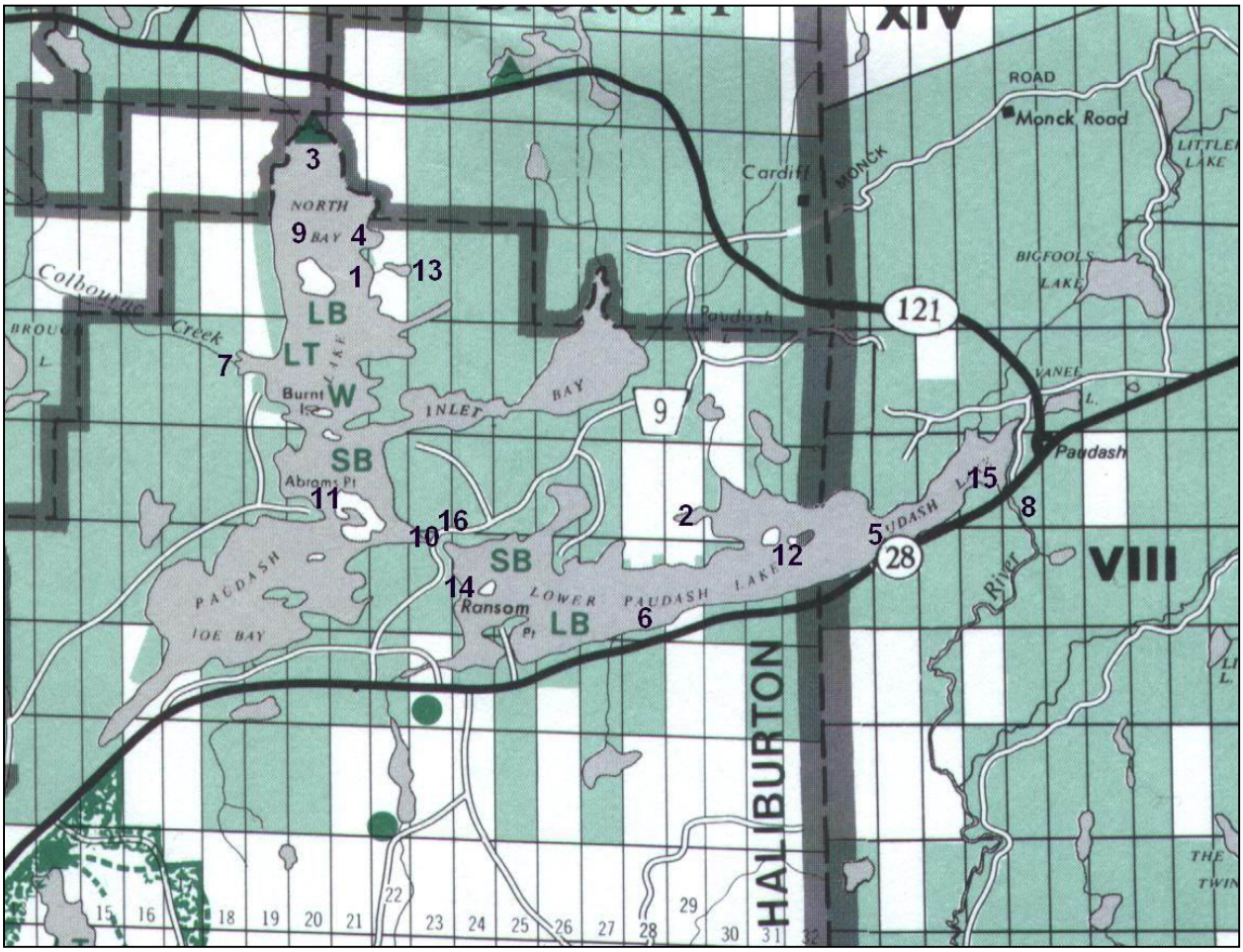
15. ***The feasibility of having an official nautical chart prepared for the Lake should be investigated.***

16. ***The PLCA should consider supporting Bill S-8, The Personal Watercraft Act, and other agencies should be encouraged to do so.***

4.2 Social, Cultural and Historic Sites

Cultural and historical sites are essential elements that maintain and improve the quality of the social environment and, where appropriate, these sites should be protected and enhanced. The Paudash Lake watershed has many locally important sites. These areas or features represent values that contribute to the character, culture and history of the area. Most of these historical sites are in private ownership, and private stewardship of these sites is imperative; Map 7 provides the location of these sites.

Map 7 Points of Interest



Points of Interest on Paudash Lake

1. Blueberry Hill – is located on the east side of North Bay on Crown Land. Known as one of the best blueberry gathering areas, local residents are often found climbing the steep and rocky slope. Access to the Blueberry Hill is by boat only.

2. Mud Bay (aka The Back Bay) – a “treasure in Paudash Lake” consisting of drowned land (land under water). Well worth a visit for a naturalist or someone seeking a quiet place.

3. North Bay Beach - a beautiful, natural sand shoreline that is used by many rural and local residents, as well as lake residents with young families, whose properties have steep or rocky shorelines. It has boat launching and picnic facilities. The Annual Regatta is held at this location.

4. The Diving Rocks and the Cliffs on North Bay - looks like fun, but not for the timid.

5. The Sand Bar - located in shallow water, the sand bar is at the eastern end of Lower Paudash Lake, just west of Sand Island. In Bob Lyons book called Touring the Past, it is reported that "Paudash Lake ended at Towel's cottage, where there was a sand bar that you could walk across." "In fact the Smiths, Edwards, etc., often walked across it to attend church at S.S.-7 School. From the sand bar a small stream flowed down to the dam (Lyon)".

6. The Fox and Hounds – a local pub and restaurant with good food.

7. Colborne Creek – a provincially significant wetland and an excellent place to see lots of wildlife.

8. Paudash Dam – originally constructed in 1928 and rebuilt in 1958, the dam is owned by MNR and managed by the CVCA.

9. North Bay – the deepest part of Paudash Lake with the best lake trout habitat.

10. The Bridge at the Narrows – the only bridge on the lake, which was originally built by McGillivray in the 1800's to provide access to the Burleigh Road.

11. Ship Island – until the tornado of 2002, this Island had trees that looked like tall masts and a bow sprint.

12. Chapman's Island (aka Johnston Island) – the site of the first cottage on Lower Paudash Lake.

13. The Lake on the Mountain – is surrounded by Crown and private land

14. Paudash Lake Marina – a busy marina and general store on the lake.

15. Wil-Lou Marine – a busy marina near the outflow of the Crowe River.

16. The Anchorage – a great resort at the heart of Paudash Lake.

Observations

- *There are many local historical, cultural and public sites that add to the quality of life on Paudash Lake*

Recommendations – Social, Cultural and Historic Sites

17. Important historical and cultural sites must be identified and protected from incompatible development.

4.3 Landscape and Aesthetics

Aesthetic values differ greatly from person to person. Some people prefer the "urban park like setting" that is characterized by manicured lawns and vegetation, and others prefer a natural setting with few interruptions of human infrastructure.

Both the residential and commercial surveys indicated that natural landscapes and aesthetics are important values, and contribute to the natural health and beauty of the lake. Maintaining a natural landscape is dependent upon the protection of such features as the shoreline and the horizon as well as the maintenance of a range of landscape types such as forest, wetland and open views.

There are two important lines in our landscape that dominate our natural environment: the shoreline and the horizon. When viewing the opposite side of the lake, our eyes are immediately drawn to these two lines and the area in between. Any development or resource activity that disrupts the natural character of these lines greatly detracts from the natural landscape. Map 1 – Watershed (insert at back of report), identifies the viewscape of Paudash Lake, which is the area that can be readily seen from any point on the lake. Development, vegetation removal, and resource extraction (forestry, mining, aggregate) in this area would be the main source of potential visual impacts, and it is important to assess these visual impacts before any development or resource activity occurs.

In order to maintain the natural appearance, shorelines and the horizon must have minimal disturbance, and shoreline development activity (boathouses, docks, recreation areas) should be kept to a minimum. High profile structures, such as two story boathouses and brightly painted buildings, detract from the natural beauty of the shoreline; however, there are no existing regulation tools that deal with the issue of colour, and communication may be the best approach. Similarly, high profile development that stands above the tree line or the horizon draws immediate attention to the structure and diminishes the natural value of the feature. Tall buildings and communication towers that stand above the treeline will have an impact on the natural aesthetics of the area and should be minimized.

Observations

- *Residential survey respondents indicate that one of the most valued attributes of the lake is the natural beauty and natural shorelines.*
- *Significant portions of Paudash Lake's shoreline remains undeveloped and in a natural state. The natural shorelines, rolling hills, and steep cliffs, surrounding Paudash Lake, contribute to the natural beauty of this area.*
- *High profile development and resource management activities (intensive forestry, aggregate, mining) can seriously impact the aesthetics of this area.*
- *Crown Land shorelines add to the natural beauty of the lake and must be protected from development.*

Recommendations – Landscape and Aesthetics

18. Work with the local townships and the Ministry of Natural Resources to ensure high profile development and resource management activities (forestry, mining, pits and

quarries) do not occur in the backlands, on heights of land, scenic areas, or within the viewscape of Paudash Lake.

19. ***Ensure that the significant removal of vegetation does not occur along the treed horizon or natural shoreline. Shoreline preservation and restoration should be encouraged.***

20. ***Ensure that the Official Plan contains policy to recognize the importance of landscapes and natural vistas on Paudash Lake.***

4.4 Noise and Lighting

Noise and indiscriminate lighting affect the enjoyment of a natural setting. Figure 4.7 outlines the concerns of residents based on the Residential Survey.

Figure 4.7 – Resident Noise and Lighting Concerns

Occurrence	% Significant Impact	% Moderate Impact	% Minimal Impact	% No impact
Daytime Noise	22	31	29	18
Nighttime Noise	14	23	38	25
Lighting	12	19	31	38

Source: Resident Survey (Summer 2003)

Peace and tranquility is highly rated as one of the essential elements of life on Paudash Lake (Figure 8.2). Ninety-one percent (91%) of the residents and 67% of the commercial operators surveyed stated that peace and tranquility is an important value.

Figure 4.7 indicates that 22% of those surveyed are significantly impacted by daytime noise and 31% were moderately impacted; nighttime noise only significantly impacted 14% of those surveyed. The survey also indicated that a great percentage of people were impacted by boat traffic and specifically PWC's. Since the lake is so heavily used during the summer months, boat traffic and specifically PWCs add to the background noise.

Some of the cottages along the shoreline have cleared natural vegetation resulting in the need for lawn mowers, weed eaters and leaf blowers. The lack of trees to absorb sound means that the opportunity for noise trespass is increased. The sound of a stereo being played on a deck or other unnatural noise can be heard from great distances, especially across water with no barriers to sound. Neither the Municipality of Highlands East or the Township of Faraday have noise control by-laws.

Light pollution is another human-made impact that affects many shoreline residents; however, it is recognized that strategically located shoreline lighting aides navigation, especially on a lake with few navigation buoys or landmarks with lighting to enable night time cruising.

The residential survey indicated that about 31% of the respondents are significantly or moderately impacted by light pollution; this could be the result of the configuration of the shoreline, as there are few open expanses of the lake. As well, a night light survey was conducted on the evening of

August 23, 2004 and a preliminary map was prepared (see Background Information Binders). The results of the survey indicated that the indiscriminate lighting on a few properties have a substantial impact on others.

The brightening of the night sky is a universal problem that continues to grow and the popularity of landscape lighting, string, spot and garden lighting of all types adds to the unnatural level of light around the lake. Research has proven that many species, including nocturnal insects that congregate around light sources, are at greater risk of predation. Bats, which consume 30-50% of their body weight in insects each night, feed on these insect masses found at light sources, which puts the insects at risk of predation. Insects, which are important pollinators and food sources for many species, and those that are unable to detect bats, are removed from the local food chain, reducing the local biodiversity (Harder, 2002). Unless some initiatives are taken to inform the public and businesses about the effects and costs associated with lighting, both viewing the stars at night and conserving the local biodiversity will become more difficult. Neither of the local townships have a by-law to control outdoor lighting.

Observations

- *A high majority of those surveyed (90%) indicated that peace and tranquility is important to their quality of life.*
- *About 31% of those surveyed indicated that they were either significantly or moderately impacted by light pollution.*
- *Excessive and unnecessary lighting detracts from the natural ambiance of the lake and results in reduced visibility of the stars.*

Recommendations – Noise and Lighting

21. Both municipalities should be encouraged to adopt a noise control by-law.

22. The PLCA should provide residents and municipal planners with examples of appropriate lighting techniques.

23. The Official Plan should include policy to limit impacts from noise and excessive lighting.

Section 5 Natural Heritage Features and Areas

5.1 Water Quality

Natural systems are dynamic yet fragile systems, responding not only to artificial stimulus but also to natural fluctuation events. All surface waters are subject to nutrient, sediment and toxic contamination, some of these come from the lake's own substrate or runoff from the landscape. These contaminants reach the surface and groundwater from the soil, geologic topography of the catchment's area, local vegetation and wildlife, precipitation and runoff, and the biological, physical and chemical processes in the water, as well as human activities in the region.

Trophic status, measured as phosphorus and chlorophyll a concentrations, is considered a good indicator or measure of a lake's ecosystem health. Eutrophication is the process of nutrient enrichment, usually by nitrates or phosphates, in aquatic systems. It occurs naturally over geological time but may be accelerated by human induced activities—a cultural eutrophication. When plant nutrient levels, such as phosphorus, increase, lake communities become more productive but less diverse. The water also becomes more turbid and algal blooms are often common.

Paudash Lake is an oligotrophic bordering on mesotrophic lake, a lake that is lacking in nutrients, which is typical of northern lakes. Unfortunately, oligotrophic lakes are more susceptible to acidification because of the low concentrations or lack of calcium ions (nutrients) to buffer or neutralize the acid precipitation. Paudash Lake lies over bedrock of both Precambrian sedimentary rocks composed largely of crystalline limestone—a calcium based rock, and granite, and the topsoil is generally acidic due to the historically dense coniferous vegetation of the area. As a result of the calcium-based bedrock, the lake is extremely resilient against acidification.

The Paudash Lake Shoreland Restoration Project (1997) was a cooperative project developed by the Paudash Lake Conservation Association, in partnership with the Ministry of Natural Resources' Bancroft District (MNR) and the Ministry of the Environment (MOE). In 1997, Paudash Lake was included as part of the MOE's Lake Partner Program—an enhanced lake monitoring series—to enhance the lake's monitoring information and support the Paudash Lake Shoreland Restoration project. During this period, the Lake Partner Program compiled water quality data from five lakes in the Bancroft District: Paudash, Eels, Baptiste, Deer and Pine. In 2001 and 2003, a revised water quality-monitoring program was initiated to capture the current state of Paudash Lake's ecosystem.

5.1.1 MOE Report on Water Quality (2004)

The following section was prepared by the MOE. This section analyzes the current and historical water quality data in order to confirm the present condition of Paudash Lake's ecosystem, as well as

identifies how the changes within the lake may potentially impact its health, the health of the aquatic species, the watershed, and its human population.

Additional information has been added to supplement MOE's report.

Paudash Lake is located in the former Townships of Bicroft, Cardiff and Faraday in Haliburton and Hastings Counties. Paudash Lake is composed of two discrete basins known as Upper and Lower Paudash Lakes. As part of the Lake Partner Program, Paudash Lake was studied in detail in 1997. A third basin, Joe Bay, has also been identified for monitoring purposes.

Water quality surveys were conducted on Paudash Lake in 2001 and 2003. Water quality parameters, as well as oxygen and temperature profiles, were measured in the deepest part of Upper Paudash (North Bay), Joe Bay and Lower Paudash Lake. Samples were collected from the euphotic zone (two times the Secchi disc depth) and from one metre off bottom. The 2001 and 2003 sampling was conducted to monitor general water quality parameters, but also for the specific purpose of monitoring the status of the oxygen habitat. The results of this sampling are presented in detail below.

Previously, water quality surveys were conducted in 1997 (May to September). In addition, historical temperature and oxygen profiles, dating back to 1973, have also been recorded. The results of past surveys were presented in a 1999 Ministry of Environment report on Paudash Lake.

This report will detail the results of the 2001 and 2003 water quality surveys, and will make some general comparisons between the historical data and the 2001 and 2003 data. Comparisons with the Provincial Water Quality Objectives (PWQO), where they exist, and recommendations for future monitoring will also be made.

Water Chemistry Analysis

The following gives a brief description of the water quality parameters, which form the basis of the water quality-monitoring program conducted by the Ministry, and provides a brief interpretation on the results obtained by the 2001 and 2003 sampling periods. Water chemistry data for the 2001 and 2003 sampling events is presented in Figure 5.1 (Upper Paudash - North Bay), Figure 5.2 (Joe Bay), and Figure 5.3 (Lower Paudash).

Figure 5.1 – Water Chemistry - Upper Paudash (North Bay)

	One Metre off Bottom				Euphotic Zone		
	July 26/2001	Sept 4/2001	Sept 12/2003	May 22/2001	July 26/2001	Sept 4/2001	Sept 12/2003
Secchi disc (m)					5	5.5	5
Calcium			8.9				9.3
Magnesium			1.66				1.82
Hardness			29				30.6
Conductivity (µs/cm)	94	106	97	90	97	99	103
pH	7.12	7.51	7.51	7.55	7.59	7.64	7.74
Alkalinity	20.5	30	20.8	22	23.5	23.5	23.9
Nitrogen; ammonium	0.008	0.128	0.02	0.016	0.008	0.008	0.021
Nitrogen; nitrite	0.002	0.004	0.001	0.005	0.002	0.002	0.001
Nitrogen; nitrate + nitrite	0.181	0.202	0.181	0.086	0.019	0.016	0.006
Phosphorus; phosphate	0.0005	0.013	0.0005	0.0005	0.0005	0.003	0.0005
Phosphorus; total	0.004	0.028	0.005	0.016	0.008	0.004	0.004
Nitrogen; total Kjeldahl	0.2	0.42	0.22	0.3	0.28	0.24	0.3
TN:TP (ratio)	95.3	22.2	80.2	24.1	37.4	64.0	76.5
Carbon; dissolved organic	3.4	4.4	3.9	3.9	4	4.3	4.7
Carbon; dissolved inorganic	4.8	7.6	1.8	4.2	4.8	5.2	4.9
Silicon; reactive silicate	1.54	2.2	1.56	1.12	0.84	0.88	0.7
							Measured in mg/L

Figure 5.2 – Water Chemistry - Upper Paudash (Joe Bay)

	One Metre off Bottom		Euphotic Zone	
	July 26/2001	Sept 12/2003	July 26/2001	Sept 12/2003
Secchi disc (m)			6.25	5.25
Calcium		9.95		10.5
Magnesium		2.22		2.24
Hardness		34		35.4
Conductivity (µs/cm)	99	102	101	106
pH	7.24	7.53	7.55	7.77
Alkalinity	28	27.8	27	27.5
Nitrogen; ammonium	0.012	0.017	0.006	0.014
Nitrogen; nitrite	0.003	0.001	0.001	0.001
Nitrogen; nitrate + nitrite	0.214	0.231	0.052	0.005
Phosphorus; phosphate	0.0005	0.0005	0.0005	0.0005
Phosphorus; total	0.008	0.009	0.006	0.006
Nitrogen; total Kjeldahl	0.28	0.26	0.24	0.3
TN:TP (ratio)	61.8	54.6	48.7	50.8
Carbon; dissolved organic	3.4	3.9	3.8	4.5
Carbon; dissolved inorganic	6.4	6.5	6	6.1
Silicon; reactive silicate	1.84	1.78	0.84	0.74
				Measured in mg/L

Figure 5.3 Water Chemistry - Lower Paudash Lake

	One Metre off Bottom			Euphotic Zone	
	Sept 4/2001	Sept 12/2003	May 22/2001	Sept 4/2001	Sept 12/2003
Secchi disc (m)	4.5	5		4.5	5
Calcium		9.95			11.7
Magnesium		2.22			2.2
Hardness		34			38.2
Conductivity (µs/cm)	107	102	99	110	113
pH	7.4	7.53	7.71	7.76	7.79
Alkalinity	31	27.8	28.5	28.5	28.4
Nitrogen; ammonium	0.128	0.017	0.02	0.002	0.022
Nitrogen; nitrite	0.001	0.001	0.004	0.001	0.001
Nitrogen; nitrate + nitrite	0.158	0.231	0.047	0.007	0.026
Phosphorus; phosphate	0.0015	0.0005	0.0005	0.018	0.0005
Phosphorus; total	0.012	0.009	0.004	0.006	0.007
Nitrogen; total Kjeldahl	0.42	0.26	0.28	0.26	0.3
TN:TP (ratio)	48.2	54.6	81.8	44.5	46.6
Carbon; dissolved organic	4.1	3.9	4.5	4.4	4.7
Carbon; dissolved inorganic	8.4	6.5	6.6	6.8	6.2
Silicon; reactive silicate	2.32	1.78	1.04	0.88	0.92

Measured in mg/L

Clarity (Secchi Depth)

Water clarity is the parameter of which people are most aware, and turbidity is a measure of water clarity (i.e., how far down the water column light can penetrate). Clarity is affected by suspended particles (sediment, algae, etc.) and the natural colour of the water; particles suspended in the water, such as clay, silt, sand and phytoplankton, scatter the passage of light through the water column. These particles enter water through natural or human caused soil erosion, waste discharge, disturbance to the riverbed, and excessive algal blooms causing an increase in turbidity. High turbidity can increase water temperatures, reduce light levels for photosynthesis for plant growth, clog the breathing gills of fish and macro-invertebrates, and decrease habitat diversity upon settling of these particles.

Water clarity is measured by using a Secchi disc, which is lowered into the water to determine the depth to which light penetrates and is, therefore, a good indication of how far down in the water column phytoplankton and vascular plants may grow. Clarity can also be used to get a sense of a lake's trophic status (oligotrophic—Secchi depth > 5 m; mesotrophic—secchi depth 3 – 5 m; eutrophic—Secchi depth < 3 m).

Paudash Lake is characterized as an oligotrophic lake—typical of northern lakes on the Precambrian shield—with clear water and low total phosphorus. Secchi disc readings were generally in excess of 5 metres for Paudash Lake, which is typical for oligotrophic lakes in the area. Lower Paudash Lake water clarity generally increased towards the end of the summer season. Secchi depths for Paudash Lake indicate that the lake is oligotrophic bordering on mesotrophic. Secchi depths ranged from a depth of 6.25 m in Joe Bay (July 2001) to a depth of 4.5 m in Lower Paudash (September 2001).

Dissolved Oxygen Profile/Temperature Profile

Most aquatic animals breathe the oxygen dissolved in the water; therefore, consistently high levels of dissolved oxygen in the water are critical to support aquatic life. Oxygen is dissolved into water from the air and is also produced by the photosynthetic activities of aquatic plants. Dissolved oxygen levels vary with water temperature and depth, flow velocity, and the presence of aquatic plants and animals. Studies have shown that fish require at least 5-6 mg/L of dissolved oxygen, while most macro-invertebrates die out at levels below 3 mg/L. Humans can affect the amount of dissolved oxygen in water through the addition of oxygen-consuming organic wastes to the water, such as sewage and food wastes, nutrients and chemicals, and by altering flow regimes.

Water temperature affects the rate of many biological and chemical processes in the waterway, particularly the amount of oxygen gas dissolved in the water. It is affected by a number of factors including the temperature of the air, the amount of shading, groundwater inflows, and stormwater runoff. Therefore, it is important to retain shoreline vegetation and prevent excessive, untreated runoff to enter the lake.

Oxygen levels are most critical for the protection of cold water fish species like lake trout. Oxygen profiles are completed to determine if oxygen depletion is a factor, with respect to ecosystem health, and to assist in the management of cold water species. Certain fish species, like lake trout, have very specific habitat requirements. Lake trout require water temperatures below 15° C and dissolved oxygen concentrations above 4 mg/L for useable habitat, but their optimal habitat is found at temperatures below 10° C and dissolved oxygen concentrations above 6 mg/L. Excessive nutrients and the resulting algae and plant growth and decomposition can cause a decrease in deep-water oxygen levels and, therefore, reduce the availability of lake trout habitat.

The PWQO for oxygen indicates that oxygen concentrations should not go below 6 mg/L at water temperatures of 10° C or colder. The PWQO do, however, recognize that oxygen concentrations in the cold, deep hypolimnetic waters are naturally lower than the objective and that some sensitive biological communities may require more stringent criteria.

In 1997, the dissolved oxygen and temperature readings indicated healthy cold water, with high dissolved oxygen content near the lake bottom. For 2001 and 2003 data, in Upper Paudash, the hypolimnium was found to contain both optimum and useable lake trout habitat. In Joe Bay and Lower Paudash, the hypolimnium was found to contain, on average, no optimum lake trout habitat. However, oxygen and temperature regimes may combine to provide a small amount of usable habitat. The results indicate that Paudash Lake has not experienced an impact on water quality due to oxygen depletion. Figures 5.4, 5.5 and 5.6 provide the Dissolved Oxygen and Temperature Profiles for North Bay, Joe Bay and Lower Paudash Lake.

Figure 5.4 - Dissolved Oxygen (DO) and Temperature Profiles, North Bay, Upper Paudash

July 26/2001			Sept 4/2001			Sept 12/202003		
Depth (m)	Temp (°C)	DO (mg/L)	Depth (m)	Temp (°C)	DO (mg/L)	Depth (m)	Temp (°C)	DO (mg/L)
0.1	23.2	6.92	0.1	20.1	7.37	0.1	20.6	8.89
1	23.2	6.91	1	20.1	7.27	1	20.5	8.97
2	23.2	6.88	2	20.1	7.24	2	20.2	9.04
3	23.2	6.81	3	20.1	7.24	3	20	9.06
4	23.2	6.83	4	20.1	7.16	4	19.6	9.07
5	23.1	6.89	5	20.1	7.22	5	19.3	9.05
6	20.5	7.71	6	20.1	7.22	6	19.2	9.07
6.25	20.3	7.78	7	20.1	7.22	7	15.8	11.1
6.5	19.6	7.84	7.25	20.1	7.24	8	11.5	11.2
6.75	18.7	8.38	7.5	20	7.22	9	9.1	10.5
7	16.4	9.31	7.75	20	7.23	10	7.3	9.7
7.25	14.8	10.22	8	15.2	9.65	11	6.6	9.29
7.5	13	10.33	8.25	13.1	9.7	12	6.1	8.95
7.75	12	10.16	8.5	12.7	9.24	13	5.9	8.95
8	10.9	10.05	8.75	10.2	9.11	14	5.7	8.81
8.25	9.3	9.12	9	9.8	9.18	15	5.6	8.78
8.5	8.4	9.04	9.25	9.7	9.35	16	5.5	8.86
8.75	8.2	8.82	9.5	8.7	8.7	17	5.4	8.96
9	8	8.67	9.75	8.2	8.49	18	5.3	8.44
9.25	7.9	8.72	10	7.9	8.4	19	5.2	8.67
9.5	8.1	8.88	11	6.8	7.95	20	5.1	8.73
9.75	7.6	8.45	12	6	7.5	21	5.1	8.64
10	7.8	8.48	13	5.8	7.21	22	5.1	8.64
10.25	7.2	8.39	14	5.5	7.12	23	5	8.64
10.5	6.4	8.31	15	5.3	7.36	24	5	8.48
10.75	6.2	8.29	16	5.2	7.42	25	4.9	8.58
11	6.2	8.24	17	5.1	7.51	26	4.9	8.61
12	5.8	8.04	18	5	7.58	27	4.8	8.7
13	5.5	7.84	19	5	7.62	28	4.8	8.52
14	5.3	7.83	20	4.9	7.68	29	4.8	8.55
15	5.2	7.82	21	4.9	7.54	30	4.7	8.57
16	5.2	7.95	22	4.9	7.57	31	4.7	8.43
17	5.1	8	23	4.8	7.29	32	4.6	8.26
18	5	8.06	24	4.8	7.12	33	4.6	7.65
19	4.9	8.14	25	4.8	7.15	34	4.6	7.65
20	4.9	8.1	26	4.7	7.15	35	4.5	7
21	4.8	8.06	27	4.7	7.15	36	4.5	6.35
22	4.8	7.8	28	4.7	6.98	37	4.5	4.82
23	4.8	7.65	29	4.6	6.97	38	4.5	3.56
24	4.7	7.66	30	4.6	6.8	39	4.5	0.6
25	4.7	7.71	31	4.6	6.62			
26	4.7	7.59	32	4.6	6.4			
27	4.7	7.56	33	4.5	6.15			
28	4.6	7.56	34	4.5	5.84			
29	4.6	7.57	35	4.5	5.38			
30	4.6	7.59	36	4.5	4.62			
31	4.6	7.47	37	4.5	4			
32	4.5	7.1	38	4.5	3.01			
33	4.5	6.82	39	4.5	1.49			
34	4.5	6.95	40	4.5	1.03			
35	4.5	6.45						
36	4.5	5.98						
37	4.5	5.6						
Mean Hypolimnetic DO:		7.77	Mean Hypolimnetic DO:		7.16	Mean Hypolimnetic DO:		8.49

Figure 5.5 - Dissolved Oxygen (DO) and Temperature Profiles
Joe Bay, Upper Paudash Lake

July 25/2001		
Depth (m)	**Temp (°C)**	**DO(mg/L)**
0.1	22.8	7.24
1	22.9	7.14
2	22.9	7.05
3	22.9	7.08
4	22.9	7.01
4.25	22.9	7
4.5	23	7
4.75	22.9	6.96
5	21.5	7.16
5.25	20.9	7.31
5.5	20.8	7.2
5.75	20.5	7.16
6	20.2	7.03
6.25	19.9	6.93
6.5	18.9	7.19
6.75	18	7.88
7	16.7	8.17
7.25	14.9	8.79
7.5	14.5	9.03
7.75	12.8	9.16
8	12.1	9.05
8.25	11.1	8.92
8.5	10.5	8.59
8.75	9.9	8.28
9	9.7	8.12
9.25	9.3	7.76
9.5	8.6	7.51
9.75	8.4	7.44
10	8.3	7.28
11	7.6	7.02
12	7.2	7.03
13	6.9	6.49
14	6.4	6.28
15	6.1	6
16	5.9	5.8
17	5.8	5.97
18	5.7	6.08
19	5.6	5.69
20	5.5	5.36
21	5.4	4.58
22	5.3	
Mean Hypolimnetic DO:		6.82

Sept 12/2003		
Depth (m)	**Temp (°C)**	**DO (mg/L)**
0.1	20.7	8.93
1	20.6	8.9
2	20.5	8.99
3	20	8.99
4	19.9	8.96
5	19.7	8.94
6	19.5	8.73
7	17.7	8.58
8	12.8	7.95
9	10	6.5
10	8.7	6.57
11	7.8	6.39
12	6.9	6.08
13	6.5	5.15
14	6.1	5.77
15	5.9	5.93
16	5.7	5.57
17	5.6	5.15
18	5.5	4.72
19	5.4	4.2
20	5.4	3.64
21	5.3	1.6
22	5.3	0.41
23	5.3	0.21
Mean Hypolimnetic DO:		5.21

Figure 5.6 - Dissolved Oxygen (DO) and Temperature Profiles Lower Paudash Lake

Sept 4/2001			Sept 12/2003		
Depth (m)	Temp (°C)	DO (mg/L)	Depth (m)	Temp (°C)	DO (mg/L)
0.1	20	8.22	0.1	20.8	9.03
1	20.2	8.25	1	20.8	9.01
2	20.2	8.25	2	20.7	8.93
3	20.2	8.23	3	20.6	8.94
4	20.2	8.12	4	20.6	9.04
5	20.2	8.27	5	19.8	8.96
6	20.2	8.24	6	19.7	8.92
7	20.2	8.05	7	19.1	8.56
7.25	20.2	8.08	8	14.4	4.24
7.5	19.9	7.33	9	11.7	3.24
7.75	19.2	7.34	10	10.2	2.35
8	17	5.98	11	9.6	2.3
8.25	15.2	5.68	12	9.2	2.39
8.5	14.8	5.12	13	8.8	1.93
8.75	13.1	4.89	14	8.2	1.7
9	12.7	4.48	15	7.8	1.08
9.25	12.2	3.97	16	7.5	0.62
9.5	11	3.68			
9.75	10.7	3.27			
10	10.6	3.19			
11	9.8	2.77			
12	9.6	2.78			
13	9.1	2.77			
14	8.6	1.81			
15	8.3	1.59			
16	7.8	1.2			
17	7.6	0.44			
18	7.4	0.26			
19	7.4	0.25			

TP (Total Phosphorus, Phosphate)

Phosphorus is a limiting nutrient—an aquatic system needs a critical minimum to function properly. A change in phosphorus levels defines the change in trophic levels of a water body or its "ecological efficiency"—the energy transfer within the system. Total phosphorus (TP) is a measure of the combined amounts of all forms of phosphorus. Elevated phosphorus levels leads to increased foaming, increased aquatic vascular plant growth, and may result in excessive algae production—high concentrations of algae and aquatic plants leads to excessive oxygen depletion in deeper bottom portions of a lake. The PWQO sets two thresholds for phosphorus levels: 1) lakes that are at, or below, 10 µg/L for the ice free period should remain below this limit; and 2) lakes that are above 10 µg/L, but below 20 µg/L, should remain below this level to prevent nuisance concentrations of algae from occurring.

In addition, trophic status of lakes (Figure 5.7) can be measured by the concentration of phosphorus (Vollenweider and Kerekes 1982). Generally, lakes with phosphorus levels less that 0.01 mg/L are considered to be oligotrophic; those with phosphorus levels between 0.01 mg/L and 0.02 mg/L are considered to be mesotrophic; and those with phosphorus levels greater than 0.02 mg/L are considered to be eutrophic.

Figure 5.7- Trophic Status of Lakes (Vollenweider and Kerekes, 1982)

Tropic Category	Total Pλ mg/m^3	Chl *a* mg/m^3
Ultra-oligotrophic	≤ 2.5	≤ 0.7
Oligotrophic	2.5-8	0.7-2.1
Mesotrophic	8-25	2.1-6.25
Eutrophic	25-80	6.25-19.2
Hypertrophic	≥ 80	≥ 19.2

Source: MNR Ontario Streams Assessment Protocol (2003)

For Upper Paudash, the TP levels remained similar within both the euphotic and hypolimnetic zones at levels, which reflect oligotrophic/low mesotrophic levels, which are, on average, below the PWQO for phosphorus levels.

For Joe Bay, the sampling shows that the TP levels remain consistently below the 10 µg/L (0.01mg/l) concentration in both the euphotic and hypolimnetic zones; levels which are consistent with oligotrophic lakes. On average, the water meets the PWQO for phosphorus levels.

In Lower Paudash, the sampling shows that the TP levels, on average, were below the 10 µg/L (0.01 mg/l) concentration, with slightly higher values recorded in the hypolimnium. On average, TP levels are consistent with oligotrophic lakes bordering on mesotrophic. On average, the water meets the PWQO for phosphorus.

An oligotrophic status is typical of lakes found on the Precambrian shield. The granite rock bed and sparse mineral soil contribute to the low nutrients and minimized energy transfer in the water.

pH

All animals and plants are adapted to a certain pH range, usually between 6.5 and 8.0. A change in pH outside the normal range of a water body will cause a loss of species depending on their sensitivity. The aquatic pH is affected by the production of and demand for oxygen and carbon dioxide as well as the catchment geology. Human caused changes in pH may result from disturbance to acidic soils, industrial wastes or burning of fossil fuels.

The PWQO indicates that water should be maintained between a pH of 6.5 and 8.5 in order to protect aquatic life—an excellent pH range is between 6.5-7.5, good/fair is 5.5-6.5, <8 (alkalinity), and poor is 5.0-5.5, 8.8-9 (alkalinity). Photosynthesis fixes or removes carbon dioxide from the water, and carbon dioxide in water forms a week carbonic acid; therefore, the more productive the lake, the higher the pH levels. Lakes with pH levels that are usually above 7.0 have high alkalinity and can, therefore, neutralize acidic runoff and precipitation.

The 2001and 2003 sampling periods showed that lake pH ranged from 7.12 to 7.79, which meets the PWQO. Paudash Lake is at a low risk of acidification because of its bedrock.

Alkalinity

The PWQO for alkalinity indicates that the alkalinity should not be decreased by more than 25% of natural ambient concentrations. Lakes with less than 10 mg/L may be susceptible to acidification and those with concentrations greater than 25 mg/L are considered not to be sensitive to acidification. In highly productive lakes, the alkalinity will rise in the epilimnium as a result of photosynthetic activity.

The 2001 and 2003 sampling periods showed that lake alkalinity ranged from 20.5 to 31 mg/L with levels being lower in Upper Paudash and highest in Lower Paudash. Alkalinity levels indicate that the lake is not sensitive to acidification.

Conductivity

Conductivity, which is greatly influenced by sodium and chloride, is the ability of a solution to conduct an electrical current due to the presence of dissolved salts (ions), which is also known as salinity or total dissolved solids (TDS). Aquatic plants and animals need natural salt in solution for their growth; however, if levels exceed the water's normal range, the community will become stressed and sensitive species will start to die off. A watershed in lowland catchments with conductivity levels at <100 µS/cm is excellent. Conductivity is affected primarily by the geology of the area, but flow and human caused changes to catchments can significantly alter natural conductivity levels.

From the 1997 MOE report, the metals and chemicals that Paudash Lake was tested for did not exceed any of the Provincial Water Quality Objectives. Chromium concentrations were higher in Paudash Lake compared to other lakes in the watershed, but not high enough to cause concern. However, the current levels of calcium do favour the proliferation for zebra mussel populations to establish themselves within the lake—caution.

Nitrogen (Ammonium, Nitrite, Nitrite + Nitrate, Total Kjeldahl (TKN))

There are five major forms of nitrogen found in fresh water: organic nitrogen (TKN), ammonium, ammonia, nitrate and nitrite. Of these, only ammonia, nitrate and nitrite are readily available to aquatic plants. As such, these three plus TKN, which is a measurement of organic nitrogen, are usually analyzed as part of water monitoring programs.

Ammonia, which is a by-product of decomposition, is found in most healthy systems at low concentrations, usually less than 1.0 mg/L. In eutrophic lakes and in oxygen depleted lake bottoms, ammonia concentrations can increase and become lethal to some organisms.

Nitrate is available for plants and can be used to help determine trophic status. In healthy lakes typical concentrations are below 0.05 mg/L. Nitrate levels may be reduced in the epilimnium due to demand and uptake by algae.

TKN concentrations are higher in eutrophic lakes because the nitrogen is tied up in the algae.

Ammonium nitrogen is a transient form of ammonia created under anoxic conditions. In a healthy system, nitrite is typically found at concentrations of less than 0.005 mg/L and occurs as a transient form of nitrogen between ammonia and nitrate under aerobic conditions.

In Upper Paudash, nitrate levels varied throughout the year with values in the euphotic zone generally remaining below 0.02 mg/L and values in the hypolimnium approaching 0.2 mg/L. Nitrite levels were generally below 0.005 mg/L. TKN levels remained fairly constant throughout the sampling period.

In Joe Bay, nitrate levels varied throughout the year with values in the euphotic zone as high as 0.05 mg/L and values in the hypolimnium over 0.2 mg/L. Nitrite levels were generally below 0.005 mg/L. TKN levels remained fairly constant throughout the sampling period.

In Lower Paudash, nitrate levels varied throughout the year with values in the euphotic zone generally remaining below 0.04 mg/L and values in the hypolimnium reaching 0.23 mg/L. Nitrite levels remained below 0.005 mg/L. TKN levels remained fairly constant throughout the sampling period.

Total Nitrogen: Total Phosphorus (TN:TP ratio)

Total nitrogen (TN) is the total of all the forms of nitrogen present and total phosphorus (TP) is a measure of total phosphorus. The ratio of TN:TP can be used to determine which element is limiting the growth of primary producers. A higher ratio indicates that phosphorus is the limiting factor. TN:TP ratios below 20:1 may result in an increased risk of algal blooms.

In Upper Paudash, the TN:TP ratio was highly variable ranging from a low of 24.1:1 in the euphotic zone to a high of 95.3:1 in the hypolimnium. In Joe Bay, the values were more consistent, ranging from as low as 48.7:1 in the euphotic zone to as high as 61.8:1 in the hypolimnium. In Lower Paudash, the values ranged from as high as 81.8:1 (spring) in the euphotic zone, but otherwise remained fairly constant at approximately 47:1. The results from the 2001 and 2003 sampling periods indicate that phosphorus is limiting the growth of primary producers in all three water bodies.

Carbon (Total Dissolved and Inorganic)

Total organic carbon (TOC) consists of both dissolved and organic carbon, and is composed of humic substances and degraded plant and animal materials. TOC can be used as a measure of eutrophication. TOC in natural waters ranges from 1 to 30 mg/L; the higher values being indicative of eutrophication, and those values less than 3 mg/L are considered to represent oligotrophic conditions.

In Upper Paudash, TOC values ranged from 5.7 to 12 mg/L; in Joe Bay, the TOC values ranged from 9.8 mg/L to 10.6 mg/L; and in Lower Paudash, the TOC values ranged from 10.4 mg/L to 12.5 mg/L.

Comparisons with Historical Data

Upper Paudash - North Bay

Water sample data from 2001 and 2003, for the euphotic zone, can be compared with that from the1997 MOE Study. Generally, there appears to be a slight increase in conductivity, pH and alkalinity, and a general decrease in nitrogen and phosphorus. The TN:TP ratio was highly variable from a low of 24.1:1 in May 2001 and a high of 76.5:1 in September 2003; TOC generally remained the same.

Comparisons of the oxygen concentrations indicate lower concentrations in 2001 than those recorded in 1997; however, the concentrations recorded in 2003 appeared to be similar to those recorded in 1997. When compared to 1984 data, there appears to be a slight increase in lake trout habitat availability, both optimal and useable habitat.

Upper Paudash - Joe Bay

Euphotic water samples from 1984 can be compared with those from 2001 and 2003. The comparison shows that water clarity was 6.25 metres in July 2001 as compared to 4.5 metres in 1984—a marked increase in water clarity. The results also show a substantial increase in the TN:TP ratio, which correlates with a decrease in TP, and a slight increase in Nitrogen over this period.

Comparisons of the oxygen and temperature profiles for September 1984 and 2003 indicate that useable lake trout habitat remained the same and that there was no optimal lake trout habitat present.

Lower Paudash

In 1997, sampling for Lower Paudash included samples from the euphotic zone only and, therefore, limited the comparisons between the 1997 study and the 2001 and 2003 sampling periods. Comparisons of euphotic samples indicate that TP, TOC, TKN and alkalinity levels remained fairly consistent, while pH generally increased. The TN:TP ratio varied substantially by season.

Future Monitoring

Water quality sampling from Paudash Lake has been collected sporadically and for differing purposes, making it difficult to compare sampling periods and to draw conclusions about trends in lake water quality. Developing a standardized monitoring program, which collects routine samples from various locations, would produce, over time, a database that could be used to establish trends in water quality. As well, creating a standardized database could also help in identifying key parameters, which are affecting water quality and, in turn, be used to focus remedial action on those activities that are deemed to be the source of the elevated or lowered parameters. This database could also be used by resource related agencies to assist in monitoring lake trout habitat, dam levels, fish management programs, and the effects of land use changes as well as other environmental factors that influence Paudash Lake's water quality health.

Inventorying and monitoring the water quality of tributary streams, particularly those that are implicated as sources of lake water quality impacts, would also assist in determining the origin of water quality impacts. Future actions, such as the identification of shoreline activities and land uses which pose a risk to water quality, and the identification and protection of riparian zones and sensitive natural areas (wetlands, fish spawning areas, etc.), will also aide in improving water quality and in increasing the health of the aquatic ecosystem.

Future monitoring should include, as a minimum, the above noted parameters, and those of interest, such as bacteria, to the Association, and sampling should take place at various locations and during various seasons.

Conclusions

Generally, there is a lack of consistent data available to make accurate assessments of how water quality is changing over time. Water quality sampling has been conducted sporadically and for differing purposes. Continued monitoring and water quality sampling would provide a more detailed picture of how water quality changes throughout the year and how the lake and individual basins are responding to changes in land use and the efforts that aim to improve water quality.

Based on the information available, water quality seems to be fairly stable with some localized improvements noted since the mid-1980s. The results of the 2001 and 2003 water quality sampling periods are similar to those presented in the 1997 MOE report, which indicated that the lake was oligotrophic bordering on mesotrophic.

Continued improvements will result in cleaner water, more aesthetically pleasing water quality such as improved water clarity, improved aquatic habitat, and the promotion of sensitive aquatic species like lake trout. Collection of data, over time, will provide the necessary data to identify trends in water quality and to identify which water quality parameters need to be addressed. Continued monitoring programs and activities aimed at improving water quality will help to achieve the goal of a healthier Paudash Lake ecosystem.

5.1.2 Major Water Quality Concerns for Property Owners

Turbidity (Siltation)

Reduction of the sun's ability to penetrate water is the result of the suspension of fine particles, such as clay, in surface water. This affects the entire food chain by inhibiting the growth of phytoplankton (small floating plant life); creating lower oxygen levels, which interferes with fish and benthic macro-invertebrate (small animals living on the bottom of a lake) respiration; impairing the visual range of fish, which impacts their ability to feed; and degrading fish spawning beds. Factors that influence and increase lake water turbidity include:

1. Landscape activities — large and small scale development activities, including unprotected placement of fill or disturbance of soil at or near the shoreline, creates the opportunity for fine soils to enter the lake water, particularly during spring runoff and rain storms;

2. Riparian disturbance — erosion created by the alteration or removal of natural shoreline structures causes fine soil particles to be washed into the lake rather than being filtered or captured by the vegetation;
3. Increased impervious surfaces — non-vegetated or developed surfaces such as fields and site-specific storm water management systems (larger developments and roads) create greater opportunity for fine soil particles and storm water runoff to be washed into a lake; and
4. Recreational impacts — increased and inappropriate boating practices create shoreline erosion through excessive wake action and disturbance of the clay and silt on the lake bottom (i.e., scouring).

Nutrient Enrichment

An increase in nutrient loading, particularly in phosphorus levels, may accelerate the eutrophication (gradual nutrient enrichment) process and increase the growth of algae and aquatic plants in a lake, because both phosphorus and nitrogen are essential nutrients for plant and animal growth. There are many natural and human sources of phosphorus and nitrogen including phosphate and nitrate found in soils and rocks, wastewater treatment plants, leaking septic systems, and runoff from fertilized land and manure storage areas. Increased levels of phosphate and nitrate encourage the growth of aquatic plants and algal blooms that in turn elevate temperature and alter other important water body characteristics such as concentrations of available dissolved oxygen. Several factors help to create or increase nutrient enrichment of lakes including:

1. Nutrients, in particular phosphorus from terrestrial/landscape runoff. Phosphorus occurs naturally in nature, but it is also generated from human-made sources (laundry detergent and fertilizers). These nutrients enter Paudash Lake through the streams that flow into the lake and the natural flow that occurs during the spring runoff;
2. Fertilizers used on lawns and gardens that border the lake introduce nutrients through runoff or groundwater;
3. Septic systems that may be poorly designed, out of date, not operating properly, or not pumped out regularly contribute to the nutrient loading of Paudash Lake;
4. The low attenuation of the soil, due to the underlying granite bedrock, increases the contamination of ground and surface water; and
5. Drainage from roads and lots, which also contributes to erosion and the concentration of suspended sediments near shore, increase aquatic chloride and sodium concentrations.

High nitrate and phosphate levels in drinking water (>1 mg/L) degrade the water quality, which poses a threat to human health; nitrate levels at <0.05 mg/L are excellent and < 0.1 mg/L is good, and phosphate levels at <0.008 mg/L are excellent and <0.025 mg/L is good. For lakes and reservoirs phosphate levels should remain between 0.005-0.05 mg/L and nitrate levels should remain between 0.10-0.5 mg/L to prevent eutrophication.

Fecal bacteria (*Escherichia* coli) measurements indicate the possible presence of disease causing bacteria, viruses and other micro-organisms, which can cause other impacts such as cloudy water and unpleasant odours. Sources of fecal contamination of surface waters include wastewater treatment, septic tanks, and domestic and wild animal feces. The PWQOs, which are numerical and

narrative ambient surface water quality criteria, for *E. coli* indicates that bacteria concentrations should not go above 100 counts per 100 ml for fecal coliform and 1000 counts per 100 ml for total coliforms in drinking and recreational waters.

Watershed runoff from roads and other impervious surfaces increases the chloride influx into the aquatic system. Excessive levels of chloride (ions) in the water can have serious biological implications (metabolic complications) on intolerant aquatic species; therefore, many municipalities have investigated the use of sand instead of salt on roads during the winter months.

For more information regarding Ontario's Provincial Water Quality Objectives (PWQO), please visit the web site at http://www.pscanalytical.com/ce/guidelines/pwqo.htm.

Toxic Substances

A toxic substance is generally defined as a substance that causes harm to the environment or human beings. Many toxins are synthetic and include polychlorinated biphenyls (PCBs), pesticides, dioxins, and furans. Other substances, such as mercury, can be a by-product of human industrial activity and contamination, or a natural occurrence. Toxins present in lake water accumulate in long-lived biological organisms such as fish and ducks and, accordingly, can present a danger to humans when these animals are consumed. Environmental factors that create or increase toxic upload and radionuclide (radioactive material) contamination from soil leaching or runoff into Paudash Lake include:

1. Mercury, which naturally occurs in trace amounts in the air, water, rocks, soil, plant and animal matter, can be leached out by the acidity in the water. Naturally occurring mercury anomalies are associated with fault zones in the bedrock, and groundwater seepages in streams are a source of mercury entering the lakes;
2. Toxins were regularly used in and were by-products of area industries until the 1970s, and may have entered the water systems through industrial discharges;
3. Pesticides, herbicides and fertilizers used at or near the waterfront can enter the watershed;
4. Soaps and cleaners containing phosphates and other chemicals used in the vicinity of the lakeshore or storm water system; and
5. Untreated storm water runoff entering the watershed will transport toxins and radionuclide contamination into the lake—the concentration levels of these toxins are dependent upon the attenuation of the local soil and site drainage regime.

Observations

- *Based on the information available, water quality seems to be fairly stable with some localized improvements noted since the mid-1980s. The results of the 2001 and 2003 water quality sampling periods are similar to those presented in the 1997 MOE report, which indicated that the lake was oligotrophic bordering on mesotrophic.*
- *Water testing on Paudash Lake has occurred sporadically since 1973. Generally, there is a lack of consistent data available to make accurate assessments on how water quality is changing over time.*

- *Secchi depths for Paudash Lake indicate that the lake is oligotrophic bordering on mesotrophic, which means that Paudash Lake water has low turbidity or is quite clear. The Secchi depths—clarity, ranged from a depth of 6.25 m in Joe Bay (July 2001) to a depth of 4.5 m in Lower Paudash (September 2001).*
- *The total phosphorus for Paudash Lake, including Upper, Lower and Joe Bay, remained consistently below 10 µg/L, which is below the Provincial Water Quality Objectives (PWQO) for phosphorus levels and, also, indicates an oligotrophic bordering on mesotrophic trophic status. The PWQO for oxygen indicates that oxygen concentrations should not go below 6 mg/L at water temperatures of 10° C or colder.*
- *In Upper Paudash, the hypolimnium was found to contain both optimum and useable lake trout habitat. In Joe Bay and Lower Paudash the hypolimnium was found to contain, on average, no optimum lake trout habitat; however, oxygen and temperature regimes may combine to provide a small amount of usable habitat.*
- *In 1997, the zooplankton hauls contained a great variety of large-sized species, indicating a healthy population. The presence of a variety of large zooplankton species in the lake is an indication of good water quality conditions as well as a healthy food chain at the lower trophic status.*
- *The 2001 and 2003 MOE report did not measure the total chlorophyll a concentration and did not inventory the plankton or zooplankton populations in the lake.*
- *An inventory of the benthic community—a good indicator of environmental impacts, was not conducted in the 2001 and 2003 inventory. Benthic invertebrates, such as the presence of caddisfly, stonefly and mayfly nymphs (similar to fish, these benthic species breathe with gills and need cold, well oxygenated water to survive), are used as early warning indicators since they respond to environmental stressors after relatively short exposure.*
- *Recent alkalinity levels indicate that Paudash Lake is not sensitive to acidification.*
- *The results from the 2001 and 2003 sampling periods indicate that the phosphorus and nitrogen levels are limiting the growth of primary producers in all three water bodies.*
- *In Upper Paudash Lake there appears to be a slight increase in conductivity, pH and alkalinity, and a general decrease in nitrogen and phosphorus. Low phosphorous levels prevent the formation of nuisance algal blooms such as blue-green algae; however, concentrations can be expected and may occur in windward embayments of Lower Paudash Lake.*
- *Comparisons of oxygen concentrations shows lower concentrations in 2001 than those recorded in 1997; however, the concentrations recorded in 2003 appear to be similar to those recorded in 1997. When compared to 1984 data, there appears to be a slight increase in lake trout habitat availability, both optimal and useable habitat.*
- *In Joe Bay, clarity was 6.25 metres in 2001 as compared to 4.5 metres in 1984—a marked increase in water clarity. Comparisons of oxygen and temperature profiles in September of 1984 and 2003 indicate that useable lake trout habitat remained the same and that there was no optimal lake trout habitat present.*
- *The MOE and MNR have identified Joe Bay and Inlet Bay as a Policy II lake, which is at capacity for new development. North Bay is identified as being near capacity, which requires Environmental Impact Studies to assess the impact of new lot creation before they are approved.*

<u>Recommendations</u> – Water Quality

23. Support the Municipality of Highland East's Official Plan policy that recognizes Inlet Bay and Joe Bay to be "at capacity" and North Bay to be "near capacity". Consider Official Plan policy that requires storm water management plans to address the contribution of surface runoff quality and quantity to aquatic eutrophication.

24. The PLCA should continue to collect water quality information, including a thorough inventory of the benthic and plankton communities, through MOE's "Lake Partner Program". A consistent monitoring program, which collects routine samples from various locations, would produce and contribute, over time, a database that could be used by cottagers, resource managers and researchers to establish trends in water quality and standardized monitoring protocols.

25. An annual report of the results of the water testing should be sent to all property owners on the lake that reports on the "State of the Water Resource".

26. A phosphorus-free life style should be promoted around the lake (flyers and posters including a list of local phosphate-free products and alternatives). Encourage residents to maintain septic systems, including regular pumping out of tanks.

27. The use of fertilizers and pesticides should be banned within 50 metres of the lake. The township may consider passing a by-law, but during the interim this could be encouraged and implemented on a volunteer basis.

28. Continue planting along the shoreline, including aquatic plants, to enhance both the buffering and uptake of seasonal nutrients and fish habitat. Decrease the amount of impervious landscapes along the shoreline by reducing the demand for manicured lawns and the construction of paved driveways…keep it natural!

29. ***Inventory and monitor the water quality of tributary streams, particularly those, which are identified as sources of lake water quality impacts.***

30. Continue to identify and protect sensitive natural areas (wetlands, fish spawning areas, etc.) as well as littoral and riparian zones.

31. Continue the educational and volunteering efforts by the PLCA, including weekend workshops and training sessions, and the preparation of new information products, such as newsletter articles and web site links, that promote both the high quality of life on Paudash Lake and the Lake Plan.

5.2 Vegetation

> *"Thanks to thousands of years of practice, natural shores are among the world's most effective, least expensive erosion controls. The mix of plants, shrubs, and trees form a complex web of roots and foliage that knits the waterfront together, holding the bank in place and fending off the impacts of wind, rain, waves, and boat wake. The bulwark against erosion is the shoreline, the place where land and water meet. In its natural state, the shoreline is a profusion of stones, plants, shrubs, fallen limbs, and tree trunks. But it's also a busy intersection, with animals, insects, and birds traveling back and forth. Moose and deer pick their way down to the water to forage or drink. Mink skulk about on hunting trips. Water birds waddle from their nests to the water. Overhanging vegetation shades and cools the water, and acts as a fast- food outlet for fish by producing a rain of aphids, ants and other insects that slip from their perches above".*
>
> Shore Primer, Department of Fisheries and Oceans Canada (2001)

The naturally occurring vegetation found in the water, in wetlands, on the shoreline, and on the uplands adjacent to a lake is important for maintaining the health of a lake system. For example, the contribution of the vegetative shoreline cover includes: littoral zone shading, which decreases water temperatures by maintaining cool summer temperatures; filtering runoff from the landscape; and providing a food source, from terrestrial insects and leaf litter, to the benthic community. In addition to providing natural beauty, vegetation is vital to the health and abundance of fish and wildlife in and around a lake. Over the years, development of Paudash Lake has caused a significant loss of this vegetation and the result has been a negative impact on the fish and wildlife population.

The benefits of retaining a naturally vegetated shoreline include:

1. Preventing soil erosion and loss of landmass by wind, waves and rain through vast rooting systems and foliage, which contribute natural cover to anchor soils and to prevent the runoff of sediments into the lakebed, as well as protecting spawning beds;
2. Preventing the fertilization of lake water and sediments by trapping the nutrient rich precipitation and runoff;
3. Shading and cooling the lake water;
4. Preserving the ecological integrity of the ecosystem; and
5. Increasing the beauty of the surrounding landscape.

Destructive activities that negatively impact the shoreline include: the removal of shoreline and aquatic vegetation; adding sand, rocks and retaining walls to artificial shoreline beaches; planting non-native or ornamental plant species such as Kentucky blue grass, Norway maple, purple loosestrife and Asian pondweed; and the artificial regulation of water levels, which creates an abnormal "false shoreline" along the lakeshore. A general survey of the shore of Upper and Lower Paudash Lake has found that extensive destruction of natural shoreline has occurred, and only a handful of properties have retained a relatively natural shoreline. According to the Mosquin et al. (1992) report, although the lake still retains stretches of unconverted shoreline, it is scattered and actively shrinking.

The Paudash Lake Shoreland Restoration Project (1997) was designed to include environmental education and improvements to the fish and wildlife habitat and the water quality of Paudash Lake through the process of planting shrubs and ground cover along the shoreline. The participating

properties were mapped, described, classified and photographed in order to prepare recommendations. Shoreline Classification included:

1. Natural—properties with no significant human disruption;
2. Regenerative—properties that have been developed in consideration of the local environmental requirements;
3. Ornamental—properties where the natural vegetation has been removed and replaced with non-native species; and
4. Degraded—properties that contribute to the degradation of the lake ecology.

Only 90 out of more than 600 lake residents and cottagers participated. The assessment phase of the shoreland restoration project resulted in cumulative agreements to plant nearly one thousand plants, available for free from the Mutual Association for the Protection of Lake Environments (MAPLE).

Natural shorelines contain three distinct zones, each with its own characteristic communities of organisms.

Littoral Zone	This zone is the section from the water's edge to the area of the lakebed where the sunlight can penetrate to the bottom.
Riparian Zone	This zone is the area from the water's edge to approximately 30 metres inland; also known as the floodplain.
Upland Zone	This is the zone beyond the riparian zone.

Although each of these zones provides a separate function to the health of the lake, it should be noted that the shoreline is a natural progression of each zone seamlessly transitioning into the next. Therefore, alteration of any zone affects the entire shoreline by diminishing the shore's ability to support life on the lake.

Littoral Zone

The littoral zone extends out from the shoreline into the lake towards a point where sunlight is no longer capable of penetrating the water column down to the lakebed or bottom. It is a highly productive transitional zone between terrestrial and aquatic ecosystems. Many plants and animals fulfill part of or their entire lifecycle (i.e., live, feed, grow and reproduce) within this zone including several rare species of dragonflies, frogs, turtles and fish.

Aquatic plant species in the littoral zone, such as duckweed, arrowhead, water milfoil, water lily and pondweed species, act as the lungs of the lake, converting sunlight into food and releasing oxygen in the process. They also capture nutrients and sediment as well as filter toxins from the terrestrial and atmospheric component of the watershed. A list of the plant species found in the littoral zone of Paudash Lake can be found in Figure 5.8.

Aquatic macro-invertebrates, such as mayfly, stonefly and caddisfly nymphs, not only provide a great food source for the minnows, frogs, birds and mammals feeding in the area, but they are also good indicators of water quality health since they respond to changes in water quality after short exposure. These insects require well-oxygenated water to survive, so if the water quality deteriorates these species will start disappearing and be replaced by more tolerant species, such as worms and chironomids, which reduces the biodiversity of the aquatic ecosystem including the food web. These insects make-up a small part of the benthic community found in the substrate and water column of the littoral zone.

Aquatic plants, rocks and submerged wood provide habitats, shade and protective cover for fish and a surface for other plants, invertebrates and algae to adhere to, and provides a food source for moose (some common aquatic plants eaten by moose during summer include *Nuphar* spp.—yellow pond lily, *Potomegeton* spp.—pond weeds, *Utricularia vulgaris*—bladderwort, *Myrophyllum verticillatum*—water milfoil, and macroscopic algae). Nutrients such as calcium, nitrogen and phosphorus, which are critical to the health of aquatic plants and animals, are released from the sediment, substrate and decaying biota, leached from soils and groundwater, and deposited into the lake from atmospheric precipitation and surface runoff from the surrounding landscape. It is this rich diversity of habitat and food sources that provides for the abundance of fish and wildlife in Paudash Lake.

Figure 5.8 – Vegetation From the Littoral Zone

Common Name	Latin Name
Curly pondweed (W-M)	*Potamogeton crispus*
Floating pondweed (W-M)	*Potamogeton natans*
Knotted pondweed (W-M)	*Potamogeton nodosus*
Sago pondweed (W-M)	*Potamogeton pectinatus*
Fern pondweed (W-M)	*Potamogeton robbinsii*
Snailseed pondweed (W-M)	*Potamogeton spirillus*
Flat-stemmed pondweed (W-M)	*Potamogeton zosteriformis.*
Water plaintain (W-M)	*Alsima plantago-aquatica*
Broad leaved arrowhead (W-M)	*Sagittaria latifolia*
Lesser duckweed (W-M)	*Lemna minor*
Watermeal species (W-M)	*Wolffia* spp.
Pipewort (W-acidic lakes and fens)	*Eriocaulon septangulare*
Pickerel weed (W-M)	*Pontederia cordata*
Water shield (W-M)	*Brasenia schreberi*
Yellow pond lily (W-M) (moose)	*Nuphar variegatum*
Fragrant white water lily (W-M) (moose)	*Nymphaea odorata*
Flat-leaved bladderwort (W-M-F)	*Utricularia intermedia*
Common bladderwort (W-M)	*Utricularia vulgaris*

F=fen, M=marsh, Moose=food source, W=wetland

Source: Mosquin et al. (1992)

The littoral zone in Paudash Lake has been subjected to many disturbances, including shoreline development, dam construction, artificial water levels, increased recreational activities, vegetation removal, acid precipitation, and increased sediment runoff, over the past century, and the alteration of the lake area continues to have a negative impact on its long-term health. Each log, rock or plant removed, or each request for "a small variance" may seem insignificant, but the cumulative effect of hundreds of these occurrences is significant.

In the Paudash Lake Shoreland Restoration Project Report (1997), Doug Brown cites Sandy Hay from the Mutual Association for the Protection of Lake Environments (MAPLE) regarding significant shoreline modification and its impact on natural habitat; for example, he states that the creation of docks has both positive and negative impacts to the lake's ecosystem. The positive aspects relate to the potential creation of fish habitat such as floating or post docks, which can provide shade and additional protected areas for fish habitat. Whereas, the negative impacts of dock construction and maintenance can have varying degrees of impact on the lakebed; for example, crib and cement docks can negatively impact a larger area of the lakebed as well as cover-up and destroy critical fish habitat.

The study also refers to excavations as a source of significant shoreline modification. The negative impacts of lake sediment excavation are the destruction of fish and vegetation habitat and an overall change in shape of the natural shoreline.

Boathouses that have concrete foundations have a negative impact on shoreline vegetation because of the excessive vegetation and sediment removal requirement for construction purposes. Retaining walls are built to stop erosion along the shoreline. Unfortunately, retaining walls usually only work for a short period of time because the soil behind or further upland from the retaining wall experiences erosion from waves and ice regardless. Not only does the installation of a retaining wall require the removal of all shoreline vegetation, it also results in the lack of nearshore vegetation in the littoral zone. The act of the retaining wall reflecting waves without any dissipation results in the waves' total energy scouring the lake bottom and the inability of plant life to grow. Hard shorelines, such as man-made retaining walls, provide inhospitable habitat for fish.

Riparian Zone

The combination of trees, shrubs and herbaceous plants along the natural shoreline makes up the riparian zone of the lake, which is the area immediately adjacent to the shoreline. The riparian zone is an exceptionally important portion of transitional land between the lake, river, stream, floodplain or wetland and the upland ecosystems such as forests.

The complex web of roots and foliage knits the waterfront together, which helps to control erosion. The vegetation, soil and bedrock act as filters to sift impurities and break down toxins, such as fertilizers, heavy metals, and excessive phosphorus, and hold onto sediments, as well as buffer excessive water from surface runoff. Figure 5.9 contains a partial list of plants that grow in the riparian zone. As well, some of the trees and shrubs listed in Figure 5.10 – Upland Tree and Shrub Species, may also be found in the riparian zone.

The typical vegetation of the riparian zone includes a mixture of deciduous and coniferous tree and shrub species such as eastern hemlock, eastern cedar, white birch, poplar, speckled alder and other upland species tolerant to shade and/or wet soil conditions. The riparian zone provides shelter, feeding grounds, and a nesting refuge for wildlife, including colonial water birds, songbirds, raptors, turtles, frogs, snakes, beavers, muskrats, raccoons and otters, as well as many other species. The vegetation, which overhangs the near shore waters, provides shade that helps to keep the water temperatures cool, windbreaks to prevent shoreline erosion, insects as a food source for amphibians, fish and other species, and leafy and woody debris that helps to maintain the nutrient cycles and provides micro-habitats in the littoral zone. There is a significant relationship between good water quality and diverse micro-habitats and the density of shoreline vegetation and woody debris in the riparian zone; with a well-functioning riparian zone, water quality is maintained and the aquatic systems are able to support life and life cycles such as spawning fish.

Figure 5.9 – Vegetation from the Riparian Zone

Common Name	Latin Name
Stiff clubmoss (W-S)	*Lycopodium* annotinum
Ground-cedar (W)	*Lycopodium complanatum*
Water horsetail (W-SF)	*Equisetum fluviatile*
Meadow horsetail (W-S)	*Equisetum pratense*
Cinnamon fern (W-SM)	*Osmunda cinnamomea*
Royal fern (W-peatland edges)	*Osmunda regalis*
Bulblet fern (W-moist woods)	*Cystopteris bulbifera*
Crested wood fern (W-S)	*Dryopteris cristata*
Spinulose wood fern (W-S)	*Dryopteris carthusiana*
Ostrich fern (W-DS)	*Matteucea struthiopteris*
Sensitive fern (W-S)	*Oolclea sensibilis.*
Christmas fern (W-BF)	*Polystichum acrostichoides*
Marsh fern (W-S)	*Thelypteris palustris*
Narrow leaved cattail (W-M)	*Typha angustifolia*
Stemless burreed (W-M)	*Sparganium chlorocarpum*
Floating burreed (W-M)	*Sparganium fluctuans*
Least burreed (W-M)	*Sparganium natans*
Slender Naiad, Water Nymph (W-M)	*Najas flexilis*
Common water weed (W-M)	*Elodea canadensis*
Canada bluejoint (grass) (W-MF, ditches)	*Calamagrostis canadensis*
Rattlesnake manna grass (W-F, shores)	*Glyceria canadensis*
Tall manna grass (W, ditches)	*Glyceria grandis*
Marsh Timothy (W-F indicator)	*Muhlenbergia glomerata*
Northern panic grass	*Panicum boreale*
Reed canary grass (W-M, ditches)	*Phalaris arundicacea*
Swamp meadow grass, Fowl meadow grass, Fowl blue grass (W-MF)	*Poa palustris*
Torrey's manna grass	*Torreyochloa pallida*
Wild rice (W-shallow water, muddy)	*Zizania palustris*
Water sedge (W-MF, ditches)	*Carex aquatilis*
Compressed sedge	*Carex aurea*
Golden sedge	*Carex lutea*
Bebb's sedge (W-MS)	*Carex bebbii*
Lesser panicled sedge (F and lakeshores)	*Carex diandra*
Soft -leaved sedge (CS, F)	*Carex disperma*
Yellow sedge (W)	*Carex flava*
Filiform sedge	*Carex gracillima*

Figure 5.9 – Vegetation from the Riparian Zone

Common Name	Latin Name
Porcupine sedge (W, ditches)	*Carex hystericina*
Inland sedge (W-FS)	*Carex interior*
Bladder sedge (W-S)	*Carex intumescens*
Lake sedge	*Carex lacutris*
Wire sedge (W)	*Carex lasiocarpa*
Bristle- stalked sedge (W)	*Carex leptalea*
Poor sedge (Poor F, CS)	*Carex magellanica*
Longstalk Sedge	*Carex pedunculata*
Cyperus-like sedge (CS)	*Carex pseudo-cyperus*
Three-fruited sedge (CS)	*Carex trisperma* var. unknown
Beaked sedge (W)	*Carex utriculata*
Greenish sedge (W)	*Carex viridula*
Fox sedge (W)	*Carex vulpinoides*
Blunt spikerush (ditches)	*Eleocharis obtuse*
Marsh spike rush (M)	*Eleocharis palustris*
Rough cotton grass (F)	*Eriophorum tenellum*
Cotton grass (F, CS)	*Eriophorum viridi-carinatum*
Hardstem bulrush (W)	*Scirpus acutus*
Black bulrush (S)	*Scirpus atrovirens*
Woolgrass (M)	*Scirpus cyperinus*
Hudsonian Bay clubrush (F, peaty ditches)	*Scirpus hudsonianus*
Floating bulrush, Mermaid's hair (W)	*Scirpus subterminalis*
Softstem bulrush (W)	*Scirpus validus*
Jack- in- the- pulpit (HS, CS)	*Arisaema triphyllum*
Water arum, Wild calla (W-SM, ditches)	*Calla palustris*
Dudley's rush (M)	*Juncos dudleyi*
Soft rush (M, ditches)	*Juncos effuses*
Bluebead lily	*Clintonia borealis*
Trout lily (TH)	*Erythronium americanum*
Canada mayflower, Wild lily-of-the-valley	*Maianthemum canadense*
Three-leaved Solomon's seal	*Maianthemum trifolium*
Red trillium (moist to dry TH)	*Trillium erectum*
Northern Blue flag (W-MSF)	*Iris versicolor*
Showy lady's-slipper	*Cypripedium reginae*
Helleborine (dry to moist TH)	*Epipactis helleborine*
Twayblade species	*Liparis spp. (loeselii)*
White adder's mouth	*Malaxis monphyllos*
Leafy white orchid	*Platanthera dilatata*
Hooded ladies'-tresses	*Spiranthes romanzoffiana*
Sweet gale (F and shorelines)	*Myrica gale*
False nettle	*Boehmeria cylindrical*
Water smartweed	*Polygonum amphibium*
Water dock	*Rumex verticillatus*
Common hornwort—"coontail"	*Ceratophyllum demersum*
Red baneberry	*Actaea rubra*
Virninia virgin bower	*Clematis virginiana*
Goldthread	*Coptis trifolia*
Water buttercup	*Ranunculus gmelini*
Tall meadow rue	*Thalictrum polygamum*
Watercress	*Nasturtium officinale (Rorippa nasturtium-aquaticum)*
Pitcher plant (BFS)	*Sarracenia purpurea*
Spatulate- leaved sundew (FS)	*Drosera intermedia*

Figure 5.9 – Vegetation from the Riparian Zone

Common Name	Latin Name
Round- leaved sundew (BFS)	*Drosera rotundifolia*
Bishop's cap—"mitrewort"	*Mitella diphylla*
Naked mitrewort (S, moist upland)	*Mitella nuda*
Wild black current	*Ribes americanum*
Wild gooseberry	*Ribes cynosbati*
Wild gooseberry	*Ribes hirtellum*
Swamp current	*Ribes lacustre*
Foanflower—"flase mitrewort"	*Tiarella cordifollia*
Black chokeberry (S, lakeshores)	*Aronia melanocarpa*
Common strawberry	*Fragaria virginiana*
Marsh cinquefoil	*Potentilla palustris*
Raspberry	*Rubus idaeus*
Narrow-leaved meadowsweet (W-S)	*Spirea alba*
Steeplebush	*Spirea tomentosa*
Wood sorel	*Oxalis acetosella*
Gaywings	*Polygala paucifolia*
Poison ivy	*Rhus radicans*
Winterberry	*Ilex verticillata*
Mountain holly (S)	*Nemopanthus mucronatus*
Touch-me-not—"jewelweed" (S, shorelands)	*Impatiens capensis*
Alder-leaved buckthorn (moist uplands)	*Rhamnus alnifolia*
Grape-woodbine (moist woods)	*Parthenocissus vitacea (Parthenocissus inserta)*
Marsh St. John's-Wort (peaty shores, F)	*Triadeum fraseri*
Sweet white violet (W, cold woods)	*Viola blanda*
Marsh blue violet (moist)	*Viola cucullata*
Northern white violet	*Viola pallens*
Water-willow, Whorled loosestrife, Swamp loosestrife (W)	*Decodon verticillatus*
Purple loosestrife (W)	*Lythrum salicaria*
Enchanters nightshade	*Circaea quadrisulcata*
Southern broadleaf Enchanter's nightshade (moist TH)	*Circaea lutetiana*
Fireweed	*Epilobium angustifolium*
Northern willow herb	*Epilobium glandulosum*
Wild sarsaparilla	*Aralia nudicaulis*
Bulb bearing water hemlock	*Cicuta bulbifera*
Water parsnip	*Sium sauve*
Bunchberry dogwood—"pop flower"	*Chamaepericylmenum canadense*
Red osier dogwood (W, CS)	*Cornus stolonifera*
One-flowered wintergreen	*Moneses uniflora*
Shinleaf (mixed upland T to IT)	*Pyrola elliptica*
Round-leaved wintergreen	*Pyrola rotundifolia*
One sided pyrola	*Pyrola secunda*
Bog rosemary (B, RF)	*Andromeda glaucophylla*
Leatherleaf (B, F, CS)	*Cassandra calyculata*
Creeping, Trailing snowberry (TB, S)	*Gaultheria hispidula*
Sheep laurel	*Kalmia angustifolia*
Bog laurel (PF, B, CS)	*Kalmia polifolia*
Labrador tea (CS, B, F)	*Ledum groenlandicum*
Low sweet blueberry (B, F)	*Vaccinium angustifolium*
Small cranberry (B, F, CS)	*Vaccinium oxycoccus*
Swamp candles (F)	*Lysimachia terrestris*

Figure 5.9 – Vegetation from the Riparian Zone

Common Name	Latin Name
Tufted loosestrife (M)	*Lysimachia thrysiflora*
Starflower (U, CS)	*Trientalis borealis*
Buckbean—"bog-bean" (F indicator)	*Menyanthes trifoliata*
Swamp milkweed	*Asclepias incarnata*
Blue vervain	*Verbena hastate*
Cut-leaved/American bugleweed	*Lycopus americanus*
Northern bugleweed (W, F)	*Lycopus uniflorus*
Wild mint	*Mentha arvensis*
Heal-all (self-heal)	*Prunella vulgaris*
Common skullcap (F, shores)	*Scutellaria galericulata*
Mad dog skullcap	*Scutellaria lateriflora*
Nightshade	*Solanum dulcamara*
Marsh speedwell	*Veronica scutellata*
Labrador bedstraw (W)	*Galium labradoricum*
Small bedstraw (FS)	*Galium trifidum*
Fragrant bedstraw (S)	*Galium triflorum*
Twinflower	*Linnaea borealis*
Canada fly honeysuckle (S)	*Lonicera canadensis*
Common elder	*Sambucus canadensis*
Hobblebush	*Viburnum alnifolium*
Wild raisin	*Viburnum cassinoides*
Nannyberry (moist)	*Viburnum lentago*
Marsh bell flower (M)	*Campanula aparinoides*
Cardinal-flower (W)	*Lobelia cardinalis*
Pale spike lobelia	*Lobelia spicata*
Yarrow	*Achillea millefolium*
Aster	*Aster spp.*
Lance leaved (eastern lined) aster	*Aster lanceolatus*
Devil's, Large leaved beggar's ticks (moist)	*Bidens frondosa*
Common fleabane	*Erigeron philadelphicus*
Spotted Joe-pye weed (W)	*Eupatorium maculatum*
Boneset (W)	*Eupatorium perfoliatum*
Field hawkweed	*Hieracium pratense*
Northern sweet coltsfoot (S)	*Petasites frigidus*
Wild lettuce	*prenanthes trioliolata*
Golden ragwort	*Seneio aureus*
Northern bog goldenrod (SF)	*Solidago uliginosa*
Common dandelion	*Taraxacum officinale*

Bog=bog, C=coniferous, D=deciduous, F=fen, H=hardwood, I=intolerant, M=marsh, P=poor, R=rich, S=swamp, T=tolerant, U=upland forests, W=wetland

Source: Mosquin et al. (1992); Newmaster et al. (1997); and NHIC (2004)

Upland Zone

The upland zone is the periphery of a lake's riparian zone. It is an area typically forested with trees and sloped having, typically, well-drained soils in comparison to those found in the riparian zone. The types of tree species and species assemblages (i.e., ecological community types) found within these forested upland zones is dependent upon several environmental factors including soil type, bedrock or substrate material, topography, climate, depth of water table, moisture regime, shade and the interrelationship with its associated ecological community. The tolerance level of each species to these varied environmental factors determines the species composition of the upland zone.

Paudash Lake is located within the Great Lakes-St. Lawrence Forest Region of Canada. Its upland zones consist of many tree species tolerant to extreme conditions such as fluctuating moisture regimes, shade or acidic soils; these tolerant species include red maple (*Acer rubrum*), eastern hemlock (*Tsuga canadensis*), balsam poplar (*Populus balsamifera*), black and white spruce (*Picea mariana*, and *P. glauca*, respectfully), yellow birch (*Betula alleghaniensis*), large-toothed aspen (*Populus grandidentata*), red oak (*Quercus rubra*), beech (*Fagus grandifolia*), ironwood (*Ostrya virginiana*) and speckled alder (*Alnus rugosa*). As well, many intolerant species, including white (dry) and red pine (dry/rich-moist) (*Pinus stobus* and *P. resinosa*, respectfully), white birch (rich-moist) (*Betula papyrifera*), maple sugar (rich-moist) (*Acer saccharum*) and basswood (rich-moist) (*Tilia Americana*), strive in the dryer, more well-drained soil conditions of Paudash Lake's uplands. The upland vegetation around Paudash Lake consists predominantly of a tolerant hard maple forest, and Figure 5.10 provides a list of the common tree species found in the vicinity.

Figure 5.10 – Upland Zone Tree and Shrub Species

Common Name	Latin Name
Canada Yew	*Taxus canadensis*
Balsam Fir (B)	*Abies balsamea*
Tamarack (W)	*Larix laricina*
White spruce (B)	*Picea glauca*
Black spruce (W)	*Picea mariana*
White pine	*Pinus stobus*
Red pine	*Pinus resinosa*
Hemlock (B)	*Tsuga canadensis*
Eastern white cedar (B)	*Thuja occidentalis*
Balsam poplar (B)	*Populus balsamifera*
Bebb's willow	*Salix bebbiana*
Pussy willow	*Salix discolor*
Diamond willow	*Salix eriocephala*
Shining willow	*Salix lucida*
Slender willow	*Salix petiolaris*
Speckled alder (W)	*Alnus rugosa*
Yellow birch (B-W)	*Betula alleghaniensis*
White birch (B-U)	*Betula papyrifera*
Beaked hazel	*Corylus cornuta*
White elm (B)	*Ulmus americana*
Striped maple—"moosewood"	*Acer pennsylvanicum*
Red maple (W)	*Acer rubrum*
Mountain maple	*Acer spicatum*
Sugar maple	*Acer saccharum*
White ash (U)	*Fraxinus americana*
Black ash (W)	*Fraxinus nigra*
Red Oak (B)	*Quercus rubra*
Largetooth Aspen	*Populus grandidentata*
Beech	*Fagus grandifolia*
Ironwood/Hop hornbeam	*Ostrya virginiana*
Basswood	*Tilia americana*

B=both, U=upland species, W=wetland species

Source: Mosquin et al. (1992)

The deep roots of trees provide stability to the shoreline. The dense foliage of the canopy buffers the shore from winds and cools the area, with its shade, as well as boosts the humidity around the lake and provides shelter for wildlife including deer, fox, squirrels, chipmunks and a great variety of birds. Another healthy effect of the upland and riparian zones is the filtering of an estimated 90 % of runoff from winter snow and rains before it enters the lake; this filtering is important to ensure that silt and sediments from shoreline development do not reach the lake.

The effects of development in the upland zone have been greater in terms of change than has occurred in the Riparian Zone. Higher density development, which has increased lot coverage and intensity of use, results in forested areas receiving a more severe impact than would be felt with lower density development.

Observations

- *Shoreline and aquatic vegetation is important for maintaining water quality and the protection of fish and wildlife habitat as well as the aesthetics of the landscape.*
- *According to Mosquin et al. (1992) the littoral, riparian and upland zones on Paudash Lake have had extensive losses of vegetation and valuable habitat, especially in highly developed areas of the shoreline where sand, rocks, retaining walls, boathouses and manicured lawns have replaced the natural vegetation.*
- *In the past few years, due to the efforts of the Paudash Lake Shoreland Restoration Project, the shoreline has retained areas of "relatively good shape" because of various restoration and re-vegetation initiatives by the local residents. However, only 90 out of the 600 plus known residents have participated in the program and, for development purposes, shoreline vegetation continues to be selectively or completely removed on Paudash Lake. Continued efforts, including Phase II of the restoration project, need to be encouraged and in some areas enforced, especially within areas of the provincially significant wetlands, to prevent further deterioration of Paudash Lake's shorelines.*
- *Development projects proposed for Upper Paudash Lake, within North Bay boundaries, will have to adhere to an Environmental/Lake Impact Assessment prior to project approval.*
- *Property owners need to be informed about landscape alternatives to manicured lawns, paved driveways and other impervious features, non-native plants species, and sandy-beaches to help reduce undesirable and inhospitable artificial landscapes along the shoreline.*

Recommendations – Vegetation

32. Lakefront owners that have > 25% disturbance of shorelines should be encouraged to restore their property shoreline areas back to a natural state by protecting and retaining the existing native vegetation and planting only native species (grasses, sedges, shrubs and trees) wherever possible. Ideally, 75% of the shoreline lot should remain in a natural state with the exception of marinas.

33. The PLCA should encourage the municipalities to ensure that new development protects the integrity of the shorelines by minimizing the loss of native vegetation and substrates, and prevents runoff, during construction, into the lake.

34. ***Encourage the municipalities to adopt Official Plan Policy regarding the retention of natural shorelines through the creation of shoreline activity protection areas, and promote the planting of trees and shrubs, the use of environmentally friendly in-water materials for docks, and minimize shoreline activity areas (areas for docks, boathouses and recreational activity) to 25% of the lot frontage.***

35. ***Encourage the restoration of degraded areas:***
    a. ***In the Littoral Zone consider in-water rehabilitation with the assistance of the Conservation Authorities (need in-water permits) by adding downed native logs and other woody debris, as well as carefully placed rocks, near the shoreline to create micro-habitats for aquatic species and to protect the natural substrate;***
    b. ***In the Riparian Zone create a buffer of native plants, shrubs and trees between the water line and lawn, to discourage erosion and prevent sediment runoff; and***
    c. ***In the Upland Zone replant native trees, in areas that do not block the view from the residence, to buffer strong winds, maintain cool water temperatures, protect slope gradient and erosion, and provide habitats for native species.***

36. ***Municipal planning documents should require the mandatory protection of shoreline buffer areas. There should be a mandatory 15 metres of vegetative, "non-disturbance" buffer along the shoreline of native vegetation; a larger buffer creates more protection for water quality and increases the aesthetics of properties.***

37. ***Property owners should be informed about the benefits of naturalizing their properties and where to find "free" native species to plant. Programs should be developed to educate, assist and encourage landowner stewardship to "naturalize" their shorelines. Two excellent restoration guides include: <u>The Shore Primer – A Cottager's Guide to a Healthy Waterfront</u>, by Fisheries and Oceans Canada (2001), and <u>Restoring Natural Habitats: A Manual for Habitat Restoration in the Greater Toronto Bioregion</u> (it is non-area specific), prepared by Hough Woodland Naylor Dance Ltd. and Gore & Storrie Ltd., for the Waterfront Regeneration Trust (1995). Both of these documents describe the principles of basic shoreline protection, including terrestrial and aquatic habitats in the riparian zone, and various rehabilitation procedures and techniques.***

38. ***The planting of native vascular plant, shrub and tree species should be encouraged because non-native or "exotic" species can have serious negative impacts on the environment. Local nurseries and landscaping businesses should be encouraged to stock and promote the use of local plants and trees as well as locate non-profit organizations that will donate native species, tools and free labour.***

39. ***The municipality should develop a "No Tree Cutting" or "Tree Preservation" forestry by-law to ensure that lots retain a percentage of their natural vegetation, including shoreline plants and trees, to prevent an increase of stormwater runoff from impervious surfaces, landscape alteration, and from resource activities such as clear-cuts.***

5.3 Wetlands

Wetlands are land types that are permanently or temporarily submerged or permeated by water, including vegetated areas of relatively shallow open water, seasonally flooding forests, swamps, marshes, fens, bogs and peatlands. They occur intermittently across the landscape along lakes, rivers and streams, or in any area where the groundwater table is close to the surface. Wetlands provide substantial ecological, social and economical value to any lake through the maintenance and improvement of water quality, the attenuation or detention of rain and runoff that assists in controlling flooding, and important habitat for wildlife, including heronries, fish spawning sites and turtle nesting grounds, as well as conditions to support a wide variety of vegetation including rare and unique species such as manna grass, beaked sedge, buckbean, pitcher plants and sundews, bog rosemary, Labrador tea and low-bush cranberry. These "special features" result in substantial social and economic benefits and opportunities for the local residents including fishing, boating, other recreational activities, wildlife viewing, and an overall appreciation for nature.

Paudash Lake has an abundance of wetlands in its watershed, especially along its vast shoreline. Paudash Lake has two Provincially Significant Wetland complexes: Inlet Bay-Eastern Lower Paudash Lake Wetland Complex and Central Paudash Lake Wetland Complex. On the Canadian Shield, development may be permitted in a provincially significant wetland and on adjacent lands (120 m) provided that an Environmental Impact Assessment (EIA) demonstrates that there will be no loss of wetland function, a loss of wetland area, or result in subsequent demand for future development, which would negatively impact existing wetland functions.

The abundance of wetlands on Paudash Lake and the general knowledge of the importance of wetlands prompted the Paudash lake Conservation Association to solicit the services of Mosquin Bio-Information Limited and Atkinson & Huizer Biosurveys to evaluate the wetlands and to complete, in 1992, A Study of the Biology and Ecology of Paudash Lake, Haliburton/Hastings Counties, Ontario, with Proposals for Management and Restoration. These evaluations sparked a series of environmental activities.

As part of this study, the wetlands surrounding Paudash Lake were evaluated using the Ministry of Natural Resources' Ontario Wetland Evaluation System (1984). The wetland evaluation system is based on scientific criteria and was primarily designed to serve the needs of Ontario's planning process. The evaluation system recognizes the critical role of wetlands in maintaining healthy ecosystems; it identifies and inventories the biophysical features or values of a wetland, and provides a method of rating wetlands relative to one another using a point system that quantifies these wetland values. Wetlands are scored based on grouping these "wetland values" into four component categories: biological, social, hydrological and special features. If the overall combined score for all four categories exceeds a score of 600 points, or if one of the Biological or Special Features components exceeds an individual score of 200 points, than the wetland is considered provincially significant.

The conclusion of the Mosquin et al. (1992) report, based on the existing provincial Wetlands Evaluation System, was that thirty-three (33) individual wetlands were connected to Paudash Lake and formed a single complex wetland, 450 ha in size. The following is a summary of the total points for the "original" wetland complex scored:

Biological Component	193
Social Component	177
Hydrological Component	99
Special Features Component	240
Total Score	**709**

This wetland complex scored a combined total of 709 points, 240 of which were scored in the Special Features Component. These scores would have normally qualified the "Paudash Lake Wetland Complex" as a provincially significant wetland, but soon after the completion of the Mosquin et al. (1992) report, the Ministry of Natural Resources released a new Wetland Policy.

In 1993, MNR revised the wetland evaluation system splitting the system into two manuals—southern and northern—in order to reflect the wetland locations south and north of the Canadian Shield, and their respective MNR site region boundaries (i.e., 7E and 6E for southern Ontario and 5E, 4E, 3E and 2E for northern Ontario), which resulted in point allotment changes for the system; therefore, many significant wetlands had to be re-evaluated.

Paudash Lake's location on the Precambrian/Canadian Shield falls within the Northern Ontario Wetland Evaluation System. Therefore, MNR had to apply the northern evaluation guidelines to the Mosquin et al. (1992) report before a designation of "provincially significant" could be applied.

In 1994, Biota Environmental Contractors applied this new system to the Mosquin et al., 1992 report to re-evaluate Paudash Lake wetlands. The *Northern Ontario Wetland Evaluation System* allows wetland complexes, but only if wetlands within the same watershed are within 750 metres of one another, which contradicted the 1.5 km allotment in the Southern Ontario Wetland Evaluation System, which was developed in 1984. Therefore, when Biota Environmental Contractors of Dorset, under contract to the MNR, applied the northern wetland evaluation to Paudash Lake, they identified four wetland complexes: Joe Bay-Paudash Lake, Paudash Lake-North Bay, Central Paudash Lake and Inlet Bay-Eastern Lower Paudash Lake; the latter two qualified as "Provincially Significant Wetlands". The Moxley Lake Wetland Complex was not originally included but, during the Lands for Life Land Use Strategy, this complex was included in the addition to Silent Lake Provincial Park.

The provincially significant Central Paudash Lake Wetland Complex, which has a total area of 78.6 ha, comprising of: thirteen (13) wetlands; four (4) wetland types (6% bog, 11% fen, 45% swamp and 38% marsh); twenty-six (26) vegetation communities (8 swamp, 16 marsh, 1 bog and 3 fen ecological community types); and two (2) site types (63% palustrine—permanent or intermittent outflow, and 37% lacustrine--exposed to the lake). The other provincially significant wetland is the Inlet Bay-Eastern Lower Paudash Lake Complex, which has a total area of 317.4 ha, comprising of: five (5) large wetlands; two (2) wetland types (79% swamp and 21% marsh); thirty (30) vegetation communities (12 marsh and 18 swamp ecological community types); and two (2) site types (67% palustrine and 33% lacustrine).

Wetland Evaluation on Paudash Lake

Inlet Bay – Eastern Lower Paudash Lake Wetland Complex:

Biological Component	158	
Social Component	146	
Hydrological Component	166	
Special Features Component	147	
Total	**617**	**Total Wetland Complex Size is 317.4**

Central – Paudash Lake Wetland Complex:

Biological Component	198	
Social Component	150	
Hydrological Component	108	
Special Features Component	178	
Total	**634**	**Total Wetland Complex Size is 78.6 ha. (13)**

North Bay – Paudash Lake Wetland:

Biological Component	94
Social Component	130
Hydrological Component	121
Special Features Component	78
Total	**423**

Joe Bay – Paudash Lake Wetland Complex:

Biological Component	112
Social Component	126
Hydrological Component	120
Special Features Component	132
Total	**490**

Moxley Lake Wetland – Silent Lake Provincial Park

Biological Component	116
Social Component	160
Hydrological Component	123
Special Features	127
Total	**526**

The Ontario Wetland Evaluation System identifies four wetland types: marsh, swamp, fen and bog; all four wetland types are found on Paudash Lake. The physiographic position of a wetland in the landscape defines its site type: isolated, palustrine, riverine and lacustrine. The site location of a

wetland strongly influences its productivity, which is based upon the different sources supplying the nutrients.

Wetlands usually support fish habitat indirectly even though no direct link to an obvious open body of water is visible at the time of viewing (e.g., seasonal inundations may occur to allow fish access). Even if there is no direct connection at any time, a wetland may be deemed essential to providing critical flow to a nearby watercourse that does provide fish habitat. Therefore, the removal or infilling of wetlands may be a contravention of the Fisheries Act.

Paudash Lake is comprised of 51.3% Lacustrine—wetlands that are exposed to the lake, which have moderate to high productivity because the local vegetation is influenced by the changes in lake water levels, and 44.7 % Palustrine—wetlands that occur upland from riverine and lacustrine wetlands, often found in headwater areas, where water flow is either intermittent or absent. Palustrine areas are often low in productivity because they rely on precipitation, overland flow and groundwater seepage for a supply of nutrients. The remaining 4% of Paudash Lake is comprised of Riverine—wetlands that are located at or along the mouth of a river flowing into a lake, which are usually very productive.

Paudash Lake is comprised of many wetlands, which are predominantly found along the shores of the lake and the mouths of its in-flowing streams and out-flowing river. These wetlands vary in size, species composition, characteristics and ecological significance. The majority of wetlands surrounding Paudash Lake are represented by treed and thicket (shrub dominated) swamps and marshes, with submergent vegetation sometimes extending well into the lake. Only a tiny proportion (2%) along the eastern shoreline of Central Paudash Lake is represented by the locally rare (in the Algonquin Region) fen-type, and only one bog, underlain with rare peat soils, which represents only 1% of the wetland, is directly across the lake from the fen wetlands.

A complete list of all wetland species, which are dispersed across the littoral, riparian and upland zones, is found in Figures 5.8, 5.9 and 5.10.

Swamps

Swamps—a 25% cover or more of trees and tall shrubs, are wooded wetlands—usually black spruce (*Picea mariana*), tamarack (*Larix laricina*), black ash (*Fraxinus nigra*) and silver maple (*Acer saccharinum)*, found in areas of fluctuating standing water, and are often covered by coniferous trees, tall shrubs—usually speckled alder (*Alnus rugosa*), herbs and mosses**.** The soil is saturated, especially during early spring after the snow melt and the rains have flooded the area, the substrate is usually continuously waterlogged and, frequently, there is an abundance of pools and channels indicating subsurface water flow but, in some areas, soils may get the opportunity to dry down to dryer conditions by late summer. The soil is often neutral or moderately acidic in reaction, and shows little deficiency in oxygen or in mineral nutrients.

Swamps represent the most common type of wetland associated with Paudash Lake, which are often situated behind or along-side the marsh-covered areas. A total of 60% of the evaluated wetlands are classified as swamp, including Wetland 17 and part of Wetlands 13, 16, 25 and 26 (see original report for location).

The swamps of Paudash Lake include both forested swamps, which include mature deciduous and coniferous trees, or dead standing trees, stumps and thickets (i.e., tall shrub swamps). Forested and thicket swamps have similar water level and chemistry characteristics, and are assessed as "swamp" wetland type, but distinguished by the predominance of either the "tree" or "shrub" form.

The Paudash Lake treed swamps are dominated with eastern cedar (*Thuja occidentalis*), tamarack (*Larix laricina*) and black ash (*Fraxinus nigra*); an undergrowth shrub layer of willow (*Salix* spp.), speckled alder (*Alnus rugosa*) and dogwood (*Cornus* spp.) species; and a groundcover layer of dense grasses, sedges and mosses. The second swamp type are the Paudash Lake thicket swamps, which are characterized by tall shrubs, including species of willow, dogwood and alder, meadowsweet and sweet gale, as well as undergrowth layers of grasses, sedges and mosses.

Marshes

Marshes are wet areas of standing or flowing water, frequently interspersed with channels or pools of deep or shallow open water; marshes account for 37% of the evaluated wetlands on Paudash Lake. Marshes may be bordered by a peripheral band of trees and shrubs (i.e., swamps), but the predominant vegetation consists of a variety of emergent, non-woody plants including dominant emergents, such as cattails and reeds, and narrow or fine-leaved emergents such as grasses, sedges and rushes. Cattails, typical marsh vegetation, are efficient colonizers of new and disturbed habitats. Cattails provide a good source of nest building materials for birds, including the marsh wren, pied-billed grebe, sora, red-winged black bird, and American bittern, as well as a food source for other animals and birds such as the Canada geese and the muskrat that eat the rhizomes and young spikes. If you have ever seen a mound of cattail leaves on the side of a pond or marsh you have located the home of a muskrat.

Low shrubs, such as sweetgale, red osier, leatherleaf and winterberry, may also occur in marshes. Where the open water areas occur, a variety of submerged plant species (spp.), such as water milfoil (*Myriophyllum* spp.), waterweed (*Elodea* spp.) and pondweeds (*Potamogeton* spp.), or floating and emergent plant species, such as water lilies (*Nymphaea* spp., and *Nuphar* spp.), water plantain (*Alisma plantago-aquatica*) and broad-leaved arrowhead (*Sagittaria latifolia*), flourish. A complete list of all the submerged and emergent plants is listed in Figure 5.8 (Littoral section).

The substrate usually consists of mineral or organic soils that have a high mineral content, but in some marshes there may also be as much as two (2) metres of peat accumulation in slightly acidic waters. The water chemistry of marshes is usually neutral to slightly alkaline and has a relatively high oxygen saturation level, but is also dependent upon interactions with several other environmental factors, including the surrounding soil and plant community.

Fens

Fens develop at groundwater seepage areas—groundwater seepage or springs is an indication of good water quality as well as marl deposits (i.e., Limestone), or alkaline conditions in the soils near lakes, which are often known as "calcareous fens". Fens are characterized by surface layers of poorly to moderately decomposed peat, often with well-decomposed peat near the base. Fens usually develop in situations of restricted drainage where oxygen saturation is relatively low and

mineral supply is restricted. The water and peat found in fens are less acidic than in bogs, and often are relatively nutrient rich since they receive water through groundwater discharge from adjacent uplands; therefore, poor fens have low pH whereas rich fens have a relatively high pH.

In general, fens are dominated with sedges, although grasses and reeds may be associated in local pools. Several plant species with narrow pH tolerances, such as buckbean (*Menyanthes trifoliate*), bog rosemary (*Andromeda glaucophylla*) and bog willow (*Salix candida*), are common in fens and are often used as indicators of fen habitats.

In the Algonquin Region of Ontario, fens are a rare wetland type, and fens represent 2% of the wetlands on Paudash Lake. The Paudash Lake fens—graminoid and treed, are fed by slow seepage from groundwater derived from the surrounding hills, and its soils are alkaline because of the marbled (metamorphic or crystalline limestone) bedrock, which supplies the groundwater with calcium. Grasses and sedges, as well as a low shrub component, dominate the graminoid fens, which are, usually, absent of trees. Shrubs and stunted trees including white cedar, black spruce and tamarack—tamaracks being the dominant tree species, dominate the treed fens.

Bogs

Bogs are peat covered areas or peat-filled depressions with a high water table and a surface carpet of mosses, chiefly *Sphagnum* species; wetland 29 (see original report), representing 1% of the wetlands associated with Paudash Lake, is classified as a bog. Peatlands are formed when there is a decrease in the decomposition of dead plant material, which in turn allows large accumulations of peat to form. Bogs are virtually isolated from mineral soil and rely solely on atmospheric deposition for its nutrient supply; therefore, as a result, bogs usually have low biological diversity, a closed drainage system, low dissolved oxygen concentrations, and the surface water and underlying peat are strongly acidic and “nutrient-poor” (deficient in mineral nutrients).

Bogs have low biological diversity (often having less than 12 different plant species), and are usually found north of the Precambiran shield; therefore, bogs are extremely rare in southern Ontario. Bogs are frequently characterized by layers of mosses such as *Sphagnum* species, ericaceous shrub species, such as bog laurel (*Kalimia polifolia)* and swamp blueberry (*Vaccinium corymbosum*), and cotton grasses and sedges, which are tolerant of acidic soils and low nutrients. They may be treed or treeless, but tree cover never exceeds 25% of the total area; black spruce (*Picea mariana)* often dominates the upper or crown vegetation of some older peat bogs as well as Tamarack (*Larix laricina*), but only in small numbers and, usually, only along the periphery of the bog.

Observations

- *There are four wetland complexes on the shore of Paudash Lake that have been evaluated under the Northern Ontario Wetland Evaluation; only two are provincially significant—Central Paudash Lake Wetland Complex and Inlet Bay-Eastern Lower Paudash Lake Wetland Complex.*
- *All four wetland types are represented on Paudash Lake’s shorelines, which are comprised of various ecological-community types, and contribute significant habitats for provincially and regionally rare faunal species, including a “species at risk” turtle, snakes and several birds.*

- *2% of Paudash Lake wetlands are fens—a provincially rare wetland type for Ontario's Algonquin Region, which includes significant plant species.*
- *Runoff and leaching of terrestrial effluents (pollutants) and habitat destruction is occurring within a provincially significant wetland at Inlet Bay.*
- *The Paudash Lake Conservation Association, in cooperation with the MNR Bancroft District office, has designed and erected four large billboards that display the location of the various wetlands of Paudash Lake, including the Provincially Significant Wetlands, at the following locations: North Bay Beach, The Anchorage, Paudash Lake Marina, and Wil-Lou Marine.*

<u>Recommendations</u> – Wetlands

40. An education program promoting the sensitivity and the need to protect wetlands should be prepared that includes the significance of wetland habitats for "species at risk" conservation in Ontario.

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41. Local official plans and zoning by-laws must identify the location of wetlands and provide appropriate policy to ensure their protection, including the enforcement of environmental/lake impact assessments for new development proposals in provincially significant wetlands as well as the associated adjacent lands.

5.4 Streams

Streams are a significant feature of the landscape. Stream-flow varies over time in response to the inflow of water from precipitation, the surrounding landscape, and groundwater sources (i.e., aquifers). North of the Precambrian Shield, permeability of the soil is reduced due to the depth of the water table, which is shallow because of a shallow impermeable layer of granite bedrock. Disturbances that increase the number of impervious surfaces in the watershed contribute to the soils poor attenuation qualities by increasing the flow of runoff, erosion, sedimentation and channelization.

Paudash Lake is a headwater lake for the Crowe River watershed. Twenty-six (26) small streams and tributaries flow into Paudash Lake and one river, the Crowe River, flows out of Paudash Lake, which connects it to other lakes downstream (see Maps 1 and 5 and Figure 5.11). These streams are either permanent or intermittent in nature, but all are an important part of the fish and wildlife habitat of Paudash Lake.

Unfortunately, to date, the 26 streams of Paudash Lake have not been studied or inventoried, but are assumed to be cold water streams that feed the cold water fisheries; environmental qualifiers and quantifiers would need to be collected to be able to properly classify each stream, which is time consuming and expensive. Common science indicates that 30 metres (m) is the minimum setback requirement along cold water streams in order to protect critical habitats of cold water fish. The majority of Paudash Lake streams occur on privately developed land, which have already met the 30 m setback requirement stipulated in the Official Plan; therefore, unless new development is proposed, stream ecology is not a management priority at this time for the MNR.

Figure 5.11 – The Streams and Tributaries of Paudash Lake

Streams	Location on Map
1. Unidentified	North Bay
2. Harding Creek	North Bay
3. Unidentified	North Bay
4. Unidentified	North Bay
5. Lake on the Mountain	North Bay
6. Unidentified	North Bay
7. Unidentified	North Bay
8. Colbourne Creek	North Bay
9. Deer Creek	Inlet Bay
10. Mink Creek	Inlet Bay
11. Anderson Creek	Joe Bay
12. Unidentified	Joe Bay
13. Silent Creek	Joe Bay
14. Unidentified	Joe Bay
15. Unidentified	Joe Bay
16. Unidentified	Joe Bay
17. Bedford Creek	Joe Bay
18. Unidentified	Lower Paudash
19. Beaver Creek	Lower Paudash
20. Big Fools Lake Creek	Lower Paudash
21. Vance Lake Creek	Lower Paudash
22. Unidentified	Lower Paudash
23. Unidentified	Lower Paudash
24. Crowe River	Lower Paudash
25. Unidentified	Lower Paudash
26. Port Hope	Lower Paudash
27. Moxley Creek	Lower Paudash

Source: Topographic Maps – Bancroft (31 F/4) and Gooderham (31 D/16)

In general, streams, depending upon their water quality and geomorphology, provide spawning and rearing habitat for a variety of fish species including minnows, suckers, sculpins, sticklebacks, bullhead catfishes, sunfishes, trout, perches, darters and walleye. The stream's flow, water temperature, and sediment bed or substrate type combined provide the necessary conditions to incubate the fish eggs deposited during the spawning season. Riffles—shallow zones, along the sandy or gravelly sediment-bed of a stream, are often the preferred spawning habitats of various fish species. The healthiest water—well oxygenated for the eggs, with a good source of food for adults—is often found in the riffles of streams. The aquatic organisms floating down stream are often caught by fish in the riffle zones; these organisms supply a significant food source for the species of fish that frequent these streams.

Observations

- *Twenty-six streams flow into Paudash Lake and one river—Crowe River, flows out of Paudash Lake; all 26 streams are on private land.*
- *Paudash Lake is one of the headwaters for the Crowe River Watershed.*
- *There is a lack of data, including fish inventories and environmental parameters, and a need for site-specific information to be able to properly classify the 26 streams that flow into Paudash Lake.*
- *Stream inventories are not a management priority for MNR Bancroft District because of pre-established 30 m setback requirements—also the minimum management requirement for cold water stream fisheries, for development in the Paudash Lake watershed, and a current lack of development pressures on these streams.*

Recommendations – Streams

42. A detailed study, which includes standardized monitoring protocols or methodologies, should be completed for the twenty-six streams that flow into Paudash Lake. Qualitative and quantitative data needs to be collected to identify and assess the specific features (presence/absence of indicator species such as brook trout) that contribute to the health of the lake system, determine the health of each stream, and classify each stream in terms of community indices (cold water vs. warm water) to be able to map the location of cold water streams in the watershed and critical cold water spawning sites within each stream.

43. A collection of long-term data, including a standardized method of collection, analysis and reporting, needs to be established for long-term monitoring and assessment of the 26 streams.

44. Official Plans and Zoning by-laws should identify the location of all permanent and intermittent warm water and cold water streams including policy to control and protect them against development impacts.

45. Through landowner contact and information brochures, property owners that own property adjacent to streams should be encouraged to help protect the water quality and natural features of these streams, such as maintaining a 20 m vegetated buffer along the stream's shoreline.

46. The streams on Paudash Lake need to be "officially" named prior to inventories. Perhaps encourage the "young" cottagers to participate in a "name that stream" contest.

5.5 Fish Community

The Paudash Lake fish community has changed significantly over the past 60 years. Historically, the lake supported a cold water fishery dominated by lake trout and Cisco. A warm water fishery including walleye, largemouth and smallmouth bass, and rock bass populations was established through stocking (rock bass was unintentional). Today, Lower Paudash Lake supports a warm water fish population that includes largemouth and smallmouth bass, yellow perch, and rock bass, and a

cool water component consisting of walleye, whereas Upper Paudash Lake continues to support cold water fish species such as lake trout and cisco—the full list of species is found in Figure 5.12.

Figure 5.12 – Fish Species in Paudash Lake

Common Name	Latin Name
Lake Trout	*Salvelinus namaycush*
Largemouth Bass	*Micropterus salmoides*
Smallmouth Bass	*Micropterus dolomieui*
Walleye	*Stizostedion vitreum (old), Sander vitreum (new)*
Yellow Perch	*Perca flavescens*
Cisco	*Coregonus artedii*
Rock Bass	*Ambloplites rupestris*
Pumpkinseed	*Lempomis gibbosus*
White sucker	*Catastomus commersoni*
Brown Bullhead	*Icalurus nebulosus*
Golden Shiner	*Notemigonus crysoieucas*
Common Shiner	*Notropis cornutus*
Bluntnose Minnow	*Pimephales notatius*
Fathead Minnow	*Pimephales promelas*
Creek Chub	*Semotilus atromaculatus*
Fallfish	*Semotilus corparalis*
Brook Stickleback	*Culaea inconstans*
Iowa Darter	*Etheostoma exile*

Source: Mosquin et al.(1992)

The changes that have occurred in the fish population, in particular the decline of lake trout and walleye populations, may be the result of a combination of environmental and human-induced factors, including: climatic changes; eutrophication (from septic tanks, lawn fertilizers); dam construction (creating a closed system—fish barrier) and controlled water levels; harvesting pressures, stocking, invasive species and other fish species; increased development pressures and population levels; removal of shoreline vegetation and access issues; and increased effluents and runoff from the watershed (sewage retention ponds in Cardiff) into areas of provincial significance (wetlands and spawning sites). In the 1980s, MNR started lake trout and walleye spawning bed observations, documentation and mapping, and rehabilitation work because the natural reproduction of both species was suspected to be moderate to low. Presently, cisco populations, as well as rock bass, are thought to be high in density, and the largemouth and smallmouth bass fisheries are considered strong.

According to MNR documentation within the last 20 years, which is based upon net inventories and angler creel surveys (winter 1990), there are 18 known species inhabiting Paudash Lake. Unfortunately, Paudash Lake, which was traditionally a cold water lake, has a species composition typical of most warm water lakes that occur in southern Ontario, indicating a move away from the traditional cold water fisheries.

The Ministry of Natural Resources' (MNR) Bancroft District manages Paudash Lake's fisheries including the monitoring and protection of fish habitat. Fisheries management practices, including fish stocking, population surveys, spawning habitat remediation, protection of critical fish habitat (littoral zone), and the accumulation of baseline date to develop appropriate management strategies, began concurrently with the development boom in the late 1920s.

Unfortunately, the current condition of the fisheries is poor, especially the walleye and lake trout fisheries, which is of great concern to the MNR, as well as the lake residents and cottagers. The Bancroft District MNR Fisheries Management Plan (1987-2001) identified the following issues concerning these fisheries:

i. Over-harvesting and angling pressures;
ii. Population decline;
iii. Stocking;
iv. Pollution and critical habitat loss;
v. Eutrophication;
vi. Dam and artificial changes in water levels;
vii. Lack of long-term data, an adequate database, and scientific knowledge;
viii. Lack of public awareness and involvement; and
ix. Species introductions and exotic species.

5.5.1 Fish Stocking and Introductions

In 1929, MNR began stocking lake trout, cisco and largemouth and smallmouth bass, and walleye, by 1932, into Paudash Lake. Stocking continued periodically for some species, alternating between years, and consistently for other species.

Walleye were continuously stocked from 1932 to 1951, for a total of eleven stockings that averaged 500,000 walleye fry each time. During the 1960s, monitoring efforts determined that the walleye population was declining. By the 1980s, very low numbers and recruitment of walleye were reported, so in the mid-1980s MNR stocked, approximately, 33,000 (1984-87) and 50,875 (1988) walleye fingerlings per year into Lower Paudash and Inlet Bay to maintain the warm water fisheries; 1989 was the last year that walleye were stocked (468,000 MO1—one month old) because stocking was not successful in raising recruitment numbers or increasing the population. The last fall walleye index netting (FWIN) survey, which assesses walleye populations by measuring relative abundance and key biological characteristics of the population, was conducted in 2001. The FWIN relies on a strict protocol to ensure that results are comparable across years or between lakes.

Currently, the walleye population may be stressed by several environmental factors combined including habitat loss, angling pressures from the 1950s through to the 1970s, and the dam on the outlet of Paudash Lake. This type of bust and boom of walleye has occurred in several other lake introductions; it seems that some intricate part of their lifecycle is deficient, or may be stressed by an external factor, and population declines are a result of continual harvest. Perhaps, Paudash Lake was not the best lake for walleye introductions because of water clarity—Secchi disc readings of greater than 3 metres (m) is not recommended, since Paudash Lake Secchi depths ranged from 4.5 m to 6.25 m.

Bass, both largemouth and smallmouth, were stocked in the lake until 1955; no stocking rates were provided by the MNR. Currently, the bass population may also be in decline due to varying environmental stresses, but population assessments or population indices have not been verified. The last recorded bass nest mapping was initiated by MNR in the early 1990s to identify critical (high density) shorelines for spawning bass. Bass nest and spawn along shorelines; largemouth bass nest in the detritus of the lake sediment and are often hard to spot, whereas smallmouth bass

excavate gravelly nests, which can be seen from the water's edge. Shoreline development and runoff, which reduces habitat quality and quantity as well as eutrophication and competition by rock bass, may also be contributing to the decline in bass populations in the warm water communities of the lake.

Cisco or lake herring have been stocked only three times—1929, 1938 and 1959, during the stocking history of Paudash Lake. Their population is thriving to a point that MNR has considered investigating Cisco population numbers, and instating a reduction netting removal program if densities are too high. Lake herring is staple food for adult lake trout. Both lake trout and cisco spawn near shoals in the fall, but lake trout prefer rocks and boulders to deposit their eggs, whereas lake herring prefer gravelly substrate to spawn. Adult cisco will prey on fish eggs and fry of other species, which may potentially include lake trout. As well, the larvae and juveniles of both lake trout and lake herring may compete for the same food base, such as zooplankton and invertebrates, during their rearing stage in the littoral zone.

Lake trout was first stocked in 1929 and consecutively until 1964; between 1964 and 1972 no lake trout were stocked for reasons unspecified by MNR—perhaps the lake had reached capacity at that time and MNR wanted to promote natural reproduction, or efforts were being concentrated on the walleye population. Stocking recommenced in the early 1970s and continued every other year—an average of 9,400 adults per second year—until 1992, which was the last year of lake trout stocking in Paudash Lake. Stocking of lake trout has ceased because a naturally reproducing population has been established and it is MNR's policy not to stock reared populations on top of naturally reproducing ones; artificially increasing lake trout populations causes added stress to the native population, either through competition, genetic hybridization, and/or increased angling pressure.

During the stocking of largemouth and smallmouth bass, rock bass were unintentionally introduced to Paudash Lake. Rock bass are native to Ontario, but are usually found within the Great Lakes watershed, south of the Precambrian Shield. Since this "accidental" introduction, netting results have confirmed that the rock bass population has been established and is thriving; recent netting results indicate that they are dominating the lake. Due to their "hardiness" or tolerance to poorer or "stressed" conditions, rock bass have negatively impacted the inland lake sport fish species by out-competing them for resources in the littoral zone. Interpreting an excerpt taken from Species Introductions and Their Impacts in North American Shield Lakes, studies provided by M.J. Vander Zanden, K. A. Wilson, J.M. Casselman, and N.D. Yan, it shows that the invasion of rock bass into inland lakes has been devastating to lake trout population, because the somatic growth and growth potential of lake trout have been reduced by 25-30% in studied lakes.

> *"Competition between bass and lake trout has not been generally recognized, and it is erroneously assumed that bass introductions have no effect on lake trout populations. This interaction has been overlooked because bass inhabit inshore, littoral areas while lake trout inhabit offshore, pelagic areas. Despite these differences, bass and lake trout often share a common resource, and the introduction of bass has translated into the interruption of the trophic linkage of prey fish and lake trout. Invariably, anglers lose interest in these once-good lake trout fisheries and advocate the need for stocking, although such actions provide minimal benefit and could decrease the growth of existing lake trout because fish prey production has been diminished. The only advantage in stocking would be to provide potential prey for lake trout; this is an inefficient and unproductive way to try to bolster lake trout productivity and angling success"* (excerpt taken from Vander Zanden et al. 2004).

Currently, research by MNR (with Dr. John Casselman) and Ontario Federation of Hunters and Anglers (OFAH) on rock bass and Haliburton lake trout is concentrating on the cost-effectiveness of removing rock bass from a lake and returning it to pre-introduction productivity. It is hypothesized that if the prey-base can be restored with the removal of rock bass, then the lake trout population should experience increased productivity, which should lead to an increased, sustainable fishery.

5.5.2 Fish Habitat

Fish habitat, especially spawning and nesting areas, is primarily located in the littoral zone and near shore areas of the lake. Nesting and feeding sites vary among species, but a lake with a variety of habitats that include an ample supply of vegetation, such as woody debris, shade and rock, are indicative of good water quality and a healthy ecosystem. Unfortunately, the potentially negative impacts from development result in a loss of habitat and subsequent reduction in fish productivity.

"Fish habitat means the spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes."

Fish Habitat Protection and Pollution Prevention Section 34 (1) "fish habitat",
Fisheries Act (R.S. 1985, c. F-14)
Source: http://laws.justice.gc.ca/en/F14/60370.html Updated to August 31, 2004

The type of habitat necessary to support each fish population varies among species, however, it is understood that the maintenance of healthy shorelines, the retention of vegetation and conserving wetland habitats as well as the health of the streams entering Paudash Lake are all critical factors in maintaining a healthy and diverse fish community in Paudash Lake.

Walleye or yellow pickerel (*Sander vitreus*) and lake trout (*Salvelinus namaycush*) use rock and rubble substrates along shorelines for spawning, whereas bass nests can vary among species from gravelly, rock and rubble—smallmouth bass (*Micropterus dolomieu*), to sandy, detritus organics—largemouth bass (*Micropterus salmoides*).

Lake trout spawn in late fall, usually mid-October, during the night when temperatures are cooler; the young hatch in February and often move towards the centre of the lake where it is warmer. Preferred spawning beds are on shallow rocky shoals, one to three metres below the surface. The female lake trout, using her body, tail fin or snout, usually cleans the area before laying her eggs. The eggs, when released by the female, are fertilized by the male and then drift down into the safety of the crevices in the rocky bottoms where they remain until hatching, usually in late February, with fry emergence by early April.

Walleye spawn in early spring, usually mid-May, and at night because adults are sensitive to bright lights and will often use sunken logs, boulder shoals, or weed beds to shield against the sun, often within similar shoal areas that are used by lake trout later in the year. Adult walleye prefer large shallow lakes as well as streams, rivers and herbaceous wetlands, with high turbidity—reduced clarity, because walleye are sight predators that hide in the vegetation stocking prey. Currently, there are 38 mapped walleye spawning sites

Bass species nest in warm shallow areas of the lake, and on occasion in streams, which the males excavate to build nests and guard the young once they have hatched. Both largemouth and smallmouth bass have, on occasion, been caught in streams and rivers, and are documented by experts to spawn in these areas. Largemouth bass prefer slow-moving streams, which contain an abundance of aquatic vegetation, and smallmouth bass prefer swift flowing, less turbid waters in rivers and smaller streams.

Cisco, also known as lake herring (*Coregonus artedii*), spawn near shorelines—1 to 3 m (3-10 feet) above a variety of substrate, in the fall from October to December when the water and ambient temperatures have cooled. Adult lake herring are predominantly pelagic species that form large schools in the deeper waters; they have been known to prey on other fish species eggs.

Other fish species identified by MNR inventories include: white sucker (*Catostomus commersoni*), brown bullhead (*Ictalurus nebulosus*), rock bass (*Ambloplites rupestris*), pumpkinseed (*Lepomis gibbosus*) and yellow perch (*Perca flavescens*) as well as various unidentified cyprinid, minnow or "bait fish" species.

White sucker (*Catostomus commersoni*) spawn in early spring from May to June in gravelly streams. Adults prefer warm shallow lakes and bays for foraging.

The brown bullhead (*Ameiurus nebulosus*) will occur along the shallow bottoms of warm lakes, bays or slow moving streams. Spawning occurs in spring; adults will excavate a shallow nest in a lake bottom of mud or sand, or among vegetation, or near a rock or log. The nests are usually found along the shoreline in bays or creek mouths; the young are raised in these warm water shallows where they feed on benthic invertebrates.

Rock bass (*Ambloplites rupestris*) generally inhabit rocky areas of shallow, warm water lakes and warm reaches of streams. Spawning occurs in mid-May after the adult males have excavated shallow nests, wherever possible—preferring gravelly substrate, so that the female is able to deposit her eggs. Many nests can often be found clustered together in suitable habitat within the littoral zone, where the young are able to survive by feeding on benthic invertebrates and other small fish.

The pumpkinseed (*Lepomis gibbosus*) inhabits weedy bays of warm water lakes, preferring clear water, with a vegetative cover. Adult males dig shallow nests in areas of slow moving water on hard bottoms within areas of aquatic vegetation, and guard the young when they hatch.

Yellow perch (*Perca flavescens*) is a very adaptable species that is able to utilize a wide variety of warm to cooler habitats. Spawning occurs from mid-April to early May in the shallows of lakes near vegetation where transparent eggs are excreted in the form of a gelantinous tube and become attached to aquatic vegetation. The young live in schools, often associated with minnow species, including spottail shiner (*Notropis hudsonius*), within the littoral zone.

Cyprinid (minnows) species' habitat preferences and spawning schedules vary; more information on the community of minnows can be provided once a thorough inventory of the lake community is assessed.

5.5.3 Fish Contaminants

Contaminated runoff from the watershed enters the surface and groundwater sources, which are taken-up directly by primary producing plankton and indirectly by aquatic organisms feeding on them. Many contaminants, such as mercury, dichlorodiphenyltrichloroethane (DDT) and PCB's, make it into the aquatic and terrestrial ecosystem, biologically accumulating up the food chains, which magnifies or increases their negative impacts, along the way.

Contaminants such as mercury that bioaccumulate in the fatty tissues of fish is a concern in Paudash Lake, especially for expectant mothers and young children. Figure 5.13 shows data taken from the 2003-2004 Guide To Eating Ontario Sport Fish produced by the MOE; the guide indicates that Paudash Lake fish have been tested for mercury, PCB's, mirex, photomirex, pesticides and other heavy metals.

Health Canada established a guideline levels of 0.5 parts per million (ppm) of methyl mercury in fish; waters with high mercury levels in fish are closed to commercial fishing and the local MNR office monitors the mercury levels of fish annually on recreational lakes. Values in the table indicate the number of meals that can be consumed, without exceeding a tolerable daily toxin limit, per month. The guidelines for women of childbearing age and children under 15 years of age are more stringent; MOE advises that women of childbearing years and children under the age of 15 should eat only those fish, from any size category, designated with a clear fish in the guide, which indicates no more than four (4) meals of these freshwater fish per month, and for other designations, those fish should not be consumed; for other individuals, no more than eight (8) meals (clear fish symbol) or otherwise designated (numerical symbols) per month. For complete information with respect to the recommended consumption rates the guide should be obtained from the local MNR or MOE office, or on-line at http://www.ene.gov.on.ca/envision/guide/, and studied.

Figure 5.13 – Guide to Eating Fish—Number of Meals per Month for Paudash Lake

Species	Fish Size—total length, in centimetres (inches)								
	1	2	3	4	5	6	7	8	9
	15-20	20-25	25-30	30-35	35-45	45-55	55-65	65-75	>75
	(6-8)	(8-10	(10-12)	(12-14)	(14-18)	(18-22)	(22-26	(26-30	(>30)
Walleye					4*, 8	0*, 4	0*, 2	0*, 2	0*, 2
Northern Pike			4*, 8	0*, 4	0*, 4	0*, 4			
Smallmouth Bass	4*, 8	4*, 8	0*, 4	0*, 4	0*, 4	0*, 4			
Largemouth Bass	4*, 8	4*, 8	4*, 8	4*, 8	0*, 4				
Yellow Perch	4*, 8	4*, 8	0*, 4						
Rock Bass	4*, 8	4*, 8							
Brown Bullhead	4*, 8	4*, 8	4*, 8	4*, 8					
White Sucker				4*, 8	4*, 8	4*, 8			

Note – one * indicates the number of meals per month for women of childbearing age and children under the age of 15

Source: MOE's 2003-2004 Guide to Eating Ontario Sport Fish

5.5.4 Lake Trout

In the past two decades, the two major issues for the MNR, which are suspected to have contributed to the decline in lake trout populations, are eutrophication—the water quality and development limitations on Inlet Bay and Joe Bay, and the artificial draw down of lake water levels. In recent years, thirteen (13) spawning sites have been mapped but only four (4) of these sites are verified as "active" (Map 5) in Paudash Lake (MNR 2005). Inactivity at some spawning shoals may be indicative of habitat degradation at that specific location or simply a preference by the fish species for another site in the lake.

Recruitment may be reduced because of the loss or degradation of critical shoal habitats, the loss of eggs in the shallow shoreline waters because of desiccation and winter kill during fall water level drawdown, and degradation of juvenile habitat through eutrophication.

Lake trout spawn close to shore, and these reproductive habitats are vulnerable to infilling, sedimentation, and water drawdown that can adversely affect natural reproduction of lake trout stocks. However, when denied access to traditional sites during experimental studies, lake trout rapidly selected and deposited eggs at alternate sites (Gunn et al.1996). Aquatic resource managers, therefore, need reliable methods of identifying and protecting this important habitat (Gunn et al. 1996). In general, lake trout spawning bed mapping enables resource managers to have a subjective look at shoreline habitat and to make suggestions as to where these fish may be spawning. These areas are then checked to document usage (MNR 2004).

Certain fish species, like lake trout, have very specific habitat requirements. Lake trout live in cold water and require water temperatures below 15°C and dissolved oxygen concentrations above 4 mg/L for useable habitat, but their optimal habitat is found at temperatures below 10°C, with dissolved oxygen concentrations above 6 mg/L. Excessive nutrients and the resulting algae and plant growth and decomposition can cause a decrease in deep-water oxygen levels and, therefore, reduce the availability of lake trout habitat, especially juvenile lake trout habitat.

Oxygen levels are most critical for the protection of cold water fish species like lake trout. Oxygen profiles are completed to determine if oxygen depletion is a factor with respect to ecosystem health, and to assist in the management of cold water species. When phosphorous is added to a lake, it creates algae, and when algae dies and falls to the lake bottom, decomposition takes place; this process of decomposition uses up the available dissolved oxygen.

Lake trout spawning shoals are tight to shore, usually within 1-2 metres of the shoreline, are not wide, and are found over broken rock and rubble. There has been a hypothesis stated that a correlation exists between the controlled water levels and lowered success of lake trout spawning shoals. However, due to the fact that lake trout are impacted by several stresses, such as loss of habitat, competition and eutrophication, in order to fully understand the decline in lake trout populations, scientist would have to address each stress separately. To date, MNR has addressed the stresses that are within their mandate to protect and sustainably manage natural resources, such as naturally reproducing lake trout and their habitats.

According to the Mosquin et al. (1992) report, the artificial manipulation of lake water levels, to meet human needs, negatively affects the littoral zone's (near shore) ecological function, shoreline habitat, aquatic species migration, and the normal annual flushing of the lake. The fall drawdown exposes the "sensitive habitats" within the littoral zone to freezing which kills many species including lake trout, amphibians, reptiles and invertebrate eggs and larvae, which are essential to the freshwater food chains. Lake trout spawning beds are one of these sensitive habitats, and there is a concern that the winter drawdown may expose or crush these eggs and cause a high rate of mortality because these spawning beds become covered in ice over winter.

In 1991, the MNR proposed an agreement with the Crowe Valley CA and the PLCA to move the commencement of the last fall water level drawdown at the dam, traditionally on Thanksgiving, from October the 12th to the 30th of September, in order to complete the process by the end of September before the lake trout spawn.

There was some concern from cottagers that they would not be able to use their boats from Labour Day to Thanksgiving, however, most have been able to make the adjustment; marina operators have also co-operated and made adjustments. The initial concern focused on navigation; however, the problem was not the change in the water level, but the timing of the drawdown. It was clear that this was not the preferred option for the PLCA, which was the creation of a fixed weir at the dam in order to create natural, seasonal fluctuations of Paudash Lake water levels to eliminate the artificial manipulation of lake levels. Whether or not the change in dates of the drawdown has been successful in improving the lake trout population is not known since the MNR has been unable to find the resources to initiate the follow-up research, which was anticipated for 2000. This proposal of the PLCA was vetoed by the CVCA because of concerns about managing the hundred-year flood.

Lake trout is recognized as a valuable sport fish, but it is also a great indicator of water quality and the overall health of the lake's ecosystem. Lake trout tend to be more sensitive to negative impacts, such as a decrease in dissolved oxygen, an increase in water temperature, or increasing turbidity, than most other fish species; therefore, the presence, and the spawning and recruitment success, of lake trout populations is used as an environmental indicator to assess the health of Paudash Lake.

In general, lake trout are only found in 2000, less than 1%, of Ontario's lakes. Unfortunately, in the past decade, these populations have been gradually declining due to the combination of various environmental stresses derived from watershed activities including eutrophication and acidic precipitation—lake trout are particularly vulnerable to temporary acid shock as well as other toxins during spring runoff, which negatively impacts lake trout populations. Paudash Lake is fortunate to be part of the small percentage of Ontario lakes that have and support lake trout, and the residents and other users of Paudash Lake must be vigilant in their efforts to protect this great natural resource.

Observations

- *The Paudash Lake's lake trout population is naturally reproducing, and, as of 1992, artificial recruitment (stocking) has stopped.*
- *Paudash Lake was historically a cold water fishery and continues to be managed as such, and includes a walleye component.*

- *Walleye stocking efforts have been unsuccessful, so MNR no longer stocks walleye.*
- *The last Fall Walleye Index Netting (FWIN) survey, to measure walleye populations, was conducted in 2001.*
- *Rock bass and cisco (lake herring) populations are quite dense.*
- *Cyprinid species (minnow) populations have not been thoroughly inventoried; information data is lacking concerning spawning requirements and habitat.*
- *The Lake trout population is declining because of the negative impacts of several stressors acting together including eutrophication, loss of habitat from shoreline disturbances, competition from invasive species such as cisco and rock bass, and predation; unfortunately, no monitoring of spawning sites have been initiated recently.*
- *Rock bass were accidentally introduced into Paudash Lake when largemouth and smallmouth bass were stocked in the early 1950s, and populations were established by the 1960s.*
- *According to current data, Paudash Lake has four active lake trout spawning sites, and thirteen spawning shoals have been mapped. The abundance of historical sites (sites with inactivity, usually greater than 20 years), and/or other potential spawning sites is unknown, so shorelines should be protected from incompatible shoreline development.*
- *The past water level management regime may have negatively impacted lake trout spawning beds—winter kill and desiccation of eggs, as well as other important littoral habitats; the earlier fall drawdown may be addressing these issues; unfortunately, no recent assessment has been initiated; and due to the natural ecology of lake trout, they are often stressed by multiple and compounded stresses.*
- *Lack of information regarding spawning site locations and population sizes exists for the minnow populations in Paudash Lake.*
- *The last angler creel survey was in the winter of 1990. Creel surveys help resource managers monitor "catch and harvest" of various fish species, potential occurrence of invasive species, and the angling pressures on the lake, the biological characteristics of harvested fish and total fish yields, as well as providing incredibly important base data to support fisheries management direction and to assess local fisheries management activities.*
- *Lack of information regarding species inventory, community index, and spawning and habitat requirements in streams.*
- *Fall Walleye Index Netting Project was conducted in 2001.*
- *In Upper Paudash, the hypolimnium was found to contain both optimum and useable lake trout habitat (see 5.1 – Water Quality).*
- *In Joe Bay and Lower Paudash, the hypolimnium was found to contain, on average, no optimum lake trout habitat. However, oxygen and temperature regimes may combine to provide a small amount of usable habitat (see 5.1 – Water Quality).*

<u>Recommendations</u> – Fish Community

47. MNR should continue the practice of not stocking fish because stocking doesn't seem to be working for the Paudash Lake fish community—sport fish populations are declining, therefore, stocking won't help to improve the production of populations if the true cause or causes of population declines aren't identified. The real stressors should be identified, assessed and monitored.

48. ***If the best science should recommend the resumption of stocking at any time in the future, fisheries managers should use local stock that is ecologically adapted to the local environmental conditions of Paudash Lake (If stocking should be resumed in the future, fisheries managers should apply good science and use local stock that is ecologically adapted to the local environmental conditions of Paudash Lake) to repopulate declining cold water and warm water sports fish, and move the current fish community towards the "original" fish community prior to invasive species.***

49. ***The PLCA should provide volunteers to the MNR in order to assist with the annual active bass nest and walleye spawning surveys—a netting index per species to collect the data necessary for lake assessment and management strategy improvements.***

50. ***In some areas, lakefront residents that have significantly altered or disturbed the shoreline habitat should be encouraged to return a significant portion of their property to as natural a state as possible, including in-water rehabilitation efforts.***

51. ***Encourage 30 m vegetated shoreline setbacks, especially new setbacks, and the requirement for shoreline vegetation buffers for development adjacent to critical fish habitat.***

52. ***Discourage sport fish tournaments. Restrict Rock Bass derbies to July and August—after bass spawning season.***

53. ***The last volunteer angler creel surveys were initiated by the MNR in the early 1990s (winter). New annual volunteer creel surveys should be initiated to encourage local anglers to maintain an angling diary as an inventory technique (templates available from the Kawartha Fisheries Association).***

54. ***A thorough species inventory needs to be initiated by the PLCA, in partnership with the MNR, to identify native, rare and exotic species and estimate relative abundance indices for the lake as well as identify important habitat sites for protection along the shoreline. The PLCA could hire a few summer students to seine the shorelines of Paudash Lake; MNR and staff biologists could train the students on how to survey and collect voucher specimens and provide the necessary equipment to perform these surveys. Note – A zoological expert in species identification is important because most of the fish caught along the shoreline in seine nets are quite small and often difficult to properly identify. As well, MNR standard protocols for data collection must be used to ensure the value of the data.***

55. ***Standardized methodologies for monitoring and collecting data on the lake need to be made as well as gathering historical data and managing it within a standardized and accessible database.***

56. ***The MNR should conduct a follow up survey of the impact of the early drawdown of the lake level on lake trout population in Paudash Lake.***

57. ***The MNR should conduct further studies to determine whether further regulation, such as closing the lake for winter fishing, and construction of a permanent weir are required to support the lake trout fishery.***

5.6 Wildlife and Wildlife Habitat

The area around Paudash Lake has an abundant wildlife population, including mammals, birds, reptiles and amphibians, which make wildlife viewing an important recreational pastime for lake residents; 79% of resident surveys indicated that nature appreciation was highly valued by the cottagers. Protection of wildlife habitat in and around the lake is, therefore, vital to the conservation of biological diversity and the preservation of self-sustaining species' populations around Paudash Lake. However, if habitat fragmentation continues because of development pressures, loss of this valuable resource will be the end result.

Although Figures 5.14, 5.15 and 5.16 list all the variety of species to be found in the Paudash Lake watershed; this report focuses on certain specific wildlife species, or those species of particular interest to Paudash Lake users, and provides comments, observations and recommendations that generally apply to all wildlife.

While ducks and other birds migrate south to more favourable climates, some mammals of the Paudash Lake area have developed methods to survive the harsh winters of the Algonquin Region. Many mammals, including bats and the black bear, enter into hibernation or torpor (sporadic periods of hibernation) where they sleep for extended periods of time during the winter months, whereas other mammals, such as the white-tailed deer, moose, weasel, beaver, vole and bobcat, which remain active year-round, have adapted their behaviours according to the local climate.

Figure 5.14- List of Common Mammals In the Paudash Lake Area

White-tailed Deer	Porcupine	Woodchuck (Groundhog)
Moose	Bats (Northern long-eared, eastern pipistrelle and little brown)	Mice (white-footed, meadow-jumping mouse, and deer)
Elk	Weasel species (least, short-tailed and long-tailed)	Moles spp. (star-nosed)
Raccoon	Red Fox	Shrew spp. (short-tailed)
Black Bear	Eastern Chipmunk	Vole spp. (meadow)
Lynx*	Squirrels (red and grey)	Beaver
Mink	Flying Squirrels (southern)	Muskrat
Bobcat	Grey Wolf	Hares (snowshoe hare)
Striped Skunk	Coyote	Rabbits (eastern cottontail)
Northern River Otter		
Marten		
Fisher		

*A 20-year-old sight-record identified Lynx as being in the vicinity of Paudash Lake; recorded faunal sightings greater than 20-years-old are no longer considered verified by the NHIC.

Source: Mosquin et al. (1992); Discovery My Village (2002); and NHIC (2004)

5.6.1 Significant Mammals

White-tailed Deer (Odocoileus virginianus)

White-tailed deer are at their northern range limit in Ontario because of the harsh winter conditions. Fortunately, deer have adapted themselves to survive these harsh conditions by migrating from summer ranges into "deer yards", which provide suitable winter cover and food for winter survival, such as dense coniferous forests where travel is easier under the treed canopy.

"Yarding", which is an important behaviour of herding in large concentrations, helps deer to survive cold temperatures and harsh winds, provides "camouflaged" protection against predators, and offers a food source of woody browse from hardwood trees and/or conifer needles, such as white cedar and hemlock trees. Deer will continue to use deer yards even when food supplies are low, indicating that shelter is a priority, for deer, over food. Deer yards are also travel corridors—where the snow is less deep, which helps deer to conserve energy, as well as providing an escape from predators.

The location of deer yards associated with Paudash Lake and other important wildlife habitat is shown on Map 5 (insert at back of report).

Raggedly browsed vegetation—ripped or torn instead of neatly clipped due to lack of incisors; "buck rubs"—polished scars or missing bark from low saplings, shrubs, or small trees due to bucks rubbing their antlers; and "buck scrapes" or pawed depressions in the ground, scat, or body-sized depressions in leaves or snow are all evidence of deer presence in the upland zones.

Deer can more readily survive the harsh winters when a wetland has significant winter cover. Low activity during the winter months allows for efficient energy saving, but the reduction or loss of deer yards results in a scarcity of food and coupled with the exhaustion of fat reserves means deer will starve and die. The management alternative is to feed wintering deer by supplementing their diets with feed, which prevents a large loss of wintering deer, but this creates an artificial carrying capacity causing high reproduction, which causes problems during the spring and summer months by eliminating almost entirely the local vegetation diet.

For further information on deer habitat and deer ecology contact the Bancroft MNR District office or visit http://www.mnr.gov.on.ca/MNR/ on-line.

Moose (Alces alces)

Moose feed on woody and leafy plant material found in wetlands, particularly willow species (*Salix* spp.), trembling aspen (*Populus tremuloides*), redosier dogwood (*Cornus stolonifera*), red maple (*Acer rubrum*), white birch (*Betula papyrifera*), pin cherry (*Prunus pennsylvanica*), and balsam fir (*Abies balsamea*), during the winter months, and aquatic plants, particularly water shield (*Brasenia schrebie*) and yellow pond lily (*Nuphar* spp.) and pondweed species (*Potamogeton* spp.), during the summer months. During June and July, moose are able to get sodium and minerals from the new growth of aquatic plants, but must rely on natural or artificial mineral licks, including roadside ditches and salt blocks, during the winter. Therefore, moose are often spotted grazing out in the open in shallow bays, beaver ponds, or along roadside ditches.

Moose feeding areas are incredibly important to protect because they provide the necessary mineral and dietary intake to sustain the species throughout the summer months, especially during calving season in late May-early June. Like many other cervids, moose lose weight during the winter and need to regain it during the summer; during the winter a moose will consume 40-50 pounds (18-22 kg) a day and 50-60 pounds (22-27 kg) of plant material per day in summer.

Late September and early October is the beginning of the rut season in Ontario. Bulls will travel long distances in search of a receptive female to mate with and, during this time and the calving season,

moose behaviour is unpredictable and dangerous. Wolves are the main predator of moose, but have become extirpated in many natural ranges of the moose in North America; in recent years, humans and cars have increased predation rates on moose populations. Where deer and moose habitats overlap, moose frequently develop a fatal illness—brainworm disease, which remains dormant in deer but is easily contracted by moose from deer feces which contaminated surrounding vegetation.

Since the mid-1900s, Canadian moose have been involved in a relocation-rehabilitation project, with the aid of the Ontario Ministry of Natural Resources, to repopulate Michigan's Upper Peninsula moose population, which had become extirpated due to brainworm, predation, over-harvesting and loss of habitat in the early 1900s.

The Provincial government (MNR) has implemented a new moose hunting regulation in the Pembroke and Bancroft areas to help ensure the sustainability of local moose populations. The new regulations have established a moose calf tag system, a new six-day archery season, and a requirement that hunters report their results, which provides important harvest data to help MNR make effective moose management decisions for the future by ensuring a sustainable moose population to protect Ontario's natural heritage. However, this does not apply to wmu 60A in which Paudash Lake is located.

Elk (Cervus elaphus, "Wapiti" in Native tongue)

Elk is a very large member of the cervid or deer family; moose is the largest, standing six and a half to seven and a half feet tall. The Elk is brown, with darker under parts (juveniles are spotted until three (3) months of age), and has a thick neck, slender legs, a rump patch, with a yellowish-brown tail (moose, which resemble elk, lack the rump and tail), many-tined antlers (males only), and canine incisors—a unique feature for ungulates which is exclusive to elk.

Elk are primarily nocturnal—actively feeding on woody vegetation and lichen at dawn and dusk, and bedding down during the day. Elk are very gregarious (social) creatures, with strong herding instincts; for example, a bull during rutting season will often congregate with several cows, creating a breeding harem. The breeding season commences in late August to November—peaking in October and November, when 1 or 2 (usually one) calf is born nine (9) months later during the summer months.

The elk will frequently mark its territory by stripping bark from seedlings and rubbing the seedlings with their antlers and muzzle as well as urinating in dug depressions in the ground or on trees. Elk are also quite vocal creatures, especially during the rutting season or when warning the herd of impending danger.

The Provincial Elk Restoration Advisory Committee is responsible for the reintroduction of Elk to Ontario. A combination of over-harvesting by the early settlers and habitat loss caused the extirpation of the eastern elk population. The elk re-introduction project is a provincially mandated effort to re-establish this ungulate to its historical natural range; the goal of the elk program is to introduce 500 animals to Ontario.

Two herds from the Rocky Mountain Elk—a genetically similar stock, from Alberta have been successfully relocated to certain parts of Ontario. The Ontario Ministry of Natural Resources approved the elk restoration plan in 1997, which has been successfully received by several release sites in northern Ontario including Bancroft—North Hastings Elk Restoration Project (Bancroft). In January 2000 and 2001, 70 and 50 radio-collared elk, respectively, were released to North Hastings, 25 km southeast of the Town of Bancroft. The studies include population dynamics, elk/deer interaction, and monitoring elk movements. Past introduction attempts, since the 1890s, by the Ontario government have been sporadic and sighting reports have been occasional and scattered throughout Ontario. In February 2004, an elk cow and calf were reported to the Bancroft MNR.

Black Bear (Ursus americanus)

The black bear is a nocturnal, omnivorous feeder, feeding primarily on vegetation, insects, fish and small mammals. Feeding signs include logs or stones turned over for insects; decayed logs or stumps torn apart for grubs; ground pawed up for roots; anthills or rodent burrows excavated; berry patches torn up; fruit-tree branches broken; and rejected bits of carrion or large prey. Trees scared with tooth marks or claw scratches ("bear trees" marking their territory), ripped tree bark, rub marks and snagged hair, well-furrowed trails, and scat are all a good indication that you are in "bear country".

Black bears may move slowly and awkwardly but are, in fact, quite fast runners (up to 50 km/hr or 30 mph), good climbers, and great swimmers. These bears have poor eyesight, but have a well developed sense of smell and hearing; black bears will often stand on their hind legs to detect airborne scents up-wind. The black bear does have, although rarely heard by humans, distinct calls, which include angry growls, whining calls, various sniffing noises, and moaning or teeth chattering to threaten other bears.

Bears hibernate during the winter months and breed in the spring; the sow—the female bear, gives birth to naked newborns in the den, which feed on her milk during hibernation. Beware, that sows with cubs are often aggressive if the cubs are threatened; therefore, never approach a black bear in the wild.

The bear is primarily solitary except during breeding or feeding at dumps. Nuisance bears have become a major problem in Ontario because of open dumps or human encroachment on their natural habitats. Nuisance bears are dangerous because they begin to lose their fear of humans and become bolder, acclimatized bears. Therefore, never encourage a bear by feeding it, because acclimatized bears are hard to get rid of; they will return and must either be relocated or, unfortunately, "destroyed" (shot).

Many black bears are killed by poachers for a variety of parts including the teeth, claws, and especially the gall bladder, which is sought after as an aphrodisiac. One gall bladder can be worth several thousand dollars on the black market. This illegal trade in black bear parts is one of the biggest threats to their existence today. In 1992, the Ontario Ministry of Natural Resources banned the spring bear hunt, originally introduced to reduce the male bear population in an area to prevent a rise in nuisance bears, to reduce the number of cubs orphaned, due to misidentified adults, during the spring hunt.

There has been a lot of pressure by the public to reinstate the spring bear hunt, but the black bear population, around the world, has been hard hit by poaching that the ban will not be lifted for some time in Ontario. The MNR Bancroft District office has a bear population index program, which is conducted each year, and when public safety becomes an issue the MNR takes action. The District office works with the public to remove attractants and to advise folks about what to do when a bear is encountered.

Other Interesting Mammals

Other interesting animals within the wetlands and watershed of Paudash Lake, including the Town of Bancroft, are the rarely seen bobcat, Canadian lynx and the grey wolf (eastern red (Algonquin) wolf may also be present); several bats species including the northern long-eared, eastern pipistrelle and the little brown; various rodents including porcupine, beaver, deer and white-footed mouse, meadow vole, muskrat, woodchuck, eastern chipmunk, red and eastern grey squirrel, and southern flying squirrel; rabbits and hares; weasels including American marten, fisher, least, short-tailed and long-tailed weasel, mink and northern river otter; and raccoon.

Some of these mammals are provincially rare species in Ontario because of their low population numbers or limited dispersal due to human encroachment, intensive trapping for fur, roads and cars, habitat destruction due to development or pollution, and/or direct persecution. For example, the northern river otter's population has drastically declined in Ontario and much of its North American range because its fur was extensively trapped in the past and, more recently, toxic pollutants especially mercury has taken its toll on the remaining populations. It is, therefore, incredibly important to understand the intricate role that each of these species plays in balancing the health of the natural environment, and to help maintain and conserve the local ecosystem's biological diversity because the loss of just one species offsets the balance—without bats, for example, Paudash Lake would be overrun with moths and other flying insects.

5.6.2 Significant Birds

"Birds are the affirmation of life. They symbolize freedom.
The whimsy of their songs has filled our souls with joy and wonder."
Ornithologist, Roger Tory Peterson

Paudash Lake is home to a great variety of bird species, which are listed in Figure 5.15 and nesting locations shown on Map 5 – Natural Areas and Features. Many of these species are migrant songbirds, which migrate from the South American regions to breed in Ontario during the spring and summer months. Other species such as ducks, geese, owls and some coniferous songbirds are year-round residents of Paudash Lake's watershed and can be seen at various times of the year on or near Paudash Lake.

Habitat preferences vary with each bird species—some prefer the dense forest cover while others prefer the open fields, shores or wetland areas. The variety of birds that exist in the Paudash Lake area is a product of the variety of natural habitat, including food sources (both insects and vegetation) and nesting sites, found in the region. Certain wetlands have exceptional waterfowl staging, moulting and breeding areas as well as significant stopover areas within its marshes, swamps and fens; these areas are critical habitat during moulting or may provide desirable

vegetation and cover during migration. For instance, the outlet of Lower Paudash, where it opens early in the spring, is used as a staging area for migrating ducks and waterfowl. Therefore, in order to protect this diversity, it is important for the residents to ensure that the current variety of existing habitat is maintained and protected within the Paudash Lake region.

Figure 5.15 - Paudash Lake Birds Common Name	
Common Loon	Pied-billed Grebe
American Bittern	Great Blue Heron
Canada Goose	Wood Duck
Mallard	American Black Duck
Blue-winged Teal	Ring-necked Duck
Lesser Scaup	Greater Scaup
Common Goldeneye	Bufflehead
Hooded Merganser	Common Merganser
Turkey Vulture	Osprey
Bald Eagle	Northern Harrier
Sharp-shinned Hawk	Cooper's Hawk
Northern Goshawk	Broad-winged Hawk
Red-shouldered Hawk	Red-tailed Hawk
American Kestrel	Ruffed grouse
Killdeer	Spotted Sandpiper
Common Snipe	American Woodcock
Herring Gull	Mourning Dove
Yellow-billed Cuckoo	Great Horned Owl
Barred Owl	Northern Saw-whet Owl
Common Nighthawk	Whip-poor-will
Chimney Swift	Red-throated Hummingbird
Belted Kingfisher	Yellow-bellied sapsucker
Downy Woodpecker	Hairy Woodpecker
Northern Flicker	Pileated Woodpecker
Olive-sided Flycatcher	Eastern Wood-Pewee
Alder Flycatcher	Least Flycatcher
Eastern Phoebe	Great Crested Flycatcher
Eastern King Bird	Northern Rough-wing Swallow
Tree Swallow	Barn Swallow
Purple Martin	Blue Jay
American Crow	Common Raven
Black-capped Chickadee	Red-breasted Nuthatch
White-breasted Nuthatch	Brown Creeper
House Wren	Winter Wren
Sedge Wren	Goldencrowned Kinglet
Ruby-crowned Kinglet	Veery
Swainson's Thrush	Hermot Thrush
Wood Thrush	American Robin
Grey Catbird	Brown Thrasher
Cedar Waxwing	European Starling
Solitary Vireo	Yellow-throated Vireo
Warbling Vireo	Philadelphia Vireo
Red-eyed Vireo	Nashville Warbler
Yellow Warbler	Chestnut-sided warbler
Magnolia Warbler	Black-throated Blue Warbler
Black-throated Green Warbler	Yellow-rumped Warbler
Blackburnian Warbler	Pine Warbler

Figure 5.15 - Paudash Lake Birds Common Name	
Black-and-white Warbler	American Redstart
Ovenbird	Northern Waterthrush
Mourning Warbler	Common Yellowthroat
Canada Warbler	Scarlet Tanager
Rose-breasted Grosbeak	Indigo Bunting
Rufous-sided Towhee	Chipping Sparrow
Field Sparrow	Vesper Sparrow
Savannah Sparrow	Song Sparrow
Swamp Sparrow	White-throated Sparrow
Dark-eyed Junco	Bobolink
Eastern Meadowlark	Red-winged Blackbird
Common Grackle	Brown-headed Cowbird
Northern Oriole	Purple Finch
Red Crossbill	Pine Siskin
American Goldfinch	Evening Grosbeak
House Sparrow	

Source: Mosquin et al. (1992) and NHIC (2004)

Ducks

American black ducks and mallards are found in most areas around Paudash Lake and have adapted to the increased population and boat traffic, whereas other water birds, such as the wood duck, prefer the more secluded and protected wetland areas away from human activities. American black ducks and mallards make their nests in spring on the shorelines and wetlands surrounding Paudash Lake, which, unfortunately, makes their eggs and young more vulnerable to dry-land predators such as foxes and raccoons.

Diving ducks found on the lake, such as the common merganser and the common loon, live primarily on the open waters of the lake where they can continually dive for food, such as small baitfish or mussels, including consuming large quantities of zebra mussels. These two birds can dive to great depths to pursue their prey and roam over the entire lake in search of food.

The American black duck is a species that is the subject of unique concern in the Paudash Lake wetlands because it has been suffering continuous decline on its wintering areas in the United States. In southern Ontario, American black duck populations have been reduced to very low populations, whereas the mallard has been steadily increasing its population numbers substantially. It is important, especially to the ecological and recreational stability of Paudash Lake, to retain the marshes and swamps that have suitable brood-rearing habitat—emergent vegetation for cover and shallow water for feeding, for the American black duck.

During the spring and fall migration periods, Paudash Lake is used as a staging area, attracting a great variety of ducks that commonly nest further north; the most common of these visitors are the Lesser Scaup (Bluebills), Bufflehead and Goldeneye. The attraction to Paudash Lake is the availability of food; ducks prefer the areas of the lake that have significant patches of aquatic vegetation, which are primarily found in the littoral zone. A good supply of aquatic invertebrates, vegetation and small fish is required in order for these ducks to forage adequately and continue their migration northward towards the Hudson Bay Lowlands in the spring or southward towards the

tropics in the fall. Therefore, in order for Paudash Lake to attract and retain a diverse and healthy community of migratory water birds, shoreline residents must help maintain a healthy aquatic ecosystem, with a significant supply of healthy aquatic vegetation, along the shoreline and within the littoral zone.

Heronries

The maintenance of established heronries and associated feeding areas is important to ensure the stability of breeding populations of herons and egrets because established heronries are an important biological resource for Ontario. The Great Blue Heron is the largest and most wide spread heron in Ontario, and those colonies located on the Canadian Shield are smaller and more numerous than colonies south of the shield. Heronries may be occupied for decades due to the favourable habitat conditions; if birds are forced to relocate, the alternative habitat may be less qualified or even inhospitable for breeding.

Colonial water birds, such as the Great Blue Heron, are especially vulnerable to human activity and disturbance, as well as habitat destruction, during the breeding season, especially when large numbers of birds are concentrated in a confined area. Herons tend to desert nests and entire colonies if disturbed during pair bonding, nest construction, or early egg-laying stages. The desertion and relocation of entire colonies impedes a population's reproductive output, and may affect the stability of the entire regional population of herons.

The effects of human activity may vary in response to a number of environmental factors such as location or timing of the disturbance. As well, the density of the vegetation in and surrounding the colony may further influence the impact of the disturbance, because the removal of trees and shrubs facilitates the intrusion of humans and predators as well as increases the exposure of nests to fluctuating water levels and run-off. Therefore, by retaining the natural vegetation and conserving wetland habitats along the shorelines, and within the riparian and upland zones, natural buffers against disturbance can be maintained and alternate nest sites provided in order to help protect Ontario's heronry populations.

Loons

The common loon is the provincial bird of Ontario, but only a few (one to two) breeding pairs will inhabit a lake at one time. The loon's haunting call, has become a symbol of the peace and solitude of northern living; it would be difficult to imagine Paudash Lake without nesting loons. Unfortunately, this could become an unacceptable reality unless the residents of Paudash Lake ensure that proper loon habitat conditions—quiet lakes surrounded by rocky and forested natural shorelines that offer an abundance of baitfish for their diets—are maintained. Loons rely on an abundant supply of baitfish in a lake for their diets. Maintaining clear, uncontaminated water in a lake allows the loons to use their astonishing speed, lightning fast underwater pivots, and quick thrusts to hunt and seize baitfish in Paudash Lake.

The loon's streamlined body and webbed feet are built for maximum efficiency underwater; unfortunately, this design makes them very awkward on land. The loon's nest are usually located on small islands, built close to shore so that these birds rarely have to move over more than a foot or

two of land. The nest is usually no more than a pile of twigs or a hollow area in the dried riparian vegetation. A loon usually lays two large eggs, and the young enter the water within a few hours of hatching; you can often see the adults carrying their young on their backs across the lake. The proximity of nests close to the water allows for a quick escape route from danger; unfortunately, it also exposes their nests to flooding, swamping and wave action. It is, therefore, vitally important to protect the reproductive ability of loons to assist them in rearing healthy young each year despite their small broods.

Today, increased human activity is one of the main causes for losses of loon populations on northern lakes. Loons are particularly sensitive to development, shoreline disturbances and fluctuating water levels. Power boaters and other activities that cause excessive waves, flooding and noise disturb the nesting loons, loon chicks, or feeding loons. Sensitivity to such disturbances will often cause loons to abandon nesting sites and/or the lake completely. The presence of loons on a lake is often used as a biological indicator of the ecosystem's health.

For more information on specific bird species or to report a sighting, please contact Bird Studies Canada at http://www.birdstudiescanada@bsc-esc.org, the Ontario Breeding Bird Atlas at http://www.birdsontario.org/atlas/, the Long Point Bird Observatory at http://www.bsc-esc.org, or the Natural Heritage Information Centre at http://www.mnr.gov.on.ca/MNR/nhic/nhic.cfm.

5.6.3 Significant Reptiles and Amphibians

Paudash Lake shorelines, riparian zones and wetlands are home to a variety of reptiles and amphibians (Figure 5.16), including several rare and/or "species at risk" turtle and snake species.

In the past 20 years, there has been a noted decline, by scientists, in the world's amphibian population; a significant decline that has initiated the use of biological indicators, such as frogs, to highlight, and identify notable environmental changes in ecosystem health. The decline of amphibian populations and the loss of biological diversity have been linked to several combinations of environmental factors caused by human activities, including the food trade, industrialization, habitat destruction for development purposes, and climatic and other landscape changes, such as acid rain, greenhouse gases, habitat loss, stream channelization and effluents leaching into wetlands.

Amphibians are particularly at risk because of their lifecycle requirements; frogs and salamanders need both healthy aquatic and terrestrial habitats to fulfill their lifecycle. The loss of shoreline vegetation increases water temperatures and ultra-violet light exposure to the water column, which are both detrimental to these species' eggs, which hatch in the littoral zone, and many toxins that are leached into the soils or deposited by rain inhibit normal growth in tadpoles. In 1991, summer observations indicated that several species including the northern leopard, mink and green frog were all well represented on the lake. Bullfrogs were less abundant, because they are at their northern range limit, but are still well represented on the lake.

Figure 5.16 – List of Reptiles and Amphibians In the Paudash Lake Area

Amphibians	
Common Name	**Scientific Name**
Spotted Salamander	*Ambystoma maculatum*
Eastern Red-backed salamander	*Plethodon cinereus*
American Toad	*Bufo americanus*
Spring Peeper	*Pseudacris crucifer*
Gray Treefrog	*Hyla versicolor*
Wood frog	*Rana sylvatica*
Northern Leopard frog	*Rana pipiens*
Green frog	*Rana clamitans*
Mink frog	*Rana septentrionalis*
Bull frog	*Rana catesbeiana*
Reptiles	
Common Name	**Scientific Name**
Common Snapping turtle	*Chelydra serpentina serpentina*
Midland Painted turtle	*Chrysemys picta marginata*
Blanding's turtle*	*Emydoidea blandingii*
Spotted turtle*	*Clemmys guttata*
Eastern Garter snake	*Thamnophis sirtalis sirtalis*
Northern Water snake	*Nerodia sipedon sipedon*
Northern Redbelly snake	*Storeria occipitomaculata occipitomaculata*
Eastern Hog-nosed snake*	*Heterodon platirhinos*
Eastern Milk snake*	*Lampropeltis triangulum triangulum*
Eastern Smooth Green snake	Opheodrys *vernalis*

Note – one * indicates a species with a species at risk status designation

Source: Mosquin et al. 1992 and NHIC 2004

Turtle and snake species have declined dramatically over the past 20 years because of habitat loss due to development encroachment, road traffic, and direct persecution. Many turtles lay their eggs in in-ground nests, which are heavily predated by both terrestrial and aquatic mammals, along sandy shorelines or gravelly roadsides and trails, and the adults are often killed by on-coming traffic prior to or after the laying of these eggs. Unfortunately, snakes are often injured or killed because of misidentification. For example, the eastern Massasauga rattlesnake is Ontario's only venomous snake and is primarily found in the Georgian Bay area; however, many other non-lethal snakes resemble the rattler, including the eastern hog-nose snake and the eastern milksnake, which are both found in the Paudash Lake watershed, and have been "destroyed" because of misidentification and lack of education.

Several reptiles, including Blanding's turtle, spotted turtle, common five-lined skink, the eastern hog-nosed snake and the eastern milksnake, found in the Haliburton and Hastings counties, are all "at risk" and have special status designations both provincially and nationally in Ontario and Canada, which affords them some protection (Ontario Endangered Species Act and the Species At Risk Act) against "wilful" persecution and habitat destruction.

From the Mosquin et al. (1992) report, there is a narrow representation of turtles on the lake, despite the extensive high quality habitat available on Paudash Lake; the report recorded only three turtle species (Snapping, Midland Painted and Blanding's Turtle) for the Paudash Lake area. These low numbers may be caused by the annual drawdown of the lake each fall. Turtles burrow in the sediments of the lake's shallow waters during hibernation; in late fall as the water temperatures

begin to drop and as shoreline mud flats freeze, the hibernating turtles could become frozen in the lake's sediment. However, now that the fall drawdown is completed by September 30th, and well before turtles hibernate, this situation may correct itself.

If you find a turtle's nest or an injured turtle on your property or along the roadside, please contact the Kawartha Turtle Trauma Centre at http://www.kawarthaturtle.org/ or the Toronto Zoo at http://www.torontozoo.com/ to find out how you can help.

Observations

- *There is a wide variety of wildlife on Paudash Lake.*
- *Most of the land that abuts and surrounds Paudash Lake is privately owned. Accordingly, the management of wildlife habitat is substantially dependent on each owner's ability, knowledge and desire to manage his property.*
- *Significant numbers of ducks and other waterfowl, including loons and American black ducks,, are found on Paudash Lake, but their prime nesting habitats have not been identified.*
- *Fall drawdown of the lake water level may play a role in the decline of the turtle population, but with the fall drawdown complete by September 30th, well before turtles hibernate, this may no longer be a factor in turtle decline.*
- *Shoreline vegetation is incredibly important for the wildlife in Paudash Lake.*
- *One elk sighting of a cow and her calf in the winter of 2004.*
- *Deer yards are an important feature to maintain the deer population during the winter months.*
- *Moose mineral requirements are met with an ample supply of aquatic vegetation.*
- *The MNR Bancroft District has a black bear population index program, which is conducted each year, and a public advisory program about nuisance bears.*

Recommendations – Wildlife

58. A program should be established by the PLCA to locate the nesting sites of loons, ducks, colonial birds, and other waterfowl in order to identify important habitat areas, and literature that promotes the protection of wildlife habitat and shorelines should be distributed to property owners.

59. Turtle nesting sites should be identified and protected against predation; property owners should be informed about the techniques available to protect turtle nesting sites (Kawartha Turtle Watch and the Toronto Zoo).

60. Lakefront owners should be encouraged to return a significant portion of their shoreline to natural vegetation to encourage nesting and create suitable habitats for other species.

61. A revised inventory of the animal species, including breeding birds, smaller mammals such as voles, moles and bats, and insects should be prepared. The last Mammal Atlas was published in 1994 and the Paudash Lake animal inventory relies upon the findings in the Mosquin et al., 1992 report.

62. Planning of shoreline development is required to protect the remaining wildlife habitat of Paudash Lake including the following suggestions:

a. ***Minimum frontage requirements on remaining undeveloped lots should be at least 60 metres (200 feet) and increased frontage requirements would be preferred;***
b. ***Wood lot clearing along the shoreline of important conifer and hardwood trees should be restricted; and***
c. ***Greater restrictions regarding alteration of natural shorelines should be imposed including the identification of a maximum shoreline activity area.***

5.7 Exotic and Invasive Species

Exotic (non-native) and invasive species describes organisms that have been introduced into non-native habitats. The introduction of these invading species cause widespread and unpredictable changes to habitats, and is a worldwide problem. Scientific research has recognized the serious threat of exotics, second to habitat destruction, to the local biological diversity and overall health of the ecosystem, especially in aquatic environments. Ecological changes can result in damages to ecosystems, native fish and wildlife populations, local infrastructure and disruption of commerce, as well as threatening human health due to poorer water quality conditions from the loss of biological diversity.

In the absence of natural predators, competitors, diseases and parasites, populations of exotic species can explode and out-compete native species for food and habitat. Once established, these species are almost impossible to eliminate, and control of nuisance exotic species can cost millions of dollars and impose other serious threats to the local environment, such as the release of non-native predators and competitors, or spraying toxic chemical substances to control outbreaks. The impacts of several invading species are often greater than the sum of their individual affects on a system, and established, as well as new populations of exotics, continue to be introduced into Canada.

Introductions of non-native aquatic species have occurred through a variety of pathways including unregulated ballast water discharge, natural barrier removal, stocking and lack of education, which causes accidental releases from aquariums, bait harvesters, anglers and the live fish food trade. Unless precautions are taken to remove these organisms, these exotics will spread from one body of water to another. Once introduced, minnows, crayfish, mollusks, larval and adult invertebrates, and other live bait can unknowingly be transported to other Ontario inland waters by recreational watercraft, bait buckets, fishing gear and fish stocking.

The introduction of exotic or non-native species into a lake affects the natural balance of the ecosystem. Currently, only three exotic species have been identified in Paudash Lake's watershed including zebra mussel veligers, rock bass and purple loosestrife, with the latter two having established populations in the Paudash Lake watershed.

Rock bass

Rock bass (*Ambloplites rupestris*) were accidentally introduced into the Paudash Lake system, possibly in the late 1940's or early 1950's, when largemouth and smallmouth bass were stocked,

and quickly became an established resident as early as 1960s. Rock bass are “hardy fish”, tolerant of stressed aquatic systems and are, therefore, an aggressive competitor for many species, especially largemouth and smallmouth bass and lake trout. It is hypothesized that rock bass populations may be negatively impacting (causing several stresses) the bass population by predating (feeding) on their larvae and lake trout populations through direct competition for resources.

Purple loosestrife

Purple loosestrife (*Lythrum salicaria*) is a plant native to Europe and Asia that has seriously impacted wetland habitats since its introduction to North America, as an ornamental plant, in the 1800s. There are several plant species that mimic or look similar to the purple loosestrife, such as fireweed (*Epilobium angustifolium*), blue vervain (*Verbena hastate*) and water-willow or swamp loosestrife (*Decoden verticillatus*) but, unlike the purple loosestrife, these plants are native. Purple loosestrife reproduces at an alarming rate, spreading along roads, canals and drainage ditches, and has invaded marshes and lakeshores choking out the natural wetland vegetation that occurs around it. Unfortunately, complete eradication of this plant is impossible, even though mechanical removal has been effective in controlling or slowing down the spread in some areas of Ontario, because there are no native herbivores that have the potential to control *L. salicaria* found in North America (http://www.invasivespecies.com/).

In recent years, however, research has focused its attention on several native purple loosestrife pathogens and parasitic insects, from Europe—100 different insect species most commonly associated with purple loosestrife—and Asia, for their potential as biological control agents. The selected species were chosen from the Coleoptera (beetle order): Curculionidae (weevil family) because of their association with purple loosestrife in Europe, their mobility and their good host finding abilities. At several release sites in Ontario, complete defoliation of large purple loosestrife stands (many hectares) have been reported with local reductions of more than 95% of the biomass. However, it is not yet clear what type of replacement communities will develop.

In summer 2003, the Paudash Lake Conservation Association (PLCA) participated in a controlled study sponsored by the Ontario Federation of Anglers and Hunters’ (OFAH) Invasive Species Project, in cooperation with Ontario Beetles Inc. The Ontario Living Legacy Fund funded the study—the usual cost of $900 per 5,000 beetles was waived, to assist with determining the effectiveness of using natural biological predators as a means of controlling major infestations of purple loosestrife.

The larvae of ten thousand beetles—*Galerucella* spp. (species), were released along two highway corridor sites: 1) Highway 28 just north of its intersection with highway 118; and 2) Highway 118 on the Haliburton side of the county line. Most of the beetle larvae were released in the latter area, since Highway 28 had already been showing signs of purple loosestrife diebacks—black stocks, from a minor beetle release program two years ago.

Beetle population sizes are totally dependent upon the amount of food available in an area. Scientific evidence has shown that when beetles have consumed all the available food in one area, they are able to locate new sources of loosestrife species and will relocate within the watershed.

The beetle release program will enable OFAH to gather baseline data to determine best practices for the future for this type of biological control. In September 2003, PLCA volunteers did stem counts, flower head length, and total dry weight of biomass surveys in the site on Highway 118—five separate one square metre plots, and forwarded the summarized data to OFAH. In June 2004, PLCA volunteers counted beetle "eggs" at the same location on Highway 118. The September and June surveys will be repeated over the next few years in order to measure and identify the impacts of the beetle release program. The Paudash Lake Conservation Association is only one of 40 lake associations participating in this baseline research project.

Zebra mussels

Zebra mussels (*Dreissena polymorpha*) have been invading the inland lakes of Ontario since their introduction into the Great Lakes, probably as a result of discharge from the ballast of the ocean going ships. Zebra Mussels attach to recreational boats that are used on the Great Lakes; if these boats are launched into inland lakes, without the hulls being cleaned, zebra mussels can be introduced into that lake. It was reported in 1998 that there was evidence of zebra mussel veligers in Paudash Lake, but no adults have been reported as of this time. According to the MOE, the species was only identified in larval form (veligers) and it is speculated that the chemistry of the water may prevent adult formation; however, slightly elevated levels of calcium in Paudash Lake do make it hospitable.

Several other invasive aquatic animal species to watch-out for include the Rusty Cray Fish (*Orconectes rusticus*)—Kawartha Lakes; the Spiney Water Flea (*Bythotrephes cederstroemi*)—Kennisis Lake, Bella Lake and Lake of Bays; and the Round Goby (*Neogobius melanostomus*)—Sturgeon Bay (1999) and Hastings (2003). These species have all been accidentally introduced through bait release and contaminated watercrafts. Exotic aquatic plant species to watch-out for include the Eurasion Milfoil (*Myriophyllum spicatum*)—currently undergoing trial biocontrols with a native weevil; European Frogbit (*Hydrocharis morsus-ranae*); Fanwort (*Cabomba caroliniana*)—Kashabog Lake and the Kawarthas; Culry pondweed (*Potamogeton crispus*)—associated with European milfoil; and Flowering Rush (*Butomus umbellatus*). All of these invasive species have been identified and are now established in many inland lakes and wetlands of Central Ontario. Both Round Goby and Spiney Water Flea have been identified in many Haliburton, Hastings and Muskoka County lakes. Currently, there are no known observations of these species in Paudash Lake or its surrounding wetlands, but since these species have been carelessly introduced into other inland lakes of the area and are extremely competitive with Ontario's native species, cottagers and visitors should be extremely cautious about bait release, transport and planting of non-native species, and the maintenance of their recreational water vehicles.

Observations

- *Exotic and invasive species, such as rock bass, purple loosestrife and zebra mussel veligers, have invaded Paudash Lake; no adult zebra mussels have been reported as of the summer of 2003.*
- *Invasive and exotic species pose a serious threat to the lake's health, as well as the ecological, social and economic stability of the community. Exotics species out-compete local, native species and threaten already stressed rare and species at risk species, which*

reduces biodiversity via uncontrolled dumping of ballast waters, baitfish harvest and lack of education.

- *Low hardness and alkalinity concentrations suggest that the threat from zebra mussel colonization is limited, but possible.*

<u>Recommendations</u> – Exotic Species

63. The Paudash Lake Conservation Association should post signage at all points of water access regarding the invasion of exotic species, their harmful effect on the lakes, and the procedures to ensure protection of the lake ecosystem.

64. Stakeholders around the lake can do their part by covering each purple loosestrife plant with a garbage bag to avoid disturbing the seeds, and pulling out the plant by the root or cutting off the flower spikes and dry seed heads; in areas with high densities may require biological or chemical control methods.

65. It is very important, if you are a boater, angler, sailor, canoeist or water-skier, to take precautions to prevent the transport of exotic species from one lake, river or stream to another.

66. You can also assist efforts to raise awareness of invading species, prevent their spread, and track their distribution by participating in various innovative projects, including the OFAH and Invading Species Hotline (1-800-563-7711): a toll-free number for the public to report sightings and obtain free information on invading species.

67. Establish a local "Invading Species Watch": a volunteer-based monitoring program to detect zebra mussels, spiny water flea and other invasive plankton species.

68. Increase public awareness to local resource users and schools by using educational tools, such as Zebra Mussel Mania Traveling Trunk (a set of educational activities available on loan for elementary schools to teach their students about invading species), and Project Purple (an initiative aimed at raising awareness of the threat that purple loosestrife poses to wetlands, and involving the public in control activities and workshops).

5.8 Rare Species and Species at Risk

The causes of rarity or scarcity of a species are many and varied, and may be natural or related to human activity. Rarity may be caused by the lack of suitable breeding habitat, lack of migratory stopover areas, poor winter habitat, predation, unregulated hunting, disease, pollution, habitat destruction or over-collecting. Rarity may also be due to the fact that the particular population is at its natural limits of its distribution range. Rare species are considered very important and worthy of protection efforts because of their biological, social and, most often, economical value. Many of these species are ranked in accordance to their rarity, which are established by the Natural Heritage Information Centre (NHIC), and are significant species and of conservation priority.

Significant species are those regarded as provincially or regionally rare or sparse natural heritage feature. The Natural Heritage Information Centre (NHIC) (http://www.mnr.gov.on.ca/MNR/nhic/nhic.cfm) collects, manages, and ranks Ontario species based on a number of factors such as

biological and habitat requirements, distribution, population size, threats, management strategies, etc.; these ranks are used by the NHIC to set protection priorities for rare species and natural communities, and are not legal designations. Those species that are classified as S1, S2, or S3 (S is used by the NHIC (and NatureServe) which refers to the Provincial (or Subnational) rank, and 1,2,3 are codes for occurrence rarity ranging from <5 to 100 in the province, and those species with a 4 or 5 numerical code are usually considered secure and not rare because of population occurrences >100 to widespread or common) are rare and tracked by the NHIC, and are species considered to be provincially significant.

Species being tracked by the NHIC are generally known from fewer than 100 occurrences across the province, and are often designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and/or the Committee on the Status of Species at Risk in Ontario (COSSARO) as 'species at risk'—an official status, which may afford the threatened and endangered species some protection in Ontario and Canada. For more information regarding distribution, provincial ranks and distribution status of Paudash Lake species, or if you would like to report a rare species, please contact the NHIC (http://www.mnr.gov.on.ca/MNR/nhic/nhic.cfm) and Ontario Parks, which includes access to the "Species at Risk in Ontario (SARO) List" (http://www.ontarioparks.com/english/sar.html).

A "Species at Risk" designation status of 'special concern', 'threatened' or 'endangered' by COSSARO and/or COSEWIC directs the planning, recovery and conservation efforts, and affords some legal protection for threatened and endangered designated species in Ontario (i.e., Ontario Endangered Species Act and the Species at Risk Act). Other species are or may be of conservation concern, but their formal conservation status has yet to be evaluated.

All species are important to the biological diversity of the local area. Some municipalities use rare species lists, which are identified in Ontario's bird, plant, mammal, amphibian and reptile, and butterfly atlases, of regionally or provincially significant species in land-use planning and in evaluations of natural areas, wetlands and environmentally sensitive areas (ESAs). The protection of endangered and threatened species and their habitats from wilful harm or destruction is federal and provincial law, but it is still necessary to monitor all species for evidence of decline and to contribute efforts to slowing or preventing population declines, loss of habitat, and/or the extirpation of these species from the province all together.

For more information regarding the laws and regulations in place in Ontario and for the Paudash Lake watershed for the protection of fish and wildlife, please contact the MNR Bancroft District or visit the MNR web site at http://www.mnr.gov.on.ca/MNR/.

Regionally significant breeding bird species, in the northern wetland evaluation system (2000), for Site Region 5 in Paudash Lake include (2003 data):

- **Lesser Scaup** *(Aythya affinis)* - not tracked by the NHIC
- **Sedge Wren** (*Cistothorus platensis*)- no longer tracked by the NHIC and presumed secure
- **Pied-billed Grebe** *(Podilymbus podiceps*) - no longer tracked by the NHIC and presumed secure (2003)

- **Yellow-throated vireo** *(Vireo flavifrons)* - no longer tracked by the NHIC and presumed secure

Provincially significant species, in the northern wetland evaluation system (2000) in Paudash Lake include (2003 data):

- **Cooper's Hawk** (*Accipiter cooperrii*) - no longer tracked by the NHIC, but sensitive/vulnerable to development. There are forest management guidelines set for Cooper's hawk, as well as songbirds and wetland birds, that MNR has produced to help set management priorities or precautions; for more information contact MNR Bancroft)
- **River Otter** (*Lutra canadensis*) - not tracked by the NHIC and presumed secure)

The river otter is considered provincially significant in the wetland evaluation system, however, this system groups species in southern and northern Ontario and the river otter is actually quite abundant in northern Ontario.

Provincially significant, tracked species (2003 data, and 2004 MNR confirmation), with some species having official conservation status designations (status verified with 2004 COSEWIC and SARO lists), include:

1. **Greater Scaup** *(Aythya marila)*
    - No status
    - Source: Mosquin et al. (1992)

2. **Red-shouldered Hawk** *(Buteo lineatus*)
    - Species at Risk – COSEWIC SC and MNR SC status
    - Source: Elements from the counties of Haliburton & Hastings, NHIC (2004), Mosquin et al. (1992), and ROM (range extends into Paudash Lake watershed)

3. **Spotted Turtle** *(Clemmys guttata)*
    - Species at Risk – COSEWIC END and MNR SC status—soon to be updated to an END MNR status
    - Source: Elements from Haliburton & Hastings County, NHIC (2004) and ROM (range not found in Haliburton or within Paudash Lake watershed, but the Herpetological Atlas (NHIC) identifies a few sightings in northern and southwestern areas of Haliburton County)

4. **Blanding's Turtle** *(Emydoidea blandingi)i*
    - Species at Risk – COSEWIC No status and MNR THR
    - Source: Elements from the counties of Haliburton & Hastings, NHIC (2004) and Mosquin et al. (1992)

5. **Common Five-lined Skink** *(Eumeces fasciatus)*
    - Species at Risk – COSEWIC SC and MNR SC status

- Source: Elements from the Crowe Valley Conservation Authority, NHIC (2004) and ROM (range extends into the northern range of Paudash Lake watershed)

6. **Peregrine Falcon** *(Falco peregrinus anatum)*
   - Species at Risk – COSEWIC THR and MNR END-R status
   - Source: Elements from Haliburton & Hastings County, NHIC (2004) and ROM (range extends into Paudash Lake watershed)

7. **Southern Flying Squirrel** *(Glaucomys volans)*
   - Species at Risk – COSEWIC SC and MNR SC, status
   - Source: Elements from the counties of Haliburton & Hastings, NHIC (2004) and ROM (range extends into Paudash Lake watershed)

8. **Bald Eagle** *(Haliaeetus leucocephalus)*
   - Species at Risk – COSEWIC NAR and MNR END-R status
   - Source: Mosquin et al. (1992) and ROM (range extends into southwestern Haliburton County, but not in Paudash Lake watershed)

9. **Eastern hog-nosed Snake** *(Heterodon platirhinos)*
   - Species at Risk – COSEWIC THR and MNR THR status
   - Source: Elements from Haliburton County, NHIC (2004) and ROM (range extends into Paudash Lake watershed)

10. **Eastern Milksnake** *(Lampropeltis triangulum triangulum*)
    - COSEWIC SC and MNR SC status
    - Source: Mosquin et al. (1992) and ROM (range extends into Paudash Lake watershed)

11. **Eastern Small-footed Bat** *(Myots leibii)*
    - No status
    - Source: Elements from Hastings County, NHIC (2004)

12. **Northern Long-eared Bat** *(Myotis septrentrionalis)*
    - No status
    - Source: Elements from the counties of Haliburton & Hastings, NHIC (2004)

13. **Eastern Pipistrelle Bat** *(Pipistrellus subflavus)*
    - No status
    - Source: Elements from the counties of Haliburton & Hastings, NHIC (2004)

END-R – Endangered status; species regulated under the Provincial Endangered Species Act
END – Endangered status; species not regulated
THR – Threatened status
SC – Special Concern status

For more information regarding species status and protection in Ontario consult the with Ontario Parks SARO list at http://www.ontarioparks.com/saro-list.pdf.

ROM – Royal Ontario Museum's web site (last updated 2005), in collaboration with the Ministry of Natural Resources, regarding status of species at risk in Ontario. All relevant information on each species, including distribution ranges in Ontario, is extracted from COSEWIC status reports. The distribution ranges for each species are "expected ranges", and current accuracy should be verified with experts; however, all above mentioned species in this lake plan have been verified by the MNR.

The ROM web site has also identified the "expected ranges" of other species at risk species in Haliburton and Hasting Counties; however their occurrences within Paudash Lake watershed have not been verified by MNR. For more information visit the ROM web site at http://www.rom.on.ca/ontario/risk.php.

Locally rare in the central region of Ontario (Regionally Significant plant species for Haliburton County) include (2003 data, and 2004 NHIC confirmation):

14. **Least Burreed** *(Sparganium natans*) - also known as *S. minimum.* A small distribution in Ontario with only a single site listed in Haliburton County; therefore, it is rare

15. **Bog Candle** (Leafy white orchid) *(Platanthera dilatata*) - also known as *Habenaria dilatata*. Most orchids are sensitive to habitat change and are, therefore, considered rare species in Ontario.

No 'Regionally Significant' plant species are listed for Hastings County (2004 NHIC confirmation).

Observations

- *There are fifteen rare or significant faunal species recorded for the Haliburton and Hastings area, including three rare breeding birds, two rare turtles and two rare snakes for the Paudash Lake area.*
- *Two plant species found in fens along the shoreline of Paudash Lake are considered to be rare in the central region of Ontario.*
- *Fens are rare in Ontario's Algonquin Region.*
- *The Blanding's turtle and the spotted turtle both inhabit Paudash Lake and are both considered to be a provincially rare species; spotted turtle is designated as "endangered" by COSEWIC and "special concern" by COSSARO/MNR (MNR designation is soon to change to endangered). All turtle species, except for the more common snapping turtle and western and midland painted turtles, are being tracked in Ontario by the NHIC due to their sensitivity to development, loss of habitat, and low reproductive success due to predation and traffic mortality (for more information regarding tracked turtles in Ontario visit the web sites of, or contact directly the NHIC, the Toronto Zoo, or Kawartha Turtle Watch).*

- *The river otter is considered to be a provincially significant species in the wetland evaluation system, although it is not considered rare for northern Ontario.*
- *Rare species inventory for vascular plants, invertebrates, crayfish, molluscs, fish and reptiles (turtles and snakes) need to be assessed; just because a species hasn't been seen that doesn't mean it might not inhabit the area.*
- *The eastern hog-nosed snake is protected under the Provincial Policy Statement (PPS) and Schedule 9 of the provincial Fish and Wildlife Conservation Act (FWCA), Peregrine falcon is protected under the PPS, the provincial Endangered Species Act (ESA,) and the federal Species at Risk Act (SARA), and the bald eagle is protected under the PPS and the provincial ESA from wilful persecution and/or habitat destruction.*
- *If you are undertaking planning application work for locations with SAR species, the Natural Heritage Reference Manual states that COSEWIC endangered species, such as the Spotted Turtle, will receive policy protection under the Provincial Policy Statement (significant portions of habitat for endangered and threatened species).*
- *The following websites may be consulted for current information on federally and provincially designated Species at Risk:*
    - *Ontario Parks & SARO List* http://www.ontarioparks.com/english/sar.html
    - *Royal Ontario Museum (ROM) – Ontario's Species at Risk* http://www.rom.on.ca/ontario/risk.php
    - *Natural Heritage Information Centre* http://www.mnr.gov.on.ca/MNR/nhic/nhic.cfm
    - *COSEWIC* http://www.cosewic.gc.ca/
    - *Environment Canada, Canadian Wildlife Service (CWS) – Species at Risk* http://www.speciesatrisk.gc.ca/

***Recommendations* – Rare Species and Species at Risk**

69. Cottagers need to be educated about the provincial and federal legislation regarding species at risk and the incentives that are in place for private stewardship efforts as well as be encouraged to ground truth for rare species, such as the proper identification of those rare species, being tracked in the Paudash Lake area.

70. The identification and location of endangered or threatened species should be reported promptly to the Natural Heritage Information Centre—the Ontario Ministry of Natural Resources, Peterborough or your local MNR office.

71. The location of rare and "species at risk" nesting, basking, hibernating or other habitats should not be publicized since many of these species are rare or "at risk" due to direct persecution.

72. Public awareness workshops or web pages posted on the Cottagers Association web site for links and information regarding the protection of rare species' habitat and how to naturalize their property to encourage rare species establishment.

73. A thorough inventory of rare and species at risk needs to be assessed, especially for reptiles (turtles and snakes), invertebrates, fish and birds, which are negatively impacted by shoreline destruction.

74. Provincial and/or federal agencies, or Non-government Organizations (NGOs) may have funding money to include Paudash Lake into an inventory and monitoring study for rare or "at risk" species; volunteers could help locate these species, with proper diagnostic training and field equipment.

Section 6 Physical Elements

It is important to examine the physical aspects of the area surrounding Paudash Lake in order to identify potential constraints affecting present and new land development. Soils, floodplains, narrow water bodies, steep slopes, and the location of productive forests, renewable and non-renewable resources, and minerals and aggregates are discussed in this section.

6.1 Soils

The soils of the Paudash Lake area occur over Precambrian bedrock, and are thin and sparse. Therefore, soil potential for agriculture is low, which accounts for the abandonment of crop farming in the late 1800's. There are scattered pockets of organic soils in the area, which accounts for the wetlands present along the shoreline of the lake. The soils, typically present in the area, occur under deciduous or mixed forest vegetation in areas of mild or humid temperatures, and include Luvisols, Brunisols, Podzols, Gleysols and some organic soil types.

The geological features of Paudash Lake are consistent with those of the Algonquin Highlands Physiographic Region. The bedrock is mostly plutonic rock of granite and Precambrian sedimentary rocks composed largely of crystalline limestone (Chapman and Putman 1984). The water in Paudash Lake is, therefore, extremely resilient against acid rain and other causes of acidification because of the calcium rich bedrock. The soils exhibit textures including coarse, medium and fine sand gravel. The soil composition shows a very low base derived from granite. The mode of deposition could have been glacial (till) and fluvial. The topsoil is generally acidic due to the historically dense coniferous vegetation (Brown 1997).

Observations

- *The overall thin soil cover of rock, silt and fine sand makes many areas susceptible to erosion, if disturbed, and stabilization by regeneration is difficult due to topography and other factors.*
- *At construction sites, improperly contained fine soil particles and clay can result in uncontrolled erosion and introduction of sedimentation into the lake and its streams. Silting and sedimentation lead to water turbidity, which has the potential to affect the entire food chain.*

Recommendations – Soils

75. Development that results in major alteration of landscape and soils should be required to submit Storm Water Management and Construction Mitigation Plans. Construction specifications should include:

a. Appropriate assessment of soil characteristics causing sedimentation and erosion;

b. Construction measures (silt fences, hay bails, runoff ponds) that are needed to prevent silting and erosion of the banks of water courses.

76. The PLCA should encourage the municipalities to use appropriate silt screens and follow proper construction mitigation guidelines for all shoreline development.

6.2 Floodplains

Property development in floodplain areas puts the property and the health and safety of residents at risk, and therefore new development in floodplains should not be permitted. In addition, the placement of fill in floodplain areas displaces water and results in other off site impacts, such as increased water levels and flows, and downstream impacts. Local official plans and zoning by-laws should recognize the 100-year floodplain elevation of 342.8 metres, identified by MNR, and include policy that prohibits development and the filling of these areas.

Observations

- *Floodplains on Paudash Lake are limited and flooding is not a major concern.*

6.3 Minerals and Aggregates

Uranium - Decommissioning of Abandoned Uranium Mines

Historical Background – The first outcrops of uranium in the vicinity of Paudash Lake were discovered in 1922. Following World War II, there was considerable interest in the mining of uranium, and in 1956 Bicroft Uranium Mines Ltd. began operations. Canadian Dyno Mines Ltd., adjacent to Farrell Lake, began operations in 1958. The other uranium mines, Faraday and Greyhawk, adjacent to Bow Lake on Highway 28, opened in 1957. All of them closed in the early 1960s, but Madawaska Mines Ltd. reactivated Faraday and Greyhawk in 1976; that mining operation ceased in 1982, and there has been no uranium mining activity in the area since that date. Map 1 – Paudash Lake Watershed and Map 6 – Land Use indentifies the location of these mines.

The economic and social impact of the uranium mines on the Paudash Lake and Bancroft area has been substantial. At the peak of production in the late 1950's, the Bicroft and Dyno Mines employed approximately 1,000 people. The Village of Cardiff (200 houses) was created to accommodate the mine workers and their families. Bicroft Heights (17 staff houses) was built to meet the housing needs of staff and managerial personnel of the Bicroft Mine, and the Dyno Estates (15 bungalows) was built to meet the same requirements for the Dyno Mine operation. An eight-room schoolhouse, enlarged by 1958 to eleven rooms, was erected in the Village of Cardiff and soon filled to capacity. The uranium boom and the resulting creation of the Village of Cardiff was an important factor in the growth of Bancroft as a business centre. According to one commentator at the time, “the story of Cardiff Village is a boom that refuses to go bust”.

Regulatory Authority for the Decommissioning of the Mine Sites – The primary jurisdictional authority for the decommissioning of the Bicroft and Dyno Mine Sites, which ceased operations in the 1960s, is not clear. The Atomic Energy Control Board (AECB), now re-named the Canadian

Nuclear Safety Commission, did not regulate the operations and the decommissioning of uranium mines, directly, until 1977, over ten years after the two mines ceased operations.

Since the other two uranium mines in this area (Faraday and Greyhawk) closed in the 1960s but were reactivated by Madawaska Mines Ltd. in 1976 and continued to operate until 1982, this mining company was obliged to formally decommission the site to standards set by the Atomic Energy Control Board.

The Paudash Lake Conservation Association (PLCA) has been involved in the struggle to resolve the jurisdictional dispute between the federal and provincial governments regarding the decommissioning of the Bicroft and Dyno Mines, since the early 1980s. In the early stages of the campaign, it was clear that no level of government would accept responsibility for the closure. The Ontario government was adamant that since it involved uranium, it was a clear responsibility of the federal government and the AECB and the federal government was equally firm that the jurisdiction rested with the Ontario Ministry of Northern Development and Mines. With the financial assistance of the Ontario Ministry of the Environment, the PLCA contracted the Canadian Institute for Radiation Safety (CAIRS), who issued three reports for the PLCA. These reports supplied important and scientifically credible information, and were an important factor in convincing local, regional, provincial and federal levels of government of the need to find a resolution to the jurisdictional deadlock.

The PLCA approached the Bancroft and District Chamber of Commerce in an effort to get their support in the campaign to initiate the decommissioning of the Bicroft and Dyno Mine Sites, which depended on breaking the deadlock of the jurisdictional dispute between the federal government and the provincial government of Ontario. The result was a meeting with the AECB, jointly sponsored by the Bancroft and District Chamber of Commerce and the PLCA, on September 7th, 1989, attended by mine representatives, local elected officials, area cottage representatives, and others. At that meeting, the AECB undertook to meet with owners of the mine sites concerning remedial actions at their properties and to report back to community representatives. This was followed by another meeting on January 19th, 1990, which allowed the AECB an opportunity to provide a status report to the community regarding their discussion with the owners of the mine sites.

Essentially, without prejudice to the jurisdictional dispute, the AECB agreed to provide supervision for the decommissioning of the mine sites on the basis of the voluntary compliance and at the expense of the owners of the mine sites. At the request of the AECB, an Interim Liaison Committee, consisting of the Reeves of Faraday and Cardiff, the Chamber of Commerce and the PLCA, was formed and the AECB agreed to maintain a reporting function to the community as to the status of closures. The presidents of the Bancroft and District Chamber of Commerce and the Paudash Lake Conservation Association chaired the Interim Liaison Committee.

In February 1990, in an article for the PLCA Newsletter, Dr. Rene Levesque (recently appointed President of the AECB) summed up the achievements of these two meetings as follows:

> "The AECB is satisfied with the progress made to date for assessing and implementing the remedial action for the two idle mine sites at Dyno and Bicroft. As

reports and plans become available, they will be reviewed by AECB staff, in cooperation with other appropriate government agencies and local groups.

I would like to emphasize, that the cooperation of the Bancroft and District Chamber of Commerce as well as the Paudash Lake Conservation Association is very much appreciated by the AECB. A coordinated, cooperative effort is the best way to resolve issues of public concern such as those existing at the Dyno and Bicroft sites."

In the years following the two meetings, the remedial work at the Bicroft and Dyno mines sites proceeded, under the supervision of the AECB. However, there has been no public acknowledgement of closure of the process and there has been no resolution of the jurisdictional dispute. Who will be ultimately responsible for monitoring these two abandoned mine sites?

The most recent initiative was the publication by the Ontario Ministry of the Environment of a new study, Bancroft Area Mines (Madawaska, Bicroft and Dyno Mines): Assessment of Impacts on Water, Sediment and Biota from Historic Uranium Mining Activities (July, 2003).

The intent of this study was to provide information on environmental impacts to surface water from the three mine sites to the lead regulatory agencies, the Canadian Nuclear Safety Commission (formerly the AECB) and the Ontario Ministry of Northern Development and Mines, which are responsible for the closure, licensing and future use of these sites. The Executive Summary of the study indicates: "One of the proposed uses put forward by the current owners of the Madawaska and Dyno properties has been to return the sites to Crown ownership. Prior to agreeing to receiving the properties, the Crown needed to determine whether there are environmental liabilities associated with the sites for which the Crown may become responsible." This proposal to return the Madawaska and Dyno sites to Crown ownership does not, at this moment, include the property of the Bicroft mine site, which is of direct concern to the residents and cottagers of Paudash Lake.

A follow-up report entitled Bancroft Area Mines: Assessment of Contaminants in Sports Fish from Bentley Lake, Bow Lake, Farrel Lake, Paudash Lake and Centre Lake, released by the Ministry of the Environment (February 2004) provides data on sports fish collected in the spring of 2001. For Paudash Lake, the fish data collected in 2001 were compared with previous sport fish data collections from the lake (1976-1990). The results are available in the latest annual MOE publication and The Guide to Eating Ontario Sports Fish, (2003 - 2004). Fish samples were taken from the five lakes identified in the report, and the results of these tests are encouraging. They indicate that there are no concerns with eating sport fish from any of these lakes due to contamination from radionuclides. However, while radium 226 was not detected in any of the filet samples, it was detected in whole fish samples from Farrel Lake. Since radium 226 has the potential to be deposited in the bone marrow, consumers are advised to eat only boneless, skinless filets of fish from Farrel Lake. Any restrictions regarding consumption of sport fish from these five lakes is due to mercury, commonly found in sport fish throughout Ontario.

Minerals and Aggregates

Aggregates, such as sand, gravel and rock used for construction, industrial, manufacturing and maintenance purposes, are plentiful, and numerous sand and gravel pits are currently in operation

in the watershed and around Paudash Lake. Known aggregate sites are identified on Map 6 – Land Use (insert at back of report).

Observations

- *There is no municipal regulation of gravel pits in the Paudash Lake watershed although existing operations appear to be satisfactory.*
- *The municipalities should include Official Plan policy to prohibit mines, pits and quarries within the site horizon of the lake and to take into account rehabilitation of existing pits when operations are ended.*
- *There are, at present, no active mining operations in the Paudash Lake area.*

Recommendations – Minerals and Aggregates

77. New mineral and aggregate extraction sites and quarry expansions should be regulated to prevent negative impacts on streams feeding into Paudash Lake.

78. Municipalities should adopt a Pits and Quarries By-law that includes requirements for watershed protection and to rehabilitate resource properties after operations cease.

79. Official Plans should be amended to prohibit the creation of new pits and quarries or mining sites within the site horizon of Paudash Lake (viewscape as shown on Map 1).

6.4 Narrow Waterbodies

Development on narrow waterbodies tends to create problems for navigation and decreases the aesthetic beauty of the immediate area. Too many docks and boathouses protruding into a narrow bay or portion of a river may increase congestion and create a hazard with respect to water users. In addition, a congested portion on the waterbody detracts from the overall visual beauty of a waterbody. To discourage congestion in these areas, some municipalities in Ontario have introduced official plan policy requiring increased lot frontage and other design considerations in narrow portions of lakes and rivers (e.g., District of Muskoka Official Plan, County of Hastings).

The Official Plan for the County of Hastings identifies narrow water bodies as a physical constraint to property development. The County of Hastings Official Plan states:

> "In waterfront areas, no lot shall be approved adjacent to a narrow water body unless the water frontage is at least 100 metres in order to ensure safe boating and swimming conditions, to avoid an overdeveloped appearance in a constricted area, and to help ensure a reasonable separation between residential uses."

Generally, the County of Hastings Official Plan policy requires increased frontages of up to 100 m (328 ft) where a narrow waterbody on a lake is less than 150 m (492 ft), or a river is less than 50 m (164 ft) wide.

Observations

- *There are many narrow waterbodies on Paudash Lake.*
- *The County of Hasting Official Plan contains policy requiring a shoreline frontage of at least 100 metres for new lots on narrow waterbodies.*
- *The Municipality of Haliburton East Official Plan does not contain detailed policies on narrow waterbodies.*

Recommendations – Narrow Waterbodies

80. The Municipality of Highlands East should be encouraged to establish official plan policy and zoning standards for property redevelopment that are compatible with maintaining the character of the narrow waterbody such as increased setbacks, decreased building height allowances, restricted locations for boathouses, decreased dock length, and increased requirements for shoreline buffers.

6.5 Steep Slopes

Development on steep slopes can result in substantial alteration of the natural landscape and visual impact due to the prominence and location of development, intrusion of the skyline, erosion, slope instability, damage to fish and wildlife habitat, and a significant increase in storm water runoff. Map 1—Watershed (insert at back of report), provides contour information that can be used to identify areas of steep slopes.

Land with steep slopes should be shown as a component of hazard lands and properly mapped. The background statement in the County of Hastings Official Plan states:

> "Residential development should not take place on lands having environmental constraints and is discouraged in areas possessing important natural characteristics. Buildings should be set back far enough from the crest or toe of steep slopes to ensure structural stability and to avoid erosion hazards and visual intrusion into the landscape. Natural features should be altered as little as possible."

The Official Plan for the Municipality of Highlands East contains policies regarding the construction of buildings in hazardous areas, but does not deal with the visual impact of development.

Observations

- *Several areas surrounding the lake have steep slopes and the design of buildings on steep slopes must receive special attention to take into account terrain and aesthetic considerations.*

Recommendations – Steep Slopes

81. Property with steep slopes should be identified in the township's planning documents and special standards should be considered that address density, location of septic systems, visual impact, and buffer zones within these areas.

6.6 Forestry

There are different government control mechanisms regulating tree cutting in Crown forests and privately owned forests. The following section was prepared by Bruce Fleck, Bancroft District Forester, MNR. For information on tree species see Section 5.2.

Crown Land Forestry

A portion of the forested land surrounding Paudash Lake and adjacent to many cottage properties is under Crown ownership. All forest management activities on these lands may only be carried out in accordance with the approved Forest Management Plan (FMP) for the Bancroft Minden Forest 2001-2021 (to be renewed effective April 1st, 2006).

Forest management plans are prepared with public participation. Notices inviting input are posted in local newspapers, and cottage associations are individually notified at appropriate stages of plan preparation. A Local Citizens' Committee (LCC) is part of the system of public participation. A member of the Paudash Lake Conservation Association (PLCA), representing the concerns of lake residents and cottagers, is a member of the LCC. The current plan can be viewed at the MNR offices in Bancroft, Minden and Peterborough during regular business hours.

A forest management plan establishes objectives for the Crown forest and strategies for their achievement for a twenty year period. The locations of proposed operations are established for a five year period. Every five years the plan is reviewed, updated and a further five years of operations are determined. Details with respect to access, harvesting locations, harvesting methods, renewal and maintenance activities, and environmental and fish and wildlife habitat protection are described. For a complete and up-to-date list of environmental protection guidelines, contact any Ministry of Natural Resources office or visit their web site at http://www.mnr.gov.on.ca.

Private Land Forestry

Tree cutting on privately owned forested lands in Haliburton County must be in accordance with Tree Cutting By-law No.2655 dated November 26th, 2003. This by-law applies to forests greater than four (4) hectares in size. It does not apply to trees cut for personal use, to construct buildings for which a building permit has been issued, trees along roads, injured trees, or trees on lands for which council has approved their destruction to allow for other land uses.

The by-law requires landowners or logging contractors to apply for a permit to cut trees; to cut trees only in accordance with an approved permit; prohibits tree cutting in provincially significant wetlands or areas of natural and scientific interest (ANSIs) designated by the MNR; restricts clear cutting using a residual tree density rule; establishes diameter-based restrictions for different tree species; and allows logging operations to be carried out beyond the diameter limit where a prescription has been prepared by a Registered Professional Forester(RPF) and trees are marked by certified tree markers. Further, tree cutting within 15 metres (m) of the high water mark of any lake, river or watercourse, or 15 m of any maintained public road is prohibited unless designated

by a certified tree marker or RPF. There are significant penalties for individuals and for corporations for contraventions of the by-law.

Figure 6.1 – Minimum Diameter for Selected Species
County of Haliburton Trees By-law 2655 (Table 1)

	Point of Measurement in cm above ground level (inches)	Minimum Diameter in cm (inches)
Sugar maple, red maple, yellow birch, basswood, white ash, black cherry, red pine, hemlock, spruce	30.48 (12) 20.32 (8) 10.16 (4)	35.56 (14) 43.18 (17) 50.80 (20)
Red oak, white pine	30.48 (12) 20.32 (8) 10.16 (4)	40.64 (16) 50.80 (20) 60.96 (24)

There are no restrictions with respect to tree cutting on private lands within Hastings County at this time.

Observations

- *The Haliburton County tree cutting by-law prohibits the cutting of trees in provincially significant wetlands, ANSI's and within 15 m from a shoreline. However, the by-law only applies to properties that are > 4 hectares (10 acres), and does not deal with the visual impact of tree removal.*
- *There is no tree cutting by-law within the County of Hastings.*
- *Forestry activities on Crown land must be in accordance with the approved Forest Management Plan for the Bancroft Minden Forest 2001-2021. The Plan will be renewed by April 1st, 2006 and the PLCA should review its implications within the watershed of Paudash Lake.*

Recommendations - Forestry

82. Property owners and municipalities should be encouraged to follow sound forestry practices, especially near lakes and streams.

83. The PLCA must continue to participate in the Forest Management Plan for the Bancroft Minden Forest 2001-2021 to determine implications on the Paudash Lake watershed.

84. The Haliburton tree cutting by-law should be amended to include restrictions on tree cutting in waterfront areas regardless of the size of property (i.e., <10acres).

85. The County of Hastings should be encouraged to adopt and implement a tree cutting by-law defining certification requirements, site protection rules, and silvicultural requirements.

86. Municipalities should be encouraged to require sound forestry practices for commercial operations and to address visual impact.

Section 7.0 Land Use

The purpose of this section is to describe the current land uses around the lake and to provide a review of the Ministry of Natural Resources policies for Crown land and the municipal official plan and zoning by-law policies for private land.

7.1 Current Land Use

7.1.1 Summary of Land Use

The current land use surrounding Paudash Lake is shown on Map 6 (insert at back of report). About 15% of the shoreline of Upper Paudash Lake and 5% of Lower Paudash Lake shoreline is Crown land. There are also portions of Crown land surrounding North Bay in Upper Paudash Lake.

The shoreline is predominantly seasonal and permanent residential properties, with 10 tourist commercial uses that are primarily concentrated on Lower Paudash Lake. In 1988, Niblett and Associates conducted a land use survey and the results are presented in Figure 7.1.

Figure 7.1 – Shoreline Development – 1988

	Upper Paudash	Lower Paudash	Total
Seasonal Dwellings	302	179	481 (68%)
Permanent Dwellings	71	50	121 (17%)
Vacant Residential Lots	64	38	102 (14%)
Resorts and Marinas	2	2	4 (<1%)
Total	439	269	708

Source: Niblett and Associates (1988)

According to municipal assessment information (Map 6 – Land Use (insert at back of report)) the current number and type of lots are shown in Figure 7.2. Figure 7.3 provides a detailed breakdown of the properties on Upper Paudash for locations on Inlet Bay, North Bay, Joe Bay and the central portion of the lake. The total number of lots in 1992 was 708, which increased to 728 in 2004. While there is a slight difference in the number of total lots between 1992 and 2004, this may be accounted for the following reasons: new lots created since 1992; the commercial properties not identified in 1992; and a difference in the lot counting practices. The 2004 inventory includes lots that are located on the backside of roads that run parallel to the shoreline, where direct access to the lake is permitted. As well, the increase in lots on Lower Paudash may be a result of lots within the Hamlet of Paudash being counted in the current inventory.

In 2004, there were 728 private shoreline lots on Paudash Lake, which includes 490 seasonal residential lots, 136 permanent residential lots, 92 vacant lots, and 10 commercial lots. Eighty-four percent (84%) of residences on Upper Paudash are seasonal compared to seventy percent (70%)

on Lower Paudash. The higher percentage of permanent residences on Lower Paudash is likely due to the proximity of year round maintained roads. North Bay has the lowest percentage of permanent residents, only about 2%, which is likely due to the lack of roads and the number of properties that are water access only. Many of the 92 vacant lots appear to be undersized and therefore may not be able to obtain a building permit without a variance to the by-law.

Figure 7.2 – Shoreline Development (2004)

	Upper Paudash	Lower Paudash	Total
Seasonal Dwellings	312	178	490 (67%)
Permanent Dwellings	60	76	136 (19%)
Vacant Residential Lots	54	38	92 (13%)
Commercial Zoned Lots	3	7	10 (1%)
Total	429	299	728 (100%)

Source – Map 6 – Land Use

Figure 7.3 – Shoreline Lots - Upper Paudash Lake (2004)

	Inlet Bay	North Bay	Joe Bay	Total
Seasonal Dwellings	26	147	139	312
Permanent Dwellings	7	15	38	60
Vacant Residential Lots	7	23	24	54
Commercial Lots	1	1	1	3
Total	41	186	202	429

Source – Map 6 – Land Use

According to the Summer 2003 Residential survey, the footprint of 92% of all residential buildings is less than 1,500 sq. ft., and almost half of them are less than 1,000 sq. ft. Seventy-six percent (76%) of all residential lots had more than one accessory building, and 26% of all lots had a sleeping cabin; most sleeping cabins (74%) are less than 300 sq. ft. in area.

Almost every property had at least one dock, and the most common type is pole and post (30%), followed by crib docks (25%), floating (22%) or a combination of docks (17%); the most common length of dock is less than 30 feet (86%). Only 25% of residential lots have boathouses and 57% of them are located on dry land; 75% of all boathouses are one-storey in height.

According to the Summer 2003 Residential Survey, about 54% of residents have been on the lake for greater than 30 years and 62% of families have been on the lake for at least two (2) generations; only 10% of families have been on the lake for four (4) generations.

There are 10 commercially assessed shoreline properties on Paudash Lake: seven (7) are located on Lower Paudash and three (3) on Upper Paudash Lake. There is also one Bed and Breakfast operation (Northern Lights B&B) located on Upper Paudash.

Figure 7.4 – Commercial Properties

Upper Paudash	Lower Paudash
The Anchorage Resort	Wil-Lou Marine and Sports
Parkwood Beach Park (Inlet Bay)	Paudash Shores Cottages
Black Forest Schnitzel House and Motel	Paudash Lake Marina
	White Birch Cottages
	Fox and Hounds Restaurant
	Somerset Inn
	Finn Point Cottages

Observations

- *A considerable amount of undeveloped property on the lake exists, which contributes greatly to the natural beauty of the lake. These properties have the potential of being sub-divided into a large number of residential lots.*
- *The economic importance of the tourist industry is essential to the area and must be supported. Commercial development on Paudash Lake must be balanced with the protection of the natural and social amenities that attract people to the area. The protection of the lake's environmental elements must have priority.*

Recommendations – Land Use

87. The zoning by-laws for Highlands East and Faraday should provide consistent direction with respect to boathouses:

- ***No two-storey boathouses;***
- ***Only dry land boathouses are permitted;***
- ***Increased side yard setbacks of a minimum of 4 metres from the side lot line to ensure that a boathouse is not constructed in front of the neighbours' property and view;***
- ***Maximum height of 4 m, measured from top of dock to highest point of the roof; and***
- ***A boathouse shall be erected only on a lot having the required minimum 30 m (100 ft) shoreline frontage, not be in critical fish habitat, and have an increased side yard setback where the roof is a sundeck.***

88. The balance between natural and developed sections of the shoreline should be appropriately maintained by regulations to restrict the cumulative size and location of docks and boathouses, as follows:

a. Shoreline construction should total no more than the following:

- ***For single residences, 25% of shoreline frontage or up to 23 m, whichever is less;***
- ***For resorts commercial development, 33% of shoreline frontage; and***
- ***For marinas 50% of shoreline frontage.***

b. A natural vegetative buffer, at least 20 m in depth and covering 75% of the shoreline, should be provided on all residential lots.

89. The PLCA should encourage residents to install pole and post supported docks or floating docks instead of crib docks because of their lower impact on the lakebed and aquatic life.

90. ***Applications for rezoning and subdividing shoreline property should receive careful and scrupulous attention, with the involvement of all interested parties. Notices of applications should be sent to the Paudash Lake Conservation Association.***

7.1.2 Residential Occupancy

According to the Residential Survey conducted in 2003, 26.6% of all responses were permanent households and 73.5% were seasonal households. According to the Mosquin et al. (1992) report, and based upon a survey in 1991, 11% of all responses were permanent residences and 89% were seasonal residences, which indicates a substantial rise in cottage conversion to permanent use of 15.6 % from 1991 to 2004. As well, the Residential Survey indicates that 13.5% of existing seasonal households intend to convert to permanent use in the near future. This trend, of cottage conversion from seasonal to permanent use, appears to be continuing.

The number of people living on and using the lake can have a direct impact on water quality and the lake's social elements, such as decreased natural landscapes and increased noise, recreation and boating activity. Occupancy refers to the number of residential users and the duration of time of their stay on the lake. Unfortunately, longer visits to the cottage increase the amount of phosphorus generated from human waste and sewage. Figure 7.5 indicates that the summer season had the highest percentage of days occupied, followed by winter, spring and fall seasons.

Figure 7.5 – Residential Occupancy by Season

	Average No. of Days Used	Percentage of Days Occupied
Spring	32.8	36.4%
Summer	55.9	62.1%
Fall	32.5	36.1%
Winter	36.4	40.4%

Note – Based on 90 days per season

Source - Summer 2003 Residential Survey

Figure 7.6 indicates the number of occupants per residential property by season. During the winter, spring and fall seasons, about two-thirds of all households consists of one or two persons (55-68%), but during the summer this trend reverses, with two-thirds of all households having three or more persons.

Figure 7.6 – Number of Occupants

No. of Occupants	Spring	Summer	Fall	Winter
1 - 2 persons	58.7%	32.6%	55.8%	68.7%
3 - 4 persons	33.1%	38.9%	32.7%	16.9%
5 - 6 persons	5.3%	18.1%	9.7%	12%
7 - 8 persons	2.3%	8.3%	0.9%	2.4%
More than 9	0.8%	2.1%	0.9%	0%

Source Summer 2003 Residential Survey

Observations

- *Seventy-three percent (73.5%) of all residences on Paudash Lake are seasonally occupied and 26.5% are permanently occupied. A small, but significant, number of seasonal residents have plans to convert their cottages to permanent residences.*

7.1.3 Septic Systems

The Ministry of the Environment (MOE) conducted a review of Septic systems in 1977 through the Cottage Pollution Control Program. The provincial program was initiated in 1970 "to detect and have corrected faulty private sewage disposal systems of cottages located on recreational lakes". "The objective of the program is to investigate and, in conjunction with the owner, to undertake abatement work on those systems found to be faulty".

"There were 363 private sewage disposal systems inspected on Paudash Lake during the summer of 1977. Of these, 160 or 44% were classified as seriously substandard, 116 or 32% were unsatisfactory due to improper disposal of solid waste or wash water, and 3 or 1% were classed as direct polluters." Only 61 systems or 16.7 % were deemed to be satisfactory (Figure 7.7).

As of December 31st, 1977, 97 faulty systems had been corrected and 23 owners had signed agreements to have work completed during the construction season of 1978. The remaining property owners were notified, by letter, about the problems regarding their septic systems, and MOE officers directed their efforts toward obtaining commitments from these owners over the following year.

Figure 7.7 – Results of 1977 Septic System Inspection

Classification of Systems	No. of Systems	%
Satisfactory	11	3.0
Satisfactory Performance	50	13.7
Seriously substandard	160	44.0
Nuisance (wash water)	46	12.6
Nuisance (solid waste)	70	19.2
Direct Polluter	3	0.8
Unclassified Temporarily	22	6.1
Unclassified	2	0.6

Source: MOE (1977)

The classification of systems (MOE) is as follows:

1. Satisfactory – the system meets all current standards of good design, construction and location, and is properly maintained.
2. Satisfactory (Acceptable) Performance – the system may not quite meet current standards of design and construction but is properly located with respect to distance from the lake, well, etc. and is maintained in good condition.
3. Seriously Substandard – a system, which does not meet current standards of design, construction and location and/or is in a state of neglect. Although this system is not deemed to be causing pollution at the time of inspection, a potential hazard exists. The owner is notified of the deficiency and is advised that consideration should be given to updating the system in the near future.
4. Nuisance (Waste Water) – a system causing wash water to be exposed on the surface of the ground either directly through a waste pipe, escaping from a seepage pit or just thrown on the ground surface. Such a condition is known as a Public Health Nuisance. Wash water discharged from any sanitary fixture is contaminated and creates an unhealthy environment. Phosphates and other nutrients from wastewater discharges encourage weed growth and affect the aesthetic quality of the lake.
5. Nuisance (Toilet and Solid Waste) – a system causing fecal or urinary discharges to be exposed on the surface of the ground, either directly through a pipe or escaping from some part of a sewage disposal system including a privy. Also included in this classification is "solid waste" or garbage of a kind, which can cause a "nuisance" such as domestic garbage containing food waste.
6. Direct Polluter – a system, which is permitting sewage to contaminate the ground water, or to reach the lake either by direct discharge through a pipe or ditch or over the ground surface.
7. Unclassified (temporarily) – a system, which has been given a preliminary classification by the student inspector where he feels he cannot use any of the preceding classifications and has doubts about the system, or part of it. These systems require further inspection by the supervisor, who will attempt to make a final classification after a thorough investigation.
8. Unclassified – a system where it is not possible by the end of the survey to make a classification. This category includes only a few abandoned premises in a dilapidated condition with a system that is obviously not in use and could not be used.

In 1992, at the request of the PLCA and in cooperation with the Township of Cardiff, the Cottage Pollution Control Program (MOE) conducted a survey of private sewage disposal systems on Upper Paudash Lake within the boundaries of Cardiff Township. In 1994, the PLCA hired an environmental student, trained by and in cooperation with the MOE and with Cardiff Township, to complete this survey and to include those systems found in Bicroft Township, on Upper Paudash Lake.

Observations

- *In 1977, the Cottage Pollution Control Program (MOE) conducted a survey of 363 private sewage systems. Only 16.7% were deemed to be satisfactory and MOE took action to correct the problems.*

<u>Recommendations</u> – Septic Systems

91. The PLCA should encourage the Municipality of Highlands East and the Township of Faraday to undertake a Septic Re-Inspection Program.

7.2 Crown Land Use Regulation

Within the watershed of Paudash Lake, there are a wide range of activities carried out on Crown lands and waters. These activities are subject to the Bancroft District Land Use Guidelines and Land Use Atlas, The Forest Management Plan, the Bancroft Fisheries Management Plan and the Ontario's Living Legacy Land Use Strategy.

7.2.1 Public Lands Act

The Ministry of Natural Resources (MNR) is responsible for the management of Crown land, pursuant to the Public Lands Act, which includes acquisition, disposition and management of Crown lands and waters. The Ministry endeavours to administer all Crown assets in the best interest of the public. Chapter 413, Part 1 and 3 of the <u>Public Lands Act</u> states that 25% of all Crown shorelines will be set aside for public recreation and access. Since 15% of the shoreline of Upper Paudash Lake and 5% of the shoreline of Lower Paudash Lake is Crown land, the Public Land Act prevents the further disposition of Crown shorelands.

7.2.2 Ontario's Living Legacy

The MNR's 1999 Ontario's Living Legacy (OLL) Land Use Strategy outlines the intended strategic direction for the management of Crown lands and waters throughout Ontario. The OLL strategy sets a framework for future land and resource management on Crown lands, and provides guidance and direction on what activities are preferred in certain areas and what activities will not be permitted. Any new or revised plans for Crown lands must be consistent with the intent of the OLL strategy. The OLL strategy will replace current direction provided in existing planning documents such as the District Land Use Guidelines.

There is one Provincial Park addition within the Paudash Lake watershed called the Silent Lake Provincial Park Addition. Figure 7.8 outlines the permitted activities within park additions.

The Silent Lake Provincial Park Addition (Map 8) is comprised of 169 hectares (ha) of land north of the existing park. The addition will connect Moxley and Lowrie lakes and protect the Moxley Lake Wetland. The park addition falls in site district 5E-11, and is comprised of mature mixed forests of yellow birch, sugar maple and hemlock, over marble bedrock and rich marble-based wetlands. The ravine and ridge landscape, along with the calcium rich seepage of the area, provide ecological conditions for exceptionally rare fauna and flora.

Figure 7.8 – Ontario's Living Legacy Land Use Strategy
Permitted Uses

Use	Provincial Park Addition
Commercial timber harvest	Not permitted
Commercial hydro development	Not permitted
Mineral exploration and mining	Not permitted
Bait fishing, commercial fishing, fur harvesting and wild rice harvesting	Existing uses only
Sport hunting	Permitted
Sport fishing	Permitted, except in sanctuaries
Seasonal recreational camps	Existing uses only
Tourism facilities and recreational trails	Existing uses only
Road construction across waterway parks	Identified prior to regulation

Source: Ontario Living Legacy Land Use Strategy

A Management Plan was prepared for the original Silent Lake Provincial Park in 1986 and it designated four nature reserve zones totalling 233.8 hectares. Any nature reserve zoning in the new addition would have to be accomplished through a future park planning process, and none is proposed at this time. According to Ken Cain (MNR), the 1986 Management Plan specifies no hunting in the original park and the OLL Land Use Strategy permits it in the 169 ha addition.

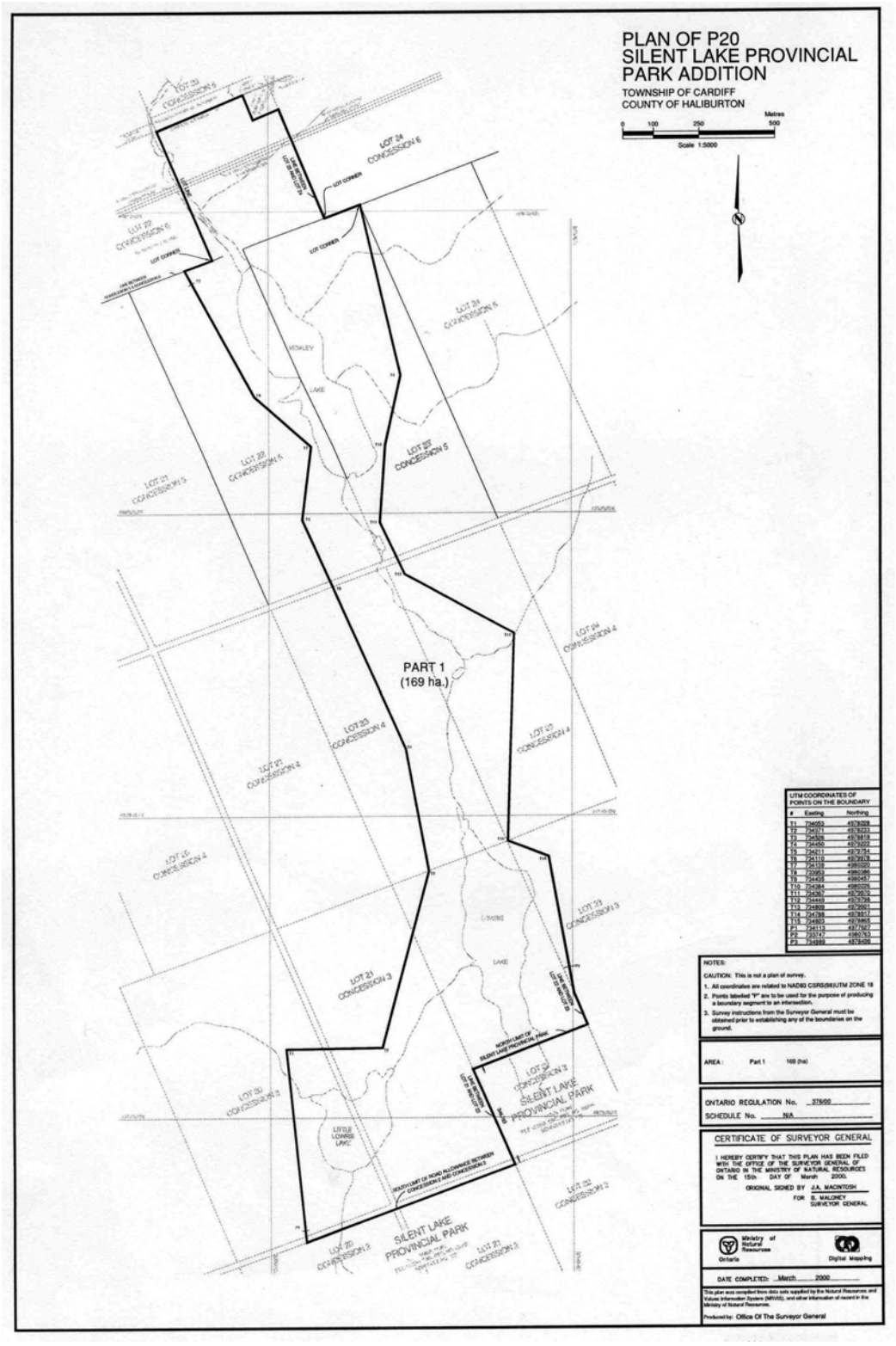
Observations

- *Only 15% of the shoreline of Upper Paudash and 5% of Lower Paudash is Crown land; the Public Lands Act restricts the further disposition of shoreline Crown land.*
- *The Silent Lake Provincial Park Addition protects the Moxley Lake from incompatible development and site alteration.*
- *Ontario Parks will have to confirm a "nature reserve" designation through a future park planning process.*

Recommendations – Ontario Living Legacy

92. The PLCA should encourage and support Ontario Parks planning process to designate the Silent Lake Provincial Park addition as a Nature Reserve.

Map 8 - Silent Lake Provincial Park Addition



7.3 Municipal Planning Regulations

The purpose of this section is to describe the municipal planning regulations that apply to Paudash Lake in order to ensure that appropriate consideration is given for the protection of lake values and to promote the consistent application of land use regulations.

Within most municipalities there are policies and regulation tools that govern land use. Official plans provide general land use policy to describe how land can be used. An official plan is prepared with the input of the public and it ensures that future planning and development will meet the needs of the community. All development must conform to the official plan and zoning by-laws, which provide a means to regulate the use and location of buildings and structures. Site plan control by-laws and consent agreements can also ensure certain construction and design standards are maintained.

The eastern tip of Lower Paudash Lake is within the Township of Faraday, County of Hastings, and the western portion of Lower Paudash and the entire Upper Paudash Lake is within the Municipality of Highlands East, County of Haliburton (Map 1—insert at back of report). Approximately, 90% of the shoreline of Upper and Lower Paudash Lakes is in the Municipality of Highlands East.

7.3.1 Official Plans

Paudash Lake falls under the umbrella of three official plans. Both the County of Haliburton and Hastings have their own official plan. The official plan for the County of Haliburton provides a general policy framework and development strategy, and more detailed policies are in the Municipality of Highlands East. The planning hierarchy in the County of Hastings differs from the County of Haliburton, as there is only one official plan at the county level that provides detailed land use policies for all of the lower tier municipalities. The Township of Faraday does not have an official plan and they follow the land use direction provided by the County plan.

County of Haliburton Official Plan

The official plan for Haliburton County is a recent document and has not been approved by the Ministry of Municipal Affairs as of the date of this report. The official plan evolved from a 1997 strategic plan and provides the following vision:

> *"A county with a co-operative environment within which the different players and population groups have worked together to achieve a sustainable natural environment; a more stable, diversified and year round economy based on clean, small to medium sized economic activities; residential development, both seasonal and permanent in keeping with maintaining a small town atmosphere, environmental integrity and adequate accessible services; and a strong sense of regional identity with a more inclusive and tolerant community with all it takes to provide a high quality life for family and individuals".*

The County of Haliburton operates as a two-tiered system of municipal government. The County Plan establishes general policy and guidance and detailed planning is carried out through the local official plans in conformity with the County Plan. The County of Haliburton is the approval authority for local official plans and amendments thereto.

The policy framework for the official plan covers three general areas: environment, resources and settlement pattern.

Environment – The County official plan notes that there is a need for innovative approaches to protecting, sustaining and restoring Haliburton lakes, forests and habitats, and outlines approaches based on watershed, lake capacities and remedial actions to sustain and improve environmental quality and ecological function. Local official plans will identify natural heritage lands, and these areas will be protected from incompatible development. As well, strategies for the protection of ground and surface water resources will be included in local official plans. These may include lake capacity estimates, lake flow control, waterfront setbacks, shoreline protection, forest buffers and water level management. Development must also respect and not encroach on natural hazards.

Resources – Mineral deposits will be protected for future use. Development of sand, gravel and natural stone deposits will incorporate buffer zones and rehabilitation plans. Policies to control watershed flow management will be developed in co-operation with local and senior levels of government. Local plans will contain policies to address the conversion of Crown lands to private ownership and use.

Settlement Patterns – Four main settlement patterns have been identified; one of them being identified as “cottage communities”. The official plan ensures that the development of cottage communities is environmentally sustainable and properly serviced.

Municipality of Highlands East Official Plan

The Municipality of Highlands East was created on October 6th, 2000, as the amalgamation of the former Townships of Glamorgan, Monmouth, Cardiff and Bicroft. The official plan is the first for the municipality and has been prepared “with regard” to the draft County of Haliburton Official Plan as well as the Provincial Policy Statement. The Municipality of Highlands East Official Plan was adopted by Council on October 14th, 2003, and is currently waiting for final approval from the Ministry of Municipal Affairs and Housing.

Principles – The official plan establishes principles for Growth and Settlement, the Environment and the Lakes, the Economy, the Rural Area and Municipal Infrastructure. The strongest principles appear to address the environment and the lakes. Policy 1.2.2.1 states that “Council will respect the environment and will follow the principle of sustainability, and will consider the cumulative impacts of planning decisions, while recognizing that development proposals cannot be addressed on an individual basis in isolation from past and future decisions.” The Official Plan will put forward an “environment first approach” in evaluating land use developments. Policy 1.2.2.4

states “land uses in close proximity to the shoreline will be regulated in an effort to minimize impacts on lake water quality and to protect shoreline areas from degradation.”

Development Policies – Development policies provide specific direction for a range of matters. The following provides an overview of those that are most relevant to maintaining the quality of life around Paudash Lake.

Abandoned Mines (2.1.4.1) – Two abandoned mines are identified on the Land Use Schedule (Dyno and Bicroft), and any development within 500 metres of these sites will be required to complete a Mine Hazard Site Evaluation.

New Sewage Technology (2.1.5.4) – While the use of new technology in sewage disposal is encouraged, it is not permitted on lakes that are at or near development capacity.

Crown Land (2.1.9) – Development on Crown land must have regard for planning policies of the Municipality.

Mineral Exploration and Mine Development (2.1.10) – Exploration and mine development is encouraged and requires an official plan and zoning by-law amendment.

Division of Land (2.2.2) – Consents will only be considered if it conforms to all requirements of the municipality’s zoning by-law and septic system requirements. Lot creation, such as these, will not be permitted in wetlands, areas susceptible to erosion, flooding, or within significant wildlife, fish and/or biological areas. Development may be permitted outside of these areas provided there is no negative impact on the natural feature and/or its function. An Environmental Impact Study may be required.

Environmental Impact Study (2.3.2) – Environmental Impact Studies (EIS) are required for major development proposals including official plan amendments and plans of subdivision. Where an EIS is required within 300 m of a lake, it shall include a Lake Impact Assessment to demonstrate that the proposed development will not impair water quality or compromise MOE water quality objectives.

Vegetation Cover (2.3.5) – New development in the shoreline shall be sensitive to the preservation of tree cover and vegetation so as to prevent erosion, siltation and, if possible, nutrient migration. The implementing zoning by-law will establish shoreline setbacks and regulations to protect natural vegetation.

Lake Management Plans and Strategies (2.3.6) - Council supports the preparation of Lake Management Plans that assess issues such as carrying capacity, shoreline development, vegetation retention, shoreline erosion, cottage conversion, septic system maintenance, and other important issues. Plans, such as these, are encouraged to establish monitoring programs. Amendments to the official plan and zoning by-laws will be considered for matters not already addressed in the official plan, and Council may undertake peer reviews of Lake Management Plans.

Cold Water Lakes at Capacity (2.3.7) – Inlet Bay and Joe Bay are identified as being at capacity, where the amount of habitable development has already reached or exceeded the lake's capacity. New development within 300 metres (m) of these waterbodies will not be permitted except on an existing lot of record, or where the septic tile bed is located more than 300 m from the lake, or where an environmental impact statement demonstrates there will be no impact on water quality.

Cold Water Lakes Near Capacity (2.3.8) – North Bay is identified at being "near capacity", and new lot creation or expanding commercial development will not be permitted on these lakes unless an EIS can demonstrate that the development will not compromise MOE water quality objectives.

Recreational Carrying Capacity (2.3.9) – Council will have regard to the recreational carrying capacity of a lake when considering major development proposals. Lakes with a surface area of more than 40 hectares (98.8 acres) of surface area shall generally be based on a ratio of one unit for each 2.5 ha (6.2 acres) of surface area. Density above these guidelines may be permitted subject to the preparation of a Boat Impact Study. According to the formula, the surface area of Upper Paudash is 754.7 hectares, which would permit 301 units. Lower Paudash has a surface area of 461.3 hectares, which would permit 184 units. Both Upper and Lower Paudash Lake have exceeded the recreational carry capacity, and major development will, therefore, require a Boat Impact Study.

Moose and Dear Concentration Areas (2.3.11) – These areas are identified on Schedule B to the Official Plan, and new development should be generally compatible and the removal of vegetation shall be sensitive to the role of these areas.

Fish Habitat (2.3.11) – Fish habitat is identified on Schedule B to the Official Plan and development, including lot creation, within 120 metres of these features may require mitigation measures, which may include increased setbacks.

Wetlands (2.3.16) – Provincially and locally significant wetlands are identified on Schedule B, and are to be protected and maintained in their natural state. However, development is permitted within the wetland or within 120 m of the wetland, provided an EIS is prepared. The results of which ensure that the development will not result in the loss of wetland function, conflict with existing wetland management practices, or result in the loss of contiguous wetland area or wetland complex.

Development Policies also apply to endangered and threatened species, floodplain management, groundwater resources, and hazardous slopes, which may need to be addressed when evaluating development proposals. In the case of steep slopes greater than 1 to 3, an increased setback from tops of bank is required.

Land Use Designations – There are five different types of land use designations in the Paudash Lake watershed: Rural, Settlement Area, Shoreline, Aggregate Resource and Environmental Protection. The Environmental Protection designation applies mainly to wetlands, and the Shoreline designation generally applies to all lands within 300 m of Paudash Lake. The remaining areas are designated Rural, except for the Village of Cardiff, which is the only Settlement Area in the watershed. There are no areas designated for Aggregate Resources within the watershed.

Rural Designation (3.1) – The uses that are permitted include a range of residential, commercial, agricultural and resource management. New residential lots shall require a lot area of 0.8 to 2.0 hectares to assist in maintaining the character of the rural area. New commercial and industrial uses shall require a zoning by-law amendment, and are subject to site plan control. New golf courses will require a zoning by-law amendment, as well as an EIS and a hydrogeological report.

Settlement Designation (3.2) – Permitted uses within the Village of Cardiff include a mixture of residential, commercial and light industrial.

Shoreline Designation (3.3) - Three of the four objectives of the shoreline designation relate to the environment, as follows:

- To ensure that the quality of the lake and river environment is maintained or improved;
- To provide for environmentally sound development in shoreline areas; and
- To ensure that the natural state of the shoreline is maintained to the greatest extent possible.

Permitted uses include single detached residential dwellings, accessory bed and breakfasts, home occupations, marinas and recreational tourist commercial uses. Guest cabins are permitted, provided the lot has a minimum area of 0.8 hectares, and may be subject to site plan control.

In order to maintain the shoreline in its natural vegetative state, the zoning by-law will establish minimum setback requirements, and the standard will be higher for commercial development. The zoning by-law will also establish provisions, which require the retention of the majority of natural vegetation on the shoreline. Where minor variations are required, a landowner may apply to the Committee of Adjustment for a minor variance.

Small-scale commercial uses are permitted and may include convenience stores, personal service shops, artisan studios and other similar uses. A zoning by-law amendment is required for new uses or expansion of existing uses.

Tourist commercial uses are permitted and may include resorts, inns, timeshare developments, camping and cottage rental establishments, and are subject to a zoning amendment, as well as an EIS, Lake Impact Assessment and site plan control.

Aggregate Resource Designation (3.4) – There are no areas within the Paudash Lake watershed that are designated for Aggregate Resource use. New extractive uses require an Official Plan Amendment, and Policy 3.4.5.1 "generally" restricts their location to areas that can be screened from public view.

Environmental Protection Designation (3.5) – These lands are comprised of Provincially and locally significant Wetlands and Areas of Natural and Scientific Interest. No permanent buildings or structures are permitted, except for flood and erosion control, and the permitted uses are limited to resource management uses. An EIS is required for any development proposal within 120 metres of a wetland.

Site Plan Control (5.6) – Site Plan Control agreements can be used for all commercial, industrial and institutional uses. As well, Section 5.6.1 states that, "shoreline residential dwellings may also be subject to site plan control to ensure that there is adequate vegetative buffering and setbacks to protect the water quality from the impacts of shoreline development."

Observations

- *The County of Haliburton's Official Plan speaks clearly to protecting, sustaining and restoring lakes, but it is a "strategic plan" rather than a land use plan, and the specific details are left to the Municipality of Highlands East Official Plan.*
- *The Municipality of Highlands East's Official Plan provides comprehensive land use direction and promotes the principle of "environment first".*
- *The Council supports the preparation of lake management plans and will consider official plan amendments on matters not already addressed in the official plan.*
- *Inlet Bay and Joe Bay are identified as being at capacity, and new development within 300 m (984 ft) of these waterbodies will not be permitted except on an existing lot of record, or where the septic tile bed is located more than 300 m from the lake, or where an environmental impact statement demonstrates that there will be no impact on water quality.*
- *North Bay is identified as being "near capacity", and new lot creation or expanding commercial development will not be permitted on this waterbody unless an EIS can demonstrate that the development will not compromise MOE water quality objectives.*
- *Council will have regard to the recreational carrying capacity of a lake when considering major development proposals. According to the formula, the surface area of Upper Paudash is 754.7 ha, which would permit 301 units, and Lower Paudash has a surface area of 461.3 ha, which would permit 184 units. Both Upper and Lower Paudash Lakes have exceeded the recreational carrying capacity and further major development will require a Boat Impact Study.*
- *Provincially and locally significant wetlands are designated Environmental Protection, and no buildings or structures may be constructed. Permitted uses are limited to resource management activities. However, development is permitted in provincially significant wetlands provided an EIS demonstrates no negative impact.*
- *Policies regarding steep slopes do not require an increase in frontage when new lots are being considered.*

- *The Official Plan does not include policies about narrow waterbodies, lighting and privacy, or shoreline activity areas.*
- *The Official Plan generally encourages the preservation of tree cover and shoreline vegetation, but does not provide detailed policy direction to be implemented in the zoning by-law.*

<u>Recommendations</u> – Municipality of Highlands East Official Plan

93. The Official Plan should be strengthened with policies that implement the principle of "environment first". More specifically, the official plan should provide more detailed policies with respect to the following:

- ***a) Shoreline vegetation preservation including width, permitted uses, and restoration;***
- ***b) Development constraints related to steep slopes and narrow waterbodies including a definition and a requirement for increased lot frontages;***
- ***c) Shoreline activity areas that includes the maximum shoreline area allowed for shoreline structures and frontage coverage policies;***
- ***d) Shoreline coverage policies that requires the scale of buildings to be related to shoreline frontage;***
- ***e) Allows the enhancement of certain policies for specific lakes provided that the necessary background information is available;***
- ***f) Lighting and privacy concerns;***
- ***g) The prohibition of aggregate and mining operations within the viewscape of Paudash Lake; and***
- ***h) Prohibits any development or site alteration within provincially significant wetlands and within 120 metres of the wetland.***

Official Plan of the County of Hastings

The County of Hastings has a single-tiered planning system, and the official plan for the County of Hastings is the only official plan in the county. The Township of Faraday implements the County official plan through their zoning by-law. Both of these documents only apply to the eastern tip of Lower Paudash Lake. The following policies are from the County of Hastings Official Plan.

Goals and Objectives (2.0) – The Official Plan provides an extensive list of goals and objectives that form the basis, and provides general direction to the following matters: social, settlement, economic, environmental protection, agriculture, water, historical preservation, transportation, community improvement, and extraction (aggregate and minerals). Goals related to environmental protection generally protect and enhance natural heritage features and environmentally sensitive areas. Goals related to water resources ensure that "surface and groundwater quality and quantity are protected, conserved and managed in a sustainable fashion", and encourage the use of mitigating measures, such as setbacks from shorelines.

Land Use Policies (3.0) – Specific policies are provided for seven (7) land use designations and three of these land use designations (Environmental Protection, Rural and Hamlet) are located in the watershed of Lower Paudash Lake.

Environmental Protection Designation (3.2) – Wetlands, floodplains, erosion hazards, organic soils, steep slopes, and other similar physical limitations are included in the Environmental Protection designation. Provincially significant wetlands are identified by a "W" on the land use schedule, which includes the wetland on the eastern end of Lower Paudash Lake. The permitted uses in these areas are limited to conservation, wildlife management, appropriate passive recreational uses, and existing agricultural uses. According to policy 3.2.5 c, new development and site alteration may be permitted in or within 120 m of a provincially significant wetland provided an EIS is prepared and can demonstrate no negative impact to the features or functions of the wetland.

Policy 3.2.6 identifies "environmentally sensitive areas" as lands that have unique, natural or scientific features. These lands include fish habitat, significant woodlands, significant valley lands, significant wildlife habitat, and significant areas of natural and scientific interest. Environmentally sensitive lands also include all lands within 30 metres (100 ft) of the high water mark of warm water streams and lakes, and 300 metres (1000 ft) from cold water lakes. However, development may be permitted in these areas when an Environmental Impact Statement indicates no adverse impacts on the natural features of ecological functions.

Policy 3.2.9 requires a lake capacity study to be required prior to development on all cold water lakes. On warm water lakes, like Lower Paudash Lake, a Lake Capacity study may also be required for major development (i.e., more than two new residential building envelopes or non-residential development of a similar impact).

Rural Designation (3.3) – Unlike the Municipality of Highlands East, the County of Hastings includes all shoreline areas within the Rural designation. The "waterfront" area is a sub category in the Rural designation and is generally defined to include all lands within 300 metres of lakes and 30 metres of any other navigable waterbody.

In order to avoid an overdeveloped appearance and to keep buildings in proportion to their surroundings, lot coverage in the waterfront areas shall be kept to a low level. New waterfront lots shall have a minimum area of 0.4 hectares (1 acre) and a lot frontage of 46 metres (150 ft), and the lot frontage may be increased where sensitive habitat or other constraints exist. No new lot shall be approved adjacent to a narrow waterbody unless the water frontage is at least 100 metres (330 ft). A narrow water body is an area where the minimum average distance from shoreline to shoreline is 150 metres for a lake and 50 metres for a river.

Residential dwellings in waterfront areas shall be setback at least 30 metres (100 ft) from the high water mark, and this may be reduced where the location of an existing road would render this impossible subject to a variance and site plan approval being obtained. A natural vegetative buffer, 15 metres (50 ft) in width, should be maintained wherever possible and the clear cutting of trees is also discouraged in this buffer. A greater buffer may be required as determined by an Environmental Impact Statement.

Filling in of the shoreline is not permitted for the purpose of creating more space for development. Second tier or backlot development is not permitted where adequate and open access to the shoreline is not available. The preparation of Secondary Plans or Land Management Plans is, therefore, encouraged where significant development is anticipated.

Tourist based commercial uses in waterfront areas shall be located, so they are readily available to tourist traffic, either by road or water, without passing through residential areas. Therefore, the natural environment, open space character and scenic qualities of the area are protected.

Tent and trailer parks require an amendment to the zoning by-law prior to the establishment of a new park or expansion of an existing operation. The minimum lot area shall be 4 hectares (9.9 acres) with a maximum of 50 campsites.

Tourist establishments include motels, hotels, rental cabins or other roofed accommodations, and docks, eating establishments, and convenience stores. An amendment to the zoning by-law is required for new tourist establishments or the expansion of an existing one. A minimum lot area of 2 hectares (5 acres) is required, and the preferred density should be a maximum of one unit per 0.4 hectare (1 acre). Adequate buffering between the tourist establishment and any adjacent residential use is required. No building, structure, septic tank or tile field, except a marine facility for the laundry and/or security of boats, shall be closer that 30 metres (100 ft) from the high water mark. Water and sewage works must have approval from the Ministry of the Environment of the County peer review agent.

Industrial and agricultural uses are also permitted throughout the “Rural” area including the waterfront subcategory.

Hamlet Designation (3.4) – The community of Paudash is considered to be a hamlet. Low-density residential uses are permitted, along with semi-detached dwellings, duplex dwellings, or an apartment associated with a commercial establishment. Retail, service and highway commercial uses are permitted, along with “dry” industrial uses. Traditionally, hamlets have developed within a compact centre core, where ribbon or strip development on the hamlet’s periphery is discouraged. The minimum lot size for each dwelling unit is 0.4 ha (1 acre).

Extractive Designation (3.8) – Lands designated “extractive” include licensed or permitted mines, pits and quarries. There is only one high potential area designated as an “extractive (reserve)” in the watershed, east of the Village of Cardiff. The intention of this designation is to protect this area for future extraction use by discouraging the location of any land use on or adjacent to these areas. An amendment to the official plan and the implementing zoning by-law shall be required for a new or expanded extraction operation. A number of policies, such as impact assessments on cultural and heritage resources

and site development plan and agreements, must be adhered to when making such applications.

General Development Policies (6.0) – An extensive array of policies regarding the division of land by plans of subdivision/condominium and consent are noted in the section 6 of the Official Plan. Contained therein is a subsection on Consents in Waterfront Areas. Consents will not be approved if there will be adverse affects on the important wildlife habitat, fish habitat areas, and wetlands, or where terrain constraints require dwellings, sewage disposal systems, or significant vegetation alteration within 30 metres (100 ft) of the high water mark.

Bed and breakfast establishments are encouraged to locate within or near heritage buildings, along scenic routes and trails, near cultural and recreational facilities, and within or near central commercial districts. They shall be placed in an appropriate zone classification.

Implementation (7.0) – The implementation section of the plan contains policies with respect to: holding by-laws; interim control by-laws; temporary use provisions; increased height and density by-laws; cash in lieu of parking; site plan control; property maintenance and occupancy by-law; and other administration matters.

Observations

- *The wetlands at the east end of Paudash Lake are designated as provincially significant on the land use schedule for the Township of Faraday. Permitted uses are generally limited to resource management activities; however, agriculture is a permitted use.*
- *Policies regarding narrow waterbodies, setbacks from the high water mark, natural vegetative buffers, and lake capacity studies are provided.*
- *Although second-tier or backlot development is permitted, it is not defined. The policy that requires adequate and open access to the lake may encourage development next to road allowances leading to water.*
- *There are detailed policies regarding lot sizes for tourist commercial uses and tent and trailer parks. New tourist commercial uses and tent and trailer parks require a zoning by-law amendment.*
- *Residential lots require a minimum frontage of 46 metres and an area of 0.8 hectares.*
- *There is a lack of policy on the character of waterfront residential development.*
- *Industrial uses may be permitted on the shoreline.*
- *There are no Official Plan policies that address the visual and scenic qualities of the waterfront.*
- *There are no policies specifically defining steep slopes or the mitigation measures to be imposed in these areas.*
- *There is no policy regarding shoreline activity areas, or that limit the amount of shoreline development (docks, boathouses and shoreline recreation areas) that is permitted.*
- *There are no policies relating to lighting and privacy.*

<u>Recommendations</u> – County of Hastings Official Plan

94. The Official Plan should be strengthened with policies that implement the principle of "environment first". More specifically, the official plan should provide more detailed policies with respect to the following:

- ***a) Policies regarding the waterfront character should be introduced, such as "the waterfront is primarily made up of individual residential dwellings interspersed with commercial development primarily in the form of marinas, resorts and tent and trailer camps. The waterfront is a focus for recreation, fish and wildlife, and relaxation. Development should not detract from those attributes that contribute to character, and the natural form must dominate over the built form." Industrial and agricultural development should be prohibited in waterfront areas. As well, policies on the rural/waterfront interface need to be articulated. Rural resource use, such as aggregate extraction and forestry, should not be permitted in the waterfront area. Wooded hillsides, as viewed from the lake, should also be exempted from forestry or aggregate or mineral operations;***
- ***b) Exterior lighting – All lighting should be directed inwards on the property and be dark sky compliant;***
- ***c) Prominent public views and features such as rock cliffs, tree lines, and other landmarks should be protected. This can be done by limiting encroachment by development and encouraging the dedication of these lands;***
- ***d) A definition of steep slopes and how they are measured should be incorporated into policy. Some municipalities identify steep slopes (being > 40%) as areas where increased frontages are required. These slopes are generally measured over a horizontal distance inland of 45 metres (150 ft), from the shoreline, for at least 100 metres (330 ft) along the shoreline;***
- ***e) The number, scale and massing of shoreline structures need to be regulated. Boathouses should be limited to single storey, and the cumulative width of docks and boathouses should not exceed 25% of the lot frontage. The remaining shoreline should be maintained as a natural vegetative buffer;***
- ***f) Shoreline lot coverage policies should be required that limits the scale of buildings to the amount of shoreline frontage. This policy will help to prevent the construction of oversized dwellings on undersized lots;***
- ***g) Two tiers of development between the lake and the nearest year round maintained road should be prohibited. Limited backlot development (on the opposite side of a year round maintained road) could be permitted, but at a very low density; and***
- ***h) The Implementation section of the plan should be expanded to make note of site plan control that can be used for limiting tree removal for shoreline residential development.***

7.3.2 Zoning By-laws

Municipality of Highlands East Zoning By-law (3rd draft, March 2003)

The Municipality of Highlands East is currently updating their comprehensive zoning by-law and has circulated a third draft for review. The purpose of the new zoning by-law is to translate the new Official Plan policies into specific provisions that regulate land use (permitted uses), and that restrict the location, massing and density of buildings and structures. The proposed by-law has a framework that is similar to most other "cottage country" by-laws in that it has general provisions

and definitions that apply to all zones and specific provisions that apply only to the particular zone category.

The shoreline of Paudash Lake is predominantly zoned Shoreline Residential (S, SR1, SR2 and LSR) and Environmental Protection (EP). There are seven shoreline properties zoned Tourist Commercial (TC); one property zoned Extractive Industrial (MX), at the mouth of Moxley Creek; and one zoned General Commercial (Paudash Lake Marina). The remaining areas within the watershed are predominantly zoned Rural (Ru) and Rural Residential (RuR).

General Provisions – General provisions regulate a range of matters that are similar across many zones. The following general provisions are the most applicable to the issues and concerns addressed by the Lake Management Plan:

1. *Accessory Building Structures and Uses* (Section 3.1)
    a. The *total lot coverage* of all accessory buildings and structures, excluding decks, shall not exceed 5 % of the lot area or exceed a height of 4.5 metres (14.8 ft).
    b. A *boat dock or launching ramp* may be erected provided it is located no closer than 1.5 metres to the side lot line on the 90-degree projection thereof.
    c. A *boathouse* must comply with Section 3.31, which requires all buildings and structures to be setback a minimum distance of 30 metres (98.4 ft) on Inlet Bay and Joe Bay (See #14 below).
    d. An *attached or detached private garage* may only be erected with an interior side yard of a minimum of 1.5 metres (4.9 ft). The maximum area of any garage or boathouse shall be 70 sq. metres (753.5 sq ft).
    e. *Decks, steps, balconies or patios* may project into any required yard at a maximum of 2.0 metres (6.6 ft), but not closer than 1.5 metres to any lot line. Where the floor of any porch, balcony or deck is in excess of 1.0 metre above finished grade, the side and rear yard requirement for the principal building shall apply.
    f. *Gazebos* may be permitted in the front yard of a lot adjacent to a waterbody provided that:
        i. The maximum area is 10.0 sq. metres. (107.6 sq. ft.);
        ii. The setback from the normal average or maintained high watermark is at least 4.0 metres (13.1 ft);
        iii. The setback from the side lot line is at least 2.0 metres (6.6 ft); and
        iv. The height shall not exceed 2.5 metres (8.2 ft).

    g. A *guest cabin* is permitted in all shoreline residential zones provided that:
        i. No cooking facilities are located in the building;
        ii. The building has an area of 25 sq. metres (269.1 sq. ft.) or less;
        iii. The building is single storey and the height does not exceed 4.5 metres (14.8 ft); and
        iv. The building complies with all of the setbacks that apply to the principal building on the lot.

2. *Dwelling on a Lot* (Section 3.5) – Unless otherwise permitted, no more than one dwelling unit shall be permitted on a lot.

3. *Environmental Protection Area* (Sections 3.6 and 3.7) – Lands zoned Environmental Protection (EP) (except lands under water) may be included in the calculations of lot area and yard requirements. Setback requirements shall be measured from the limit of the normal or maintained high watermark. Section 3.7 states that the setback for buildings and structures shall be a minimum of 30 metres (100 ft) from any EP zone boundary.

4. *Frontage on Public Roads, Private Roads or Navigable Waterways* (Section 3.8) – Permits a use, building or structure on existing lots of record in accordance with the specific zone requirements.

5. *Home Occupation* (Section 3.10) – A home occupation is permitted in a dwelling subject to restrictions on signs; people employed in the occupation; no retail; not more than 25% of the gross floor area is used for the home occupation; and no external storage of goods. A bed and breakfast or unlicensed day nursery is permitted.

6. *Minimum Opening Elevation for Paudash Lake* (Section 3.14) – No opening to a dwelling or addition, which increases the floor area of the dwelling, shall have an opening of less than the minimum elevation of 342.8 metres (1124.7 ft) CGD.

7. *Mobile Homes* (Section 3.15) – Mobile homes may be used as dwelling units provided they meet certain requirements.

8. *Natural Vegetation Area—Shoreline* (Section 3.19) – Where existing natural vegetation exists on a shoreline lot, the development of new residential uses shall not result in the removal of more than 70% of the natural vegetation in the required setbacks from the high water mark for the purpose of establishing access to or a view of the waterfront.

9. *Non-Complying Lots, Buildings and Structures* (Section 3.20) – Where a building is located on an undersized lot, or within the minimum required setbacks, the building can be enlarged, reconstructed or repaired with certain requirements. An undersized lot may be built on provided that all other applicable provisions are adhered to and that a sewage system complies with the Building Code.

10. *Non-Conforming Uses* (Section 3.21) – The use of any existing lot, building or structure for a purpose prohibited by the by-law is allowed to continue; when the use ceases for two years, the use is deemed discontinued. A building, such as this, cannot be enlarged unless it is to be used for a purpose permitted in the by-law. Interior alterations and the restoration of a damaged building to a safe condition are permitted. The effective date for legal non-conformity for Cardiff Township is December 31st, 1979 and Bicroft is December 19th, 1978.

11. *Outdoor Storage* (Section 3.23) – Outdoor storage is limited to 15% of the lot area.

12. *Setback from Rivers and Streams* (Section 3.29) - No building shall be located within 30 metres of any river, stream, creek or watercourse.

13. *Setbacks from Slopes* (Section 3.30) – No building shall be located within 20 metres (65.6 ft) of a slope or embankment that exceeds 33% or 3 to l.

14. *Setbacks from High Water Mark* (Section 3.31) – No building or structure except marine facility and pump houses, shall be located within 20 metres (66 ft) of the normal or maintained high water mark or any lake, river, stream or other watercourse. All buildings in a commercial zone must be setback a minimum of 30 metres (98.4 ft). Notwithstanding these requirements, the setback for all development on Inlet Bay and Joe Bay is 30 metres (98.4 ft).

15. *Trailer and/or Boat Storage* (Section 3.37) – Only two vehicles (boats, tourist trailers, motorized mobile truck camper, or other similar vehicle) can be stored in the side or rear yard, as long as such boat shall not exceed 7 metres (22.9 ft) in length and 10 metres (32.8 ft) for other vehicles, and that such a vehicle is not used for human habitation.

Specific Zone Provisions

Shoreline Residential Zone Provisions (SR-1, SR-2, LSR, S) – The uses permitted in all of the shoreline residential zones include single detached dwellings and a home occupation, which may include a bed and breakfast. The specific regulations for these shoreline residential zones are as follows:

Figure 7.9 – By-law Requirements for Zones on Shoreline – Highlands East

Requirements	SR1	SR2	LSR	S	CT
Lot Area*	0.6 ha	0.8 ha	0.8 ha	4.0 ha	4.0 ha
Lot Frontage*	45 m	60 m	60 m	100 m	60 m
Lot Coverage*	10%	10%	10%	10%	20%
Front Yard*	20 m	8 m	20 m	20 m	15 m
Side Yard*	6 m	6 m	6 m	6 m	6 m
Rear Yard*	8 m	8 m	8 m	15 m	15 m
Max. Height	10 m	10 m	10 m	10 m	10 m

Notes - Minimum Ground Floor area for all Shoreline Residential zones is 65 sq m (700 sq ft).
- * denotes minimum requirements

Commercial Zones (CT, CT-9, CG1 and MX, MX-2) – Within all of the Tourist Commercial Zones, the permitted uses can include: cabin establishment, camping establishment, cottage establishment, hotel, marina, motel, restaurant, tourist resort, accessory assembly hall, convenience store and a single detached dwelling. The specific regulations are shown in Figure 7.9 (above).

Additional regulations are required for camping, cottage, cabin establishments, and tourist resorts located in Tourist Commercial Zones (Figure 7.10),

Figure 7.10 – Lot Requirements for Camping, Cottage and Cabin Establishments – Highlands East

	Requirements
Minimum Lot Area	5.0 ha (12.4 ac)
Minimum Site Area	150 sq metres (1615 sq ft)
Minimum Open Space`	50% of lot area
Maximum Lot Coverage on all sites	15% of lot area

Rural Zones (Ru, RuR) – The greater percentage of the rural lands in the watershed is zoned Rural (Ru), and there are no shoreline properties zoned for Rural uses. The permitted uses in this zone include: single detached dwellings, agricultural uses, farm, hunt camp, kennel, logging, lodging or boarding houses, portable asphalt plant, riding stables, and veterinary hospital, amongst other uses.

There are also isolated Rural Residential (RuR) zones throughout the watershed that permit single detached dwellings and home occupations on lots with 0.8 hectares in area and lot frontage of 60 metres (196.8 ft).

Environmental Protection (EP) – The purpose of the Environmental Protection Zone is to prohibit development within naturally sensitive areas, and the only uses that are permitted are resource management, which are defined to mean the preservation, protection and improvement of the components of the natural environment. No building or structures are permitted except for a 1.8 metres (6 ft) wide floating dock where the entire frontage of a residential lot is zoned Environmental Protection (EP).

Observations

- *The proposed by-law is quite comprehensive and deals with many of the issues that are important to the lake community.*
- *Shoreline Structures – There is no limitation on the size, shape, length and width of docks and boathouses.*
- *Mobile homes are permitted as dwelling units, and this is not in keeping with the existing development in the shoreline area.*
- *Up to 70% of the natural vegetation in the required setback from the highwater mark can be removed. This is not consistent with maintaining natural shorelines.*
- *There are no minimum sizes documented for an existing lot of record, and significantly undersized lots may be developed provided they meet the yard setbacks and lot coverage.*
- *Lots with small shoreline frontage and large areas are permitted to construct very large buildings on the shoreline that may be out of character with the lot frontage. For example, lot coverage on a 0.8 hectares (2 acres) lot will permit a ground floor area of 809.3 sq. metres (8,712 sq. ft.) regardless of the amount of shoreline frontage. Other "cottage country" municipalities have adopted provisions to prevent this from occurring.*

- *The height of buildings is measured as being halfway between the eaves and the ridge. The roofs of new shoreline dwellings tend to be more steeply pitched than traditional cottages and, as the pitches become steeper, the top of the desired roof becomes higher. As well, it should be clearly stated that the height of a building is measured on the side of the building that faces the lake.*
- *Inlet Bay and Joe are "at capacity" and no more lots are to be created. This has not been addressed in the zoning by-law.*
- *North Bay is "nearing capacity" and the shoreline setback is only 20 metres.*

<u>Recommendations</u> – Highlands East Zoning By-law

95. The PLCA should work with the Municipality of Highlands East to have the following adopted as an amendment to the zoning by-law:

- ***a) A restriction on the width of shoreline structures such that "the total cumulative width of docks and boathouses shall not exceed 25% of the lot frontage up to 10 metres (33.2 feet,) whichever is less";***
- ***b) Zone the lakebed of the waterbody Open Space (OS) to control the location and size of shoreline structures located below the high water mark;***
- ***c) Mobile homes should not be permitted as dwellings in the shoreline area;***
- ***d) At least 75% of the natural vegetation between the dwelling and the high water mark should be retained. "On a lot, an area of land 15 metre (50 ft) wide, abutting and running parallel to the high water mark, shall be retained as a natural vegetation area". This is extremely important in retaining the natural shoreline and its associated natural habitat and aesthetic values, and the provision of privacy;***
- ***e) Existing lots of record in the shoreline residential zones should have a minimum lot frontage and lot area. Lots that do not meet the criteria should be combined or added to abutting lots. A minimum lot size of 30 metres (100 ft) frontage and 1393.5 sq. metres (15,000 sq. ft.) area is used in other cottaging areas in Ontario;***
- ***f) Limit the size of shoreline buildings relative to the size of lot that is immediately adjacent to the shoreline. The following wording should be considered: "for all the buildings and structures constructed or erected within 60 metres (200 ft) of the high water mark abutting the lot, lot coverage shall be based on that portion of the lot area within 60 metres (200 ft) of the high water mark abutting the lot. For all buildings and structures constructed or erected on the lot, beyond 60 metres (200 ft) from the high water mark abutting the lot, lot coverage shall be based on the total lot area";***
- **g)** ***The height of buildings should be measured to the highest point of the building on the side that faces the lake; and***
- **h)** ***A separate zone should be created for Inlet Bay and Joe Bay. It should limit the lot frontage and lot area to those that existed at the time of the passing of the by-law. All lots should be subject to site plan control.***

Township of Faraday Zoning By-law (By-law 3-93)

Due to fact that the Township of Faraday only encompasses a small area of Lower Paudash Lake and that they are not undertaking a by-law review at this time, a detailed account of the relevant sections of the Faraday Zoning By-law has not been completed. In addition, the provisions of the previously Highlands East By-law appear to be more extensive and have already been cited.

Observations

- *There is no limitation regarding the size of boathouses.*
- *There are no provisions for a natural vegetative buffer along the shoreline.*
- *The minimum lot coverage in the Seasonal Residential (SRS) zone is quite extensive (25%).*
- *Many of the properties along the south shore of Lower Paudash Lake, in the Township as well as in the community of Paudash, are zoned Rural Residential (RR,) and this zone permits a converted Dwelling House, which can include two dwellings in one building. As well, there is no minimum lot frontage requirement measured along the waterfront for this zone.*
- *The maximum lot coverage in a Rural Residential (RR) zone is 25% and is quite extensive.*
- *A portion of land on the north side of lower Paudash Lake is zoned Rural (RU), which permits agriculture, farm, kennel, livestock facility, and riding and boarding stables. These types of uses have associated water quality concerns next to waterbodies and wetlands.*
- *The maximum height of building in a Rural Residential (RR) zone and Seasonal Residential (SR) is 11 metres. Height is measured at the front of the building, and the by-law deems the street or right of way to be the front lot line in the case of a lot which fronts on both a navigable waterway and a street. As well, the height for a gable roof is measured from the grade at the front of the building to the average height between the eaves and the ridge. This could result in the overall height of the building being much greater.*
- *There is no open space zone in the Township by-law. Open space zones are used in many municipalities for resource related lands in the rural area that do not contain agricultural or industrial extractive uses.*
- *There are no existing lots of record provisions.*
- *The Hazard Land (HL) zone, on the Zone Map A3 of the by-law, does not reflect the boundaries of the provincially significant wetland on the east end of Lower Paudash Lake.*

Recommendations –Township of Faraday Zoning By-law

96. Many of the recommendations for the Township of Highland East should also be considered for this by-law. These recommendations are only noted briefly here and have been expanded in the review of the aforementioned by-law:

- ***a) Restrict the size and cumulative width of shoreline structures;***
- ***b) Establish minimum shoreline buffer requirements and a definition;***
- ***c) Establish minimum existing lot of record provisions;***
- ***d) Reduce lot coverage for lots that abut the lake to 10% based on the lot area within 60 m (200 ft) of the shoreline;***
- ***e) The height of buildings should refer to overall height of the building and be measured on the lake side of the building;***
- ***f) Only one dwelling unit and one private cabin per lot should be permitted on lots that abut a lake;***

g) Certain resource related uses, such as agriculture, industrial extraction, and forestry, should be prohibited within 152 m (500 ft) of the high water mark of a lake; and

h) ***Identify the provincially significant wetland on the east end of Lower Paudash Lake as an Environmental Protection zone, and prohibit all forms of development, except for a floating dock on adjacent lots that completely front on this wetland.***

7.3.3 Site Plan Control Regulations

Site plan control is a tool used by municipalities, under the authorization of section 41 of the Planning Act, to deal with the massing of buildings, public access in and around buildings, parking, lighting, landscaping-garbage facilities, land alteration, and stormwater management. Although originally designed for commercial land, site plans can be useful on residential lands, particularly for waterfront lots and the preservation of vegetation.

A site plan and agreement can be entered into with the municipality and landowner and registered on title to the property so that it is binding on future landowners. Securities can be taken and held by a municipality especially in cases where the desire to re-naturalize a property exists.

Currently both the Township of Highlands East and Faraday have a site plan control by-law that is used for commercial and industrial development; however, the former Township of Bicroft is not subject to it.

Observations

- *Site plan control in Highlands East and Faraday Township applies to commercial and industrial properties only.*
- *Site plan agreements are not subject to a public participation process and can be approved without notification of adjacent property owners.*

Recommendations – Site Plan Control

97. The municipalities should be encouraged to extend site plan control to residential properties, especially when adjacent to sensitive natural areas.

98. ***The townships should be requested to notify the local ratepayers groups of Site Plan Control applications for major commercial and industrial development or redevelopment along the shoreline.***

7.3.4 Consent Agreement (51/26)

Under Section 51(26) of the Planning Act, a municipality or approval authority, or both, may enter into agreements imposed as a condition of the consent of the agreement, which can relate to vegetation retention, tree planting, the use of site plan agreements, or the incorporation of recommendations from reports on such items as fish habitat and stormwater management.

Any agreement under this section of the Planning Act can be registered on title and is, therefore, binding on successive owners; however, it cannot apply to existing lots of record.

Observations

- *Consent Agreements can be registered on title to properties that are being subdivided, and the terms are binding on subsequent owners.*
- *Consent Agreements can be used to address matters such as retention of natural buffers, provision of storm water management measures, and conditions to mitigate impacts of fish and wildlife habitat.*

Recommendations

99. ***The Municipality must ensure that the terms of the Consent Agreement are not violated by providing adequate site inspections before, during and after completion of the project.***

Section 8 Lake Values, Concerns and Solutions

8.1 Lake Values

The Residential and the Commercial Survey (Summer 2003) identified the most valued features on the lake. The surveys provided an open-ended question: "what do you value the most about Paudash Lake?", and Figure 8.1 identifies these features, in order of priority.

Figure 8.1 – Most Valued Features

Commercial Operators	Residents
Clean Lake	Peace and Tranquility
Picturesque Views	Water Quality and Clarity
Peace and Tranquility	Beautiful Views and Scenery
Water Quality	Wildlife Viewing

Source – Summer 2003 Resident and Commercial Survey

Both the residents and the commercial operators identified similar values; a clean lake and water quality were the two most valued features of the lake. The natural shoreline, natural habitat, and recreational opportunities also ranked relatively high. It is interesting to note that while peace and tranquility was a valued feature to both interest groups, it received a much higher rating for residents than it did for commercial operators; this difference of opinion may be related to the importance of tranquility to residents and recreational opportunities to stakeholders. While these can sometimes be conflicting uses, it is anticipated that through communication and the development of a Lake Management Plan an appropriate balance can be achieved.

Residents and commercial operators were also asked to rank the importance of thirteen (13) values, which contributed to their enjoyment of Paudash Lake. Figure 8.2 lists those values that were identified in the survey as being important in order of priority.

Figure 8.2 – Ranking of 13 Most Valued Features

Commercial Operators	Residents
Water Quality (100%)	Water Quality (95%)
Water Quantity (86%)	Peace and Tranquility (91%)
Water Level (77%)	Swimming (83%)
Wildlife Viewing (77%)	Water Level (76%)
Swimming (77%)	Wildlife Viewing (75%)
Fishing (69%)	Natural Shorelines (73%)
Peace and Tranquility (67%)	Water Quantity (72%)
Night Skies (60%)	Night Skies (64%)
Non-Power Boating (55%)	Non-Power Boating (62%)
Natural Shorelines (54%)	Landscapes (59%)
Landscapes (46%)	Fishing (58%)
Power Boating (39%)	Power Boating (47%)
Hunting (30%)	Hunting (9%)

Source – Summer 2003 Resident and Commercial Survey

8.2 Impacts on the Lake

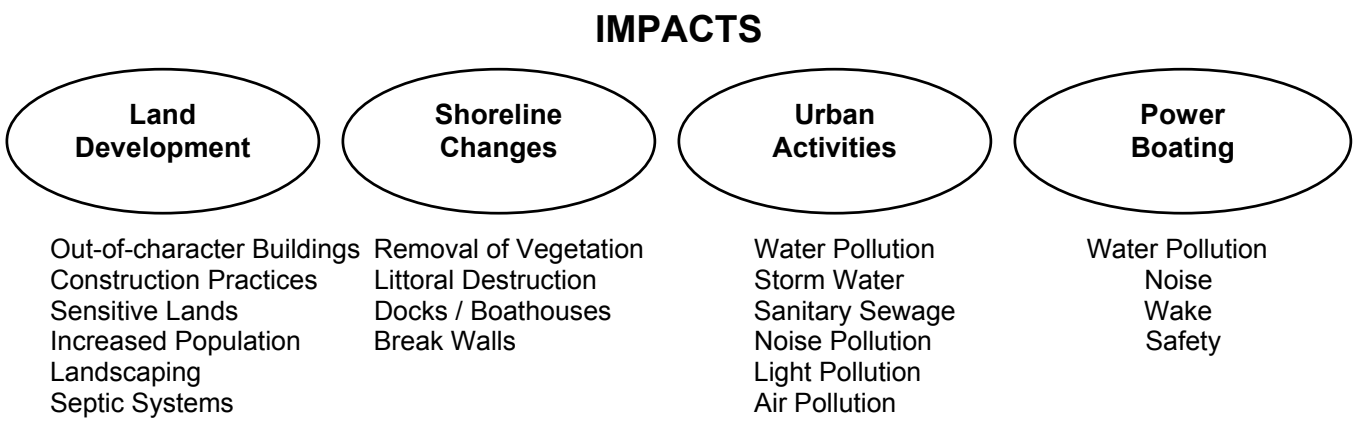
There are certain activities that impact the valued features of the lake. Often a single event, or a combination of small events, can be sustained without a significant impairment of a lake value or feature. However, the cumulative impact of ongoing activities can result in a negative result or the creation of a situation that becomes intolerable to lake users. The ability of a lake to sustain many small impacts is known as its carrying capacity.

> *"Carrying capacity refers to the maximum number of development or recreational activities that can be sustained by a given social, natural or physical element before its quality diminishes. The threshold limit is the maximum number of impacts that a certain value can sustain."*

Sometimes, a single event or action will not impact a lake value, but it may take repetitions of these "single events or actions" for any impacts to be noticeable. For example, the removal of one tree may not result in any detectable impacts, but the removal of many trees could result in loss of habitat, affect the natural beauty of a shoreline, or cause erosion.

Impacts include anything that results in a negative change of a lake value. Impacts on Paudash Lake can be generally grouped under the headings of land development, shoreline changes, urban activities and boating. These impacts are briefly summarized in the following section, and details of the impacts are provided throughout the report.

Figure 8.3 – Description of Impacts



1. Land Development

a) Out-of-Character Buildings – A building may be out of character compared to its lake surroundings because it may be too large, poorly sited, or have unattractive features that can adversely affect the natural beauty of the lake.

b) Construction Practices – During construction, significant damage to the lake's natural, social and physical features can occur unless proper care is taken. The removal of vegetation and topsoil can result in erosion. Sand and silt from construction sites can be washed into a lake

during rainstorms or along improperly designed, or protected, drainage channels and land gradients. Unstable banks can collapse into a watercourse, and silting and sedimentation can result in increased turbidity, which has the potential to affect the entire lake food chain.

c) Hazard / Environmentally Sensitive Lands / Fish Habitat – Hazard lands and environmentally sensitive lands consist of wetlands, stream valleys, floodplains and steeply sloped areas. Development in these areas requires additional caution during construction. Therefore, development applications and building permits must receive intensive scrutiny to avoid adverse impact on wildlife and fish habitat, as well as to prevent inappropriate structures. By-law requirements in these areas should be more stringent than for normal development.

d) Increased Population – Along with development comes an increase in residential, recreational and commercial activities, and the potential corresponding increase in their harmful effects on the lake and community: including increased sewage, noise and light pollution; intensive traffic, boating and fishing; and possible adverse changes to the shoreline and littoral zone.

e) Landscaping – Different views are held on what constitutes attractive landscaping. Unfortunately, urban landscaping, which normally requires replacement of natural vegetation with cultivated lawns and ornamental plantings, is not suitable on shoreline lands as described below in “Shoreline Changes”. Fertilizers, herbicides, and pesticides used on lakeside property have an increased potential to be transported into the water, harming water quality. Nutrients from fertilizers stimulate the growth of aquatic plants and algae, and when aquatic plants die and decompose, dissolved oxygen is consumed and the oxygen available to fish, especially cold water fish, is diminished. At present, off-site migration of fertilizers is not thoroughly understood and studies are in progress.

f) Septic Systems – Improper construction and maintenance of septic systems can result in the release of nutrients and bacteria into the lake. Released nutrients, such as phosphorous, increase plant growth reduce dissolved oxygen over a period of time. High levels of certain bacteria can have a serious affect on public health.

2. Shoreline Changes

Note that permits by municipal, provincial and federal agencies may be required when undertaking the following categories of work and activities.

a) Removal of Shoreline Vegetation – Removal of shoreline vegetation adversely affects the natural shoreline, which is ultimately desired for scenic beauty. In addition, the elimination of vegetation roots takes away the holding action on the shoreline and causes erosion, which produces silting and, eventually, the destruction of fish habitat. The removal of trees destroys their shading capability in the water, which is needed to maintain cooler water temperatures for fish in shallow waters. A naturally vegetated shoreline filters nutrients and sedimentation and this action disappears with its removal.

b) Destruction of Littoral Zone – The littoral zone is the lake area from the water’s edge to where light no longer penetrates to the bottom. Ninety percent (90%) of the species in a lake either live in or pass through this zone, since it offers areas to forage, breed and for protection against predators for young fish and amphibians. Aquatic plants, logs, downed trees, and

submerged rocks are crucial parts of the ecosystem, and their removal is destructive to its various ecological functions. For example, creating a sand beach smothers spawning areas, buries amphibian eggs, covers vegetation, and fills in hiding spots; all negative impacts which ripple through the food chain with a deleterious effect on aquatic life.

c) Docks and Boathouses – Construction of a dock can impact both fish habitat and scenic values. Depending on the time of construction, location and design, docks can impact fish spawning, interfere with navigation, and disrupt the lakebed. Floating docks are the least disruptive option on submerged lands; pipe or pile docks are preferred in areas with aquatic vegetation, as they permit sunlight to penetrate; and crib and concrete pier docks are the least desirable because of increased disruption to the lakebed. In addition to the impact caused by a dock, a boathouse has a detrimental effect on the natural beauty of the lake's shoreline. It disrupts the normal line of sight along a shoreline and, depending on its dimensions, architectural features, and maintenance, can be an eyesore. Many lakes will not allow boathouses to be constructed and, those that do should have stringent controls over dimensions and percentage of developed shoreline.

d) Break walls – Break walls are often needed to stabilize shorelines. However, concrete and other vertical break walls are of little use for fish or other aquatic organisms because they will deflect wave energy rather than dissipate it, usually resulting in erosion problems elsewhere. Properly constructed, slanted, rock rubble embankments, however, can increase fish habitat diversity, encourage vegetation growth, and dissipate wave action.

3. Shoreline Activities

a) Storm water – Phosphorous is a nutrient that stimulates aquatic growth. Storm water from urban landscapes contains phosphates, which originates from fertilizers used on home lawns and landscaping, and is one of the largest sources of phosphorous for a lake. Storm water can also contain other water pollutants such as silt and sediment from soil erosion, oil from paved areas, and chemicals that are accidentally or improperly allowed to flow into storm sewers.

b) Noise Pollution – Noise from traffic and powerboats, and the concentration of noise from other activities, can interfere with enjoyment of the serenity of the lake.

c) Light Pollution – Commercial and residential properties and sections of major highways are lit at all times during the night. While this is needed for safety and security reasons, it interferes with the view of starlit skies, creates a distraction for those wishing to experience surroundings that are true to nature, and may impact the behaviour activities of nocturnal animals.

d) Air Pollution – Air contaminants from heating and industrial sources can be troublesome to those wishing to escape the sources of airborne pollutants by seeking refuge on the lake.

4. Power Boating

a) Noise – High-speed passage or "racing" of powerboats increases noise levels carried across the lake due to the fact that sound travels very well over water.

b) Wake – Wake from powerboats can cause intense rocking to floating docks and smaller crafts, which contributes to shoreline erosion.

c) Water Pollution – Pollution is a result of, in particular, two-stroke engines, but also from on-board sanitary facilities.

d) Safety Issues – A powerboat's high-speed passage near swimmers and other boats, as well as through the channel and narrow waterways, is hazardous.

e) Personal watercraft – Are particularly at the top of resident's concerns since they are noisy, operated at high speeds, and are powered by two-stroke engines.

The valued lake features, which are affected by each of the above impacts, are shown in Figure 8.4 below.

Figure 8.4 – Effects of Impacts on Valued Lake Features

	VALUES AFFECTED BY IMPACTS						
IMPACTS	Scenery	Water Quality	Peace and Quiet	Wildlife Habitat	Boating & Fishing	Privacy	Tourism
Land Development							
Out-of-Character Buildings	X	-	-	-	-	-	-
Construction	X	X	X	X	X	X	X
Hazard and Environmentally Sensitive Lands	X	X	-	X	-	-	-
Increased Population and Land Use	X	X	X	X	X	X	X
Landscaping	X	X	-	X	X	X	X
Septic Systems	-	X	-	X	-	-	X
Shoreline Changes							
Removal of Shoreline Vegetation	X	X	X	X	X	X	X
Destruction of Littoral Zone	X	X	-	X	X	-	X
Docks and Boathouses	X	-	-	X	X	-	-
Break Walls	X	X	-	X	-	-	-
Urban Activities							
Storm water	-	X	-	X	X	-	X
Noise Pollution	-	-	X	-	-	-	X
Light Pollution	X	-	-	-	-	-	X
Power Boating							
Noise	-	-	X	-	-	-	-
Wakes	X	X	-	X	X	-	-
Oil, Exhaust, and Sanitary Facilities	-	X	-	X	-	-	X
Unsafe Speeds	-	-	-	-	X	-	X

8.3 Lake Concerns and Solutions

Many of the issues that were identified, at the workshops and in the survey, directly impact the general values that attract people to the area. These values are threatened due to the increased presence of human activities such as boat traffic, pollution and noise. Figure 8.5 provides a brief summary of these issues as well as the solutions that were generated by residents and commercial operators through the survey and the workshops.

Some general solutions that apply to all of the issues include the following:

- Promote education and awareness programs with respect to all identified issues;
- Develop information about what agency is responsible for what issues and to whom one would report incidents or concerns;
- Maintain open communication with all levels of government and confirm the issues;
- Encourage more involvement and participation from all residents, particularly young people;
- Work with neighbours to jointly and directly communicate concerns, politely but assertively, to those who are creating them;
- Find ways for the PLCA to "partner" with local businesses and government agencies;
- Always set a good example and take personal responsibility;
- Where legislation or regulation is needed, campaign to lobby politicians;
- Seek solutions to problems, which balance personal freedoms and regulation, using common sense;
- Review issues and solutions with local contractors;
- Develop a voluntary "Code of Conduct" for dealing with issues that have an impact on community values, but are unregulated by law; and
- Where possible, mutually develop "Best Management Practices" with local contractors.

Figure 8.5 - Issues and Solutions

Issues and Impacts	Solutions
1. Water Pollution Inappropriate construction, faulty septic systems, fertilizer & pesticide use, and bathing/shampooing in the lake.	• Increased awareness, education and public participation • More information, publicity and media coverage of problem • Conduct regular & appropriate water quality testing • Regulate & develop septic system reinspection programs • Improve zoning by-law enforcement by municipalities • Enact a by-law to prohibit pesticide and fertilizer use near the lake • Enact a by-law to fine polluters • Involve the next generation in solving the problem • Bring problem to the attention of municipalities & the province • Seek changes in legislation
2. Noise Pollution Loud music, PWCs, power boats, ATVs, dirt bikes, highway 28 traffic, all night parties, and noisy neighbours.	• Increased awareness, education and public participation • Set limits, controls and hours of operation of noisy vehicles • Enact a noise by-law in both municipalities and enforce it • Increased response rate from Ontario Provincial Police • Personal intervention (assertive but polite) • Clear accessible guidance as to whom to report incident • More information, publicity and media coverage of problem

Figure 8.5 - Issues and Solutions

Issues and Impacts	Solutions
Noise Pollution (Cont'd)	• Encourage folks to leave urban lifestyles in the city • Involve the next generation • Convene neighbours to speak as a group to "noisy neighbours" and try to reach accommodation • Develop with the municipalities a conflict resolution model to deal with "difficult" neighbours • Plant a natural sound barrier to absorb traffic noise between Highway 28 and the cottages • Seek changes in legislation
3. Personal Water Craft Inappropriate behaviour by few operators impacts many.	• Promote operator awareness and education • Set limits and/or control hours of operation • More information, publicity and media coverage of problem • Increase the use of mufflers on PWCs • Ban PWCs from the lake • Involve the next generation in solving the problem • Bring to attention of province and municipalities • Seek changes in legislation
4. Noisy, Large, Fast Boats	• Set limits and seek to control boat size on the lake • Promote increased operator awareness through education • Work with OPP to help get dangerous operators off the lake • Bring to attention of province and municipalities • Seek changes in legislation
5. Light Pollution	• Promote increased awareness and education • Set limits on wattage and hours / seasons of operation • More information, publicity and media coverage of problem • Involve next generation in solving the problem • Seek more involvement from municipalities • More involvement / participation of all residents
6. Shoreline "Urbanization" and Shoreline Erosion	• Notify MNR (Conservation Officer) where unlawful alteration of shoreline is suspected • Notify Department of Fisheries & Oceans where possible loss of fisheries habitat is suspected or where there appears to be an active sedimentation and erosion issue that is causing impact on fish habitat • Engage municipalities in solving the problem • Enact tree cutting by-laws in each municipality which restrict the removal of trees on the shore land • Notify OPP to control boats speeding and causing wakes • Work with the commercial landscaping people to try to achieve the adoption of "best management practices" • Promote increased awareness and education about the impacts of erosion and effluents due to the removal of shoreland shrubbery • Invite more involvement / participation • Help to facilitate more shoreland restoration initiatives • Get the next generation involved • More information, publicity and media coverage of problem • Contact municipal, provincial and federal agencies before planning or proceeding with work

Figure 8.5 - Issues and Solutions

Issues and Impacts	Solutions
7. Unsustainable Development Inappropriate development involving too much density, lot coverage, and intensity of use.	• Municipalities should stringently limit the size of new development on the lake • Municipalities should enforce the zoning by-laws in all new construction and reconstruction activities
8. Alteration of Lake Levels Management of water levels to enhance fish and wildlife populations.	• Stop regulating water levels and let the dam spillway do the job • Work with the municipalities, the MNR and the CVCA to try to find a reasonable compromise
9. Road Maintenance	• Encourage stewardship activities to accomplish this • Work with the Federation of Ontario Cottagers' Associations (FOCA) to obtain road liability insurance
10. Protection and Improvement of Fisheries	• Investigate the walleye stocking program developed by the Baptiste Lake Association, as a possibility for Paudash Lake • Consider a moratorium on winter fishing for lake trout, to improve successful regeneration • Construction of a permanent weir.
11. Invasive Species	• Work in partnership with business interests, the Ministry of Natural Resources, and the Ontario Federation of Anglers & Hunters to stop the spread of zebra mussels and other invasive species
12. Taxes Concern that taxes will rise beyond the ability of pensioners to keep their homes.	• Work with the Federation of Ontario Cottagers' Associations to lobby the Ontario government to keep the lid on cottage property taxes • Work with the local municipality to restrain rate increases
13. Uranium Mine Tailings	• Monitor the ongoing (nearly completed) decommissioning of the Dyno and Bicroft mine sites
14. Lack of Access to Emergency Services (Ambulance, fire, police)	• Work with municipality to ensure timely 911 access
15. Protection of Crown Land	• Support MNR to continue their policy of not selling Crown Land on the lake

Section 9 Action Plan

Section 9 of the Paudash Lake Management Plan identifies the actions that are critical to the overall success of the Plan. Over the course of two years, through two Stakeholder Workshops with government and commercial interests and two Residents Workshops as well as information gleaned from surveys returned from residents and commercial interests around the lake, we have been able to determine the key issues identified by both residential and commercial interests. All of these issues have been addressed through Observations and Recommendations developed throughout the Lake Management Plan.

These issues and concerns, which are remarkably similar whether they are based on opinions of residents or of commercial operators, have been documented in Section 8 of the Plan. Relative priority of these issues and proposed remedial actions were determined through the reaction of participants at the Second Stakeholder Workshop involving government agencies, municipal representatives, and commercial operators as well as members of the PLCA Lake Plan Committee. The 10 key issues are:

1. Monitoring, Protecting and Enhancing Water Quality;
2. Maintaining and Improving Septic Systems;
3. Maintenance and Restoration of Natural Shorelines;
4. Promoting Sustainable Development Through Municipal Planning Policy
5. Boating Activities and Boating Behaviour;
6. Protecting and Enhancing Fish Habitat;
7. Inventory of Streams Flowing into Paudash Lake;
8. Noise and Light Pollution;
9. Managing Water Levels; and
10. Improving Communications.

For each of these issues, participants in the Second Stakeholder Workshop identified one or more strategies to mediate, resolve or assist with managing resolution of the problems. In addition, the Lake Management Plan itself contains a variety of resolutions to deal with these issues. This section will rely on both of these sources to propose an Action Plan.

The Paudash Lake Management Plan is a community document resulting from in-depth consultation with stakeholders and residents. Some issues relate more specifically to land use planning, so these recommendations will be addressed to municipal governments and government ministries directly mandated to regulate land use decisions. Other issues and recommendations relate to activities that could be undertaken by a voluntary organization, such as the Paudash Lake Conservation Association, as part of a lake stewardship program. Still other recommendations will be made to the population at large and will rely on the establishment of “best practices” to mitigate the impact of the activities of some members of the community. The effectiveness of the Action Plan will depend on the degree to which both municipalities, all government agencies, commercial operators, members of the Paudash Lake Conservation Association, and the public at large contribute to the implementation of the Paudash Lake Management Plan.

Issue 1 - Monitoring, Protecting And Enhancing Water Quality	
Objective	To maintain and improve, where possible, the water quality standards of Paudash Lake, and to promote public awareness of lake water quality and identify opportunities and support standards that may improve the quality of lake water.
Description	1. Water Quality Testing – To continue to collect water quality information through the MOE's "Lake Partner Program" as well as a thorough inventory of the benthic and plankton communities. Maintaining a consistent monitoring program, which collects routine samples from various locations, will produce and contribute to, over time, a database that could be used by lake residents, resource managers, and researchers to establish trends in water quality and standardized monitoring protocols. 2. Encourage a Phosphate-Free Life-Style in the Lake Community – To assist the municipalities with educating, on a regular basis, all members of the lake community about the importance of using only phosphate-free laundry and dishwasher detergents and refraining from using pesticides, herbicides and chemical fertilizers on waterfront properties. 3. Establishment of Buffer Zones –To encourage the Municipality of Highlands East and Faraday Township to establish buffer zones within 15 m of the high water mark in order to protect tree and vegetation cover as well as the riparian and littoral zone habitat from development, and to mitigate the impact of septic field nutrients and surface water runoff into the lake. 4. Identification and Protection of Wetlands –To ensure that the municipalities have maps that depict all wetlands within their jurisdiction, especially the identified Provincially Significant Wetland complexes on Paudash Lake, and to ensure that land use planning decisions are consistent with provincial policy and Official Plans.
Tasks	1. Water Quality Testing: a) Maintain water quality monitoring programs, which includes the monitoring of inflows to Paudash Lake, with the MOE and the MNR; b) Implement a long-term water quality monitoring plan and test for nutrients and dissolved oxygen and temperature profiles as well as other factors identified by the MOE; c) Maintain accurate records of all water quality data and distribute results, at least on an annual basis, to MOE, municipalities, agencies and residents; d) Initiate benthic (aquatic insects living near the shoreline) and plankton community monitoring surveys; and e) Continue to monitor, with the assistance of the Ontario Federation of Anglers and Hunters, for invasive species such as zebra mussel, spiny water flea, round-faced goby and purple loosestrife.

Issue 1 - Monitoring, Protecting And Enhancing Water Quality	
Tasks (cont'd)	2. A Phosphate-Free Life-Style in the Lake Community: a) Continue to encourage the use of phosphate-free products through the PLCA Newsletter, notices to the public, and on the PLCA web site; b) Identify alternatives to non-ecologically sound products (environmentally friendly laundry and dishwater products, etc.) and ensure that these phosphate-free products, which can be identified in the PLCA Newsletter and on notices to the public, are widely available for purchase at local stores; c) Solicit and encourage public support for a municipal ban in Highlands East and in Faraday Township on the use of herbicides, pesticides and chemical fertilizers on properties abutting a water-body, or at least within a defined buffer zone measured at 15 metres from the high water mark, and challenge and encourage each municipality to establish a by-law to this effect; d) Encourage the reduction of all fertilizer and agricultural inputs within the upper watershed of Paudash Lake; e) Provide a scientifically based analysis of the harmful side effects of herbicides, pesticides and other chemical fertilizers, and agricultural inputs to the health of the lake's ecosystem, and distribute this information broadly, within the community, via the Newsletter, articles in the local media, or through other means of communication; f) Encourage local residents to create "grey water pits" for the proper disposal of water from exterior showers, washing machines, and all other gray water sources; and g) Inform residents that the introduction of soaps and shampoos directly into the lake water is harmful to the lake, even if the products are biodegradable. 3. Establishment of Buffer Zones: a) Encourage the Municipality of Highlands East and Faraday Township to pass zoning by-laws to create a buffer zone, which should measure 15 metres from the high water mark and be maintained in a natural undisturbed state, on lake front properties; b) Encourage the Municipality of Highlands East and Faraday Township to pass Zoning By-laws that require a 30 metre setback of septic systems from the high water mark; c) Encourage the MNR and the Department of Fisheries and Oceans (DFO) to enforce the rules regarding erosion and sediment control in the buffer zones; d) Make a formal request to municipalities to enforce responsible development and construction practices, including, for example, the use of silt screens and other construction mitigation measures; e) Make a formal request to municipalities to develop municipal stormwater management and action plans; and f) Collect and share scientific data, in collaboration with the MNR and the municipalities, to demonstrate the importance of buffer zones to the health of the lake's ecosystem.

Issue 1 - Monitoring, Protecting And Enhancing Water Quality	
Tasks (continued)	4. <u>Identification and Protection of Wetlands</u>: a) Distribute maps that accurately identify the boundaries of the wetlands of Paudash Lake, in particular, the boundaries of the two Provincially Significant Wetland (PSW) Complexes, to each municipality; b) Make a formal request to municipalities to identify the location of wetlands in official plans and zoning by-laws, if they have not done so already. Encourage the municipality to provide appropriate land use policy to ensure their protection, and require an environmental or lake impact assessment to be completed and peer reviewed by a qualified consultant at the expense of the proponent, selected by the municipality, for proposals of any development in or adjacent to Provincially Significant Wetlands (PSWs); c) Ensure that all wetlands have the same level of protection as the PSWs; and d) Develop an education program that highlights the ecological significance of wetlands, including the significance of wetland habitats for “species at risk” conservation in Ontario, and promotes the need for wetland conservation.

Issue 2 - Maintaining And Improving Septic Systems	
Objective	To ensure septic systems are properly maintained, improved and upgraded.
Description	1. Mandatory Regular Septic System Reinspection – To cooperatively work with both municipalities to initiate a mandatory septic system reinspection program, which would be contracted to the Regional Health Unit, to be conducted every 5 years; 2. Regular Maintenance of Septic Systems – To conduct a campaign among lake residents to promote the regular pumping out of septic systems every three to five years; and 3. New Technology for Septic Systems – To monitor the licensing of new septic system technology and make the municipalities and residents aware of its availability.
Tasks	1. Mandatory Regular Septic System Reinspection Program: a) Hold a workshop with other jurisdictions, which have successfully implemented a septic reinspection program, to collect and disseminate information; b) Encourage participation and share information with both the Municipality of Highlands East and Faraday Township; c) Investigate the possibility of assisting the municipalities, through potential grant applications and the hiring and training of summer students to conduct inspections, in the implementation of the program; d) Encourage the municipalities to adopt a regular septic system reinspection program that ranges from the oldest ones first, and the most recently installed, last; e) Encourage the Regional Health Unit to require property owners to make the necessary upgrades and/or repairs to faulty septic systems; and f) Make a formal request to the municipalities to pass a by-law requiring that a septic system inspection be completed, and if necessary repaired or replaced, prior to the conclusion of any sale of property in the township or the issuance of building permits for expansion or reconstruction. 2. Regular Maintenance of Septic Systems: a) Continue to provide information to members and residents about the importance of pumping out septic systems every three to five years, through articles in the Newsletter, the web site, and other notices. 3. New Technology for Septic Systems: a) Distribute information about new septic system technology to the municipalities, lake residents and PLCA members, through articles in the Newsletter, local media, and/or on the PLCA web site; and b) Encourage residents installing new systems to use only new technology that is determined by the MOE and the scientific community to have a beneficial impact on the water quality of Paudash Lake.

Issue 3 - Maintenance and Restoration of Natural Shorelines	
Objective	To ensure that natural shorelines are maintained and degraded shorelines are rehabilitated
Description	1. Establishment of a Natural Shoreline – To establish buffer zones, in cooperation with the municipalities, that would protect natural vegetation in areas between the development site and the high water mark; 2. Implement Phase Two of the PLCA Shoreland Restoration Program – To restore shorelines, in cooperation with the municipalities and property-owners, by planting indigenous plants to reduce erosion and nutrient loadings as well as mitigate the impact of contaminants from surface runoff water; and 3. Replace Shoreline Structures – To provide assistance and advice to residents who need to upgrade old structures near the shoreline.
Tasks	1. Natural Shoreline Maintenance: a) Encourage the municipalities to establish a buffer zone in the zoning by-law; b) Encourage the municipalities to discourage "urbanization" of shorelines (e.g., excessive tree removal and hard shoreline walls); c) Encourage the municipalities to discourage excessive scale of building size in relation to lot frontage; d) Encourage the municipalities to restrict current practices of shoreline modification such as fill, retaining walls, lawns and the creation of beaches; e) Encourage the municipalities to encourage "invisible" development; f) Promote the importance of improving buffers, shorelines and habitat areas to all local residents; g) Support MNR and DFO mandates by providing information that will assist local residents in making improvements to fish spawning and rearing bed habitats along their shorelines; h) Improve awareness by educating the public on how a shoreline can be protected and remain "user friendly"; i) Remain realistic about buffer requests and, in cooperation with the municipalities, allow modifications, (i.e., depth), where appropriate; j) Encourage the municipalities to advocate new development that protects the integrity of the shorelines by minimizing the loss of native vegetation and substrates and prevents sediment deposits into the lake; and k) Continue encouraging lake residents to plant native plants along the shoreline, including aquatic plants, to enhance buffering and uptake of seasonal nutrients as well as fish habitat, and to decrease impervious landscapes by reducing the demand for manicured lawns and paved driveways.

Issue 3 - Maintenance and Restoration of Natural Shorelines	
Tasks (continued)	2. <u>Phase Two of the Shoreland Restoration Program</u>: a) Rally support from the municipalities and shoreline residents to participate in the PLCA Shoreland Restoration Program; b) Inventory erosion sites, obtain landowner support, prepare a vegetation plan, and implement through third party funding or voluntary support; c) Investigate the most suitable format for this second phase, develop a budget, raise funds, and hire professional staff, if necessary, to extend the Program; d) Report the results of the program's second phase to the municipalities, appropriate agencies, and lake residents; e) Encourage lake residents to restore all degraded sites within the following areas: i. Littoral Zone – in-water rehabilitation with the assistance of the Conservation Authorities (need in-water permits) by adding downed native logs and other woody debris as well as carefully placed rocks near the shoreline to create micro-habitats for aquatic species and to protect the natural substrate; ii. Riparian Zone – create a buffer of native plants, shrubs and trees between the waterline and lawn, to discourage erosion and prevent sediment runoff; and iii. Upland Zone – replant native trees, in areas that do not block the view from the residence, to buffer strong winds, maintain cool water temperatures, protect slope gradient, and prevent erosion as well as to provide habitats for native species. f) Encourage lakefront owners that have >25% shoreline disturbance to restore their property shoreline areas back to a natural state, wherever possible, by protecting and retaining the existing native vegetation and planting only native species (grasses, sedges, shrubs and trees)—ideally 75% of the shoreline lot should remain in a natural state with the exception of marinas; and g) Persuade local nurseries and landscaping businesses to stock and promote the use of local plants as well as identifying non-profit organizations that will donate native species, tools and free labour; and 3. <u>Replace Shoreline Structures</u>: a) Provide information, in the Newsletter and/or on the PLCA web site, to residents concerning the replacement of shoreline structures (docks, ramps, shore walls)—a topic that could be a useful subject for a future workshop.

Issue 4 - Promoting Sustainable Development through Municipal Planning Policy	
Objective	To ensure local official plans and zoning by-laws contain direction that maintains a balance between the natural, social and physical environment and development in order to guide sustainable development and redevelopment on the lake.
Description	1. Update Official Plans – To initiate discussions with the Municipality of Highlands East, Hastings County and the Township of Faraday to develop more specific Official Plan policy, with respect to Paudash Lake, that is consistent with this study and its recommendations; and 2. Update Zoning By-laws – To initiate and encourage discussions with the Municipality of Highlands East and Faraday Township to update and amend their current Zoning By-laws, respectfully, to bring both By-laws into conformity with recommendations from this Plan. 3. Tree Cutting and Pit and Quarry By-law – To initiate discussions with both municipalities to update or adopt appropriate tree cutting by-laws and pits and quarry by-laws.
Tasks **Official Plan Checklist**	1. Update Official Plans: a) Maintain a good understanding of the current land use patterns to be able to identify potential development pressure points when reviewing Lake Management Plan and Official Plans; b) Assist local municipalities to determine if appropriate standards and safeguards are in place for new or redevelopment proposals; and c) Use the following checklist and those identified in the Lake Management Plan as a basis for negotiating amendments: Municipality of Highlands East – Encourage the municipality to process a lake specific Official Plan Amendment, which would incorporate the principles and policy direction provided in this study: • Shoreline vegetation preservation including width (15 metres), permitted uses and restoration. • Development constraints related to steep slopes and narrow water bodies including a definition and requirement for increased lot frontages. • Shoreline activity areas that include maximum shoreline area allowed for shoreline structures and frontage coverage policies. • Lot coverage policies that require the scale of buildings to be related to shoreline frontage and lot area immediately adjacent to the shoreline, especially on undersized lots. • Noise and light pollution. • Prohibition of aggregate and mining operations within the viewscape of Paudash Lake.

Issue 4 - Promoting Sustainable Development through Municipal Planning Policy	
Official Plan Checklist (cont'd)	• Consideration that all new lots (with the exception of islands) may eventually be used as permanent residences and to set development standards accordingly. <u>County of Hastings</u> – Encourage the County to strengthen the official plan with policies that implement the principle of "environment first" but, more specifically, the official plan should provide more detailed policies with respect to the following listed below. • Policies regarding the waterfront character should be introduced as the following: "the waterfront is primarily made up of individual residential dwellings interspersed with commercial development primarily in the form of marinas, resorts, and tent and trailer camps. The waterfront is a focus point for recreation, fish and wildlife, and relaxation. Development should not detract from those attributes that contribute to its character, and the natural form must dominate over the built form." Industrial and agricultural development should be prohibited in waterfront areas; policies on the rural / waterfront interface need to be articulated; rural resource use, such as aggregate extraction and forestry, should not be permitted in the waterfront area; and wooded hillsides, as viewed from the lake, should also be exempted from forestry or aggregate or mineral operations. • In respect to exterior lighting, all lighting should be directed inwards on the property and be dark sky compliant. • Prominent public views and features, such as rock cliffs, tree lines and other landmarks, should be protected; this can be done by limiting encroachment by development and encouraging the dedication of these lands. • The definition of a steep slope and how they are measured should be incorporated into official plan policy. Some municipalities identify steep slopes as areas where increased frontages are required; these slopes are generally measured over a horizontal distance inland of 45 metres (150 ft) from the shoreline for at least 100 metres (330 ft) along the shoreline. • The number, scale and massing of shoreline structures need to be regulated. For example, boathouses should be discouraged and be limited to a single storey; the cumulative width of docks and boathouses should not exceed 25% of lot frontage and not greater than 10 metres (33 ft) of the lot frontage; and the remaining shoreline should be maintained as a natural vegetative buffer. • There should be a requirement that shoreline lot coverage policies limit the scale of buildings relative to the amount of shoreline frontage; this policy would help prevent the construction of oversized dwellings on undersized lots. • Site plan control could be used for limiting tree removal for shoreline residential development.

Issue 4 - Promoting Sustainable Development through Municipal Planning Policy	
Official Plan Checklist (cont'd)	• Two tiers of development between the lake and the nearest year round maintained road should be prohibited, and limited backlot development (on the opposite side of a year round maintained road) could be permitted, but at a very low density.
Zoning By-law Checklist	2. <u>Update Zoning By-laws</u>: a) Obtain a better understanding of the current zoning by-laws and identify potential development pressure points; b) Assist local municipalities to determine if appropriate standards and safeguards are in place for new and redevelopment proposals; c) Ensure that the Municipality of Highlands East and the Township of Faraday have incorporated similar zoning by-law provisions to regulate similar types of development on Paudash Lake; d) Encourage local municipalities to adopt lake-wide standards that are consistently applied (i.e., building height, shoreline setbacks, sleeping cabins, lot coverage); and e) Use the following checklist of issues as well as those that were identified in the Lake Management Plan. <u>Municipality of Highlands East</u> – Encourage the Municipality of Highlands East to consider the following as amendments to the zoning by-law. • Place a restriction on the width of shoreline structures: "the total cumulative width of docks and boathouses shall not exceed 25% of the lot frontage up to 10 metres (33.3 ft), whichever is less". The Township of Lake of Bays and the Township of Muskoka Lakes currently utilize this type of provision. • Zone the lakebed of the water body to control the location and size of shoreline structures located below the high water mark. • Prohibit mobile homes as dwellings in the shoreline area. • A minimum of 75% of the natural vegetation between the dwelling and the high water mark should be retained. For example, "on a lot with an area of land 15 metres (50 ft) wide abutting and running parallel to the high water mark shall be retained as a natural vegetation area." This is extremely important in retaining the natural shoreline and its associated natural habitat and aesthetic values, and the provision of privacy. • All existing lots of record in the shoreline residential zones should have a minimum required lot frontage and lot area. Those lots that do not meet the criteria and should be combined or added to abutting lots or a study to completed to address the development constraint. A minimum lot size of 30 metres (100 ft) frontage and 1393.5 sq. metres (15,000 sq. ft) area should be considered. • Limit the size of shoreline buildings relative to the size of the lot that is immediately adjacent to the shoreline. The following wording should be considered: "for all buildings and structures constructed or erected within 200 feet of the high water mark abutting the lot, lot coverage shall be based on that portion of the lot area within 200 feet of the high water mark abutting the lot.

Issue 4 - Promoting Sustainable Development through Municipal Planning Policy	
Zoning By-law Checklist (Cont'd)	For all buildings and structures constructed or erected on the lot beyond 200 feet from the high water mark abutting the lot, lot coverage shall be based on the total lot area". • The height of buildings should be measured to the highest point of the building on the side that faces the lake. • A separate zone should be created for Inlet Bay and Joe Bay, which would also apply to North Bay when it reaches capacity. Residential development on these lots should be subject to site plan control. <u>Faraday Township</u> — Encourage Faraday Township to consider the following as amendments to the Zoning Bylaw. Suggestions for amendments include those noted above for Highlands East and below. • Restrict the size and cumulative width of shoreline structures. • Require that new lots have a minimum frontage of at least 60 m (200 ft). • Establish minimum shoreline buffer requirements and provide a definition. • Establish minimum existing lot of record provisions. • Reduce lot coverage for lots that abut the lake to 10% based on the lot area within 60 m (200 ft) of the shoreline. • The height of buildings should refer to the overall height of the building and be measured on the lakeside of the building. • Only one dwelling and one private cabin (with no kitchen) should be permitted on lots that abut a lake. • Certain resource related uses such as agricultural, industrial extraction, and forestry should be prohibited on patent land within 152 m (500 ft) of the high water mark of a lake. • Identify the Provincially Significant Wetland on the east end of Lower Paudash Lake in an Environmental Protection Zone, and prohibit all forms of development, except for floating docks on adjacent lots that completely front on this wetland. As well, encourage the implementation of policies that confirm with the Provincial Policy Statement (PPS). 3. <u>Tree Cutting and Pit and Quarry By-law</u> a) Persuade the County of Haliburton to amend the tree-cutting by-law to include restrictions on tree cutting in waterfront areas, regardless of the size of property, (i.e. < 10 acres); b) Encourage the County of Hastings to adopt and implement a Tree Cutting By-law with similar restrictions as mentioned above; c) Educate and promote ecologically sound forestry practices on private land, especially near lakes and rivers, among lake residents; and d) Encourage municipalities to adopt a Pits and Quarries By-law that includes requirements for watershed protection and the rehabilitation of resource properties after operations have ceased.

Issue 5 – Boating Activities and Boating Behaviour	
Objective	To address negative boating behaviours through education and cooperation with local authorities.
Description	1. Boating Behaviour and Public Safety; 2. Boating Behaviour and Impact on Enjoyment of the Lake; and 3. Boating Behaviour and the Environment. Many lake residents and stakeholders have identified motorized and non-motorized boating activities as one of the major recreational values. Unfortunately, boating behaviour by a few residents is creating a danger to public safety, creating noise and disturbance for many, polluting the lake, and, frequently, the wake action impacts the shoreline (erosion) and habitats in the littoral zone.
Tasks	1. Boating Behaviour and Public Safety: a) Educate lake residents about the "Best Practices for Boat Safety", especially for large power boats and PWCs; b) Promote safe boating practices, per boat type, to avoid unnecessary regulations of boat speeds, etc.; c) Encourage and assist the OPP and the Coast Guard to enforce water traffic laws and obtain the required information for convictions; d) Persuade lake residents to approach boat operators, who are endangering themselves and others along the shoreline and on docks, and encourage them to operate the boat in a safe manner; e) Promote the Boat Operators Certification Program (costs, schedules) to encourage all boaters to become certified operators; and f) Continue to encourage and assist, on an annual basis, the OPP with the annual courtesy vessel inspections, and develop alternate programs for boaters that would offer free inspections of safety equipment without risk of being charged for infractions. 2. Boating Behaviour and Impact on Enjoyment of the Lake: a) Encourage the municipalities to utilize a "Noise By-law" that includes a provision limiting the hours during which it is permissible to operate a boat whose motor exceeds a defined decibel limit; and b) Assist the OPP in obtaining the required information for "Noise By-law" infractions. 3. Boating Behaviour and the Environment: a) Develop and promote signage at boat ramps, newsletters and other media material, in cooperation with the Canadian Coast guard, regarding reduced wake provisions in the Narrows, as well as encouraging lake residents to reduce the wake activities in order to prevent erosion;

Issue 5 – Boating Activities and Boating Behaviour	
Tasks (continued)	b) Promote prevention of oil spills by educating the lake residents about the value of switching to a more efficient engine, (e.g., switching from a 2 stroke to a 4 stroke engine or highly efficient 2 stroke), and encourage residents to take appropriate care when filling their engines to prevent spills; c) Promote the pleasures of non-power boating among PLCA members; d) Encourage local marina operators to obtain and use equipment that power cleans the bilges of boats prior to being launched into Paudash Lake; e) Encourage the municipalities to close all public access points to the lake, and require that boats be launched following proper maintenance and cleaning at an authorized marina; f) Discourage sport fishing derbies for bass and walleye (excluding rock bass), which brings a lot of boats and garbage onto Paudash Lake, increases the threat of invasive species introduction into the lake, and may be harmful to other non-target fish populations; g) Identify and communicate, through articles in the newsletter and/or on the PLCA web site, the negative environmental impacts that may be caused by improper boating behaviour in fast power boats, including the impacts of wake actions on shorelines, docks, wetlands, natural habitat and other sensitive areas; h) Post signage to promote awareness of locally important wildlife habitats, which may encourage boaters to reduce speeds and noise levels in the waterways if they have prior warning of nesting areas; and i) Encourage the development of new slalom ski courses adjacent to Crown land.

Issue 6 - Protecting and Enhancing Fish Habitat	
Objective	To promote the protection and enhancement of fish habitat and fish populations.
Description	1. Quality of the Sport Fish Fishery – To protect spawning age fish, protect and enhance aquatic habitat, and to promote sustainable harvest; 2. Fish Habitat - Quality and Quantity – To naturalize shorelines with native trees and shrubs, protect water quality for aquatic species, such as lake trout, by monitoring dissolved oxygen and temperature profiles, and to improve spawning habitat through a land use control strategy; 3. Establishment of Benchmark Indices of the Fish Community and Habitat – To determine warm water species relative abundance and lake trout population index; 4. Collect Inventory Data on Catchment Waters – To protect source water, and inventory the fish and benthic community; 5. Maintaining Cold Water Temperature with Appropriate Oxygen Concentration to Help Sustain Naturally Reproducing Lake Trout – To monitor the dissolved oxygen and temperature profiles. 6. Fixed Weir at the Dam – Revisit the issue of establishing a natural rhythm of water flow and levels in order to protect shorelines and protect fish affected by artificial manipulation of water levels; 7. Re-Establishment of Sport Fish Stock - Investigate appropriate methods for rehabilitating and repopulating sport fish, other than lake trout; and 8. Protection of Aquatic Habitat - Land use controls strategy.
Tasks	1. Quality of the Sport Fish Fishery: a) Encourage MNR to enforce Ontario Fishery Regulations in regards to the harvest of spawning age fish; b) Support and continue to encourage MNR and DFO in their activities to protect known habitat through the Public Lands Act and Fisheries Act; c) Develop in cooperation with the DFO, the MNR and the local Stewardship Council, an information package for landowners regarding protection and enhancement of fish habitat, and circulate it to lake residents; d) Encourage and assist the MNR to document spawning activities and identify critical shoreline habitat; and e) Encourage and assist the MNR to conduct a volunteer creel survey to document harvest activity (fishing gear, fish size, quotas, time of capture or season, etc.) and if necessary, initiate a process to amend the Ontario Fishery Regulations to support the sustainable management and harvest of Paudash Lake fisheries.

Issue 6 - Protecting and Enhancing Fish Habitat	
Tasks (continued)	2. Fish Habitat – Quality and Quantity: a) Continue to educate landowners and lake residents about the necessity and process of maintaining a natural shoreline; b) Encourage the Municipality of Highlands East to continue prohibiting development on Joe and Inlet bays, which are at capacity, and discouraging or limiting development on North Bay, which is near capacity; and c) Assist the MNR, in cooperation with community partners, to physically improve lake trout spawning beds, where required, by adding rock rubble to the areas below the high water mark. 3. Establishment of Benchmark Indices of the Fish Community and Habitat: a) Encourage and assist MNR to conduct a Near Shore Community Index Netting Program; b) Encourage MNR to conduct a Spring Littoral Index Netting Program for Lake Trout; and c) Encourage MNR to update the bass spawning activity files. 4. Collecting Inventory Data on Catchment Waters: a) Initiate a project to map and assess all streams including their sources (headwaters) and route to Paudash Lake; b) Conduct an aquatic stream inventory to gather information regarding the physical, chemical and biological characteristics of each watercourse; and c) Conduct a rapid inventory assessment, using kick and sweep methodology, to collect samples from the streams' benthic community. 5. Maintaining Cold Water Temperature and Appropriate Oxygen Concentrations to Support a Naturally Reproducing Lake Trout Population: a) Initiate, with advice from the MOE, a regular dissolved oxygen and temperature profile testing program, and share this information annually with local municipalities, appropriate agencies, and local lake residents; and b) Continue, in cooperation with the Lake Partner Program, sampling phosphorus levels and conducting Secchi disc measurements of water clarity to collect base line data, which will be updated regularly and shared annually with local municipalities, appropriate agencies, and local lake residents.
	6. Fixed Weir at the Dam: a) Encourage the Crowe Valley Conservation Authority to reconsider the establishment of a fixed weir at the dam to allow the natural, seasonal rhythms of water fluctuation, which would help protect shoreline habitats and fisheries; b) Request the support from the municipalities and the MNR for this request; and c) Request that the MNR evaluate the impact of the early drawdown on lake trout population in the lake by reassessing the spawning areas, after drawdown completion, to ensure sufficient substrate is available to spawning fish.

Issue 6 - Protecting and Enhancing Fish Habitat	
Tasks (continued)	7. Re-establishment of Sport Fish Stock: a) Initiate a cooperative process, to be managed by a committee of interested property owners, with the MNR to determine appropriate methods of rehabilitating and repopulating the sport fish, other than lake trout, to Paudash Lake; b) Encourage the MNR to implement a slot size limit on sport fish for the Paudash Lake fish community; c) Continue to research and initiate activities that reduce the rock bass population in Paudash Lake; and d) Encourage the MNR to conduct further studies to determine whether regulation (OFR) amendments, such as closing the lake for winter fishing and the construction of a permanent weir, are required to support the lake trout fishery in Paudash Lake. 8. Protection of Aquatic Habitat: a) Encourage the municipalities to prohibit development and increase setbacks, where appropriate, (i.e., adjacent to critical habitat); b) Encourage lake residents to reduce nutrient loadings in order to improve water quality; c) Encourage lake residents to restore buffer zones and the littoral and riparian zones in order to improve water quality and habitats; d) Post signage, at all water access points, regarding the threat of invading exotic species, their harmful effects on lakes, and the procedures to ensure protection of the lake system and aquatic habitat; e) Establish a local “Invading Species Watch”—a monitoring group to detect zebra mussel and spiny water flea as well as other invasive species; and f) Increase public awareness about invasive and exotic species to the local resource users and schools by using education tools such as the *Zebra Mussel Mania Traveling Trunk* (educational activities about invasive species for teachers and their students) and *Project Purple* (an initiative that raises awareness about the threats that purple loosestrife poses to wetlands, which involves the public in control activities and workshops).

Issue 7 - Inventory of Streams Flowing into Paudash Lake	
Objective	To gain a better understanding of the contribution that inflowing streams have on the health of the lake (fish habitat, wildlife habitat, water quality).
Description	1. Inventory of the Physical, Chemical and Biological Characteristics of Streams Flowing in Paudash Lake – To initiate a detailed study, which includes standardized MNR monitoring protocols or methodologies, to be completed for the streams that flow into Paudash Lake. Qualitative and quantitative data should be collected to identify and assess the specific features (e.g., presence or absence of indicator species that contribute to the health of the lake system and each individual stream). The inventory will also classify each stream in terms of community indices (cold water vs. warm water) in order to map the location of cold water streams and the critical cold water spawning sites within each stream.
Tasks	1. Stream Inventory: a) Develop a project to classify, name and study the streams which flow into Paudash Lake, including the following: • Consult with the municipalities and other agencies to develop a project plan; • Prepare a budget; • Apply for third party funding; • Recruit volunteers to participate in the project; • Find a qualified individual to administer the project; and • Distribute the results of the project to all municipalities, appropriate agencies, and lake residents. b) Insist that the stream inventory includes a shoreline evaluation and an assessment of nutrient loadings from all upstream point sources; c) Insist that the stream inventory includes a component for long-term water quality monitoring and analysis of water quality trends; d) Initiate, with the assistance of the MNR, the collection of fish and benthic community inventory data; e) Identify areas where remedial action should be taken to restore shorelines and/or reduce nutrient loadings, and through landowner contact and information brochures, property owners that own property adjacent to streams should be encouraged to help protect the water quality and natural features of these streams such as maintaining a 30 metre vegetated buffer along the stream's shoreline; f) "Officially" name each stream, prior to the inventories by proposing to the municipalities that the PLCA and the municipalities jointly sponsor a youth contest for young lake residents to "Name that Stream"; g) Propose that the official plans and zoning by-laws identify the location of all warm water and cold water streams, and include policy to control and protect them against development impacts; and h) Propose that all new mineral and aggregate extraction sites and quarry expansions should be regulated to prevent negative impacts on streams feeding Paudash Lake.

Issue 8 – Noise and Light Pollution	
Objective	To reduce noise and light pollution on Paudash Lake.
Description	1. Reducing Noise Pollution – To work in collaboration with the municipalities to reduce noise levels from stationary and mobile sources; and 2. Reducing Light Pollution – To work in collaboration with the municipalities to develop lighting standards and to inform lake residents about the alternatives for reducing the extraneous impact of outside lighting on the dark night sky.
Tasks	1. Reducing Noise Pollution: a) Request that the municipalities pass and enforce a "Noise Control Bylaw", which can be applied to stationary and mobile sources (i.e., powerful boats), that includes restrictions on the time of day and night mandated for noise causing activities; b) Request that the official plan of the Municipality of Highlands East be amended to include policy to limit impacts from noise; c) Encourage lake residents to directly ask noisy neighbours to turn down the volume and reduce noise that is encroaching on their enjoyment of the lake; d) Circulate information to lake residents about how noise travels in the country, especially across water, and articles to this effect should be published in the Newsletter and in the local media; and e) Provide support to the enactment of the Personal Water Craft Act by Parliament. 2. Reducing Light Pollution: a) Work with the municipalities to help restrict light pollution; b) Publish "best practices" with respect to the use of outdoor lighting including an education document about the shielding of lights and the direction of beam; and c) Provide information to lake residents on the availability and sources of "dark sky friendly" electrical components.

Issue 9 – Managing Water Levels	
Objective	To have a better understanding of the effects of the current water level management regime and the options to managing water levels.
Description	1. Establishment of a Fixed Weir at the Dam – To investigate the pros and cons of establishing a fixed weir at the dam.
Tasks	1. Establishment of a Fixed Weir at the Dam: a) Review water level controls with the appropriate authorities; b) Determine the impact of the natural, seasonal fluctuation of water levels on all stakeholders; c) Obtain, if warranted, the consent of the municipalities and the residents and commercial operators on the lake for the establishment of a fixed weir at the dam; d) Obtain, if necessary and warranted, the consent of the MNR for the establishment of a fixed weir at the dam; e) Request, if warranted, that the Crowe Valley Conservation Authority also consent to the establishment of a fixed weir; and f) Determine, in collaboration with the MNR, the DFO, and the Crowe Valley Conservation Authority, the cost of implementing the fixed weir, who should pay, and who should do the work.

Issue 10 – Improving Communications	
Objective	To improve communications with shoreline residential and commercial operators, agencies and all lake users.
Description	1. Establishing an Effective Network of Two-Way Communications between the PLCA and Lake Residents – To provide opportunities for all lake residents to mix and mingle, which will encourage face-to-face encounters and allow lake residents to choose how and when they would like to support PLCA initiatives towards lake stewardship.
Tasks	1. Establishing an Effective Communication Network: a) Hold an annual "meet and greet" (open house) to have the opportunity to meet the local community face-to-face, rather than relying on letters; b) Hold an annual Barbecue and/or Corn Roast to facilitate face-to-face encounters; c) Consider organizing a Flotilla or Boat Tour to various cottages; d) Reward the positive stewardship efforts of lake residents through the creation of an award that would be presented to those lake residents who have had a positive impact on the environment; e) Always explain and never demand because the objective, for example, is to explain what happens if you don't pump out your septic system regularly, or what happens if you wash your laundry in the lake; f) Develop information packages or kits, available for sale to lake residents, about the variety of environmentally friendly practices and products available; g) Provide a "mini-starter's" or "welcome to the lake" information package to all new property owners on the lake, which should be hand-delivered; and h) Continue educational efforts, such as workshops, weekend training, and volunteer sessions that promote the high quality of life on Paudash Lake and encourage the implementation of the recommendations in the Lake Management Plan.

Implementation

Figure 9.1 proposes time lines for the accomplishment of the actions identified above. Prior to initiating the implementation of these proposed projects, it is recommended that the projects be reviewed and confirmed. The following five steps provide the general process to be followed to identify the projects that will be implemented.

Step One	Identify projects to be undertaken
Step Two	Select "champions" or leaders for each project, and representative committee members, if required
Step Three	Review details of project and confirm work plan
Step Four	Implement work plan
Step Five	Monitor progress and undertake follow-up actions, if necessary

Figure 9.1 —Tentative Project Schedule

Issues	2005	2006	2007	2008	2009
1. Monitoring, Protecting and Enhancing Water Quality					
2. Maintaining and Improving Septic Systems					
3. Maintenance and Restoration of Natural Shorelines					
4. Promoting Sustainable Development Through Municipal Planning Policy					
5. Boating Activities and Boating Behaviour					
6. Protecting and Enhancing Fish Habitat					
7. Inventory of Streams Flowing into Paudash Lake					
8. Noise and Light Pollution					
9. Managing Water Levels					
10. Improving Communications					

The Paudash Lake Conservation Association hopes to participate in a Dock Talk program for which the Federation of Ontario Cottagers Association is currently seeking funds and potential partners. If those funds are granted, it will be possible to make use of a wide variety of materials for the purposes of communicating with lake residents. A Dock Talk program will enable the PLCA to communicate with local residents in a face-to-face approach. Some of the messages may include "best practices" with respect to water quality protection, buffers, septic reinspection and regular pump-out programs, shoreline restoration activities, the protection of fish spawning and rearing sites, boating behaviour, noise and light pollution, invasive species monitoring, and a variety of other topics.

GLOSSARY

Acid precipitation: Precipitation with a pH lower than 5.0, which is the value produced when naturally occurring carbon dioxide, sulphate and nitrogen oxides dissolve into water droplets in clouds. Acidification or increased acidity may be caused naturally by gases and aerosols ejected by a volcanic eruption or by human-made emissions (burning of fossil fuels) into the atmosphere. The effects of acidification on vegetation, soils and surface waters are dependent upon the form of acid precipitation (acid mist tends to coat leaves and, therefore, has more severe side affects to vegetation than acid rain, which washes rapidly from plant surfaces but, instead, may have serious side affects to the soil), and the pH and natural buffering of the soil and surface water into which it falls.

Algal blooms: A sudden growth of algae in an aquatic ecosystem. It can occur naturally in spring or early summer when primary production exceeds consumption by aquatic herbivores. Algal blooms, which are a characteristic symptom of eutrophication, may also be induced by nutrient enrichment of waters due to pollution.

Alkalinity, alkaline: In freshwater, alkalinity is mainly composed of bicarbonates, carbonates and hydroxides, and is generally measured by titration with acid to a fixed end point. Aquatic systems with a pH level greater than 7.

Ambient temperature: The dry-bulb temperature prevailing in the surrounding air.

Anoxic: The condition of oxygen deficiency or absence of oxygen. Anoxic sediments and anoxic bottom waters are commonly produced where there is a deficiency of oxygen, owing to very high organic productivity, and a lack of oxygen replenishment to the water or sediment, as in the case of stagnation or stratification (layering) of the body of water.

Bacteria: Fecal bacteria (Escherichia coli) measurements indicate the possible presence of disease causing bacteria, viruses and other micro-organisms, which can cause other impacts such as cloudy water and unpleasant odours.

Benthic zone, benthos: In shallow regions, where the benthic zone is well lit, the zone is referred to as the benthic littoral region and it supports some of the world's most productive ecosystems. Benthos, in freshwater, is the collection of organisms attached to or resting on the bottom sediments and those which bore or burrow into the sediments.

Biological indicators, indicator species: A species that is of narrow ecological amplitude with respect to one or more environmental factors and that is, when present, therefore, indicative of a particular environmental condition or set of conditions. For example, fish species and many aquatic invertebrates vary in the amount of dissolved oxygen they require and those species present in a body of water provide an indication of the extent to which the water is contaminated with organic material.

Brainworm disease: The adult brainworm (*Parelaphostrongylus tenuis*) is a roundworm or nematode normally found in the venous sinuses and subdural space of the brain of white-tailed deer in eastern North America. Moose, elk, caribou, reindeer, mule deer, sheep, goats and guinea pigs are susceptible to infection. However, they are abnormal hosts, and in them the worm frequently causes cerebrospinal nematodiasis, a disease of the nervous system.

Cervids (Cervidae): A family of browsing or grazing animals, with 16 genus and 43 species throughout the world. Usually, antlers are present only in the male, with the exception of the caribou, which have antlers on both the male and female. Most species are gregarious, living in herds with elaborate social organization.

Channelization: Is the structural alteration made to a stream's channel in order to speed the flow of water and thus prevent it from flooding. Channelization usually involves cutting off meanders to straighten a stream; the shorter straight channel will have a steeper gradient than before and its increased velocity will transport more water perhaps enough to prevent flooding in an area.

Chlorophyll a: Is a variant, in plants, of chlorophyll, the green pigment that participates in photosynthesis by absorbing radian energy from the sun for carbon-dioxide fixation. Chlorophyll a is used to measure, in aqueous solution, the primary productivity of ecosystems. The chlorophyll content of the community occupying a given area can form an index of the area's productivity.

Cold water fish: Species that are best adapted for or prefer, or usually occur at, water temperatures less than 19°C.

Conductivity: Is the ability of a solution to conduct an electrical current due to the presence of dissolved salts (ions), which is also known as salinity or total dissolved solids.

Coniferous, conifers: Cone-bearing trees or gymsosperms (e.g., "softwoods") such as pines, spruces and firs.

Deciduous: Applied to trees that shed their leaves seasonally; deciduous trees are generally Angiosperms (e.g., "hardwoods") such as oaks and maples.

Decomposition: The breakdown of constituent nutrients by decomposers in the natural environment, some of which are used by the decomposer (e.g., heterotroph which feeds on detritus) and some of which is released to be recycled into the ecosystem (the final stages of the "nutrient-cycle").

Dioxins: A member of a range of about 300 compounds produced as by-products of certain industrial chemical processes and also by the incomplete incineration of chlorinated hydrocarbon compounds, especially polychlorinated biphenyls (PCBs).

Dissolved oxygen level: The concentration of oxygen held in solution in water, which is usually measured in mg/L (sometimes in $\mu g/m^3$) or expressed as a percentage of the saturation value for a given water temperature. The solubility of oxygen varies inversely with temperature; a rise in temperature creates a decline in the availability of dissolved oxygen. The dissolved oxygen level is an important first indicator of water quality. In general, oxygen levels decline as pollution increases.

Diurnal: It applies to species that are active only in daylight.

Ecological community types: A specific assemblage of species, which may have similar habitat requirements including soil type (sand, silt or clay), pH levels, ambient temperature, slope condition, and moisture regime, living together at a particular site or at various sites, with similar habitat characteristics, found across the landscape. These ecological community types, or groups of organisms, are often indicative of a particular environment or set of environmental conditions and are, therefore, used an "ecological indicators".

Ecosystem: A discrete unit that consist of living (biotic) and non-living (abiotic) parts, interacting to form a stable system. Fundamental concepts include the flow of energy via food chains and food webs, and the cycling of nutrients biogeochemically. Ecosystem principles can be applied at all scales from a pond, to a lake, or to the whole planet.

Effluents: An outflow from a sewer or sewage system and/or a discharge of liquid waste, as from a factory or nuclear plant.

Emergent aquatic plants: The aqueous vegetation which stand predominantly higher than the water surface, or are partially submersed in water.

Epilimnium: The upper, warmer circulating water in a thermally stratified lake during the summer. Usually, it forms a layer that is thin compared to the hypoliminion.

Euphotic Zone: The upper, illuminated zone of aquatic ecosystems, which is above the compensation level (the compensation level is the depth at which light penetration in aquatic ecosystems is so reduced that oxygen production by photosynthesis just balances oxygen consumption by respiration, and, therefore, the zone of effective photosynthesis). In freshwater systems, the euphotic zone is divided into the littoral (shallow edge) and limnetic (deeper water) zones.

Eutrophication, eutrophic: the process of nutrient enrichment, usually by nitrates or phosphates, in aquatic systems. It occurs naturally over geological time, but may be accelerated by human activities such as sewage disposal or land drainage, which are sometimes termed "cultural eutrophication". The rapid increase in nutrient levels stimulates algal blooms. On death, bacterial decomposition of the excess algae may seriously deplete oxygen levels, which are especially critical in thermally stratified lakes, since the decaying algal material typically sinks to the hypoliminum—bottom layers, where oxygen replenishment is impossible. The extremely low levels of oxygen concentrations lead to fish deaths, which create a further oxygen demand, which leads to further deaths.

Exotics, invasive: An introduced, non-native species.

Floodplain: The part of a river valley that is made of unconsolidated, river-borne sediment and is periodically flooded. It is built up of relatively coarse debris left behind as a stream channel migrates laterally, and of relatively fine sediment deposited when bankfull discharge is exceeded. A floodplain is a relatively flat region flanking most streams and formed by deposition of finer grained sediments during periodic flooding of the stream waters

Fossil fuels: All deposits of organic material that are dug from the ground and are capable of being burnt for fuel such as coal, oil and gas.

Furans: One of a range of polychlorinated dibenzofurans that are produced from the incomplete incineration of chlorinated hydrocarbons, especially polychlorinated biphenyls (PCBs); severe exposure to furans can cause liver damage and liver cancer.

Genetic hybridization: An individual animal that results from a cross between parents of differing genotypes—the genetic constitution of an organism, as opposed to its physical appearance. Strictly, most individuals in an outbreeding population are hybrids.

Grasses and sedges: Grass family (Poaceae) species have hollow stems, which are jointed and round with leaves in 2 vertical rows and their fruit is a grain. Sedge family (Cyperaceae) species have solid stems, which are not jointed and usually 3-sided with leaves in 3 vertical rows and their fruit is an achene.

Great Lakes-St. Lawrence Forest Region: A forested ecological community type, which is predominantly the northern deciduous-evergreen "mixed" forest region of Ontario.

Heavy metals: Metals that have a density greater than 5 g/cm^3, such as copper and zinc; some species have shown a tolerance to aquatic or soil contaminated by metals.

Herbicide: A chemical substance, which suppresses, and is usually designed to eliminate, plant growth; it may be selective or a non-selective weed killer.

Hibernation: A strategy for surviving winter cold that is characteristic of some mammals. The metabolic rate is reduced to a minimum and the animal enters a deep sleep, surviving on food reserves stored as fat in the body during the favourable summer period.

Humic, humus: Dark-brown decomposed organic substances that are aerobic—requires oxygen—for part of the year.

Hypolimnium, hypolimnetic waters: The lower, cooler non-circulating water in a thermally stratified lake during the summer. If the thermocline is below the compensation level (see euphotic zone), the dissolved oxygen supply of the hypoliminion depletes gradually; therefore, replenishment by photosynthesis and by contact with the atmosphere is prevented.

Limiting factor, limiting nutrient: Any environmental condition or a set of conditions (nutrient levels) that approaches most nearly the limits of tolerance (maximum or minimum) for a given organism; an aquatic system needs a critical minimum of certain nutrients, such as phosphorus, to function properly.

Littoral zone: The shallow-water regions of aquatic ecosystems in which rooted plants occur and light penetrates to the lakebed.

Macro-invertebrates (benthic): An invertebrate with a body length greater than 2 mm.

MAPLE: The Mutual Association for the Protection of Lake Environments is a non-profit environmental organization incorporated in 1987 to promote the preservation of the natural lake environments. Through the maintenance of existing natural shorelands and wetlands, it promotes the restoration and enhancement of waterfronts by encouraging natural regeneration and initiating re-vegetation of shoreland.

Mercury: It naturally occurs in trace amounts in the air, water, rocks, soil, plant and animal matter, and can be leached out by the acidity in the water. Naturally occurring mercury anomalies are associated with fault zones in the bedrock, and ground water seepages in streams are a source of mercury entering the lakes.

Mesotrophic: Applied to waters having levels of plant nutrients intermediate between those of oligotrophic and eutrophic waters.

Micro-habitat: A precise location, with specific or preferred environmental characteristics, within a habitat where an individual species is normally found (e.g., within a deciduous oak woodland habitat woodlice may be found in the micro-habitat beneath the bark of rotting wood).

Mineral soils: A soil composed, principally, of mineral matter, the characteristics of which are determined more by the mineral than by the organic content.

Nocturnal: During the night-time; applied to a type of circadian rhythm—a biological clock that is reset by cues (e.g., dawn) from the environment—in which the organism performs its main activities at night.

Nutrient cycle: A biogeochemical cycle, in which inorganic nutrients move through the soil, living organisms, air and water, or through some of these (e.g., nitrate or nitrite—forms of nitrogen); minerals, such as potassium and magnesium, are involved in the cycle only as sources of replenishment.

Nutrient enrichment/loading: See “eutrophication”.

Nymph, larva: The stage in the lifecycle of an animal, during which it is motile and capable of feeding itself, that occurs after hatching from the egg and prior to the reorganizations involved in becoming adult. The appearance of the larval form differs markedly from that of an adult of the same species. The term “larva” is applied loosely to fish, amphibians and certain insects, although the term “nymph” is frequently applied to insect larvae.

Oligotrophic: Refers to nutrient-poor aquatic ecosystems with low primary-productivity. Typically oligotrophic lakes are deep, with the hypoliminion much more extensive than the epilimnion. The low

nutrient content means that plankton blooms are rare and littoral plants are scarce. The low organic content means that dissolved oxygen levels are high. By comparison to eutrophic lakes, oligotrophic lakes are considered geologically young, or little modified by weathering and erosion products.

Omnivorous: A heterotroph—an organism that is unable to manufacture its own food, which feeds on both plants and animals, and thus operates at a range of trophic level.

Optimal Habitat: Optimum environmental conditions needed, such as temperature, dissolved oxygen concentrations, and pH levels, which tend to maximize species' potential success at survival.

Organic soils: Soil with a high content of organic matter and water; the term usually refers to peat or peatlands.

Over-harvesting: The overexploitation of plants or animals.

Oxygen and Temperature Profiles: Measurements of both dissolved oxygen and temperature taken at set intervals from the surface to the bottom of a water body.

Pelagic species: Organisms that inhabit the open water.

Pesticide: A chemical substance, which suppresses, and is usually designed to eliminate, insect growth; it may be selective or a non-selective insect killer.

pH: A value on a scale of 0-14, which gives a measure of the acidity or alkalinity of a medium or solution. A neutral medium has a pH of 7; acidic media has pH values of less than 7; and alkaline media of more than 7. The lower the pH the more acidic is the medium, and the higher the pH the more alkaline is the medium.

Phosphorus (P): An element that is an essential nutrient for all living organisms, but its availability is limited in aqueous environments, which is, therefore, why phosphorous is a "limiting nutrient/factor" in aquatic ecosystems.

Photosynthesis: The process in green plants, and certain other organisms, where carbohydrates are synthesized from carbon dioxide and water using light as an energy source. Most forms of photosynthesis release oxygen as a byproduct.

Phytoplankton: The plant plankton and primary producers of aquatic ecosystems, comprising mainly of diatoms in cool waters, and dinoflagellates (protozoans) that are "heterotrophs" (grazers) but are closely allied to brown algae and diatoms found in warm waters.

Point source discharge: A situation where a large quantity of pollutants is emitted from a single source such as a smokestack, a volcano, or a sewage outfall.

Polychlorinated biphenyls (PCBs): One of a range of compounds first synthesized in 1881 and manufactured in 1929, and used mainly as liquid insulators in heavy-duty electrical transformers. They were detected in the environment in 1966, and associated with reduced reproduction success in marine birds and mammals; they are also believed to compromise the immune system in animals. Restrictions on their use were imposed in North America and Europe in the 1970s, but they continue to cause contamination during the disposal of old equipment-containing PCBs into the ground and their natural persistence (don't break down easily) in the environment.

Precambrian Shield: The Canadian Shield is a large geographic area in eastern and central Canada, composed of bare rock dating to the era (between 4.5 billion and 540 million years ago). It is also called the Precambrian Shield, or Laurentian Shield, or Laurentian Plateau**.** The current layout of the Shield is one of very thin soil lying on top of bedrock, with many bare outcrops. This arrangement was

caused by glaciation during the last ice age, which covered the shield and scraped the rock clean in doing so. The multitude of rivers and lakes in the entire region is caused by the watersheds of the area being so young and in a state of sorting themselves out. The shield was originally an area of very large mountains and much volcanic activity, but over the millennia the area was eroded to its current much flatter appearance. Precambrian rocks (granite and quartz based) outcrop extensively in shield areas such as northern Ontario. The shield is one of the world's richest areas of mineral ore; it is filled with substantial deposits of nickel, gold, silver and copper.

Predation: The interaction between species populations in which one organism, the predator, obtains energy (as food) by consuming, usually killing, another, the prey.

Primary productivity: The rate at which biomass is produced by photosynthetic autotrophs (mainly green plants) in the form of organic substances some of which are used as food materials. The primary production of an ecosystem is the amount of organic material accumulated.

Provincial Water Quality Objectives (PWQO): PWQO are numerical and narrative ambient surface water quality criteria, applicable to all waters of the province (e.g., lakes, rivers and streams) except those areas specifically designated such as areas influenced by the Ministry of Energy and Environment (MOEE) approved point source discharges.

Recruitment: A measure of the number of fish that enter a class during some time period, such as the spawning class or fishing-size class.

Relative abundance: An index of fish population abundance used to compare fish populations from year to year. This does not measure the actual numbers of fish, but shows changes in the population over time.

Secchi disc: A disc used in a simple method for measuring the transparency of water. The disc is 20 cm across and divided into alternated black and white quadrants. It is lowered into water on a line until the difference between the black and white areas cease to be visible, at which point the depth is recorded. This procedure provides a convenient method for comparing the transparency of water at different sites.

Sediment: Material derived from pre-existing rock, from biogenic sources, or precipitated by chemical processes, and deposited at or near the Earth's surface.

Sedimentary rock: Rock (e.g., limestone) formed by the decomposition and compression of mineral and rock particles, but often including material of organic (carbon/calcium (cation ions) based) origin. Lakebeds comprised of sedimentary rock have the ability to neutralize acid precipitation.

Sedimentation: Particles of organic and mineral substances, which settle out in solution.

Soil attenuation: The ability of the soil to absorb and retain precipitation—the infiltration capacity of soil; the greater the attenuation the less likelihood of flooding occurring within the watershed. Hydric soils—wetlands, are a great example of soils with a high attenuation or absorbing ability.

Spawning: Fish reproduction, which is species-specific (e.g., different environmental conditions, such as temperature or available habitat that are required to initiate reproduction in different species).

Stocking: To artificially increase fish populations, to stimulate recruitment success and increase sport fishing opportunities, by adding individuals, either reared in a hatchery or transported from another freshwater environment, to the local aquatic community.

Stream profile: Includes the point of origin of the stream called the head, the point of termination called the mouth, and a decreasing gradient of the stream channel towards the mouth; the slope of the land and stream channel is greatest at the head and smallest at the mouth.

Substrate: Any object or material upon which an organism grows or to which an organism is attached; an underlying layer of gravel, sand or other substances found on the lakebed.

Surface and storm water runoff: The flow across the land (overland flow) of water, which accumulates on the surface when the rainfall rate exceeds the infiltration capacity of soil—attenuation. The rate of runoff is determined by the attenuation or the infiltration capacity of the soil, which is affected by several factors such as the soil type, presence and type of vegetation, and impermeable surfaces (clay lids, roads, fields, buildings, etc.).

Thermocline: Generally, a gradient of temperature change, but applied more particularly to the zone of rapid temperature change between the warm surface waters (epilimnion) and cooler deep waters (hypolimnion) in a thermally stratified lake in summer.

Torpor: A state of adaptive hypothermia used by endotherms in order to save energy. In torpor, the body temperature of an animal may fall to within 1°C of the environmental temperature, which in some cases may itself be at about or even just below freezing. All metabolic processes slow down to as little as one-twentieth of the normal rate. A state of torpor is entered during hibernation and when resources are insufficient to allow the maintenance of body temperature.

Total nitrogen (TN): Is a measure of all combined forms of nitrogen.

Total organic carbon (TOC): Consists of both dissolved and organic carbon, and is composed of humic substances and degraded plant and animal materials.

Total phosphorus (TP): Is a measure of the combined amounts of all forms of phosphorus.

TN:TP ratio: Is used to determine which element is limiting the growth of primary producers.

Tributary streams: Are the smaller streams, which collect materials, and supply water to the main stream or river in the area.

Tropic status: Refers to the rate of nutrient supply and productivity of a system.

Turbidity: Is a measure of water clarity (i.e., how far down the water column light can penetrate).

Upland Zone: The upland zone is the periphery of a lake's riparian zone.

Upper crown: The individual trees, or clumps of trees, which stand predominantly higher than the top of the continuous canopy—the part of the woodland or forest community that is formed by the trees, of many forests.

Useable habitat: Environmental conditions, such as temperature, dissolved oxygen concentrations, and pH levels, which are able to maintain a species' potential success at survival.

Warm water fish: Species that are best adapted for or prefer, or usually occur at, water temperatures greater than 25°C.

Water quality parameters: A measurable and/or observable environmental variable of water quality such as water clarity, pH and temperature.

Watershed (catchment area or drainage basin): The area from which a surface watercourse or a groundwater system derives its water; catchments are separated by divides—the boundary between separate catchment areas, which are usually marked topographically by high ground. A watershed is an area of land that is drained by a distinct stream or river system and is separated from other watersheds by ridge top boundaries.

Wetlands: A general term applied to open water habitats and seasonally or permanently waterlogged land areas including lakes, rivers, marshes, swamps, bogs and fens. Wetland habitats, such as marshes, swamps, fens and bogs, are among the most vulnerable to destruction since they can be drained and reclaimed for agriculture or forestry, drained for pest control, or modified for water supply, flood control, hydroelectric power schemes, waste disposal, etc.

Wetland complex: Many areas of Ontario contain closely spaced wetlands that vary in size from a fraction of a hectare to several hundred hectares. The density of wetlands per unit of areal landscape may be so complex that delineation of the wetland units into individually recognized wetlands would not be an ecologically or functionally sound process. Wetland complexes are commonly related in a functional way, and the wildlife in the area of the complex is dependent upon the presence of the entire complex of wetlands. Complexes are separated wetlands, which are only connected by surface waters or ground water with distances no greater than 0.75 km north of the Canadian Shield or 1.25 km south of the Shield in Ontario.

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