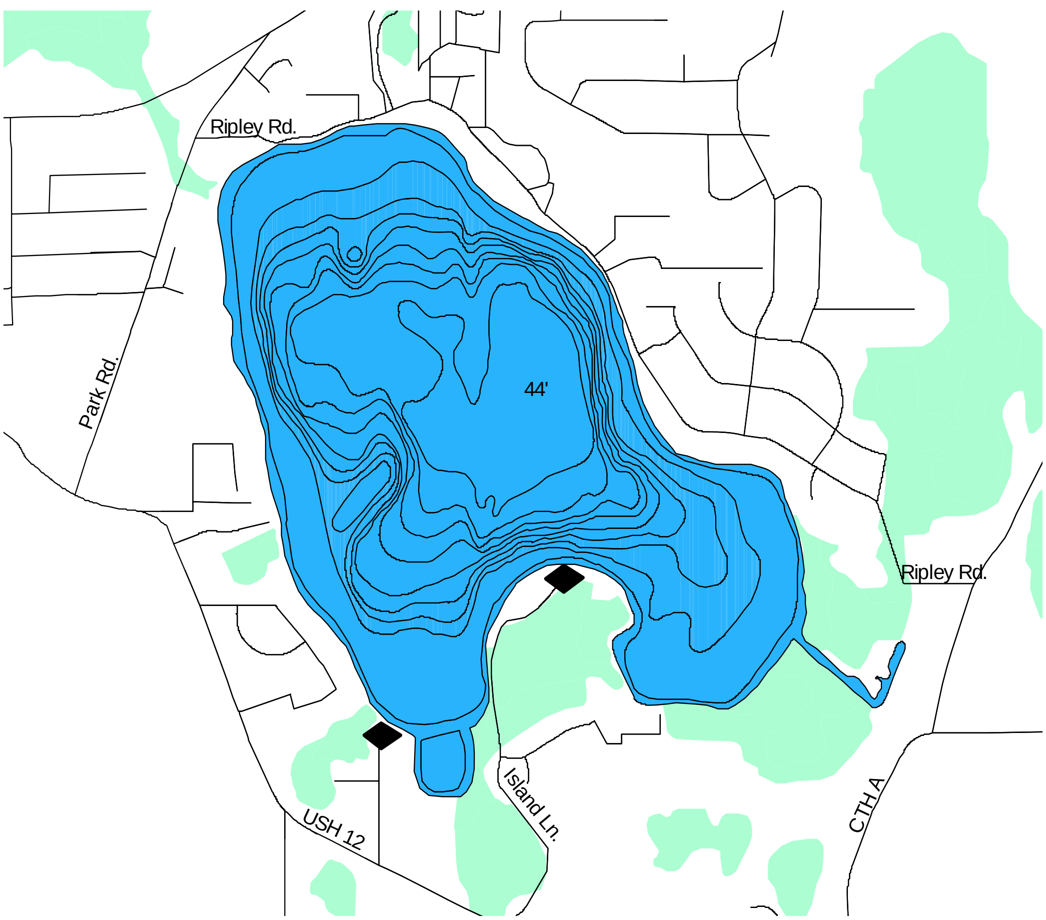
LAKE RIPLEY
MANAGEMENT PLAN



LAKE RIPLEY MANAGEMENT PLAN

LAKE:	Lake Ripley
LOCATION:	Oakland Township Jefferson County, Wisconsin
MANAGEMENT UNITS:	Lake Ripley Management District Lake Ripley Priority Lake Project 101 E. Main St., Suite 2 P.O. Box 22 Cambridge, WI 53523 Telephone: (608) 423-4537 Facsimile: (608) 423-9905 E-Mail: ripley@bminet.com
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AUTHOR OF PLAN:	Paul Dearlove, Project Manager Lake Ripley Priority Lake Project
PLAN APPROVAL DATE:	____________

John Molinaro, Chair Lake Ripley Management District	Date	Joanne Knilans, Commissioner Lake Ripley Management District	Date
Tim Lorden, Secretary Lake Ripley Management District	Date	Pam Rogers, Jefferson County Rep. Lake Ripley Management District	Date
Mike Sabella, Treasurer Lake Ripley Management District	Date	Paul Jorstad, Oakland Township Rep. Lake Ripley Management District	Date
Steve Decker, Commissioner Lake Ripley Management District	Date	Paul Dearlove, Project Manager Lake Ripley Priority Lake Project	Date

INFORMATION UPDATES
TRACKING SHEET

DATE	CHAPTER	SUB-SECTION	INFORMATION UPDATED	PROJECT MGR. INITIALS

FORWARD

Restoration. In the last ten years, it seems that everyone has become interested in restoration. We restore old houses, we restore old boats, we restore old cars. We have developed an appreciation for those things cherished by our parents, grandparents and great grandparents. In a way, that's what the Lake Ripley Management District is trying to do… restore Lake Ripley.

In reality, our goals have been to protect and preserve the Lake. We are fighting, at the very least, an uphill battle. The nature of all lakes is that they are born, as in the case of Lake Ripley, by glacier activity, and from that moment on they are in a slow process of dying. The aging process of lakes, as they fill in with sediment and transform into new phases, is nature's way, the natural course of things. So, you may ask; "what are we trying to do?" Well, unfortunately, the dying process has been accelerated by progress. Development around the Lake, the invention of the boat motor, and the introduction of non-native species are just a few ways we have rushed the natural process.

One source tells us that one of the first land grants on Lake Ripley was established on June 30, 1846 when Donald Matheson was granted entry to 158.6 acres on the north shore of Lake Ripley. At that time, most of the property was farmed and the Lake was used as an available source of water for livestock. The land remained about the same for almost sixty years, passing from brother to brother, from brother to sister, from uncle to niece. Today, that property comprises the land from the A-frames to the far end of Shore Place—over 200 individually owned houses and lots.

Now, this is not to suggest that we oppose progress. The great environmentalist David Brower once said; "We're not blindly opposed to progress, we're opposed to blind progress." Progress is necessary for man to grow and evolve. But, we need to be aware of what was and what part of our past should be preserved.

So, in a way, that is what the Lake Ripley Management District does. We try to restore as much of what Lake Ripley was before 1846. This is not an easy thing to do. We don't have anybody left to ask. There is very little written to describe the Lake back then. We do know that there were at least three times as many acres (1,500) in wetlands. These acres naturally cleaned the waters entering the Lake. There were certainly fewer houses, and therefore more land to absorb rainfall and runoff. We also know there were fewer boats and no motors.

Now, we're not going to recommend that we run around and tear down houses, and we're not going to ban all boats from the Lake. But there are ways to improve the situation and slow the inevitable, and in some cases, unnaturally accelerated dying of the Lake. That's what this document is all about.

Not only will this Comprehensive Lake Management Plan set out recommendations and suggestions on how to improve Lake Ripley, but it will also document for future generations; where we were 10 years ago, where we are now, and where we want to be in the future.

All the suggestions and recommendations contained within are not written in stone. These are the best management practices that are available at this time. We are blessed to live in an era when technology is being developed at an almost unbelievable pace. We intend to take advantage of any and all progress that can improve the management of Lake Ripley and its watershed.

So, in a sense, this document is a gift to the children of the Lake Ripley community; a gift to those that are here now, and those to come. It may be a cliché to say that "our future is in our youth," but it was true 100 years ago, it is true now, and it will be true 50 years from now. A popular saying amongst those who restore old homes is that they have no ownership of their property, but they are only caretakers for those to come. In the same sense, the Board of the Lake Ripley Management District is only the caretaker for Lake Ripley and for those to come.

John Molinaro
Chair, Lake Ripley Management District

EXECUTIVE SUMMARY

Lake Ripley is a 418-acre drainage lake located near the Village of Cambridge in Southern Wisconsin. The lake and its eight-square-mile drainage basin are situated within the Town of Oakland in western Jefferson County, just over 20 miles east of the City of Madison. Lake Ripley is publicly accessible, and supports a variety of activities, including swimming, fishing and pleasure boating. Relaxing, observing wildlife and simply enjoying the peaceful atmosphere are other favorite pastimes. The lake is recognized as an important natural resource for the community, and is considered a regional asset of environmental, recreational and economic significance.

Lake Ripley's status as an area attraction and popular recreational destination has led to ever intensifying development and lake-use pressures. Consequently, the lake suffers from the effects of non-point source pollution, habitat loss, hydrologic manipulations and recreational conflicts. Although still described as a high quality resource, great efforts are necessary to combat a variety of problems associated with an impaired and abused ecosystem. Manifestations of these problems routinely take the form of nuisance algae blooms, excessive weed growth, poor water clarity, declining flora and fauna biodiversity, and reduced recreational safety and enjoyment.

The Lake Ripley Management District (LRMD) was formed as a special purpose, local unit of government in 1990 to specifically address these concerns. Consisting of area property owners and directed by a seven-member board of directors, the LRMD raises funds and implements programs for lake-protection and rehabilitation purposes. Some ongoing programs include aquatic plant harvesting, sensitive habitat protection and restoration, water quality monitoring, fish stocking, litter cleanups, educational campaigns, and a volunteer "Lake Watch" patrol. The LRMD also administers a Wisconsin Department of Natural Resources (DNR) "Priority Lake Project" in an effort to control non-point sources of pollution entering Lake Ripley. The Project, which has been operating since 1993, uses cost-share incentives and educational programs to encourage landowners in the watershed to engage in various pollution-reduction strategies.

Although the Lake Ripley Priority Lake Project's focus is effectively targeted to deal with many of the lake's primary concerns, it fails to address every important issue. For instance, there is little to no guidance on such topics as recreational conflict resolution, aquatic plant control, fisheries and wildlife management, and in-lake nutrient reduction. There is also a lack of guidance on how to deal with differing and often changing public perceptions, priorities and expectations associated with Lake Ripley and its management. Some type of plan was therefore necessary to provide interpretation, direction and a framework for decision making with regard to these issue areas. Such a plan was needed to decipher the dynamic and complex inter-relationships that govern aquatic ecosystems. This is because every lake looks and behaves differently, has its own set of problems, and demands its own set of solutions. It was also needed to objectively evaluate management options, establish realistic expectations, and lay out a cost-effective course of action.

In response, the LRMD secured a DNR Lake Planning Grant to help finance the development of a Comprehensive Lake Management Plan. The planning process involved a complete assessment of public concerns, lake-use preferences and management priorities. It also included a thorough assessment of existing conditions, and an accurate characterization of the different problems affecting the lake. Furthermore, it provided an evaluation of all available management alternatives, and set forth a multi-year action strategy to resolve each of the issues at hand. The final product is a one-stop information source and strategy document that shall guide protection and improvement efforts on Lake Ripley well into the future. All recommendations are based on a combination of scientific analysis and public input, and represent the latest innovations, techniques and levels of understanding. Because resource conditions and management technologies are sure to change over time, the Plan shall be continually revised and updated to adapt to these changes.

The following is an abbreviated overview of the key findings and recommendations presented within the Lake Ripley Management Plan. For further details and a complete discussion on each topic, please refer to the appropriate section in the Plan.

KEY FINDINGS (PUBLIC INPUT)

- The top three reasons people purchase property on or near Lake Ripley include the small community atmosphere, the enjoyment of peace and tranquility, and the participation in various recreational pursuits, respectively. In order of importance, preferred lake-use activities include enjoying peace and tranquility, swimming, motor boating, appreciating the lake's scenic beauty, and fishing.
- Clear water ranks as the most important attribute leading to an enjoyable lake-use experience, followed by peace/tranquility and overall ecosystem health. Water clarity is perceived to be at its worst following heavy motor boat and Jet Ski traffic. Overall water clarity conditions during the summer months are most frequently described as cloudy. This is a change from the 1992 survey when water clarity was described as mostly clear.
- Aquatic plant growth in Lake Ripley is generally considered to be at a healthy level, with some indication that nuisance weeds still pose a problem. This is an improvement over the 1992 survey results when most respondents reported excessive plant growth.
- The quality of fishing on Lake Ripley is rated as fair. Among local anglers, the preferred sport fisheries are bluegill, largemouth bass and walleye.
- The top three conditions that are perceived to have changed for the worse include Jet Ski traffic, motor boat traffic, and the level of peace and tranquility, respectively. Jet Ski and motor boat traffic also represents the number one factor for both contributing to problems on Lake Ripley and negatively impacting people's use and enjoyment of the lake. Problems are mostly attributed to the aggressive operation of watercraft in near-shore, shallow water areas. Strong support was received to expand no-wake zones to incorporate these areas. Other major factors detracting from the lake-use experience are poor water clarity, noise, and the runoff of fertilizers and pesticides into the lake.
- Although most people generally feel the lake is sufficiently regulated and has an adequate law enforcement presence, there is a widespread opinion that jet skis warrant stricter regulation, mostly due to problems with noise and safety. Respondents also indicated a need for enforcing existing regulations that are routinely violated. In reference to the placement of piers, most would not favor additional regulation.
- Most people favor expanding slow-no-wake times and/or locations if deemed necessary for the purpose of promoting safety and protecting sensitive aquatic habitat. However, previous surveys and public input show a preference for modifying no-wake zones over adjusting the currently established no-wake times.
- A slight majority of the survey respondents believe they have a voice in decision-making matters pertaining to the management of Lake Ripley. A much stronger majority claim they are adequately informed of lake-management efforts and decisions. Newsletters, special mailers and newspaper articles, respectively, are the preferred methods of communication.
- Most people feel the Lake Ripley Management District and Wisconsin Department of Natural Resources should continue to be the responsible authorities for managing and financing lake-improvement activities.

KEY FINDINGS (SCIENTIFIC ANALYSIS)

- Development and population densities around Lake Ripley, high property valuations, and the lake's popularity as a recreational attraction all underscore the importance of the resource and the need for active management.
- Lake Ripley is a moderately deep, hard-water lake that is well buffered against the effects of acidification. The lake is moderately high in nutrients and biologically productive. It undergoes thermal stratification during the summer that generally leads to oxygen depletion in deeper water areas.
- Lake Ripley has a watershed-to-lake surface area ratio (12:1) that makes it relatively prone to water quality problems caused by runoff pollution from the watershed. Its hydraulic retention time (1.17 years)

suggests that the lake would best be served by nutrient reduction strategies targeted within the contributing watershed.

- Agricultural and residential development has resulted in water quality and habitat degradation in downstream Lake Ripley. Wetland destruction and soil erosion caused by poor land-use practices are primarily to blame. Ditching, drain tiling, stream channelization, construction site erosion, shoreline development, and the proliferation of water-impervious surfaces throughout the watershed all contribute to this degradation.
- Groundwater contributes as much as 30-45% of the lake's water supply, and plays an important role in maintaining good water quality conditions. Extensive groundwater pumping and the loss of critical groundwater recharge areas to development are serious threats to this water source.
- Designated "sensitive areas" around Lake Ripley support threatened habitats necessary in sustaining a diversity of native plants, fish and wildlife. They include undisturbed shorelines, near-shore wetlands and native aquatic plant communities.
- Lake Ripley suffers from the effects of cultural eutrophication, or accelerated nutrient enrichment caused by human activity in the watershed. Activities that increase the amount of eroded soil, fertilizers, and polluted runoff that gets delivered to the lake speed up the eutrophication process. This situation leads to nuisance algae blooms, excessive weed growth, poor water clarity, and oxygen depletion.
- Water quality and fisheries data collected over a ten-year monitoring period generally do not reveal any significant trends, suggesting stable conditions. The exception is the recent indication of an increase in rough fish numbers (e.g. carp) and a corresponding decline in specie diversity.
- Total phosphorus and chlorophyll *a* concentrations are generally indicative of "good" water quality, while Secchi depth ranges are generally indicative of "fair" water quality. The lake's trophic status is upper-mesotrophic to eutrophic; meaning it has moderate to high levels of nutrients and biological productivity.
- The rooted aquatic plant community in Lake Ripley is significantly disturbed, but still supports a diversity of native species. A diversity of native plants provides the foundation for a healthy and balanced aquatic ecosystem by protecting water quality and provided important habitat. Current threats include the invasion of non-native species (e.g. Eurasian watermilfoil), pollution, and disturbances caused by shallow-water motor boating.

<u>GENERAL RECOMMENDATIONS</u>

- Reduce the amount of phosphorus and sediment that is delivered to the lake by employing Best Management Practices (BMPs) throughout the watershed.
- Determine relative significance of external versus internal nutrient loading to the lake. Control in-lake nutrient sources if shown to be a serious component of the eutrophication problem.
- Control the effects of eutrophication by implementing programs that minimize the effects of nuisance aquatic plant and algae growth.
- Prevent further wetland loss by protecting them from inappropriate development and disturbance. Increase wetland acreage in the watershed whenever possible through restoration.
- Protect critical habitats through the preservation of natural shorelines and native aquatic plant communities.
- Promote fishery and wildlife diversity by protecting water quality and preventing habitat destruction.
- Protect groundwater resources by encouraging sound development practices that limit the extent of water-impermeable surfaces.
- Separate conflicting lake uses to enhance safety, protect ecologically sensitive areas, and support a mixed-use recreational environment.

<u>SPECIFIC RECOMMENDATIONS</u>

<u>On-lake Actions</u>:

- Expand slow-no-wake zones to incorporate near-shore, shallow water areas.
- Develop slow-no-wake policy to take affect during periods of abnormally high water levels.

- Continue selective mechanical harvesting of Eurasian watermilfoil.
- Update aquatic plant inventory and management plan.
- Determine extent and significance of in-lake nutrient recycling caused by phosphorus release from anoxic bottom sediment.
- Continue sport fishery enhancement programs through habitat protection, carp control, and limited fish stocking.
- Continue intensive, long-term, water quality monitoring program.
- Ensure proper lake-rule postings at public access points, and continue educating lake users about applicable rules and ordinances.
- Raise the public launch fee in accordance with State regulations to collect additional funds for maintenance and upkeep of the facilities.
- Propose local ordinance that prohibits the feeding of waterfowl, and implement other approved waterfowl-control strategies.

Watershed-based Actions:

- Continue implementing the goals and objectives of the Lake Ripley Priority Lake Project.
- Encourage the use of no-phosphate fertilizers within 200 feet of the lake.
- Propose shoreland-zoning rule that regulates the type and placement of high-intensity lighting on piers, boathouses and shorelines.
- Continue implementation of an intensive information and education campaign directed toward watershed residents and lakefront property owners.
- Continue to acquire and/or establish conservation easements on critical wetland properties throughout the Lake Ripley watershed.
- Continue public education and wetland/prairie restoration activities at the Lake District Preserve.
- Continue to track funding opportunities that can be used to help finance lake-protection and improvement projects.
- Continue the annual "Lake Sweep" and similar litter cleanup projects to remove trash from area waterways and shorelines.
- Continue implementation of the volunteer "Lake Watch" program to compliment law enforcement efforts during the peak boating season.
- Support the continued funding of a summer lake patrol officer that can maintain an enforcement presence on weekends and holidays throughout the summer.

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CHAPTER 1: INTRODUCTION

1-1 BACKGROUND

Lake Ripley is located in Jefferson County within the Town of Oakland, and just east of the Village of Cambridge. According to the Jefferson County Land & Water Resource Management Plan for 2000-2005, Oakland represents one of the two fastest growing towns in the county, while Cambridge is among the fastest growing incorporated communities. Much of this explosive growth may be attributed to the appeal of one of the area's crown jewels—Lake Ripley. The lake is a regional asset and popular vacation destination that supports a variety of recreational pursuits. People have historically been drawn to its shores for both business and pleasure. The high value and density of development around the lake's vicinity is testimony to its significance as one of the area's primary attractions. Although the Lake Ripley Management District (LRMD) only amounts to about 7% of the total land area in Oakland Township, it represents 65% of the township's total assessed valuation (based on 1999 assessment figures). This illustrates the importance of the lake not only as an environmental and recreational asset, but also as an economic amenity. The distribution of development in Oakland Township based on 1998 county land-use data is depicted in Figure 1 below.

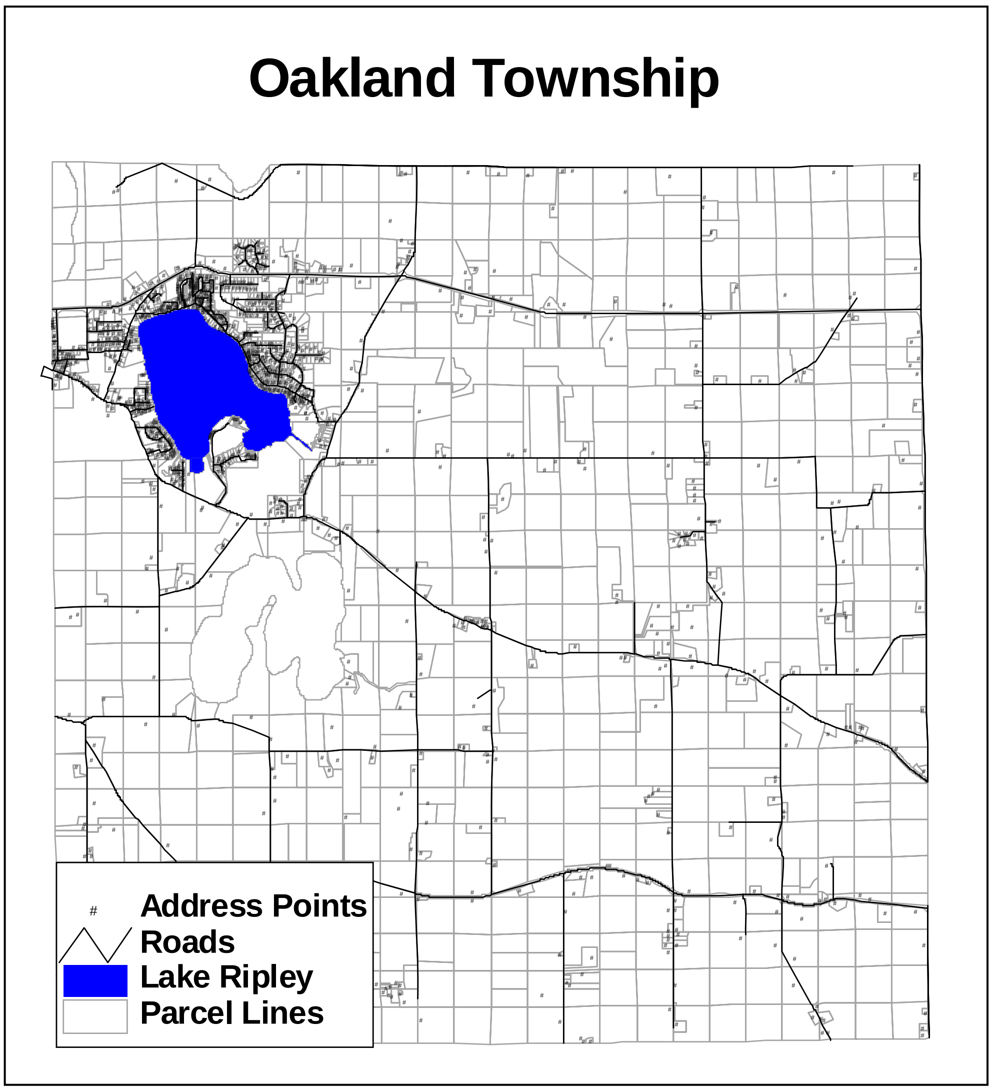


Figure 1: Distribution of Development in Oakland Township

Unfortunately, Lake Ripley's popularity has led to ever intensifying development and lake-use pressures that continue to negatively impact the health and quality of the resource. The ongoing challenge for resource managers is to implement cost-effective programs that protect the lake and address its unique problems while supporting a mixed-use recreational environment. Conflicting perceptions, priorities and expectations make this task especially daunting. Simply figuring out where to begin can be difficult, especially when faced with multiple issues and competing lake-use interests. Applying a "quick-fix" solution, or not fully understanding all the potential ecological repercussions and recreational tradeoffs associated with a given management strategy are common mistakes that can prove very costly. Proper planning is therefore necessary to ensure that management actions do not inadvertently exacerbate an existing problem, or create entirely new problems.

In response to such concerns, the LRMD decided to prepare a Comprehensive Lake Management Plan. The Plan is meant to facilitate the protection and rehabilitation of Lake Ripley by accurately identifying underlying problems, and offering holistic, watershed-scale management strategies to address these concerns. It is also meant to outline the potential risks and consequences associated with particular management actions. This is important since there is no silver bullet strategy that will produce equal benefits on every lake. Each lake is inherently unique, and each is likely to behave and respond in completely different ways. The lake-management plan is intended to help answer the following types of questions:

- What are the long-term goals and objectives?
- What are the problems, and whom do they affect?
- What are the management priorities?
- What information gaps must be rectified before action can be taken?
- What management options can be used to address the identified problems?
- What are the potential benefits and drawbacks associated with each option?
- What is the most appropriate course of action?

1-2 GOALS & OBJECTIVES

The LRMD received a Wisconsin Department of Natural Resources' (WDNR) Lake Planning Grant in the spring of 1999 to develop a Comprehensive Lake Management Plan for Lake Ripley. This effort will guide resource protection and improvement efforts on and around Lake Ripley over at least the next several years. It also serves to strengthen the awareness, understanding, and decision-making capacity of the LRMD Board of Directors as it strives to protect and manage the lake and its watershed. Non-point source pollution control, aquatic plant and fisheries management, water quality protection, and recreational conflict resolution are among the many issues that this plan attempts to address.

1-3 RELATIONSHIP TO OTHER PLANS

A number of reports, studies and plans have been completed that focus on various aspects of Lake Ripley and its associated watershed (see Appendices). Consideration was given to the key findings and recommendations derived from these prior efforts during the development of this Comprehensive Lake Management Plan. The objective was to complement and build upon (rather than duplicate) past efforts by updating information, re-evaluating public opinions, and adjusting outdated strategy recommendations whenever appropriate.

1-4 PROJECT JUSTIFICATION

Lake Ripley is one of 50 lakes that the WDNR selected for long-term trends monitoring in 1986. As a result, the lake is regularly sampled to assess ambient water quality conditions and trends. This has produced a wealth of important baseline data characterizing the health and overall quality of the lake. During the WDNR's Basin Water Quality Planning process, Lake Ripley was identified as a high quality resource ranking "high" for watershed management funding. This led to the lake being designated as a "Priority Lake Project" by the WDNR in 1992. Consequently, a Non-point Source Pollution Abatement Plan was prepared to help resource managers pinpoint pollutant-loading hot spots in the watershed, and to identify Best Management Practices that could be implemented to improve water quality conditions. This plan has been instrumental in guiding a number of watershed management efforts designed to reduce pollutant loading to the lake. It also effectively documented the condition and physical setting of the resource as it existed in the early 1990s.

Unfortunately, the plan was not designed to directly address other important issues that can also have a profound affect on the lake. These issues include excessive aquatic plant growth, nuisance algae blooms, impaired fish populations, loss of wildlife habitat, and recreational conflicts—just to name a few. The LRMD therefore decided to develop a Comprehensive Lake Management Plan to further direct both short- and long-term courses of action pertaining to the protection and improvement of Lake Ripley. The Plan is intended as a fully integrated reference document, containing all key findings and recommendations concerning the lake and adjoining watershed. It outlines resource management goals and objectives, and provides a strategic methodology and framework for making a variety of decisions. The Plan is also designed to be an adaptive decision-making tool that can be modified and continuously updated as resource conditions change or new information becomes available.

1-5 PROJECT DELIVERABLES

The Lake Ripley Management Plan shall serve as a one-stop information source and action strategy. As long as the plan is regularly updated with the latest information on hand, it should continue to provide sound guidance well into the future. Project deliverables include the following:

1. Description of existing physical, chemical, biological and demographic conditions
2. Water quality assessment of the lake and inlet tributary
3. Survey of public opinions and concerns regarding the lake and its management
4. Ranking and prioritization of lake-use preferences, values and perceived problems
5. Identification and analysis of significant problems interfering with the use and enjoyment of the lake
6. Overview of past and ongoing management efforts
7. Cost-benefit analyses of applicable management strategies
8. Review of remaining information needs
9. Discussion of major findings and recommendations
10. Proposed action strategy and implementation guidelines

1-6 PLANNING METHODOLOGY

Lake managers that fail to plan appropriately are at risk of being reactionary and misguided in their decision making. Without clearly articulated goals and objectives, it is possible for vocal interest groups to unduly influence the decision-making process by encouraging knee-jerk responses to complex issues. For instance, there may be pressure to take immediate action to resolve a perceived problem that is not adequately defined or understood. Acting upon such pressures to appease an interest group without understanding the nature, significance and complexity of the problem would be premature and irresponsible. Grasping blindly at management strategies that are currently en vogue is sure to lead to less than desirable results over the long run, especially when strategy selection is not predicated on careful research and planning. The best way to ensure an effective, publicly supported lake management program is to follow the steps below.

1. Collect and interpret both scientific and pubic opinion data relevant to the lake and its watershed. This step is used to evaluate the condition of the resource, its problems, and the shared needs and priorities of its users.

2. Perform a feasibility analysis that explores the costs and benefits of various management options. This step allows managers to better understand the benefits, costs and limitations associated with various protection and rehabilitation strategies.

3. Implement management strategies that are based on sound scientific principles, and that cost-effectively address the identified problems. This step ensures that priorities are met by addressing the root causes of resource impairments.

Adhering to the above methodology encourages sound decision making while increasing the probability that the best lake-improvement strategy is ultimately implemented. Actions that may be ineffective, cost-prohibitive or ecologically harmful are avoided. Instead, resource managers are better able to control the underlying causes of real problems, rather than waging a losing battle fighting undefined or symptomatic issues. Following this methodology, the Lake Ripley Management Plan was completed in several phases. Each project phase is described in detail below.

PHASE I: WATER QUALITY EVALUATION

The first phase of the project was to perform an assessment of water quality conditions on Lake Ripley. Water quality evaluations were conducted at two monitoring stations located at the inlet, and one monitoring station over the deepest point on the lake. The inlet sampling procedure closely followed the methodology that was employed as part of the Lake Ripley Water Quality Appraisal completed in 1994. Monitoring results were then combined with already existing information for the purposes of trend analysis.

Water chemistry testing, physical measurements and biological evaluations were taken twice per month from early spring to the end of the summer growing season (March – October) at the two inlet monitoring stations. Information on channel flow, sediment depth, macro-invertebrate composition, pH, dissolved oxygen, temperature, and ortho-phosphorus concentrations were obtained in the field. Grab samples were also submitted to the Wisconsin State Laboratory of Hygiene for further analysis. These samples were tested for dissolved reactive phosphorus, total phosphorus, total nitrogen, ammonia-nitrogen, pH, alkalinity, turbidity, and suspended solids. Results were then compared with those of the 1994 Water Quality Appraisal to identify changes over time.

Water quality sampling also took place over the deepest point in the lake as part of a very simplified, in-lake phosphorus loading study. Samples were collected once during late summer stratification (mid August) and once following fall turnover (late October). Total phosphorus concentrations were measured within one meter of the bottom and within one meter of the water surface. Surface measurements of chlorophyll *a* and Secchi transparency were also recorded. The results helped predict whether significant amounts of phosphorus are being released from the bottom sediment during periods of anoxia in the lake's deep hypolimnion.

Student and teacher volunteers from Cambridge High School assisted with the implementation of the sampling program. Results of the water quality monitoring are discussed in Chapter 2--Existing Conditions.

PHASE II: PUBLIC PRIORITIES & NEEDS ASSESSMENT

The second phase was to inform all interested stakeholders (i.e., LRMD residents, lake users, local community members, etc.) about the project. This was accomplished by holding locally televised informational meetings and public hearings, distributing newsletters, and issuing press releases to the local newspapers. These forums and information/education sources were used to communicate the purpose of the lake management planning effort, and to invite stakeholders to participate in the process. Once the public was informed of the project, surveys were distributed to all LRMD residents. The surveys were used to solicit public opinions and attitudes regarding a variety of topics related to Lake Ripley and its management. Survey results were ultimately shared with the public through special mailers and subsequent public meetings, and were used to prioritize lake-use preferences and perceived problems. Survey results were also compared to those of earlier opinion surveys to identify how perceptions have changed over time.

Phase III: Synthesis of Existing Information

The third phase was to build upon prior studies and planning efforts by retrieving all available information pertaining to the lake and surrounding watershed. This information was then summarized, updated when possible, and merged to create a single information source for easy reference. Because of the project's comprehensive scope, there are separate sections describing each interrelated component of the resource, including physical, chemical and biological conditions. This phase also determined if critical information gaps persist and, if so, how they should be rectified.

Phase IV: Problem Identification

The fourth phase was to analyze available data to define both new and continuing problems that threaten the health and recreational attributes of the resource. Problems were evaluated based on actual or potential magnitude of impact to the resource, affected lake use, and other criteria. Geographic Information Systems (GIS) software was utilized as a data management, analysis and mapping tool for this project phase. The GIS will be used on a continual basis by the LRMD and Priority Lake Project to maintain information databases, analyze resource data, and prepare customized maps and visual displays for public presentations and educational workshops.

Phase V: Evaluation of Management Options

The fifth phase of the project was to evaluate various management options by performing cost-benefit analyses. Evaluation criteria included estimated costs, implementation timeframe, potential positive/negative impacts (recreational and ecological), applicability to Lake Ripley, and overall likelihood of success. Management strategies were categorized based on the nature and location of the particular problem or symptom being addressed.

Phase VI: Development of Action Strategy & Implementation Guidelines

The sixth and final phase was to recommend a multiple-year course of action. This phase included the development of an adaptive timeline for implementing management strategies. It also provided, when appropriate, evaluation criteria and specific milestones that could be used to track progress and gauge success.

Key findings, conclusions and recommendations of the Plan were made available to the public through an intensive information and education campaign. Locally televised public meetings, newsletters, press releases and direct mailings were used to communicate with area stakeholders.

CHAPTER 2: EXISTING CONDITIONS

2-1 INTRODUCTION

Every lake is unique. This explains why each lake looks and behaves in a different way, has its own set of problems, and demands its own set of solutions. Understanding the complex inter-relationships that drive aquatic ecosystems is the first and most important step in managing these fragile and dynamic resources. A general understanding of the concepts and processes described in this chapter is an essential prerequisite to understanding and implementing a successful lake protection and rehabilitation program.

2-2 LOCATION

Lake Ripley and its watershed are located in western Jefferson County, in the Town of Oakland, just east of the Village of Cambridge. The lake and drainage basin are positioned entirely within the north half of Township 6 North, Range 13 East of the Wisconsin Plat, Sections 3-10 & 15-18 (see Appendix A). Major urban centers within easy driving distance of Lake Ripley include Madison, Milwaukee, Rockford (IL) and Chicago (IL). A location map depicting the Lake Ripley watershed is included as Figure 2 below.

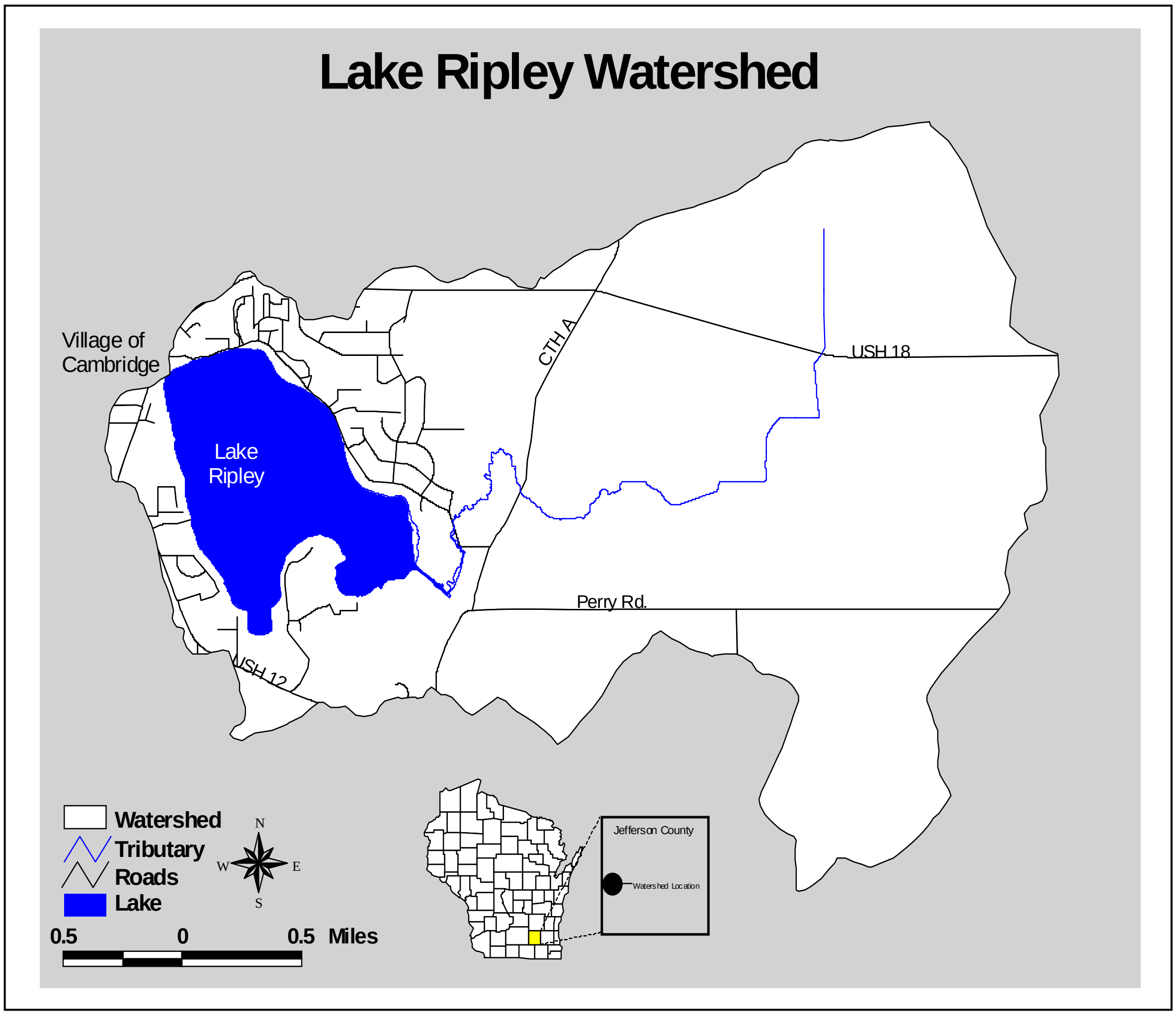
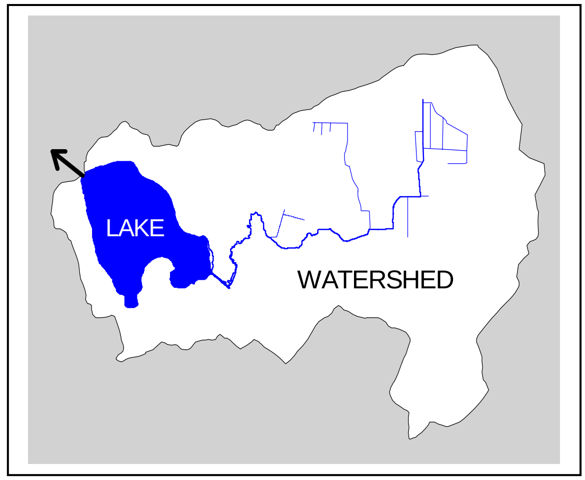


Figure 2: Lake Ripley Watershed Boundaries & Location

2-3 WATERSHED DESCRIPTION

DEFINITION



Resource managers often think of a lake as a reflection of its watershed. This is because the health and quality of a lake is often directly linked to the health and quality of its surrounding drainage basin, or watershed. A watershed is the total land area that is capable of draining surface water to a particular water body. Its outermost boundary is defined by topographic high points on the adjacent landscape, and can be visualized as a giant bathtub with the lake situated where the drain is located. The watershed area is delineated from the lake's outlet and includes the surface area of the lake. The larger the watershed area, the more surface water it is able to collect and convey downstream as overland flow, also known as stormwater runoff. Lake Ripley lies at the terminus of an eight square mile watershed that drains mostly farmland. Both surface water and regional groundwater flow generally from east to west toward the lake.

WATERSHED-TO-LAKE RATIO

Watershed-to-lake surface area ratios are used to estimate the level of influence the surrounding landscape has on water quality. As the size of the watershed increases in relation to the size of the lake, the greater the likelihood of pollutants entering the lake via surface runoff. This runoff is generated from snowmelt, precipitation and groundwater-derived discharge that does not evaporate or infiltrate into the soil. Instead, it collects on the landscape and is eventually conveyed down gradient toward a receiving water body, transporting everything it can pick up and carry from the watershed to the lake. The actual amount of pollutants, sediment and other material delivered depends on watershed size, soil types, topography, land-use practices and runoff flow characteristics.

Lake Ripley has a 0.653 square mile surface area, which equates to a watershed-to-lake surface area ratio of just over 12:1. Lakes with ratios greater than 10:1 are known to more often experience water quality problems when compared to lakes with smaller ratios. This is especially true in developed watersheds that are dominated by fertile, erodible soils, and poor land-use practices that produce excess runoff and erosion. Knowing the size of a particular watershed, as well as its defining topographic features, soil types and land uses will offer clues as to how much management effort will need to be focused in these critical upland areas.

GEOLOGIC SETTING & SOIL TYPES

Glacial features largely control the topography in the Lake Ripley Watershed. Lake Ripley itself is situated in a kettle depression, and maintains an average surface elevation of 835 feet above mean sea level. The lake is part of an extensive outwash plain that stretches from south of Lake Ripley to Lake Mills. This area incorporates all the features associated with a stream-built, or melt-water terrace. Water apparently trapped by the kettle moraine to the east and the terminal moraine to the south formed large areas of shallow lakes that have long since drained away, resulting in large areas that are low and nearly flat. A network of drainage ditches and tile systems have historically been used to convert wetlands into cropland.

According to the USDA's Soil Survey of Jefferson County (1979), the most common soil associations found in the watershed are Houghton-Adrian, and Fox-Casco-Matherton. Houghton-Adrian soils are found in the depressions of old glacial lake basins and stream valleys. They are poorly drained and nearly level, and typically have a black to dark brown organic layer of about 51 inches in thickness. If adequately drained, these soils have a fair to good potential to support corn and specialty crops. Wetness is a severe limitation, making these soils often unsuitable for residential or similar development. Fox-Casco-Matherton soils, on the other hand, are found on outwash plains and terraces, and tend to be well drained and gently sloping to very steep. The surface layer is typically dark, grayish brown silt loam about 10 inches in thickness. These soils have fair to good potential to support commonly grown farm crops. In addition, they have fair to good potential for residential and other urban uses. As a result of the permeability of the underlying sand and gravel, pollution of groundwater is a hazard if the soils are used for waste disposal.

LANDSCAPE FEATURES

Agriculture represents the watershed's dominant land use, with heavy residential uses occurring mostly within a half-mile radius of the lake's periphery. Prior to European settlement, the watershed supported extensive wetlands interspersed with upland prairie and oak savanna. Subsequent alterations to the landscape for agricultural and residential development have eliminated about two-thirds of the original 1,500 acres of wetlands, mostly through ditching, land filling and drain tiling. Remaining wetlands are critical for providing wildlife habitat, flood attenuation, pollutant filtration, and fish spawning and rearing areas.

Watershed development has also artificially extended the length of the inlet stream over the years as a result of ditching and channelization. The inlet has increased from 2.5 miles (1907 topographic map) to 4.25 miles in length (1993 non-point source inventory). The increase in both stream length and tiling resulted in increased surface water runoff, sedimentation and nutrient transport to Lake Ripley. There has also been a corresponding decline in infiltration and groundwater recharge. Much of the water that originally filtered through the soil and replenished the groundwater supply now runs off of fields, transporting eroded soil and nutrients into the wetlands and Lake Ripley. The increased volume of surface drainage created a more defined channel through the wetlands, diminishing their functionality as natural water quality buffers.

A topographic map showing the location of existing wetlands, hydric soil types (indicative of wet conditions), and drainage ditches is shown in Figure 3 below. A slightly more detailed and annotated topographic map can be found in Appendix B.

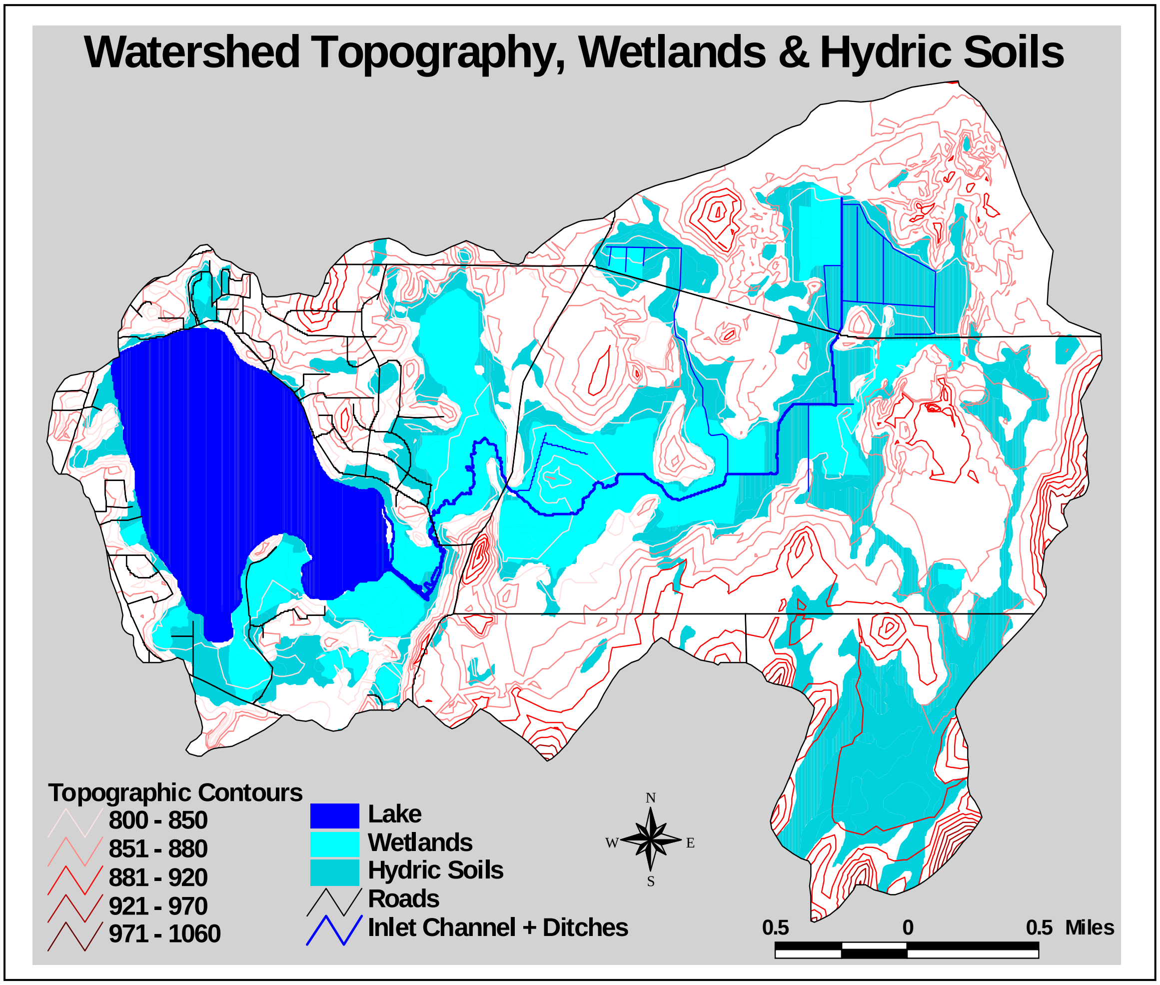


Figure 3: Watershed Topography, Wetlands & Hydric Soils

Demographics & Land Uses

There are nearly 700 residences and 2,000 people residing within the boundaries of the Lake Ripley watershed. As of July 2000, the watershed and Lake District together supported roughly 1,468 legal property owners (1,338 parcels). Separately, the watershed contains 1,452 property owners (1,118 parcels), and the Lake District contains 1,285 property owners (1,174 parcels). Population varies on both a weekly and seasonal basis, especially near the lake, with summer weekends attracting the greatest number of visitors. Development and lake-use pressure is high on Lake Ripley due to its proximity to major urban centers, such as Madison, Milwaukee, Chicago and Rockford. Approximately 70% of the land area in the watershed, located mostly east of the lake, is used for agricultural purposes. The remaining 30% is split evenly between residential land uses and natural areas (e.g. wetlands and woodlands). A general land-use map based on 1998 land information data is included as Figure 4 below.

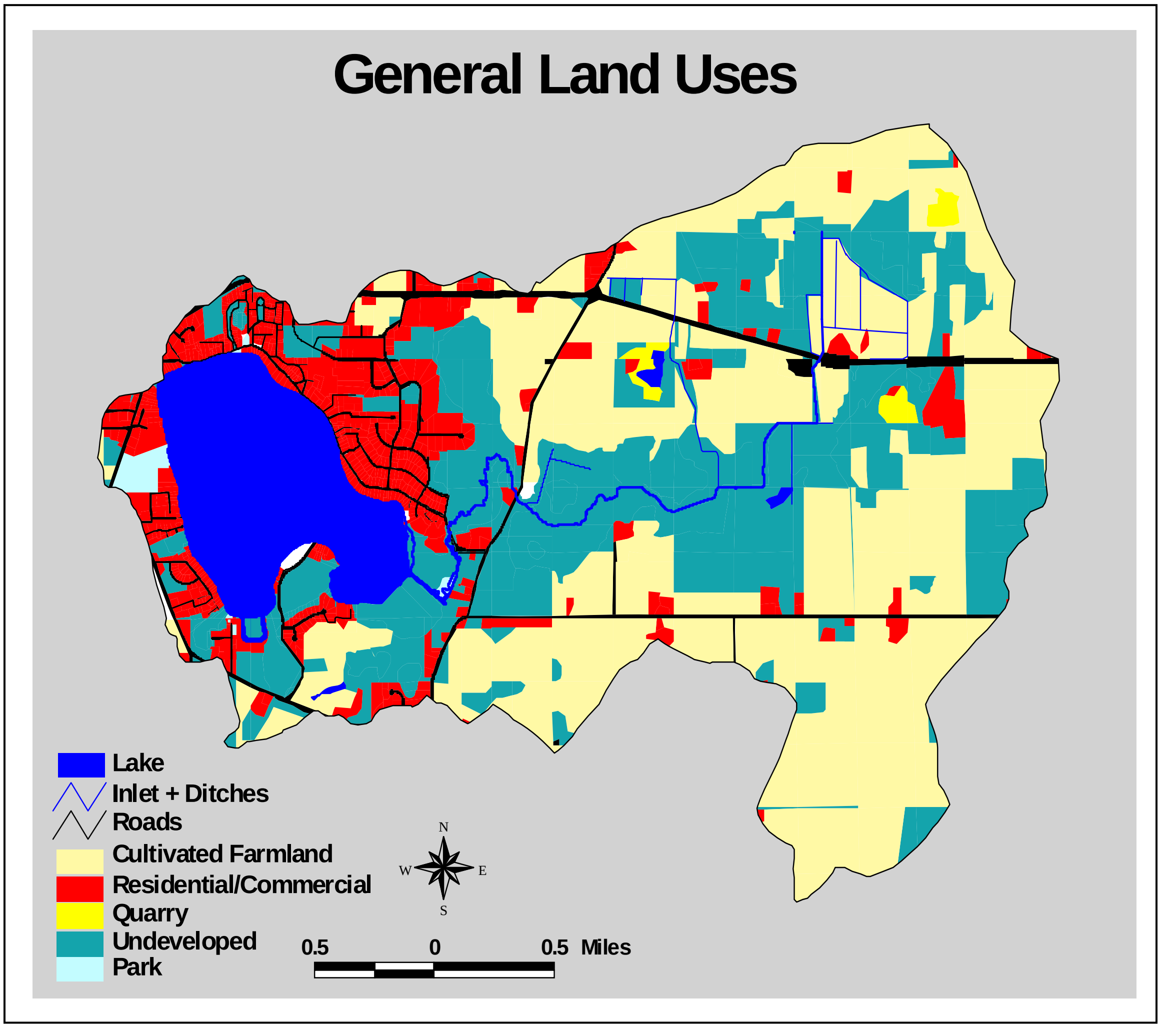


Figure 4: General Watershed Land Uses

A more comprehensive description and assessment of the Lake Ripley watershed can be found in the 1998 (rev.) Non-point Source Control Plan for the Lake Ripley Priority Lake Project (Appendix C). This plan has guided management efforts in the watershed since it was approved in 1995.

2-4 LAKE DESCRIPTION

Lake Ripley is a 418-acre marl lake with a maximum depth of 44 feet. It formed during the last glacial period from a kettle depression left behind by the retreating ice sheets. Lake Ripley is part of the Lower Koshkonong Creek and Lower Rock River Drainage Basins. Although surface water represents the predominant source of water to the lake, groundwater can contribute as much as 30-45% of the lake's water supply. The lake is used primarily for recreational purposes such as swimming, fishing, boating, wildlife viewing, and the enjoyment of peace and tranquility.

The shoreline is almost fully developed with about 170 part-time and year-round residences bordering the lake. A boat launch located at the north end of the Island Lane peninsula offers the only point of access for general public use. There is also a privately owned marina at the south end of the lake, as well as a community park and beach along the western shoreline. Protected "sensitive areas" were established through a town pier ordinance along the relatively undisturbed shoreline wetlands. Located at the periphery of the two bays, these sensitive shorelines are restricted from further pier development to preserve valuable habitat (see Appendix D). Special slow-no-wake zones also serve to protect these sensitive habitat areas.

2-5 LAKE TYPE

Lakes may be classified according to their primary source of water, and how that water enters and leaves the system. Drainage lakes like Lake Ripley receive most of their water from the watershed in the form of stream drainage. These lakes have a prominent inlet and outlet that serve to move water through the system. For instance, Lake Ripley has one inlet tributary stream (unnamed) entering its southeast corner, and one outlet stream (Koshkonong Creek) exiting at its northwest corner. Drainage lakes are referred to as artificial lakes, impoundments or flowages when a dam is responsible for at least one-half of their maximum depth.

Other lake types include seepage, spring and drained lakes. Seepage lakes are landlocked water bodies that get most of their water as precipitation or runoff, supplemented by groundwater from the immediate drainage area. They do not possess an inlet or outlet, and are subject to seasonal fluctuations in water level. Spring lakes, also called groundwater drainage lakes, obtain their water primarily from local groundwater. Although these lakes do not posses an inlet, they do have a defined outlet. Finally, drained lakes receive most of their water from precipitation and direct surface drainage from the surrounding land. They have no inlet, but do have a continuously flowing outlet.

Knowledge of lake types is important when attempting to identify and address various water quality and quantity problems. By examining the different sources and quality of water that recharge a lake, resource managers are able to better pinpoint the root causes of water quality impairments. For example, if stream discharge provides the major source of water (e.g. drainage lakes), nutrient levels are often high and water exchange takes place more rapidly. These lake types have the most variable water quality depending on the amount of runoff and human activity in the watershed. If groundwater is the major water source, the lake is usually well buffered against acid rain, contains low to moderate amounts of nutrients, and has fairly slow water exchange rates. This includes all groundwater drainage lakes and some seepage lakes. Local septic systems or groundwater contamination could cause water quality problems in these lake systems.

2-6 HYDRAULIC RETENTION TIME

The average length of time water remains in a lake is called the retention time, or hydraulic residence time. It is primarily determined by lake size, water source, and watershed size. Rapid water exchange (flushing) rates allow nutrients to be flushed out of the lake quickly. Such lakes respond best to management practices that decrease nutrient input. Impoundments, small drainage lakes, and groundwater drainage lakes fit this category. Longer retention times occur in seepage lakes with no surface outlets. Nutrients that accumulate over a number of years in lakes with long retention times can be recycled annually with spring and fall mixing. Thus, the effects of watershed protection may not be apparent for a number of years. Nevertheless, lakes with long retention times tend to have the best water quality since they are usually deeper with smaller watersheds.

Average retention times range from several days for some small impoundments to many years for large seepage lakes. Lake Ripley has an average retention time of about 1.17 years. This value suggests that the lake would best be served by nutrient reduction strategies targeted within the contributing watershed.

2-7 LAKE MORPHOMETRY

Lake morphometry (or bathymetry) describes a lake's physical dimensions. Lake Ripley's physical characteristics include lake volume (7,561 acre-feet of water), surface area (418.1 acres), shoreline length (4.85 miles), mean depth (18 feet) and maximum depth (44 feet). In terms of surface area, approximately 34% of the lake is less than five feet deep, while about 41% is greater than 20 feet deep. The deepest point occurs near the lake's center, approximately 1,000 feet from the east shoreline. A bathymetric map depicting the bottom topography of Lake Ripley is included as Figure 5 below. A more detailed and annotated bathymetric map can be found in Appendix E.

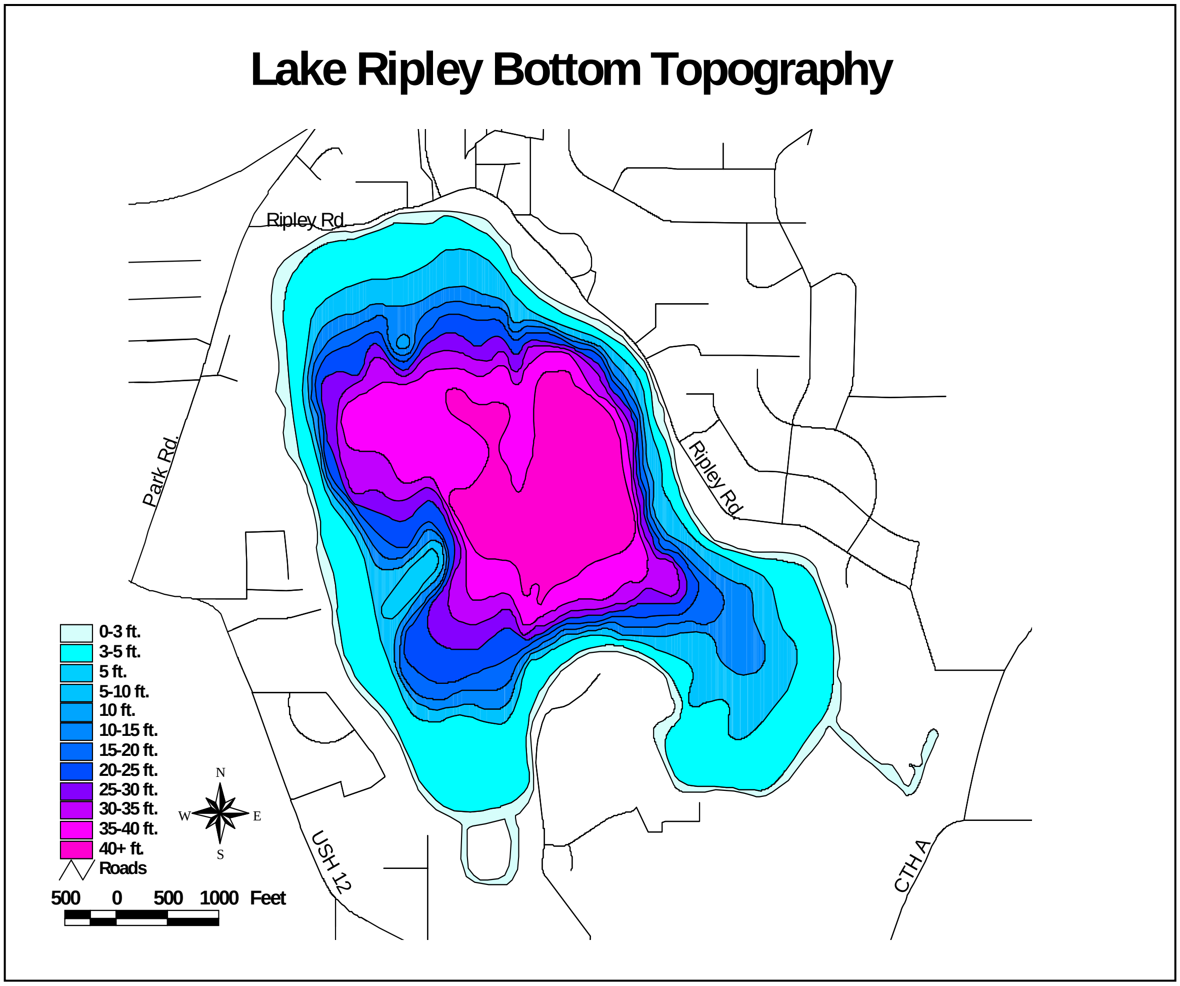


Figure 5: Lake Ripley Bathymetry

Surface area, maximum and mean water depths, basin shape, shoreline length, water volume, and other physical measurements can offer many clues as to how a lake should appear and function in a natural state. For example, a lake's morphometry will dictate how well its water column is able to mix and self-aerate. The extent to which the water mixes affects the lake's water quality and ability to support a diversity of aquatic life. The complete mixing of a lake's water column is called "turnover." While shallow lakes tend to continuously mix throughout the year due to wind and wave action, deeper lakes turn over less frequently—typically as a result of seasonal temperature changes or large storm events. This is because deeper lakes undergo a process known as thermal stratification.

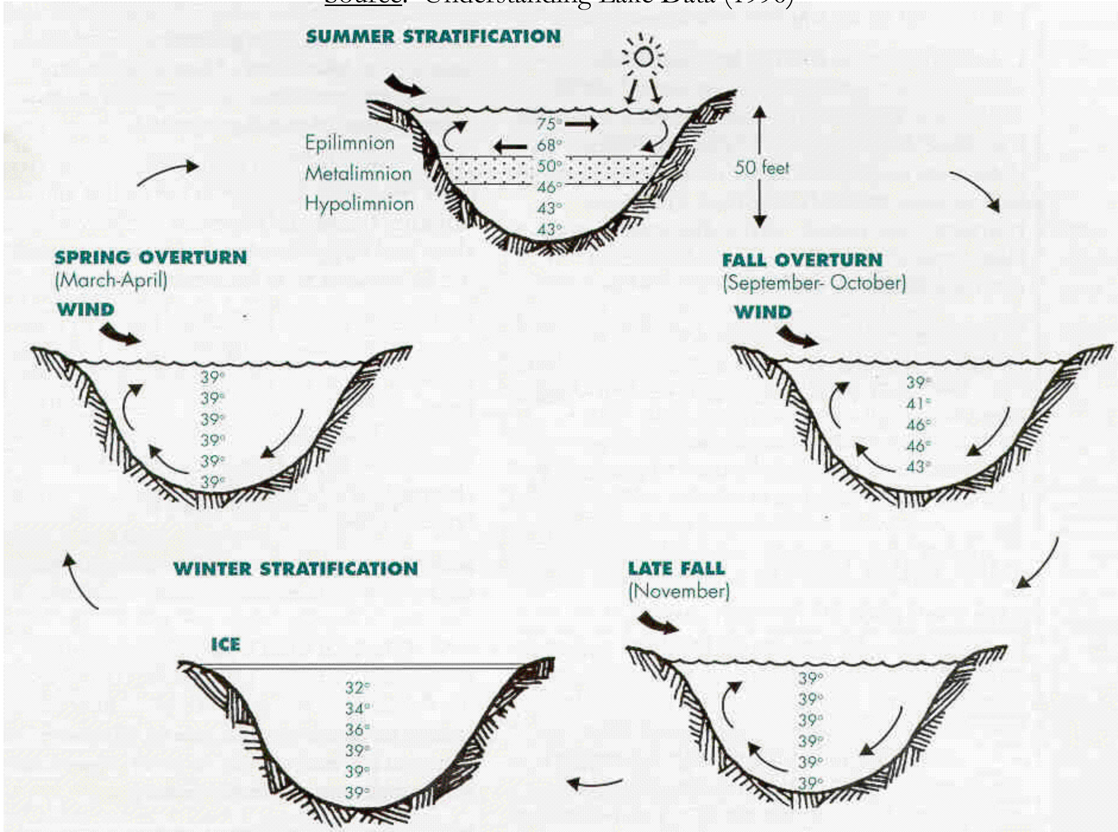
2.8 THERMAL STRATIFICATION

Thermal stratification occurs in deep lakes during stable weather conditions when the water column forms horizontal water layers of varying temperatures and densities. As air temperatures rise in the spring, a temperature-density "barrier" begins to form in deeper water bodies between the warmer, lighter surface water that is heated by solar energy and the underlying denser, colder water. This barrier is marked by a sharp temperature gradient called the thermocline. The zone where the thermocline occurs is known as the metalimnion. It separates the warmer, less dense, upper zone of water called the epilimnion, from the cooler, more dense, lower zone called the hypolimnion. Summer stratification generally occurs in lakes where depths are greater than 20 feet. However, depending on their shape, small lakes can stratify even if they are less than 20 feet deep. In larger lakes, the wind may continuously mix the water to a depth of 30 feet or more.

Lakes may also undergo a second stratification period during the winter months. Because water density peaks at 39°F, winter stratification develops with a temperature difference of only 7°F between the top and bottom (39°F on the lake bottom versus 32°F right below the ice). This explains why ice floats and forms at the water's surface. The ice layer at the surface helps maintain stratification by preventing wind from mixing the water column. The ice also helps insulate the water beneath it, which prevents deeper lakes from freezing solid.

The temperature and density of the water column will be fairly consistent from top to bottom in both the early spring and late fall. The uniform water density allows the lake to mix completely, replenishing the bottom water with dissolved oxygen and recycling nutrients up to the surface. This destratification process is called spring and fall turnover. Due to its morphometric characteristics, Lake Ripley is one of only two dimictic, or "twice mixing," lakes in Jefferson County.

Source: Understanding Lake Data (1996)



It is important to note that lakes that experience strong thermal stratification are frequently subject to oxygen depletion in the hypolimnion. As algae, plant debris and other organic material fall into the hypolimnion to decay, oxygen becomes depleted to the extent that anaerobic conditions may develop. A strong sulfur odor is frequently associated with such waters. This oxygen deficiency can stress a cool water fishery, and may cause the mobilization of phosphorus from nutrient-rich bottom sediment into the overlying water. During turnover, the fertile bottom water is then mixed throughout the water column, creating a situation that favors nuisance algae blooms.

2-9 TROPHIC STATUS & EUTROPHICATION

Lakes are routinely characterized according to their trophic status, or level of primary productivity. Eutrophication is a term used to define the aging process of a lake, and describes the response of a lake to nutrient enrichment. Water bodies that receive excessive amounts of nutrients, such as phosphorus and nitrogen, are most likely to become eutrophic systems. Once in the lake, these excess nutrients increase fertility levels and contribute to murky water conditions, algae blooms and nuisance weed growth—the symptoms of eutrophication.

A lake's trophic status describes its degree of eutrophication. Lakes can be classified as either oligotrophic, mesotrophic or eutrophic. Oligotrophic lakes are generally clear, deep and free of weeds or large algae blooms. They are low in nutrients and are not capable of supporting large fish populations. However, these lakes often develop a food chain that can sustain a very desirable fishery of large game fish. Eutrophic lakes have poor water clarity, are high in nutrients, and support a large biomass of aquatic plants and animals. They are usually either weedy or subject to frequent algae blooms, or both. Although capable of supporting large fish populations, these lakes are also susceptible to oxygen depletion. Rough fish are commonly found in eutrophic lakes. Mesotrophic lakes lie between the oligotrophic and eutrophic stages. Devoid of oxygen in late summer, their hypolimnions limit cold water fish and cause phosphorous cycling from sediments. It is important to recognize that a natural aging process occurs in all lakes that cause them to become shallower and increasingly eutrophic over time. However, people can accelerate the eutrophication process by engaging in activities that allow greater quantities of nutrients to enter the lake.

Trophic status is determined by correlating three water quality parameters--phosphorus concentration, chlorophyll *a* concentration and Secchi transparency. The trophic status of Lake Ripley fluctuates between mesotrophic and eutrophic (meso-eutrophic). This equates to a trophic state index (TSI) value that is greater than or equal to 50. A similar lake left undisturbed would maintain a TSI value of about 40. The trophic status of Wisconsin lakes based on chlorophyll a, Secchi depth, and total phosphorus values is presented in Table 1 below.

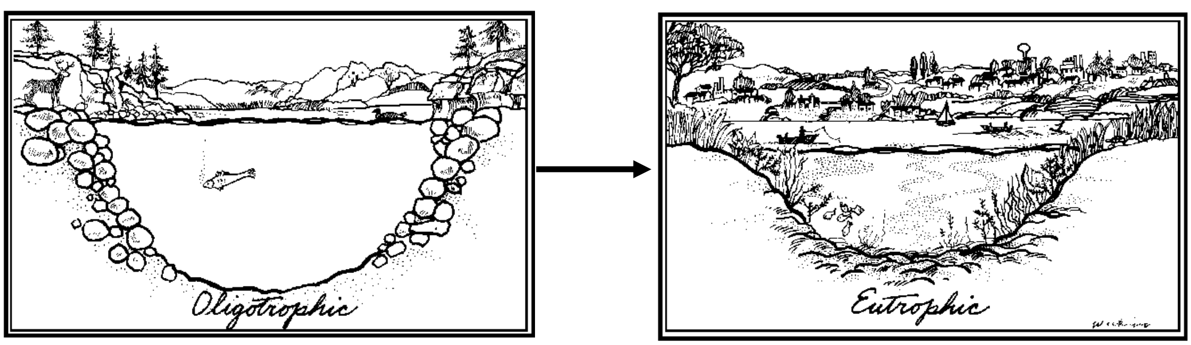


Table 1: Trophic classification of Wisconsin lakes based on total phosphorus, chlorophyll a, and Secchi depth values.

(Adapted from Lillie and Mason, 1983.)

Trophic Level	Trophic State Index	Total Phosphorus (mg/l)	Chlorophyll *a* ([g/l)	Secchi Depth (meters)
Eutrophic				
------------------------	-----------50----------	--------0.017----------	-----------7.4----------	-----------2.0----------
Mesotrophic				
------------------------	-----------40----------	--------0.005----------	-----------2.0----------	-----------4.0----------
Oligotrophic				

2-10 LIMITING NUTRIENT

Phosphorus (P) and nitrogen (N) are the two nutrients that most directly influence plant and algae growth; the extent of which depends on the relative abundance and availability of each nutrient. These nutrients usually enter lakes in the form of polluted runoff that may contain sediment, manure, pet waste, chemical fertilizers, and organic debris, among others. The erosion of stream banks, construction sites, shorelines and farmland all contribute sediment and nutrients to downstream lakes. Failing septic systems around smaller, unsewered lakes can also contribute significantly to nutrient-loading problems.

Plants need both phosphorus and nitrogen to grow. However, phosphorus minimization is generally the focus of lake-management programs because it is (1) most frequently the limiting nutrient that controls the rate of algae growth, and (2) it is easiest to manipulate since the element has no gaseous component in its biogeochemical cycle. N:P ratios are used to determine which nutrient most "limits" or controls algae productivity by comparing the relative availability of each nutrient within the water column. A limiting nutrient is an element that is critical to the growth of primary producers, but is found in short supply relative to other required elements found in a particular water body. Because the essential nutrient is in short supply, it effectively limits the amount of primary productivity the lake is capable of supporting. A N:P ratio greater than 15:1 near the surface may generally be considered phosphorus limiting; a ratio from 10:1 to 15:1 indicates a transition situation; and a ratio less than 10:1 usually indicates nitrogen limitation. Lakes with intermediate ratios could be limited from time to time by either element, but by reducing phosphorus availability, phosphorus could be made the limiting factor.

The limiting nutrient for algae growth in Lake Ripley is predominantly phosphorus. This is not surprising since phosphorus is the key nutrient affecting the amount of algae and weed growth in the vast majority of Wisconsin's lakes. According to the 1994 Water Resources Appraisal, phosphorus sources to the lake include watershed inflow (83%), direct precipitation (9%), and groundwater inflow (8%). The lake bottom may also be a significant source of phosphorus. Phosphorus is commonly released from nutrient-rich bottom sediment as a result of physical disturbance, high pH levels, and/or anoxic conditions. This phosphorus may cause noxious algae blooms, especially when it is mixed throughout the water column during the summer growing season.

Knowledge of the phosphorus content of sediment in various locations along the lakebed is useful in identifying potential "hot spots" that are most likely to contribute the largest amounts of nutrients to the lake. This information can be used to determine whether management techniques such as dredging and alum treatments will effectively correct a potential in-lake, nutrient-recycling problem. Sediment cores are generally taken at certain locations in a lake to better characterize the depth and distribution of nutrient-rich bottom sediments. In addition, total phosphorus concentrations at the top and bottom of the water column can be compared. These measurements can suggest whether phosphorus is actually collecting in the anoxic hypolimnion from sediment releases during the summer stratification period. Total phosphorus data were available from the surface and bottom of Lake Ripley for the summers of 1993, 1996, 1997, 1998 and 1999. Results indicate average lake-surface values of 0.02 mg/l, and average lake-bottom values of 0.09 mg/l. These findings suggest sediment phosphorus release is occurring during summer stratification. However, relative to other lakes with confirmed nutrient recycling problems, the deep-water phosphorus accumulation in Lake Ripley is comparatively small.

Total phosphorus concentrations and associated trophic state indices from 1986-1999 are illustrated in Figures 6 and 7 below. When phosphorus concentrations exceed 0.025 mg/l at the time of spring turnover in natural lakes and impoundments, these water bodies may occasionally experience excess growth of algae or other aquatic plants. In hard water lakes like Lake Ripley where limestone is dissolved in the water, marl (calcium carbonate) precipitates and falls to the bottom. These marl formations absorb phosphorus, reducing its overall concentration as well as algae growth. Hard water lakes often have clear water, but may be weedy since rooted aquatic plants can still get phosphorus from the sediments.

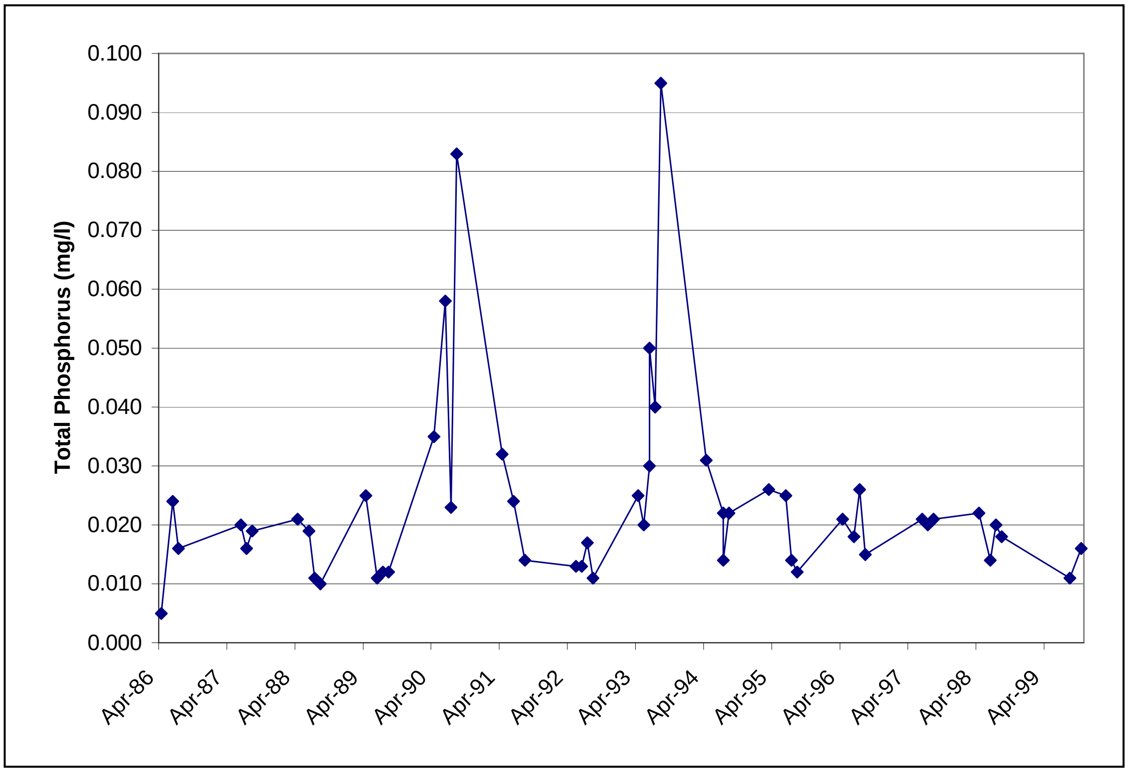


Figure 6: Total Phosphorus Measurements (1986-1999)

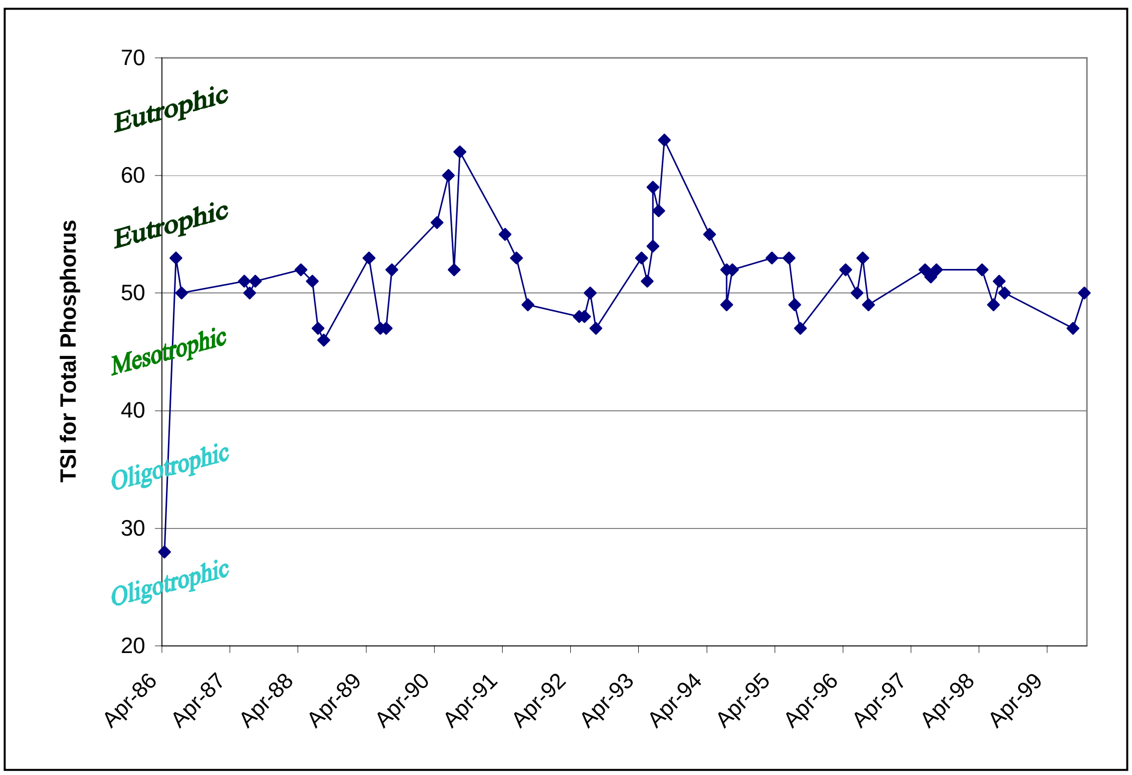


Figure 7: Trophic State Indices Based on Corresponding Phosphorus Readings (1986-1999)

2-11 PHYTOPLANKTON (ALGAE)

Phytoplankton is a scientific term used to describe free-floating, microscopic plant life, more commonly known as algae. Algae are the primary producers that form the base of the aquatic food chain. The amount of sunlight and nutrients that are available in a lake, among other factors, will dictate algae abundance. In eutrophic lakes, high nutrient fertility can cause nuisance algae blooms that make the water appear very green and murky. Blue green algae (cyanobacteria) are even known to produce a floating green scum thick enough to shade out aquatic plants. High concentrations of wind-blown algae may accumulate on shorelines where they die and decompose, causing noxious odors, unsightly conditions and oxygen depletion.

Controlling nuisance algae populations in lakes is a difficult undertaking. Because algae are microscopic plants that are free-floating and even free-swimming in the water column, managing the whole lake rather than just the problem areas is necessary. Since algae populations are caused by high nutrient concentrations, attempting to eliminate algae by attacking it directly with algacides (chemical herbicides) is a short-term solution that may become a costly management approach over the long run. The best way to manage excessive algae is to both reduce the flow of nutrients into the lake, and control the availability of nutrients that are already contained within the lake.

Chlorophyll *a*, the green pigment found in all photosynthesizing organisms, is commonly used as an indicator of algae biomass. Chlorophyll *a* values for Lake Ripley during the summer months are generally indicative of a eutrophic, or highly productive ecosystem, but occasionally were representative of a mesotrophic system. Chlorophyll *a* concentrations and associated trophic state indices from 1986-1999 are illustrated in Figures 8 and 9 below. There does not appear to be any obvious trends toward increasing or decreasing chlorophyll a concentrations over the 13-year monitoring period.

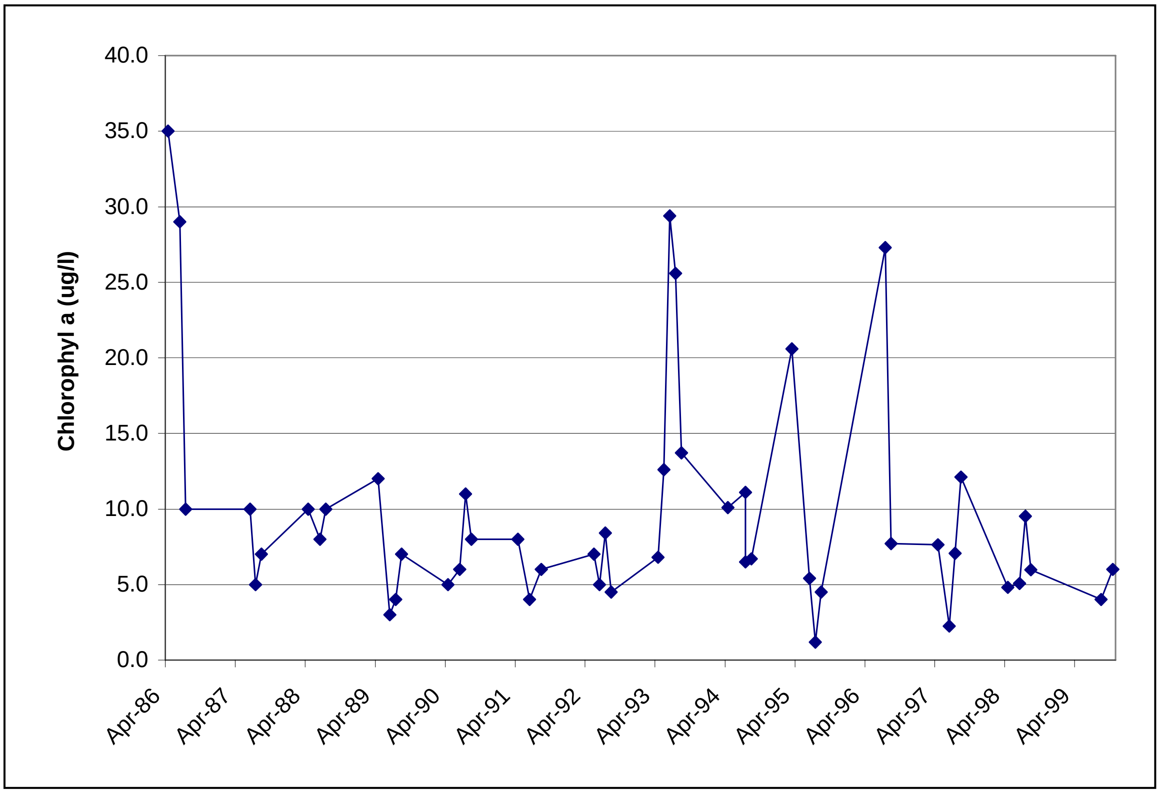


Figure 8: Chlorophyll a Measurements (1986-1999)

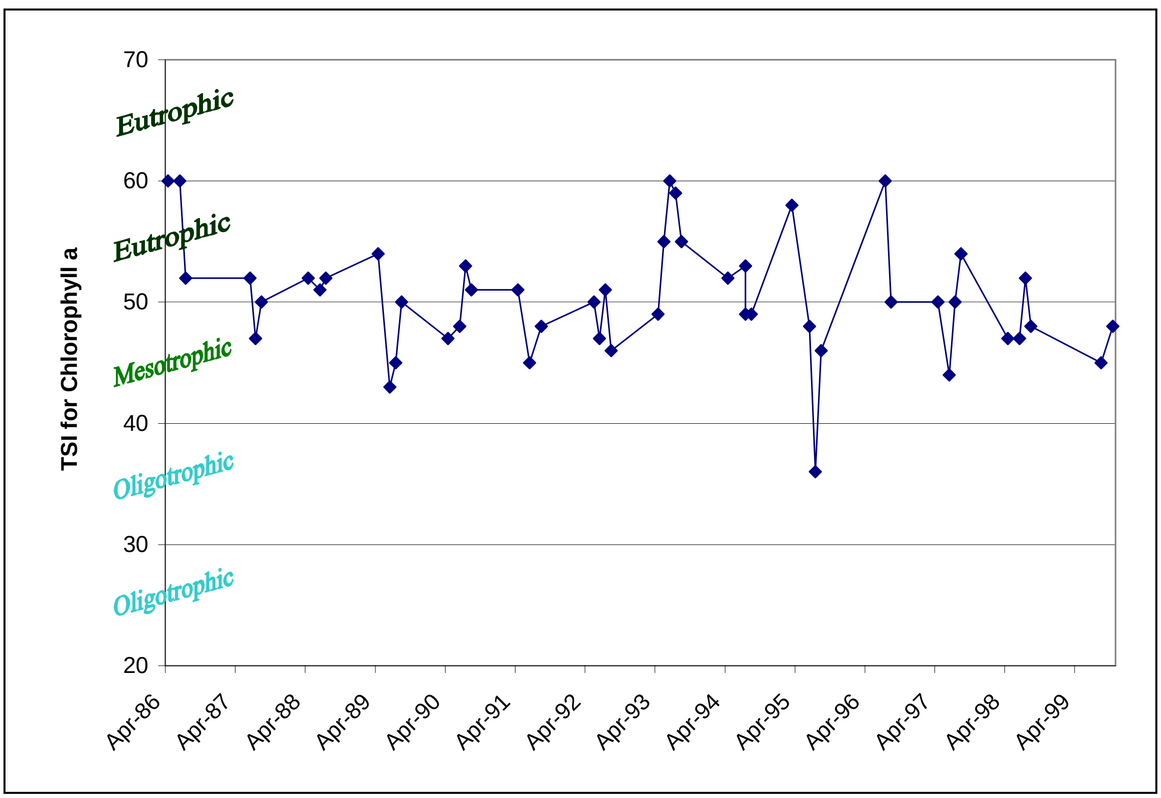


Figure 9: Trophic State Indices Based on Corresponding Chlorophyll a Readings (1986-1999)

2-12 WATER CLARITY

Water transparency measurements are taken with a device known as a Secchi disc, which is used to evaluate the clarity of a lake's water column. A Secchi disc is an eight-inch-diameter, black-and-white patterned plate that is lowered into the water until it reaches a depth at which it is no longer visible from the water surface. The recorded depth can be compared to values from other lakes and used as an indicator of overall water clarity.

Generally, sunlight can penetrate to a depth equal to 1.7 times the Secchi depth. The depth to which light is able to penetrate, the photic zone, roughly coincides with the depth where there is enough oxygen to support fish and other aquatic life. Transparency may be affected by factors such as turbidity (suspended sediment and particulate matter), water color, and free-floating algae cells. Secchi depth measurements are often used in conjunction with chlorophyll ***a*** and total phosphorus concentrations to determine a lake's trophic status and overall water quality condition.

Secchi-depth measurements for Lake Ripley and associated trophic state indices from 1986-2000 are illustrated in Figures 10 and 11 below. Over this timeframe, Secchi measurements ranged from 3-21 feet, with the majority of readings between 4 and 9 feet. These values are mostly indicative of a mesotrophic to eutrophic ecosystem. There does not appear to be any obvious trends toward increasing or decreasing water clarity conditions over the 14-year monitoring period.

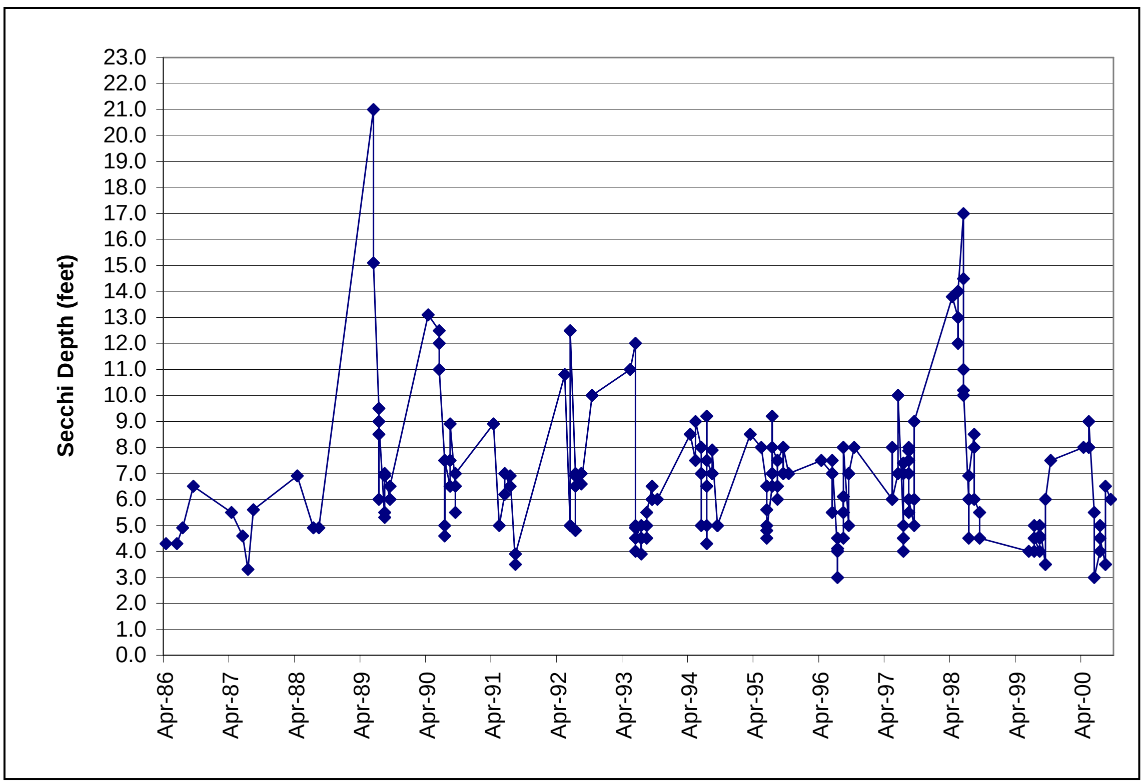


Figure 10: Secchi Depth Measurements (1986-2000)

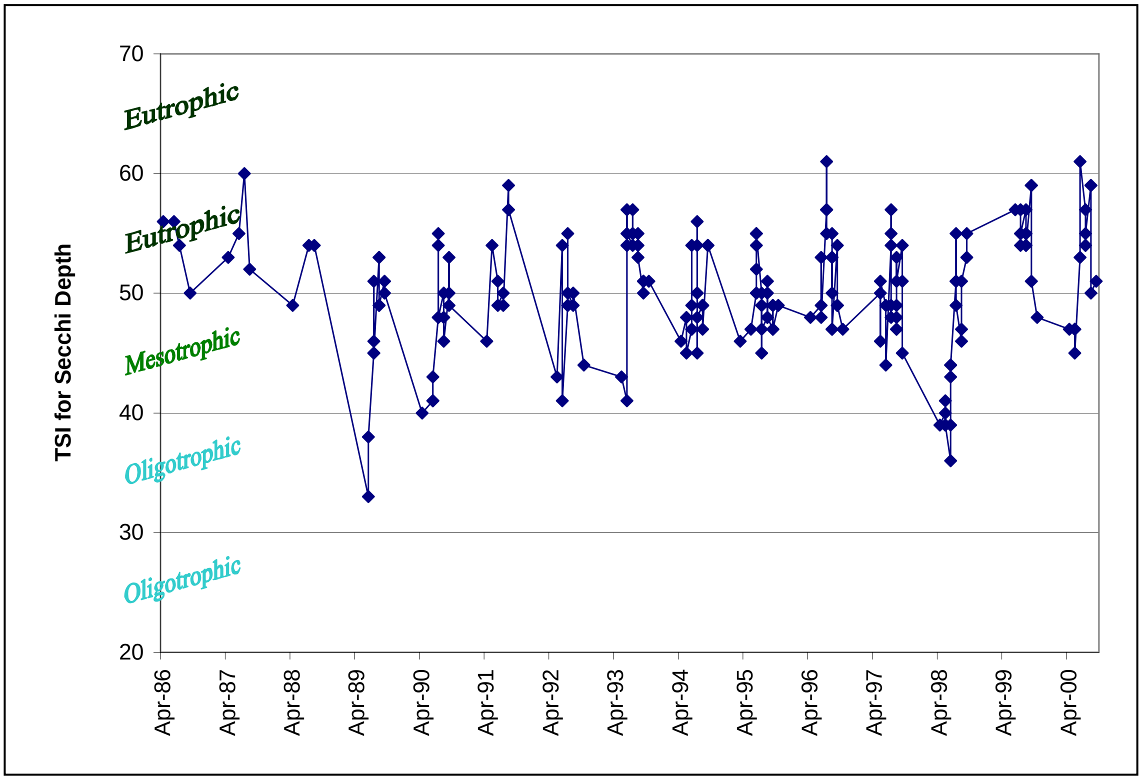


Figure 11: Trophic State Indices Based on Corresponding Secchi Readings (1986-2000)

2-13 WATER QUALITY INDEX

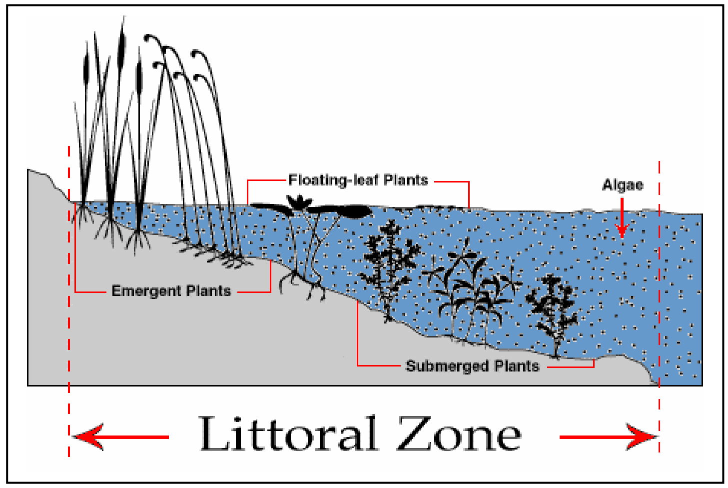
Lillie and Mason (1983) classified all Wisconsin lakes using a random data set collected in the months of July and August. The water-quality index that was developed is based on surface total-phosphorus and chlorophyll *a* concentrations and Secchi depths. Applying the water-quality index to Lake Ripley revealed that the measured surface total-phosphorus and chlorophyll *a* concentrations were generally indicative of "good" water quality, while Secchi depths were generally indicative of "fair" water quality. Table 2 shows the total phosphorus, chlorophyll *a* and Secchi depth ranges that correspond with each water quality ranking. Typical value ranges for Lake Ripley are highlighted in gray.

Table 2: Water quality index for Wisconsin lakes based on total phosphorus, chlorophyll a and Secchi depth values.

(Adapted from Lillie and Mason, 1983)

Water Quality Index	Total Phosphorus (mg/l)	Chlorophyll a ([g/l)	Secchi Depth (meters)
Excellent	<0.001	<1	>6.0
Very good	0.001-0.010	1-5	3.0-6.0
Good	0.010-0.030	5-10	2.0-3.0
Fair	0.030-0.050	10-15	1.5-2.0
Poor	0.050-0.150	15-30	1.0-1.5
Very poor	>0.150	>30	<1.0

2-14 LITTORAL ZONE



The relative abundance, distribution and types of rooted aquatic plants (called macrophytes), fish, and other aquatic organisms provide an excellent indicator of lake quality. For example, macrophyte composition and abundance are dependent upon many environmental variables, including water depth, water clarity and sediment type. Macrophytes are most prevalent in shallow lakes with nutrient-rich bottom sediments and extensive littoral zones. The littoral zone is the biologically productive portion of a lake that is able to support rooted plant growth. The depth at which sunlight is able to penetrate the water column in quantities necessary to promote photosynthesis determines the extent of the littoral zone. Uniformly shallow lakes will usually have the most significant littoral areas. However, deeper lakes that have extensive, irregular shorelines with lots of small bays and narrow channels may also support expansive littoral zones.

Lake Ripley's biologically productive littoral zone supports a diversity of flora and fauna, including several endangered species. Rare species found during a 1994 survey include the least darter, pugnose shiner, lake chubsucker, Blanding's turtle, bullfrog, cuckoo flower and black tern. Pollution and loss of habitat threaten these sensitive species which rely heavily on good water quality, functioning wetlands and a diverse aquatic plant community.

2-15 PLANT COMMUNITY

A diversity of native aquatic vegetation is the foundation of a healthy and balanced lake ecosystem. Such a situation is ideal for maintaining good water quality and wildlife habitat conditions. Plants provide nutrient buffers, stabilize bottom sediment, oxygenate the water during photosynthesis, provide shelter and spawning habitats for fish, act as refuges for zooplankton (algae consumers), and serve as food sources for wildlife. Aquatic plant growth is limited by factors such as sunlight availability and sediment type.

Degraded lakes are disturbed ecosystems characterized by too much or too little aquatic vegetation that is usually dominated by non-native, invasive "weeds." An absence of vegetation usually leads to poor water quality and a loss of fish and wildlife habitat. This situation favors an increase in algae growth and a reduction in water clarity. A different set of problems occurs when non-native aquatic weeds become overly abundant. This situation reduces native plant diversity, impedes certain recreational functions of the lake, stunts fish growth, and can cause dramatic fluctuations in dissolved oxygen levels. The decomposition of plant material is also shown to release nutrients that were previously tied up in the living plant tissues. Isolated areas in a lake where either native plant growth is sparse or a nuisance weed condition exists are excellent indicators of localized disturbances. Disturbances can be caused by pollution, sedimentation, motor boat damage, or the chemical eradication or over harvesting of plant beds.

Twenty-nine aquatic plant species were identified in Lake Ripley during a 1994 inventory. Most of these species are native and provide excellent habitat for wildlife, fish and aquatic life. Examples of high value plants include water lilies, bulrushes and pondweeds. Eurasian watermilfoil, on the other hand, is a nuisance species that is not native to Wisconsin. Under the right conditions, this exotic invader will out-compete native plants and form monotypic stands of dense vegetation. Such prolific growth can eventually reduce biological diversity and restrict recreational use of the water. Although residents have complained of nuisance weed growth over the years, recreation has fortunately not substantially suffered as a result. An exception occurred in 1989 when Eurasian watermilfoil reached peak growth conditions and occupied roughly 40% of the lake surface area. This milfoil explosion was the impetus for property owners to form the Lake Ripley Management District the following year. Since 1991, Eurasian watermilfoil has not been a severe nuisance, which reflects the efforts of an ongoing mechanical harvesting program and the cyclical nature of milfoil populations. Refer to the most recent Lake Ripley Aquatic Plant Management Plan (Appendix F) for more information pertaining to Lake Ripley's aquatic plants.

2-16 FISHERIES

Lake Ripley has long been considered one of Wisconsin's finest largemouth bass lakes, and is famous for producing the state record in 1940 (11 pounds, 3 ounces.). In addition to largemouth bass, a 1982 Wisconsin Fish Distribution Study found the lake to support as many as 33 other fish species. However, recent fish surveys suggest a declining trend in diversity, and a corresponding increase in carp numbers. In 1946, it was reported that bluegills, walleyes, northern pike, largemouth bass, yellow perch, crappies, and bullheads were major contributors to the sport fisheries. During the 1950s and early 1960s, the former Wisconsin Conservation Department removed bowfin (dogfish) and longnose gar from Lake Ripley as "rough fish", but fisheries managers have come to appreciate the importance of these species for aquatic diversity and control of slow-growing panfish and young carp. The lake has been stocked with an average of 21,000 walleye fingerlings every two years since 1986. Walleye stocking is intended to supplement natural reproduction and control the stunted perch population. Current fisheries management focuses on sustaining largemouth bass, which is considered the primary gamefish in the lake. Management efforts are also directed toward protecting existing shoreland wetlands to enhance northern pike spawning.

Annual fisheries surveys have been performed on Lake Ripley since 1992 (Appendix G). Survey results indicate no obvious trends toward increasing or decreasing sport fishery populations. The most diverse species assemblage was consistently found in the South Bay area. This particular location is characterized by a relatively diverse native plant community and less shoreline development. The presence of wetland and aquatic vegetation is a key element providing cover, spawning sites and structure for fish. Water lilies are particularly abundant within the bays, and their rhizomes provide the critical firm substrate for bass nests. Survey results are summarized for the largemouth bass and walleye fisheries in Figure 12 and 13 (respectively) below. The graphs depict the minimum, maximum and average lengths that were surveyed from 1992-2000, as well as the number of fish caught per hour of sampling, referred to as "Catch Per Unit of Effort" (CPUE). Size-frequency distributions were representative of similar lakes in Southern Wisconsin. No unusual trends were evident.

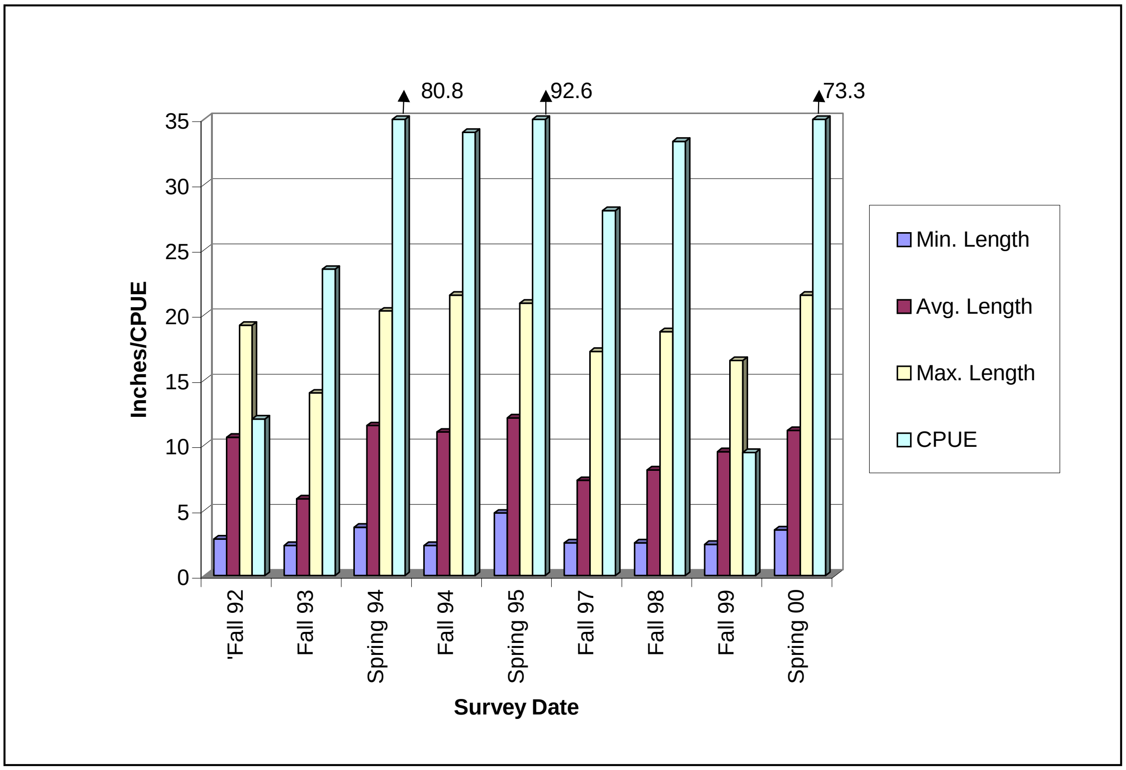


Figure 12: Fishery Survey Results for Largemouth Bass (1992-2000)

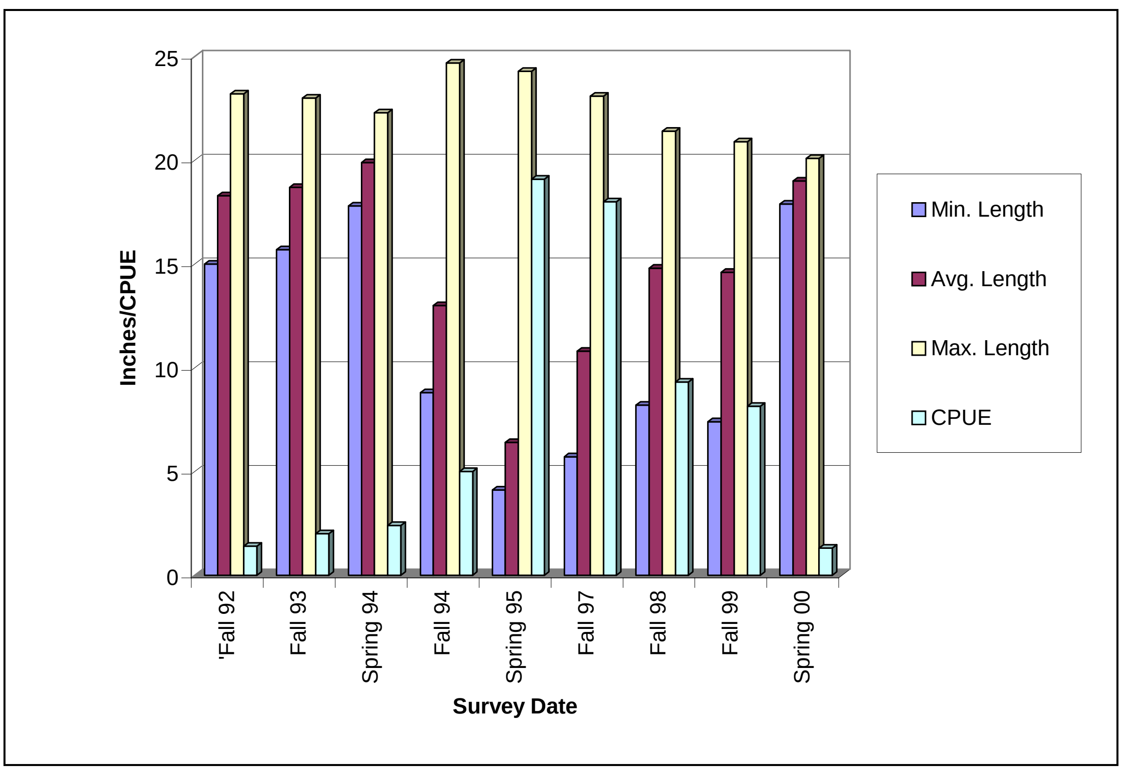


Figure 13: Fishery Survey Results for Walleye (1992-2000)

2-17 DISSOLVED OXYGEN & TEMPERATURE

Dissolved oxygen is one of the most critical factors affecting lake ecosystems, and is essential to all aquatic organisms that require aerobic conditions to live. The solubility of oxygen is dictated by water temperature. Basically, the colder the water temperature, the more oxygen it is able to hold in solution. Dissolved oxygen is also more abundant in water that is well mixed and in greater contact with the atmosphere. Areas in a lake that support photosynthesis will further enhance dissolved oxygen levels during daylight hours. This helps explain why oxygen levels fluctuate throughout the water column depending on variables such as time of day, water depth, clarity and temperature. When dissolved oxygen concentrations become depleted, the survival of fish and other oxygen-dependent aquatic life becomes compromised. The water quality standard for oxygen in "warm water" lakes is 5.0 mg/l, which is the minimum amount of oxygen needed for most fish to survive and grow. Dissolved oxygen measurements taken at the inlet during the 1999 sampling period showed values generally ranging from about 7.0 to 10.0 mg/l. However, oxygen levels fell to a low of 2.0 mg/l during late summer.

The amount of oxygen present within the hypolimnion of deeper lakes plays an important role in the mobilization of nutrients from the bottom sediments into the surrounding water column. Phosphorus can be chemically converted into a more soluble state and released from bottom sediments when the overlying water becomes devoid of oxygen, or anoxic. These anoxic conditions commonly occur within the hypolimnions of deeper, eutrophic lakes where the rate of decomposition and bacterial respiration exceeds the rate of photosynthesis and natural aeration. For instance, as thermal stratification isolates the hypolimnion from the atmosphere, the surface supply of oxygen from the atmosphere is sealed off. The remaining dissolved oxygen is often rapidly consumed when respiration rates increase due to excessive decomposition of organic material that settles to the bottom. As anoxia develops, phosphorus contained in the sediments chemically converts into a more soluble state, migrating from the sediments to the surrounding water. When the lake eventually destratifies (mixes), any nutrients that were released from the bottom sediments are transported throughout the water column where they become available for algae growth. It should be noted that anoxic conditions are also capable of developing in weedy, shallow lakes, especially during non-daylight hours when bacterial and microbial respiration is likely to exceed photosynthesis.

2-18 ACIDIFICATION

pH measures the concentration of hydrogen ions in a lake. Lower pH waters have more hydrogen ions and are more acidic than higher pH waters. A pH of 0 indicates that a particular water sample is highly acidic, while a pH of 14 suggests a highly basic sample (7 is considered neutral). Every 1.0 unit change in pH represents a tenfold change in hydrogen ion concentration. Therefore, a lake with a pH of 6 is ten times more acidic than a lake with a pH of 7.

Low pH is shown to increase the solubility of certain metals that can become toxic in higher concentrations, such as aluminum, zinc and mercury. It is also harmful to the survivability of fish and other aquatic organisms. In Wisconsin, pH ranges from 4.5 (acid bog lakes) to 8.4 (hard water, marl lakes like Lake Ripley). Lakes having good fish populations and productivity generally have a pH between 6.7 and 8.2. Lower pH lakes are often found in the northern part of the state where acid rain has a greater impact on surface waters due to the limited buffering capacity of regional soils. Natural, unpolluted rainfall is relatively acidic, and typically has a pH of between 5 and 6. However, rainfall varies from a pH of 4.4 in southeastern Wisconsin to nearly 5.0 in northwestern Wisconsin. Fortunately, naturally acidic precipitation is usually neutralized as it is exposed to acid-buffering carbonates in the environment.

The amount of dissolved carbon dioxide in a lake, which is influenced by photosynthesis and respiration processes, generally affects pH levels. For instance, as carbon dioxide levels increase, pH will correspondingly decrease, and vice versa. Water chemistry data indicate that the pH of Lake Ripley and its inlet tributary generally range from about 7.2 to 9.3, with most readings falling between 7.8 and 8.9. These values are common for southeastern Wisconsin lakes, and indicate that the system is well buffered from acidification. Acidity effects on different fish species is presented in Table 3 below.

Table 3: Effects of acidity on fish. (Adapted from Olszyk, 1980)

Water pH	Effects
6.5	Walleye spawning inhibited
5.8	Lake trout spawning inhibited
5.5	Smallmouth bass disappear
5.2	Walleye, burbot, lake trout disappear
5.0	Spawning inhibited in many fish
4.7	Northern pike, white sucker, brown bullhead, pumpkinseed sunfish, rock bass disappear
4.5	Perch spawning inhibited
3.5	Perch disappear
3.0	Toxic to al fish

2-19 ALKALINITY & HARDNESS

A lake's hardness and alkalinity are each affected by the types of minerals found within the watershed's soils. Hardness and alkalinity increases the more the lake water comes into contact with minerals containing bicarbonate and carbonate compounds. These compounds are usually found with two hardness ions: calcium and magnesium. If a lake receives groundwater from aquifers containing limestone minerals such as calcite and dolomite, hardness and alkalinity will be high. High levels of hardness (>150 mg/l) and alkalinity can cause marl (calcium carbonate) to precipitate out of the water. Hard water lakes like Lake Ripley tend to be more productive and support larger quantities of fish and aquatic plants than soft water lakes. They are also usually located in watersheds with fertile soils that add phosphorus to the lake. As a balancing mechanism, however, phosphorus precipitates with marl, thereby controlling algae blooms. If the soils are sandy and composed of quartz or other insoluble minerals, or if direct rainfall is a major source of lake water, hardness and alkalinity will be low. Lakes with low amounts of alkalinity are more susceptible to acidification by acid rain and are generally unproductive.

Lake Ripley has high alkalinity and "low" sensitivity to acid rain due to its significant buffering capacity. It is also classified as a marl lake with "hard" to "very hard" water. Table 4 shows relative hardness levels for lakes with varying concentrations of calcium carbonate (CaCO3). Table 5 shows relative sensitivity levels of lakes to acid rain based on alkalinity values.

Table 4: Categorization of hardness by mg/l of calcium carbonate (CaCO3).

Level of Hardness	Total Hardness as mg/l CaCO3
Soft	0-60
Moderately hard	61-120
Hard	121-180
Very Hard	>180

Table 5: Sensitivity of lakes to acid rain based on alkalinity values. (Adapted from Taylor, 1984)

Sensitivity to Acid Rain	Alkalinity (ppm CaCO3)	Alkalinity (ueq/l CaCO3)
High	0-2	0-39
Moderate	2-10	40-199
Low	10-25	200-499
Nonsensitive	>25	>500

2-20 PALEOLIMNOLOGY

The water quality history of a lake is often preserved within the deep-water sediment profile. Several types of plankton (microscopic plants and animals) are useful water quality indicators and are preserved as fossils within the bottom substrate. In addition to the fossil records, pollutants and sedimentation rates are also preserved in the bottom sediment. The top sediment layers were deposited recently while deeper sediments represent historic lake conditions. Specific layers are dated using a naturally occurring radionuclide, Pb210. This type of analysis is called paleolimnology.

A paleolimnological study was conducted on sediment cores taken from the bottom of Lake Ripley in 1992. The purpose of the study was to determine historic changes in water quality conditions by evaluating lake-bottom stratigraphy. Key findings indicate that the lake's water quality began to degrade around 1870 as a result of European settlement and subsequent watershed development and wetland drainage. By the end of the century, watershed erosion had dramatically increased sediment loading to the lake, causing a corresponding increase in plant and algae production. Watershed erosion rates continued to increase until about 1950 when they stabilized and even declined beginning around 1960. Around 1970, nutrient runoff to the lake increased once again, most likely from residential development, and the lake's water quality again declined. Sediment cores indicate that the present water quality of the lake is worse than at any other time in the last 250 years.

Since significant portions of the watershed have been permanently altered, it would not be feasible for the lake to return to pre-settlement conditions. However, at a minimum, the lake can be protected from further degradation by reducing phosphorus inputs and protecting groundwater, wetlands and habitat. For more information, refer to the complete paleoecological study found in Appendix H.

CHAPTER NOTES:
A summary of the lake and watershed's physical, chemical, biological & demographic characteristics is included in Table 6 below. Additional water quality information can be found in the Lake Ripley Water Resources Appraisal completed by the Wisconsin Department of Natural Resources and Lake Ripley Management District in 1994 (see Appendix I).

Table 6: Summary of physical, chemical, biological & demographic characteristics.

PHYSICAL DESCRIPTION	
Origin of lake:	Glacial kettle
Lake type:	Drainage (w/ one inlet & one unregulated outlet)
Surface area:	418 acres
Shoreline length:	4.85 miles
Mean depth:	18 feet
Maximum depth:	44 feet
Volume:	7,561 acre-feet
Hydraulic residence time:	1.17 years
Thermal stratification:	Dimictic (twice mixing)
Summer anoxic zone:	20-44 foot depths
Shoreline development index (lake shape):	1.7 (circle=1; number increases as lake irregularity increases)
Number of bays:	2
Inlet/outlet flow rates:	4.9/8.9 cubic feet per second (average annual for 1993)
Groundwater contribution:	30-45%
Watershed size:	8 square miles (5,120 acres)
Watershed-to-lake surface area ratio:	12:1
Watershed land uses:	70% agriculture, 30% residential, 30% wetland/woodland
Wetlands:	385 acres (1,500 acres in 1908)
Major soil associations:	Houghton-Adrian, and Fox-Casco-Matherton
Topography:	Mostly flat to gently rolling terrain

Inlet stream/main ditch length:	4.25 miles (2.5 miles in 1907)
Sediment loading sources:	Ditches (75%), shorelines (7%), construction sites (13%), cropland (4%), existing urban (1%)
Sedimentation rate:	1.3 centimeters/year
Public lake access:	1 improved boat launch
Sewer:	Municipal sewage treatment system
CHEMICAL & BIOLOGICAL DESCRIPTION	
Nitrogen to phosphorus ratio:	>27:1 (1993 average)
Limiting nutrient:	Phosphorus
Nutrient sources:	Watershed runoff (83%), atmospheric (9%), groundwater (8%)
Trophic status:	Upper-mesotrophic to eutrophic
Water quality indices:	Total phosphorus ("Good"); chlorophyll *a* ("Good"); Secchi transparency ("Fair")
Nutrient sensitivity:	Low
Alkalinity & hardness:	High
Acidification sensitivity:	Low
Winter fish kill sensitivity:	Very low
Sport fisheries:	Largemouth bass, walleye, northern pike, panfish
Total fish species:	34 (1982 inventory)
Total aquatic plant species:	22 (1989 & 1991 inventories)
DEMOGRAPHIC DESCRIPTION (1998 Data)	
Watershed parcels & residences:	1,118 parcels; 689 residences
Lake district parcels & residences:	1,174 parcels; 819 residences
Lakefront parcels & residences:	175 parcels; 141 residences
Lake district assessed valuation:	$123,832,425 (1999)

CHAPTER 3: MANAGEMENT STRUCTURE & HISTORY

3.1 OVERVIEW

Lake Ripley is a popular resource enjoyed by both residents and tourists alike. This popularity for a relatively small lake increases the chances of user conflicts between passive and active forms of recreation. Intense lake usage and development pressures have also disrupted the ecological stability of Lake Ripley over the years. Water quality has subsequently suffered, and residents have periodically complained about excessive algae and aquatic weed growth. In 1989, an invasive weed known as Eurasian watermilfoil reached peak nuisance conditions by taking over about 40% of the lake's surface area. The milfoil encroachment exacerbated existing recreational impediments, and eventually led to the formation of a lake management district to combat the problem and protect the health of the resource.

3.2 LAKE RIPLEY MANAGEMENT DISTRICT

The Lake Ripley Management District (LRMD) was formed in 1990 under Chapter 33 of the Wisconsin Statutes. It is a local, special-purpose unit of government that serves close to 1,500 year-round and seasonal property owners located around the lake. District boundaries contain major portions of the immediate drainage basin, and closely follow the Oakland Sanitary District boundaries (see Figure 14 below). The LRMD is charged with conducting any work in Lake Ripley and its watershed that would protect or enhance the opportunities for public enjoyment of the lake. A seven-member board of directors administers Lake District activities. The board includes five elected residents, as well as appointed representatives from Oakland Township and Jefferson County.

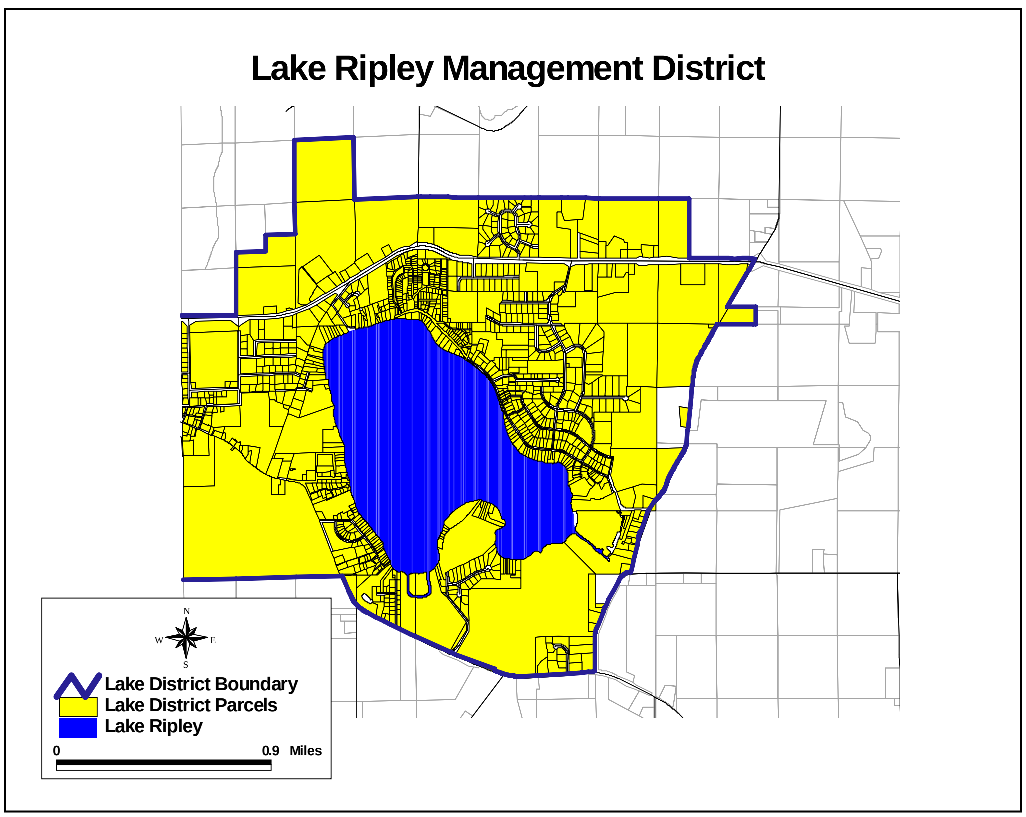


Figure 14: Lake Ripley Management District

Operational funding may be derived from a combination of local tax dollars, grant awards, private donations, and special assessments or charges. The LRMD is authorized to levy a maximum of 2.5 mils to finance projects that maintain and improve the quality of life in and around Lake Ripley. Since its inception, however, a 0.5 mil tax rate has not been exceeded as of the date of this report. As noted earlier, the LRMD represents about 7% of the total land area in Oakland Township, but accounts for 65% of the township's total assessed valuation (based on 1999 assessment figures).

3.3 LAKE RIPLEY PRIORITY LAKE PROJECT

Beginning in 1992, Lake Ripley was targeted as a "Priority Lake Project" through the Wisconsin Department of Natural Resources' (WDNR) Non-point Source Water Pollution Abatement Program. This designation was received upon recognizing that (1) the lake was a valuable recreational and economic amenity, (2) it was significantly threatened by the effects of non-point source pollution, and (3) there was a high potential for overall improvement once appropriate pollution-control measures were implemented. As such, the WDNR provides the LRMD with technical and financial assistance for the purpose of protecting and improving water quality through the reduction of non-point source pollution.

The project is administered jointly by the WDNR and Department of Agriculture, Trade & Consumer Protection at the state level, and implemented by the LRMD at the local level. State grants are used to retain professional staff and provide cost-share assistance for the installation of eligible Best Management Practices. The Jefferson County Land & Water Conservation Department and University of Wisconsin-Extension provide ongoing technical assistance. The Lake Ripley Priority Lake Project includes an initial three-year planning phase and at least a 10-year implementation phase that is scheduled to wrap up in 2006. Primary objectives include the following:

- Reduce the amount of phosphorus and sediment entering the lake by 30% and 50%, respectively.
- Minimize the effects of eutrophication.
- Prevent further wetland loss or disturbance.
- Increase wetland acreage in the watershed, and vegetated buffer strips along drainage routes.
- Preserve undeveloped shoreline areas as water quality buffers and wildlife refuges.
- Promote natural shorelines by planting native vegetation.
- Protect designated lake sensitive areas.
- Promote native aquatic plant communities.
- Protect the fishery and wildlife diversity within the lake and watershed.
- Protect groundwater resources.

3.4 MANAGEMENT HISTORY

Since organized management started on Lake Ripley in the early 1990s, over a half-million dollars in outside funding has been obtained to help finance lake protection and improvement projects. This figure is projected to double within the next several years, primarily for the purpose of financing the administration and cost-share efforts of the Lake Ripley Priority Lake Project. Major achievements over the past decade include the following:

1. Formation of the Lake Ripley Management District
2. State-supported acquisition and operation of a mechanical weed harvester to manage aquatic vegetation and control nuisance Eurasian watermilfoil growth
3. First Lake District in Wisconsin to receive State-funding for the implementation of a "Priority Lake Project" to control non-point source pollution
4. Completion of numerous erosion-control and watershed protection cost-share projects, including one of the first shoreline bioengineering projects in Wisconsin
5. Completion of numerous, State-financed resource inventories and water quality studies

6. Long-standing partnership with Cambridge High School to conduct regular "Lake Sweep" clean-ups, water-quality testing, and community education programs
7. Renovation of the public boat launch
8. Recognition by the Wisconsin Association of Lakes for accomplishments in the area of lake management and stewardship
9. Protection of sensitive aquatic and shoreline habitat through development of local ordinances that preserve these critical areas (e.g. no-wake zones & pier-development restrictions)
10. Acquisition of the 99-acre Lake District Preserve to protect and restore wetland and prairie habitat
11. First Lake District in Wisconsin to create a volunteer "Lake Watch" to assist enforcement efforts and monitor lake rule violations
12. Development of a Comprehensive Lake Management Plan to guide decision-making over the next several years and beyond

A more detailed list of some of Lake Ripley's landmark historical events is presented in Table 7 below. This list is not exhaustive, and is based on the completeness and accuracy of available historical documents.

Table 7: Landmark historical events on Lake Ripley.

DATE	EVENT
1907	Ole Evinrude, founder of Evinrude Outboard Motors, tests some of his first motors on Ripley
1940	The state record largemouth bass (11 lbs., 3 oz.) is caught on Lake Ripley
Circa 1940	O.H. Perry Sr. donates 41 acres of wetlands adjacent to the Lake Ripley inlet to the DNR
1964	Vasby's channel is privately excavated at the southern tip of South Bay
1984	A municipal sewer system is installed around most of the lake
1986	Lake Ripley is selected by the DNR as one of 50 lakes statewide to receive long-term trends monitoring for water quality
1989	Lake residents purchase a weed harvester to combat Eurasian watermilfoil invasion
1990	Formation of Lake Ripley Management District
1991	-DNR Lake Planning Grant received to perform paleolimnological analysis of sediment cores; -Mike Spellman (LRMD Chair) receives certificate of appreciation from the governor
1992	-LRMD becomes first in Wisconsin to administer a DNR-funded "Priority Lake Project"; -DNR Lake Planning Grant received to conduct a fishery inventory; -An Aquatic Plant Management Plan is developed for Lake Ripley; -A lake resident survey is taken to solicit public opinions and concerns about the lake; -The LRMD partners with Cambridge High School to do annual water quality studies
1993	-Lake Ripley is identified by the DNR as an outstanding resource needing long-term protection; -The first edition of the Ripples newsletter is produced; -A detailed lake and watershed inventory is conducted as part of the Priority Lake Project
1994	-Watershed landowners begin signing up for cost-share assistance via the Priority Lake Project; -The public boat launch is renovated using state and federal grant monies; -WAL awards the LRMD an "Outstanding Lake Stewardship Certificate of Appreciation"; -A new weed harvester is purchased using a DNR Waterways Commission Grant; -A Lake Ripley Water Resources Appraisal is completed
1995	-The Nonpoint Source Pollution Abatement Plan is approved for the Priority Lake Project; -The LRMD is awarded a lake stewardship award from Wisconsin Association of Lakes (WAL); -Local ordinance passed restricting pier construction along sensitive shoreline habitat areas; -Local ordinance passed prohibiting the use of motors in Vasby's Channel to protect spawning
1996	-An opinion survey is conducted regarding slow-no-wake restrictions and jet ski use; -A study is conducted researching the effect of shallow-water motor boating on aquatic habitat
1997	-99-acre Lake District Preserve is purchased using DNR Lake Protection Grant and donations; -Local ordinance passed prohibiting the burning of yard waste in specific areas near the lake
1998	-The volunteer "Lake Watch" program is started to monitor lake rule violations;

	-John Molinaro (LRMD Chair) joins the Lake Leaders Institute sponsored by WAL; -Wetland and prairie restoration activities begin at the Lake District Preserve
1999	-DNR Lake Planning Grant received to develop a Comprehensive Lake Management Plan; -A lake district resident opinion survey and public hearings are conducted to identify problems and management priorities
2000	Lake Ripley Management Plan is completed with multi-year action strategy

CHAPTER 4: PUBLIC PRIORITIES & NEEDS ASSESSMENT

4-1 INTRODUCTION

Actively involving the public is important in facilitating the identification and prioritization of desired lake uses and problems. In addition, public involvement helps educate users about the lake ecosystem, their role in contributing to certain problems, and the actions they can take to reduce or eliminate the severity of these problems. Greater understanding and awareness of problems will generally lead to increased cooperation in their solution and thus a greater likelihood of program success.

It is important to recognize that a lake cannot be all things to all people, and that lake uses often conflict and must be separated. Therefore, desired lake uses and values must be prioritized based on considerations such as level of lake resident support, and feasibility of attainment given the nature of the lake environment. Prioritizing is commonly used to resolve mutually exclusive recreational desires and management goals. It also reduces the likelihood that any random interest group would be able to unduly influence the decision-making process by making false claims of "need" or "resident support."

Public opinions pertaining to lake-use preferences and perceived problems were evaluated using feedback from surveys and public hearings. Surveys included the following:

- 1999 – Comprehensive survey of LRMD residents (Appendix J)
- 1995 -- Boating opinion survey of LRMD residents (Appendix K)
- 1992 – Comprehensive survey of LRMD residents (Appendix L)

The purpose of these surveys was to determine the general feelings of the respondents regarding the lake, their impression of the overall management policies, and whether there were any suggestions regarding new policies or ideas for improving the lake.

4-2 PUBLIC SURVEY RESULTS

In the summer of 1999, a survey was developed and distributed to all property owners in the Lake Ripley Management District. The purpose of the effort was to engage public participation in the lake planning process by soliciting the opinions and concerns of Lake District residents regarding the lake and its management. Responses were used to help prioritize and rank desired lake uses, and to identify the problems jeopardizing the health and recreational value of the resource. Ultimately, 307 of 800 surveys were completed and returned for analysis, representing a 38% response rate. The high response rate exceeded expectations, and may be indicative of a prevalent interest to protect and enhance this valued resource. Results from the 1999 survey are presented below. Whenever appropriate, comparisons are made to past surveys to identify trends and changed perceptions.

DEMOGRAPHICS

The overwhelming majority of survey respondents are residential property owners living within one-quarter mile of Lake Ripley (81%). Permanent residents outnumber part-time residents by a ratio of 1.5:1. Those that identify themselves as having part-time residency status (39%) generally choose to spend time on the lake over weekends during the summer months. These part-timers primarily hail from Wisconsin and Illinois communities located within a 100-mile radius of Lake Ripley. Small community amenities, peace and tranquility, and recreational pursuits represent the top three reasons for purchasing property on or near Lake Ripley. The greatest percentage of respondents (37%) claim they owned property within the Lake District for more than 20 years. Although only Lake District residents were surveyed, many respondents (44%) either mistakenly think they are not members of the district, or give the impression they are uncertain by failing to respond to the question. (The above demographics are very comparable to those identified in the 1992 survey, with no significant deviations.)

User Preferences

A vast majority of the respondents (82%) feel Lake Ripley has adequate public access. In order of importance, popular lake-use activities include enjoying peace and tranquility, swimming, motor boating, appreciating lake views, and fishing. Clear water easily ranks as the most important attribute leading to an enjoyable lake-use experience, followed by peace/tranquility and overall ecosystem health. The use of personal watercraft such as jet skis ranks a distant 12th, with only 5% of the respondents ranking the activity among their top three choices. (These user preferences are similar to those revealed in the 1992 survey. No significant changes in user preferences were identified since the earlier survey was performed.)

Opinions on Existing Conditions

Sharing space on the lake does not appear to be a critical issue at this time. Respondents generally do not feel crowded on the lake during summer weekdays (62%), and only moderately crowded on summer weekends (42%). The overall water clarity of Lake Ripley during the summer months is most frequently described as cloudy (45%). This is a noticeable change from the 1992 survey when water clarity conditions were described as mostly clear (71%). Water clarity is perceived to be at its worst following heavy motor boat and personal watercraft traffic (63%). The amount of aquatic plant growth in Lake Ripley is perceived to be at a healthy level (43%), with some indication that nuisance weeds still pose a problem (27%). This is an improvement over the 1992 survey results when most respondents (57%) reported excessive plant growth. Among local anglers, the preferred fish species to catch on Lake Ripley are bluegill, largemouth bass and walleye. The quality of fishing is rated as fair (52%), with many anglers consistently practicing catch-and-release (48%).

Perceived Problems

The top three lake conditions that are perceived to have changed for the worse include personal watercraft traffic, boat traffic, and peace/tranquility, respectively. Boat and personal watercraft traffic also represent the number one factor for both contributing to problems on Lake Ripley <u>and</u> negatively impacting people's use and enjoyment of the lake. Specifically, concerns seem to mainly focus on problems associated with large horsepower motor boats and personal watercraft operating at imprudent speeds in near-shore, shallow-water areas. Other major factors negatively influencing the use and enjoyment of the lake include poor water clarity and noise. Finally, the runoff of fertilizers and pesticides into the lake is viewed as another major problem contributor.

Management Opinions

In 1992, most survey respondents felt the most important action to be taken was to develop a long-term management plan for the lake, followed by fish stocking and aquatic weed harvesting. These opinions led to a major walleye stocking and weed harvesting effort, and were used to support the development of the Lake Ripley Management Plan. The 1999 survey, on the other hand, seems to show a strong bias toward managing motor boat and personal watercraft traffic. Although most respondents feel there is an adequate law enforcement presence on Lake Ripley (57%), there is a widespread opinion that the use of personal watercraft should be more strictly regulated, mostly because of problems with noise and safety. Less than 9% of the respondents feel that personal watercraft use on Lake Ripley causes little or no problems. In reference to the placement of piers, most would <u>not</u> favor additional regulation (65%). It is generally felt that the lake is sufficiently regulated at the present time (54%); although about a quarter of the respondents believe the lake to be under regulated. Only 4% identify "too many boating restrictions" as a top factor negatively impacting their use and enjoyment of the lake.

A majority of the survey respondents (56%) favor expanding slow-no-wake <u>times and/or locations</u> for the purpose of promoting safety and protecting sensitive aquatic habitat. However, the 1995 boating opinion survey revealed a top preference for maintaining the slow-no-wake hours set forth in the existing ordinance (7:30 P.M. to 11:00 A.M.). This earlier survey also showed significant support for the inclusion of engine size restrictions, and more controls on the use of personal watercraft. In fact, a majority of these survey respondents (63%) were opposed to ANY use of personal watercraft on Lake Ripley. Other regulatory policy changes that were considered in the 1995 survey included designated slow-no-wake days, expanded/reduced no-wake hours, and an "electric motors only" policy. However, these proposed policy changes did not receive significant levels of support at the time of this earlier survey.

Only a slight majority of respondents (44% vs. 39%) believe they have a voice in decision-making matters pertaining to the management of Lake Ripley. A much stronger majority (61%) feels they are adequately informed of lake-management efforts and decisions. Newsletters, special mailers and newspaper articles, respectively, are considered the best means of communication between the lake management district and its members. This particular opinion was also expressed in the 1992 survey. As to who should be responsible for managing and financing lake-improvement activities, respondents most frequently point to the Lake Ripley Management District and Wisconsin Department of Natural Resources.

PUBLIC HEARING

A special public hearing was conducted in the spring of 2000 to present the above survey results and solicit additional public feedback. Approximately two dozen participants were available to verify the accuracy of the survey results, discuss certain topics in greater detail, and share additional concerns that were not previously addressed. Major discussion items centered on the perceived need for better enforcement of existing rules, too much non-resident access and use of the lake, and the problems associated with near-shore use of motor boats and personal watercraft. A signed petition was also received from a group of residents asking that buoys be placed around the lake to keep powerboats and jet skis in deeper water away from shore. The stated intention was to protect shallow-water habitat, and separate conflicting lake uses.

At the conclusion of the hearing, participants were asked if they felt a need to form a resident advisory committee for lake management planning purposes. It was suggested that such a committee would consist of representatives from different interest groups, and would be separate from the LRMD Board of Directors. Participants overwhelmingly rejected the need for a special public advisory committee for two reasons. First, it was felt that the survey and public meetings offered ample opportunity for resident participation in the process. And second, the current LRMD Board of Directors was viewed as an elected governing body that, by its nature, already represents a cross-section of interests.

4-3 MANAGEMENT IMPLICATIONS

Based on public input, management efforts should primarily focus on several key issue areas. Maintaining and improving water clarity while promoting a peaceful and tranquil lake setting represent obvious public priorities. Although swimming, motor boating and fishing all received high rankings as preferred lake-use activities, they each enjoy mutually exclusive conditions and require at least some degree of separation. Swimmers predominantly favor clear water and sandy bottoms away from motor boats and anglers. Motor boating, on the other hand, is ideally suited for open, deep-water areas where navigation is relatively unimpeded. Finally, the typical angler will generally gravitate toward quieter areas that offer more aquatic plants and bottom structure. Because of these inherent differences, resource managers need to pay close attention to the conflicting nature of each activity so as to prevent any one use from dominating over the other. Every effort will be made to balance the unique needs of preferred recreational uses with the overall health and stability of the larger ecosystem.

It is also readily apparent that heavy motor boat and personal watercraft traffic is perhaps one of the most significant issues affecting Lake Ripley at the present time. This activity is perceived as a major problem in terms of its impacts to water clarity conditions, aquatic habitat, safety, and peace and tranquility—among others. The operation of personal watercraft, in particular, is of concern to a majority of area residents. As a possible resolution to such problems, public sentiment is supportive of expanding slow-no-wake rules if necessary to promote safety and protect sensitive aquatic habitat. A greater separation between active and passive forms of recreation may be necessary to most effectively support a mixed-use recreational environment. However, caution is warranted so as not to institute too many unnecessary or duplicative restrictions that would over regulate the use of the lake. Better enforcement of existing regulations should be the first step if attempting to modify current behavioral patterns.

Finally, it appears that most residents support the existence and continuation of the Lake Ripley Management District in terms of managing the lake. However, more work may be needed to encourage public participation in the decision-making process. Communication with LRMD constituents remains vitally important, especially in terms of education and increasing general awareness of programs and policies. Methods of communication should be direct and consistent, with newsletters and special mailers representing the medium of choice.

CHAPTER NOTE:
Refer to Appendix J for a graphical presentation of the 1999 survey results.

CHAPTER 5: PROBLEM IDENTIFICATION & ANALYSIS

5-1 INTRODUCTION

Many factors can negatively influence the health and quality of a lake. Irresponsible watershed development, shoreline disturbances, wetland drainage, habitat destruction, and lake-use pressures are just some of the factors that might contribute to any number of problems and recreational impairments. Each of these activities is capable of upsetting a balanced and stable ecosystem, and producing a variety of unwelcome consequences. Separating the root cause of a particular problem from its more observable symptoms is the key to a successful lake management program.

To illustrate, consider a lake that is plagued with algae blooms. Because nuisance algae growth can prevent lake users from fully enjoying the resource, it is tempting to conclude that algae is the "problem" in this situation. In actuality, however, the algae bloom is merely the "symptom" of a much larger problem called eutrophication. In other words, the real problem is most likely nutrient enrichment from construction site erosion, agricultural runoff or some other activity that creates conditions favorable for algae growth. Employing symptomatic solutions that attack the algae directly rather than controlling the root cause or source of the problem is a recipe for failure over the long run. Common mistakes such as these often prove costly, especially if management strategies are prematurely and incorrectly chosen that do not appropriately address the real issue at hand. It is also important to determine if the issues identified can realistically be alleviated through lake-management efforts.

Not all problems produce easily observable symptoms. For instance, a gradual decline in the health of a particular fishery or the slow deterioration of water quality may signify a serious problem, but can go unnoticed for a long time. The ongoing collection and analysis of scientific data is necessary for resource managers to diagnose and address such concerns in a timely manner. Listed below are some common and readily apparent symptoms that signify larger, underlying problems.

- Murky water
- Excessive weed growth
- Algae blooms
- Small fish size/numbers
- Mucky lake bottom
- Recreational conflicts
- Disappearance of natural shorelines
- Carp problems
- Shoreline erosion
- Loss of wildlife diversity
- Extreme water level fluctuations
- Noise & safety issues

The following is a discussion of the four major factors that contribute to problems on Lake Ripley—eutrophication (excessive fertility), hydrologic alterations, habitat destruction, and lake-use conflicts.

5-2 EUTROPHICATION

Accelerated eutrophication is arguably the most significant problem affecting Lake Ripley today. Eutrophic waters are those that are severely impacted by nutrient enrichment and excessive productivity. Surface waters located within larger watersheds that are urbanized, intensively farmed, or face strong development pressures are at the highest risk of exhibiting eutrophication problems. Symptoms include nuisance algae blooms, excessive weed growth, poor water clarity and mucky lake bottoms. Although general water quality conditions have not significantly limited recreation in most years, intense residential development near the lake and widespread agricultural land uses pose serious threats to Lake Ripley. In fact, sediment cores taken from the lake bottom as part of a paleolimnological study suggest that these types of land uses have consistently degraded the lake over time. Over a decade of water quality monitoring confirms many of these findings.

Eutrophication problems are caused by external phosphorus loading from the watershed, and/or internal phosphorus recycling from the lake itself. Identifying the relative nutrient contributions from each source is usually necessary before the right management strategy can be formulated.

EXTERNAL NUTRIENT LOADING

External nutrient loading is the influx of eroded soil, fertilizers, polluted runoff, organic debris and other material from the surrounding watershed to the receiving water body. This material is delivered to the lake primarily as stormwater runoff, and may contain large amounts of phosphorus and other nutrients that fuel algae blooms and weed growth. Unregulated construction sites, poor farming practices, irresponsible fertilizer applications, vegetative clear-cutting, and unstable shorelines and drainage ditches are just a few of the factors that can increase nutrient inputs to the lake. This is especially true in the absence of proper measures that limit stormwater runoff and control soil erosion.

Water bodies with large watershed-to-lake surface area ratios (>10:1) are much more likely to experience water quality problems due to nutrient loading from the adjacent landscape. Since Lake Ripley has a ratio of approximately 12:1, the watershed will always have a great influence on water quality and productivity. Consequently, external loading is believed to be responsible for the vast majority of nutrient inputs to Lake Ripley.

Protecting and managing the watershed is paramount to maintaining the health and quality of Lake Ripley. Erosion-control measures known as Best Management Practices (BMPs) are used to control the sources of external nutrient loading. BMPs include grassed waterways, vegetative buffers, reduced tillage, field stripcropping, contour cropping, nutrient management, shoreline erosion control, and wetland restoration. The sources of external nutrient loading should be addressed before any in-lake management techniques are implemented. If not, in-lake management efforts will not be as effective over the long run, especially if external nutrient loading is significant.

INTERNAL NUTRIENT RECYCLING

Internal nutrient loading, also called in-lake phosphorus recycling, occurs when nutrients are released from the lake bottom or by the life cycles of aquatic plants and organisms. This process is usually more significant in lakes with smaller watersheds and longer hydraulic retention times. Hydraulic retention describes the length of time a given volume of water remains in the lake before it is able to be replenished by new water entering the system. When this timeframe is long, in-lake nutrient recycling is more likely to account for a significant proportion of the total nutrient loading to the lake.

There are multiple in-lake mechanisms that can trigger internal phosphorus releases. One, well-documented mechanism is a lack of dissolved oxygen (called anoxia) at the bottom of the lake. This condition frequently occurs in the deep hypolimnion of eutrophic lakes where the decomposition of organic matter depletes the available supply of dissolved oxygen. In this situation, phosphorus that was previously tied up in the bottom sediments is chemically converted to a soluble state and released into the surrounding water. Severe algae blooms and other problems materialize when this phosphorus-rich water migrates toward the well-lit surface waters where algae populations are abundant. It is a common occurrence during spring and fall turnover when lakewide mixing takes place.

The anoxic hypolimnion is not the only area known to cause large-scale, in-lake phosphorus releases. The shallow, littoral zone of many lakes is also shown to contribute to internal phosphorus recycling as a result of anoxia, sediment disturbance and elevated pH. Anoxic conditions may develop in shallower areas during non-daylight hours when respiration exceeds photosynthesis, causing phosphorus to be released from near shore areas. Also, sediment disturbance caused by wind and wave action and motor boating activity may re-suspend bottom sediment that is rich in phosphorus, increasing nutrient availability in the water column. Finally, pH levels may increase as carbon dioxide concentrations are depleted during photosynthesis. These high pH conditions are shown to be a mechanism for phosphorus release due to complex biochemical processes.

Developing a phosphorus budget is usually recommended to more accurately identify the actual sources of internal nutrient loading, especially before an expensive management technique is considered which may not target the actual problem area. Options to control internal nutrient loading include phosphorus precipitation and inactivation (alum treatments), hypolimnetic withdrawal, artificial circulation, hypolimnetic aeration, sediment removal (dredging), and dilution/flushing techniques. Each of these options is described in detail in the following chapter. Although in-lake nutrient recycling does occur in Lake Ripley, it's relative significance has not yet been quantified. Existing information suggests that it is not currently an issue of concern, especially when compared to external nutrient loading.

MANAGEMENT CONSIDERATIONS

The most obvious symptoms of eutrophication are nuisance plant and algae growth. Therefore, a great deal of time and effort is spent managing these biological consequences of a eutrophic water body. Even if all major nutrient sources are being addressed, plant and algae production could continue to represent an ongoing problem. This appears to be the case for Lake Ripley. Therefore, combining nutrient-reduction strategies with more symptomatic-oriented solutions is probably both unavoidable and appropriate. For aquatic plant control, options include mechanical and manual harvesting, plant screens (sediment barriers), water level manipulation (drawdown), dredging, and chemical treatment (herbicides). Algae control techniques include biomanipulation as a top-down approach, nutrient reduction as a bottom-up approach, and chemical treatment (algacides). Each of these options is described in detail in the following chapter.

Lake Ripley is an ecosystem with two alternative stable states of equilibrium—algae dominated or rooted aquatic plant dominated. Algae and aquatic plant abundance represent two ecological variables that are inextricably linked. This relationship makes it difficult if not impossible to manipulate one variable without dramatically affecting the other variable. For example, reducing or eliminating algae growth will result in improved water clarity, enhancing sunlight penetration through the water column and, thus, plant growth. Conversely, eliminating plant growth will create conditions favorable for increased algae growth. The elimination of aquatic vegetation removes the lake's ability to stabilize its own bottom sediment and assimilate the nutrients that fuel algal blooms. It also reduces the amount of structural habitat used by algae-consuming zooplankton. As you can see, it is very easy to trade one problem for another if special precautions are not taken.

Controlling algae and aquatic plant growth are objectives of this Lake Management Plan. However, because there are numerous benefits associated with a healthy and diverse native plant community, algae reduction is given priority over aquatic plant control as a management goal. Furthermore, the amount of algae growth in the lake is closely tied to overall water quality/clarity. A majority of the desired lake uses and values will be supported if a reduction in algae growth is achieved in conjunction with a thriving, but controlled plant community.

5-3 HYDROLOGIC ALTERATIONS

Landscape alterations and surface/groundwater manipulations can adversely impact the quality and quantity of water that enters Lake Ripley. Ditching, drain tiling, stream channelization, groundwater pumping, plant removal, soil compaction, and the development of water-impervious surfaces can all negatively affect regional hydrology and water quality. Engaging in activities that reduce the soil's ability to infiltrate and retain water, for instance, decreases groundwater recharge rates and increases stormwater runoff volumes. Because Lake Ripley receives much of its water from groundwater (30-45%), water quality will continue to decline if the quantity and quality of this important water source is further compromised.

Increased runoff results in less groundwater recharge, more erosion and more pollution that is subsequently transported to the lake. Wetland drainage throughout the Lake Ripley watershed has only exacerbated this problem. With only about 30% of the original 1,500 wetland acres remaining, the surrounding landscape has lost much of its natural ability to absorb and filter excess surface runoff. The result is an increase in flooding incidents and a gradual decline in water quality conditions. These problems will continue to worsen unless existing and drained wetlands are protected and restored.

Any new development activities that unnecessarily increase water-impervious surfaces will further threaten our water resources. Buildings, parking lots, tennis courts, driveways and roads are just a few examples of water-repelling, rather than water-infiltrating structures. The cumulative impact of these structures reduces groundwater-replenishment rates while increasing the volume and flow rate of stormwater runoff. Construction activities can often magnify the problem through inappropriate soil compaction and vegetation removal. The result is more frequent flooding, soil erosion and pollutant transport that degrades downstream water bodies.

5-4 HABITAT DESTRUCTION

The loss of aquatic habitat and biological diversity is a common problem on heavily developed lakes like Lake Ripley. Shoreline development, sedimentation, invasion of exotic species, removal of native plants, pollution, and lake bottom disturbances all contribute to the destruction of valuable fish and wildlife habitat. If not adequately addressed, habitat loss can cause ecological instability and dramatic shifts in the food web. These impacts can be seen in the decline of "sensitive" plant and animal species, and a corresponding increase in "tolerant" specie types.

Woodland, prairie and wetland habitats within the Lake Ripley watershed are each disappearing at an alarming rate. Uncontrolled residential and agricultural land uses are primarily to blame for this discouraging trend. Conservation easements, public property acquisitions, restorations and sound land management are various tools that are currently used to preserve such important wildlife habitats. The continued protection of these critical habitat areas is an ongoing focus of lake and watershed management efforts.

Aquatic habitat essential for sustaining fish, amphibians, macroinvertebrates and other wildlife is also threatened. A diversity of native aquatic plants is known to provide the foundation for a healthy and balanced ecosystem. However, this high quality vegetation is being lost or replaced by non-native, invasive weeds like Eurasian watermilfoil. These exotic species displace native plants, exhibit nuisance growth rates, and reduce the habitat value of the overall plant community. Eutrophication caused by nutrient and sediment pollution is one of the main factors contributing to this unfortunate situation. Another major factor is the impact of shallow-water motor boating. The physical damage to the plants by boat propellers, and the constant scouring of the lake bottom by boat-induced turbulence promotes the spread of tolerant weedy species. Restricting high-speed motor boat and Jet Ski traffic to deeper water is a common means of protecting valuable aquatic habitat.

5-5 LAKE USE CONFLICTS

Many problems arise when conflicting recreational uses compete for time and space on the lake. Since lakes cannot be all things to all people, certain sacrifices and compromises must be made to support a mixed-use recreational environment. The first logical step is to determine what types of activities a particular lake is capable of supporting. A very small, shallow and weedy lake, for instance, might be more appropriate for fishing and canoeing versus motor boating and water skiing. Conversely, a larger and deeper lake might be well suited for more aggressive activities that require larger, deeper areas. The next step is to determine how the majority of lake residents prefer to use the lake, and how these priorities may be jeopardized due to the current condition or use of the lake.

Once lake-use preferences and management priorities are identified, a lake can be zoned in a manner that best supports conflicting, mutually exclusive interests. For instance, consider passive versus active recreation types. Passive recreation such as swimming, canoeing, sailing and fishing are considered "quiet" sports, and usually prefer specific settings and areas away from heavy motor boat activity. Active recreation includes noisier sports such as water skiing, power boating and jet skiing. These activities usually prefer a different set of conditions (e.g. deep, open water areas), but can occur in almost any location where navigation is not unreasonably obstructed. Conflicts occur when the two recreation types attempt to occupy the same general locations at the same time. When this happens, active recreation types almost always displace passive recreation types.

Conflicts may also arise between different activities that fall within the same recreational classification. For example, although fishing and swimming are each passive forms of recreation, they also require their own space and unique conditions. Anglers may prefer a quiet, undisturbed area with an abundance of aquatic plants and bottom structure. Swimmers, on the other hand, may demand sandy bottoms, no aquatic vegetation, and an area free of fishing boats and dangerous hooks. Time and space zoning can help direct different lake activities to minimize conflict. It can also be used to facilitate the protection and management of ecologically sensitive areas that are easily threatened by certain lake uses.

Underwater turbulence produced by personal watercraft and motor boats, for instance, is frequently strong enough to disturb plant beds and bottom sediments, especially in shallow water. This constant scouring of the lake bottom is detrimental to sensitive aquatic habitat, re-suspends phosphorus-rich sediment, and encourages the spread of undesirable plant species. Since eliminating boats or banning certain horsepower engines may not be feasible on many lakes, it might be appropriate to restrict certain activities to specified locations on the lake that are best suited for that lake use. Passive recreational uses such as fishing and canoeing might be permitted in the shallow, weedy areas, while more aggressive activities like water skiing and jet skiing might be directed to deeper, open water areas.

Public opinion surveys suggest that lake-use conflicts are a major issue of concern on Lake Ripley. Specifically, there is widespread discontent with the safety and environmental implications of near-shore, shallow-water motor boat and personal watercraft traffic. As more and more people use the lake, this problem will continue to intensify unless properly addressed.

CHAPTER 6: OVERVIEW OF IN-LAKE MANAGEMENT STRATEGIES

6-1 INTRODUCTION

This chapter provides an overview of management strategies that are commonly used to control in-lake sources of eutrophication and its symptoms—plant and algae growth. The reader is reminded that such strategies are best considered once watershed sources have been adequately addressed. They may also be used in conjunction with ongoing watershed protection efforts. Each technique is described in detail, and evaluated based on its (1) applicability to Lake Ripley, (2) potential positive and negative impacts, and (3) cost-effectiveness. The management techniques discussed below may or may not be appropriate for Lake Ripley. Actual recommendations are presented in the next chapter. The purpose of the following discussion is to mainly provide additional information on popular lake-improvement strategies for future reference and possible consideration.

6-2 CONTROL OF INTERNAL NUTRIENT LOADING

ALUM TREATMENTS

Alum treatments use aluminum sulfate (alum) to lower the lake's phosphorus content by removing the nutrient from the water column and retarding its release from anoxic lake sediments. Alum is a nontoxic material that is commonly used in lakes to reduce phosphorus levels, thereby controlling the nutrient that encourages algae growth. On contact with water, alum forms an aluminum hydroxide precipitate known as floc. Aluminum hydroxide reacts with phosphorus to form an aluminum phosphate compound that is insoluble in water under most conditions, depriving algae of this critical nutrient. As the floc settles, inorganic phosphorus and phosphorus-containing particulate matter is removed from the water column. The floc, which is believed to be harmless to aquatic life, eventually consolidates with the sediments. When applied in sufficient quantities, the floc forms a chemical barrier that retards phosphorus release at the sediment-water interface as anoxic conditions develop in the hypolimnion.

Hypolimnetic alum treatments do not, however, address phosphorus that may be released from the shallow, littoral areas as a result of elevated pH, sediment disturbance and/or anoxia during non-daylight hours. Some lakes may be good candidates for this procedure, especially if external nutrient loading is brought under control and high internal phosphorus releases are shown to occur within the anoxic hypolimnion of the lake. When implemented correctly, this technique can provide an effective, nontoxic and long-term approach to algae control by reducing concentrations of the limiting nutrient that usually drives algae growth. However, it should be noted that increased plant growth often occurs due to improved water clarity conditions following an alum treatment.

Phosphorus precipitation and inactivation through alum treatments should be implemented during spring turnover when most phosphorus is in an inorganic fraction. Alum may either be applied at the surface or injected into the hypolimnion when algae blooms inhibit the application process. Treatments should be applied primarily over the anoxic zone of the lake. The anoxic zone in Lake Ripley occurs at depths of 15 feet and greater, but a natural process known as sediment focusing (caused by physical wind-driven mixing) is likely to transport some of the resulting floc toward the deeper holes. Note that sediment with a high moisture content may cause the floc to settle below the sediment surface, reducing its effectiveness. If alum is applied in shallower areas, boat traffic speed should be reduced to "no wake," especially in areas less than 10 feet deep for up to four weeks after treatment. Toxicity problems from lowered pH are unlikely given the relatively high alkalinity and buffering capacity of Lake Ripley.

Applicability: Lake Ripley may be a good candidate for this procedure if a phosphorus budget shows that external nutrient loading is being effectively managed, and high internal phosphorus releases are shown to occur within the anoxic hypolimnion of the lake.

Longevity of Effectiveness: A number of case studies indicate that this approach can significantly lower the phosphorus content of a lake, maintain that low level for many years, and bring about a measurable and lasting improvement in trophic state. Alum treatments may be effective for up to 12 years following the initial treatment if external nutrient loading has been controlled. Average effectiveness timeframe is between 7-10 years.

Estimated Costs: There is a high initial cost that is amortized over the long-term. Actual costs are highly variable, depending upon local salaries, equipment rental fees, and the price of chemicals. It is estimated that an alum treatment for Lake Ripley would cost $150,000 to $200,000, which includes $12,000 to deliver and set up the equipment and about $500 per treated acre. If algae blooms prevent an effective surface application, alum may have to be injected directly into the sediment, increasing costs by approximately 20 percent. The Lake District can apply for a Wisconsin Lake Protection Grant to help fund the project (up to $200,000).

Potential Benefits:
- Dramatically and immediately reduces in-lake phosphorus concentrations
- Establishes floc layer that chemically retards future phosphorous releases from the bottom sediment
- Increases water clarity
- Reduces algae populations

Potential Drawbacks:
- Reduces pH and could cause acidity problems in acid-sensitive lakes
- Increases plant growth as a result of increased water clarity
- Unknown long-term toxicological impacts to sensitive benthic organisms
- Procedure may need to be repeated approximately every 7-10 years to maintain effectiveness

ARTIFICIAL CIRCULATION

The purpose of this management technique is to destratify and mix the water column of a lake by injecting compressed air near the lake bottom. If sufficiently powered, rising air bubbles will induce lake-wide mixing, eliminating thermal gradients within the water column while aerating portions of the lake that were previously devoid of oxygen. Artificial circulation is used to prevent an anoxic hypolimnion from forming near the bottom of deeper lakes, thereby preventing the release of phosphorus from the bottom sediments. Circulation pumps are usually operated continuously throughout the summer stratification period so that aerobic conditions are always maintained. Improper use of this technique could harm an established cool-water fishery, or mix nutrient-rich water throughout the water column, exacerbating an existing algae problem.

Applicability: Artificial circulation is not recommended for Lake Ripley at the present time. This technique has not produced enough positive results in other similar lakes to be considered an established and effective long-term procedure. Existing case studies have shown mixed results. For instance, dissolved oxygen concentrations usually increase as expected, however Secchi transparency often decreases and total phosphorus often increases or remains the same. There is concern that the elimination of thermal stratification could elevate deep-water temperatures, which could in turn harm the walleye fishery. This aeration procedure may also cause increased turbidity through the re-suspension of sediments.

HYPOLIMNETIC AERATION

This management technique uses an airlift device to bring nutrient-rich and oxygen-poor water from the hypolimnion of deeper lakes to the surface where it can be aerated without thermally destratifying the lake. Hypolimnetic aeration attempts to reduce the extent of an anoxic hypolimnion that forms near the bottom of deeper, eutrophic lakes. As a result, a smaller portion of the lake bottom is allowed to become oxygen deficient and capable of releasing phosphorus into the water. Because the lake is not allowed to destratify, a cool-water fishery can be adequately protected. Aerators need a large hypolimnion to work properly, and are most effective in deep lakes. As with artificial circulation, improper use of this technique may circulate nutrient-rich water. A poorly designed aeration system may also destratify a lake, or keep sediment and organic matter in suspension for longer periods of time.

Applicability: Hypolimnetic aeration may be of benefit to Lake Ripley if a phosphorus budget shows that significant nutrient release occurs along the anoxic lake bottom. It would also preserve the existing walleye fishery by maintaining thermal stratification and cool water habitats. Lake Ripley's anoxic hypolimnion is believed to be of sufficient size to support this strategy.

Longevity of Effectiveness: This technique is effective as long as the aeration system remains operational throughout the summer stratification periods.

Estimated Costs: Costs are highly variable and will depend on both the size and complexity of the aeration system, as well as the amount of electrical power needed for the pumping equipment.

Potential Benefits:

- Oxygenates the hypolimnion to prevent sediment phosphorus release
- Maintains thermal stratification for cool water fishery needs
- Expands aerobic habitat conditions that sustain many types of aquatic life

Potential Drawbacks:

- Hypolimnetic aeration is not as effective in shallower lakes with small hypolimnions
- It is easy to become locked into this strategy for the long term
- Aerators may keep organic matter and sediment in suspension for longer periods of time
- Destratification is possible if hypolimnetic aeration is done improperly
- This management option is more experimental rather than a time-tested management strategy
- If the system is turned off, oxygen depletion and sediment phosphorus release may occur
- An improperly designed system will circulate nutrient-rich water that increases algae growth

HYPOLIMNETIC WITHDRAWAL

Hypolimnetic withdrawal addresses phosphorus releases that occur within the deep, anoxic zone by removing nutrient-rich, hypolimnetic water before it mixes with the entire water column. The principal purpose of this technique is to change the depth at which water leaves the lake, from the surface to the deep hypolimnion, so that higher nutrient-content water is discharged from the lake. Hypolimnetic withdrawal is accomplished by installing a tube along the lake bottom from the deep area to the outlet. The tube acts as a siphon, removing nutrient-rich water from the hypolimnion and discharging it at the outlet.

The technique requires a sufficient water exchange rate to replenish the amount of water that needs to be discharged. Hypolimnetic withdrawal should only be implemented during the summer stratification period when anoxic conditions develop in the hypolimnion. If not used appropriately, it may produce thermal instability and destratification that could introduce nutrient-rich, anoxic water to the lake's epilimnion. There may also be negative impacts downstream caused by the discharge of poor quality water. There are few documented case histories regarding this procedure. The technique is most applicable to stratified lakes and small reservoirs in which anaerobic hypolimnia restrict fish habitat and promote the release of phosphorus from the sediments.

Applicability: May be applicable under two conditions. First, a phosphorus budget should suggest internal nutrient recycling from the deep anoxic zone is a significant problem. Second, discharge measurements should indicate that the lake has sufficient recharge capacity to support a summer hypolimnetic withdrawal.

It is questionable whether Lake Ripley has the necessary recharge capacity. It is also questionable whether a siphon could function properly without the need for a more costly pumping system.

Longevity of Effectiveness: The longevity of effectiveness is indefinite as long as the siphon is operational, and external nutrient loading is adequately controlled.

Estimated Costs: This strategy involves low operational costs as long as the gravity-fed siphon functions properly. Costs would include a capital outlay for a pump (if required), pipe, and an aeration device for discharge water (if needed).

Potential Benefits:
- Reduces the extent of an anoxic hypolimnion that may cause sediment phosphorus release
- Removes oxygen-poor, nutrient-rich water
- Relatively inexpensive if there is not a need for a pumping station

Potential Drawbacks:
- May require a pumping system to remove and discharge hypolimnetic water
- Could potentially cause thermal destratification that would mix nutrient-rich water throughout the lake
- May cause negative impacts downstream due to the discharge of poor quality water

SEDIMENT REMOVAL (DREDGING)

This management alternative may be used to address phosphorus releases that occur in the shallow, littoral areas of a lake. However, dredging is more frequently employed to deepen a lake, or remove aquatic plants. If sediments are the source of internal nutrient loading, and the bulk of nutrients are located in the top 1-1.5 feet of a sediment core, then removal of that layer by dredging may provide the most reliable and permanent solution. If bottom sediment is rich in nutrients below that depth, then dredging would only expose more sediment with the same high nutrient content, providing little or no expected decrease in internal loading. This technique will also have limited effectiveness if external sediment loading is not controlled prior to implementation. Dredging may be very effective if targeted areas have sediment that is high in phosphorus. However, all nutrient-rich sediment will need to be removed for this strategy to work effectively. Lakes most suitable for dredging have shallow depths, low sedimentation rates, organically rich sediments, long hydraulic retention times, and the potential for extensive use following dredging.

Sediment must be analyzed to determine how difficult it will be to dredge the material and its appropriateness for land disposal. Selective "spot" dredging is less expensive and is not as detrimental to aquatic plant and animal habitat, biodiversity, various recreational uses, and aesthetics. One strategy is to breach a dam, if available, in order to draw down the lake and expose near shore sediment that can then be removed by earth-moving equipment. This may be the simplest and most cost-effective method, even though mechanical and hydraulic dredging are much more common approaches to sediment removal. Dredging is an extremely expensive and involved process. It requires identifying the source of sediment; evaluating sediment cores (thickness, distribution, grain size, organic content, contaminant analysis, nutrient analysis); determining the volume of sediment to be removed; evaluating potential environmental impacts; securing a de-watering and disposal site; and obtaining the appropriate local, state and federal permits.

Applicability: Not applicable at the present time as a cost-effective technique to control internal nutrient loading in Lake Ripley. Dredging is currently very cost prohibitive and ecologically disruptive, not to mention impractical due to the lake's size and depth. In addition, recent sediment core analyses suggest relatively insufficient nutrient content to justify such action. Sediment removal is best served in situations where it would facilitate public access in very shallow, high-traffic areas.

Longevity of Effectiveness: Long-term effectiveness is likely if external sediment/nutrient loading is addressed and all nutrient-rich sediment is removed. Dredging may need to be repeated depending on sedimentation rates.

Estimated Costs: Sediment removal is currently an extremely expensive management strategy. Costs are highly variable, depending upon site conditions, access, nature of the dredge material, disposal method, monitoring and other factors. It is not uncommon for lake-dredging efforts to end up being multi-million dollar projects. Partial funding through the Waterways Commission is possible only when dredging is used for navigational and public access purposes.

Potential Benefits:
- Deepens the lake and may improve navigation
- Removes plant material and associated sediment from the lake
- Removes the nutrient-rich material that contributes to in-lake nutrient recycling

Potential Drawbacks:
- Represents a very massive and expensive undertaking
- Causes temporary increase in turbidity due to re-suspension of sediment
- Damages or destroys fish spawning habitat
- Destroys benthic (bottom-dwelling) organisms that represent an important component of the food chain
- Releases heavy metals and other contaminants within the sediment (if present)
- Releases anaerobic gases such as ammonia and hydrogen sulfide, which can threaten aquatic life
- Requires a large, suitable land area near the lake for sediment de-watering and disposal purposes

DILUTION & FLUSHING

Dilution and flushing is a management technique that uses large quantities of nutrient-poor water from an upstream source to dilute nutrient concentrations in the lake and flush out algae cells. Lakes with low initial flushing rates, or hydraulic retention times, are poor candidates because in-lake phosphorus concentrations could increase unless the dilution water is essentially devoid of phosphorus. Flushing rates of 10-15% of the lake volume per day are believed to be sufficient in most cases.

Applicability: Lake Riley is not a candidate for this management approach for two reasons. First, a large, upstream source of nutrient-poor water has not been identified. Second, the lake does not have a sufficient flushing rate or outlet structure that could handle the required discharge.

6-3 CONTROL OF EUTROPHICATION SYMPTOMS

AQUATIC PLANT HARVESTING

It is important to recognize that aquatic plants form the foundation of a healthy lake ecosystem by protecting water quality and producing oxygen. A diversity of aquatic plants is important in filtering pollutants, absorbing nutrients, stabilizing the lake bottom, as well as providing food, spawning habitat and structural refuge for aquatic life. Unfortunately, the aquatic plant communities found in heavily used, eutrophic lakes have frequently undergone significant degradation. "Disturbances" such as shallow-water motor boat traffic, non-point source pollution, sediment loading, and aggressive plant eradication efforts only accelerate the degradation process. The result is a gradual decline in plant diversity as the lake is taken over by non-native, nuisance plant species. Because these weedy species have few competitors and are tolerant to eutrophic conditions, they tend to grow to nuisance proportions to the detriment of native, beneficial species. This in turn detracts from the recreational enjoyment of the lake, and justifies the use of appropriately targeted plant-control methods.

When excessive weed growth becomes a problem, mechanical harvesting can be used to cut and remove the upper portion of rooted aquatic plants that grow close to the water's surface. Unlike herbicide applications where plants are left in the lake to decompose, mechanical harvesters are designed to physically remove plant material from the water. This prevents decaying plant matter from depleting dissolved oxygen levels and releasing nutrients that could culminate in further plant and algae growth. Harvesters can also clear an area of vegetation without the post-treatment waiting period associated with herbicides and without significant danger to non-target species.

The typical harvester is a highly maneuverable, low-draft barge designed with one horizontal and two vertical cutting bars, a conveyor to remove cut plants to a storage unit on the machine, and another conveyor to unload plants onto shore. Harvesters vary in size and storage capacity from about 200 cubic feet of cut vegetation to 800 cubic feet. Cutting rates range from about 0.2 to 0.6 acres per hour, depending on machine size. Harvesting works best in open, unobstructed areas of the lake where the water is three to six feet deep. A selective harvesting approach, rather than clear cutting, is recommended to avoid causing serious habitat disturbance. Mechanical harvesting is most effective when used to: (1) open navigation lanes to access open water areas; (2) control nuisance vegetation in high-intensity recreational user zones; and (3) create edge habitat for fish through weed-choked fishing areas. Most harvesting operations are successful in producing at least temporary relief from nuisance plants by removing organic matter and associated nutrients without the addition of potentially deleterious substances.

Aquatic plants that are cut are required by law to be removed from the water for a number of reasons. Fragments of certain plants that are not removed from the water can re-root and form new weed beds. Also, plant material that is left in the water to decompose will deplete oxygen levels and may release nutrients that fertilize algae blooms. Finally, floating plants can obstruct navigation. When harvesting is performed properly, however, the problems associated with plant fragmentation can be avoided. Plant disposal is usually not a problem, in part because lakeshore residents and farmers often will use the plant material as mulch and fertilizer.

Applicability: Lake Ripley is a prime candidate for an ongoing weed-harvesting program to control Eurasian watermilfoil, especially since the Lake District already possesses the necessary equipment.

Longevity of Effectiveness: This strategy allows only temporary relief of nuisance aquatic weeds. Harvesting is most effective when it is repeated multiple times during each growing season. Research indicates that there is often a carry-over effect from season to season where less growth occurs in subsequent years following multiple harvests.

Estimated Costs: A high capital outlay for equipment is required, and may be energy- and labor-intensive and thus expensive. However, it is usually somewhat less expensive than herbicide treatments over the long run. Expenditures for a particular project will vary depending on machine cost and reliability, operator wages, fuel, insurance, equipment storage, and the amount of down time. Operating costs can be quite variable, but generally average around several thousand dollars per year with labor comprising from 20-65% of the total operating costs.

Potential Benefits:

- Removes nuisance plant material and associated nutrients from the lake
- Provides temporary but immediate relief from nuisance aquatic plants
- Could encourage positive shifts in species composition by reducing competition from aggressive species
- Reduces the thick vegetative cover that causes stunting of panfish
- Avoids the use of potentially harmful chemicals
- Allows specific areas and plant species to be targeted for control
- Permits most recreational use of the water to continue during operations
- Poses little danger to non-target organisms (except when inadvertently removed with the cut plants)
- Harvested plants may be used as a nutrient-rich soil conditioner or fertilizer

Potential Drawbacks:

- Controls relatively small areas per unit of treatment time
- Harvesting can be over-used, destroying critical aquatic habitat

- Could contribute to vegetative fragmentation and spread of nuisance, non-native species
- Could encourage unfavorable shifts in species composition by promoting opportunistic species
- Could damage valuable, native plant species
- There is the potential to inadvertently harvest small gamefish along with the plant material
- Operating depths may be limited
- Requires regular cutting during each growing season for effective control
- Excessive plant growth may continue in extremely shallow areas where larger harvesters cannot gain access

Manual harvesting of aquatic weeds can also be used to control plant growth in smaller, more confined areas. This technique is usually the simplest, most species-selective method for small, shallow water areas. However, it is also the most labor-intensive method. Plants should be pulled from the sediment by the base so the root systems are removed in their entirety. The frequency and practicality of continued hand harvesting depend on the availability of labor, the re-growth or re-introduction potential of the vegetation, and the level of control desired.

Manual harvesting techniques include dragging, raking, cutting and pulling. Dragging is an inexpensive method that involves pulling "draglines" through weed beds. Draglines are constructed of rope, wire or chains that can be placed into the water from either shore or boat, and then pulled in manually or towed. They are often used in water that is greater than six feet deep, but are not effective at removing root systems. Raking can be done in shallow water with a long-handled steel garden rake or pitchfork. The root systems of certain plant species will be removed, while others will remain in place. Hand-held weed cutters are specially designed rakes or cutters that are manually thrown out into the lake and slowly retrieved. While rakes can remove the entire root systems, cutters usually leave root systems to regenerate. Hand pulling is the most labor-intensive method, but it is also the most effective and species-specific.

AQUATIC PLANT SCREENS (SEDIMENT COVERS)

Aquatic plant screens are synthetic barriers typically constructed of fiberglass mesh or polyvinyl fabric that are placed on the lake bottom in near-shore areas. The purpose of the screens is to smother existing vegetation, inhibit light penetration and prevent new plants from rooting. The most effective covers are opaque, durable, negatively buoyant, vented and gas-permeable. Plastic sheets of polyethylene, polypropylene, fiberglass or nylon are all used as aquatic plant screens. Gravel, sand and clay are also used as sediment covers, although these materials are less effective plant barriers.

Installation requires securely anchoring the screens to the substrate in the spring before plants begin growing. This is often difficult to accomplish over heavy plant growth, in soft sediment, and on steep slopes. Aquatic plant screens work well in small, flat, shallow areas or where other methods are not feasible. These barriers will need to be periodically removed and cleaned as sediment deposits on the screen surface. They should be removed every 1-3 years in the fall for cleaning. The barriers do not effectively control algae or free-floating plants. Effectiveness is highly correlated with application techniques and type of material used.

<u>Applicability</u>: Applicability to Lake Ripley is restricted to small, flat, shallow areas with firm substrates where recreation is unreasonably impacted by nuisance plant growth. Suitable locations may include community swimming beaches and public piers that are inaccessible to mechanical harvesters.

<u>Longevity of Effectiveness</u>: Strategy effectiveness depends on the quality of the materials and installation methods used. At a minimum, plant screens should be removed and cleaned every one to two years to prevent sediment build-up and re-rooting.

<u>Estimated Costs</u>: The more effective synthetic materials are very expensive, running at least several thousand dollars per acre of coverage. Installation is also very labor intensive, which will drive up costs.

Potential Benefits:

- Causes little negative impact to the lake
- Use is confined to small, site-specific areas
- Sediment covers can be installed in areas that will not be disrupted by boat traffic or harvesters
- No toxic chemicals are used

Potential Drawbacks:

- Materials are expensive to purchase
- Plant screens are difficult to apply over large areas, over obstructions, in deeper water, and on slopes
- May be difficult to secure to the bottom, especially if gases are trapped beneath the covers
- Plant screens may be difficult to remove or relocate, and may tear during installation
- Some materials do not last more than a few seasons, and are degraded by sunlight
- A permit may be required before installation can take place
- Benthic invertebrates may be eliminated in treatment areas

WATER LEVEL MANIPULATION (DRAWDOWN)

Altering the water levels in lakes is sometimes used to manage nuisance weed growth that may occur in shallower areas. This is accomplished by either significantly raising or lowering water levels, usually by regulating an outlet-control structure. Recreational use of the water is often severely restricted during implementation, especially if a drawdown is performed.

Raising water levels will essentially drown out certain plant species by limiting sunlight availability through increased water depths. This strategy is often not feasible as previously dry, lowland areas would be subjected to flooding and increased shoreline erosion. It also requires a significant amount of extra freeboard on a dam to retain sufficient quantities of water. Alternatively, lake level drawdowns are used to expose near-shore sediments to prolonged freezing and drying. Some rooted plant species are permanently damaged by these conditions and the entire plant is killed if exposed to freezing for two to four weeks. Other species, however, are either unaffected or enhanced. Sediment compaction and oxidation is a secondary benefit that can increase near-shore water depths.

This management technique is best suited for reservoirs or water bodies that have a suitable outlet control structure and a steady water flow that will refill the lake or reservoir by the summer. On smaller water bodies where a drawdown is performed, the reduced volume of water and dissolved oxygen can cause fish kills. Similar to artificially raising water levels, a drawdown may damage banks and shorelines, and fish spawning grounds may be adversely affected. A winter drawdown should be conducted to control vegetation through freezing and scouring, as opposed to a summer drawdown that will usually encourage plant growth. To be most effective, complete freezing and desiccation are required, and freezing operations should be alternated every two years with no drawdown so that resistant species do not become firmly established.

Applicability: Water level manipulation as a plant-control strategy would not be applicable to Lake Ripley. The lake does not currently have an outlet-control structure, and has inadequate inflow/outflow characteristics to support such an effort.

PLANT REMOVAL BY DREDGING

Dredging involves the physical removal of sediment and associated rooted plants. In extreme cases of overgrown aquatic vegetation, conventional or specially adapted dredging machines may be used to remove vegetation and underlying sediments. The resulting depth increase, if sufficient, will reduce or eliminate the potential for rooted vegetation to become re-established by inhibiting light penetration. However, this effective depth would have to exceed 10-15 feet in Lake Ripley. Dredging operations are expensive to implement, and the disposal of sediments can be difficult if a nearby disposal site is not available. This strategy will be a short-lived treatment method unless sediment is removed entirely from the lake's photic (light-penetrating) zone. Spot dredging to create boat channels or deepen high-use areas is a cheaper compromise to dredging an entire lakebed. For more discussion on dredging, refer back to Section 6.2 under sub-heading "Sediment Removal."

Applicability: Plant removal by dredging would have limited applicability to Lake Ripley. It is often a prohibitively expensive and ecologically damaging procedure. Dredging is best served in very shallow, weed-choked areas that unreasonably restrict public access to the lake.

CHEMICAL CONTROL (HERBICIDES)

Aquatic herbicides are often used in problematic areas to aggressively control small pockets of nuisance, pioneer species before they can spread throughout the lake. Preferred treatment areas are small, confined and absent of high quality native species. Herbicides can be either broad spectrum or fairly species-specific. Contact and systemic herbicides are both available and commonly employed, but each leaves plants in the water to decay. Application rates and frequencies depend upon physical conditions (e.g. wave action, currents, dilution, water temperature, etc.). Plants differ considerably in their susceptibility to chemical treatment. Chemical treatment should be viewed as a last resort when other methods fail or prove infeasible. This treatment method may limit certain water uses, and chemical drift can potentially damage or destroy desirable plant beds.

The herbicide 2, 4-D (2,4-dichlorophenoxyacetic acid) is one of the most common and most effective chemicals used to systemically control Eurasian watermilfoil. This particular herbicide has been shown in certain situations to shift community composition from watermilfoil and coontail, to beneficial pondweeds and wild celery. Proper timing of herbicide applications is extremely important for both effective control and to avoid other potential problems. Timing involves knowing water temperatures and waiting until vigorous plant growth is present, but not waiting until plants are fully grown which would result in large amounts of weeds decomposing and robbing the water of oxygen.

Although herbicides do not address the source or underlying cause of the problem, it may be the only option available for short-term relief if nutrient sources cannot be addressed. It is recommended that this management technique be implemented only if other strategies are determined to be infeasible due to costs or other considerations. If necessary, herbicides should be targeted to small areas to control isolated stands of exotic, invasive plant species.

Applicability: Because Eurasian watermilfoil has already spread throughout the entire lake, there is limited applicability for this technique. If necessary, applications can be targeted to small, isolated pockets of nuisance milfoil growth that cannot be controlled using mechanical harvesting methods.

Longevity of Effectiveness: Chemical control is a temporary control strategy, and must be repeated on a fairly regular basis.

Estimated Costs: Costs depend on the size of the area being treated and the type of chemical used.

Potential Benefits:
- Temporary and relatively fast relief of nuisance aquatic weed growth
- Offers some selectivity so certain specie types can be targeted
- Chemical applications are not very labor intensive
- Provides longer control when compared to mechanical harvesting

Potential Drawbacks:
- Provides only temporary relief of nuisance aquatic plant growth
- Fails to remove plant material and associated nutrients from the lake
- Decreases in dissolved oxygen levels due to decomposition of plant matter
- Some nuisance species may be unaffected by the herbicides

- Aggressive, pioneer species can re-colonize treated areas
- Could produce more frequent and severe algae blooms
- Toxicity issues are poorly understood
- Herbicides produce no restorative benefit, show no carryover of effectiveness to the following season, and may require several applications per year

Chemical Conrol (Algacides)

Algacides are chemical agents that are applied to the water to control algae growth. These chemicals are usually applied in liquid form at the lake's surface, killing algae cells on contact through selective toxicity. Although this technique does not address the source or underlying cause of the algae problem, it may be the only option available for short-term relief if nutrient sources cannot be addressed. Algacides are generally applied in small ponds, and may be appropriate when other strategies are infeasible due to costs or other considerations. Before using algacides, it is important to understand all the risks that are associated with a particular chemical. Considerations include toxicity to non-target aquatic life, chemical persistence in the environment, and indirect impacts to dissolved oxygen levels.

Applicability: Algacides are not recommended for use on Lake Ripley for a number of reasons. Drawbacks of using this strategy to control algae in Lake Ripley include the following:

- Chemical applications may be toxic to non-target aquatic life
- Oxygen depletion may occur from the rapid die-off and subsequent decomposition of algae
- Blue-green algae are known to become increasingly tolerant to the algacides
- Chemicals residues may accumulate in the sediment
- Must be repeated on a regular basis, and may be expensive over the long run

Biomanipulation for Algae Control

Biomanipulation attempts to alter the food web (usually through fish management and stocking programs) to create a less favorable environment for algae, thereby improving water quality conditions. It is a top-down management strategy that may be used to compliment bottom-up management strategies that manipulate nutrient inputs. Biomanipulation is based on a theory known as the Trophic Cascade Hypothesis. Simply stated, top predators such as large gamefish can ultimately control the abundance and productivity of lower trophic levels, such as algae, which in turn can affect water clarity and nutrient recycling. The Trophic Cascade Hypothesis predicts that a large number of piscivorous (fish-eating) fish will consume large numbers of smaller, planktivorous (plankton-eating) fish, resulting in a decline in the abundance of planktivores. Lower numbers of planktivores will consequently consume fewer zooplankton (algae consumers), allowing for the development of a large zooplankton population. Large numbers of zooplankton will then consume large numbers of algae, reducing algae abundance and increasing water clarity.

Biomanipulation may be accomplished by directly enhancing the success of piscivores (e.g. walleye, bass, northern pike, etc.) through stocking programs, angler harvest restrictions, and/or habitat improvements. Another option is to reduce the number of planktivores (e.g. perch, bluegill, sunfish, etc.) within a lake through selective fish removal programs and habitat manipulations. Fewer planktivores translates into a higher survival rate for algae-grazing zooplankton. Reducing planktivore populations has the added benefit of freeing up food resources for small piscivores that could otherwise get out-competed during early life stages. Creating habitat conditions that are more favorable to zooplankton will further enhance the effects of biomanipulation. For example, oxygenating the hypoliminion will allow for greater vertical migration of zooplankton within the water column, increasing their ability to avoid capture by planktivores. Aquatic plant beds can also be protected to provide structural refuge for zooplankton.

Applicability: Biomanipulation should only be used in conjunction with other strategies if a significant, long-term improvement is going to be achieved. Full implementation of a biomanipulation project, which prohibits the harvesting of gamefish, may be unpopular since fishing is identified as a top priority lake use.

Longevity of Effectiveness: If the sources of excess nutrients to the lake are fully addressed, biomanipulation can have a lasting and sustained effect. The success of this technique relies heavily on the continued health and viability of the sport fishery (e.g. walleye, largemouth bass and northern pike).

Estimated Costs: Costs are relatively low, and are associated with fish stocking (currently State-funded) and habitat enhancement efforts. Habitat enhancement may involve using the mechanical harvester to control Eurasian watermilfoil. Costs are also associated with information and education programs that encourage anglers to practice catch-and-release.

Potential Benefits:

- Harnesses the natural power of the food web to keep algae production in check
- May provide a fairly self-sustaining control mechanism
- Does not involve the use of potentially harmful chemicals or expensive equipment
- Improves the sport fishery

Potential Drawbacks:

- Can be very difficult to effectively manipulate the food web
- Requires angler participation to prevent the over-harvest of sport fishes
- Must usually be used in conjunction with other strategies (e.g. nutrient reduction) to produce observable changes

CHAPTER 7: SUMMARY OF RECOMMENDATIONS

7.1 INTRODUCTION

Selecting an appropriate course of action that will best address a particular problem while minimizing unwanted side-affects is a complicated task. It requires careful planning and a complete understanding of all the potential limitations, tradeoffs and consequences associated with each available management option. Regardless of the management strategy chosen, it should be recognized that permanent and observable changes in the overall condition of a lake are rarely if ever accomplished over night. Lakes can be very slow to respond, especially if they are already severely impacted or degraded. The following questions should always be answered prior to selecting and implementing a potentially costly management program.

- What is the problem?
- Which interest groups does the problem affect and how?
- What are the underlying causes of the problem?
- Is it economically, ecologically and publicly feasible to address the underlying causes of the problem?
- What management strategies are available that can improve the situation?
- Do these strategies address the cause of the problem, or do they attack the symptoms?
- What are the potential drawbacks and side-affects associated with each strategy?
- How immediate are the results?
- How long does the strategy remain effective once implemented?
- Will the strategy in any way restrict the use of the water?
- Are any special permits or approvals needed prior to implementation?
- What are the short and long-term costs and benefits compared to other available options?

These and other questions will need to be answered before the right strategy can be selected and implemented successfully. It is a good rule of thumb to first protect what you have before attempting to rehabilitate what has been lost. This is because protection is almost always more effective and less expensive than rehabilitation. Critical sites in the lake and throughout the watershed that function to maintain the health of the resource should be identified as soon as possible. The faster these sites are identified, the faster they can be preserved and properly managed for the benefit of the lake. Critical sites might include high-quality aquatic plant beds, riparian wetlands and undeveloped shorelands. These areas act as natural water quality buffers and provide ideal habitat conditions for a diversity of wildlife, among other benefits. Once a critical site is identified, there are a number of ways to ensure long-term protection. Conservation easements, purchase of development rights, property acquisitions, and special zoning restrictions can all be used effectively, depending on the situation.

7.2 SELECTION METHODOLOGY

Management techniques were selected only after careful consideration was given to potential ecological and recreational impacts, estimated implementation costs, longevity of effectiveness, and overall potential for success. In most cases, strategies that address the root causes of problems were favored over symptomatic solutions. Although many symptom-oriented techniques enjoy faster results and lower initial costs, the benefit-to-cost ratio usually decreases over time as the underlying problem is left unresolved. Efforts were also made to avoid lake-protection strategies that would serve only to add unnecessary or duplicative layers of regulation.

In selecting viable management strategies, it was recognized that Lake Ripley is influenced by a number of complex physical, chemical and biological components. These components are extremely dynamic and affect the lake's responsiveness to management efforts. Because the lake is a highly interactive system, it is impossible to alter one characteristic, such as algae growth or the clarity of the water, without affecting some other aspect, such as rooted aquatic plant growth. The complexity and interactive nature of the system, as well as the tradeoffs associated with different management actions, were carefully considered during the strategy selection process. The selection of management options was based on high priority lake uses and problems identified through a combination of public input and the evaluation of available scientific data.

7.3 OVERVIEW OF RECOMMENDED STRATEGIES

Lake-protection strategy recommendations are grouped under two main categorical headings—"Lake-Specific Actions" and "Watershed-Based Actions." The first category refers to recommendations that apply strictly to the use, regulation and management of the lake itself. Whereas the second category refers to recommendations that apply to the surrounding land area that directly influences the overall health of the lake. Note that many of the proposed strategies are derived from earlier studies and planning efforts. In such instances, the applicable study or planning document is referenced and included in the appendices of this report. The reader is strongly advised to refer to these other information sources whenever appropriate.

Under each strategy recommendation is an abbreviated list of issues that the proposed action is intended to address upon implementation (See "Issue Key" below). Primary benefits are highlighted in bold letters, while secondary benefits are left as non-highlighted text. The Issue Key should be used to quickly identify recommendations that target specific issues of concern as they arise.

ISSUE KEY

WC	=	Weed control
AC	=	Algae control
SP	=	Shoreline protection
H	=	Habitat
F	=	Fisheries
WQ	=	Water quality
A	=	Aesthetics
R	=	Recreation
E	=	Education
S	=	Safety
I	=	Information/understanding
MF	=	Management funding

LAKE-SPECIFIC ACTIONS

1. **Expand slow-no-wake zones to incorporate near-shore, shallow-water areas.**
   [**H**, **S**, **WQ**, **R**, **SP**, F, WC]
   Shallow, near-shore aquatic habitat is proven to be very susceptible to impacts associated with motor boat and personal watercraft traffic. Impacts include the re-suspension of bottom sediment, destruction of valuable aquatic plant communities, increased shoreline erosion, wildlife disturbance, proliferation of nuisance weeds, and the displacement of passive recreation (e.g. swimming, canoeing and fishing). Expanding the slow-no-wake zones would serve to separate conflicting lake uses, minimize sediment re-suspension, create a refuge for wildlife, reduce shoreline erosion rates, and protect shallow-water aquatic habitat that is sensitive to disturbance. According to feedback from public surveys and hearings, this type of strategy is strongly supported by a majority of the lake community.

   A proposed ordinance should be submitted to the Oakland Town Board that establishes a no-wake boundary either (1) along the five-foot depth contour, (2) at a 300-foot distance from shore, or (3) an acceptable variation of these two methodologies. The no-wake boundary may also be set up to incorporate the existing protected areas in each of the two bays. This may be necessary to maintain adequate protection of designated "sensitive" areas that support high quality aquatic habitat. The most appropriate option would be the one that best supports the targeted benefits while still remaining feasible in terms of implementation. No-wake markers should be in place as soon as possible following ice-out to protect spring spawning areas. Markers should then be removed no earlier than September 30th of each year.

2. **Develop slow-no-wake policy for periods of abnormally high water levels.**
[**SP**, **S**]
Although Lake Ripley is relatively self-regulating in terms of water level fluctuations, an emergency action plan may be necessary during unusually wet conditions. This situation occurred during the spring and early summer of 1999, affecting many lakes in Southern Wisconsin. In fact, neighboring Dane County was forced to respond by instituting an emergency no-wake rule on all county lakes for part of the summer. Public landings were temporarily closed and no-wake zones were extended to protect shorelines threatened by these dangerously high lake levels.

As a precautionary measure, it is advisable for Lake Ripley to have its own emergency no-wake policy. A staff gauge should be installed near the outlet to monitor changes in lake levels, especially during high precipitation events that may cause larger than normal lake-level fluctuations. When the lake rises to a specified numerical level on the gauge, the lake would automatically be designated as "slow-no-wake" until water levels recede to an acceptable point. This type of policy would protect against excessive shoreline erosion, flooding, and personal property damage that can be caused by high-water boat wakes. A no-wake policy should be developed prior to a crisis situation so as to avoid unnecessary public controversy and delayed response times.

3. **Continue selective mechanical harvesting of Eurasian watermilfoil, and regularly update the Aquatic Plant Management Plan.**
[**WC**, **H**, I, F, R, A]
Generally, most lake uses and benefits will be supported if a reduction in algae growth is achieved in conjunction with a thriving, but well-managed native plant community. This is best accomplished by reducing nutrient inputs which are known to fuel algae blooms, while minimizing ecosystem "disturbances" that encourage the proliferation of non-native (exotic), rooted plant species. It is these exotic species that typically develop into extensive, monotypic stands of nuisance vegetation that cause most lake-use impairments. Therefore, the ideal strategy is to target exotic species whenever they become a nuisance in high traffic areas, and at the same time protect native plant communities that offer a number of water quality and wildlife habitat benefits. Attempting to significantly and indiscriminately reduce all rooted plant growth throughout the entire lake is likely to create conditions of increased turbidity and nutrient availability that would favor more frequent and larger scale algae blooms.

Mechanical harvesting was previously identified by the Wisconsin Department of Natural Resources as the preferred management strategy for controlling aquatic weed growth in Lake Ripley (see Appendix F). Harvesting efforts should continue to focus on dense, monotypic stands of Eurasian watermilfoil and other non-native weeds once they have reached the surface in depths no less than three feet. Priority attention should be directed toward popular navigation routes, public access points, and any open-water wake areas that are impacted by nuisance weed growth conditions. Native, beneficial plant species (e.g. water lilies, pondweeds, water celery, spiny niad, etc.) should be left undisturbed and protected whenever possible. A diversity of native vegetation rarely impedes recreational use of the water, and is critical for habitat and water quality.

Another aquatic plant inventory should be conducted to update information that is now several years old. The inventory is necessary to determine how the plant community (specie types, locations, relative densities, etc.) has evolved over time and responded to management efforts. An updated Aquatic Plant Management Plan should also be prepared once the inventory is complete. DNR Lake Planning Grants are available to help finance these types of efforts.

4. **<u>Determine extent of in-lake nutrient recycling from anoxic sediment phosphorus release</u>.**
[**I**, AC, WQ]
Phosphorus is identified as the limiting nutrient responsible for algae growth in Lake Ripley. Existing evidence suggests that most of the total phosphorus load to the lake is in the form of polluted runoff from the surrounding watershed. However, it has not yet been quantified how much phosphorus loading is derived from in-lake sources versus watershed inputs. A phosphorus budget identifies the quantity and sources of the various nutrient inputs into the lake. This information is used to determine high nutrient-loading areas, and to select the management techniques that are best designed to address these areas.

The release of phosphorus from nutrient-rich bottom sediments and decaying organic matter may represent a significant component of the lake's nutrient budget that drives algae growth. Given Lake Ripley's watershed-to-lake surface area ratio, it is more probable that phosphorus loading from external sources, rather than internal nutrient recycling, is the main problem. However, this assumption should be verified. As nutrient and sediment loading from the watershed is brought under control through the Lake Ripley Priority Lake Project's cost-sharing efforts, in-lake sources become more of an issue and deserve greater attention.

DNR Lake Planning Grants are available to help fund this type of study. Prior to implementing a potentially expensive phosphorus budget analysis, continued monitoring of total phosphorus concentrations is recommended during and immediately after summer stratification. Phosphorus concentrations should be compared from the top and bottom of the water column when the hypolimnion becomes anaerobic, and then when the lake turns over in the fall. This information would suggest whether significant quantities of phosphorus are mobilized from the bottom sediment under anoxic conditions. Although limited water quality data do indicate nutrient accumulation within the hypolimnion, it is unknown whether this accumulation is ultimately significant.

5. **<u>Continue sport fishery enhancement programs through habitat protection, carp removal and limited fish stocking</u>.**
[**F**, H, WQ]
The Lake Ripley fishery will be best served by taking the following actions:
- Protect sensitive aquatic habitat;
- Encourage the moderate growth of a diversity of native plant species;
- Selectively control non-native plant species like Eurasian watermilfoil;
- Reduce sediment and nutrient loading from the adjoining watershed;
- Prevent over-harvesting of sport fishes (largemouth bass, walleye and northern pike); and
- Implement programs that reduce "rough" fish populations like carp

The installation of artificial habitat (e.g. fish cribs) is not recommended as long as Lake Ripley supports a flourishing and healthy plant community. These structures displace native plant habitat, and focus fish populations over confined areas, facilitating over harvesting by anglers. However, lakefront property owners should be encouraged to let natural "treefalls" remain in the water or at the water's edge as long as they do not represent navigational obstructions. Maintaining a well-vegetated shoreline and protecting shoreland wetlands is also important for providing structural refuge, as well as spawning and rearing sites. Fish stocking programs should be performed under the guidance of DNR fisheries biologists, and is presently limited to walleye fingerlings. Other sport fishes such as largemouth bass and northern pike are self-sustaining due to natural reproduction, and would not be well served by stocking.

Fish management efforts should focus on promoting catch-and-release, as well as implementing programs that reduce carp numbers. However, it should be noted that direct carp-removal efforts are rarely successful at significantly reducing populations, especially over the long term. Carp are generally not a problem in less eutrophic lakes with good water clarity and a healthy plant community. Therefore, fisheries management should concentrate on improving water clarity, protecting native aquatic vegetation, and preventing the over harvest of game fish.

6. **<u>Continue intensive, long-term, water quality monitoring program</u>.**
   [**I**, WQ]
   Water quality monitoring should proceed as an ongoing and long-term evaluation tool. Monitoring data are needed to accurately assess the condition of the lake, diagnose problems, and gauge the success of management efforts. Information on water chemistry, biological indicators, and physical characteristics should continue to be collected at both the inlet and outlet, and over the deepest point on the lake. Recommended sampling parameters include dissolved oxygen, temperature, pH, total phosphorus, total nitrogen, suspended solids, Secchi depth, chlorophyll a, macroinvertebrates, and inlet/outlet flow rates. Maintaining a working partnership with Cambridge High School is strongly recommended to support the continuation of this program.

7. **<u>Ensure proper lake-rule postings at all public access points</u>.**
   [**E**, R, S]
   Lake rules should be clearly posted in high visibility locations at the public boat landing, as well as the Lake Ripley Marina and the Lake Ripley Community Park upon permission of the property owners. At a minimum, postings should include local ordinances and a detailed map of the lake identifying points of interest, such as no-wake protected areas. All information should be clearly visible and easy to read. Water-resistant informational brochures and maps could also be made available at these popular access sites.

8. **<u>Raise public launch fee in accordance with State regulations to acquire additional funds for maintenance and upkeep.</u>**
   [**MF**, A, S]
   Members of the lake community have expressed concern about the upkeep and policing of the public landing. Problems include littering, illegal parking, and violations of posted launch rules. Raising the daily and annual launch fees would help Oakland Township to collect additional funds that could be used to resolve these issues. However, raising fees at a pubic landing for the sole purpose of restricting non-resident use of the lake is not recommended, as such practice is a violation of State law according to the Public Trust Doctrine. Lake Ripley is defined as "waters of the state" pursuant to Chapter IX of the State Constitution, and therefore should be forever "free." The State establishes a maximum public access fee on lakes that is equivalent to the amount charged by the Wisconsin State Parks system.

   The current fee structure at the Lake Ripley public landing from May 1st to September 30th is as follows: $3.00 for a daily pass; $10.00 for an annual resident pass; $15.00 for an annual non-resident pass; and $5.00 for an annual senior citizen pass. It is recommended that the Lake District propose that the Town of Oakland adjust its current fee structure to reflect the rates charged at State parks. This maximum fee structure is as follows: $5.00 resident daily pass; $3.00 resident senior citizen daily pass; $7.00 non-resident daily pass; $18.00 resident annual pass; $9.00 resident senior citizen annual pass; $25.00 non-resident annual pass.

9. **<u>Propose local ordinance that prohibits the feeding of waterfowl, and implement other waterfowl-control strategies.</u>**
   [SP, WQ, E]
   The exploding waterfowl population on Lake Ripley is problematic for the following reasons:
   - Waterfowl, and especially Canada geese, damage shorelines via trampling , foraging and defecation;
   - Their activities increase nutrient loads to the lake which could help fuel algae blooms;
   - Their territorial behavior may displace other wildlife;
   - They can introduce pathogens and parasites to the lake, such as those that cause "Swimmer's Itch."

Lake residents have employed a vast arsenal of strategies to discourage geese and other waterfowl from congregating along their shorelines. Techniques such as string goose barriers, repellents, raptor decoys, noisemakers, and the planting of shoreline vegetation have all been used with varying degrees of success. However, the best means of controlling nuisance waterfowl populations is to take away their preferred habitat and easy food sources. Canada geese are especially attracted to flat, suburbanized waterfronts with large expanses of turf grass at the water's edge. These short grasses provide a favorite food source, are easy to access from the water, and do not provide cover for the birds' natural predators. Waterfowl numbers can also swell as a result of year-round hand feeding by lake users and residents. Feeding can encourage some waterfowl to break their seasonal migratory patterns, instead preferring to over-winter where food remains prevalent all year round.

If populations continue to increase and cause problems, it may be necessary to prohibit people from feeding the waterfowl by enacting a local ordinance. In the meantime, information and education efforts should discourage residents from engaging in such activities. Residents should also be informed of effective shoreland landscaping techniques that support wildlife other than geese.

WATERSHED-BASED ACTIONS

1. **Continue implementing the goals and objectives of the Lake Ripley Priority Lake Project.**
[**MF**, **WQ**, **I**, **E**, SP, WC, AC, H]
Controlling the amount of eroded soil, fertilizers, pesticides, stormwater runoff and other pollutants that enter Lake Ripley from the surrounding watershed is of the highest priority. External, or watershed-based, nutrient loading is currently the largest contributor of a host of problems on Lake Ripley. These problems include noxious algae blooms, excessive weed growth, poor water clarity, mucky lake bottoms, and destroyed aquatic habitat. Encouraging conservation farming practices, enforcing construction site erosion control measures, installing stormwater retention areas, and stabilizing shorelines and drainage ditches are all examples of Best Management Practices (BMPs) that control the amount of non-point source pollution that enters the lake. BMPs should continue to be implemented and maintained throughout the watershed. It is also important to continue monitoring watershed development activities to ensure compliance with stormwater and erosion-control regulations. (Refer to the Non-point Source Control Plan in Appendix C for specific recommendations.)

   The LRMD is encouraged to participate (whenever feasible) in land use planning and zoning decision-making processes that dictate the density, type and location of future development within the watershed. Future regulations should include vegetative cover removal restrictions, performance standards for stormwater management, wetland protection provisions, and restrictions on development of steeply sloped or highly erodible areas.

2. **Encourage the use of no-phosphorus fertilizers within 200 feet of the lake.**
[**E**, **WQ**, **AC**, **WC**]
Phosphorus is identified as the limiting nutrient that controls the amount of algae growth in Lake Ripley. Fertilizers, pet waste, eroded soil, and ash from the burning of yard waste can all contain high concentrations of phosphorus, and may easily be washed into the lake during storm events. Lakefront property owners should be encouraged to limit or eliminate the use of phosphorus-containing fertilizers on lawns adjacent to the lake. The use of fertile lake water or no-phosphate products should be promoted, and special care should be taken to avoid over-fertilizing. Also, property owners should be encouraged to keep their grass between 2-3 inches in height, and prevent leaves and grass clippings from entering the lake.

   If widespread voluntary compliance is not achieved, the Lake District may want to propose an ordinance that officially prohibits this activity. It may also be possible to simply amend the existing leaf-burning ordinance, which was adopted in 1997 for similar reasons. It should be noted that information and education is the preferred strategy for addressing this particular problem. Enforcing an ordinance that does not completely ban the use of all fertilizers and herbicides within a certain distance of Lake Ripley would be extremely difficult. However, although problematic to enforce, a more targeted ban based on phosphorus content would have the benefit of allowing lakefront owners to use no-phosphate fertilizers. This flexibility may be appropriate for those poor-soil areas where it is perceived necessary to use fertilizers to maintain healthy lawn and plant growth.

3. **Propose shoreland zoning modification that regulates the type and placement of high-intensity lighting on piers, boathouses and shorelines.**
[**A**]
Light pollution is a growing problem around developed lakes. A nuisance situation can occur when property owners install bright floodlights on piers, boathouses, gazebos, and along the shoreline that project light out over the lake or onto neighboring properties. The LRMD is encouraged to work with the Jefferson County Zoning Department and/or the Town of Oakland to develop policies that address this concern. The proposed ordinance or zoning restriction would limit the type and location of high-intensity lights within the shoreland zone. A permit system is recommended that allows certain types of light fixtures for safety and security purposes, but prohibits unnecessary or inappropriate lighting systems.

4. **Continue implementation of an intensive information and education campaign directed towards lakefront property owners.**
[**E**]
Lake and watershed residents should continue to be educated and informed of issues and management efforts related to Lake Ripley. Educational programs should focus on the importance of sound land/lake-use practices, and how our actions can both negatively and positively impact the resource. Based on public survey results, quarterly newsletters and direct mailings are recommended as the primary means of communication. Secondary methods should include public meetings, local newspaper articles, brochures, educational displays, and presentations to homeowners groups. For the benefit of non-resident lake users, laminated informational brochures could be made available at access sites that contain lake maps, important phone numbers, local ordinances and other lake rules. (Refer to the Non-point Source Control Plan in Appendix C for additional recommendations.)

   As an example educational effort, lakefront property owners could be encouraged to establish shoreline buffer strips by planting or maintaining a thickly vegetated area between a manicured lawn and the lake. A well-vegetated buffer strip along the water's edge that consists of native plants, shrubs and trees will provide numerous water quality, wildlife habitat and aesthetic benefits. In addition, landowners could be asked to attempt to *reduce* the amount of impervious areas (e.g., driveways, patios, sidewalks, etc.), and *increase* vegetated areas on their properties during future improvement projects. Impervious surfaces do not allow water to infiltrate, and increase surface water runoff volumes and velocities.

5. **Continue to acquire and/or establish conservation easements on critical wetland properties throughout the Lake Ripley watershed.**
[**H**, WQ, A]
The historic ditching, drainage and development of wetlands throughout the watershed resulted in a corresponding decline in water quality and wildlife habitat. The long-term protection and restoration of these wetland areas is important to maintaining the quality of Lake Ripley. Wetland property owners should be routinely approached and encouraged to establish conservation easements on these critical areas. Property acquisitions should be considered a secondary option due to the high expense and long-term management requirements that are associated with property purchases. DNR Lake Protection Grants are available to help finance the purchase of properties deemed critical for water quality protection. Depending on eligibility, funding may also be available through the Lake Ripley Priority Lake Project that can be used to finance certain types of conservation easements.

6. **Continue public education and wetland/prairie restoration activities at the Lake District Preserve.**
[**E**, **H**, WQ, A]
The 99-acre Lake District Preserve represents the Lake District's largest and arguably its most important asset used for lake-protection purposes. Public access and educational efforts should continue at the preserve, as well as wetland and prairie restoration activities. It is strongly recommended that the LRMD take any action necessary to plug the eroding agricultural drainage ditch that still transects the preserve property on its east side. This last remaining ditch at the preserve is causing the degradation of adjoining wetlands, and serves as a direct pollutant conduit to Lake Ripley. According to the Non-point Source Control Plan for the Lake Ripley Priority Lake Project, agricultural drainage ditches in the watershed are estimated to contribute 75% of the total sediment that enters the lake each year (see Appendix C).

MISCELLANEOUS ACTIONS

1. Continue to track public and private funding opportunities at the local, state and federal levels. Submit grant applications whenever appropriate to obtain support for both new and ongoing management efforts. [**MF**]
2. Continue the annual "Lake Sweep" and other litter clean-up projects to remove debris from area waterways and shorelines. [**A**, **E**, WQ]
3. Support the continued funding of a summer lake patrol officer to maintain an enforcement presence on weekends and holidays throughout the boating season. [**R**, **S**, E]
4. Continue implementation of the volunteer "Lake Watch" program to compliment law enforcement efforts. [**R**, **E**]

7.4 SHELVED OR REJECTED ACTIONS

Some management options were either temporarily shelved or rejected outright, depending on such factors as cost, feasibility and applicability. They are included in the lake management plan for three reasons. First, it was necessary to objectively investigate every available management alternative to facilitate comparison shopping among strategies. Familiarity with a range of different options is helpful in evaluating potential benefits and limitations. This allows for the most objective appraisal of the alternative's applicability to the lake. Second, since conditions change over time, a management alternative that may not appear viable now may become so later. Third, lake residents and users are likely to question why certain strategies were selected over others. If any major option is left out of the discussion for whatever reason, decision-makers may be accused of pushing personal agendas and not weighing the merits of all the alternatives. Each of the following actions, unless otherwise stated, is currently shelved for possible future consideration.

LAKE USE REGULATION

- Restricting or banning the use of certain watercraft/engine types on Lake Ripley
  The imprudent operation of large, high horsepower motor boats and personal watercraft (e.g. jet skis) is viewed as a serious concern and significant problem on Lake Ripley. Many of the cited problems could be resolved through better enforcement of existing regulations, and by implementing the recommendation to expand slow-no-wake zones. In any event, "across the board regulation by boat size, type, or horsepower has been considered an unwarranted restriction of public rights in previous court rulings" (Guidelines for Ordinance Writing & Buoy Placement in Wisconsin Waters, Bureau of Law Enforcement, DNR, William G. Engfer, 1992).

  Pursuit of this strategy is not recommended unless serious safety or environmental issues arise that cannot be addressed by enforcing existing regulations, or by implementing the recommendations presented in this plan. If the need does become warranted, the Lake District should consider a program that includes a special "grandfather clause" for watercraft purchased before a certain date, and phases out the offending watercraft or engine type over a several year period. This would minimize the impact of an immediate and significant investment loss for owners of watercraft prior to the rule change. In the meantime, information and education efforts should encourage the purchase of quieter, less polluting and more fuel-efficient four-cycle engines—as opposed to two-cycle engines. Problems associated with two-cycle engines are already being addressed at the state and federal levels. For instance, manufacturers of personal watercraft are now mandated to use more efficient motors on any new watercraft produced after a certain date. Information and education efforts should also stress the importance of understanding and complying with existing lake rules.

- Implementing more restrictive time zoning for certain forms of recreational activities
  The adjustment of slow-no-wake times was not strongly supported according to the results of the 1995 Boating Opinion Survey. The most recent public survey, however, indicated that a slight majority of residents would be in favor of "expanding slow-no-wake times and/or locations for the purpose of promoting safety or protecting sensitive habitat areas on Lake Ripley." Therefore, no-wake time adjustments are recommended only if such policy changes can significantly improve safety or protect sensitive habitat. It appears that most noise, safety and environmental-impact issues can be adequately addressed through space zoning as opposed to time zoning strategies. However, if time zoning becomes warranted at some point in the future, the Lake District might consider adopting special slow-no-wake or no-motor time periods for the benefit of passive recreation and quiet sports.

- Instituting a maximum speed limit on the lake
  This strategy is not recommended at the present time. The small size of the lake is a natural deterrent to high-speed boating. There are also existing state regulations that already prohibit watercraft from generating dangerous wakes and speeding in close proximity to other boats, piers, rafts, etc. Again, the proposed expansion of slow-no-wake zones may eliminate any strong need for additional regulation as additional no-wake space is freed up for more passive recreation. Pursuit of this strategy is warranted only if serious safety issues arise that cannot be addressed through enforcing existing regulations, or by implementing the recommendations presented in this plan.

- Restricting the number of non-resident lake users who could access the lake at any given time
  Charging high public access fees or otherwise engaging in activities that solely restrict non-resident use of the lake is a violation of State law under the Public Trust Doctrine. Lake Ripley is defined as "waters of the state" pursuant to Chapter IX of the State Constitution, and therefore should be forever "free." Therefore, both residents and non-residents have equal right to reasonable access and use of Lake Ripley. The State allows establishing maximum access fees equivalent to those charged by Wisconsin State Parks. It should be noted that hundreds of thousands of state and federal grant dollars have been received to help finance lake management and improvement efforts due to the fact that the lake has public access.

WATER LEVEL CONTROL

- Installing an outlet control structure to regulate water levels
  Water level fluctuations are currently not identified as an issue of major concern according to public survey results. In addition, water levels appear to remain naturally self-adjusting and relatively stable on Lake Ripley, with the possible exception of severe drought or a very large storm event. Installing an outlet control structure to manage water levels would most likely have a negligible impact due to the low flow rate and shallow topographic gradient of the outlet stream. Such a structure could also create future political problems due to disagreement on what levels should be maintained and for what purpose.

  If water levels later become an issue of concern, both state and federal permit approvals would be required to install a control structure. The permit process would most likely require a thorough evaluation of upstream and downstream impacts; the establishment of maximum and minimum water levels; and special property easements where the proposed dam would be constructed.

NAVIGATION

- Dredging the inlet channel to facilitate boat access to Lake Ripley
  The inlet channel is becoming shallower over time due to sedimentation and the accumulation of decaying organic material. Consequently, navigation and access to the lake is restricted for those property owners living along the channel. Dredging is one of the only measures available that can be used to effectively deepen the inlet channel for purposes of navigability. This management technique is often prohibitively expensive, and there are very limited opportunities for cost-share assistance. It also requires a large disposal area in close proximity to the lake, may increase short-term turbidity levels, and can destroy fish-spawning habitat.

  Dredging is not recommended at the present time. However, dredging may become necessary at some point in the future if sedimentation rates are not adequately curtailed.

EXTERNAL NUTRIENT CONTROL

- Modifying DNR-owned wetlands to improve functionality as natural filter of sediment
  DNR wetland experts evaluated the inlet wetlands in 1999, and suggest that any structural modifications to the inlet channel or the adjoining wetlands would prove counterproductive. At present, the wetlands are in "relatively good condition" even though they are receiving increased water volumes and sediment loads from upstream ditches and surface runoff. Hydrologic manipulations or channel modifications would most likely have a detrimental impact to the native wetland plant community, and a negligible impact to downstream water quality. Unless this appears otherwise, management should focus on controlling upstream sources of sediment loading and polluted runoff by implementing the recommendations of the Non-point Source Control Plan for the Lake Ripley Priority Lake Project (see Appendix C).

IN-LAKE NUTRIENT CONTROL

- Phosphorus precipitation and inactivation using alum treatments
  This strategy is recommended if a phosphorus budget shows large and significant quantities of phosphorous being released from the anoxic lake bottom. If in-lake nutrient loading is significant relative to external loading from the watershed, an alum treatment may be an effective technique to address the problem. However, external sources of phosphorous must first be brought under control if an alum treatment is to have lasting effectiveness.

- Hypolimnetic withdrawal to remove and discharge anoxic, nutrient-rich water
  Strategy selection is dependent upon the results of a phosphorus budget. Recommended for consideration only if it is determined that in-lake nutrient loading from anoxic bottom sediments is significant relative to external loading from the watershed. Feasibility will be based on a combination of lake morphometry, outflow characteristics, and potential downstream impacts caused by the discharge of nutrient-rich, oxygen-poor water.

- Artificial circulation to promote lake-wide mixing and aeration
  Strategy selection is dependent upon the results of a phosphorus budget if intended as a measure to control in-lake nutrient recycling. Recommended for consideration only if it is determined that in-lake nutrient loading from anoxic bottom sediments is significant relative to external loading from the watershed. External nutrient loading must be adequately addressed before any consideration should be given to this in-lake management approach.

The use of artificial circulation solely for fishery enhancement purposes is not recommended at this time. This technique may adversely impact the cool water walleye fishery by breaking down thermal stratification.

- Hypolimnetic aeration to reduce anoxia and prevent sediment phosphorus release
  Strategy selection is dependent upon the results of a phosphorus budget if intended as a measure to control in-lake nutrient recycling. Recommended for consideration only if it is determined that in-lake nutrient loading from anoxic bottom sediments is significant relative to external loading from the watershed. Feasibility will be based on the volume and extent of the anoxic hypolimnion that would require aeration.

  The use of hypolimnetic aeration exclusively for fishery enhancement purposes is not recommended at this time. However, if hypolimnetic oxygen depletion is shown to adversely impact a popular fish species (e.g. walleye), this technique may be warranted since it does not break down thermal stratification.

- Removal of nutrient-rich sediment through dredging
  Dredging for the purpose of controlling in-lake nutrient recycling is not recommended at the present time. This technique requires the removal of all nutrient-rich bottom sediment that contributes to phosphorus release. The removal of such material in a lake of this size and depth is currently prohibitively expensive and impractical. In any event, sediment core analyses suggest that the bottom sediment is not of significant phosphorus content to warrant concern at this time.

SYMPTOMATIC SOLUTIONS

- Herbicides and algacides to control aquatic plant and algae growth
  Chemical applications represent a band-aide approach that fails to address the underlying cause of the problem. Treatments would be required on a regular and continual basis at great cost over the long run. This technique may deplete dissolved oxygen levels due to the decay and decomposition of plant and algae matter that is left in the lake. There is also inconclusive information regarding the long-term impacts and persistence of these chemicals in the environment.

- Water level manipulations to control aquatic plant growth (drawdown)
  Not recommended, and not feasible. Lake Ripley is not capable of supporting this type of management technique due to inflow and outflow limitations.

- Sediment barriers to control aquatic plant growth
  Not recommended at the present time. This strategy has been found to be prohibitively expensive, labor intensive, and relatively ineffective on other lakes. Sediment barriers and aquatic plant screens are most effective when used in small, shallow, public swimming areas.

- Dredging to control aquatic plant growth
  Dredging is a plant-control technique that physically removes the entire plant and associated sediment from the lake bottom. It is not currently recommended based on the considerable expense of such a project, as well as the ecological repercussions involved. Dredging is a massive undertaking that can destroy valuable aquatic habitat, increase turbidity, and release nutrients from the lake bottom.

CHAPTER 8: EVALUATION OF PROPOSED ORDINANCES

8.1 SLOW-NO-WAKE ZONES

CONCERNS ADDRESSED

There is a host of safety and environmental issues caused by motor boats and personal watercraft that operate at imprudent speeds in near-shore, shallow-water areas. Public opinion surveys indicate that this issue is a chief concern among LRMD residents for multiple reasons.

1. Shallow-water motor boat traffic negatively impacts water quality by stirring up bottom sediment. Residents rank clear water as an attribute of primary importance, and overwhelmingly agree that water clarity is at its worst following heavy motor boat traffic.
2. This type of activity destroys sensitive aquatic habitat that is vital in supporting a diversity of fish and wildlife, as well as protecting water quality. The physical cutting of aquatic vegetation by boat propellers and the constant scouring of the lake bottom by boat-induced turbulence are harmful to a healthy plant community. These disturbances favor tolerant "weedy" species over sensitive native species.
3. Quiet or passive forms of recreation (e.g. canoeing, swimming, fishing, etc.) may be disproportionately excluded from the lake. Motor boat and personal watercraft traffic was reported as the number one factor contributing to problems and reducing people's use and enjoyment of the lake.
4. Shallow-water boating may dramatically reduce the level of peace and tranquility that LRMD residents and users so much enjoy. Peace and tranquility was identified as the number one lake-use activity next to swimming.
5. Near-shore motor boat traffic produces wakes that increase the incidence of shoreline erosion.
6. This activity can pose serious risks to both safety and personal property damage. Because swimmers are among the lake users who utilize near-shore, shallow-water areas, heavy motor boat and personal watercraft traffic represent a danger to this user group.

JUSTIFICATION

Lake-use zoning can be an effective tool for the management of competing water-based activities. It can also be used to reduce the potential impact of these activities on the health of the resource. Studies now suggest that shallow-water areas are very sensitive and vulnerable to motor boat disturbances from an ecological standpoint. Shallow-water boating may impact high-quality aquatic plant communities through direct cutting, bottom scouring, sediment re-suspension, and increased wave activity. Increased turbidity, aquatic plant disturbance, wildlife displacement, and shoreline erosion are all serious issues that can be exacerbated by boat traffic operating at wake-producing speeds in shallow-water areas.

An expanded no-wake buffer would not only limit ecological disturbance, but would improve safety by further separating competing lake uses. No-wake zones have the dual benefit of both slowing boats down where appropriate, and directing traffic to more suitable locations. Motor boat traffic that is redirected to deeper waters away from shore will most likely have a negligible impact on sensitive aquatic habitat and passive forms of recreation.

COST-BENEFIT ANALYSIS

Advantages:

- Reduces shoreline erosion caused by near-shore boat wakes
- Improves safety of swimmers, waders, and canoeists
- Reduces user conflicts by creating a separation between passive and active recreational activities
- Reduces navigational safety risks caused by shallow-water bottom obstructions
- Prevents sediment disturbance and re-suspension caused by prop wash (improving water clarity)

- Limits disturbances to aquatic plants and prevents the spread of undesirable species
- Reduces the amount of chopped up plant debris that collects along the shore
- Protects aquatic habitat that is necessary to maintain a healthy fishery
- Reduces the level of noise that can be heard from the shoreline
- Establishes shallow-water refuge for wildlife
- Marker buoys allow lake users to better visualize the location of no-wake zones

Drawbacks:

- Confines motor boat and personal watercraft activity to a smaller area of the lake
- Visual impact of additional buoys on the lake
- Requires an information and education effort to increase public awareness of the new ordinance
- Presents a greater challenge for enforcement if water depths are used as no-wake boundaries
- Includes costs associated with buoying off the expanded no-wake zones

ACTION STRATEGY

1. LRMD passes resolution supporting strategy;
2. LRMD submits proposed ordinance to Town of Oakland (see below);
3. Town of Oakland approves ordinance and directs town police to carry out its objectives;
4. LRMD initiates information & education campaign to publicize the new ordinance;
5. LRMD obtains appropriate DNR permits to install additional buoys;
6. LRMD works with Town of Oakland to coordinate the purchase of buoys and equipment;
7. Town of Oakland installs buoys before May 1st, and removes them after September 30th of each year.

The ordinance is intended to expand no-wake boundaries to incorporate shallow, near-shore areas on Lake Ripley. Several options on how these boundaries can be delineated are presented below. The ordinance should clearly specify the methodology for installing the buoys, including the location and spacing of each buoy. It is estimated that about 30 buoys would be needed to allow for a 400-foot spacing distance. At $80/buoy, the buoys would cost approximately $2,400. Other potential equipment requirements include a depth finder, buoy anchoring systems and off-season storage facility. Education and enforcement will be needed on an ongoing basis to ensure success of the new regulatory policy.

Individual lakefront property owners are not permitted by the DNR to install their own buoys unless unusual circumstances apply. They can, however, get a permit and place their own buoys if an approved management plan is being followed.

Option 1: 5-Foot Depth Contour

Establish no-wake boundary along the 5-ft. depth contour, rather than a fixed distance from shore that ignores variations in lake-bottom topography. In locations where the 5-ft. depth contour is within 100 ft. of piers or the shore, buoys shall be installed no less than the 100-ft. distance to comply with State law. This strategy effectively protects shallow, ecologically sensitive areas from disturbance, but fails to provide an equitable buffer for noise and shoreline erosion control along the length of the lake's shoreline. It also slightly relaxes the no-wake restrictions that are presently in effect in East Bay, where the current area of protection exceeds the five-foot depth boundary. Implementation and enforcement may be problematic since depth contours are irregular and often difficult to see or visualize. Therefore, a more liberal use of buoys may be necessary to adequately delineate the no-wake boundary.

Option 2: 300 Feet from Shore

Establish no-wake boundary 300 feet from shore. This is a 200-foot increase over the existing State regulations for motor boats, and a 100-foot increase for personal watercraft. Because the strategy does not adjust to changes in water depth, it may be unnecessarily restrictive in some locations, while still inappropriately lax in others in terms of protecting shallow areas. The strategy provides an equitable buffer for noise and shoreline erosion control, but fails to protect all shallow, ecologically sensitive areas. In addition, it relaxes the no-wake restrictions that are presently in effect in East Bay, where the current area of protection exceeds the 300-foot boundary. Implementation, compliance and enforcement would be simplified since fixed distances from shore are easier to follow than water depths as reference points.

Option 3: 5-Foot Depth Contour + 300 Feet from Shore

Establish no-wake boundary by combining the above two methodologies. The no-wake zone would be delineated based on the greater of the five-foot depth contour or 300-foot distance from shore. This strategy both fully protects shallow, ecologically sensitive areas, and provides the maximum recommended buffer for noise and shoreline erosion control. However, it slightly relaxes the no-wake restrictions that are presently in effect in East Bay, and may be difficult to implement and enforce. Implementation, compliance and enforcement may again be problematic given the difficulty of dealing with a depth contour that is irregular and difficult to visualize. Combining distances from shore with depth contours may also be confusing and overly reliant on buoy markers.

Option 4: 300 Feet from Shore + Protected Bays

Establish no-wake boundary at a 300-foot distance from shore, and maintain the existing no-wake restrictions in the two bays. This strategy would protect most of the shallow, ecologically sensitive areas, and provide an effective buffer for noise and shoreline erosion control. It also builds on the current ordinance that establishes no-wake restrictions in the two bays for the purpose of protecting sensitive shorelines. Although this option is most restrictive, it may also be the easiest to implement and enforce.

8.2 HIGH-WATER POLICY

CONCERNS ADDRESSED

Although an infrequent occurrence, there have and will continue to be unusually wet seasons when a series of large storm events can produce high water conditions on Lake Ripley. Abnormally high lake levels are of concern due to safety, economic and water quality reasons. As water levels rise beyond their normal range, the risk of near-shore flooding, shoreline erosion and property damage also rises. Safety and navigation may also be compromised if elevated water levels are able to detach pier sections, free boats from their hoists, obscure hazardous underwater obstructions, or dislodge stumps and branches from the shoreline. These problems are only exacerbated by boat wakes, which act to compound the damage that is inflicted upon shorelines and increase the risk of property damage or injury.

JUSTIFICATION

Establishing a high-water policy through a countywide or township ordinance would alleviate the problems associated with extreme lake-level fluctuations. The policy should specify a maximum, numerical water level that, if exceeded, would trigger the implementation of a temporary slow-no-wake ordinance on the entire lake. Slow-no-wake rules would remain in effect until water levels recede back to within the acceptable range. By adopting an enforceable high-water policy before a crisis situation develops, the Lake District and township would avoid unnecessary public controversy and delayed response times.

COST-BENEFIT ANALYSIS

Advantages:

- Protects against shoreline erosion
- Protects piers, docks, boats and other property from wave damage
- Reduces extent of near-shore flood damage
- Reduces chance of injury caused by navigational obstructions and hazards
- Allows for immediate and defined action

Drawbacks:

- Limits recreational use of the lake during high-water periods

- Creates another ordinance and layer of regulation
- Requires an emergency law enforcement responsibility
- Necessitates an information & education protocol when the policy goes into effect

ACTION STRATEGY

1. LRMD installs an easy-to-read, permanent staff gauge near the Lake Ripley outlet;
2. LRMD ensures accessibility to staff gauge for monitoring purposes;
3. LRMD works with DNR to establish a maximum, numerical lake level that triggers the policy;
4. LRMD establishes a numerical lake level that cancels the policy as waters recede;
5. LRMD proposes a high-water, slow-no-wake ordinance to the Town of Oakland;
6. Town of Oakland adopts ordinance and outlines a plan of action for enforcement;
7. LRMD develops a program to monitor the staff gauge during extreme wet weather conditions;
8. LRMD creates an information and education protocol.

8.3 PUBLIC LAUNCH FEES

CONCERNS ADDRESSED

The public boat landing is a heavily used and somewhat abused access point to Lake Ripley. Some lake community members have complained that there is a lack of general maintenance and rule enforcement at the public launch. Littering, illegal parking and violations of posted launch rules are all issues that may warrant greater attention. By raising launch fees, the Town of Oakland could collect additional funds to help pay for increased upkeep and policing of the popular access site. The fee increase, however, should not be used for the purpose of discouraging access and use of the lake. Raising fees an excessive amount for this purpose would be contrary to the Public Trust Doctrine and a violation of State law.

JUSTIFICATION

Lake Ripley is defined as "waters of the state" pursuant to Chapter IX of the State Constitution, and therefore should be forever "free." Raising public access fees is permissible by State law as long as the increase does not exceed a specified cap. The State establishes a maximum fee structure that is equivalent to the amount charged by the Wisconsin State Parks system. The purpose of setting a maximum charge is to prevent unreasonably restricted access to public waters that may discriminate against low-income individuals.

That said, launch fees could legally be raised by as much as 70-80% from their current levels. The current fee structure was established by town ordinance in April of 1995, and has not been adjusted for inflation or increased public use of the launch. An incremental or one-time increase in access charges would not be overly cost-prohibitive to the general public. It would also allow the Town of Oakland to acquire additional income that can be used to pay for improved maintenance and enforcement.

COST-BENEFIT ANALYSIS

Advantages:

- Allows for the collection of additional income by the Town of Oakland
- Remains consistent with the maximum fee structure permissible under State law
- Helps defray the costs associated with additional upkeep and maintenance of the launch site
- Helps defray the costs associated with increased enforcement of posted rules
- Involves only very minor implementation expenditures

Drawbacks:

- Requires a revision of the existing ordinance
- Necessitates the updating of fee-collection envelopes and instructions

- Increases public access costs
- Demands that additional attention be given to monitoring the public landing

ACTION STRATEGY

The current fee structure at the Lake Ripley public landing from May 1st to September 30th is as follows: $3.00 for a daily pass; $10.00 for an annual resident pass; $15.00 for an annual non-resident pass; and $5.00 for an annual senior citizen pass. It is recommended that the Lake District propose that the Town of Oakland adjust its current fee structure to reflect the rates charged at State parks. This maximum fee structure is as follows: $5.00 resident daily pass; $3.00 resident senior citizen daily pass; $7.00 non-resident daily pass; $18.00 resident annual pass; $9.00 resident senior citizen annual pass; $25.00 non-resident annual pass.

1. LRMD proposes ordinance revision to the Town of Oakland;
2. Town of Oakland adopts proposed changes to the existing ordinance;
3. Town of Oakland updates its fee-collection system;
4. LRMD works with Town of Oakland to publicize the fee increase;
5. Town of Oakland devotes additional resources to maintaining the launch site.

8.4 NUISANCE WATERFOWL

CONCERNS ADDRESSED

Feeding geese and other waterfowl encourages them to reside on lakes longer and in greater numbers than would naturally be possible. Large numbers of waterfowl have the potential to significantly impact the rate and pathways of nutrient cycling in aquatic ecosystems because they consume and excrete large amounts to maintain a high metabolic rate. While some recent studies show that bird droppings may contribute relatively large percentages of the total phosphorus loading to a lake, most other studies have concluded that waterfowl were not an important nutrient loading factor in lakes. Rather, large bird populations were often associated with productive lakes because of the abundant food supply.

At a minimum, large waterfowl populations can have a negative impact on smaller lakes by facilitating the in-lake recycling of nutrients. Nuisance waterfowl can also damage shorelines and property through trampling, grazing and defecation. These activities can cause soil compaction, reduce vegetative cover, and add nutrient-rich fecal matter to the lake. The parasite that contributes to a skin irritation referred to as "Swimmer's Itch" is also linked to waterfowl activities. Implementing programs and strategies that control nuisance waterfowl would therefore benefit swimmers, shoreline property owners, and even water quality.

JUSTIFICATION

Adopting a local ordinance that prohibits people from feeding geese and other waterfowl would benefit the wildlife, shoreline property owners, certain lake users and the lake itself. Regular feeding can cause dependency on people for food, poor nutrition, and the spread of diseases. It can also cause delays in migration patterns and encourage birds to become permanent residents. Even if only a few individuals are habitually guilty of such feeding activity, their actions can have a profound affect on the health and migratory patterns of large numbers of waterfowl. Feeding restrictions are warranted given the apparent increasing waterfowl populations and the associated problems they create. Adoption of an ordinance should be done in conjunction with an information and education strategy that promotes other waterfowl management strategies.

COST-BENEFIT ANALYSIS

Advantages:

- Discourages waterfowl populations from growing to unsupportable levels
- Preserves the health and sustainability of existing populations
- Reduces the likelihood of in-lake nutrient recycling caused by bird defecation
- Reduces the chances for an outbreak of the "Swimmer's Itch" parasite
- Protects shorelines from trampling and over-grazing

Drawbacks:

- Requires another ordinance and added layer of regulation
- Prohibits an activity that may be enjoyed by some lake users
- Compliance may be difficult to monitor and enforce

ACTION STRATEGY

1. LRMD proposes ordinance to the Town of Oakland;
2. Town of Oakland adopts new ordinance;
3. LRMD implements information and education program regarding issue;
4. LRMD promotes other effective management techniques, including the following:

Natural & Artificial Barriers

Giant Canada geese prefer large expanses of Kentucky Bluegrass mowed right up to the water's edge. Limiting the extent of manicured lawns, planting tall trees to interfere with the birds' flight paths, and establishing near-shore shrubs to reduce the birds' on-ground visibility are recommended control strategies. Geese generally will not establish nesting territories in areas where they cannot easily walk to and from the water's edge. Steep vertical banks, thick vegetation and artificial barriers are each effective at discouraging geese. Good results have also been reported using 20-pound test, or heavier, monofilament line to make a two- to three-strand fence. The first strand should be placed approximately six inches above the ground, with each additional strand placed six inches above the previous.

Frightening Devices

A federal permit is not required to merely scare or herd migratory birds. However, all applicable State and local laws must be observed when using frightening devices. Pay particular attention to laws governing the making of loud noises, discharging of firearms, use of pyrotechnics, and use of free-running dogs. Also consider the possible reaction of neighbors. Move frightening devices every two to three days and use them in varying combinations to improve efficacy and prevent habituation. Waterfowl can be difficult to disperse once they become established on a lake or feeding site. Promptness and persistence are the keys to success when attempting to repel nuisance waterfowl.

Population Control

Migratory birds, including most waterfowl, as well as their nests and eggs are federally protected by the Migratory Bird Treaty Act. Persons wishing to take any migratory bird outside of the legal hunting season must first secure a federal permit from the U.S. Fish & Wildlife Service, and in some cases a State permit is also needed. Destroying nests and eggs is another method used to control nuisance waterfowl populations. This method is especially effective with nuisance Canada geese. A federal permit is required before engaging in this type of activity.

8.5 SHORELAND LIGHTING

CONCERNS ADDRESSED

The natural beauty and aesthetic appeal of a darkened lake after nightfall is becoming increasing jeopardized by the growing prevalence of light pollution. Many lakefront property owners and lake users attach great value to the natural appearance and serenity of a lake cloaked in darkness. A nuisance situation can occur when property owners install bright floodlights on piers, boathouses, gazebos, and along the shoreline that project light out over the lake or onto neighboring properties. By reasonably restricting the use of such lighting systems, safety and security can be maintained without having to sacrifice this valued aesthetic attribute.

JUSTIFICATION

Light pollution is a growing problem around developed lakes, and may likely become a significant issue of concern on Lake Ripley. This situation can be avoided by establishing a local ordinance or shoreland zoning guidelines that limit the type and location of high-intensity lights within the shoreland zone. While some variations of lighting systems would be permitted for safety and security purposes, other variations would be prohibited unless unusual circumstances apply. Reducing bulb wattage, adjusting the location of lights, and using shades and covers to control the direction of light are all potential strategies that can be used to minimize the effects of light pollution.

COST-BENEFIT ANALYSIS

Advantages:

- Reduces the effects of light pollution on Lake Ripley
- Addresses the issue of shoreland lighting before it becomes a bigger problem

Disadvantages:

- Requires another ordinance or added layer of shoreland zoning regulation
- Fosters perception of reduced security
- Requires the development of guidelines and specifications for what is permitted

ACTION STRATEGY

1. LRMD works with the zoning department and/or Town of Oakland to develop policy;
2. LRMD proposes new ordinance or zoning restrictions on the use of high-intensity lights;
3. Zoning department develops permit system;
4. LRMD implements information and education effort to inform residents of zoning change.

CHAPTER 9: CONCLUSION

It is vitally important to recognize the inherent complexity and fragility of aquatic ecosystems. The dynamic nature of lakes makes them extremely challenging to manage, especially due to the difficulty in anticipating how they will respond to various protection and rehabilitation efforts. Because all lakes are unique, management strategies are never completely transferable or universally effective. As the Lake District's understanding of the resource increases, so does its ability to accurately diagnose and solve its problems.

Keeping the public both informed of lake-management actions and involved in the decision-making process should be considered an ongoing commitment. Increasing lake resident participation in decision-making processes and through volunteer opportunities is a great way for people to learn about the resource and their role in its protection and improvement. Usually, greater cooperation and support of lake-management activities can be achieved by employing this strategy. Newsletters, fact sheets, press releases, and public meetings are all methods used to disseminate information and solicit public involvement.

Continuous monitoring is also very important. The information collected provides insights into the condition of a lake, as well as how it changes over time and under different situations. Monitoring is also helpful in the early identification of potential problems. Monitoring data are frequently used to evaluate the effectiveness of management practices, especially since the natural variability of lakes may mask management results. Furthermore, monitoring data can reveal long-term water quality trends and changes, which can then be used to justify the implementation of specific protection and rehabilitation programs.

Finally, keep in mind that protection is almost always cheaper and more effective than rehabilitation. All residents and lake users should learn how they can become better environmental stewards, as well as take an active role in protecting this cherished resource. Working together and taking action before a crisis situation occurs is an excellent way to help ensure the future health and quality of Lake Ripley.

CONTACT INFORMATION
(2000-2001)

FEDERAL GOVERNMENT

U.S. Army Corps of Engineers (ACOE)

ACOE is the federal agency responsible for issuing permits to allow alterations of wetlands and navigable waterways.

Contact: Jim Knowles, Regulatory Specialist
1617 East Racine Avenue
Waukesha, WI 53816
(414) 547-3064

U.S. Environmental Protection Agency (EPA)

EPA is the federal agency responsible for carrying out the nation's pollution control laws. It provides technical and financial assistance to reduce and control air, water and land pollution.

Contact: EPA – Region V
77 W. Jackson Blvd.
Chicago, IL 60604-3590
(312) 886-7935

U.S. Fish & Wildlife Service (FWS)

FWS is the federal agency that works with participating Land Conservation Committees to protect and restore wetlands through a matching grants program.

Contact: Art Kitchen, Wildlife Biologist
Wisconsin Private Lands Office
4511 Helgesen Drive
Madison, WI 53718
(608) 221-1206 ext. 13

U.S. Farm Service Agency (FSA)

FSA is the U.S. Department of Agriculture agency that administers agricultural assistance programs including price supports, production controls, and conservation cost sharing.

Contact: Peter Overlein
134 W. Rockwell
Jefferson, WI 53549
(920) 674-2020 ext. 107

U.S. Natural Resource Conservation Service (NRCS)

NRCS is the U.S. Department of Agriculture agency that provides soil survey, conservation planning, and technical assistance to local landowners. They also administer the Conservation Reserve Program, and the Wetland Reserve Program.

Contact: Ron Pribnow, District Conservationist
134 W. Rockwell Street
Jefferson, WI 53549
(920) 674-2020

U.S. Geological Survey (USGS)

USGS is a federal scientific research body that monitors many of the nation's lakes and streams.

Contacts:

Herb Garn, Lakes Supervisor
Bill Rose, Lakes Contact
Water Resources Division, Lake Studies Team
8505 Research Way
Middleton, WI 53562-3586
(608) 821-3834

STATE GOVERNMENT

Wisconsin Department of Natural Resources (WDNR)

WDNR is the state agency responsible for managing state-owned lands and protecting public waters. WDNR also administers programs to regulate, guide and assist Land Conservation Committees, Land & Water Conservation Departments, and individual land users in managing land, water, fish and wildlife.

Contacts:

Don Bush, Fisheries Biologist
2514 Morse Street
Janesville, WI 53545
(608) 743-4800

Mike Cross, Conservation Warden
437 E. Clancy Street
Jefferson, WI 53549
(920) 674-3944

Susan Graham, Lake Mgmt. Coord.
3911 Fish Hatchery Road
Fitchburg, WI 53711
(608) 275-3329

Mike Halsted, Water Mgmt. Specialist (Permits)
2514 Morse Street
Janesville, WI 53545
(608) 743-4820

Ruth Johnson, NPS Coordinator
N7725 Hwy 28
Horicon, WI 53032
(920) 387-7869

Charles Kilian, Wildlife Specialist
South Central Region – Lake Mills
(920) 648-3054

Jim Leverance, Basin Team Leader
2514 Morse Street
Janesville, WI 53545
(608) 743-4825

Douglas Lubke, Fisheries Technician
2514 Morse Street
Janesville, WI 53545
(608) 743-4824

Dave Marshall, Water Resources Mgr.
3911 Fish Hatchery Road
Fitchburg, WI 53711
(608) 275-3338

Tim Parsons, Community Assistance (grants)
P.O. Box 7921
Madison, WI 53707-7921
(608) 267-9385

Al Shea, Director
Bureau of Watershed Management
P.O. Box 7921
Madison, WI 53707-7921
(608) 267-2759

Patrick Sheahan, Government Outreach
3911 Fish Hatchery Road
Fitchburg, WI 53711
(608) 275-3315

Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP)

DATCP is the agency responsible for establishing statewide soil and water conservation policies and administering the state's soil and water conservation programs. DATCP administers state cost-sharing funds for a variety of LWCD operations, including support of staff, materials and conservation practices.

Contacts:
David Jelinski, Director, Bureau of Land & Water Resources
Mary Rose Teves, Chief, Resource Evaluation and Grants Section
P.O. Box 8911
Madison, WI 53708-8911

Drew Zelle, Engineering Technician (Cost-share Projects)
451 W. North Street
Juneau, WI 53039
(920) 386-0170

University of Wisconsin – Extension (UWEX)

UWEX is the outreach branch of the University of Wisconsin system responsible for formal and informal educational programs throughout the state.

Contacts:
Steve Grabow, Com. Develop. Agent
Suzanne Wade, Basin Educator
864 Collins Road
Jefferson, WI 53549
(920) 674-7295

Christine Javid, Newsletter Editor
Agriculture Hall, Room 216
1450 Linden Drive
Madison, WI 53706-1562
(608) 262-1916

Tamara Dudiak, Outreach (legal guidance)
Laura Felda, Lake Monitoring
Robert Korth, Outreach Supervisor
Dorothy Snyder, Program Assistant
UW-EX Lakes Program
1900 Franklin Street
Stevens Point, WI 54481
(715) 346-2116

Wisconsin Association of Lakes

WAL is a membership association consisting of inland lake protection and rehabilitation districts and associations throughout the State of Wisconsin.

Contacts:
Donna Sefton, Executive Director
Jo Ellen Seiser, Admin. Assistant
P.O. Box 126
Stevens Point, WI 54481
(800) 542-5253

William O'Connor, Attorney
Wheeler, Van Sickle and Anderson, S.C.
25 W. Main Street, Suite 801
Madison, WI 53703
(608) 255-7277

JEFFERSON COUNTY GOVERNMENT

Jefferson County Farm Drainage Committee

The Jefferson County Farm Drainage Committee oversees organized legal drain issues throughout the county.

Contacts:
Kenneth Degner
N8974 Hwy SC
Ixonia, WI 53036
(920) 261-4065

Joseph Grove
N8935 Horseshoe Road
Watertown, WI 53094
(920) 261-0349

Randy Wegner
W1630 CTH B
Sullivan, WI 53178
(414) 593-8420

Jefferson County Highway Department

The Jefferson County Highway Department maintains county-owned roads and highways.

Contacts: Jeffrey Haas, Commissioner
Ken Schakelman, Construction Superintendent
Steve Masche, Construction Superintendent
David Endl, Shop Superintendent
141 W. Woolcock Street
Jefferson, WI 53549
(920) 674-7289

Jefferson County Land & Water Conservation Department

The mission of the Jefferson County Land & Water Conservation Department is to promote the implementation of land and water conservation practices and to achieve greater environmental stewardship of the land.

Contacts: Patricia Cicero, Resource Conservationist
Jeff Gaber, Soil & Water Conservationist
Michelle Staff, GIS Technician
Mark Watkins, County Conservationist
320 South Main Street
Jefferson, WI 53549
(920) 674-7110

Jefferson County Land Information Office

The Jefferson County Land Information Office compiles and maintains real estate rolls and maps of property assessment and taxation. The office also administers a Geographic Information System showing property ownership, zoning, public land survey, ortho photography, land use inventories, environmental corridors, land conservation planning, park and open space planning, and others.

Contacts: Andrew Erdman, Director
Rhonda Sukys, Cartographer
320 South Main Street
Jefferson, WI 53549
(920) 674-7254

Jefferson County Parks Department

The Jefferson County Parks Department is responsible for maintaining and improving the park facilities currently included within the park system, as well as expanding the system as the demand for additional recreational facilities increases.

Contact: Joseph Nehmer, Director
320 South Main Street
Jefferson, WI 53549
(920) 674-7260

Jefferson County Zoning and Sanitation Department

The Jefferson County Zoning and Sanitation Department advises applicants about required permits and approvals, issues permits, makes inspections, and takes enforcement actions under the Jefferson County Zoning, Land Division/Subdivision, Floodplain, and Sanitation Ordinances. The office maintains Geographic Information System map files and files for the Farmland Preservation Program.

Contacts:

Bruce Haukom, Zoning Administrator
Robert Klotz, Zoning Technician
320 South Main Street
Jefferson, WI 53549
(920) 674-7130

OAKLAND TOWN GOVERNMENT

Contacts:

Jim Buchta, Town Assessor
97 N. Main Street
Fort Atkinson, WI 53538-1860
(920) 563-7604

Linda Dieckhoff, Town Clerk
P.O. Box 602
Cambridge, WI 53523
(608) 423-9635

Bruce Gondert, Town Police Chief
P.O. Box 602
Cambridge, WI 53523
(608) 423-7415

Jerry Hahn, Building Inspector
Independent Inspections
S30W24670 Sunset Drive
Waukesha, WI 53186
(800) 422-5220

Ray Kisow, Town Chair
P.O. Box 41
Cambridge, WI 53523
(608) 423-3300

Marian Pohlman, Town Treasurer
N3717 Airport Road
Cambridge, WI 53523
(608) 423-4058

UPDATES: Refer to the most recent editions of the following publications for current contact information:

- Jefferson County Directory
- The Lake List (U.W.-Extension, Lakes Program)
- Wisconsin Department of Natural Resources Directory