Lake Ripley Management District

# LAKE RIPLEY IMPROVEMENT PLAN

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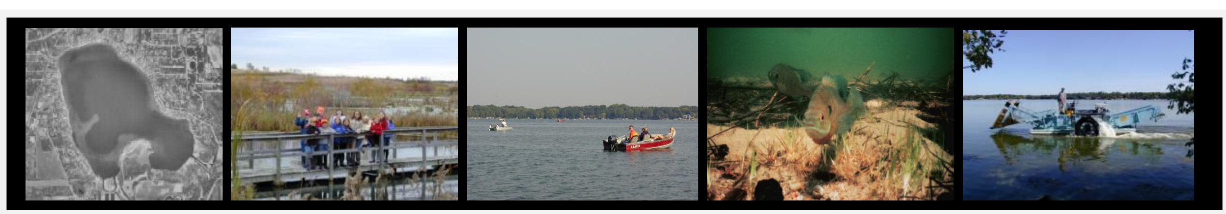
## A Condition Assessment and Strategy for Protection and Rehabilitation



# Lake Ripley Improvement Plan

**A Condition Assessment and Strategy for Protection and Rehabilitation**

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|---|---|
| AREA OF INTEREST: | Lake Ripley Management District/Lake Ripley Watershed<br>Town of Oakland, Jefferson County, Wisconsin |
| MANAGEMENT UNIT: | Lake Ripley Management District<br>N4450 County Road A<br>Cambridge, WI 53523<br>Phone: (608) 423-4537<br>E-mail: ripley@charterinternet.com<br>Web address: www.lakeripley.org |
| 2009-2010<br>BOARD OF DIRECTORS: | John Molinaro, Chair<br>Mike Sabella, Treasurer<br>Jane Jacobsen-Brown, Secretary<br>Dennis McCarthy, Commissioner<br>Georgia Gomez-Ibanez, Commissioner<br>Gene Kapsner, Town of Oakland Appointee<br>Walt Christensen, Jefferson County Appointee |
| PLAN AUTHOR: | Paul Dearlove, Lake Manager<br>Lake Ripley Management District |
| PLAN APPROVAL DATE: | November 21, 2009 [L.R.M.D. Resolution #2009-2] |

***Funded through the Wisconsin Lake Planning Grant Program***

Lake Ripley Management District

**Resolution # 2009-2**

**RESOLUTION OF THE LAKE RIPLEY MANAGEMENT DISTRICT**
**TOWN OF OAKLAND, COUNTY OF JEFFERSON, WI**

**Relating to:** Acceptance and adoption of Lake Ripley Improvement Plan

**WHEREAS** Lake Ripley is a valuable resource used by the public for outdoor recreation and the enjoyment of natural scenic beauty; and

**WHEREAS** Lake Ripley's quality and condition affects local property values, tax base, tourism and economic activity; and

**WHEREAS** there is a continued need for responsible and holistic long-range planning to better manage the lake, its watershed, and its use for the purpose of promoting public health and welfare; and

**WHEREAS** pursuit of the goals and recommendations detailed in the abovementioned Plan will further the mission of the Lake Ripley Management District in protecting and enhancing this valued natural resource.

**IT IS, THEREFORE, RESOLVED THAT:**

The Lake Ripley Management District Board of Commissioners hereby approves and adopts this Lake Ripley Improvement Plan.

Adopted this 21st day of November, 2009
By a vote of: 7 in favor 0 against 0 abstain

BY: Jane A. Jacobsen-Brown
Secretary, Lake Ripley Management District

# FORWARD

By: John Molinaro, Chair

In 1988, Lake Ripley was being invaded; invaded by Eurasian watermilfoil, a non-native lake weed that made it almost impossible to use the lake for any type of recreation. The weeds were so thick that you couldn't back a boat off a pier or reel a fishing lure through the water. In some places, they were so dense that birds could literally walk on the surface of the water.

This situation prompted a group of concerned citizens to organize and raise the money needed to purchase and begin operating a mechanical weed harvester. During the summer of 1989, volunteers ran the harvester seven days a week for 8-10 hours a day. It marked the beginning of a long process of restoring Lake Ripley to the beautiful lake it is today.

What we learned from that first, organized effort was how much we didn't know about lake management. So, the following year, we started the process of creating a Lake Management District with help from UW-Stevens Point and the Wisconsin DNR. It involved circulating landowner petitions, and getting the approval of the Town of Oakland and Jefferson County. We then hit the ground running and began taking the necessary steps to evaluate and improve the lake. It is an effort that continues to this day, almost 20 years later.

Lake Ripley has changed in many ways over the years. It is certainly not the same as it was prior to the first land grants, when Native Americans visited its shores to fish, hunt and bury their dead on the rises overlooking the lake. It is not the same as it was before Ole Evinrude invented the outboard motor, nor is it the same as it was before the arrival of pontoons and boatlifts. These changes are not good or bad in themselves. Rather, they made it clear that there will always be changes affecting the lake, and that we must plan for the changes we know and prepare for the changes yet to come.

For over a year, we have been working on developing a new Lake Management Plan. Our first plan, completed nearly ten years ago, is the ruler by which we measure our success, and the guide by which we plan for the future. It is now time to reevaluate our progress, examine the new science, and plan for the next ten years. Our first efforts to control milfoil growth back in the late '80s were a reaction to a crisis. Our current work continues to be driven by a well-thought-out plan, rooted in science, guided by community input, and observant of the needs of those who love and want to preserve our beautiful lake.

Over the years, we have accomplished a great deal in our commitment to preserve and protect Lake Ripley. The repair of thousands of feet of farm ditches and shoreline has controlled erosion and reduced the amount of polluted runoff entering the lake. The purchase of the Lake District Preserve and the restoration of area wetlands that filter the water entering the lake has been a major accomplishment. Continued weed harvesting is achieving its objectives, and lake monitoring is still used to guide our actions. None of this could have been accomplished without an effective lake manager, a dedicated Board, and an involved community. We thank all those individuals and groups who have supported the Lake District with their time, their money and their ideas.

This, however, is not the time to sit back on our laurels and pat ourselves on the back for a job well done. We must remain vigilant, because there are always new and emerging threats that will need to be confronted. This guidance document will always be in a state of transition, and, as new science and information become available, we will apply that knowledge to our goals and initiatives. As we plan for future action, we will continue to seek your input and ask for your help. I am confident that, as in the past, our community will step forward when needed.

Our focus remains constant: to protect and preserve Lake Ripley. Fifty years from now, few will remember the names of the many individuals who have workrd so hard to accomplish this mission. It is enough to know that future generations will sit on the end of a pier, with their toes in the water, while the summer sun warms their face, and will remember with a smile the time they spent at Lake Ripley.

*"The ultimate test of man's conscience may be his willingness to sacrifice something today for future generations whose words of thanks will not be heard."*

-- Gaylord Nelson, former Wisconsin governor and founder of Earth Day

# EXECUTIVE SUMMARY

## OUR MISSION

The Lake Ripley Management District seeks to preserve and enhance Lake Ripley's water quality, its fish and wildlife communities, and its overall ecological health, while ensuring public access and use of the lake that is safe, fair and practical.

## A VISION FOR THE FUTURE

Scenic shorelands, good fishing, abundant wildlife and clean water are a part of our local culture. They are why many of us choose to live here, why tourists come to visit, and why area property values remain so strong. While our connections to and preferred uses of the lake vary greatly, all of us share in the responsibilities of its care. By investing in Lake Ripley's continued stewardship, we believe the community and future generations will be rewarded by a cleaner, healthier lake and a higher quality of life than would otherwise be possible.

We envision Lake Ripley as a clean and naturally scenic water body that improves regional property values and economies, provides opportunities for outdoor recreation, and contributes positively to our collective quality of life. Specifically, we consider the following to be realistic expectations that we should strive to fulfill. Taken together, they represent an ambitious but practical vision for the future of Lake Ripley.

- High-quality aquatic plants and shoreland habitats support a lake ecosystem that is rich in native flora and fauna.
- The lake and its surroundings abound with opportunities to view a diversity of native species and natural features that inspire learning, nature appreciation and outdoor exploration.
- Recreation occurs in a shared manner that equitably balances the competing demands and expectations found among diverse user groups.
- The mix of lake uses is compatible with the general public interest, identified community priorities, and the lake's ecological and sociological carrying capacities.
- The lake is safe and attractive for swimming, and there are no beach closings due to high bacteria levels or potentially toxic blue-green algal blooms.
- The watershed that drains surface water to the lake contains high-functioning wetlands and protected natural areas that help safeguard water quality and general lake health.
- Local development and associated land-use practices incorporate effective conservation measures that control soil erosion, preserve wetlands and groundwater-recharge areas, and generally minimize adverse impacts to the lake.

- Residents, property owners, local government entities and other stakeholders are aware of Lake Ripley's environmental, economic, recreational and cultural value to the community.

- The public maintains a vested interest in the lake's long-term protection and rehabilitation, and is committed to making the necessary investments for the benefit of future generations.

- There is broad understanding and support of ongoing management designed to address problems and threats through cost-effective action.

To achieve our mission and vision for the future, we have set forth five goals for which the Lake District is committed to pursuing. These goals are: 1) **Clean, clear water**; 2) **Thriving, native aquatic life**; 3) **Safe, fair and responsible lake use**; 4) **Cost-effective management action**; and 5) **A well-informed and engaged citizenry**. A brief status report is provided for each goal, as well as the objectives necessary for attaining the goal. Also included are some specific, representative metrics (or health indicators) combined with realistic targets for what we hope to achieve that we can use to continually track and evaluate our progress.

## GOAL #1: CLEAN, CLEAR WATER

**Status:**
Landscape condition and land uses within a 7-square-mile watershed affect Lake Ripley's water quality. How we live on the land dictates the amount of stormwater runoff and pollutants delivered to the lake. In fact, the fossilized evidence in sediment cores extracted from the lake bottom indicate much better water quality prior to 1870, which was when the land was first cleared for agriculture and early European settlement. Water quality then rapidly declined in response to increased watershed-erosion rates. It was not until the 1950s when erosion rates and lake conditions first began to stabilize, primarily due to improved agricultural practices. Further improvements were made after 1990, following the start of the Lake Ripley Priority Lake Project and implementation of watershed-conservation measures. Recent lake modeling estimates that the main sources of continued phosphorus loading—the drivers of algal growth—include row-cropped agriculture (70%) and higher-density urban areas around the lake (17%).

Water quality monitoring reveals that Lake Ripley routinely exceeds its desired Trophic State Index (TSI). TSI is a water quality index ranging from 1-100, with values less than 50 being desirable for most lakes. The index is used as a well-accepted indicator of overall lake health. TSI is based on the lake's phosphorus concentrations (plant nutrient), chlorophyll concentrations (algal pigment) and water clarity. A combination of high phosphorus, high chlorophyll and low water clarity translates into poor water quality for lakes. Monitoring records show that Lake Ripley's water quality has ranged from very good to poor, with TSI values frequently in the 50s, particularly during high-runoff periods. Prior to 1870, TSI values were closer to 40 and representative of less eutrophic conditions. Lake modeling that was done as part of a 1994 Water Resources Appraisal predicted further water quality declines if pollutant-loading rates at the time remained unchanged.

**Objectives:**

1. Reduce the delivery of pollutants to the lake, especially phosphorus and sediment originating from construction sites, existing urban areas, and row-cropped farm fields within the outlying watershed.
2. Minimize lakebed disturbances—such as carp activity and aggressive motor boating in shallow-water areas—that contribute to the re-suspension of bottom sediment and mobilization of phosphorus into the water column.
3. Permanently protect and restore groundwater-recharge zones, wetlands, and shoreland buffers that improve the quantity and quality of stormwater runoff.
4. Maximize the capacity of the 167-acre Lake District Preserve to absorb runoff and protect Lake Ripley's only inlet tributary stream.

**Metrics:**

1. Trophic State Index (TSI)

   Targets:
   - TSI < 50 (mesotrophic conditions)
   - Summer mean total phosphorus < 24.0 µg/L (ideal: < 20 µg/L; best case: 12 µg/L)
   - Summer mean chlorophyll-*a* < 7.3 µg/L
   - Summer mean Secchi clarity ≥ 6.5 ft

2. E. coli (*Escherichia coli*) bacteria levels

   Target: < 235 cfu/100 ml (or no beach closings)

3. Macroinvertebrate diversity

   Target: Macroinvertebrate populations in the inlet and outlet streams are comprised of diverse species, particularly those intolerant to pollution and poor water quality.

4. Watershed landscape condition

   Targets:
   - Rural watershed land uses are retained outside the Town's urban service boundary (east of County Rd. A).
   - Well-vegetated shoreland buffer areas are increased along all shoreline, stream and drainage-ditch corridors.
   - Remaining wetland acreage is permanently protected around the lake, and filled or drained wetland acreage is restored whenever feasible.
   - Agricultural acreage under conservation farming practices is increased, including acreage subject to no-till cropping and nutrient-management planning.
   - Number of rain gardens and rain barrels used in residential areas is increased.
   - Eroding drainage ditches that connect to the inlet tributary stream are repaired or, preferably, plugged.
   - Total annual phosphorus loading is reduced by at least 19% through the implementation of watershed Best Management Practices (BMPs) in order to maintain a TSI below 50.

## GOAL #2: THRIVING, NATIVE AQUATIC LIFE

**Status:**
Lake Ripley is home to a diverse assemblage of aquatic plants, fish and animals. Some indigenous species documented in and around Lake Ripley are listed as rare or endangered, while other species are classified as non-native and invasive. All require particular habitat conditions and demonstrate varying sensitivities to pollution, habitat loss and other disturbances. A species-rich community of native aquatic plants and fish is an indicator of good lake health, whereas their absence or displacement by non-native species is often a sign of trouble.

Wetlands and near-shore littoral areas are particularly important for sustaining much of the aquatic life found in Lake Ripley. Since the early 1900s, over a third of the wetlands around Lake Ripley have been lost due to drainage and filling. Loss of wetlands causes hydrologic instability, reduces spring flow to the lake, increases the rate of runoff and pollutant delivery, and reduces vital habitat for fisheries, wildlife and endangered resources. The quality of the lake's biologically-rich littoral zone (shallow, near-shore area) is of equal importance in sustaining aquatic life, but remains threatened by the ongoing effects of shoreline development, beach grooming, motor boating and other recreational-use pressures.

Lake Ripley is currently plagued with the non-native Eurasian watermilfoil, curly-leaf pondweed, zebra mussel and common carp. Aquatic plant inventories indicate that Eurasian watermilfoil has been on the decline since it peaked in the late 1980s, while curly-leaf pondweed continues to maintain a limited but potentially-expanding presence. Sediment and nutrient loading has favored these tolerant, weedy species while reducing overall biodiversity. As for the lake's fishery, field surveys show fairly stable populations of all species, with carp currently comprising a small component of the overall community. Zebra mussels were a relatively recent introduction to the lake, and are still sustaining high numbers after their apparent peak in 2008. Other invasive species that pose immediate threats due to their close geographic proximity to Lake Ripley include the spiny waterflea, quagga mussel and New Zealand mudsnail—among others. Many of these species enter the Great Lakes through transoceanic shipping, and spread to inland lakes primarily through transient, recreational boat traffic.

**Objectives:**
1. Protect and restore native fish and wildlife habitat found in and around the lake.
2. Reduce the potential for the introduction and spread of aquatic invasive species.
3. Manage existing biological communities (plants, fish, etc.) in a manner that supports identified management goals and priorities.

**Metrics:**
1. Aquatic plants

   Targets:
   - Stable or increased *native* species richness (total number of species).
   - Eurasian watermilfoil and other non-native species comprise a small and decreasing fraction of overall plant community.
   - The aerial extent of bulrush and lily pad beds is maintained or expanded.
   - No further fragmentation or disturbance of identified "Critical Habitat Areas."

2. Fish

    Targets:
    - Stable or increased *native* species richness (total number of species).
    - Sustained presence of previously inventoried sensitive species, including the lake chubsucker (*Erimyzon sucetta*), least darter (*Etheostoma microperca*) and pugnose shiner (*Notropis anogenus*).
    - Carp represent a small and decreasing fraction of the overall fishery.
    - Desired size-frequency distributions are maintained for sport fish populations.
    - Increased number of littoral tree-drops to serve as coarse woody habitat.
    - Increased number of native trees growing near the shoreline for cover and a source of food, and for future recruitment of coarse woody habitat to the lake.
    - Maintenance of water quality conditions sufficient to sustain pollution-sensitive biota.

3. Wetlands

    Targets:
    - No further loss of existing wetland acreage.
    - Existing wetlands are protected and restored to their fullest functional value.
    - Wetland acreage and function are returned (when feasible) to areas subjected to past hydrologic manipulation.

**GOAL #3: SAFE, FAIR AND RESPONSIBLE LAKE USE**

**Status:**

While Lake Ripley is of modest size, it is both a popular and accessible recreational destination that can support a range of activities. This popularity has created challenges as different user groups compete for time and space on the lake. Public opinion surveys consistently reveal that boat traffic and congestion routinely interfere with people's use and enjoyment of the lake. According to a 2003 recreational boating study, Lake Ripley's estimated carrying capacity was regularly exceeded during summer weekends and other peak-use times.

Such high-intensity lake use, combined with the expansion of private and public access facilities, can create a host of safety and environmental problems. A number of lake-use and lakeshore-development policies are in effect at the state and local level to help address these concerns. These pertain to slow-no-wake times, slow-no-wake areas, and shoreland zoning provisions that set permitting standards for certain development activities next to the lake.

**Objectives:**

1. Minimize the potential for user conflict by supporting policies that fairly balance competing recreational demands.
2. Promote recreational uses and intensities that are compatible with the lake's physical, ecological and social carrying capacities.

**Metrics:**

1. Public access

    Target: The current level of public access is maintained with no expansion or increase in the number of public boat-access facilities.

2. Private pier development

    Targets:
    - Pier sizes, densities and number of mooring spaces meet Wisconsin DNR standards (NR 326).
    - No further pier development—except for the repair, maintenance or replacement of existing piers—in designated "Critical Habitat Areas" (formerly called "Sensitive Areas"), unless it can be shown that impacts will be fully mitigated.

3. Boating densities

    Target: Boating does not exceed estimated carrying-capacity thresholds as per the formula described in *Lake Ripley Watercraft Census and Recreational Carrying Capacity Analysis* (LRMD, 2003).

4. Law enforcement

    Target: Lake rules are enforced through regular Town of Oakland police patrols during the boating season, with emphasis on summer weekends and other peak lake-use periods.

5. Public survey input

    Target: Opinion survey results reflect favorable reviews regarding the lake's overall recreational atmosphere (i.e., fairness of rules, perceived compliance levels, degree of crowding, adequate enforcement, etc.).

**GOAL #4: COST-EFFECTIVE MANAGEMENT ACTION**

**Status:**

In 1991, the Lake Ripley Management District began operations under authority of Chapter 33 of the Wisconsin Statutes. It is a local, special-purpose unit of government that serves property owners living around the lake. The mission of the District is to preserve and enhance Lake Ripley's water quality, its fish and wildlife communities, and its overall ecological health, while ensuring safe, fair and practical lake use. To accomplish this mission, the District engages in a number of tax- and grant-supported programs in accordance with approved management plans and operating permits. A seven-member board of directors is responsible for directing the affairs of the District with the help of a full-time lake manager and two part-time weed-harvesting employees.

**Objectives:**

1. Management actions advance stated planning goals.
2. Management programs are appropriately targeted and cost-effective as set forth in approved guidance documents.
3. Monitoring is routinely conducted to evaluate resource conditions and management progress.
4. Funding and staffing resources are sufficient to implement recommended management actions.
5. The latest scientific information, strategy guidance and technological innovations are fully utilized as they become available.

**Metrics:**

1. Management-planning directives

   Target: Plan recommendations are regularly reviewed, implemented and updated according to an approved schedule.

2. Lake District operating budget

   Target: The Lake District budget provides for sufficient resources to implement, on a timely basis, recommended management activities necessary to achieve identified goals.

3. Public survey input

   Target: Realistic management expectations are maintained, and programs are viewed as effectively addressing community priorities.

4. Monitoring-data archives

   Targets:

   - The lake's shoreline is videotaped every few years to document changes in shore conditions and development activities.
   - An annual census of piers, boat lifts, rafts and moored watercraft is maintained to document resident boating facilities and lake-use potential.
   - Documentation of on-lake boat counts and lake-use observations is maintained during each boating season to track trends over time.
   - Secchi depth measurements are taken at least twice per month (May to September).
   - Basic water chemistry (total phosphorus, chlorophyll-*a*, etc.) is evaluated at least three times per year (after spring turnover, during mid-summer stratification, and after fall turnover).
   - Invasive species information (locations, population estimates, etc.) is collected as per Wisconsin DNR guidance.
   - Documentation of cost-shared conservation measures and estimated pollutant reductions is maintained as projects are completed.
   - Aquatic plant inventories are performed every 4-5 years.
   - Annual weed harvesting reports are maintained that document staff hours, cutting areas, number of loads harvested, and plant species collected.
   - Public opinion solicitations are conducted every 5-7 years to track awareness and general attitudes associated with ongoing management challenges and their proposed solutions.

**GOAL #5: A WELL-INFORMED AND ENGAGED CITIZENRY**

**Status:**

Results of public opinion surveys show that most respondents feel well informed of issues related to Lake Ripley and its management. The Lake District seeks to communicate with and solicit participation from its constituents using multiple media outlets. These include public meetings and hearings, dissemination of printed materials (such as newsletters), e-mail bulletins, local newspaper articles, educational workshops, Web postings, and lake and watershed tours—among others. Social-marketing strategies are now being tested as a way of increasing the effectiveness of these communications, and to improve participation rates in the Lake District's landowner cost-share program.

**Objectives:**

1. Maintain open lines of communication with Lake District constituents, watershed property owners, and affected stakeholders using diverse media outlets.
2. Use the *Ripples* newsletter as the primary means of information sharing.
3. Actively solicit community participation and involvement in protection and rehabilitation efforts.

**Metrics:**

1. Outreach tools

   Targets:
   - A minimum of three Ripples newsletters are disseminated each year.
   - E-mail bulletins are used as needed to distribute announcements and time-sensitive information to interested constituents.
   - The Lake District website is updated on at least a quarterly basis.
   - Welcome Wagon informational packets are mailed on at least a quarterly basis to new District and watershed property owners.
   - All meeting agendas and proposed operating budgets are posted and published on a timely basis.
   - Board meetings and public hearings are well publicized and aired on local cable television.
   - An informational boat tour is offered each year for the benefit of Town of Oakland Board members.
   - Community events (watershed tours, lake fairs, litter cleanups, etc.) are regularly used to educate and engage citizen volunteers.
   - Social-marketing strategies that target specific, meaningful behavior changes are incorporated into existing outreach programs.

2. Public survey input

   Target: Opinion survey results give favorable reviews for quality of outreach materials and effectiveness of communication strategies.

3. Volunteer and landowner participation

   Targets:
   - Mechanisms are in place for attracting and retaining volunteers to support ongoing programs.
   - A critical mass of targeted landowners adopt recommended conservation measures as a result of outreach and incentive programs.
   - School groups are solicited to participate in service-learning projects.

## RECOMMENDATIONS

The following is a bulleted list of strategy recommendations intended to further the Lake District's overall mission, goals and objectives. As a consequence of their implementation, the expected outcome would be the safeguarding of a high-quality natural resource that strengthens area property values, provides unique outdoor recreational opportunities for the community, and enhances the overall quality of life of its residents.

<u>Watershed Conservation</u>

- Continue the restoration and improvement of the 167-acre Lake District Preserve.
- Provide project design, permitting and cost-sharing assistance to targeted landowners for the implementation of eligible Best Management Practices (BMPs).
- Partner with targeted landowners to protect identified "critical areas" and improve wetland function.
- Encourage the planting of native trees throughout the watershed.
- Consider providing free soil tests as a service to both residential and agricultural landowners for the purpose of reducing fertilizer use.

<u>Land-Use Policy</u>

- Advocate for policies that reward developers who incorporate green infrastructure and low-impact development (LID) practices.
- Advocate for policies at the Town and County levels that limit the amount of road salt applied on area streets.
- Advocate for policies at the Town and County levels that call for the use of grass swales, rain gardens and other measures to capture and treat street runoff, as opposed to the creation of curb-and-gutter systems that connect to storm sewer outfalls.
- Advocate for the adoption of a Town or County ordinance that would regulate or prohibit the development of high-capacity wells where their operation could negatively affect Lake Ripley or its inlet tributary.
- Advocate for the development of multi-modal transportation options around Lake Ripley that can be incorporated during street-reconstruction planning.
- Work with Town of Oakland to explore the possibility of strengthening existing construction site erosion-control rules and enforcement standards.
- Ensure that Lake District property annexed by the Village of Cambridge remains a part of and under the taxing authority of the District, and remains subject to shoreland zoning provisions.
- Support the Town of Oakland's comprehensive growth plan (adopted 11-18-08) that places limits on the eastward expansion of the urban service area within the Lake Ripley watershed.

<u>Lake-Use Policy</u>

- Maintain slow-no-wake and no-motor zoning ordinances in their current form.
- Support Town of Oakland's lake-patrol program, and advocate for increased enforcement hours during peak-use boating times.
- Discourage policies or actions that would increase motor boat access to the lake.

- Work with the Town of Oakland in advocating for and instituting an outdoor lighting ordinance, particularly if outreach efforts prove ineffective at curbing unnecessary light pollution.

<u>Management of Lake Biota</u>

- Use mechanical harvesting to cut and remove non-native, invasive lake weeds.
- Implement strategies that promote a diverse and thriving native plant community—both on shore and throughout the lake's littoral zone—to protect water quality and enhance fishery habitat.
- Explore the feasibility of using spot herbicide treatments or hand pulling to more aggressively control curly-leaf pondweed colonies in East Bay.
- Support walleye stocking, carp-control efforts, and a thriving native aquatic plant community as "biomanipulation" tools that can positively influence water quality.
- Protect designated Sensitive Areas, now called Critical Habitat Areas, by ensuring adequate enforcement of the Town of Oakland's pier and boating ordinances that affect these locations, and by advocating for additional protections if deemed necessary.
- Partner with Wisconsin DNR to complete a re-evaluation and re-mapping of Lake Ripley's Critical Habitat Areas, a process that was started in 2008.
- Work with Wisconsin DNR to revisit bag and size limits for bass, northern pike and walleye to ensure that current fish-harvest policies are achieving stated objectives.
- Investigate the feasibility and potential effectiveness of installing a carp barrier in the outlet channel.
- Assist targeted landowners in securing federal permits to implement egg-oiling efforts if deemed necessary to control nuisance, non-migrating geese populations.

<u>Public Education and Outreach</u>

- Explore using additional incentive programs and community-based social marketing strategies to increase landowner participation rates relating to the implementation of watershed Best Management Practices (BMPs).
- Utilize multiple forms of media and social-marketing techniques to enhance the public's ability to understand, evaluate and advocate for actions and policies that protect the lake.
- Organize paid or volunteer watercraft inspectors to educate boaters about aquatic invasive species at boat launches.
- Maintain high-visibility informational signage at the public boat landing and other access locations.
- Ensure that the public is made aware of strategies or approaches to problems that the Lake District considers impractical, ill-advised, of questionable impact, or beyond the District's charge and authority.

<u>Evaluation and Analysis</u>

- Use computer modeling to identify realistic sediment/phosphorus reduction targets on a watershed and subwatershed basis.
- Estimate the extent and sources of in-lake phosphorus recycling by developing more refined phosphorus and hydrologic budgets for the lake.

- Assist the Wisconsin DNR and other permitting authorities to ensure a thorough and comprehensive permit evaluation of any future dredging proposals related to Lake Ripley's inlet channel or Vasby's Ditch.

Capacity Building

- Encourage board members and staff to attend continuing education seminars, lakes conferences and technical workshops.
- Utilize Board committees, citizen task forces, volunteer groups and student internships to increase the capacity of Lake District programs.
- Seek out grant opportunities and diverse partnerships to advance Lake District initiatives.

Long-Term Monitoring

- Maintain an updated inventory of completed projects and targeted properties that remain eligible for approved BMPs.
- Monitor changes in land-use conditions to identify potential problem areas and better target BMPs.
- Support the continuation of long-term trends monitoring on Lake Ripley by the Wisconsin DNR, including regular monitoring of water quality, fishery and aquatic plant conditions.
- Monitor water quality conditions by tracking a range of parameters and biotic indicators in accordance with recommended monitoring schedules.
- Support annual electrofishing inventory and occasional fyke-net surveys by Wisconsin DNR fisheries biologists to monitor fish-community health.
- Conduct aquatic plant inventories at least every 4-5 years to evaluate changes in the plant community.
- Monitor lake use to track long-term changes in boating behavior and recreational-use patterns.
- Survey opinions of property owners and lake users at least every several years.
- Synthesize and evaluate all available monitoring data at regular intervals to re-evaluate trends and diagnose emerging problems.
- Update management-planning findings and recommendations as needed.

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# MANAGEMENT AUTHORITY AND PLANNING MANDATES

*"If you don't know where you are going, how can you expect to get there? An intelligent plan is the first step to success. The man who plans knows where he is going, knows what progress he is making and has a pretty good idea when he will arrive."*

-- Basil S. Walsh, American motivational speaker and author

## 1-1 LAKE DISTRICT AUTHORITY, SCOPE AND CAPACITY

### WISCONSIN STATUTORY AUTHORITY

The Lake Ripley Management District is a special-purpose, local unit of government representing and acting on behalf of area property owners to protect and manage Lake Ripley. The District was officially formed in December of 1990 by resolution of the Jefferson County Board. It was established as an Inland Lake Protection and Rehabilitation District under Chapter 33 of the Wisconsin Statutes (see "Operating Authority and By-Laws" in Appendix A).

### JURISDICTIONAL BOUNDARIES

Lake District boundaries approximate those of the Oakland Sanitary District. They extend just past Highway 18 to the north and Highway 12 to the south, and share a boundary with County Road A to the east and the Dane-Jefferson County line to the west (see Figure 1). These jurisdictional boundaries overlap with the western third of the watershed, which drains surface water to the lake. The Lake District incorporates about 7% of the Town of Oakland's total land area, and covers approximately 1,800 acres of land around Lake Ripley (see Figure 2). It is completely contained within the Town of Oakland in western Jefferson County, Wisconsin.

### GOVERNANCE

A seven-member board of commissioners is elected to set policy and authorize activities carried out by the Lake District. The board consists of five elected property owners within the District (serving staggered, three-year terms), and two appointed commissioners representing Jefferson County and the Town of Oakland. The Board convenes regular business meetings, usually on a monthly basis, that are noticed and open to the public.

**2009-2010 Lake Ripley Management District Board of Commissioners and staff. Front row (left-right): John Molinaro, Georgia Gomez-Ibanez, Jane Jacobsen-Brown and Gene Kapsner. Back row (left-right): Dennis McCarthy, Walt Christensen, Mike Sabella and Paul Dearlove.**

The Annual Meeting of the electors (resident voters) and property owners is held each August, at which time a budget for the next fiscal year is approved and elections are conducted. State law authorizes the Lake District to tax up to a maximum rate of 2.5 mills ($2.50 per $1,000 of equalized valuation) for the purpose of financing its programs and operations. However, since its inception, the Lake District has never exceeded a 0.5 mill rate. This is partly due to the fact that various grants, and occasionally donations, are routinely secured to supplement local tax dollars to increase management capacity. Appendix B contains the Lake District's latest operating budget, as well as a summary of the District's past property valuations, budgets, mill rates and associated tax levies.

A full-time lake manager is retained by the Board to manage the affairs of the Lake District, and to direct its programs and activities. The lake manager also supervises seasonal weed-harvesting staff, and oversees the work of any volunteers or student interns who may be assisting with project-specific activities. The position was created in 1993 for the original purpose of directing a 13-year, state-funded Priority Watershed Project focused on identifying and controlling sources of polluted runoff. The position was made permanent and fully tax supported starting in 2007 when the Project grant ended.

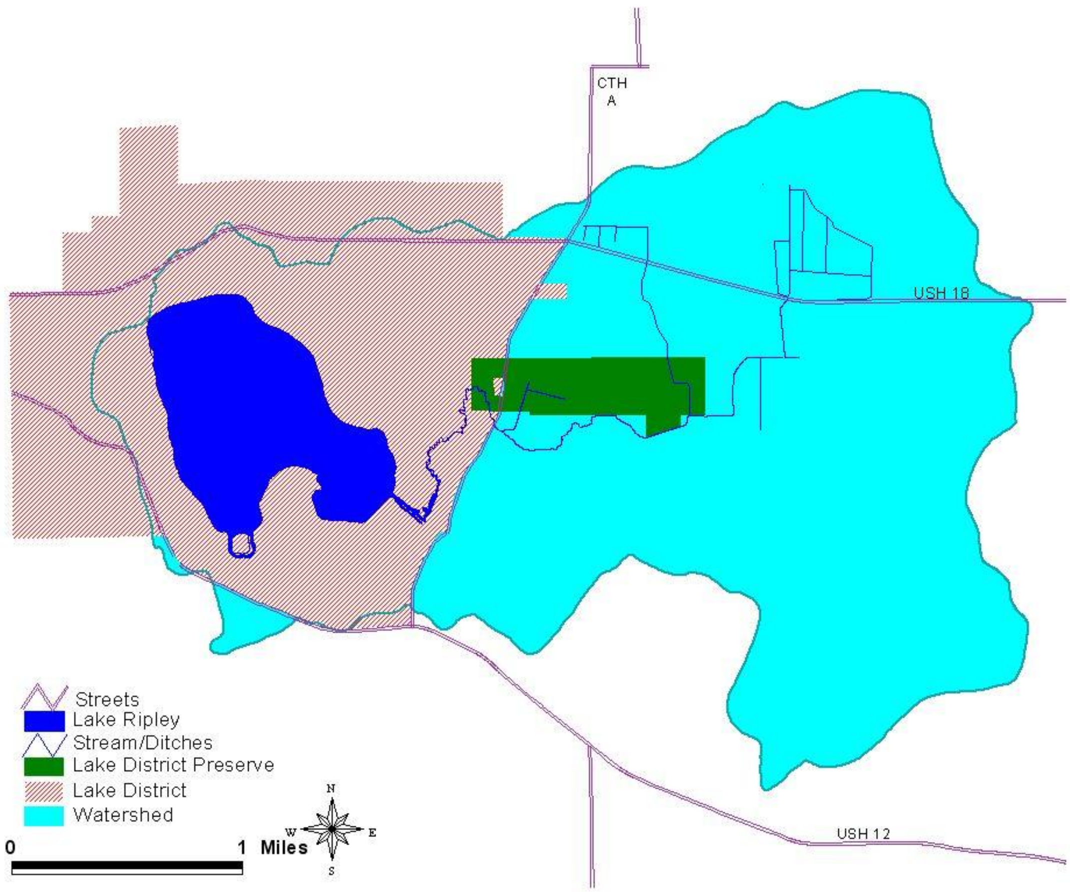


**Figure 1: Boundary Map of Lake Ripley Management District, Lake Ripley Watershed, and the 167-acre Lake District Preserve**

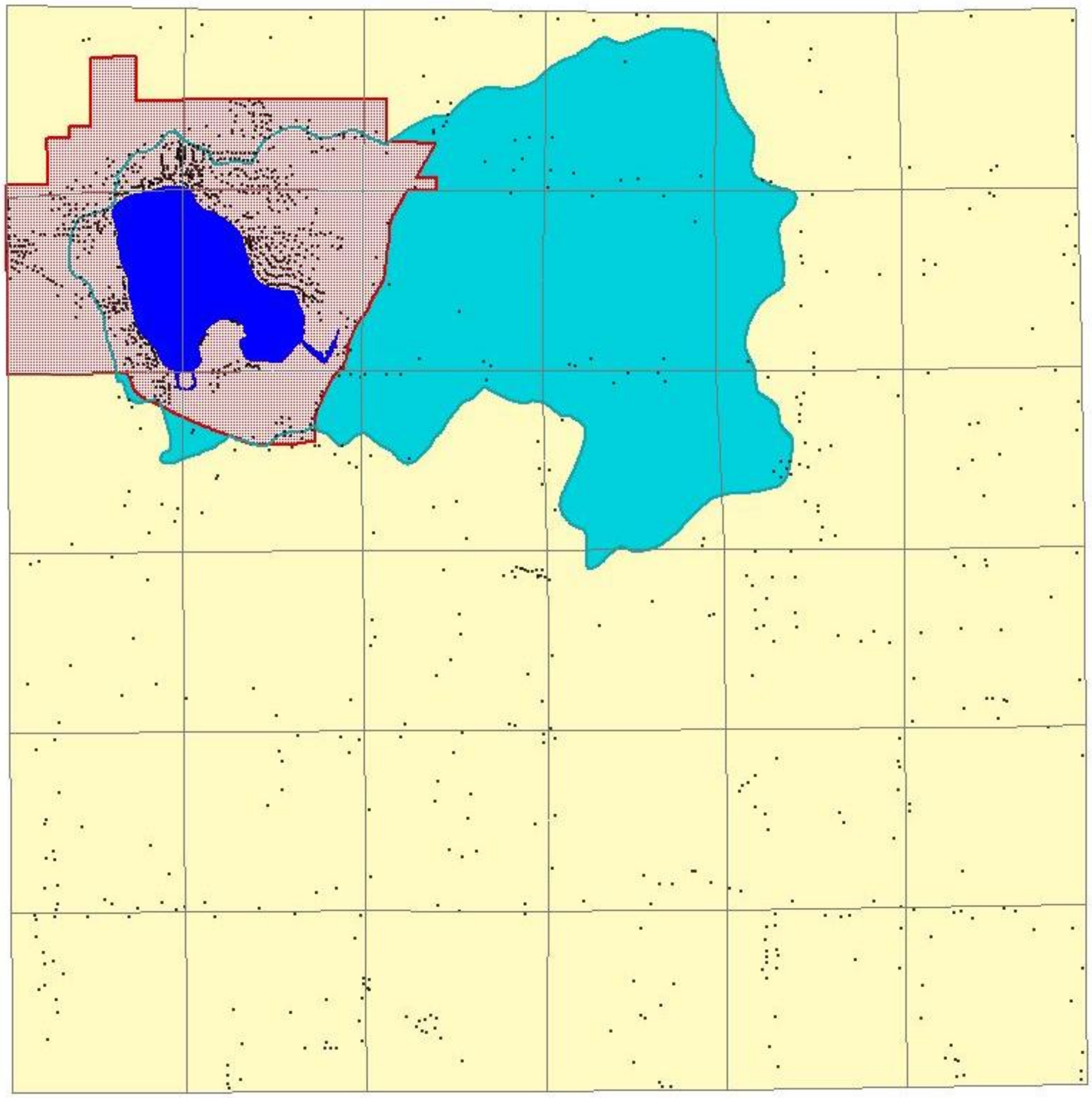

**Figure 2: Map of the Lake Ripley Management District, Lake Ripley Watershed, and Residential Address Points within the Town of Oakland**[1]

## CAPACITY FOR PLAN DEVELOPMENT AND IMPLEMENTATION

The Lake District is well positioned to develop and successfully implement this comprehensive lake and watershed improvement plan. While it has no rule-making, permitting or regulatory authority, the District has unique powers and resources that give it the capacity to shape positive change on Lake Ripley and throughout the watershed. Strengths include:

- A 19-year operating history;
- A governing board comprised of members with diverse backgrounds and experiences;

[1] 2005 Jefferson County land parcel data

- Employment of a full-time, professional lake manager to carry out all District activities;
- Established programs and strong intergovernmental partnerships;
- A record of effective public outreach, management planning, fundraising, policy advocacy and project implementation;
- Ownership of valuable land interests (like the 167-acre Lake District Preserve) and capital equipment assets (such as those related to weed harvesting, lake monitoring and office administration);
- A vast repository of lake-related information and actionable management guidance; and
- The organizational capacity capable of addressing large, complex problems.

## 1-2 MISSION AND MANAGEMENT PHILOSOPHY

> ***Mission:*** *To preserve and enhance Lake Ripley's water quality, its fish and wildlife communities, and its overall ecological health, while ensuring public access and use of the lake that is safe, fair and practical.*

The above mission shall be accomplished using a multi-faceted, watershed-based approach that engages all affected or controlling stakeholder groups (i.e., lake users, lakefront property owners, watershed landowners, local business interests, local government officials, regulators, community nongovernmental organizations, etc.). This big-picture approach shall recognize the complexity and interconnected nature of the larger lake ecosystem and hydrologic cycle. Our overriding goal is to take cost-effective action that best serves the resource and the common interests of Lake District property owners.

Management decisions will favor long-term solutions that (1) address the root causes of actual problems, and (2) strive to fairly balance competing interests that are compatible with our mission. Strategies may involve collecting and sharing information about the lake and watershed, identifying and controlling sources of pollution, managing aquatic invasive species, protecting and restoring fish and wildlife habitat, and generally advocating for the shared enjoyment and stewardship of Lake Ripley.

In summary, we affirm that a clean, healthy and attractive Lake Ripley creates property value while affording numerous quality-of-life benefits. A growing body of evidence shows that a well-maintained lake not only provides the community with abundant recreational opportunities, but adds value to local properties and businesses by making the area a more desirable place to live, work and visit. Some of this evidence is briefly summarized as a literature review in Appendix C.

## 1-3 PURPOSE OF PLAN

Lake Ripley's accessibility and popularity have long contributed to watershed-development and lake-use pressures that affect its overall condition. Ongoing concerns include overdevelopment, soil erosion, polluted stormwater runoff, nuisance algal blooms, problem weed growth, the introduction and spread of aquatic invasive species, loss of habitat and natural scenic beauty, and seasonal overcrowding that leads to a less than desirable recreational climate.

This plan is intended to address these and other concerns, namely by promoting well-informed decisions that can best protect and enhance this valuable community resource. It is a challenge made more difficult in light of two realities. One is the sheer scale, complexity and evolving nature of the main problems that threaten Lake Ripley's long-term health. The second is the changing and sometimes conflicting value judgments, perceptions and expectations found among the lake's property owners and visitors.

To be successful, lake protection and rehabilitation must be guided by a comprehensive and well-publicized plan. Such a plan is needed to assess baseline conditions, diagnose problems, set forth management goals, and articulate a practical vision and strategy for the future. Because even the most well-intentioned actions can have unanticipated consequences, this plan will help decision makers avoid exacerbating an existing problem or creating entirely new problems. Specifically, this plan seeks to address the following types of questions:

- What are our management goals and priorities?
- What are the main problems, and whom do they affect?
- What are the expected outcomes of recommended strategies?
- How will results be measured and communicated over time?
- Who will do the work and how will it be funded?
- What level of protection or recovery should ultimately be expected?
- How long will it take to achieve the desired results?

This Lake Ripley Improvement Plan is meant to be comprehensive in scope, and is designed to serve as a fully-integrated reference and guidance document. It incorporates and builds upon prior resource assessments and planning efforts, mainly through informational updates, public opinion re-evaluations, and the revisiting of past strategy recommendations. To remain both relevant and effective, the plan should be allowed to evolve and adapt in response to new information, changing resource conditions, and an unpredictable future. The overriding purpose of the plan is to strengthen the decision-making capacity of the Lake District as it strives to protect and manage the lake at the watershed level.

## 1-4 PLAN DELIVERABLES

The following deliverables were produced as a result of the development of this plan:

1. A complete description of past and current resource conditions.
2. A re-evaluation of management priorities as defined by public opinion surveys and evolving lake conditions.
3. An analysis of the main problems and threats related to water quality, lake use, aquatic plants, fish and wildlife communities, and general watershed health.
4. The identification and mapping of "critical areas" that provide vital habitat or water quality-protection benefits.

5. The refinement of pollutant-loading and lake-response models.
6. The establishment of goals, objectives, tracking metrics, and specific targets based on ambitious but realistic management expectations.
7. A community-based social marketing plan targeting specific behavior changes (referenced and presented as separate, stand-alone documents).
8. The presentation of recommended actions.

## 1-5 RELATIONSHIP TO OTHER PLANS

To date, the Lake District has operated on the basis of information and recommendations set forth in three key management plans. They include:

- Nonpoint Source Pollution Control Plan for the Lake Ripley Priority Lake Project[2]
  Published: 1998
  Design life: 10 years

- Lake Ripley Management Plan[3]
  Published: 2001
  Design life: 5-10 years

- Lake Ripley Aquatic Plan Inventory and Management Plan[4]
  Published: 2002
  Design life: 4-7 years

Most of the recommendations generated from these earlier planning efforts were subsequently implemented, or are currently the subject of ongoing management action. In addition, resource conditions from which these recommendations were formulated have since changed. Since the time these plans were prepared, a number of Best Management Practices (BMPs) were carried out in the watershed (i.e., farm drainage-ditch closures, shoreline repairs, wetland restorations, etc.), improved lake-use policies were instituted, educational programming was conducted, and at least one new aquatic invasive species (the zebra mussel) was discovered. Planning updates are now needed to adapt strategies to changing conditions, and to stay ahead of emerging threats. This plan provides those updates and consolidates all recommendations within a single guidance document.

[2] Wisconsin Department of Natural Resources, Wisconsin Department of Agriculture, Trade and Consumer Protection, Lake Ripley Management District, and Jefferson County Land Conservation Department. 1998. Nonpoint Source Control Plan for the Lake Ripley Priority Lake Project. Wisconsin Nonpoint Source Water Pollution Abatement Program. Publication WT-512-98.
[3] Lake Ripley Management District. 2001. Lake Ripley Management Plan.
[4] Lake Ripley Management District. 2002. Lake Ripley Aquatic Plant Inventory and Management Plan.

## 1-6 PLANNING METHODOLOGY

Failing to plan invites reactionary and misguided decision making, which leads to less than desirable results over the long run. To avoid this problem, the following planning methodology was employed which involved four key phases:

**Phase I: Describe past and current conditions**

The first phase consisted of gathering, updating and interpreting both scientific and social-science data relevant to the lake and its watershed. This step was necessary to define the many interrelated factors and variables that influence present lake conditions.

**Phase II: Diagnose problems and threats**

The second phase involved the analysis of available data to diagnose the lake's main problems and threats. Consideration was given to the nature and source of the particular problem, its magnitude of impact, affected lake uses, and other criteria.

**Phase III: Identify goals, objectives and tracking metrics**

The third phase was meant to help target management action to efficiently allocate limited resources. Goals and objectives were established in accordance with Lake District mandates, and were guided by the results of public opinion surveys, available planning guidance, and resource/institutional constraints. This step was also used to develop metrics and targets that could be used to track progress over time.

**Phase IV: Recommend management strategies**

The fourth phase involved identifying applicable management strategies that appeared most promising from a cost-benefit standpoint. This step attempted to propose specific actions that would advance identified goals, and that would cost-effectively address identified problems. Preference was given to those strategies that control the root causes, rather than the mere symptoms, of a particular problem or threat.

# -2-
# LAKE AND WATERSHED OVERVIEW

*"A lake is a landscape's most beautiful and expressive feature. It is earth's eye; looking into which the beholder measures the depth of his own nature."*

-- Henry David Thoreau, American philosopher and naturalist

## 2-1 LOCATION

Lake Ripley taken on a calm, summer morning.

Lake Ripley is located in Township 6 North, Range 13 East, Sections 7-8, Town of Oakland, in western Jefferson County, Wisconsin (see Figure 3). It is situated on the eastern edge of the Village of Cambridge (Dane County), and about 25 miles east of Madison. The Lake Ripley watershed, or the land area that drains surface water to the lake, covers just over seven square miles of the surrounding landscape within Sections 3 to 10 and 15 to 18. The mostly rural watershed includes the immediate lake area and extends 2.7 miles east of the lake. At its widest points, the watershed stretches four miles along its east-west axis, and three miles along its north-south axis.

## 2-2 HISTORICAL MILESTONES

According to Burris (1971), Native American burial mounds found along Lake Ripley's north and east shore mark the remains of an ancient civilization, and offer evidence of some of the first humans that frequented the lake (see Figure 4).[5] Long after these ancient Indians vanished, the modern indigenous tribes of the Pottawatomie and Winnebago came to fish and hunt around its shores.

It was not until the mid-19th century before European settlement began in earnest, bringing with it large-scale watershed changes that helped shape the lake into what it is today. A U.S. government survey conducted from 1834-1836 under the direction of Robert Lytle, Survey General, mapped and named the lake (see Figure 5). There were already 15 lots established around the lake at the time of the survey. The landscape around the lake at this time was characteristic of oak savanna, and consisted of a mix of wetlands, upland prairie, and central-hardwood woodlands.

[5] Burris, John E. 1971. A Study of Man's Effects on Lake Ripley. University of Wisconsin-Madison. Zoology 518 Report.

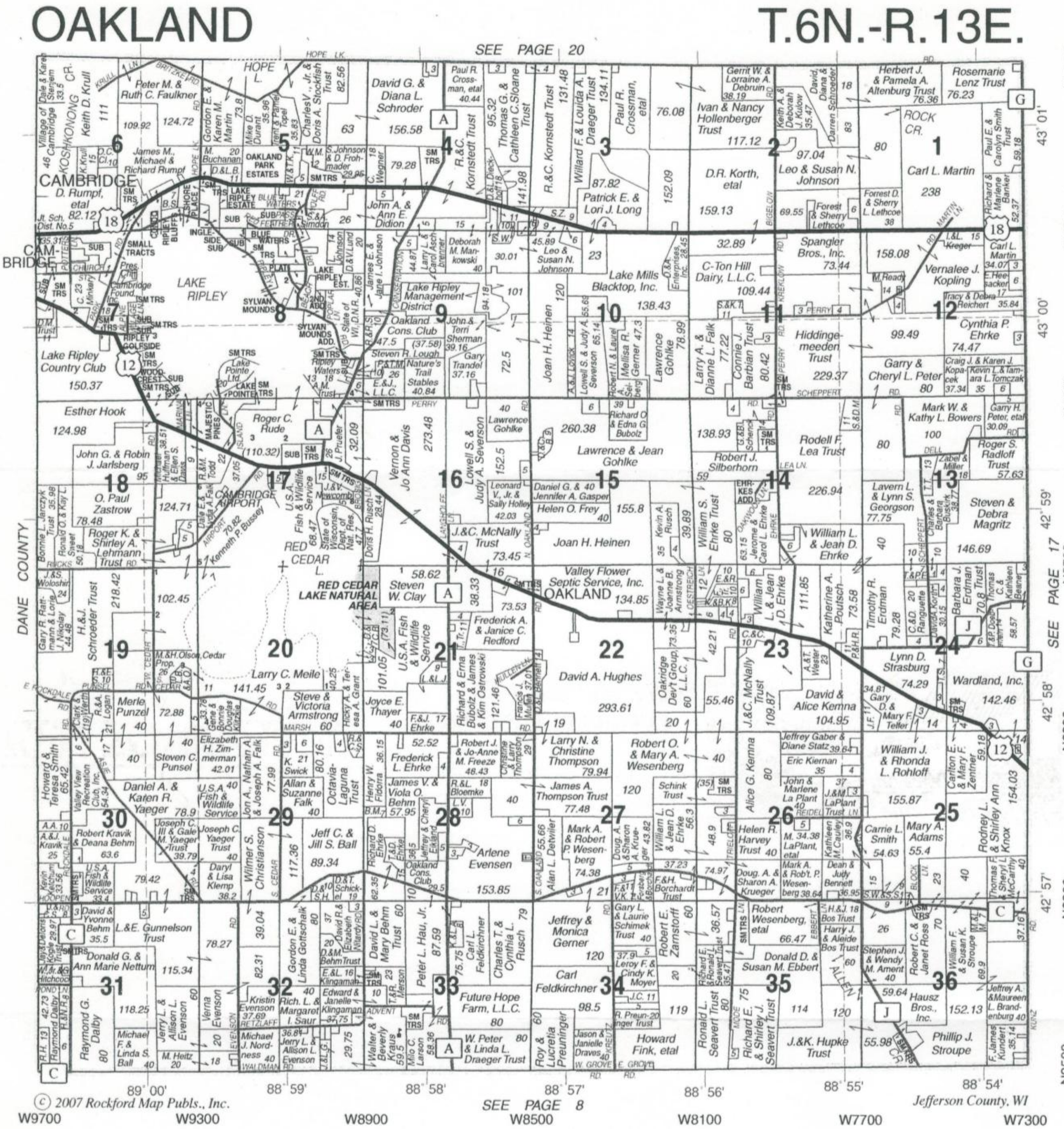


**Figure 3: Town of Oakland Plat Map (2007)[6]**

[6] 2007 Rockford Map Publishing, Inc.

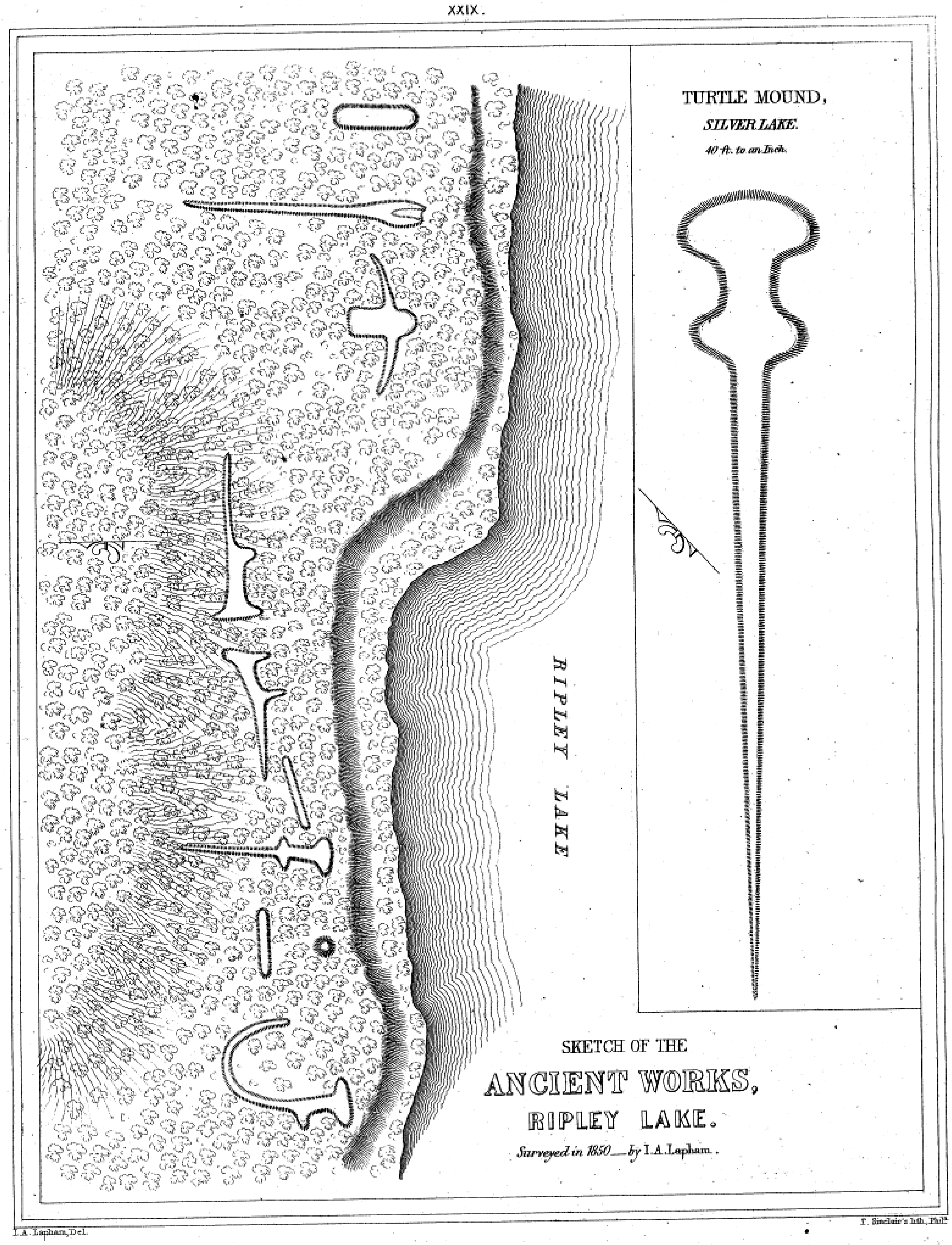


**Figure 4: Map of Native American Effigy Mounds on Lake Ripley[7]**

[7] Lapham, Increase Allen. 1811-1875. The Antiquities of Wisconsin. Washington: Smithsonian Institution, 1855. plate 29.

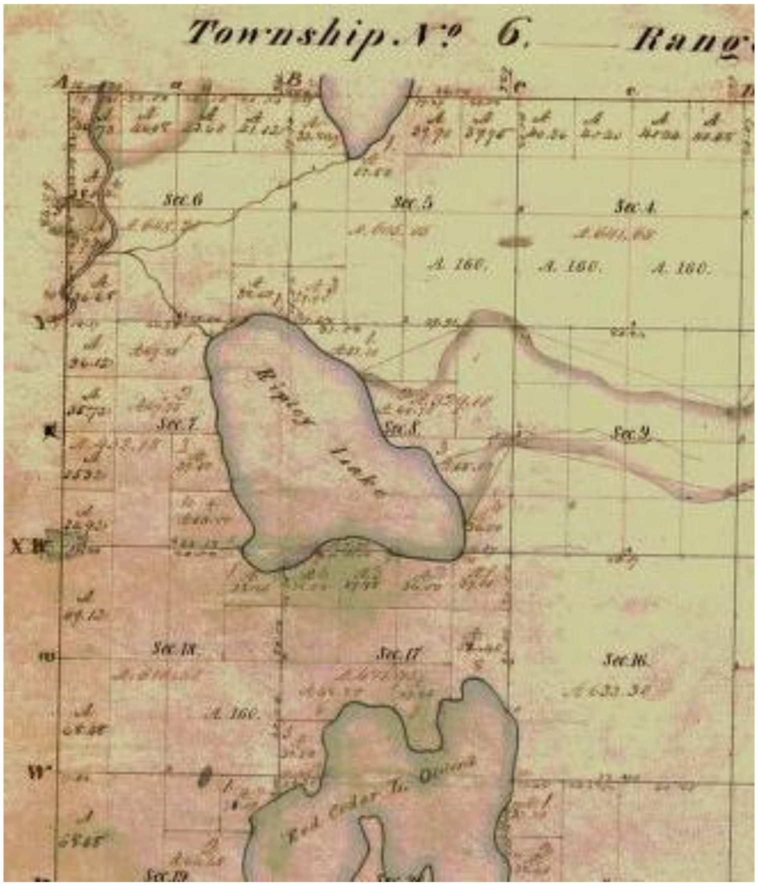


**Figure 5: 1835 Oakland Township Plat Map Showing Lake Ripley Area[8]**

During the late 1830s and early 1840s, European settlers started arriving. The first recorded settler, George Dow, was a Scottish immigrant from New York. Dow purchased a 242-acre government tract on Lake Ripley as an agricultural holding in 1840. The lake at that time was known as Lake Dow.[9] For the next 30 years, the Lake Ripley area was primarily devoted to farming, with about 400 people living in the vicinity by 1872. This time period marked the start of large-scale watershed alterations as early agricultural development led to extensive land clearing and wetland drainage.

The lake became a popular recreational destination for tourists and vacationing families following the completion of a railroad line from Milwaukee to Madison in 1881. Captain Cowles built the first summer home (named Inglesides) on the lake in 1882, prompting the building of a few additional summer houses over the next 13 years.[10] Summer home construction intensified when a railroad spur from the Town

[8] Garrison, Paul J. and Robert Pillsbury. 2009. Paleoecological Study of Lake Ripley, Jefferson County. Wisconsin Department of Natural Resources, Bureau of Science Services; and University of Wisconsin-Oshkosh, Department of Biology. PUB-SS-1062 2009.
[9] Dow, G. and A.B. Carpenter. 1877. Cambridge. In Dane County and Surrounding Towns; being a History and Guide. Wm. J. Park and Co. Madison, WI. Pp.366-370.
[10] Cambridge News, July 13, 1961, p.3.

of London to the Village of Cambridge was established, making the area easily accessible to summer visitors from Chicago and Milwaukee. Willerup Park, which is currently known as the Willerup Bible Camp, was purchased on Lake Ripley's west shore in 1886.

Lake Ripley became a small but popular summer resort area during the early part of the 20th century. This was also the time when Ole Evinrude, founder of Evinrude Outboard Motors, tested some of his first engine prototypes on the lake. Cedar Lodge was the first hotel built to accommodate visitors, followed shortly by The Hayden and Edgewood Villa. By 1914, Cedar Lodge had 14 cottages and could accommodate 130 people.[11] Cedar Lodge even produced a tourist pamphlet extolling the beauty of Lake Ripley and the vast number of bass and pickerel waiting to be caught.

While the railroad spur to Cambridge was discontinued in 1916, the lake remained a popular vacation spot. In 1924, there were two large hotels, three smaller ones, and a number of privately owned cottages.[12] Foundation Park (now called Lake Ripley Park and owned by the Cambridge Foundation) was purchased in 1932 as a place for the community to gather and enjoy the lake. Sometime shortly prior to this date, a rubble dam was first built at the outlet in an attempt to maintain water levels during drought conditions. The dam was raised and reinforced in 1932 by the Lake Ripley Betterment Club.[13]

Although the hotels eventually disappeared from Lake Ripley, cottages continued to be built along its shores, especially after World War II, and the lake remained popular with summer vacationers and tourists. Lake Ripley received additional notoriety in 1940 when the state record largemouth bass was caught, weighing a hefty 11 pounds, 3 ounces. Aerial photographs at this time show evidence of early hydrologic modifications, particularly the dredging and channelization of Lake Ripley's inlet.

Following World War II, agricultural mechanization greatly increased and the use of synthetic fertilizers became common practice. This resulted in a larger proportion of land within the watershed under cultivation, as well as increased rates of nutrient application onto the landscape, greater soil erosion, and increased nutrient runoff. Residential construction also affected the lake by increasing soil erosion rates, and by contributing sewage effluent as a result of failing septic systems.

By 1949, a small stream inlet on the north side of the lake was closed off and a pumping station was built in what is still called the Shore Place Subdivision. Originally a tamarack marsh, the growing subdivision was permitted to pump septic-contaminated water and divert it outside the watershed to the north. This practice was evident in a 1970 sanitary survey that discovered a fecal coliform count of 4,000/100 ml in a Highway 18 drainage ditch close to where the pump was discharging. Pumping continues to this day to keep nearby homes from flooding, but the

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[11] Chase, Wayland and Lowell Noland. The History and Hydrography of Lake Ripley. Trans. Wisconsin Academy of Sciences, Arts and Letters, vol. 23, 1927.
[12] Scott, B.M. 1924. History of Cambridge, Wisconsin. Unpublished manuscript. 35 pp.
[13] Public Service Commission report on permit to raise dam on outlet creek of Lake Ripley, January 8, 1960.

discharge water is no longer contaminated. This is most likely due to the replacement of private septic systems by a municipal wastewater treatment facility in the early 1980s.

In 1963, excavation of the 900-foot "Vasby's Ditch" was initiated by a private landowner, eventually forming a horseshoe-shaped channel and three-acre island at the southern extent of South Bay. Aerial photographs taken between 1940 and 1963 are shown below as Figures 6-9.[14] These can be compared to a more updated 2005 aerial photograph shown as Figure 10.[15] Ten years following the completion of Vasby's Ditch, an accident at a Lakehead Pipeline facility caused the release of an estimated 250,000 gallons of crude oil. The oil spill entered the inlet creek upstream of Highway A, but was contained and cleaned up before it could reach Lake Ripley.

A municipal sewer system was installed around the lake by 1984. The sewer system replaced private septic fields and permitted wastewater to be treated and discharged outside the lake's natural drainage basin. In 1986, Lake Ripley became one of 50 lakes in the State to be selected by the Wisconsin Department of Natural Resources for long-term trends monitoring. Just three years later, the growth of Eurasian watermilfoil—a non-native, invasive lake weed—exploded and blanketed 40% of the lake surface with thick mats of vegetation. This prompted property owners to organize for the purpose of purchasing and operating mechanical weed-harvesting equipment to help manage the prolific weed growth.

By late 1990, property owners responded to the Eurasian watermilfoil crisis and continued water quality concerns by petitioning Jefferson County to organize as an Inland Lake Protection and Rehabilitation District under Chapter 33 of the Wisconsin Statutes. The Lake Ripley Management District formed and began operations the following year. An abbreviated summary of major Lake District activities and achievements is presented in Table 1.

[14] Aerial photographs copied from the Arthur H. Robinson Map Library, University of Wisconsin-Madison
[15] Digital aerial photograph from the Jefferson County Land Information Office

Figure 6:  1940 Aerial Photograph of Lake Ripley


Figure 7:  1950 Aerial Photograph of Lake Ripley


**Figure 8: 1957 Aerial Photograph of Lake Ripley**

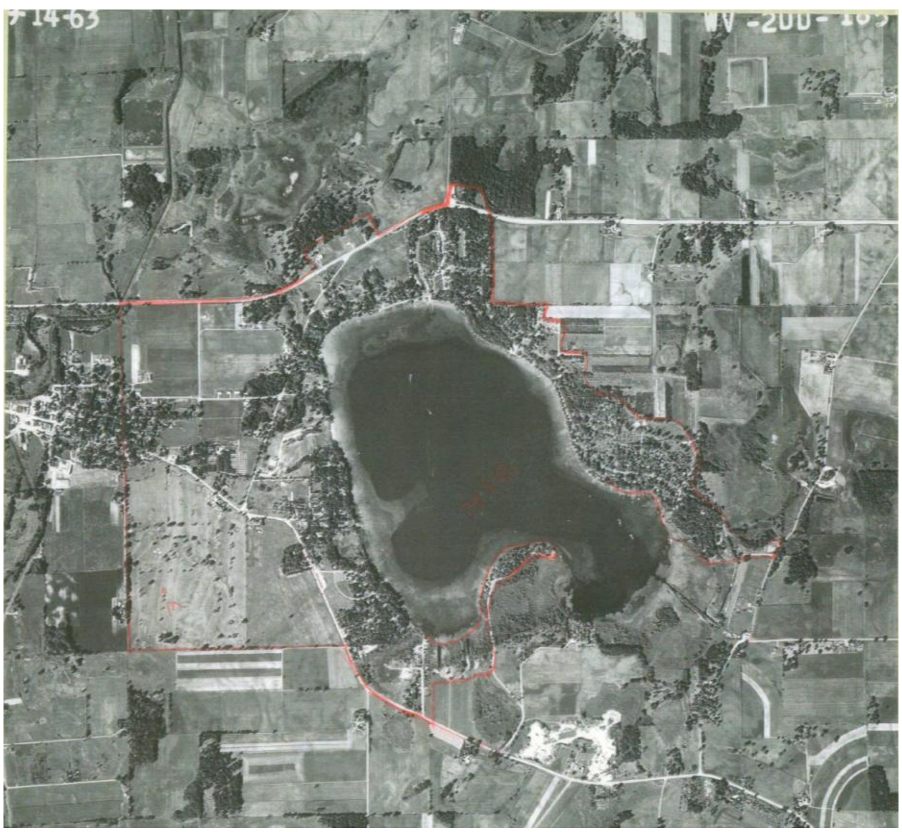


**Figure 9: 1963 Aerial Photograph of Lake Ripley**

**Figure 10: 2005 Aerial Photograph of Lake Ripley**

**Table 1: Lake Ripley Management District retrospective (1991-2009).**

| **Date** | **Major Events** |
|---|---|
| **1991** | The Lake District takes over weed-harvesting operations. Town ordinance establishes slow-no-wake zones in both bays, and a 7:30 p.m. to 11:00 a.m. daily no-wake period. A $10,000 grant pays for the extraction and analysis of a sediment core to assess past water quality conditions in the lake. The study documents dramatic declines in water quality following periods of large-scale wetland drainage and watershed development. |
| | |
| **1992** | The lake's first aquatic plant management plan is prepared to guide weed-harvesting efforts. The Lake District conducts its first landowner opinion survey to assess local demographics and perceptions relating to a variety of lake-related topics. The first "carp-a-thon" event is hosted in an effort to reduce the carp population. |
| | |
| **1993** | Lake Ripley is granted "Priority Lake" status by the Wisconsin DNR, and is declared an outstanding natural resource needing protection and long-term management. As a result, |

| | |
|---|---|
| | nearly $1 million in Priority Watershed Project grants are earmarked through 2006. The money is used to hire a project manager, develop a nonpoint source pollution control plan, pay for community outreach, and provide landowner cost-share incentives to control soil erosion and sources of polluted runoff. The *Ripples* newsletter gets its debut, and a service-learning partnership is initiated with Cambridge High School. |
| | |
| **1994** | The use of "bioengineering" to control shoreline erosion is pioneered on Lake Ripley. A $90,000 grant is used to help renovate the public boat landing. Another $31,000 grant is used to purchase a new weed harvester. A Water Resources Appraisal is completed to characterize water quality conditions and offer management guidance. 426 feet of eroding shoreline is repaired. |
| | |
| **1995** | A Nonpoint Source Pollution Abatement Plan is completed. The Lake District receives an Outstanding Lake Stewardship Award from the Wisconsin DNR, UW Extension, and Wisconsin Association of Lakes. Town ordinance establishes controls on the placement of new piers in designated "sensitive areas." Another Town ordinance prohibits the use of motors in Vasby's Channel to protect fish-spawning habitat. Wetland and natural shoreline areas on the lake's south shore are put into conservancy as a result of a Lake District lawsuit brought against the developer. 120 feet of eroding shoreline is repaired. |
| | |
| **1996** | A boater opinion survey gauges public attitudes toward existing boating rules. A $2,000 grant pays for water testing supplies. 399 feet of eroding shoreline is repaired. |
| | |
| **1997** | A Town ordinance is adopted that regulates the burning of yard waste near the lake, primarily to keep phosphorus-rich ash from washing into the water. A $120,000 grant and $47,000 in donations are used to purchase the original 99-acre Lake District Preserve. 505 feet of eroding shoreline is repaired. |
| | |
| **1998** | Wetland-restoration projects and public-access improvements begin at the Lake District Preserve. An all-volunteer "Lake Watch" program is launched to monitor lake use and report observed boating violations. 335 feet of eroding shoreline and 2,950 feet of eroding ditch banks are repaired. |
| | |
| **1999** | A $1,800 grant is used to plug a drainage ditch at the Lake District Preserve. An $8,560 grant goes toward developing Lake Ripley's first comprehensive lake-management plan. Public opinion surveys and hearings are used to gather input on the lake's condition, use, and management priorities. The first annual community litter cleanup is co-hosted with Cambridge High School. 110 feet of eroding shoreline and 5,800 feet of eroding ditch banks are repaired. |
| | |
| **2000** | The Lake District establishes an online presence with a new Website. A two-year partnership with Jefferson County seeks to evaluate the present condition and management needs of the county's lakes. 100 feet of eroding shoreline and 3,500 feet of eroding ditch banks are repaired. |
| | |
| **2001** | A $10,000 grant helps fund an updated aquatic plant inventory and management plan. Town ordinance prohibits the feeding of geese to help control nuisance populations. 379 feet of eroding shoreline and 2,550 feet of eroding ditch banks are repaired. |
| | |

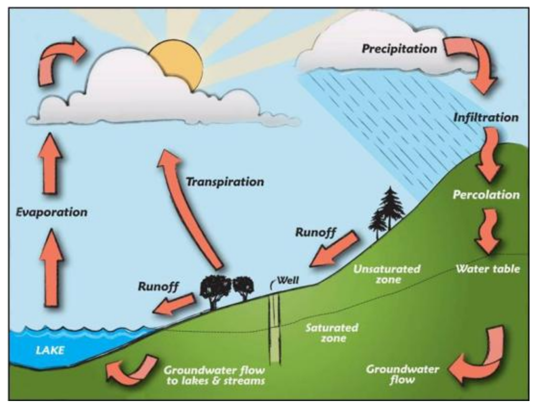
| | |
|---|---|
| **2002** | A $2,200 grant is used to plug a 7,400-ft. drainage ditch and restore 20 acres of wetlands at the Lake District Preserve. In order to perform the ditch closure, an additional two acres were added to the Lake District Preserve through condemnation procedures. 561 feet of eroding shoreline is repaired. |
| | |
| **2003** | Special deed restrictions are negotiated with a lakefront developer to protect threatened wetlands and natural shoreline areas in South Bay. A watercraft census and recreational carrying capacity analysis shows that boat traffic regularly exceeds safe and responsible levels during times of peak use. An annual inventory of piers, boatlifts, watercraft, and shoreline conditions is initiated. 436 feet of eroding shoreline is repaired. |
| | |
| **2004** | A $3,500 grant is used to research the impacts of piers on near-shore aquatic life. The study shows that oversized piers negatively alter aquatic plant communities and fish habitat on Lake Ripley due to excessive shading. A $1,500 grant is obtained to install a 3,200-square-foot rain garden at the Oakland Town Hall. The Lake District partners with Jefferson County to strengthen shoreland zoning rules governing the clearing of trees and other shoreline vegetation. 295 feet of eroding shoreline and 2,800 feet of eroding ditch banks are repaired. |
| | |
| **2005** | Town ordinance increases public boat-launching fees, expands no-wake zones to within 200 feet of shore, and prohibits future keyhole developments to address lake-crowding concerns. Zebra mussels are first discovered in the lake. A $1,000 grant is awarded to increase public awareness about aquatic invasive species. A property owner opinion survey helps gauge attitudes about the condition, use and management of the lake. $15,300 in additional landowner cost-share funding is obtained from the state. 902 feet of eroding shoreline is repaired. |
| | |
| **2006** | The Lake Ripley E-Bulletin is initiated for the purpose of disseminating time-sensitive news and announcements. Virtual tours of the Lake Ripley shoreline and Lake District Preserve are produced for local cable television. The Lake District partners with UW-Madison to design and implement a community-based social marketing program to promote the building of rain gardens. John Molinaro, District Chair, receives the Wisconsin Lake Stewardship Award from the Wisconsin DNR, UW Extension and Wisconsin Association of Lakes. 927 feet of eroding shoreline is repaired. |
| | |
| **2007** | The grant-funded Priority Lake Project ends after 13 years. From 1993-2006, over $1 million dollars in grants were received, and an estimated sediment-load reduction of 2,100 tons/year is achieved. $20,000 in grants are obtained to perform a second sediment-core analysis, and to update existing lake and watershed management plans. Another property owner opinion survey is conducted. Town ordinance establishes an emergency no-wake policy during high-water conditions. 130 feet of eroding shoreline and 3.2 acres of wetland are restored. |
| | |
| **2008** | A $200,000 grant and over $43,000 in donations are obtained to help enlarge the Lake District Preserve by 66 acres, to a total of 167 acres. Another $6,500 is raised to successfully challenge an increase in the floodplain elevation around Lake Ripley. 158 feet of eroding shoreline is repaired. |
| | |

| | |
|---|---|
| **2009** | $78,000 in additional grants help pay for the 66-acre Lake District Preserve acquisition and related restoration work. An updated, comprehensive management plan is finalized and published. A sediment-core analysis shows significant improvements in water quality, watershed erosion, and lake-sedimentation rates since 1990. Prior Lake District advocacy efforts lead to statewide restrictions on the sale and use of phosphorus lawn fertilizers. 492 feet of eroding shoreline is repaired, and another 1,430 feet is currently progressing toward completion. |

## 2-3 OVERVIEW OF RESOURCE CHARACTERISTICS

Lake Ripley is a natural, glacial kettle lake that formed approximately 12,000 years ago during the retreat of the last ice age. About a seven-square-mile watershed, as delineated from the lake's outlet, delivers surface water to the lake, predominantly as stream drainage. The lake, in turn, outflows to Koshkonong Creek and is part of the Lower Rock River and Upper Mississippi River Drainage Basins. Lake Ripley is classified as a drainage lake since it is fed by stream flow, groundwater, precipitation and runoff and is drained by a stream. Drainage lakes tend to be high in nutrients compared to other lake types, and their water quality is largely determined by watershed conditions.

The condition of Lake Ripley is ultimately determined by a combination of anthropogenic, climatic, hydrologic, geomorphic, and in-lake (physical, biological, chemical) factors. All of these forces act in concert to influence lake health. An abbreviated summary of these defining factors is provided in Table 2 below, and then described in greater detail in the sections that follow.




All lakes are products of the hydrologic cycle (or the means by which water enters and leaves the system) as represented in the above illustration. Source: UW-Extension

**Table 2: Summary of lake and watershed characteristics**

| PHYSICAL AND HYDROLOGIC DESCRIPTORS | |
|---|---|
| Lake type (origin) | Natural, glacial kettle lake |
| Lake type (hydrologic) | Drainage lake with one perennial inlet and outlet |
| Main water source | Stream flow |
| Landscape position and hydrologic-connectivity classification | Class I headwater lake that is not connected to upstream water bodies |
| Regional drainage basins | Part of the Lower Rock River and Upper Mississippi Drainage Basins |
| Lake surface area | 423.3 acres (main body); 1.7 acres (Vasby's ditch); 2.5 acres (dredged inlet channel)[16] |
| Watershed area | 4,688 acres (7.3 square miles)[17] |
| Watershed-to-lake area ratio | 11:1 |
| Shoreline length | 4.1 miles (main body)[18]; 0.57 mile (Vasby's ditch); 0.95 (dredged inlet) |
| Time of concentration | 11.14 hours (maximum travel time for water particle to reach the lake from furthest reaches of watershed)[19] |
| 100-yr. floodplain elevation | 837.99 ft. above mean sea level[20] |
| Ordinary High Water Mark (OHWM) | 836.5 ft. above mean sea level[21] |
| Average lake-surface elevation | 835 ft. above mean sea level[22] (variable) |
| Max. lake depth | 44 ft. |
| Mean depth | 18 ft. |
| Surface area < 3 ft. deep | 11% |
| Surface area <  5 ft. deep | 36% |
| Surface area < 10 ft. deep | 48% |
| Surface area > 20 ft. deep | 40% |
| Lake volume | 7,561 acre-feet[23] |
| Water residence time | 2.85 years (amount of time water resides in the lake before |

[16] Delineation by Jefferson County Land & Water Conservation Department using 2005 aerial photograph
[17] Jefferson County LIDAR Project using 2005-derived Digital Elevation Model (ESRI Spatial Analyst Watershed Tools: http://webhelp.esri.com/arcgisdesktop/9.3/index.cfm?TopicName=GP_Service_step-by-step%3A_Watershed)
[18] Ibid
[19] Montgomery Associates Resource Solutions, LLC. 2008. Floodplain Delineation Report for Lake Ripley, Jefferson County, Wisconsin. Computed using WinTR-55.
[20] Ibid
[21] 2002 OHWM determination by Wisconsin Department of Natural Resources relating to platting of Majestic Pines Subdivision
[22] U.S. Geological Survey. 1971 (photorevised), 1976 (photoinspected). Lake Mills, WI SW/4 Waterloo 15' Quadrangle.
[23] Wisconsin Department of Natural Resources. 1970. Lake Survey Map.

| | |
|---|---|
| | it is flushed out and replaced with new water)[24] |
| Inlet flow | 5 cubic ft/sec (1993 annual mean); 1.6-8.8 cubic ft/sec (1993 annual range)[25] |
| Outlet flow | 9 cubic ft/sec (1993 annual mean); 4.5-23.2 cubic ft/sec (1993 annual range)[26] |
| Groundwater component of hydrologic budget | 30%[27] |
| Surface/groundwater flow direction | Generally east to west |
| Shore development factor | 1.7 (circularity of lake shape, with 1 being a perfect circle) |
| Inlet stream length | 4.25 miles (2.5 miles in 1907, prior to drainage ditching) |
| Lake fetch | 1.3 miles |
| Lake-bottom substrates | 45% organic silt, 35% sand, 20% gravel[28] |
| Thermal properties of water column | Dimictic (summer stratification with spring and fall lake-wide mixing) |
| Summer stratification period | June to September |
| Anoxic zone | > 20 ft. during summer stratification |
| Ice-cover period | 97 days (1989-2009 average) |
| Watershed topography | Mostly flat to gently rolling |
| Watershed geology and soils | Lake is part of an extensive glacial outwash plain and terrace system; watershed soil types are primarily silt loam; common soil associations are Houghton-Adrian and Fox-Casco-Matherton[29] |
| Watershed land uses | 48.4% (2,270 acres) cropland; 12.6% (592 acres) residential; 11.6% (543 acres) wetlands; 9.5% (444 acres) surface water; 6.3% (296 acres) upland woods; 4.2% (197 acres) streets; 4.2% (197 acres) rural uncultivated; and 3.2% (148 acres) gravel pits[30] |
| Watershed impervious cover | 11%[31] |
| Wetland acreage | 543 acres (originally 1,500 acres according to a 1908 USGS inventory); about 25% of shoreline still supports wetlands[32] |

[24] Estimated using Wisconsin Lake Modeling Suite (WiLMS), Version 3.3.18.1
[25] Wisconsin Department of Natural Resources, and Lake Ripley Management District. 1994. Lake Ripley Water Resources Appraisal.
[26] Ibid
[27] Wisconsin Department of Natural Resources, Wisconsin Department of Agriculture, Trade and Consumer Protection, Lake Ripley Management District, and Jefferson County Land Conservation Department. 1998. Nonpoint Source Control Plan for the Lake Ripley Priority Lake Project. Wisconsin Nonpoint Source Water Pollution Abatement Program. Publication WT-512-98.
[28] Burris, John E. 1971. A Study of Man's Effects on Lake Ripley. University of Wisconsin-Madison. Zoology 518 Report.
[29] U.S. Department of Agriculture. 1979. Soil Survey of Jefferson County.
[30] Jefferson County Land and Water Conservation Department. 2008 Land Use Cover Maps.
[31] Information generated by Jefferson County Land & Water Conservation Department using 2008 land-use data and the Monroe County of Indiana methodology for Impervious Cover Coefficient distinction
[32] Wisconsin Department of Natural Resources. 1986. Wisconsin Wetlands Inventory.

| BIOLOGICAL AND CHEMICAL DESCRIPTORS | |
|---|---|
| Watershed ecoregion | Southeastern Wisconsin Savannah and Till Plain[33] |
| Lake type (chemical) | Marl (high in calcium carbonate) |
| Lake trophic status | Meso-eutrophic |
| Average summer water quality indices | Total phosphorus (“good”); chlorophyll-*a* (“good”); water clarity (“fair”) |
| Mean summer total phosphorus (surface) | 20.3 µg/L |
| Mean summer total phosphorus (bottom) | 70.0 µg/L |
| Mean summer chlorophyll-*a* | 8.6 µg/L |
| Mean Secchi clarity | 6.0 ft. |
| Limiting nutrient for algal growth | Phosphorus |
| Nitrogen-to-phosphorus ratio | >27:1[34] |
| Phosphorus-loading sources | Row crops (70.3%), urban/residential (17.4%), pasture/ mixed agriculture (5.5%), atmospheric deposition (4.1%), wetland (1.8%), forest (0.8%)[35] |
| Sensitivity of lake to changes in nutrient load | Low |
| Sediment loading sources (Pre-1998 estimate) | Eroding ditches (75%), shorelines (7%), construction sites (13%), cropland (4%), existing urban (1%)[36] |
| Mean sedimentation rate | 0.7 g $cm^{-2}$ $yr^{-1}$ (based on sediment-core findings)[37] |
| Alkalinity | High (160-260 mg/L $CaCO_3$) |
| Average pH | High (8.5) |
| Acidification sensitivity | Low |
| Max. plant-rooting depth | ~12-15 ft. |
| Total fish species | 39 species documented since mid-1970s |
| Winterkill sensitivity | Low (due to water depth and volume) |
| Aquatic plant species documented | 31 species[38] |
| Aquatic invasive species | Common carp (*Cyprinus carpio*); Eurasian watermilfoil (*Myriophyllum spicatum*); curly-leaf pondweed (*Potamogeton crispus*); zebra mussel (*Dreissena* |

[33] Omernik, J.M. 1987. Ecoregions of the Conterminous United States.
[34] Wisconsin Department of Natural Resources, and Lake Ripley Management District. 1994. Lake Ripley Water Resources Appraisal.
[35] Analysis using Wisconsin Lake Modeling Suite (WiLMS), Version 3.3.18.1
[36] Wisconsin Department of Natural Resources, Wisconsin Department of Agriculture, Trade and Consumer Protection, Lake Ripley Management District, and Jefferson County Land Conservation Department. 1998. Nonpoint Source Control Plan for the Lake Ripley Priority Lake Project. Wisconsin Nonpoint Source Water Pollution Abatement Program. Publication WT-512-98.
[37] Garrison, Paul J. and Robert Pillsbury. 2009. Paleoecological Study of Lake Ripley, Jefferson County. Wisconsin Department of Natural Resources, Bureau of Science Services; and University of Wisconsin-Oshkosh, Department of Biology. PUB-SS-1062 2009.
[38] 2006 aquatic plant inventory conducted by the Wisconsin Department of Natural Resources

| | |
|---|---|
| | *polymorpha*) |
| Endangered and threatened resources | WI and Federal Endangered Species: giant carrion beetle (*Nicrophorus americanus*); WI Special Concern Species: least darter (*Etheostoma microperca*), lake chubsucker (*Erimyzon sucetta*), and cuckoo flower (*Cardamine pratensis*); WI Threatened Species: pugnose shiner (*Notropis anogenus*) and blanding's turtle (*Emydoidea blandingi*)[39] |
| **LAKE-USE AND DEMOGRAPHIC DESCRIPTORS** | |
| Lake access | 1 public boat landing with 16 parking spaces; 1 private marina with boat landing; 1 public fishing/swimming pier; 1 community park and swim beach |
| Septic treatment | Municipal sewage system that discharges treated waste water to Koshkonong Creek |
| Potable water source | Groundwater (private wells) |
| Number of piers | 167 piers[40] |
| Number of parked boats | 482 boats[41] |
| Shoreland development | 90% of residences located within ¼-mile of the lake |
| Property owners who are <u>not</u> full-time residents of the Lake District | ~49%[42] |
| Lakefront property owners who are <u>not</u> full-time residents | ~65%[43] |
| Equalized valuation of Lake Ripley Management District (2009) | $237,284,218[44] |
| Lake-use zoning policies | 7:30 p.m.-11:00 a.m. daily no-wake period; no-wake within 200 ft. from shore; no-wake within 100' of piers, rafts and buoyed restricted areas; no-wake within buoyed areas of both bays; no motor use within Vasby's Channel |
| Slow-no-wake and boat-restricted areas | 125 acres |

[39] Wisconsin Department of Natural Resources, and Lake Ripley Management District. 1994. <u>Lake Ripley Water Resources Appraisal</u>.
[40] 2009 visual inventory performed by Lake District staff
[41] Ibid
[42] Estimated using mailing address information taken from 2008 Jefferson County tax-parcel data
[43] Ibid
[44] Wisconsin Department of Revenue, Certification of Equalized Value for 2009

## 2-4 DEMOGRAPHICS

Pontoon boats docked on the north shore of Lake Ripley.

Lake Ripley is both a popular recreational destination and a regional driver of economic activity. People have historically been drawn to its shores to engage in a variety of leisure activities, including fishing, swimming and boating. The high density and value of development around the lake is a testament to the lake's value and significance as one of the area's primary attractions (see Figure 11). Small, summer cottages are continuing to be converted to year-round residences around the lake as an increasingly greater share of the population shifts to full-time residency. Development and lake-use pressure is high on Lake Ripley due to its proximity to major urban centers, such as Madison (WI), Milwaukee (WI), Chicago (IL) and Rockford (IL). Population densities vary on both a weekly and seasonal basis, especially near the lake, with summer weekends attracting the greatest number of visitors.

The Lake Ripley Management District is located next to the Village of Cambridge in the northwest corner of the Town of Oakland. In 2005, the Town of Oakland (Jefferson County) supported a mostly rural population of 3,368 people and roughly 1,300 households within its 36-square-mile boundary. The Village of Cambridge (Dane County) supported a population of 1,187 people. These populations are projected to grow by about 40% over the next 25 years.[45]

Although the Lake District includes only about 7% of the total land area in the Town of Oakland, it represents 68% of the Town's total tax base.[46] This fact alone speaks to the lake's tremendous regional economic value. It also helps support the case for active stewardship, especially in light of continued development pressures and related environmental stressors that threaten the quality of this important resource. Both "improved" and "unimproved" parcels with actual lake frontage are shown in Figure 12. The number of buildings and parcels by demographic segment around the lake are presented in Table 3.[47]

[45] MSA Professional Services, Inc. 2008. Comprehensive Growth Plan for Town of Oakland, Jefferson County, Wisconsin.
[46] Wisconsin Department of Revenue. 2007 property assessment records.
[47] Jefferson County Land Information Office. 2005 land-use records.

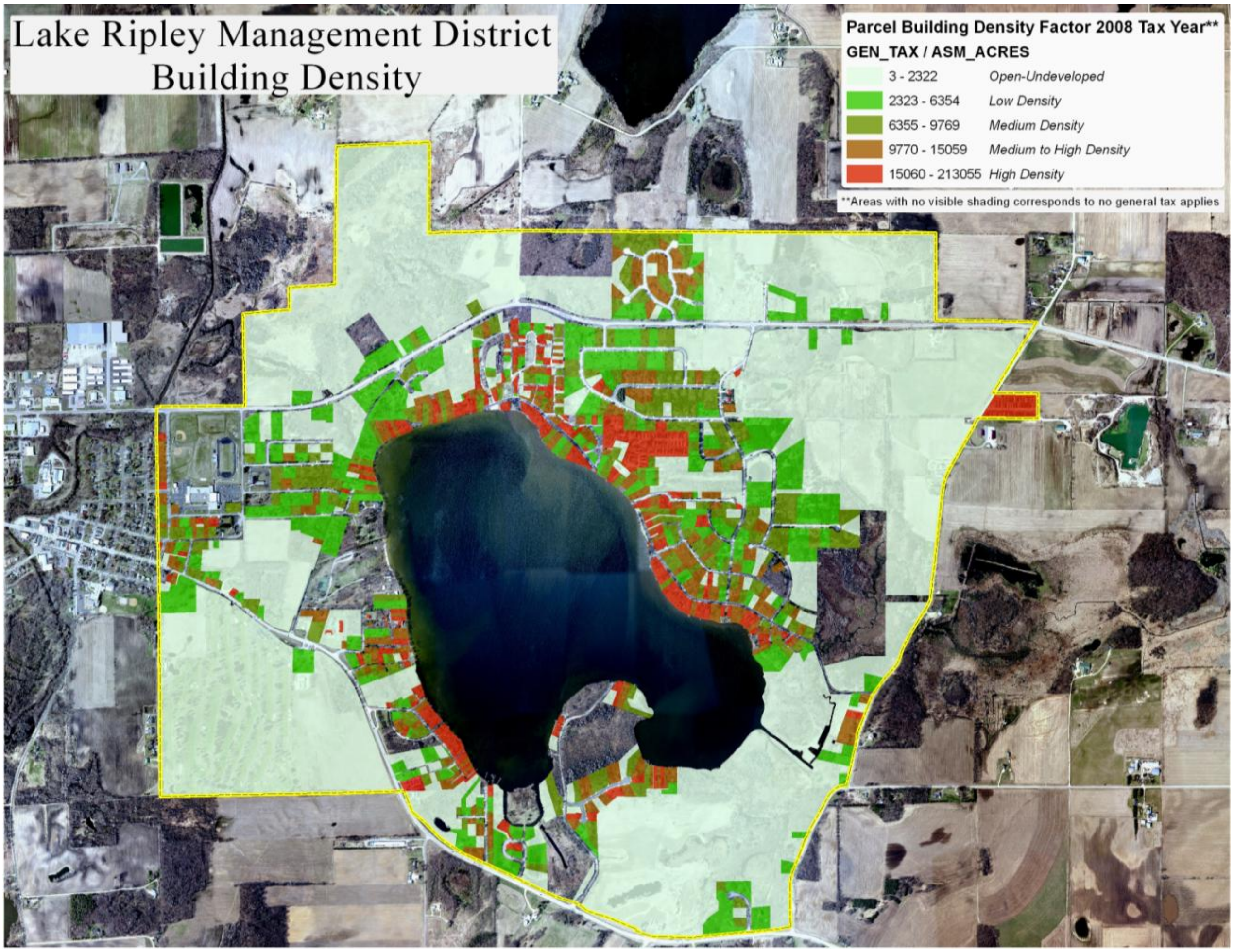



**Figure 11: Parcel Building Density in Lake Ripley Management District as Defined by Property Tax-to-Acreage Ratios**[48]

[48] Map produced by Gerry Kokkonen, GIS/Land-Use Specialist, Jefferson County Land & Water Conservation Department (2009)

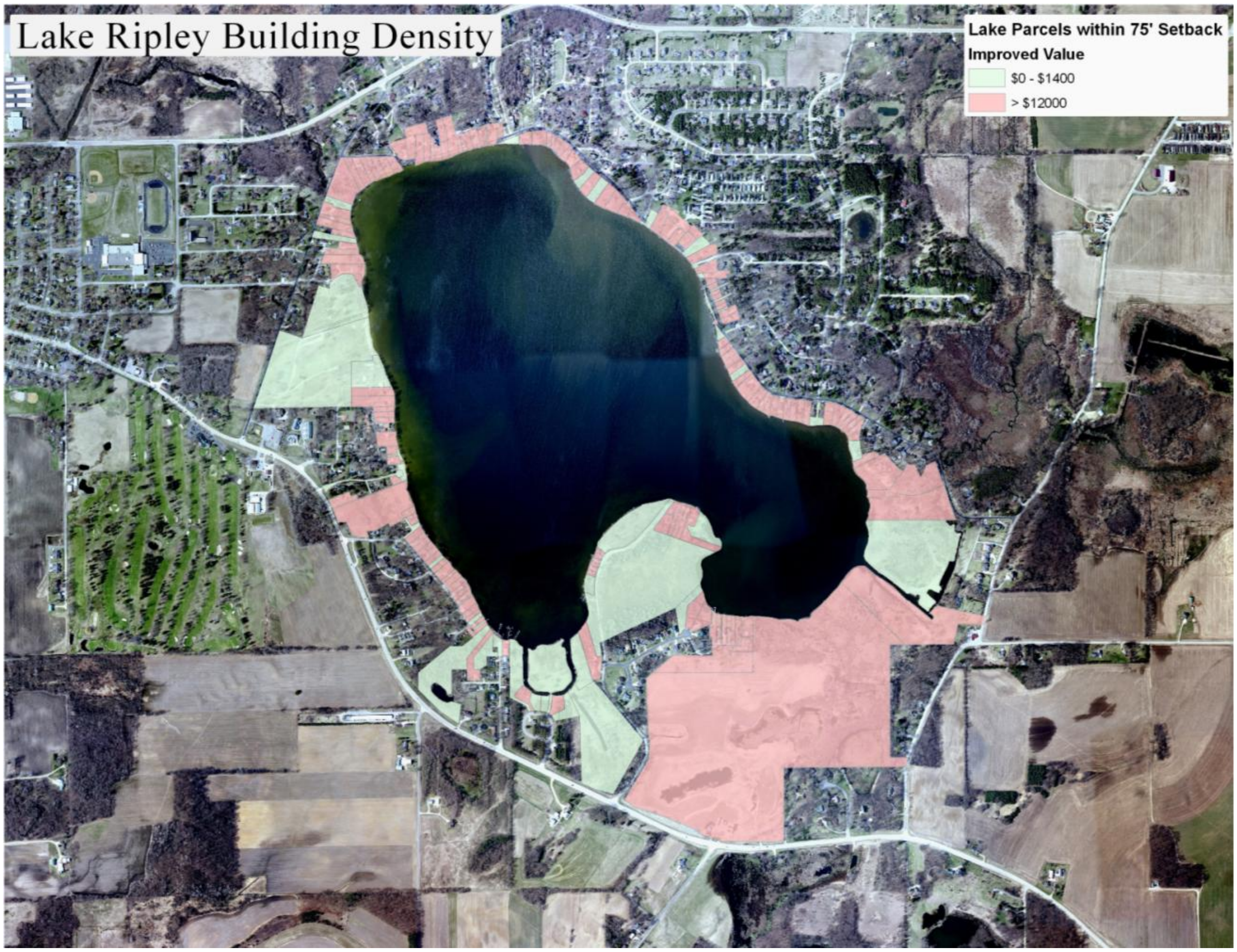



**Figure 12: Improved and Unimproved Parcels within Lake Ripley's 75-ft. Building Setback**[49]

[49] Map produced by Gerry Kokkonen, GIS/Land-Use Specialist, Jefferson County Land & Water Conservation Department (2009)

**Table 3: Buildings, parcels and property owners around Lake Ripley**[50]

| Demographic segment | Address points[f] | Parcels | Part-time residency[g] |
|---|---|---|---|
| Lakefront[a] | 160 | 211 | 65% |
| Lake District[b] | 942 | 1,269 | 49% |
| Watershed[c] | 845 | 1,253 | 58% |
| Lake District + Watershed[d] | 1,023 | 1,470 | |
| ½-mile of lake[e] | 872 | 1,203 | |
| Town of Oakland | 1,401 | 2,240 | |

[a] = parcels containing land within 75-ft. buffer of lake edge
[b] = parcels within Lake District taxing district
[c] = parcels touching or within Lake Ripley watershed boundaries
[d] = parcels within Lake District boundary plus those containing land within Lake Ripley watershed boundaries
[e] = parcels touching or within half-mile buffer of lake edge
[f] = homes and buildings with associated fire numbers
[g] = estimated based on primary mailing address information listed in 2009 tax-parcel records

A 2007 property owner survey revealed an average respondent age of 57 years old, which was based on a 23% response rate. The survey also suggested an average household size of 2.8 individuals. Most respondents indicated living within one-quarter mile of the lake, with 37% owning lakefront property. Full-time residents accounted for 57% of respondents, while the remaining 43% were seasonal/part-time residents. According to the survey, part-time residency tended to increase as property ownership moved closer to the lake. Slightly more than half of those living off the lake claimed to have deeded lake-access rights. Length of property ownership varied widely, although a majority (58%) owned their property for over a decade.[51]

## 2-5 WATERSHED DRAINAGE PATTERNS

Lake Ripley lies at the terminus of a 7.3-square-mile watershed that drains predominantly agricultural land (see Figure 13). As a drainage lake, it is primarily fed by stream flow, as well as groundwater, precipitation and direct surface runoff. The lake has an outlet that discharges to Koshkonong Creek, which is a tributary of the Rock River. Compared to other lake types, drainage lakes are more affected by surface runoff problems, generally have shorter residence times, and often require more intensive watershed protection to manage water quality.

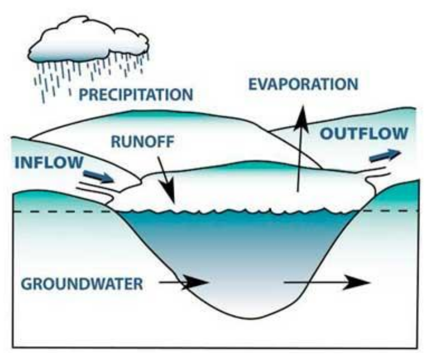


**Illustration showing the movement of water through a drainage lake. Source: Wisconsin Lakes Partnership**

[50] 2009 Jefferson County tax-parcel records
[51] Lake Ripley Management District. 2007. Lake Ripley Property Owner Opinion Survey.

Because Lake Ripley reflects the condition of the surrounding landscape from which it derives surface water, it can be viewed as largely a product of its watershed. Watershed-to-lake surface area ratios are used to estimate the level of influence the surrounding landscape has on water quality. Lake Ripley has a watershed-to-lake surface area ratio of 11:1. Lakes with ratios greater than 10:1 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. As watershed area increases in relation to the size of the lake, the greater the potential volume of pollutants entering the lake in the form of surface runoff. This runoff is generated from snowmelt, precipitation and groundwater discharge that does not evaporate or infiltrate into the soil. The actual amount of pollutants, sediment and other material delivered to the lake depends on watershed size, soil types, topography, type of land cover and other factors.

Both surface water and regional groundwater generally flow from east to west toward the lake. Figure 14 shows individual subwatersheds and generalized flow paths for surface drainage. Although Lake Ripley is part of the more extensive Lower Rock River and Upper Mississippi Drainage Basins, it is not directly influenced by hydrologic connectivity to other upstream surface waters. However, it is linked to other surface waters from an outlet perspective (via Koshkonong Creek and the Rock River), which may allow fish and other free-swimming aquatic organisms to migrate back and forth between water bodies. Koshkonong Creek is classified as a warm water sport fishery dominated by rough fish. It was returned to a free-flowing stream following the removal of the Rockdale dam in 2001.[52]

[52] Jefferson County Land and Water Conservation Department. 2005. Jefferson County Land and Water Resources Management Plan: 2006-2010.

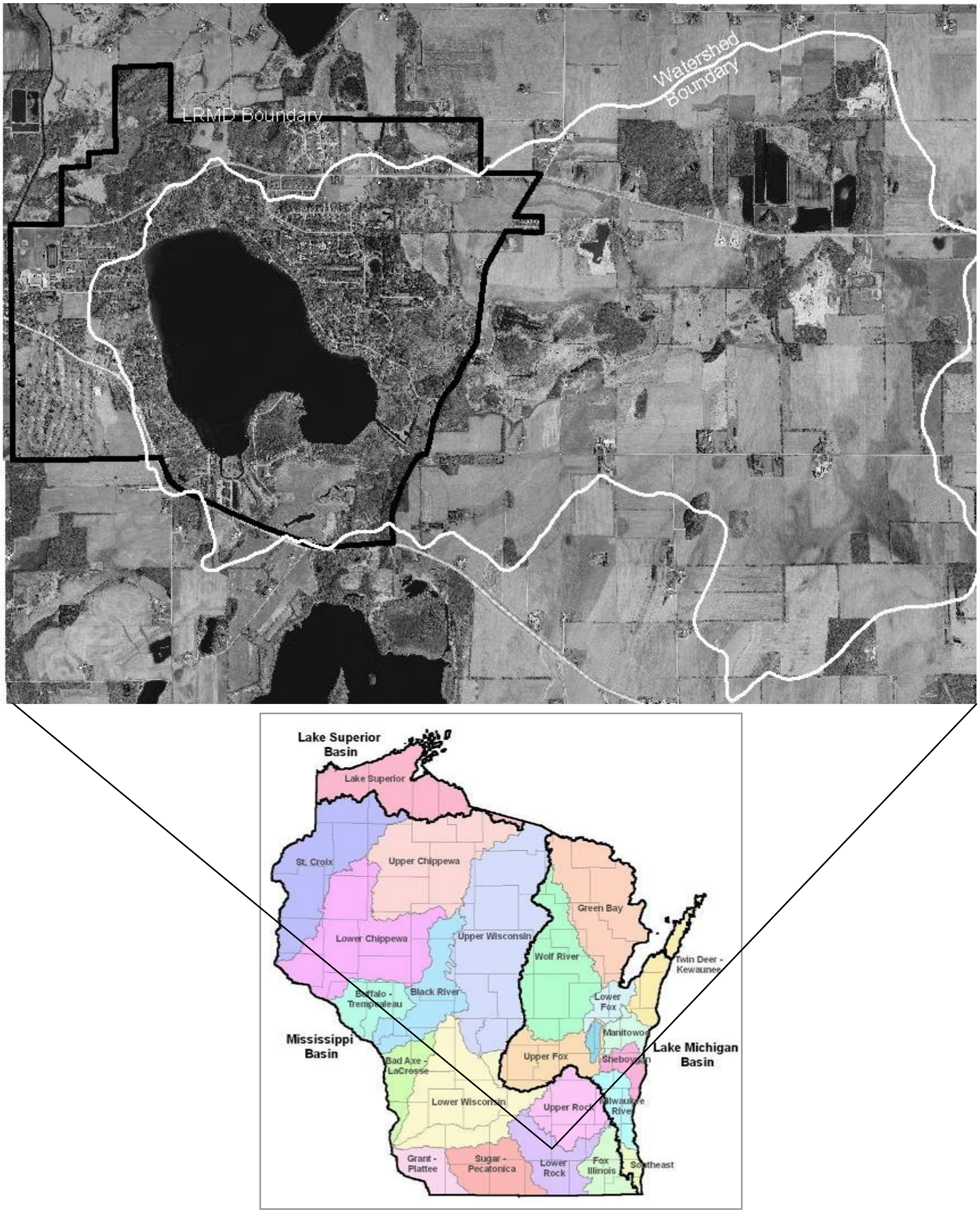



**Figure 13: 2005 Aerial Photograph of Lake Ripley Watershed Shown in Context of Regional Drainage Basins**

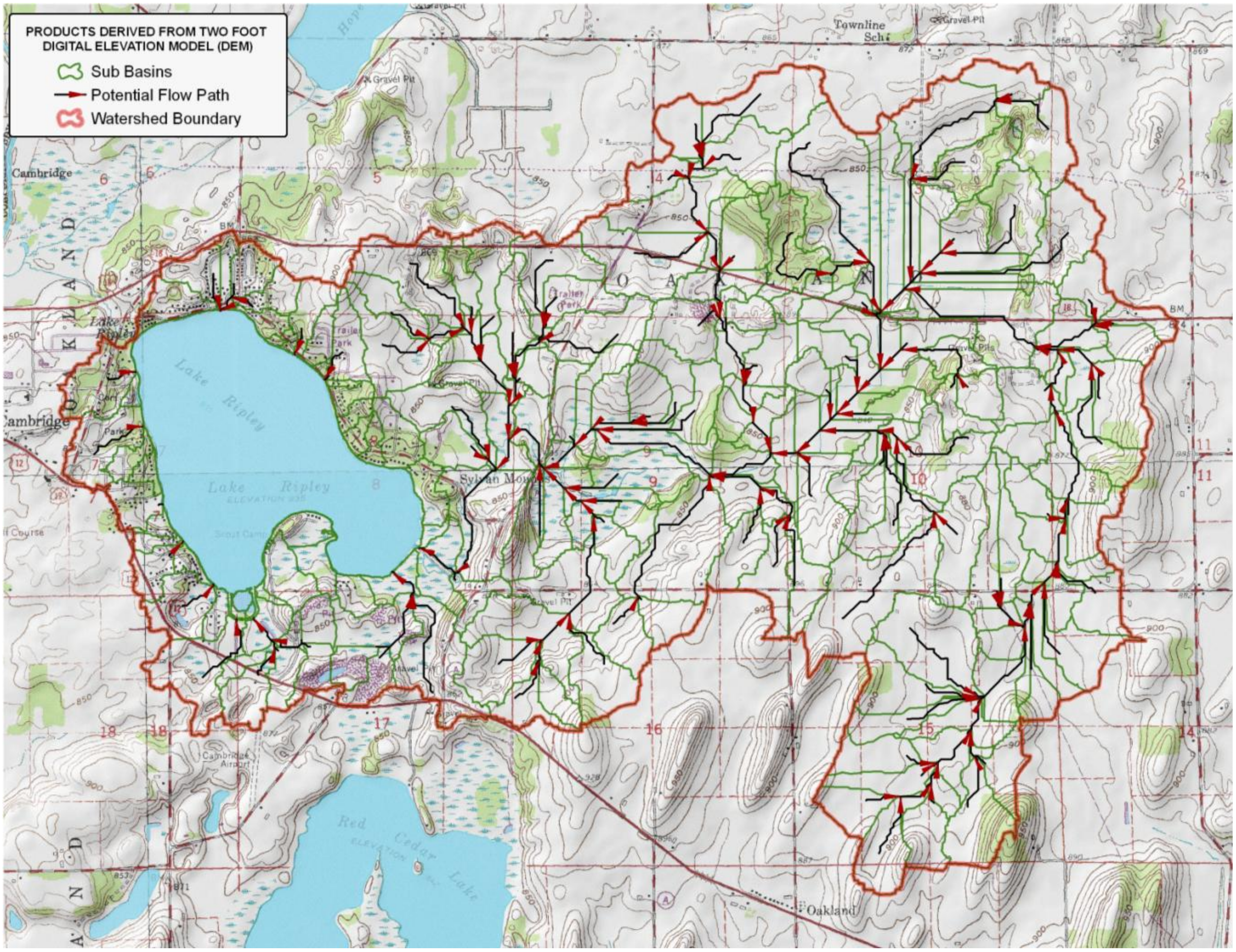



**Figure 14: Lake Ripley Subwatersheds and Overland Flow Paths[53]**

## 2-6 WATERSHED GEOLOGY AND SOILS

Glacial features largely control the topography and hydrology in the Lake Ripley Watershed. Lake Ripley itself is situated in a kettle depression formed by the retreating glaciers about 12,000 years ago.[54] 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 that was 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. As a result, there are extensive areas around Lake Ripley that are low in elevation and nearly flat in topography. Consequently, wetlands are common throughout the region. A

[53] Map produced by Gerry Kokkonen, GIS/Land-Use Specialist, Jefferson County Land & Water Conservation Department (2009), and based on Jefferson County LIDAR Project using 2005-derived Digital Elevation Model

[54] Wisconsin Department of Natural Resources. 2002. The State of the Rock River Basin. PUBL #WT-668-2002.

network of drainage ditches and tile systems have historically been used to convert wetlands into cropland.

The watershed predominantly consists of the Fox and St. Charles Silt Loam soil types on 2-6% slopes, which accounts for 31% (2,013 acres) of the watershed. Houghton Muck (9.5%, 615 acres) and Casco Loam on 6-12% slopes (9%, 585 acres) are also well represented. Table 4 lists the different soil types found within the Lake Ripley watershed.

**Table 4: Type and aerial extent of soils found within the Lake Ripley watershed**

| Soil Type | Acres | % of Total |
|---|---|---|
| Fox silt loam, 2 to 6 percent slopes | 1085.07 | 16.75% |
| St. Charles silt loam, moderately well-drained, gravelly substratum, 2 to 6 percent slopes | 928.16 | 14.33% |
| Houghton muck | 615.11 | 9.49% |
| Casco loam, 6 to 12 percent slopes, eroded | 584.61 | 9.02% |
| Wauconda silt loam, 0 to 2 percent slopes | 319.59 | 4.93% |
| Casco-Rodman complex, 12 to 20 percent slopes, eroded | 298.86 | 4.61% |
| Fox loam, 6 to 12 percent slopes, eroded | 278.88 | 4.30% |
| Matherton silt loam, 0 to 3 percent slopes | 274.73 | 4.24% |
| Wacousta silty clay loam | 266.98 | 4.12% |
| Boyer sandy loam, 1 to 6 percent slopes | 196.20 | 3.03% |
| Fox silt loam, 0 to 2 percent slopes | 189.37 | 2.92% |
| Kidder loam, 6 to 12 percent slopes, eroded | 146.81 | 2.27% |
| McHenry silt loam, 6 to 12 percent slopes, eroded | 142.13 | 2.19% |
| St. Charles silt loam, moderately well-drained, 0 to 2 percent slopes | 106.78 | 1.65% |
| Dodge silt loam, 2 to 6 percent slopes | 96.06 | 1.48% |
| Moundville loamy sand, 1 to 6 percent slopes | 93.39 | 1.44% |
| Virgil silt loam, gravelly substratum, 0 to 3 percent slopes | 91.39 | 1.41% |
| Rotamer loam, 12 to 20 percent slopes, eroded | 88.80 | 1.37% |
| McHenry silt loam, 2 to 6 percent slopes | 78.78 | 1.22% |
| Grays silt loam, 2 to 6 percent slopes | 63.04 | 0.97% |
| Lamartine silt loam, 2 to 6 percent slopes | 49.25 | 0.76% |
| Watseka variant loamy sand, 0 to 3 percent slopes | 47.41 | 0.73% |
| Pits, gravel | 40.96 | 0.63% |
| Wasepi sandy loam, 0 to 3 percent slopes | 35.88 | 0.55% |
| Palms muck | 35.06 | 0.54% |
| Adrian muck | 34.94 | 0.54% |
| Radford silt loam, 0 to 3 percent slopes | 33.56 | 0.52% |
| St. Charles silt loam, moderately well-drained, 2 to 6 percent slopes | 31.72 | 0.49% |
| Kidder loam, 2 to 6 percent slopes | 30.97 | 0.48% |
| Kidder loam, 12 to 20 percent slopes, eroded | 29.93 | 0.46% |
| Sebewa silt loam | 26.37 | 0.41% |
| Whalan variant silt loam, 0 to 3 percent slopes | 19.44 | 0.30% |
| Juneau silt loam, 1 to 6 percent slopes | 17.42 | 0.27% |
| Casco-Rodman complex, 20 to 45 percent slopes | 16.49 | 0.25% |
| Casco loam, 2 to 6 percent slopes, eroded | 13.95 | 0.22% |

| | | |
|---|---|---|
| Udorthents | 12.44 | 0.19% |
| Tuscola silt loam, 2 to 6 percent slopes | 8.96 | 0.14% |
| Whalan loam, 2 to 6 percent slopes | 8.39 | 0.13% |
| Rotamer loam, 20 to 30 percent slopes, eroded | 8.08 | 0.12% |
| Sisson fine sandy loam, 6 to 12 percent slopes, eroded | 7.17 | 0.11% |
| Kidder sandy loam, 6 to 12 percent slopes, eroded | 7.09 | 0.11% |
| Kidder loam, moderately well-drained, 2 to 6 percent slopes | 6.41 | 0.10% |
| Otter silt loam | 5.27 | 0.08% |
| Elvers silt loam | 3.89 | 0.06% |
| Wauconda silt loam, 2 to 6 percent slopes | 1.94 | 0.03% |
| Gilford sandy loam | 0.74 | 0.01% |
| **Total Acres** | **6478.47** | |

The most common soil associations found in the watershed are Houghton-Adrian, and Fox-Casco-Matherton.[55] 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 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.

A detailed soils map of the Lake Ripley watershed is shown as Figure 15, with an accompanying soils legend included on the following page.

[55] U.S. Department of Agriculture. 1979. Soil Survey of Jefferson County.

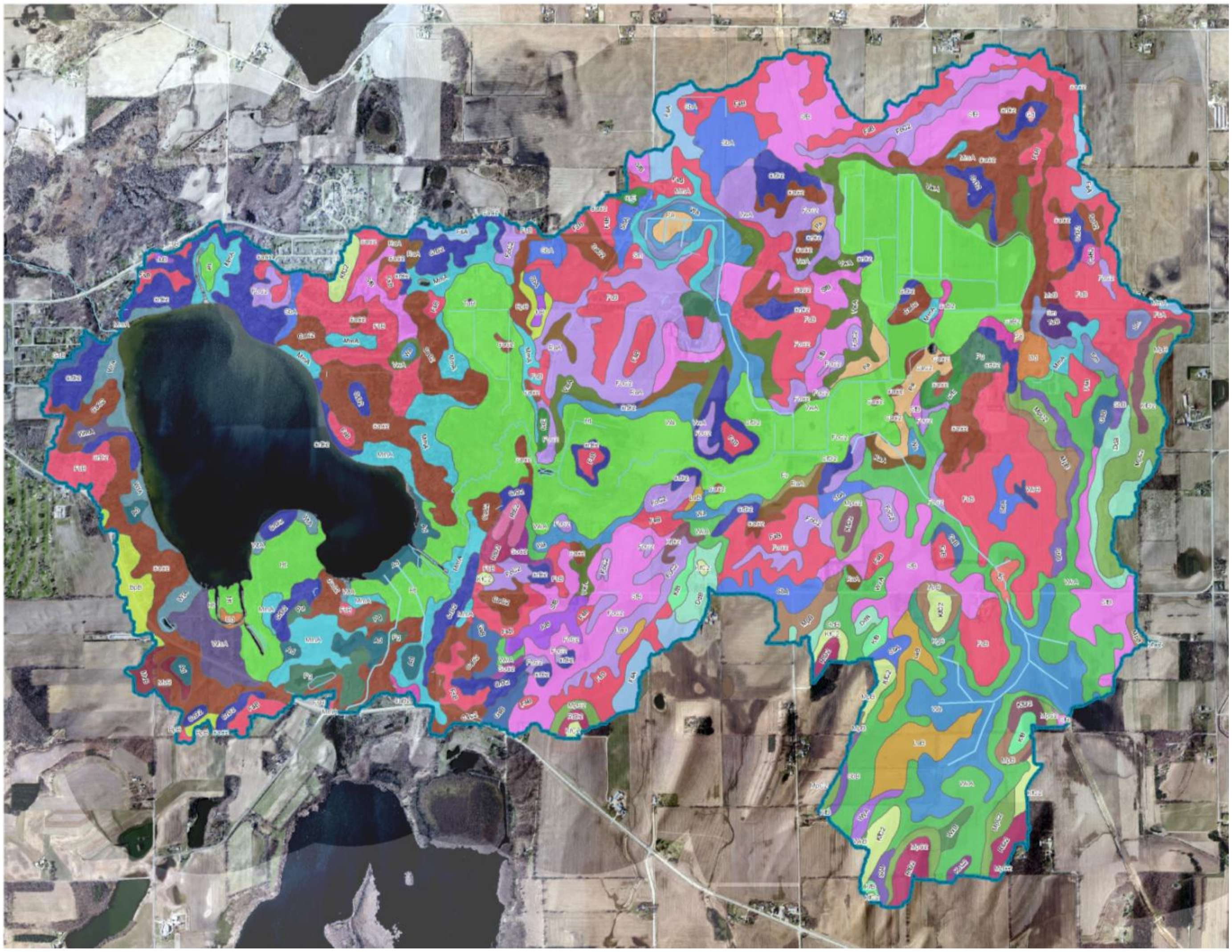


**Figure 15: Lake Ripley Watershed Soils Map**[56] (Note: Map legend shown on next page)

[56] Map produced by Gerry Kokkonen, GIS/Land-Use Specialist, Jefferson County Land & Water Conservation Department (2009), and based on U.S. Department of Agriculture Soil Survey

# Soils

**Abbr, Name**

- Ad, Adrian muck
- BpB, Boyer sandy loam, 1 to 6 percent slopes
- CaB2, Casco loam, 2 to 6 percent slopes, eroded
- CaC2, Casco loam, 6 to 12 percent slopes, eroded
- CrD2, Casco-Rodman complex, 12 to 20 percent slopes, eroded
- CrE, Casco-Rodman complex, 20 to 45 percent slopes
- DdB, Dodge silt loam, 2 to 6 percent slopes
- Ev, Elvers silt loam
- FoC2, Fox loam, 6 to 12 percent slopes, eroded
- FsA, Fox silt loam, 0 to 2 percent slopes
- FsB, Fox silt loam, 2 to 6 percent slopes
- Gd, Gilford sandy loam
- GsB, Grays silt loam, 2 to 6 percent slopes
- Ht, Houghton muck
- JuB, Juneau silt loam, 1 to 6 percent slopes
- KeC2, Kidder sandy loam, 6 to 12 percent slopes, eroded
- KfB, Kidder loam, 2 to 6 percent slopes
- KfC2, Kidder loam, 6 to 12 percent slopes, eroded
- KfD2, Kidder loam, 12 to 20 percent slopes, eroded
- KgB, Kidder loam, moderately well-drained, 2 to 6 percent slopes
- LaB, Lamartine silt loam, 2 to 6 percent slopes
- MmA, Matherton silt loam, 0 to 3 percent slopes
- MpB, McHenry silt loam, 2 to 6 percent slopes
- MpC2, McHenry silt loam, 6 to 12 percent slopes, eroded
- MvB, Moundville loamy sand, 1 to 6 percent slopes
- Ot, Otter silt loam
- Pa, Palms muck
- Pg, Pits, gravel
- RaA, Radford silt loam, 0 to 3 percent slopes
- RtD2, Rotamer loam, 12 to 20 percent slopes, eroded
- RtE2, Rotamer loam, 20 to 30 percent slopes, eroded
- SbA, St. Charles silt loam, moderately well-drained, 0 to 2 percent slopes
- SbB, St. Charles silt loam, moderately well-drained, 2 to 6 percent slopes
- SfB, St. Charles silt loam, moderately well-drained, gravelly substratum, 2 to 6 percent slopes
- Sm, Sebewa silt loam
- SoC2, Sisson fine sandy loam, 6 to 12 percent slopes, eroded
- TuB, Tuscola silt loam, 2 to 6 percent slopes
- Ud, Udorthents
- VwA, Virgil silt loam, gravelly substratum, 0 to 3 percent slopes
- Wa, Wacousta silty clay loam
- WmA, Wasepi sandy loam, 0 to 3 percent slopes
- WtA, Watseka variant loamy sand, 0 to 3 percent slopes
- WvA, Wauconda silt loam, 0 to 2 percent slopes
- WvB, Wauconda silt loam, 2 to 6 percent slopes
- WxB, Whalan loam, 2 to 6 percent slopes
- WyA, Whalan variant silt loam, 0 to 3 percent slopes

## 2-7 WATERSHED LAND USE

### CURRENT LAND-USE REPRESENTATION

Agriculture represents the watershed's dominant land use, with heavy residential development mostly confined to within about a half-mile radius of the lake's periphery (see Figure 16). Land-use cover in the watershed currently consists of 48.42% (2,270 acres) cropland, 12.63% (592 acres) urban/residential, 11.58% (543 acres) wetland, 9.47% (444 acres) surface water, 6.32% (296 acres) upland woods, 4.21% (197 acres) streets, 4.21% (197 acres) rural uncultivated land, and 3.16% (148 acres) gravel pits.

### PRE- TO POST-SETTLEMENT LANDSCAPE CHANGES

Prior to European settlement, lands draining to the lake were predominantly oak savanna that supported extensive wetlands. Wetlands and other natural areas in the watershed are considered critical for providing flood attenuation, pollutant filtration, wildlife habitat, and even spawning and nursery areas for certain types of fish like northern pike. The native prairies, for example, were rich in plant diversity with deep-penetrating root systems that greatly enhanced the porosity of the soil and its ability to infiltrate rainfall (see Figure 17). While there is no empirical data on pre-settlement infiltration rates in the Lake Ripley watershed, research has demonstrated that such rates are considerably higher in forests and meadows as compared to farmlands.[57] As infiltration rates decrease, groundwater recharge also decreases and surface runoff increases.

Since European settlement, agricultural and residential development have eliminated most of the area's woodlands and prairies, as well as about two-thirds of the original 1,500 acres of wetlands, mostly through ditching, land filling and drain tiling. Wetlands that still remain continue to be threatened by polluted runoff, sedimentation, groundwater depletion, and the spread of invasive species (i.e., buckthorn, reed canary grass, purple loosestrife, and narrow-leaf and hybrid cattails). In addition, the length of the lake's inlet tributary stream has been artificially extended as a result of ditching and channelization. Over the last century, the inlet has increased from 2.5 miles[58] to 4.25 miles in length.

Increased stream length and use of drain tiling have resulted in greater surface water runoff, sediment delivery and nutrient transport to Lake Ripley and area wetlands. In fact, farm drainage ditches that connect to Lake Ripley's inlet were all found to be eroding in the mid-1990s, contributing an estimated 2,654 tons or 75% of the total sediment load to the lake.[59] Most

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[57] U.S. Soil Conservation Service. 1972. National Engineering Handbook, Section 4: Hydrology. Washington: U.S. Department of Agriculture, Soil Conservation Service.
Knox, J.C. 1977. Human impacts on Wisconsin stream channels. *Annals of the Association of American Geographers* 67(3):323-342.
Knox, J.C. and J. Hudson. 1995. Physical and cultural change in the Driftless Area of southwest Wisconsin. In *Geographical Excursions in the Chicago Region*, ed. M.P. Conzen, pp. 107-131. Chicago: Association of American Geographers.

[58] 1907 U.S. Geological Survey topographic map

[59] Wisconsin Department of Natural Resources, Wisconsin Department of Agriculture, Trade and Consumer Protection, Lake Ripley Management District, and Jefferson County Land Conservation

of these inventoried ditches were subsequently either repaired (i.e., Long Sod Farms north of USH 18) or plugged (i.e., two ditches at the Lake District Preserve) using Priority Lake Project grants and other funding mechanisms. The stream segment lying between the lake and the mid-point of the Preserve is considered mainly a sediment-depositional area.

The management of some ditches and drainage routes within the watershed are governed by drainage districts. The locations of these special districts were determined using engineering maps supplied to Jefferson County and the Farm Drainage Commission (Figure 18). Two of the three districts located southeast of the lake are now in residential or otherwise non-agricultural land use. The other district is located approximately two miles east of the lake and is greater than 90% underground drain tile that outlets into a well-maintained drainage ditch. None of the three drainage districts were found to be contributing sediment to Lake Ripley.[60]

**IMPACTS OF DEVELOPMENT AND LAND-USE CHANGE**

Development and associated hard surfaces have also decreased the soil's capacity to infiltrate rainfall and recharge the groundwater aquifer. Much of the water that once filtered through the soil and replenished the groundwater supply now runs off of farm fields, transporting sediment and algae-producing phosphorus into drainage ditches, wetlands and Lake Ripley. This increased volume of surface drainage has also created a more incised and unstable inlet channel, diminishing the functionality of adjacent wetlands as natural water quality buffers.

Agricultural runoff is estimated to contribute the greatest volume of phosphorus (in total) to Lake Ripley. It is estimated that nearly 76% of phosphorus loading originates from agricultural land uses, and mostly from row-cropped areas.[61] However, the lake is also heavily impacted by residential development around its periphery. These urbanized areas are estimated to contribute 17% of the total phosphorus loads to the lake.[62] Since the watershed is of modest size and fairly flat, the urbanized shorelands right next to the lake are likely to exert a relatively significant influence on lake condition. In fact, the rate and amount of runoff can increase by a factor of ten under typical lakeshore-development scenarios. Research has demonstrated that once watershed development reaches a 10-12% impervious-cover threshold, waterways often experience declines in certain fish species, among other problems.[63] Impervious cover in the Lake Ripley watershed is currently estimated to be 11% (see Table 5).

Studies also show that largemouth bass nesting success declines and green frogs begin to disappear along shorelines with housing densities greater than 30 homes per mile.[64] Lake Ripley

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Department. 1998. Nonpoint Source Control Plan for the Lake Ripley Priority Lake Project. Wisconsin Nonpoint Source Water Pollution Abatement Program. Publication WT-512-98.

[60] Ibid

[61] 2009 analysis using Wisconsin Lake Modeling Suite (WiLMS), Version 3.3.18.1

[62] 2009 phosphorus-loading analysis using Wisconsin Lake Modeling Suite (WiLMS), Verison 3.3.18.1

[63] Wang, L., J. Lyons, P. Kanehl, and R. Bannerman. 2001. Impacts of Urbanization on Stream Habitat and Fish Across Multiple Spatial Scales. Springer Series in Environmental Management, Vol. 28, No. 2, pp. 255-266.

[64] Meyer, M., J. Woodford, S. Gillum, and T. Daulton. 1997. Shoreland zoning regulations do not adequately protect wildlife habitat in northern Wisconsin. U.S. Fish and Wildlife Service, State Partnership Grant P-1-W, Segment 17, Final Report, Madison, Wisconsin.

has already surpassed this particular threshold, with a current lakeshore building density of about 39 lakefront homes per mile (160 lakeshore address points divided by 4.1 shoreline miles). As housing density increases, the number of littoral treefalls per mile decreases, as does the abundance of emergent and floating-leaved aquatic plants due to typical shoreline-grooming practices. According to the Wisconsin Department of Natural Resources, nearly 80% of Wisconsin's threatened and endangered plant and animal species spend all or part of their life in the lake's littoral and shoreland zones.[65] Therefore, development-related habitat alterations and other near-shore disturbances threaten to cause local extinctions of such sensitive biota. Preserving natural shoreline vegetation or restoring native, vegetative "buffers" can help minimize these impacts (see Figure 19).

## WATERSHED AREAS CRITICAL TO LAKE HEALTH

A map showing the location of areas critical to watershed health is shown as Figure 20. Areas classified as "critical" include wetlands, lands supporting hydric soils (indicative of wetland-supporting conditions), 100-year floodplains, perennially flowing streams and ditches, 10 acres or more of contiguous forest (important for groundwater recharge and woodland habitat), and 12% or greater slopes (lands most susceptible to erosion). These areas represent a combined 1,519 acres (32% of the watershed), of which 254 acres are identified as being publicly owned (161 acres), deed restricted (47 acres), or institutionally managed for conservation purposes (46 acres).[66] Of the remaining "critical area" acreage, land-use threats are generally greatest to the north and east of the Lake District Preserve, and around the East Bay wetland complex. Protecting or restoring the condition of critical areas is important for absorbing and filtering storm runoff, preserving groundwater recharge, controlling soil erosion, providing fish and wildlife habitat, and maintaining downstream water quality.

## OTHER AREAS OF INTEREST

Farmland parcels in the watershed that are currently enrolled in soil and water conservation programs are shown on a map in Figure 21. Highlighted parcels include those that were enrolled in the Farmland Preservation and Conservation Reserve Programs in 2008, and those that have nutrient management plans on file in Jefferson County. These types of government programs offer various incentives to participating landowners who implement specific conservation-farming practices. The map also marks the locations of significant livestock and commercial operations within the watershed. Livestock operations were identified through a 2009 roadside survey conducted by the Jefferson County Land and Water Conservation Department, and should be monitored given their potential of generating water quality challenges (e.g. manure runoff) if not properly managed. At least one livestock operation that was not mapped ("beef 25-50 animals") is located between the Oakland Town Hall, a partially reclaimed gravel pit, and the Lake District Preserve.

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Woodford, J. E., and M. W. Meyer. 2003. Impact of Lakeshore Development on Green Frog Abundance. Biological Conservaton 110: 277-284.

[65] Wisconsin Department of Natural Resources. 1996. Northern Wisconsin's Lakes and Shorelands: A report examining a resource under pressure.

[66] Figures derived by Gerry Kokkonen, GIS/Land-Use Specialist, Jefferson County Land and Water Conservation Department (2009)

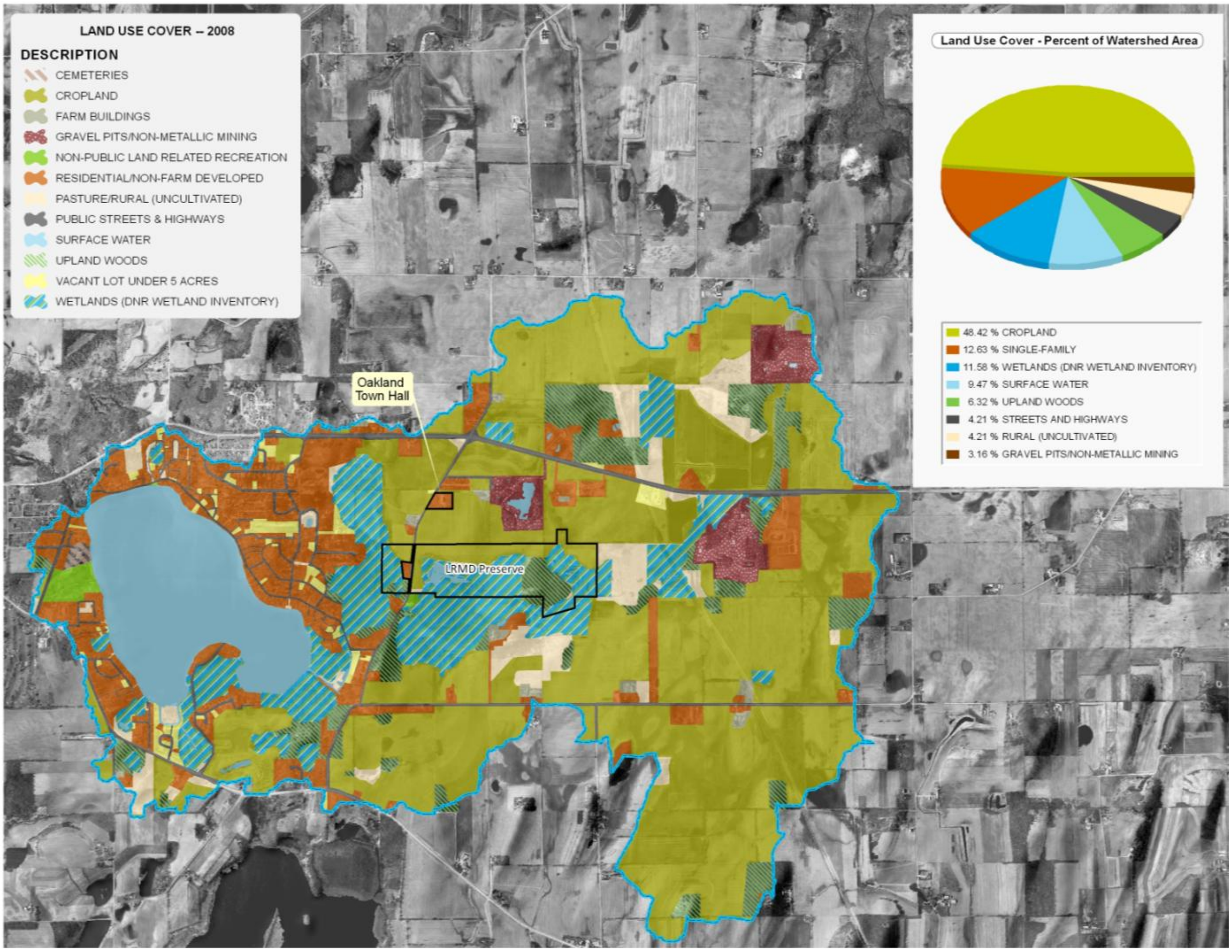



**Figure 16: Lake Ripley Watershed Land-Use Cover**[67]

[67] Map produced by Gerry Kokkonen, GIS/Land-Use Specialist, Jefferson County Land & Water Conservation Department using Jefferson County 2008 Land-Use Inventory data

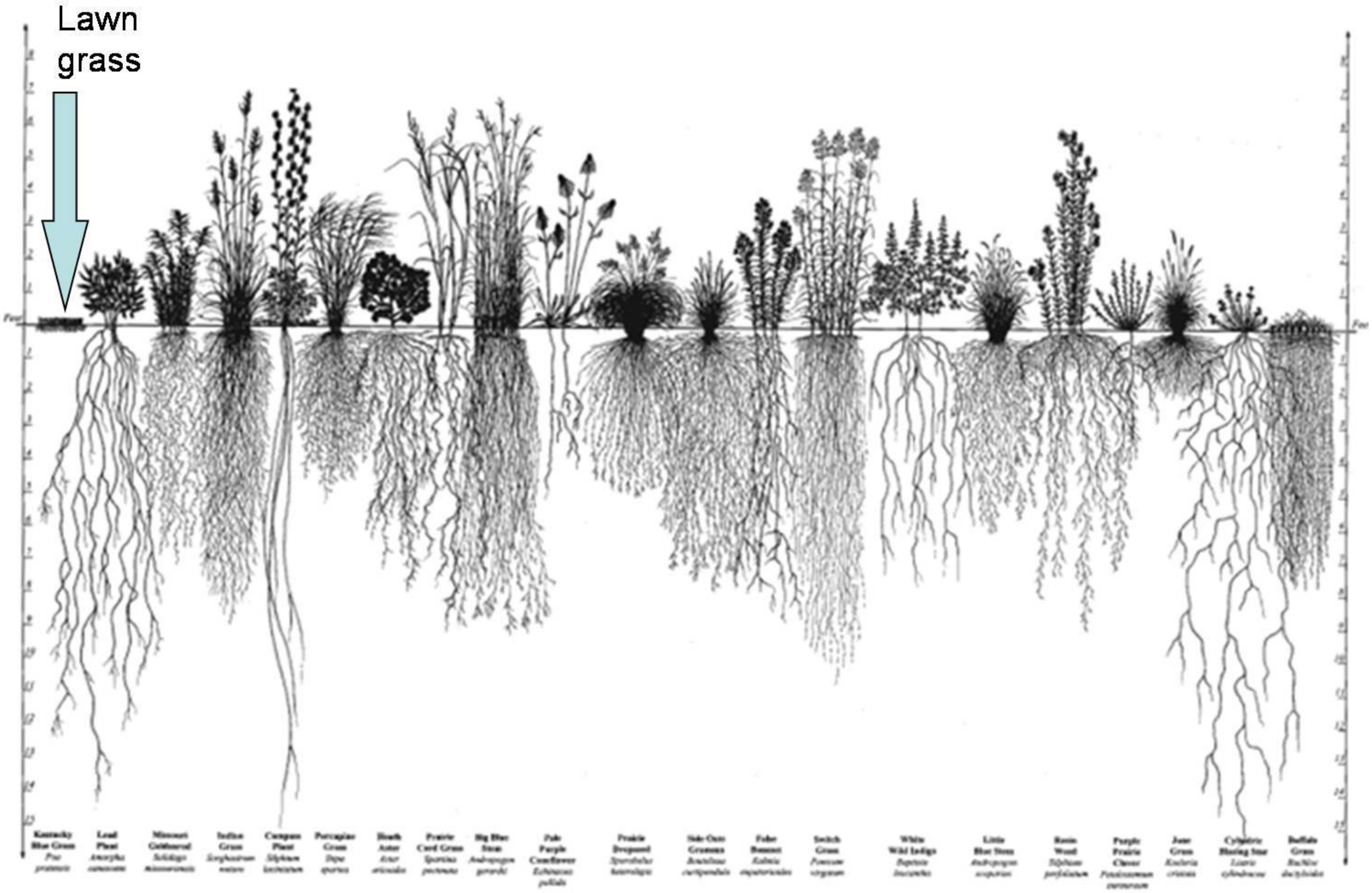



**Figure 17: Rooting Depths of Native Prairie Plants Compared to Turf Grass[68]**

[68] Illustration from U.S. Department of Agriculture's Natural Resource Conservation Service

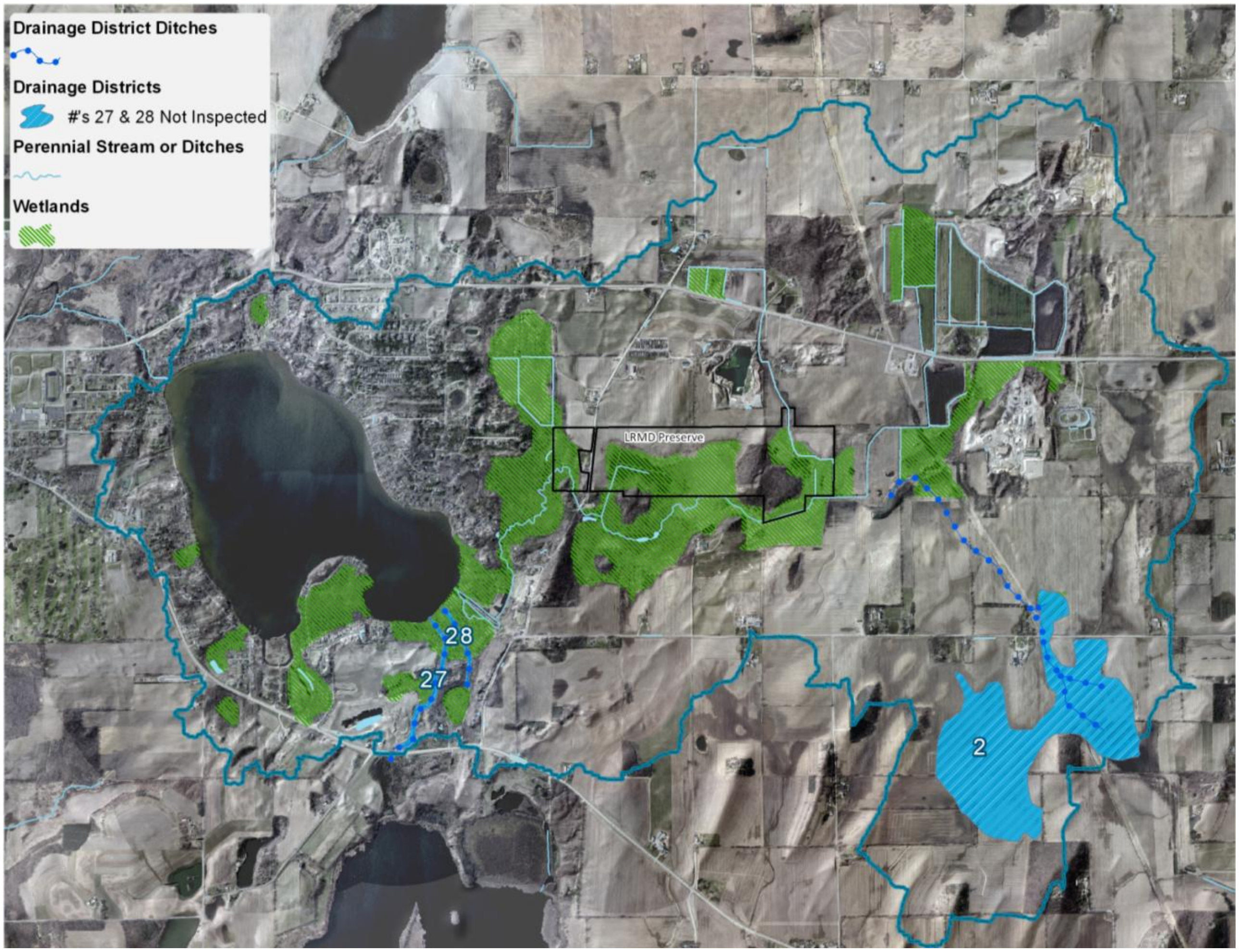



**Figure 18: Farm Drainage Districts in Relation to Watershed Wetlands, Streams and Ditches[69]**

[69] Map produced by Gerry Kokkonen, GIS/Land-Use Specialist, Jefferson County Land & Water Conservation Department (2009), and based on engineering maps on file with Jefferson County and the Farm Drainage Commission

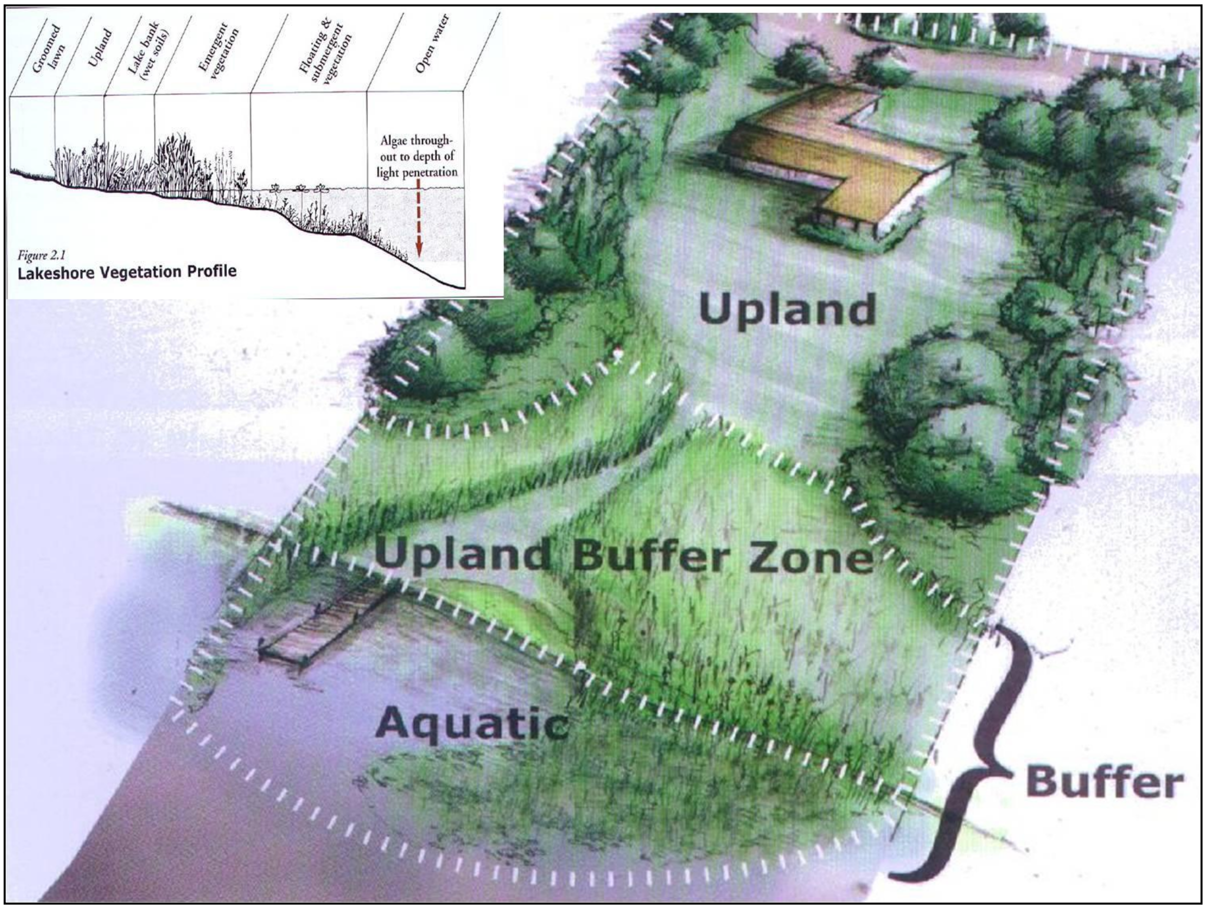



**Figure 19: Illustration of Lakeshore Buffer**[70]

[70] Illustration credit: Roxanna Esparza and Steve Adams

**Table 5: Estimated impervious cover by land-use type in the Lake Ripley watershed[71]**

| LAND USE DESCRIPTION | ACRES | % LAND AREA | IMPERVIOUS COVER COEFFICIENT[a] | TOTAL IMPERVIOUS COVER (ACRES) | TOTAL IMPERVIOUS COVER (%)[b] |
|---|---|---|---|---|---|
| CROPLAND | 2163.12 | 46.14 | 9.25 | 200.09 | 38.85 |
| PUBLIC STREETS AND HIGHWAYS | 179.67 | 3.83 | 53.40 | 95.94 | 18.63 |
| RURAL RESIDENTIAL (>2.5 ACRES) | 373.82 | 7.97 | 10.60 | 39.62 | 7.69 |
| LOW-DENSITY RESIDENTIAL (0.5-0.99 ACRES) | 168.77 | 3.60 | 21.20 | 35.78 | 6.95 |
| QUARRY/GRAVEL MINE | 144.05 | 3.07 | 21.20 | 30.54 | 5.93 |
| MEDIUM-DENSITY RESIDENTIAL (0.26-0.49 ACRES) | 105.74 | 2.26 | 27.80 | 29.40 | 5.71 |
| SUBURBAN RESIDENTIAL (1-2.49 ACRES) | 154.31 | 3.29 | 14.30 | 22.07 | 4.28 |
| HIGH-DENSITY RESIDENTIAL (0.14-0.25 ACRES) | 53.49 | 1.14 | 30.00 | 16.05 | 3.12 |
| WETLANDS (DNR WETLAND INVENTORY) | 523.73 | 11.17 | 1.90 | 9.95 | 1.93 |
| URBAN RESIDENTIAL (0.07-0.139 ACRES) | 25.98 | 0.55 | 32.60 | 8.47 | 1.64 |
| RESIDENTIAL BUSINESS | 32.36 | 0.69 | 21.20 | 6.86 | 1.33 |
| COMMUNICATION AND UTILITIES | 8.07 | 0.17 | 72.20 | 5.83 | 1.13 |
| UPLAND WOODS | 286.50 | 6.11 | 1.90 | 5.44 | 1.06 |
| NON-PUBLIC GOLF COURSES, GUN CLUBS | 24.16 | 0.52 | 12.50 | 3.02 | 0.59 |
| LIMITED BUSINESS | 4.46 | 0.10 | 44.40 | 1.98 | 0.38 |
| MUNICIPAL FACILITIES | 4.70 | 0.10 | 35.40 | 1.67 | 0.32 |
| MULTIFAMILY LOW RISE (1-3 STORIES) | 7.24 | 0.15 | 21.20 | 1.54 | 0.30 |
| CEMETERIES | 7.29 | 0.16 | 8.30 | 0.60 | 0.12 |
| LIMITED COMMERCIAL | 0.31 | 0.01 | 44.40 | 0.14 | 0.03 |
| MULTIFAMILY LOW RISE (1-3 STORIES) | 0.11 | 0.00 | 44.40 | 0.05 | 0.01 |
| SURFACE WATER | 420.10 | 8.96 | 0.00 | 0.00 | 0.00 |
| **TOTALS:** | **4687.99** | **100%** | **---** | **515.03** | **100%** |

Total estimated percent impervious cover in watershed: **11%**

[a] = factor by which a specific land-use acreage is multiplied to arrive at an estimated acres of impervious cover (higher values suggest greater amounts of impervious cover per unit of area)
[b] = percentage of total watershed impervious cover represented by the specific land-use category

[71] Information generated by Jefferson County Land & Water Conservation Department using 2008 land-use data and the Monroe County of Indiana methodology for Impervious Cover Coefficient distinction

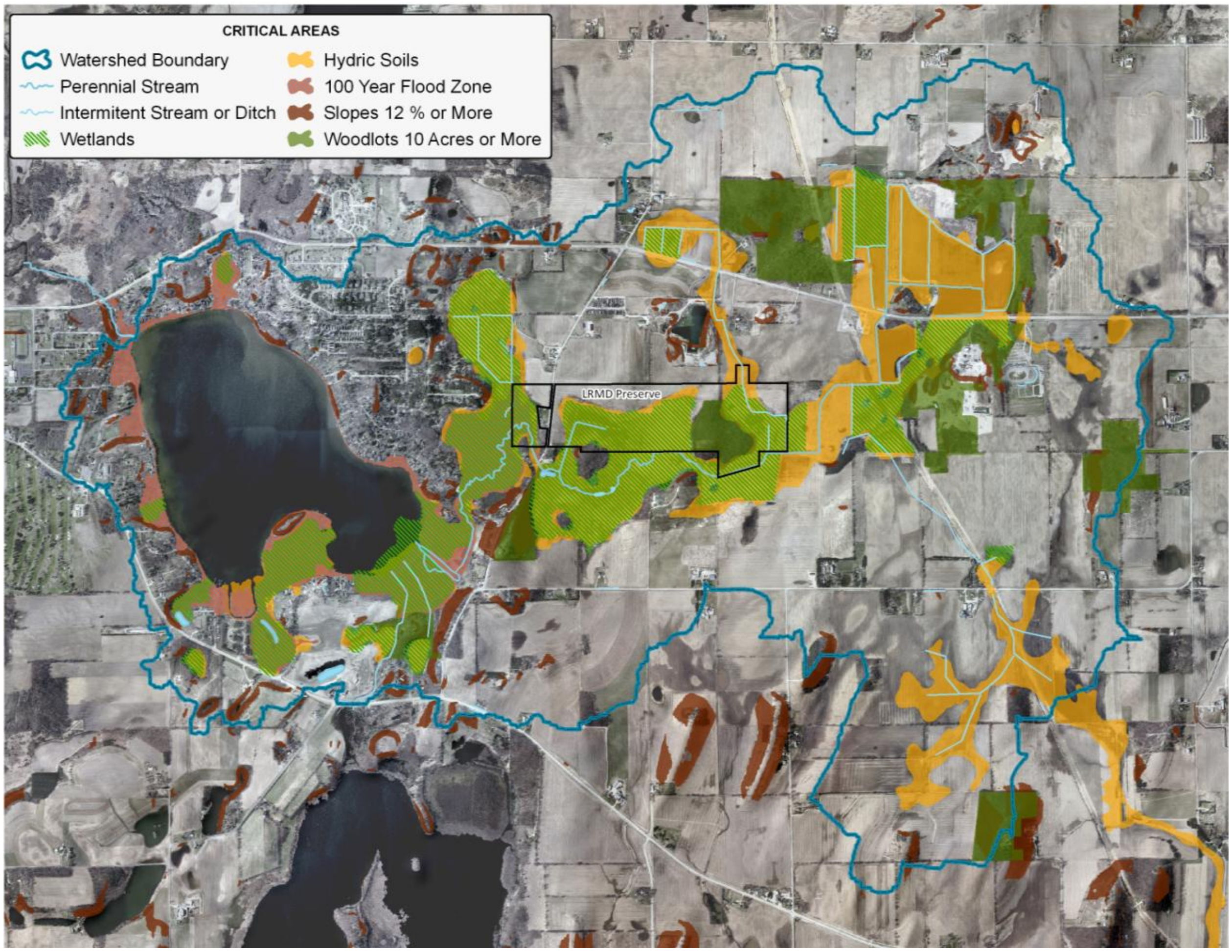



**Figure 20: Lake Ripley Watershed Critical Areas**[72]

[72] Map prepared by Gerry Kokkonen, GIS/Land-Use Specialist, Jefferson County Land & Water Conservation Department (2009)

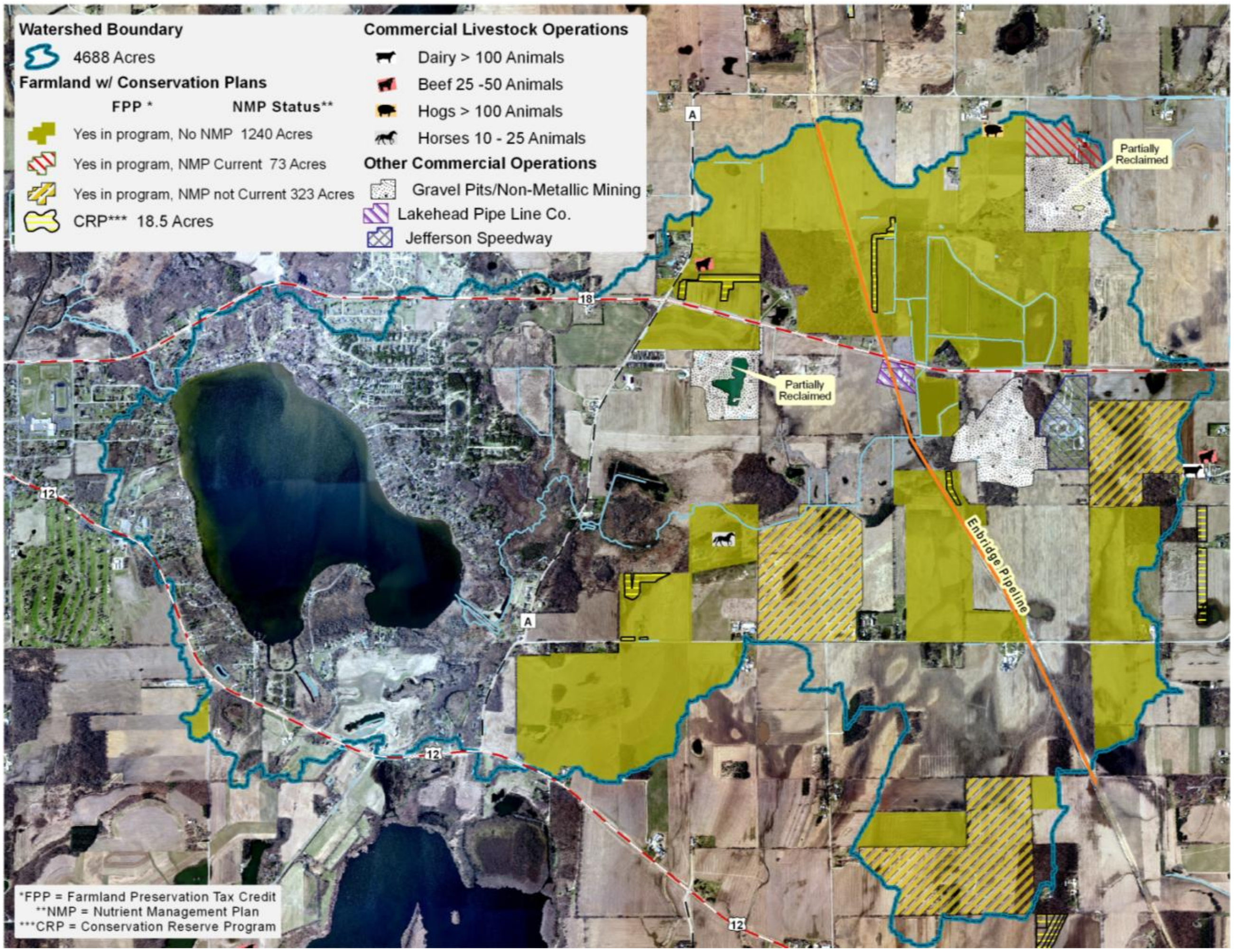



**Figure 21: Livestock and Commercial Operations, and Farmland Enrolled in Soil and Water Conservation Programs**[73]

## 2-8 GROUNDWATER

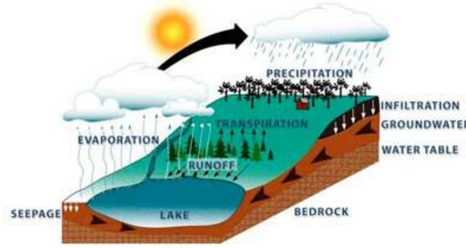
### ROLE OF GROUNDWATER

Groundwater and surface water are interconnected and should not be viewed in isolation. Lake Ripley's groundwatershed, while not precisely delineated, is another factor influencing its status. A groundwatershed is an underground drainage area. Just as surface water flows over the surface of the land in response to gravity, groundwater flows much more slowly through permeable soils and fractures in bedrock in response to gravity.

It is estimated that groundwater supplies as much as 30% of the lake's water, contributing significantly to the lake's hydrologic budget.[74] Much of this groundwater is believed to originate

[73] Map produced by Gerry Kokkonen, GIS/Land-Use Specialist, Jefferson County Land & Water Conservation Department (2009)

from permeable, upland recharge areas—mostly comprised of glacial till—found within or in close proximity to the topographic watershed boundaries. Groundwater generally flows east to west, and from higher to lower elevations in the Lake Ripley watershed area. Groundwater helps maintain steady water volumes in the lake's tributary stream (called baseflow), as well as lake levels during periods of severe drought. It is also a stable source of cool, clean, calcium-rich water that replenishes water lost through evaporation or outflowing stream discharge.




Source: Wisconsin Lakes Partnership

**FACTORS INFLUENCING GROUNDWATER QUANTITY**

Because there is a relatively short groundwater flow path to the lake, yearly weather changes can have a sizable impact on the hydrologic system. Wet years will lead to an elevated groundwater table and increased groundwater flows, as well as increased surface runoff under saturated soil conditions. Drought years will have the opposite effect. Multiple, consecutive years of abnormally wet or dry weather can have a sizable impact on the quantity of groundwater reaching the lake and area wetlands.

Groundwater withdrawal is another controlling factor. The amount of groundwater entering the lake can be reduced from well pumping and hard-surface development that prevents or restricts groundwater recharge. The rate of water use can be approximated (but underestimated) by evaluating effluent discharge volumes from the local wastewater treatment facility. In 2005, the Town of Oakland Sanitary District reported a total of 83,340,258 gallons (or 255.6 acre-feet) of effluent discharge.[75] This translates into a volume of water equal to almost 10% of the lake's total annual hydraulic loading.[76] Much of this water is estimated to originate from the Lake Ripley groundwatershed, and represents a debit on the lake's water budget as it gets used and discharged outside of the basin.

Finally, groundwater quantity is affected by landscape condition. While some types of land cover have porous soils and a high capacity to infiltrate water, others act as barriers that impede or prevent infiltration. Undeveloped natural areas such as woodlands and prairies possess a tremendous capacity, on a per unit area basis, to intercept and infiltrate rainfall. These landscapes produce limited surface runoff while facilitating the recharge of the local groundwater aquifer. The reverse is true with the proliferation of hard, water-impervious surfaces as a consequence of development and urban sprawl.

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[74] Wisconsin Department of Natural Resources, Wisconsin Department of Agriculture, Trade and Consumer Protection, Lake Ripley Management District, and Jefferson County Land Conservation Department. 1998. Nonpoint Source Control Plan for the Lake Ripley Priority Lake Project. Wisconsin Nonpoint Source Water Pollution Abatement Program. Publication WT-512-98.

[75] Personal communication with Ken Raymond, Oakland Sanitary District (Sept. 2006)

[76] Using figures generated through Wisconsin Lake Modeling Suite (WiLMS)

## FACTORS INFLUENCING GROUNDWATER QUALITY

The quality of groundwater can be jeopardized by the over-application of fertilizers and pesticides. For example, nitrate ($NO_3$) is often found as a contaminant in groundwater when water originates from manure pits, fertilized fields (or lawns), or from septic systems. Nitrate is an inorganic form of nitrogen which is necessary for plant growth. However, high levels of nitrate have been linked to water-quality and human-health problems. Also, a concentration of nitrate-nitrogen ($NO_3$-N) plus ammonium-nitrogen ($NH_4$-N) of 0.3 mg/L in the spring is adequate to support summer algal blooms if sufficient phosphorus is also present.

In 1989, elevated levels of nitrates and chlorides were reported in domestic well samples taken from the Lake Ripley watershed, indicating that groundwater was being affected by land-use activities.[77] A total of 33 area wells were then analyzed for nitrate (measured as $NO_3$-N) and the presence of triazine pesticides as part of the Lake Ripley Priority Lake Project around 1993. Nitrate levels were found to range from "not detected" to 33.2 ppm. The groundwater quality enforcement standard is 10 ppm as defined in NR 140, Wisconsin Administrative Code. There were five water samples at the time that exceeded this standard, representing 15% of the wells sampled. Triazine concentrations ranged from "not detected" to 0.6 ppb. No samples exceeded the groundwater quality enforcement standard of 3 ppb at the time of the study.[78]

[77] Kenter, A. W. and F. W. Madison. 1989. Groundwater Quality Investigation of Selected Towns in Jefferson County. Wisconsin Department of Natural Resources.
[78] Wisconsin Department of Natural Resources, Wisconsin Department of Agriculture, Trade and Consumer Protection, Lake Ripley Management District, and Jefferson County Land Conservation Department. 1998. Nonpoint Source Control Plan for the Lake Ripley Priority Lake Project. Wisconsin Nonpoint Source Water Pollution Abatement Program. Publication WT-512-98.

# -3-
# LAKE USE

*"We can learn far more about the conditions and values of a society by contemplating how it chooses to play, to use its free time, to take its leisure, than by examining how it goes about its work."*

-- A. Bartlett Gianatti, Major League Baseball Commissioner

## 3-1 OVERVIEW

Lake Ripley is a popular and accessible recreational destination frequented by local residents and visitors alike. Its close proximity to the cities of Madison (WI), Milwaukee (WI), Chicago (IL) and Rockford (IL) make it especially attractive for seasonal residents and summer vacationers. The lake supports a diverse range of activities, including boating, swimming, fishing, nature viewing and waterskiing. However, with a total surface area of only 423 acres, this finite resource is confronted with growing and changing lake-use pressures. These pressures can threaten not only the health and condition of the lake, but also the quality of the recreational experience enjoyed by its many users. In recognition of these challenges, the Lake District completed a *Lake Ripley Watercraft Census and Recreational Carrying Capacity Analysis* in 2003.[79] The major findings and conclusions resulting from this effort, along with a number of relevant updates, provide the basis of discussion contained in this chapter.

**Fishing boats on Lake Ripley, representing a dominant lake use during the slow-no-wake period**

As of 2008, there were about 634,000 boats registered in Wisconsin. This figure represents a 109% increase in state boat registrations over the last 40 years. In Jefferson County alone, boat registrations increased 127% over this same 40-year period. Boat size and horsepower have also steadily increased over the years. Over 40% of registered boats in Wisconsin were between 16 and 39 feet long in 1997-98, compared to just 18% in 1968-69.[80] While average horsepower was a mere 3.6 in 1941, it jumped to 43.3 by 1982, and is currently approaching 100 horsepower today.[81] There has also been an explosion in recent years in new types of watercraft, especially personal watercraft (e.g. Jet Skis). Personal watercraft registered in Wisconsin has risen from 6,500 in 1991 to 35,385 in 2008, representing a 544% increase over this 17-year period.[82] These

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[79] Lake Ripley Management District. 2003. Lake Ripley Watercraft Census and Recreational Carrying Capacity Analysis.
[80] Asplund, Timothy R. 2000. The Effects of Motorized Watercraft on Aquatic Ecosystems. Wisconsin Department of Natural Resources' Bureau of Integrated Science Services, and University of Wisconsin-Madison's Water Chemistry Program.
[81] Wisconsin Department of Natural Resources Website (http://www.dnr.state.wi.us/org/water/fhp/lakes/onceupon.htm)
[82] Wisconsin Department of Natural Resources. 2008. 2008 Wisconsin Boating Program Report. Wisconsin DNR Bureau of Law Enforcement. PUB-LE-314-2008.

types of watercraft present unique challenges due to their maneuverability and accessibility to shallow and remote lake areas.

Increased lakeshore development is another factor that leads to more people and more demands on the resource. Clearly, the issue of lake access and overcrowding is relevant now more than ever, especially in light of the growing number, power, speed and diversity of today's watercraft. According to a recent Lake District opinion survey, most respondents felt that adequate public access was already provided on Lake Ripley, especially with respect to boating.[83] The survey also revealed that respondents felt at least moderately crowded while using the lake on summer weekends. In descending order, the top four preferred lake-use activities included the enjoyment of peace and tranquility, swimming, observing wildlife, and walking or biking around the lake. This marks a change from earlier opinion surveys that showed higher preferences for motor boating and fishing over the latter two activities.

## 3-2 USER CONFLICT AND CARRYING CAPACITY

As the number of watercraft and level of congestion increases on a given lake, so does the probability of conflict due to competition for limited space. "The ability of a lake to accommodate a given number of users and mixed recreational uses depends on the compatibility of those uses." [84] The potential for conflict among various recreational activities competing for similar space is illustrated in the compatibility matrix shown as Figure 22. The figure depicts higher intensity activities such as waterskiing and motor boating as being most interfering to other uses.[85] Klessig (2001) noted that the focus of most user conflict involves motorized watercraft and centers on either speed or on noise and maneuverability as in the case of personal watercraft. He argued that users who cannot afford a big boat and motor or who prefer more passive recreation are in fact denied the very access in which they are supposedly entitled under Wisconsin's Public Trust Doctrine. [86]

Under crowded conditions, competing user groups may be 1) forced to tolerate greater levels of intrusion or interference, 2) tempted to engage in riskier and more aggressive behavior, 3) displaced to less optimal locations on the lake, or 4) driven off the lake entirely. "While each water body may have special suitability for particular uses, the water body can accommodate only a limited number of such uses. Beyond this point, the overload of a single use, as well as interactively between several uses, causes conflict and perhaps damage to the water resource."[87]

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[83] Lake Ripley Management District. 2009. Lake Ripley Property Owner Opinion Survey.
[84] Jones, William J. 1996. Balancing Recreational User Demands and Conflicts on Multiple Use Public Waters. American Fisheries Society Symposium 16:179-185.
[85] Ibid
[86] Klessig, Lowell L. 2001. Load Limits for Lakes. Article, University of Wisconsin – Extension.
[87] Kusler, Jon A. 1972. Carrying Capacity Controls for Recreation Water Uses. Upper Great Lakes Regional Commission.

**A** — **25% capacity**

**B** — **65% capacity**

**C** — **81% capacity**

**D** — **106% capacity**

**E** — **155% capacity**

**Digitally-altered photograph sequence depicts boating-congestion scenarios and associated carrying capacities for Deep Creek Lake, MD. Source: ERM, Inc.**

***Activity suffering impact***

| ***Recreational Use*** | Fishing | Motor boating | Waterskiing | Sailing | Canoeing | Swimming | Sunbathing | Aesthetic enjoyment |
|---|---|---|---|---|---|---|---|---|
| Fishing | -- | ◐ | ◐ | ○ | ○ | ○ | ○ | ○ |
| Motor boating | ● | -- | ◐ | ◐ | ◐ | ● | ◐ | ● |
| Waterskiing | ● | ◐ | -- | ◐ | ◐ | ● | ◐ | ● |
| Sailing | ○ | ◐ | ◐ | -- | ○ | ◐ | ○ | ○ |
| Canoeing | ○ | ◐ | ◐ | ○ | -- | ○ | ○ | ○ |
| Swimming | ◐ | ◐ | ◐ | ○ | ○ | -- | ○ | ◐ |
| Sunbathing | ○ | ○ | ○ | ○ | ○ | ○ | -- | ◐ |
| Aesthetic enjoyment | ○ | ○ | ○ | ○ | ○ | ○ | ○ | -- |

● Major effect on impacted activity
◐ Moderate effect on impacted activity
○ Minor or no effect on impacted activity

**Figure 22: Recreational Use Compatibility Matrix**

Motorized watercraft, and especially at high concentrations, can inflict a variety of damages on aquatic ecosystems. In the 2002 University of Wisconsin-Extension publication titled *How's the Water? - Planning for Recreational Use on Wisconsin Lakes & Rivers*,[88] the authors make three key observations pertaining to the environmental impacts of motorized watercraft. First, aquatic plant disturbance, shoreline erosion, and reduced water clarity from sediment re-suspension are all serious issues that can be exacerbated by boat traffic. These causal relationships are well documented in the existing body of scientific literature, including research conducted on Lake

[88] University of Wisconsin-Extension. 2002. How's the Water? – Planning for Recreational Use on Wisconsin Lakes & Rivers.

Ripley.[89] Second, most boating impacts are felt most directly in shallow waters of less than several feet deep. Third, these effects can have repercussions for other features of the aquatic ecosystem, including fish and wildlife communities.

Increased boat traffic can have far reaching ramifications on safety, environmental health, and the public's ability to use and enjoy the lake. A lake's recreational carrying capacity is the point at which it becomes a problem serious enough to warrant management. According to Jaakson et al. (1989), "carrying capacity should not be perceived as a measure but instead as a range of estimates which also reflect the demands of users and the level of environmental quality that they are willing to accept."[90]

> The ability of a water body to accommodate particular types of uses and a given number of users within defined levels of ecological disturbance and inter-use conflicts may be termed its 'carrying capacity.' Carrying capacity differs for each water body. It depends both upon natural characteristics and acceptable limits of environmental disturbance and activity conflict. Determination of the former requires objective factual studies, definition of the latter a subjective weighing of values…[91]

The need to approximate carrying capacity increases as the demand for water-based recreation intensifies due to population growth, rising affluence, ease of mobility, increased leisure time, and the popularity of lakes as leisure destinations. "Free public resources like water may inevitably be trampled by too many users, by a single, well-organized group, or by inappropriate technology that simply overwhelms other uses and sometimes destroys the natural resource itself."[92] In other words, carrying capacity attempts to answer the question: how much is too much?

Wagner (1991) concluded that the impacts of motorized watercraft appear to be largely density dependent; increased use translates into increased potential for impact.[93] However, while there is an increasing store of research and published opinions on the subject of optimal boating densities, no universal boating density standard will satisfy all lake users under all situations. Carrying capacity will undoubtedly vary depending on a given lake's physical characteristics, its susceptibility to environmental damage, the manner in which it is used, and the demands and perceptions of its users. While the first three variables can be scientifically measured or

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[89] Asplund, Timothy R. 2000. The Effects of Motorized Watercraft on Aquatic Ecosystems. Wisconsin Department of Natural Resources' Bureau of Integrated Science Services, and University of Wisconsin-Madison's Water Chemistry Program.
Asplund, T.R. and C.M. Cook. 1997. Effects of Motor Boats on Submerged Aquatic Macrophytes. Journal of Lake and Reservoir Management, 13(1): 1-12.
[90] Jaakson, R., M.D. Buszynski and D. Botting. 1990. Carrying Capacity and Lake Recreation Planning. The Michigan Riparian, November 1989, pp. 11-12, 14.
[91] Kusler, Jon A. 1972. Carrying Capacity Controls for Recreation Water Uses. Upper Great Lakes Regional Commission.
[92] Klessig, Lowell L. 2001. Load Limits for Lakes. Article, University of Wisconsin – Extension.
[93] Wagner, Kenneth J. 1991. Assessing Impacts of Motorized Watercraft on Lakes: Issues and Perceptions. Proceedings of a National Conference on Enhancing States' Lake Management Programs. Northeastern Illinois Planning Commission.

estimated, the fourth requires more subjective interpretation, which can be aided by lake-user opinion surveys and applicable research on social carrying capacities.

On the surface, the basic premise of carrying capacity seems simple. There is only so much useable surface area on a particular water body, which, in turn, limits the number of watercraft that can safely use the lake. However, what is considered useable lake surface? How much space does each type of watercraft need to ensure adequate safety? In what manner is the lake currently used, and what are the expectations of its users? Are there environmental impacts associated with existing use patterns that should be addressed? Finally, who (if anyone) should get priority use of the lake if access controls are deemed necessary?

The Lake District was fortunate to be able to answer many of these questions using information obtained from a variety of past studies and management-planning exercises. These efforts consisted of aquatic plant and biological inventories, water quality and pollutant-identification investigations, resource assessments, lake-user opinion surveys, a motor boat impact study, and watercraft census reports. This wealth of lake-specific information proved critical in making informed value judgments about Lake Ripley's estimated carrying capacity. Finally, existing research and published opinions on optimum boating densities were evaluated. These expert opinions, whenever applicable, were used as a basis for establishing a range of carrying capacity estimates for Lake Ripley.

## 3-3 LAKE ACCESS

Lake Ripley offers both private and public forms of recreational access. Dense residential development is concentrated mostly within a half-mile band around much of the lake's shoreline, and includes about 160 lakefront homes. There are also several "keyhole" subdivisions where a single lakefront lot serves as a shared access point for a larger, off-lake development. Of those who own lakefront property, over half are part-time, seasonal residents.

**Boats parked along a community pier on Lake Ripley.**

Individuals without lakefront property or deeded lake-access rights have the option of using a public boat launch located at the north end of the Island Lane peninsula. The boat landing is owned and managed by the Town of Oakland. It provides for 16 parking spaces that can accommodate vehicles with trailers, as well as a pier, port-a-potty, garbage dumpster and self-registration kiosk. A daily permit fee of $7.00 is charged for the use of the landing between May 1 and September 30. Yearly permit fees are $20.00 for Oakland property owners/residents and senior citizens, and $30.00 for all other users.

In addition, the Town of Oakland owns and manages a public fishing and swimming pier on the northeast shore. There is also a privately owned marina with a boat launch at the south end of the lake, and a community beach (Lake Ripley Park) on the west shore that offers walk-in access. The marina and park are both privately owned and require nominal user fees. Access locations are depicted in Figure 23 below.


**Left: A view of the public boat landing owned and maintained by the Town of Oakland. Middle: Public fishing and swimming pier on 65 feet of shoreline owned by the Town of Oakland. Right: Lake Ripley Marina**

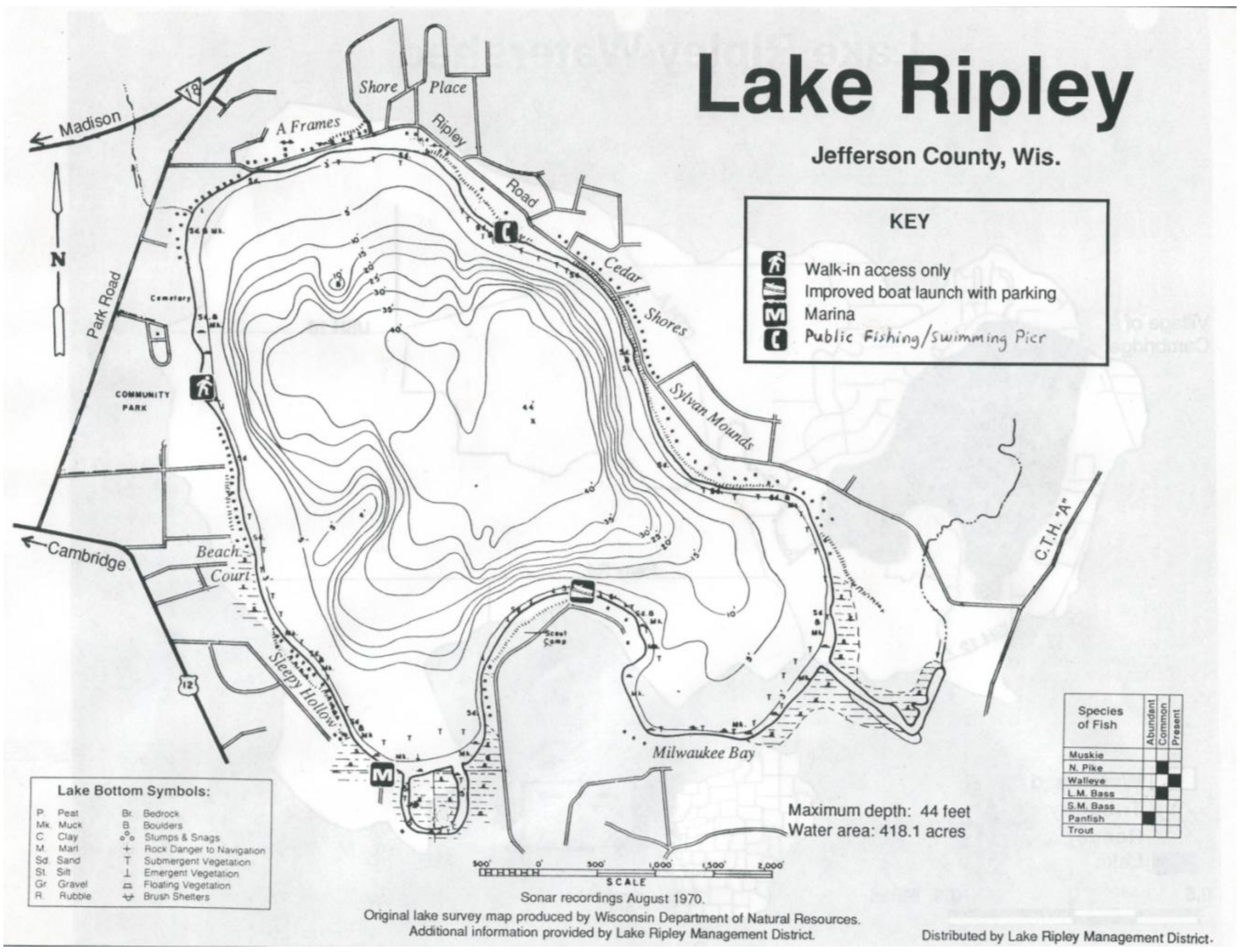


**Figure 23: Lake Ripley Access Locations**

## 3-4 LOCAL BOATING ORDINANCES

Protected, shoreline “sensitive areas” were established through a Town of Oakland pier ordinance in 1995.[94] These ecologically-valuable shoreland areas were previously found to harbor high-quality aquatic and wetland plant communities. The ordinance restricted the ability to expand or develop new piers, wharves and swim rafts within mapped areas without a Wisconsin DNR permit review. While it did not directly regulate boat traffic, the ordinance indirectly limited boating-related activities by controlling the expansion of docking areas.


**Slow-no-wake buoys found in Lake Ripley’s South Bay.**

Slow-no-wake and no-motor zones were also adopted to protect these sensitive habitat features. Slow-no-wake zones established by Town ordinance include buoyed portions of both bays, and within 200 feet of any shoreline (marked by several reference buoys). A no-motor zone, where the use of all gas and electric motors is prohibited, is located in Vasby’s Channel. No-motor buoys are positioned at both entrances of the horseshoe-shaped channel. There is also a no-wake time period in effect from 7:30 p.m. to 11:00 a.m. daily.[95] A compilation of lake-related ordinances and boating rules can be found in Appendix D.

## 3-5 ON-LAKE BOATING PATTERNS

A watercraft census and recreational carrying capacity analysis was completed for Lake Ripley in 2003.[96] Based on extensive monitoring during the 2003 boating study, it was found that there was an average of 10.5 boats operating on the lake at any given time, or one boat per 39.8 acres of total lake surface. These boats were represented as follows: fishing boats (53.5%), speed boats (20.8%), pontoon boats (17.5%), personal watercraft (4.6%), paddle craft (2.6%) and sailboats (1.4%). The distribution of watercraft is shown graphically in Figure 24. The average ratio of slow-moving and stationary to fast-moving watercraft during this period was almost 4:1.

[94] Town of Oakland. 1995. Ordinance #42: An Ordinance to Regulate the Location of Piers, Wharves and Swimming Rafts on Lake Ripley.
[95] Town of Oakland. 2006. Ordinance #2: An Ordinance to Confirm the Current Status of the Ordinance Regulating Traffic, Boating and Water Sports upon the Waters of Lake Ripley, and Prescribing Penalties for Violations Thereof by Combining All Amendments to Date in One Document.
[96] Lake Ripley Management District. 2003. Lake Ripley Watercraft Census and Recreational Carrying Capacity Analysis.

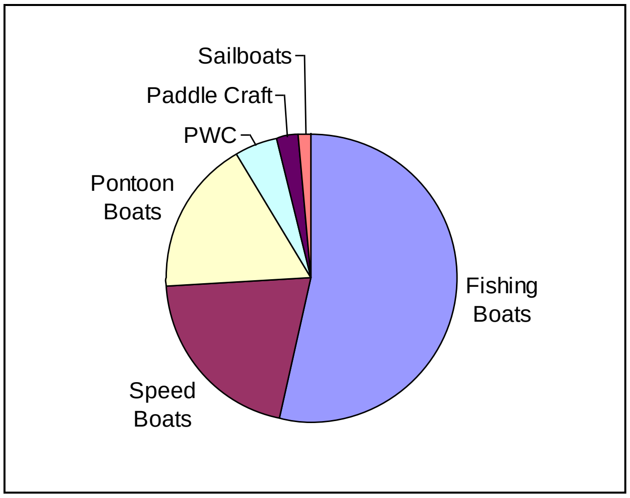


**Figure 24: Watercraft Observed During All Hours of Study Period (2003)**

During no-wake hours on mid-summer weekends and holidays, there was an average of 9.2 boats operating on the lake at one time, or one boat per 45.4 acres of total lake surface. These boats were represented as follows: fishing boats (84.2%), pontoon boats (8.4%), speed boats (3.4%), paddle craft (2.2%), personal watercraft (1.0%) and sailboats (0.8%). The distribution of watercraft is shown graphically in Figure 25. Because observations were made during the enforceable slow-no-wake period, all watercraft were slow-moving or stationary.

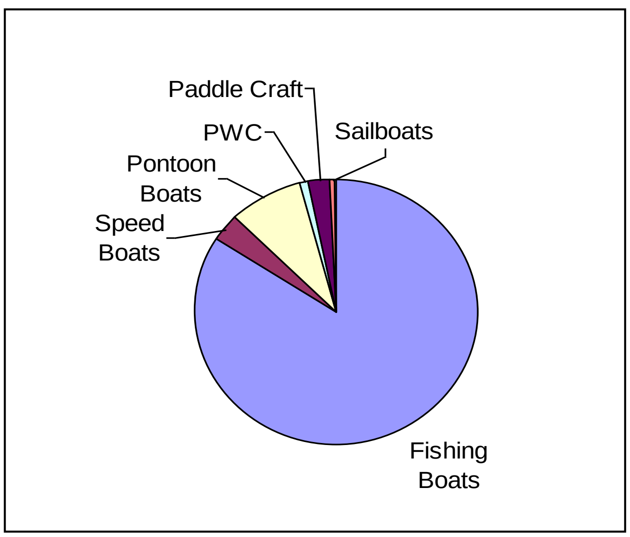


**Figure 25: Watercraft Observed During No-Wake Hours (July-August Weekends/Holidays)**

During wake hours on mid-summer weekends and holidays, there was an average of 23.6 boats operating on the lake at one time, or one boat per 17.7 acres of total lake surface. This represented the peak-use boating period for Lake Ripley. Observed boats were represented as follows: speed boats (38.7%), pontoon boats (26.4%), fishing boats (20.1%), personal watercraft

(11.1%), paddle craft (2.3%) and sailboats (1.5%). The distribution of watercraft is shown graphically in Figure 26. The average ratio of slow-moving and stationary to fast-moving watercraft during this period was 1.5:1. It was found that average boating densities and distributions by watercraft type were consistent with findings from a 1995 census, which evaluated similar time periods.

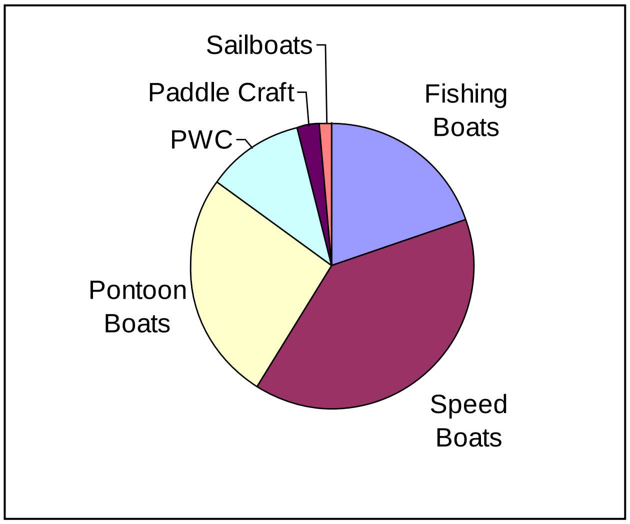


**Figure 26: Watercraft Observed During Wake Hours (July-August Weekends/Holidays)**

Boating densities occasionally reached highs of one boat per 8.5-10.5 acres of total lake surface, or 40-50 watercraft using the lake at one time. For the 2003 study period, maximum counts by boat type were as follows: speed boats (30), pontoon boats (22), fishing boats (20), sailboats (13), personal watercraft (8), and paddle craft (4). The maximum number of boats observed pulling a skier or tuber was 15.

Peak boating densities were typically reached between the late-afternoon hours of 3:00 and 5:00 p.m. on mid- to late-summer weekends and holidays. Fishing boats were generally the most dominant watercraft during the morning no-wake hours. After 11:00 a.m., the number of fishing boats usually decreased precipitously while the number of speed boats, pontoon boats and personal watercraft increased. Total boat counts typically declined by the early evening hours, although the number of fishing boats and pontoon boats occasionally spiked again during this timeframe. There did not appear to be any correlation between time of day and the number of paddle craft or sailboats using the lake.

## 3-6 PARKED/MOORED WATERCRAFT

During the 2003 boating study, a mid-summer count was taken of watercraft parked around the lake. Information was also gathered on numbers of swimming rafts, piers and boatlifts. This type of census was repeated on an annual basis during subsequent boating seasons. Several years of results are presented in Table 6 below. Numbers represent totals for each type of parked watercraft observed along the shoreline during the given year. Percentages represent each watercraft's relative contribution to the total for that year. The information is also presented graphically in Figures 27 and 28.

**Table 6: Annual counts of piers, boat lifts, rafts and parked boats on Lake Ripley (2003-2009)**

| Moored Watercraft | Summer 2003 | Summer 2004 | Summer 2005 | Summer 2006 | Summer 2007 | Summer 2008 | Summer 2009 |
|---|---|---|---|---|---|---|---|
| Pontoons | 147 (31%) | 155 (35%) | 162 (35%) | 169 (33%) | 182 (38%) | 170 (34%) | 166 (34%) |
| Runabouts | 121 (25%) | 109 (25%) | 128 (27%) | 131 (26%) | 123 (26%) | 122 (25%) | 118 (24%) |
| Motorized Fishing | 75 (16%) | 36 (8%) | 27 (6%) | 33 (6%) | 29 (6%) | 36 (7%) | 35 (7%) |
| Non-motorized | 87 (18%) | 92 (21%) | 104 (22%) | 118 (23%) | 93 (19%) | 119 (24%) | 107 (22%) |
| Sailboats | 15 (3%) | 10 (2%) | 10 (2%) | 17 (3%) | 12 (3%) | 6 (1%) | 13 (3%) |
| Jet Skis | 30 (6%) | 38 (9%) | 35 (8%) | 42 (8%) | 41 (9%) | 41 (8%) | 43 (9%) |
| **Total:** | 475 | 440 | 466 | 510 | 480 | 494 | 482 |
| -------------- | ------------ | ------------ | ------------ | ------------ | ------------ | ------------ | ------------ |
| Rafts | 19 | 12 | 15 | 29 | 22 | 18 | 20 |
| Piers | 167 | No data | 168 | 166 | 180 | 182 | 167 |
| Boatlifts | 179 | No data | 212 | 198 | 240 | 210 | 248 |
| Avg. # of Boats per Pier* | 2.8 | No data | 2.8 | 3.1 | 2.7 | 2.7 | 2.9 |

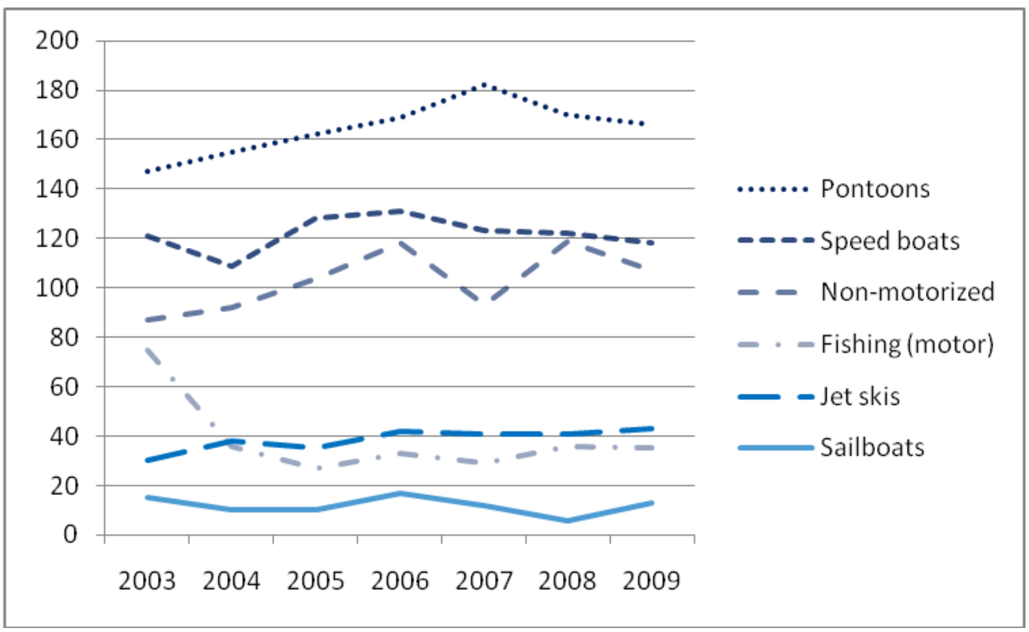


**Figure 27: Parked Watercraft Counts (2003-2009)**

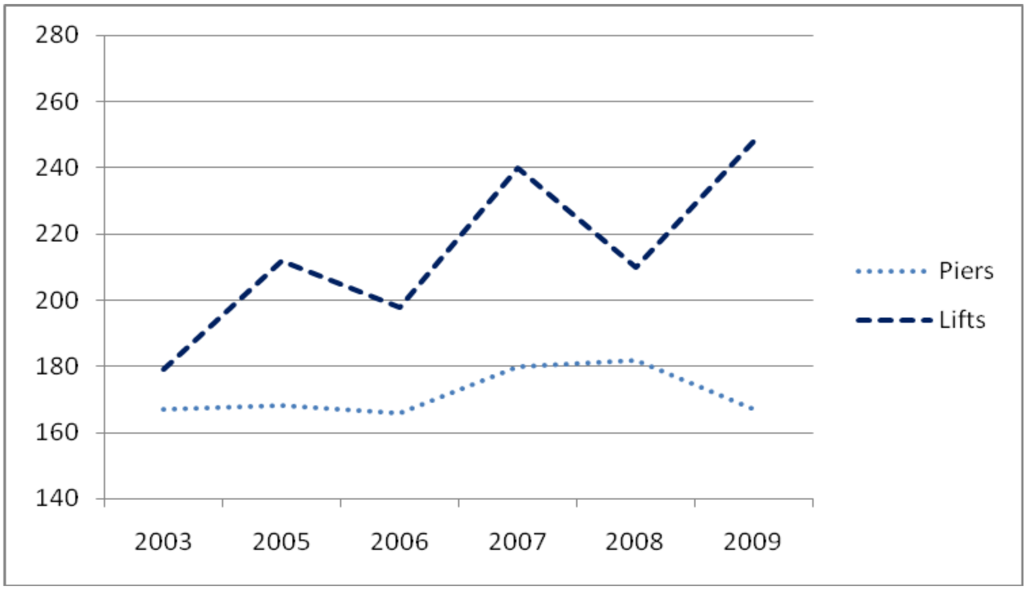


**Figure 28: Pier and Boat Lift Counts (2003-2009)**

## 3-7 USE OF PUBLIC BOAT LANDING

During mid-summer weekends and holidays, there was an average of 13.8 parked vehicles observed at the landing. This equates to 86.5% of capacity based on a maximum of 16 legal parking spaces, and assuming vehicles were equipped with boat trailers. In actuality, the number of parked vehicles routinely exceeded the number of available parking spaces, and most but not all vehicles had trailers. The maximum number of parked vehicles observed at one time was 27.

**Town of Oakland's public boat landing off Island Lane.**

According to launch-registration records obtained from the Town of Oakland, there were 1,743 daily launches during the four-month study period (May 1–September 1). This figure does not include boat launches that may have been made by any of the nearly 200 seasonal pass holders. It also does not account for daily launches that may have occurred without subsequently needing to park a vehicle at the facility. Only 3.8% of publicly-launched boats were registered out of state. The average number of daily pass users on weekdays was 9.4, while on weekends/holidays it was 22.5. A maximum of 36 daily pass users occurred on a Sunday in early June.

Given the average number of boats actively using the lake during wake hours on mid-summer weekends/holidays (23.6), it was estimated that an average of 53.4% gained access through the public landing. This percentage was generated from observation events that included both a trailer count and an on-lake watercraft count occurring within less than one-half hour of each other. The estimate is based on the assumption that each vehicle parked at the landing was associated with one publicly launched boat during the time of observation. It does not account for boat launches that may have taken place without a vehicle subsequently being parked at the public landing.  This distribution suggests that an average of only 2.3% of the 475 moored or beached watercraft surveyed in 2003 were actively using the lake at any given time during wake hours on mid-summer weekends/holidays.

## 3-8 CARRYING CAPACITY FORMULA

Lake Ripley's recreational carrying capacity was defined as the number of watercraft that can simultaneously operate on the lake without 1) compromising user safety; 2) causing significant user displacement or dissatisfaction; and 3) causing environmental harm to the resource.  This number will vary depending on the actual mix of lake uses and watercraft speeds present on the lake at any given moment.

The formula used to evaluate Lake Ripley's carrying capacity was partially based on methods developed by the U.S. Army Corps of Engineers,[97] and modeled after a carrying capacity procedure used to evaluate several lakes in Southwestern Michigan.[98]  It consisted of:

1) calculating a useable lake area that could support a range of boating activities/speeds safely and without significant environmental impact;

2) establishing minimum spatial requirements for various boating activities/speeds;

3) determining the number of watercraft that use the lake during periods of peak use, and the relative proportions of those watercraft engaged in different activities/speeds;

4) choosing optimum boating densities for the range of lake-use activities/speeds; and

5) comparing actual use to the lake's estimated carrying capacity.

### USEABLE LAKE AREA

In estimating Lake Ripley's recreational carrying capacity, the first step was to determine the useable surface area that could accommodate a mix of lake uses.  This area was first calculated by subtracting portions of the lake that are already user restricted (for safety and environmental reasons) from the lake's total surface area.  These areas included slow-no-wake zones within 200 feet of the shoreline, buoyed no-wake sections within both major bays, and the 100-foot no-wake zone around the buoyed restricted swim area at the Lake Ripley Park beach.  The restricted zones described above were subtracted from the total lake surface to arrive at a "useable" area in which mixed recreational activities could comingle.  This calculation—referred to as Scenario #1—removed 120 of the 423 total surface acres, leaving a 303-acre useable lake area (Figure 29).

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[97] U.S. Army Corps of Engineers.  1994.  Cumulative impacts of recreational boating on the Fox River-Chain O'Lakes area in Lake and McHenry Counties, Illinois:  Final Environmental Impact Statement.

[98] Progressive Architecture Engineering.  2001.  Four Township Recreational Carrying Capacity Study – Pine Lake, Upper Crooked Lake, Gull Lake & Sherman Lake.  Project #51830106.

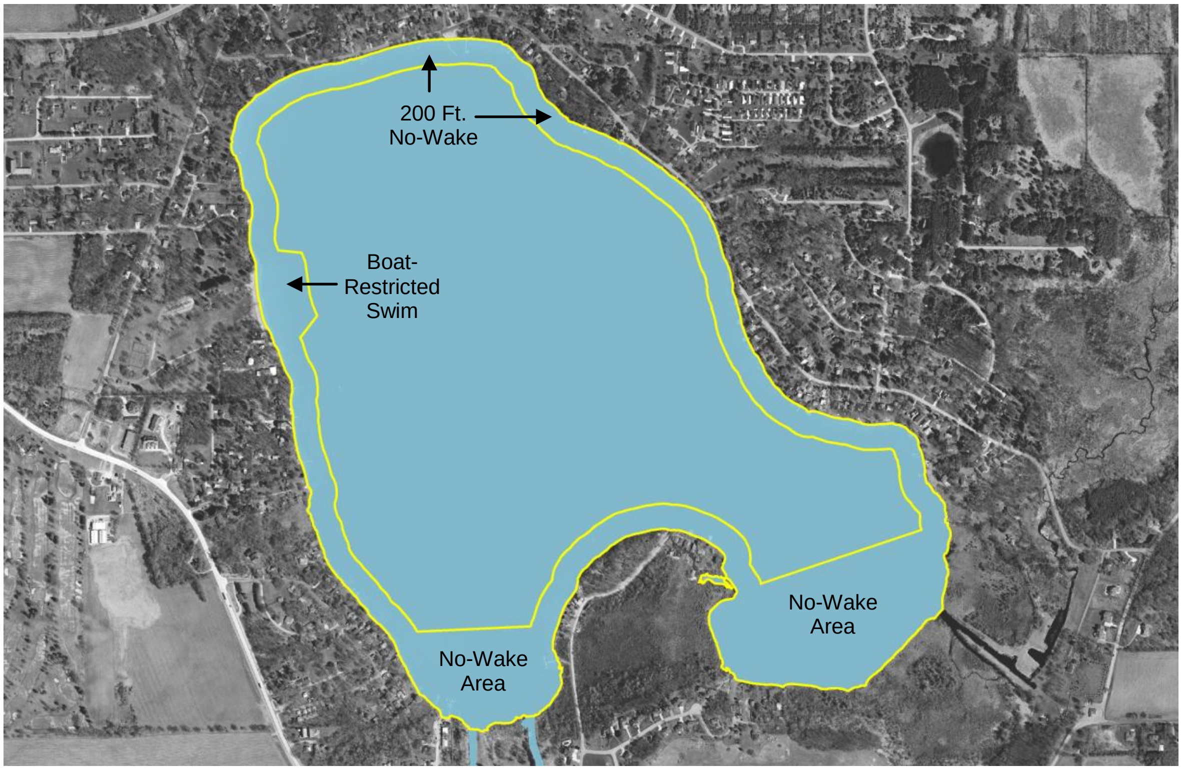


**Figure 29: Scenario #1 Useable Lake Area**

In this case, useable area describes the portion of the lake surface that is equally available and unrestricted for all competing uses. No attempt was made to expand this area by trying to assign user location preferences, as they can vary widely among and within the different user groups. Expansion of the useable area is considered appropriate only when an *overwhelming* predominance of passive lake uses (i.e. those involving stationary or slow-moving watercraft) are attempting to share the same recreational space. This is the only situation reasonably guaranteeing that user encroachment into the restricted zones is done legally and voluntarily across the board, rather than as a result of forced displacement. In this situation, the useable area may be extended to the 3-foot depth contour. Three feet was chosen to represent the minimum depth necessary to support a range of watercraft types, assuming they maintain idle speed.

After subtracting those portions of the lake that are already restricted according to State law and Town ordinance, the "useable" surface area may be further adjusted to better protect shallow, environmentally-sensitive portions of the lake. Studies have shown that shallow areas are most susceptible to adverse impacts associated with motor boat activities.[99] Impacts include sediment re-suspension, reduced water clarity, and damage to fish and wildlife habitat, among others. Wagner (1991) observed that the shallowness ratio, which compares the area of the lake less than 5 feet deep to the total area, is more indicative of the lake bottom area likely to be directly

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[99] Asplund, Timothy R. 1996. Impacts of Motor Boats on Water Quality in Wisconsin Lakes. Monona, WI: Wisconsin Department of Natural Resources, Bureau of Research.
Asplund, Timothy R. 1997. Effects of Motor Boats on Submerged Aquatic Macrophytes. Journal of Lake and Reservoir Management, 13(1): 1-12.

affected by motorized watercraft.[100] Shallowness ratios range from a low of <0.10 for lakes unlikely to be impacted to a high of >0.50 for lakes with a high potential for impact. For Lake Ripley, 143 of its 423 total acres are characterized by less than five-foot water depths, producing a shallowness ratio of 0.34. Under Scenario #2, an additional 38 acres would be removed, leaving a 265-acre useable surface area beyond the five-foot depth contour (Figure 30). Both scenarios and their corresponding useable area calculations are summarized in Table 7.

## **Optimum Boating Density**

The next step was to determine a range of optimum boating densities for Lake Ripley based on published spatial requirements estimated for various types of watercraft and their associated uses (see Table 8). Most of these published spatial requirements were determined after evaluating user-satisfaction levels under varying boating conditions. Unfortunately, no single boating density standard satisfies all lake users in all situations, especially since each lake is unique and users will have different perspectives on what constitutes congestion.

A number of different methods, each with its own set of analytical variables and assumptions, were used to arrive at the figures published in Table 8. For example, some researchers evaluated the spatial requirements of only a single user group in isolation, while others looked at how optimal boating densities change depending on the interplay among multiple uses. User surveys were commonly employed to gauge feelings of crowdedness under a variety of boating conditions. These opinions will at least partially reflect the conditions and expectations specific to that particular lake or region.

[100] Wagner, Kenneth J. 1991. Assessing Impacts of Motorized Watercraft on Lakes: Issues and Perceptions. Proceedings of a National Conference on Enhancing States' Lake Management Programs. Northeastern Illinois Planning Commission.

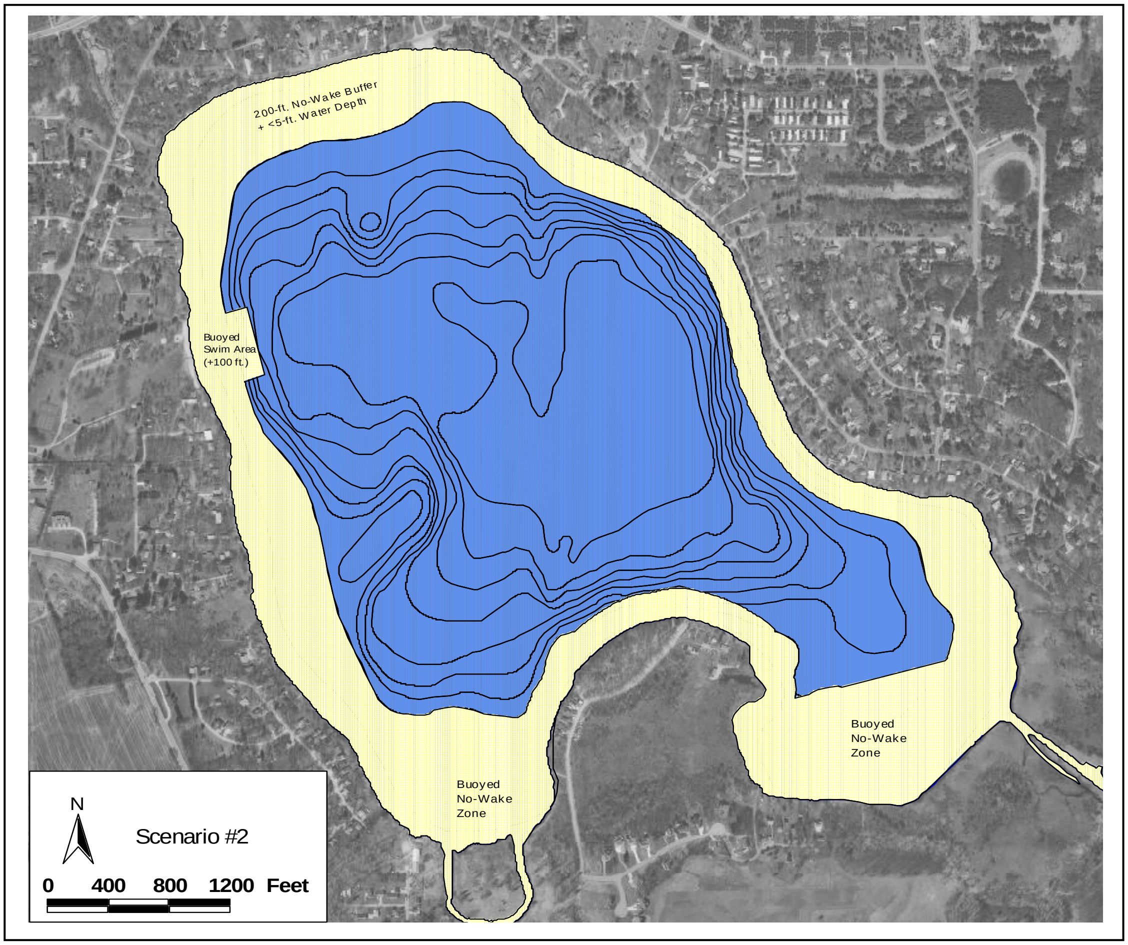


**Figure 30: Scenario #2 Useable Lake Area**

**Table 7: Scenario #1 and #2 useable lake areas**

| | **Total Lake Area (Acres)** | **General Restricted Area (Acres)*** | **Useable Lake Area for All Uses (Acres)** |
|---|---|---|---|
| **Scenario #1** | 423 | 120 | 303 |
| **Scenario #2** | 423 | 158 | 265 |

***** Figures are based on a mix of competing boating activities/speeds attempting to share the same recreational space. They do not reflect user location preferences, as they may vary considerably among and within the different user groups.

**Table 8: Summary of published optimum boating densities**[101]

| Source | Boating Uses | Suggested Density |
|---|---|---|
| Ashton (1971)[102] | All uses combined in Cass Lake | 5 to 9 acres/boat |
| | All uses combined in Orchard Lake | 4 to 9 acres/boat |
| | All uses combined in Union Lake | 6 to 11 acres/boat |
| Kusler (1972)[103] | Waterskiing combined with all other uses | 40 acres/boat |
| | Waterskiing only | 20 acres/boat |
| | Coordinated waterskiing | 15 acres/boat |
| Jaakson *et al.* (1989)[104] | Waterskiing and motorboat cruising | 20 acres/boat |
| | Fishing | 10 acres/boat |
| | Canoeing, kayaking, sailing | 8 acres/boat |
| | All uses combined | 10 acres/boat |
| Wagner (1991)[105] | All boating activities | 25 acres/boat |
| Warbach *et al.* (1994)[106] | All motorized (>5 HP) uses | 30 acres/boat |

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[101] Progressive Architecture Engineering. 2001. Four Township Recreational Carrying Capacity Study – Pine Lake, Upper Crooked Lake, Gull Lake & Sherman Lake. Project #51830106.
[102] Ashton, P.G. 1971. Recreational Boating Carrying Capacity: A preliminary study of three heavily used lakes in southeastern Michigan. Doctoral Thesis, Department of Resource Development, Michigan State University.
[103] Kusler, Jon A. 1972. Carrying Capacity Controls for Recreation Water Uses. Upper Great Lakes Regional Commission.
[104] Jaakson, R., M.D. Buszynski and D. Botting. 1990. Carrying Capacity and Lake Recreation Planning. The Michigan Riparian, November 1989, pp. 11-12, 14.
[105] Wagner, Kenneth J. 1991. Assessing Impacts of Motorized Watercraft on Lakes: Issues and Perceptions. Proceedings of a National Conference on Enhancing States' Lake Management Programs. Northeastern Illinois Planning Commission.

Each researcher's methodology and set of assumptions had to be carefully evaluated to determine the degree of applicability to Lake Ripley. Reported density figures for each lake use, or combination of lake uses, were also compared to identify accepted value ranges. Ultimately, the greatest weight was given to those figures that 1) were generated from the most relevant and replicable research methods, and 2) showed the highest correlation across studies.

Next, a sliding scale of optimal boating densities was formulated. A sliding scale was chosen as a means of capturing the range of lake uses and watercraft speeds that may be observed at any given time. Threinen's (1964) theory that a boat's space requirements are directly proportional to the speed at which the boat is traveling provided the basis for this scale.[107] Activities involving more passive boating behavior (i.e., fishing and canoeing) would translate into lower values on the scale, while more aggressive activities (i.e., waterskiing and high-speed boating) would translate into higher values.

The above procedure yielded an optimal density range of 10-30 acres per boat for Lake Ripley. The range of spatial requirements was believed to reflect the best research available at the time, and should be fine tuned whenever new and better information is forthcoming. Following this guidance, a low 10-acre-per-boat spatial requirement would be selected when the lake is dominated by stationary and slow-moving watercraft (passive boating activities). Alternatively, a high 30-acre-per-boat spatial requirement would be selected when the lake is dominated by fast-moving watercraft (aggressive boating activities). A mean optimum density of 20 acres per boat assumes a relatively equal mix of stationary, slow- and fast-moving boats engaged in a full spectrum of activities. The optimum density would consequently vary along this scale, and would depend on the proportion of slow-moving and stationary to fast-moving watercraft in relation to the useable lake area calculation (see Tables 9 and 10).

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[106] Warbach, J.D., M.A. Wyckoff, G.E. Fisher, P. Johnson and G. Gruenwald. 1994. Regulating Keyhole Development: Carrying capacity analysis and ordinances providing lake access regulations. Planning and Zoning Center, Inc.

[107] Threinen, C.W. 1964. An Analysis of Space Demands for Water and Shore. Wisconsin Conservation Department.

**Table 9: Scenario #1 carrying capacities for Lake Ripley**

| Lake-Use Mix (Prevailing Boat Speeds) | Optimum Boating Density (Acres/Boat) | Scenario #1 Useable Lake Area (Acres) | Carrying Capacity (Total # of Boats) |
|---|---|---|---|
| 100% Idle Speed or Stationary | 10 | 378* | 38** |
| 75% Idle Speed or Stationary & 25% Fast Moving | 15 | 303 | 20 |
| 50% Idle Speed or Stationary & 50% Fast Moving | 20 | 303 | 15 |
| 25% Idle Speed or Stationary & 75% Fast Moving | 25 | 303 | 12 |
| 100% Fast Moving | 30 | 303 | 10 |

* Figure is adjusted to include all portions of the lake that are at least 3 ft. deep, with the exception of boat-restricted swim areas. 3 ft. is chosen as the minimum depth to support a range of boat types at idle speed.

** Figure assumes 100% passive lake uses with equal opportunity to access restricted, no-wake areas (and not as a result of forced displacement). Other figures represent shared, mixed-use situations.

**Table 10: Scenario #2 carrying capacities for Lake Ripley**

| Lake-Use Mix (Boat Speeds) | Optimum Boating Density (Acres/Boat) | Scenario #2 Useable Lake Area (Acres) | Carrying Capacity (Total # of Boats) |
|---|---|---|---|
| 100% Idle Speed or Stationary | 10 | 378* | 38** |
| 75% Idle Speed or Stationary & 25% Fast Moving | 15 | 265 | 17 |
| 50% Idle Speed or Stationary & 50% Fast Moving | 20 | 265 | 13 |
| 25% Idle Speed or Stationary & 75% Fast Moving | 25 | 265 | 10 |
| 100% Fast Moving | 30 | 265 | 9 |

* Figure is adjusted to include all portions of the lake that are at least 3 feet deep, with the exception of boat-restricted swim areas. 3 ft. is chosen as the minimum depth to support a range of boat types at idle speed.

** Figure assumes 100% passive lake uses with equal opportunity to access restricted areas (and not as a result of forced displacement). Other figures represent shared, mixed-use situations.

## 3-9 CARRYING CAPACITY RESULTS

According to 2003 lake-use data, there was an *average* of 24 boats operating on Lake Ripley *during wake hours on mid-summer weekends and holidays*. This particular timeframe was chosen to represent the peak, mixed-use recreational period for the lake. The average ratio of slow-moving and stationary to fast-moving watercraft during this period was 1.5:1 (60% vs. 40%, respectively), resulting in an optimum boating density of 18 acres per boat on the sliding scale. Using this applied density standard, recreational carrying capacity would be 17 boats under Scenario #1 and 14 boats under Scenario #2 for these average boating conditions.

The above findings indicate that average boating densities in 2003 were between 141% and 171% of Lake Ripley's carrying capacity, depending on which of the two useable-lake-area calculations is used. Carrying capacity was ultimately exceeded 16 out of the 17 observed days that fell within this peak, mixed-use timeframe. Even in the hypothetical but impractical absence of any restricted areas on the lake, average boating densities would still represent 104% of estimated carrying capacity. Alternatively, observed boating densities during no-wake hours never exceeded carrying capacity.

From 1998-2008, random boat counts were taken by Lake Watch volunteers during the defined peak-use periods. These census data show an average of 20 boats using the lake at any given time. While slightly less than the average 24 boats documented during the 2003 study, the 10-year data record suggest that estimated carrying capacity is regularly and consistently exceeded during peak use. This analysis suggests a high probability of user conflict and potential environmental degradation on Lake Ripley due to overcrowding on busy, mid-summer weekends and holidays.

In 2009, the Lake District solicited volunteers who boat on Lake Ripley to serve on a focus group, namely for the purpose of evaluating factors that influence boating behaviors. A total of 10 local property owners and frequent boaters agreed to participate by maintaining detailed boating logs. Volunteers included both on-lake and off-lake property owners, and they used a variety of different (but mostly motorized) watercraft on the lake. A follow-up questionnaire revealed positively that all but one of the focus group participants either "never" or "rarely" encountered unfavorable lake conditions (irrespective of weather) that inhibited their preferred boating activities. Even so, the top reason for deciding *not* to boat on the lake was "too much general boat traffic," which was also cited as the least appealing factor about Lake Ripley as it applied to their preferred activities. In the future, it may prove useful to expand the sample population targeted by this type of survey, particularly for the purpose of producing statistically relevant information that is more representative of the larger boating community.

## 3-10 MANAGEMENT OPTIONS AND RECOMMENDATIONS

Evidence suggests that boating conditions on Lake Ripley regularly exceed the lake's estimated carrying capacity during periods of peak use. As a result, recreational safety and environmental quality are likely to be jeopardized absent measures to reduce overcrowding or control boat traffic. If future problems are to be averted, it is incumbent upon local policy makers to devise boating ordinances that balance the physical limitations of the resource with the demands of its users.

Common measures used to manage the causes and impacts of overcrowding include land-use controls, public access limitations, pier ordinances, and any number of watercraft-related restrictions (i.e. speed limits, lake-use zoning, outright bans, etc.). When considering such measures, care must be taken to strike a fair balance between the interests of the private riparian and the general public. To exclude either local riparians or the public in any given situation would raise serious policy as well as legal questions. Town of Oakland ordinances related to access and lake use are listed in Table 11 below. Summary information pertaining to some of these ordinances and other rules are contained in Appendix D.

**Table 11: Scenario #2 carrying capacities for Lake Ripley**

| Ordinance Number | Adoption or (Amendment) Date | Title | Description |
|---|---|---|---|
| 2 | 07/18/06 | An Ordinance to Confirm the Current Status of the Ordinance Regulating Traffic, Boating and Water Sports upon the Waters of Lake Ripley, and Prescribing Penalties for Violations Thereof by Combining All Amendments to Date in One Document | Sets forth public boat launch fees; slow-no-wake times; slow-no-wake zones; and emergency no-wake rules during flood events |
| 3 | 04/18/89 (03/18/96) | An Ordinance to Prohibit the Use of Boats Being Propelled by Motors in the Man-Made Channel Area of Lake Ripley… | Prohibits the use of motors of any kind (including electric) trolling motors in Vasby's Channel located in South Bay |
| 4 | 05/16/89 (09/30/08) | Regulation of Fishing and Hunting | Adopts provisions of Ch. 29, Wis. Stats. relating to the harvesting of fish and game |
| 13 | 12/17/74 | Adoption by resolution of Jefferson County Zoning Ordinance No. 11 | County shoreland zoning provisions for unincorporated areas dealing with building setbacks, shoreline vegetation |

| | | | |
|---|---|---|---|
| | | | removal, land disturbance, etc. |
| 30 | 04/20/99 | An Amendment to Ordinance No. 30 to Regulate the Burning of Yard Waste Near Lake Ripley | Prohibits burning yard waste within 25 feet of Lake Ripley or any of its continuously flowing streams and drainage channels. |
| 42 | 03/21/95 | An Ordinance to Regulate the Location of Piers, Wharves and Swimming Rafts on Lake Ripley | Prohibits new or expanded piers, wharves and swimming rafts without a DNR permit along shorelines mapped as "sensitive" |
| 51 | 05/15/01 | An Ordinance to Prohibit the Intentional Feeding of Geese and other Waterfowl on or Adjacent to Lake Ripley | Prohibits the hand-feeding of waterfowl or the use of feeding stations that can attract nuisance populations |
| 55 | 02/21/06 | An Ordinance to Prohibit Keyhole Developments on Lake Ripley | Prohibits new subdivision developers from granting lake access to off-lake lots through a commonly-owned shoreline area |
| 58 | 11/18/08 | Adoption of Town of Oakland Comprehensive Growth Plan | Goals include prohibiting development within floodplains and wetlands; protecting unique environmental areas; promoting good soil conservation practices; and protecting surface and ground water quality. |

A brief overview of some available management strategies and their potential relevance to Lake Ripley is presented below. This list of strategies and subsequent discussion is not intended to be exhaustive, nor is it intended to advance any particular policy agenda. Rather, it is meant as a starting point and framework for future discussion and decision making.

## SELF-REGULATION

A lake's capacity for safe and enjoyable use is finite. It is a function of user types, preferences and perceptions, as well as the actual physical limitations of the resource. Regardless of the lake, user satisfaction and perceptions of safety will typically decline in response to increased levels of boating congestion. Therefore, recreational use on lakes becomes partially self-regulating. Riparian users can self-regulate by basing lake-use decisions on a minute-by-minute assessment of weather and boating conditions. On the other hand, non-riparian users will generally self-regulate on a less frequent basis. These users must travel greater distances and expend greater effort to access the lake, and may be less inclined to abort their plans once they have arrived—even when less than optimal conditions are encountered. However, a negative boating experience may encourage these users to cut their time on the lake short. It may also dissuade them from returning unless conditions are known to have changed for the better.

Relying on self-regulation as a recreational management strategy is not recommended for Lake Ripley. In the University of Wisconsin-Extension publication titled *How's the Water: Planning* *for Recreational Use on Wisconsin's Lakes and Rivers*, the authors point out that "People often continue (or learn) to be satisfied even when conditions become more crowded, often to the detriment of the resource. This phenomenon results in more bodies of water being managed for higher densities. The acceptance of crowded conditions results in fewer opportunities to manage for lower use levels."[108] It also favors users and activities that are more tolerant of these conditions.

> Perhaps the commonest circumstance under which societies fail to perceive a problem is when it takes the form of a slow trend concealed by wide up-and-down fluctuations…Politicians use the term "creeping normalcy" to refer to such slow trends concealed within noisy fluctuations. If the economy, schools, traffic congestion, or anything else is deteriorating only slowly, it's difficult to recognize that each successive year is on the average slightly worse than the year before, so one's baseline standard for what constitutes "normalcy" shifts gradually and imperceptibly.[109]

The laissez faire policy of self-regulation is also inherently inequitable for two main reasons. First, it establishes a first-come, first-served basis of lake use. Second, it does nothing to prevent more dominant and aggressive activities from displacing more passive uses, such as those that may be most sensitive to noise, boat wakes and congestion. As crowding increases, so does the level of user conflict and frustration. Boaters must then choose whether to accept riskier operating conditions, or alter the timing and nature of their preferred lake-use activity. They may also have little choice but to encroach upon areas of the lake that are environmentally sensitive or less suited for their desired activities. The end result is an overall decrease in environmental quality, equity, and lake-user satisfaction. Consequently, attempting to allow the lake to self regulate may prove to be an ineffective and inequitable control measure.

## PUBLIC-ACCESS CONTROLS

### Facility Design

Lake Ripley's public boat landing is owned and operated by the Town of Oakland. It currently allows unlimited launches, but provides only a limited number of legal parking spaces (16) that can accommodate vehicles and their attached trailers. Users must purchase a daily or seasonal launch pass in order to leave their vehicle parked at the facility following the launch of a watercraft. While parking availability generally limits the number of public boat launches, it does not prevent users from launching a boat and parking elsewhere when the lot is full. In fact, on busy days, up to a half-dozen vehicles with trailers routinely end up at Ripley Park.[110] Illegal parking on Island Lane has also been observed, thereby effectively increasing the capacity of the landing.

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108 University of Wisconsin-Extension. 2002. How's the Water? – Planning for Recreational Use on Wisconsin Lakes & Rivers.
109 Jared M. Diamond, author of Collapse: How Societies Choose to Fail or Succeed
110 Richard H. Moen, Ripley Park Supervisor, 2003 personal communication

According to the Wisconsin Department of Natural Resources (DNR), a lake has reasonable public boating access and is eligible for natural resource enhancement services when public boating access meets certain standards. For a water body of Lake Ripley's size, the DNR requires one or more access sites which in total provide one car-trailer unit per 30 open water acres.[111] This formula yields a minimum of 14 car-trailer units based on 423 open water acres. Therefore, Lake Ripley currently satisfies the state's minimum public access requirements, making it eligible for funding assistance and resource enhancement services such as fish stocking.

The DNR uses a similar formula to determine whether a lake has too much boating access. If this is found to be the case, the DNR will not pursue public boating access development, nor will it approve permits or provide financial assistance for boating access. For a water body of Lake Ripley's size, the DNR sets a maximum of one car-trailer unit per 15 open water acres.[112] This formula yields a maximum of 28 car-trailer units based on 423 open water acres. The fact that the DNR establishes boating access limits suggests that the state does consider capacity controls at some level.

Providing new public-access facilities or expanding existing facilities that can accommodate increased capacity is not advisable for Lake Ripley. Additional parking capacity would only serve to increase carrying-capacity pressures that already exist on the lake. Furthermore, recent opinion surveys suggest that there are already adequate opportunities for public boating access on Lake Ripley.[113] Currently, watercraft using the public landing represent a significant fraction of the total number of watercraft using the lake at any given time, including during peak-use periods when overcrowding is likely to occur. Expanding the existing facility or constructing new public boating access sites can only exacerbate congestion problems unless special launching restrictions are imposed.

Conversely, reducing available parking may also not prove advisable, especially if such action leads to a loss of state financial assistance and lake-improvement services. Wagner (1991) points out that "Such restrictions may limit density but will not necessarily eliminate impacts by motorized watercraft and may be perceived as unfair by lake users."[114] They may also simply lead to increased use by riparian owners, thereby replacing users turned away by public parking limitations.

**Launch Fees**

Launching is free at the public landing unless a vehicle is to be parked at the facility. The current fee structure from May 1st to September 30th is set by Town ordinance (2006) as follows:

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111 NR 1.91(4)(d)

112 NR 1.91(5)(b)

113 Lake Ripley Management District. 2007. Lake Ripley Property Owner Opinion Survey.

114 Wagner, Kenneth J. 1991. Assessing Impacts of Motorized Watercraft on Lakes: Issues and Perceptions. Proceedings of a National Conference on Enhancing States' Lake Management Programs. Northeastern Illinois Planning Commission.

$7.00 for a daily pass; $20.00 for an annual Oakland resident or property owner pass; $30.00 for an annual non-resident/property owner pass; and $20.00 for an annual senior citizen pass.[115]

State law under the Public Trust Doctrine prohibits charging high fees for the purpose of restricting public access. While the Wisconsin DNR encourages free boat launching, it does allow a reasonable launch fee to be charged for the purpose of operating and maintaining a publicly-owned boat access site.[116] According to Section 30.77, Wis. Stats., a reasonable launch fee is one that does not exceed the maximum allowable amount under the following criteria:

(a) *Base fee*. A base is that fee that is charged a state resident vehicle for entrance to the state parks.

(b) *Public boating access surcharges*. Municipalities, lake management districts and other public boating access providers that maintain any of the following services may add to the base fee not more than the following surcharges for vehicles with trailers. No more than the base fee may be charged for non-motorized or non-trailered boats.

1. Attendant when on duty: 0.20 X Base

2. On-site toilet facilities: 0.20 X Base

3. Great Lakes sites: 0.30 X Base

4. Boats 20 ft. in length or more but less than 26 ft.: 0.30 X Base

5. Boats 26 ft. or greater in length: 0.60 X Base

(c) *Daily launch fee*. The total of the base fee and all applicable surcharges, rounded to the nearest quarter of a dollar, shall constitute the daily launch fee. A daily launch fee that is paid shall be valid for all boat access facilities provided by the issuing authority for that day. If different fees are charged by the issuing authority for different access sites, the higher fee shall be allowed for use of all the sites.

(d) *Season pass*. If a launch fee is charged, a season pass at a fee not to exceed 10 times the daily launch fee shall be provided for both residents and non-residents. A mechanism to obtain a season pass shall be provided by the public access provider at the launch site.

(e) *Prior approval required*. Each public boat access provider charging a launch fee in excess of the resident state park daily entrance fee shall provide its fee schedule to the department for approval prior to its adoption. Department approval shall be based solely on demonstration that the provider maintains the facilities or services described in par. (b) that justify charges in excess of the resident state park daily entrance fee and that a season pass is available.

(f) *Existing approved fee structures*. Reasonable fees under pars. (a) to (e) do not apply to access sites which the department has determined in a written decision to have a reasonable fee prior to the effective date of this rule.

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[115] Town of Oakland. 2006. Town Ordinance #2: An Ordinance to Confirm the Current Status of the Ordinance Regulating Traffic, Boating and Water Sports upon the Waters of Lake Ripley, and Prescribing Penalties for Violations Thereof by Combining All Amendments to Date in One Document.
[116] s. 30.77, Wis. Stats.

(g) *Differential fee based on residency*. Local units of government, including lake management districts, which maintain and operate public boating access sites, may charge differential fees on the basis of residency within the unit of government maintaining or operating the access. If a fee is charged, the fees for a nonresident may not exceed 150% of the fee charged a resident, and nonresident fees may not exceed the maximum allowable amounts except when par. (b) 4 or 5 are applicable.[117]

## RIPARIAN-ACCESS CONTROLS

### Land-Use Zoning

It is not surprising that high-density shoreland use translates into high-intensity water use. As the number of lakefront lots around a given lake increases, so does the number of potential riparian users, private access points, piers and watercraft. This trend has been evident on Lake Ripley where dense residential development is already concentrated around most of the lake's shoreline.

Keyhole subdivisions are of particular concern since they can greatly exacerbate problems associated with excessive riparian access and lake use. Keyhole or funnel development occurs when a waterfront lot is used to permit access to a larger development located away from the lake. According to Progressive AE (2001), "Funneling allows a large number of individuals to gain access to the lake through a small corridor of lake property, thereby exceeding the natural limitation on access afforded by the existing shoreline."[118] As of 2006, keyhole development is no longer permitted around Lake Ripley.[119]

Marinas can also be a source of controversy when it comes to access and overcrowding. There is presently only one, small marina that operates on Lake Ripley. Because of limited parking at the marina and close proximity of the public landing, this facility is not believed to contribute significantly to boat traffic on the lake. Anecdotal observations by Lake District staff and volunteers in recent years support this opinion. However, expansion of the marina's boat-launching and support capabilities could be cause for concern, as would the addition of other marinas on the lake.

County shoreland zoning and Wisconsin DNR rules governing the placement of piers and other structures in the water are intended to ensure reasonable development while protecting lake quality. Jefferson County's shoreland zoning rules must include minimum standards mandated under Chapter NR 115 of the Wisconsin Administrative Code. They apply to various building activities located within 1,000 feet of a lake and 300 feet from a river or stream in unincorporated areas. These rules include 75-foot building setback requirements from the water's edge, standards for boat ramps, shoreline clear-cutting restrictions, and various other provisions that can help mitigate the environmental impact of structures and surrounding development. A summary of shoreland zoning rules applicable to Lake Ripley can be found in

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[117] NR 1.91(11)

[118] Progressive Architecture Engineering. 2001. Four Township Recreational Carrying Capacity Study – Pine Lake, Upper Crooked Lake, Gull Lake & Sherman Lake. Project #51830106.

[119] Town of Oakland. 2006. Ordinance #55: An Ordinance to Prohibit Keyhole Developments on Lake Ripley in the Town of Oakland.

Appendix D. This summary was adapted from Jefferson County's *Management Plan for Rock Lake, Lake Mills*.[120]

**Pier and Boat Ramp Ordinances**

In addition to the public boat landing and the marina, there are several private boat ramps on Lake Ripley. At least two of these private ramps serve residents of keyhole subdivisions. These types of access structures could potentially become more prevalent over time. Their construction is currently regulated under county shoreland zoning, but only if they disturb a certain amount of soil or are built on a fairly steep slope. This situation is considered problematic as each new ramp represents another largely uncontrolled access point to the lake. Other problems include a host of environmental and scenic impacts to the shoreline. Many of these impacts are considered to be both cumulative and permanent. It may therefore become necessary to explore local ordinances that can better regulate these structures.

The Town of Oakland already has a pier ordinance in effect on Lake Ripley.[121] This ordinance requires a Wisconsin DNR permit for any new piers in areas designated as sensitive shoreline. These areas are generally associated with riparian wetlands, and include significant portions of both bays and about a 300-foot stretch of shoreline on the lake's west side. Elsewhere on the lake, piers have historically been loosely regulated, and have often evolved into extensive boat-docking facilities. The Wisconsin DNR sets reasonableness standards for piers, requiring a permit only if such standards are exceeded. A summary of the State rules relating to the placement of piers in public waterways can be found in Appendix D.

## WATERCRAFT-BASED REGULATION

**Bans**

Wagner (1991) concluded that the prohibition of all or certain types of watercraft is justified when safety considerations are paramount or when the minimum anticipated level of impact on the lake ecosystem is inconsistent with management objectives.[122] Even so, across the board regulation by boat size or type has been considered an unwarranted restriction of public rights in previous court rulings.[123] These rulings were based chiefly on the Equal Protection clause of the U.S. Constitution and Wisconsin's Public Trust Doctrine. However, the Courts have found laws to violate the Equal Protection clause only when based on an irrational or arbitrary classification.

> While a local boating regulation need not solve all of the watercraft-related problems facing a lake community, a regulation must reflect a thoughtful effort to address an actual threat to public health, safety, welfare or the environment. Although the Courts will generally defer to the policy decisions of elected officials, they may not

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[120] Jefferson County Land and Water Conservation Department, Rock Lake Improvement Association, and Joint Rock Lake Committee. 2006. Management Plan for Rock Lake, Lake Mills. p. 108-111.
[121] Town of Oakland. 1995. Ordinance #42: An Ordinance to Regulate the Location of Piers, Wharves and Swimming Rafts on Lake Ripley.
[122] Wagner, Kenneth J. 1991. Assessing Impacts of Motorized Watercraft on Lakes: Issues and Perceptions. Proceedings of a National Conference on Enhancing States' Lake Management Programs. Northeastern Illinois Planning Commission.
[123] Engfer, William G. 1992. Guidelines for Ordinance Writing & Buoy Placement in Wisconsin Waters. Wisconsin Department of Natural Resources, Bureau of Law Enforcement.

> sustain regulations on the free use of public waters which impose unnecessary restrictions on one type of watercraft, if other watercraft types present similar threats to public health and safety and environmental resources (O'Connor, 1998).[124]

Therefore, unless it can be reasonably established that a certain watercraft type by nature of its design is the cause of a particular problem, an outright ban may not be legally feasible.

**Horsepower and Speed Limits**

> Horsepower limits represent a modified form of prohibition, which addresses engine size but not watercraft design or operational features. Speed limits address the operational features in a general way but do not consider engine size or watercraft design. Horsepower limits are easier to implement and enforce than speed limits, while the latter are more likely to minimize disruptive ecological effects than horsepower limits. Either may be construed as unfair or arbitrary by some user groups for logical reasons. If either horsepower or speed limits are to be employed, it is advisable to base the established limit on a scientifically-defensible rationale and the specific characteristics of the lake in question. Blanket coverage of a region by these limits is apt to be inappropriate (Wagner, 1991).[125]

As with bans by boat size or type, across-the-board regulation by horsepower has been considered an unwarranted restriction of public rights in previous court rulings.[126] The Wisconsin Department of Natural Resources takes the position that ordinances regulating horsepower are overly restrictive and cannot be justified because they do not account for the fact that larger horsepower motors can be operated within established speed limit.[127] Other control measures, such as time and space zoning, are likely to be more effective and will be perceived as being more equitable. As for speed limits, the small size of Lake Ripley may act as a natural deterrent to racing and high-speed boating. Existing state regulations also already prohibit watercraft from generating dangerous wakes and speeding in close proximity to shore or other boats, swimmers, piers and rafts. Finally, studies have shown that speed limits are not very effective at minimizing environmental impacts such as sediment re-suspension and shore erosion. Most of these disturbances are caused during initial acceleration in shallow water depths, and may therefore be better addressed through slow-no-wake zoning.[128]

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[124] O'Connor, William P. 1998. Local Boating Regulation in Wisconsin: A Guide for Lake Management Organizations. Wisconsin Association of Lakes, Inc.
[125] Wagner, Kenneth J. 1991. Assessing Impacts of Motorized Watercraft on Lakes: Issues and Perceptions. Proceedings of a National Conference on Enhancing States' Lake Management Programs. Northeastern Illinois Planning Commission.
[126] Engfer, William G. 1992. Guidelines for Ordinance Writing & Buoy Placement in Wisconsin Waters. Wisconsin Department of Natural Resources, Bureau of Law Enforcement.
[127] O'Connor, William P. 1998. Local Boating Regulation in Wisconsin: A Guide for Lake Management Organizations. Wisconsin Association of Lakes, Inc.
[128] Hill, David and Michele Beachler. 2001. The Hydrodynamic Impacts of Recreational Watercraft on Shallow Lakes. Penn State University, Civil & Environmental Engineering.
Asplund, Timothy R. 2000. The Effects of Motorized Watercraft on Aquatic Ecosystems. Wisconsin Department of Natural Resources' Bureau of Integrated Science Services, and University of Wisconsin-Madison's Water Chemistry Program.

**Time and Space Zoning**

One of the most flexible approaches to regulating watercraft and separating conflicting lake uses involves the use of time and space zoning. Time zoning involves setting specific hours aside for different activities. For instance, quiet hours may be reserved for more passive activities that would otherwise be displaced by high-speed, motorized boat traffic. Lake Ripley currently has a mandatory slow-no-wake period every day from 7:30 p.m. to 11:00 a.m. In the past, Tuesdays were also set aside as slow-no-wake "quiet" days by Lake District proclamation, but only on a voluntary, non-enforceable basis. Other lakes have established quiet hours prohibiting motor use entirely, or have devised a schedule of rotating days for specific uses. According to Wagner (1991), the key is in reaching a consensus among user groups that satisfies the greatest number of users for the greatest amount of time while preserving desirable lake qualities.[129]

Space zoning involves setting aside portions of the lake for specific uses, and is commonly employed on water bodies where adequate space is available for each use. This strategy can be used to set aside safe swimming areas, protect sensitive aquatic habitats, and direct fast-moving motorized watercraft to areas of least potential impact. Within more crowded, higher-intensity user zones, traffic can be further managed by instituting waterskiing and high-speed boating routes. For example, such traffic can be restricted to a particular directional pattern around the lake (i.e. clockwise or counterclockwise). An advantage of space zoning is that it facilitates the selection of appropriate lake management techniques for each area of the lake. Management techniques can then be better targeted, leading to added cost savings and increased effectiveness. Space zoning can even be applied to the entire lake surface as an emergency measure during periods of high water. This type of ordinance is currently in effect on Lake Ripley.[130]

Buoys are often used to demarcate different user zones. On Lake Ripley, there is a buoyed swimming area adjacent to Ripley Park where all watercraft are strictly prohibited. There is also a slow-no-wake buoyed restricted area in each of the lake's two bays and within 200 feet of any shoreline as established through Town ordinance.[131] While motor boats are allowed in these particular areas, they are required to operate at idle speed. Lake Ripley's existing time and space zoning appears to be meeting its intended objectives. These policies also appear to be widely understood and accepted by lake users. No further ordinance modifications or actions are recommended at this time.

## EDUCATION AND ENFORCEMENT

Passing an ordinance or adopting a new boating law does not always change boater behavior. Education and enforcement are necessary to make even the most carefully-crafted boating rules work. Therefore, aside from regulatory approaches, the continued dissemination of information

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[129] Wagner, Kenneth J. 1991. Assessing Impacts of Motorized Watercraft on Lakes: Issues and Perceptions. Proceedings of a National Conference on Enhancing States' Lake Management Programs. Northeastern Illinois Planning Commission.

[130] Town of Oakland. 2006. Town Ordinance #2: An Ordinance to Confirm the Current Status of the Ordinance Regulating Traffic, Boating and Water Sports upon the Waters of Lake Ripley, and Prescribing Penalties for Violations Thereof by Combining All Amendments to Date in One Document.

[131] Ibid

[131] Section 30.77, Wisconsin Statutes

about existing lake rules combined with aggressive law enforcement may help alleviate many of the problems associated with overcrowding. The Lake District and Town of Oakland should continue to educate lake users about the current rules and regulations that are in effect on Lake Ripley. Each should also work to ensure that an adequate and visible police presence is maintained on the lake to stem flagrant safety violations, particularly during peak-use periods. According to Town Police Chief Bruce Gondert, an average of one citation is issued for every seven hours an officer is on the lake. Most of these citations are related to or prompted by slow-no-wake violations.[132] Appendix D includes a summary of state and local rules affecting Lake Ripley.

[132] 2009 personal communication with Bruce Gondert, Town of Oakland Police Chief

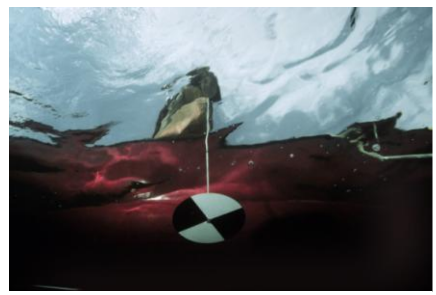
# -4-
# WATER QUALITY AND ALGAL CONDITIONS

*"High quality water is more than the dream of the conservationists, more than a political slogan; high quality water, in the right quantity at the right place at the right time, is essential to health, recreation and economic growth."*

-- Edmund S. Muske, U.S. Senator (1966 Senatorial speech)

## 4-1 INTRODUCTION

Public opinion surveys consistently show that safe water quality and good clarity are top factors contributing to local quality of life and the enjoyment of Lake Ripley.[133] These surveys also reveal a general perception that water clarity averages clear to somewhat cloudy in appearance, with the poorest conditions following large rainfall events and busy motor boating weekends. This chapter reviews the current status and long-term trends related to a host of factors that can be used as measures of water-quality conditions. Primary focus is given to the last 24 years during which regular monitoring has occurred. For an even longer-term perspective, Chapter 9-1 presents the results of sediment-core analyses that were used to reconstruct lake and watershed conditions over the last 260 years.



**An underwater view of a Secchi disc being lowered into the lake to measure water clarity. Source: UW-Extension**

## 4-2 LAKE HYDROLOGY AND MORPHOMETRY

Lake Ripley formed during the last glacial period from a kettle depression left behind by the retreating ice sheets. It receives most of its water from the watershed in the form of overland flow and stream drainage. There is both a perennial (unnamed) inlet and outlet that serve to move water through the system. The inlet enters the lake at its southeast corner, and the outlet exits to Koshkonong Creek at its northwest corner. While the outlet is partially obstructed by a rock-rubble spillway, Lake Ripley is not classified as an impoundment or flowage since the "dam" has only a negligible impact on lake depth. Although surface water represents the predominant source of water to the lake, groundwater can contribute as much as 30% of the lake's water supply.[134]

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[133] Lake Ripley Management District. 1999, 2005 and 2007. Lake Ripley Property Owner Opinion Survey.

[134] Wisconsin Department of Natural Resources, Wisconsin Department of Agriculture, Trade and Consumer Protection, Lake Ripley Management District, and Jefferson County Land Conservation Department. 1998. Nonpoint Source Control Plan for the Lake Ripley Priority Lake Project. Wisconsin Nonpoint Source Water Pollution Abatement Program. Publication WT-512-98.

Lake morphometry, or bathymetry, describes a lake's physical characteristics. Lake Ripley's physical characteristics can be described in terms of lake volume (7,561 acre-feet of water), surface area (423 acres), shoreline length (4.1 miles), fetch (1.3 miles), mean depth (18 feet) and maximum depth (44 feet). In terms of surface area, approximately one-third 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, and approximately 1,000 feet from the east shoreline. Although fairly deep at its center, almost half of the lake's surface area lies over water depths of less than 10 feet.

Lake Ripley is somewhat round in shape except for a wide peninsula that divides its southern half into two prominent bays. It consequently has a relatively low shoreline-development factor (SDF), which describes the degree of irregularity in the shape of the shoreline. SDF relates shoreline length to the circumference of a circle with the same area as the lake. A perfectly circular lake would have the lowest SDF of 1.0. As shoreline irregularity increases, so does the SDF that measures the lake's propensity to be impacted by shoreline use. High SDF values may imply greater safety risks and ecological consequences.[135] Reasons include: 1) increased shoreline development per unit of surface area; 2) tighter and more confined recreational spaces; 3) additional shoreline subjected to wake-induced erosion; and 4) greater probability for near-shore, shallow-water depths that are most vulnerable to motor boat impacts.

Lake Ripley's SDF is a relatively low 1.7. However, the lake's modest size, well developed shoreline, and extensive shallow areas tell a different but more complete story. For example, in terms of potential lake-bottom impacts from motorized boat traffic, over one-third of the total lake surface is represented by less than 5-foot water depths. Taken together, these characteristics suggest a greater vulnerability to shoreline-use impacts than what the lake's shape and correspondingly low SDF would otherwise imply. While Lake Ripley is physically capable of accommodating diverse recreational uses at one time, consideration should be given to space, depth and ecological limitations that may affect these uses. Ignoring such limitations will only invite additional user conflict and environmental degradation in the future. A bathymetric map of Lake Ripley is included as Figure 31 below.

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[135] Wagner, Kenneth J. 1991. Assessing Impacts of Motorized Watercraft on Lakes: Issues and Perceptions. Proceedings of a National Conference on Enhancing States' Lake Management Programs. Northeastern Illinois Planning Commission.

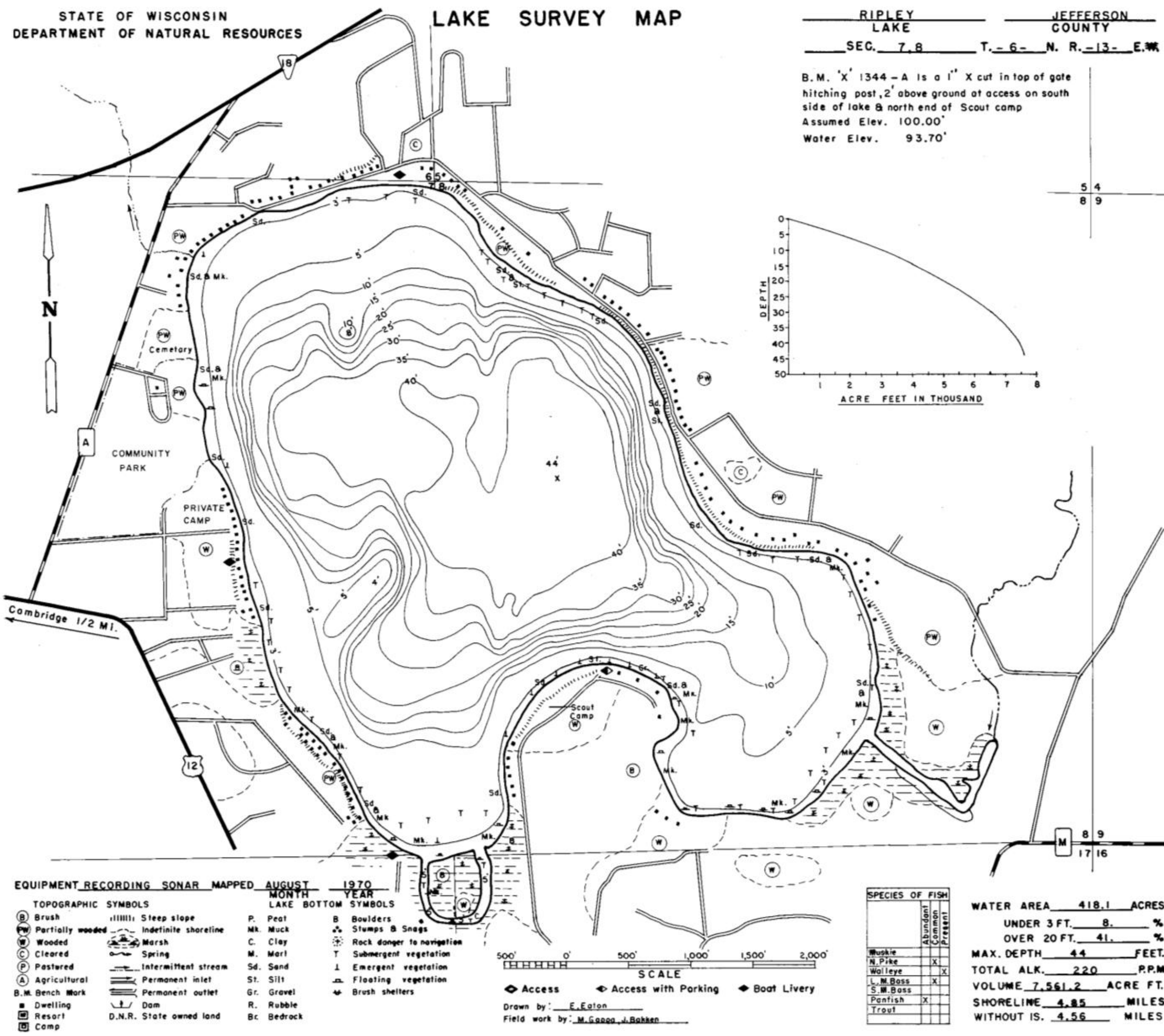


**Figure 31: Lake Ripley Bathymetry**[136]

[136] Wisconsin Department of Natural Resources. 1970. Lake Survey Map.

## 4-3 HYDRAULIC RETENTION TIME AND FLUSHING RATE

Hydraulic retention time is the average length of time water remains in a lake before it is entirely replaced, or recharged, with "new" water. It is calculated by dividing the volume of water passing through the lake per year by the lake volume. Its reciprocal value is the lake's flushing rate, or the number of lake volumes replaced per year by inflow. Retention time is strongly influenced by the size of the lake in relation to its watershed, and how the lake is supplied with water. Rapid water exchange (flushing) rates allow problematic nutrients such as phosphorus to be flushed out of the lake quickly. Lakes with higher flushing rates respond best to management practices that decrease nutrient input, mainly since nutrients cannot accumulate and get constantly recycled with spring and fall mixing. Small drainage lakes with bigger watersheds generally fit this category. With longer retention times, 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. Residence times of natural lakes commonly range from 1-10 years. Long residence times result in greater nutrient retention and recycling in most lakes. Lake Ripley, as a small drainage lake with modest watershed, has an average retention time of 2.85 years. This estimate was derived from the Wisconsin Lake Modeling Suite (WiLMS) using standard watershed-input variables, and suggests that the lake would best be served by nutrient reduction strategies targeted within the contributing watershed. Chapter 9-2 should be consulted for additional information related to the WiLMS analysis.

## 4-4 THERMAL PROPERTIES OF WATER COLUMN

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, denser, lower zone called the hypolimnion.

Summer stratification generally occurs in lakes like Lake Ripley 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. Lake Ripley can be viewed as a deep lake in the context of its potential to thermally stratify and resist lake-wide mixing of the water column.

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. Larger, deeper lakes with greater water volumes tend to lose and absorb heat more slowly, meaning they are usually the last to freeze and thaw.

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 algae-forming nutrients up to the surface. This destratification process is called spring and fall turnover (or overturn). Due to its morphometric characteristics, Lake Ripley is classified as dimictic, meaning "twice mixing." However, warming can sometimes occur too rapidly in the spring for this lake-wide mixing to be effective, especially in small sheltered kettle lakes. Figure 32 illustrates how temperatures throughout the water column change during each season.

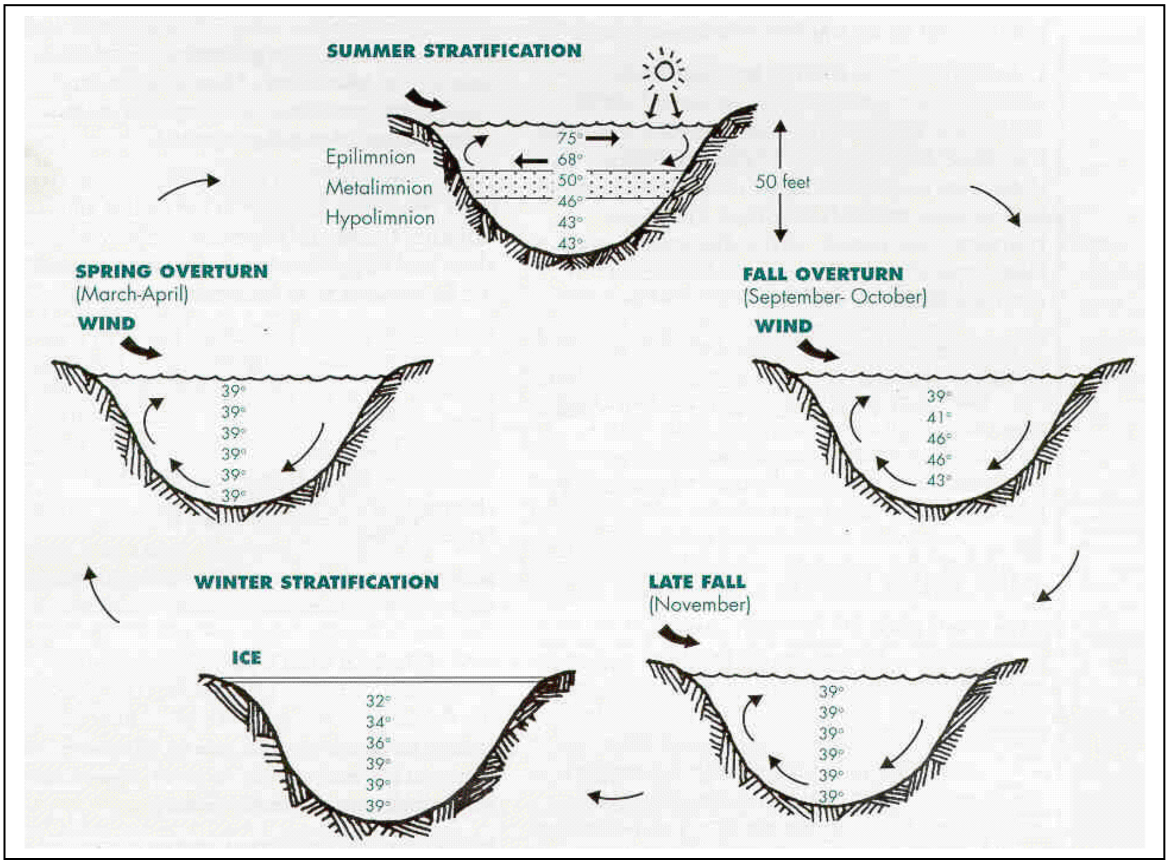


**Figure 32: Illustration of Lake Thermal Regime**[137]

Lakes that experience strong thermal stratification, like Lake Ripley, are frequently subject to oxygen depletion in the hypolimnion. As algal cells, plant debris and other organic material fall into the hypolimnion to decay, oxygen becomes depleted to the extent that anaerobic conditions

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[137] Shaw, Byron, Mechenich, C. and Klessig, L. 1996. Understanding Lake Data. Publication RP-09-96-3M-275.

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, this fertile water gets mixed throughout the water column, creating a situation that favors late-season algal blooms.

## 4-5 DISSOLVED OXYGEN AND TEMPERATURE PROFILES

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. Water temperature is also important as it influences the rate of photosynthesis, the metabolic rates of aquatic organisms, and the sensitivity of organisms to toxicity, parasites and disease.

Dissolved oxygen is 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, but could deplete levels during the evening as a result of plant decay and bacterial respiration. This helps explain why oxygen levels fluctuate throughout the water column depending on variables such as time of day, water depth, plant biomass, water 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 like Lake Ripley is 5.0 mg/L. This is the minimum amount of oxygen needed for most fish to survive and grow.

The amount of oxygen present within the hypolimnion of deeper lakes plays an important role in the mobilization of phosphorus from the bottom sediments into the surrounding water column. 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. 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. When the lake eventually destratifies (mixes), any phosphorus that was mobilized from the bottom sediments is transported throughout the water column where it becomes available for algae growth. 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.

Lake Ripley, while generally well oxygenated, does go anoxic below the 20-25-ft. water depth during the summer stratification period. However, the lake is not considered to be susceptible to winterkill conditions (low winter oxygen resulting in fish kills). This is primarily due to sufficient depths and an ample water volume that prevents “freeze-out” conditions.

## 4-6 ACIDIFICATION

A lake's pH is a measure of the concentration of hydrogen ions in the water. 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 one 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), with a statewide mean of 7.2.[138] 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.

Like most other lake-quality measures, pH varies naturally over short timeframes and even within the lake's water column. 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. Long-term water chemistry data indicate that the average pH of Lake Ripley's surface waters is 8.5. This value is higher than the statewide average but fairly typical for a southeastern Wisconsin lake, indicating that the system is well buffered from acidification. Acidity effects on different fish species is presented in Table 12 below.

**Table 12: Effects of acidity on fish[139]**

| Water pH | Effects | Comparable Acidity |
|---|---|---|
| 7.0 | | Distilled water |
| 6.5 | Walleye spawning inhibited | |
| 6.0 | | Pear juice |
| 5.8 | Lake trout spawning inhibited | |
| 5.5 | Smallmouth bass disappear | Spinach juice |
| 5.2 | Walleye, burbot, lake trout disappear | |
| 5.0 | Spawning inhibited in many fish | Carrot juice |
| 4.7 | Northern pike, white sucker, brown bullhead, | |

[138] Shaw, Byron, Mechenich, C. and Klessig, L. 1996. Understanding Lake Data. Publication RP-09-96-3M-275.

[139] Adapted from: Olszyk, D. 1980. Biological Effects of Acid Rain. Testimony, Wis. Public Service Commission Docket No. 05-EP-2. 5 pp.

| | | |
|---|---|---|
| | pumpkinseed sunfish, rock bass disappear | |
| 4.5 | Perch spawning inhibited | Beer |
| 3.5 | Perch disappear | |
| 3.0 | Toxic to all fish | |

It should be noted that ammonium hydroxide ($NH_4OH$) can form and cause low-level toxicity to fish if water pH is neutral to alkaline. The water quality standard for fish and aquatic life is 0.02 mg/L of $NH_4OH$. Ammonium hydroxide is a form of ammonia, which, in turn, is a form of nitrogen found in organic materials and many fertilizers. Ammonia is the first form of nitrogen released when organic matter decays. It can be used by most aquatic plants and is therefore an important nutrient. Depending on water temperature, ammonia can also rapidly convert to nitrate ($NO_3^-$) if oxygen is present.

## 4-7 ALKALINITY AND HARDNESS

Alkalinity (or hardness) is a measure of the amount of carbonates ($CO_3$), bicarbonates ($HCO_3$) and hydroxide (OH) present in the water. Therefore, a lake's alkalinity is affected by the types of minerals found within watershed soils and bedrock. Hardness and alkalinity increase 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 (Ca) and magnesium (Mg). 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 to precipitate out of the water. Marl appears as a white or gray accumulation on the lake bottom caused by the precipitation of calcium carbonate ($CaCO_3$). While marl deposits cause the gradual infilling of lakes, they also bind to phosphorus, resulting in lower algae populations and better water clarity than would otherwise be possible.

Hard water lakes, like Lake Ripley, tend to be more productive in terms of algal growth, 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. However, phosphorus precipitates with marl, thereby controlling the amount of this nutrient that is available for algal growth. 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.

Alkalinity is expressed as milligrams per liter (mg/L) of calcium carbonate ($CaCO_3$) per liter of water, or as microequivalents per liter (µeq/l). 20 µeq/l is equal to 1 mg/L of $CaCO_3$. Lake Ripley has high alkalinity that generally ranges from 160-260 mg/L $CaCO_3$, with a mean of 192 mg/L $CaCO_3$, and "low" sensitivity to acid rain due to its significant buffering capacity. It is further classified as a marl lake with "hard" to "very hard" water. Table 13 shows relative hardness levels for lakes with varying concentrations of calcium carbonate ($CaCO_3$), with typical values for Lake Ripley highlighted. Table 14 shows relative sensitivity levels of lakes to acid rain based on alkalinity values.

**Table 13: Categorization of hardness by mg/L of calcium carbonate ($CaCO_3$)**

| Level of Hardness | Total Hardness as mg/L $CaCO_3$ |
|---|---|
| Soft | 0-60 |
| Moderately hard | 61-120 |
| Hard | 121-180 |
| Very Hard | >180 |

**Table 14: Sensitivity of lakes to acid rain based on alkalinity values[140]**

| Sensitivity to Acid Rain | Alkalinity (mg/L $CaCO_3$) | Alkalinity (μeq/l $CaCO_3$) |
|---|---|---|
| High | 0-2 | 0-39 |
| Moderate | 2-10 | 40-199 |
| Low | 10-25 | 200-499 |
| Nonsensitive | >25 | >500 |

## 4-8 LAKE TROPHIC STATUS

Lakes are routinely characterized and evaluated according to their trophic status. Trophic status describes the level of nutrient enrichment (fertility) and primary productivity (plant and algal growth) in a lake. It is determined by assessing water clarity, phosphorus and chlorophyll-*a* data. Carlson's Trophic State Index (TSI) is a continuum scale of 0 to 100, corresponding with the clearest and most nutrient-poor lake possible, to the murkiest and presumably most nutrient-rich lake possible. Each major division of the scale (10, 20, 30, etc.) represents a doubling in algal biomass and decreased water clarity.

Lakes undergo a natural aging process, called eutrophication, as sedimentation and decay increase fertility and cause lakes to fill in over thousands of years. This process moves a lake's trophic status toward higher points along the index. As seen on Lake Ripley, human activities that increase the rate of nutrient enrichment can compress the eutrophication timeframe to only a few years or decades. This is called accelerated or cultural eutrophication. Water bodies that receive excessive amounts of nutrients (i.e. phosphorus) from their watersheds are most likely to become eutrophic, with a corresponding increase in the production of weeds and algae.

Lakes can be divided into four nutrient-enrichment categories: oligotrophic (TSI 0-40), mesotrophic (TSI 40-50), eutrophic (TSI 50-70) or hypereutrophic (TSI 70-100). Oligotrophic lakes are generally clear, deep and free of weeds or large algal blooms. They are low in nutrients, well oxygenated, and not capable of supporting large fish populations. However, these lakes often develop a food chain that can sustain a very desirable fishery with large game fish. Mesotrophic lakes lie between the oligotrophic and eutrophic stages. They have moderately clear water and may become devoid of oxygen in their bottom waters, causing phosphorus release from the sediment. 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

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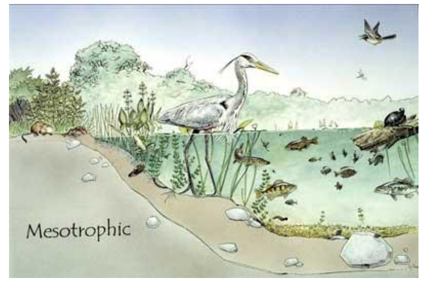
[140] Adapted from: Taylor, J. W. 1984. The Acid Test. *Natural Resources Magazine*. Wisconsin Department of Natural Resources. 40 pp.

to frequent algal blooms, or both.  Although capable of supporting large fish populations, these lakes are also more susceptible to oxygen depletion.  Rough fish like carp are commonly found in eutrophic lakes.  Finally, hypereutrophic lakes are those that are super-enriched with nutrients like phosphorus. These lakes experience heavy algal blooms throughout the summer, and may even experience fish kills.  Rough fish dominate in hypereutrophic lakes.  It is important to recognize that lakes can shift between trophic states.  This shift can be in a negative or positive direction, and would depend on watershed condition and level of management intervention.



**Under ideal water-quality scenarios, Lake Ripley would reflect mesotrophic characteristics. Source:  Wisconsin Lakes Partnership**

Lakes dominated by aquatic plants tend to have high amounts of phosphorus tied up in the bottom sediments, and relatively low phosphorus in the water column.  Conversely, lakes that produce mostly algae have high phosphorus concentrations in the water.  Most lakes have a fairly stable ratio of aquatic plants to algae.  TSI values represent the portion of nutrients (phosphorus) that are found in the water column, as evidenced by the amount of algal growth (chlorophyll-*a*). Therefore, if most of the available nutrients are held in the sediments of a lake with heavy plant growth, its true nutrient status cannot be accurately measured using TSI calculations.

Lake Ripley is best described as meso-eutrophic.  It fluctuates between mesotrophic and eutrophic conditions with a summer mean TSI of about 50.  A similar lake left undisturbed might be expected to maintain a TSI value near 40.  The trophic status of Wisconsin lakes based on chlorophyll-*a* concentration, water clarity (Secchi-disk transparency), and total phosphorus concentration is presented in Table 15 below.

**Table 15:  Trophic classification of Wisconsin lakes based on total phosphorus, chlorophyll-*a*, and Secchi depth values**[141]

| Trophic Class | Trophic State Index (TSI) | Total Phosphorus (µg/L) | Chlorophyll-*a* (µg/L) | Secchi Depth (ft) |
| --- | --- | --- | --- | --- |
| Hypereutrophic | 100 | | | |
| --------------------- | --------70---------- | --------96.0--------- | ------56.0------- | ---------1.6-------- |
| Eutrophic | | | | |
| --------------------- | --------50---------- | --------24.0--------- | --------7.3------- | ---------6.5-------- |
| Mesotrophic | | | | |
| --------------------- | --------40---------- | --------12.0--------- | --------2.6------- | --------13.1-------- |
| Oligotrophic | 0 | | | |

[141] Lillie, R.A., S. Graham and P. Rasmussen.  May 1993.  Trophic State Index Equations and Regional Predictive Equations for Wisconsin Lakes.  Wisconsin Department of Natural Resources.  Research Management Findings #35 technical bulletin.

## 4-9 PHOSPHORUS AS DRIVER OF ALGAL GROWTH

Phosphorus (P) and nitrogen (N) are the two essential nutrients that most directly influence aquatic plant and algal growth; the extent of which depends on the relative abundance and availability of each nutrient. These often problematic nutrients typically enter lakes in the form of polluted runoff that may contain eroded soil, manure, pet waste, chemical fertilizers and organic debris—among other material. The erosion of stream banks, construction sites, shorelines and farmland all contribute sediment and fertile runoff to downstream lakes. Failing septic systems around smaller, non-sewered lakes can also contribute to nutrient-loading problems.

Plants need phosphorus and nitrogen to grow. However, phosphorus reduction is often the focus of lake-rehabilitation programs because it is: (1) in short supply relative to other critical nutrients and therefore dictates the rate of algal 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 algal productivity by comparing the relative availability of each nutrient within the water column. 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 water surface is indicative of a lake that is phosphorus limited. 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 can be limited from time to time by either element, but by reducing phosphorus availability, this element can be made the limiting factor.

The limiting nutrient for algal growth in Lake Ripley is phosphorus. Typical N:P ratios in excess of 27:1 were measured during Water Resource Appraisal monitoring in 1993.[142] This is not surprising since phosphorus is the key nutrient affecting the amount of algal growth in the vast majority of Wisconsin's lakes. Sources of phosphorus to the lake include row-crop agriculture (70.3%), urban/residential areas (17.4%), pasture and mixed agriculture (5.5%), atmospheric deposition (4.1%), wetlands (1.8%), and forest (0.8%).[143] Groundwater and the lake bottom are also sources of phosphorus, but their relative contributions have not been fully quantified. Phosphorus is commonly released from nutrient-rich bottom sediment due to physical disturbance, high pH levels, or anoxic conditions. Algal blooms could then form, especially if the phosphorus is able to mix into the water column during the summer growing season.

Summer mean total phosphorus concentrations and associated TSI values from 1986-2009 are illustrated in Figures 33 and 34. Total phosphorus includes the amount of phosphorus in solution (reactive) and particulate form. Surface total phosphorus concentrations for Lake Ripley during the summer are generally indicative of a meso-eutrophic system, with average and median "summer mean" values of 20.3 µg/L and 18.8 µg/L, respectively. Most recorded values were clustered in the range of 10-25 µg/L, but with a relatively big spike in 1990 following a drought year when phosphorus recycling from anoxic sediments may have been a factor. It is actually much more typical for phosphorus concentrations to be higher during wet years (as evidenced in 1993 and 2008) and lower during drought years (as evidenced in 1988-89), demonstrating the

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[142] Wisconsin Department of Natural Resources, and Lake Ripley Management District. 1994. Lake Ripley Water Resources Appraisal.

[143] Wisconsin Lake Modeling Suite (WiLMS) analysis, Version 3.3.18.1

impacts of watershed nutrient sources on lake water quality.  No strong trend is evident toward increasing or decreasing phosphorus concentrations over the 23-year monitoring period.

When phosphorus concentrations exceed 20 µg/L at the time of spring turnover in natural lakes and impoundments, these water bodies may occasionally experience nuisance levels of algal growth.[144]  In hard water lakes like Lake Ripley, where limestone is dissolved in the water, marl (calcium carbonate) precipitates and falls to the lake bottom.  These marl formations absorb phosphorus, reducing its overall concentration in the water column as well as any related algal growth.  Hard water lakes often have clear water, but may be weedy since rooted aquatic plants can still get their required nutrients from the sediments.

[144] Shaw, Byron, Mechenich, C. and Klessig, L.  1996.  Understanding Lake Data.  Publication RP-09-96-3M-275.

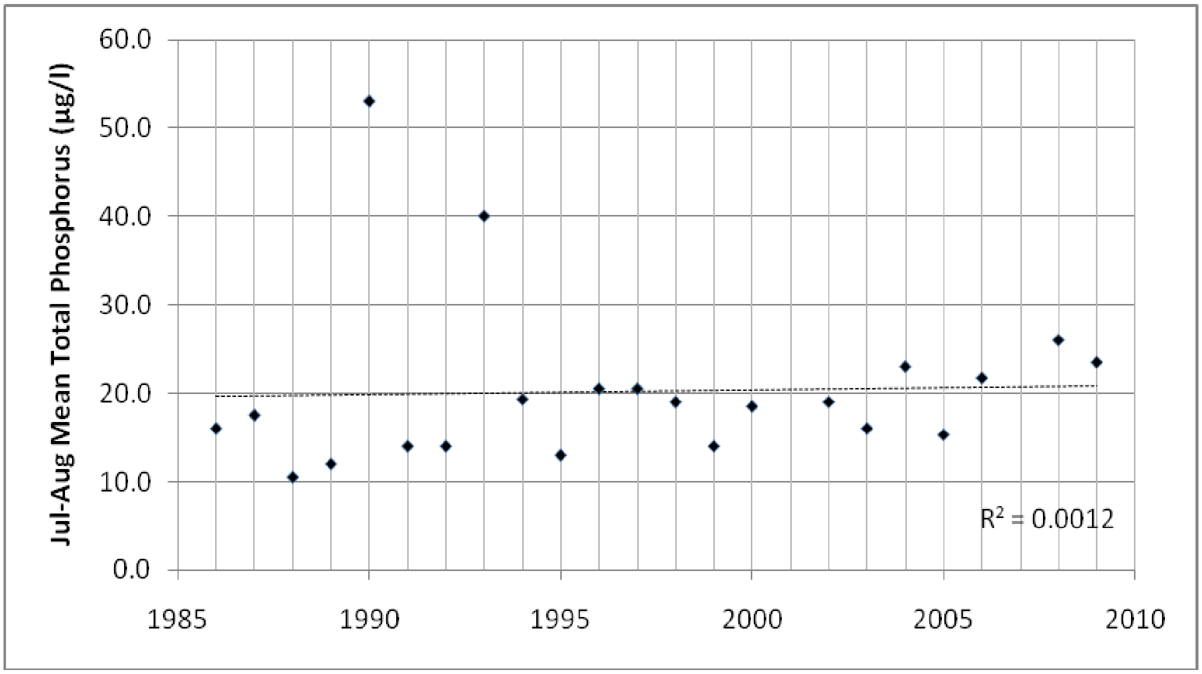



**Figure 33: July-August Mean Total Phosphorus Measurements (1986-2009)**

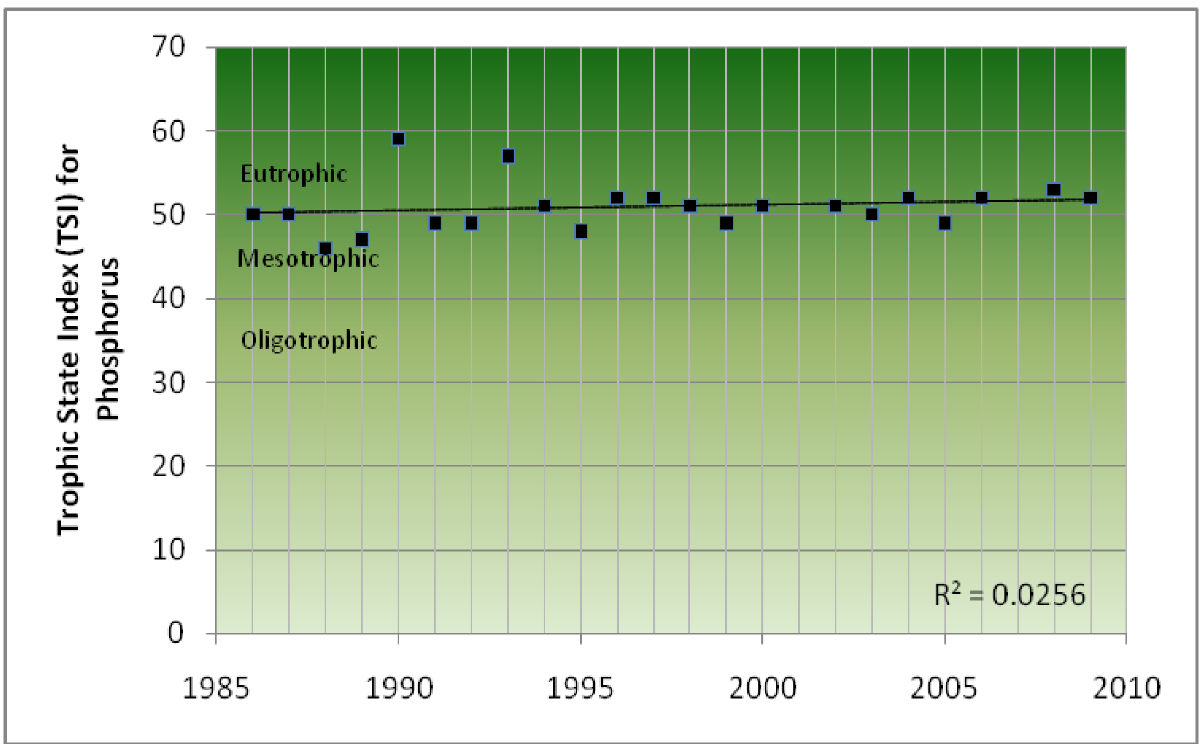



**Figure 34: TSI Based on Corresponding Total Phosphorus Readings (1986-2009)**

## 4-10 ALGAE

Algae are single-celled plants that occur either suspended in the water (phytoplankton) or attached to rocks and other surfaces (periphyton, or filamentous algae). Algae are the primary producers that form the base of the aquatic food chain. They are an essential part of the lake ecosystem, and provide food for most other lake organisms, including fish. The amount of sunlight and nutrients that are available in a lake, among other factors, will dictate algal abundance. Populations vary widely from day to day given their rapid growth and death rates.

A blue-green algal scum on the surface of a eutrophic lake. Source: Missouri DNR

In eutrophic lakes, high nutrient fertility can cause nuisance algal blooms that make the water appear green and murky. Blue green algae—which in actuality are a type of bacteria called cyanobacteria—are even known to produce a floating green scum thick enough to shade out aquatic plants and impair recreational use of the water. In fact, some blue-green algal blooms can release chemicals that are toxic to other organisms, including humans. High concentrations of wind-blown algae may accumulate on shorelines where they die and decompose, causing noxious odors, unsightly conditions and oxygen depletion.

Filamentous algae is often found attached to plants and rocks, especially in eutrophic lakes. Source: LakeLawnandPond.com

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

A supplementary "top-down" approach, called biomanipulation, uses food-web manipulations to help manage algae. By influencing predator-prey relationships, such as through the stocking of gamefish or removal of rough fish, conditions can be made more or less favorable for algal growth. For example, as the number of top predators (i.e., bass and walleye) increase, the number of planktivorous fish (i.e., bluegill and perch) should decrease, resulting in less predation on algae-consuming zooplankton. This, in turn, means higher populations of zooplankton that can graze on problem algae. Zooplankton populations can also be enhanced through the availability of sufficient plant cover where these tiny animals can escape fish predation.

However, too much plant cover can encourage the overpopulation of planktivorous fish, which can then overgraze on zooplankton and encourage greater algal growth.

Chlorophyll-*a*, the green pigment found in all photosynthesizing organisms, is commonly used as an indicator of algal biomass in lakes when sampled from the open water. Chlorophyll-*a* values for Lake Ripley during the summer months are generally indicative of a meso-eutrophic system, with average and median "summer mean" values of 8.6 μg/L and 7.8 μg/L, respectively. Chlorophyll-*a* concentrations and associated TSI values from 1986-2009 are illustrated in Figures 35 and 36 below. No strong trend is evident toward increasing or decreasing chlorophyll-*a* concentrations over the 23-year monitoring period.

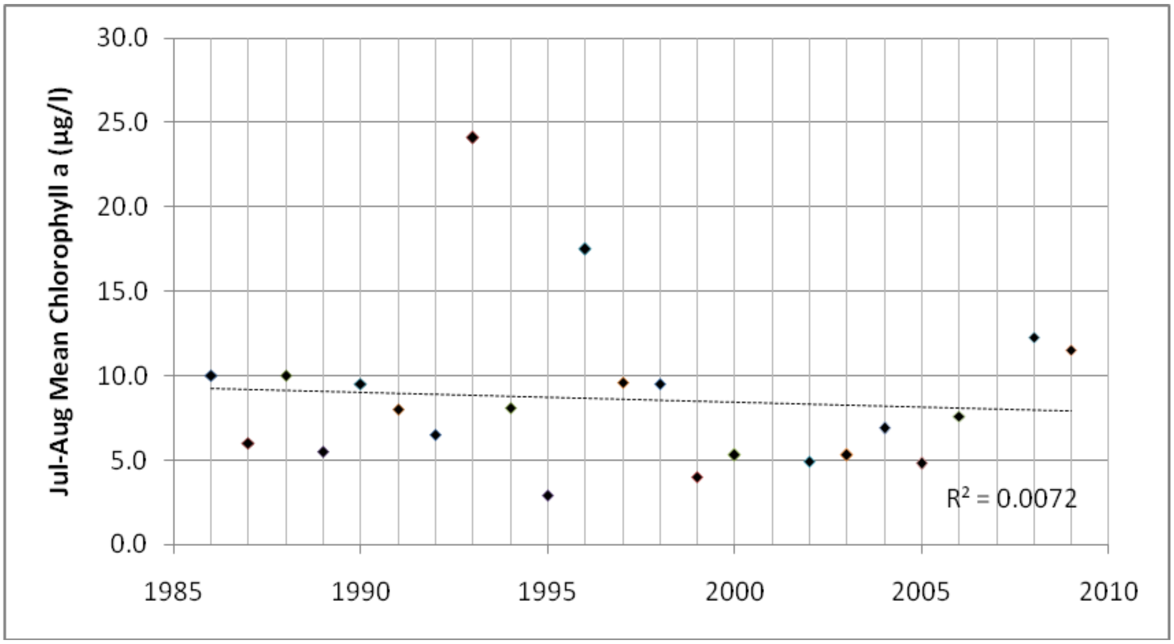



**Figure 35: Chlorophyll-*a* Measurements (1986-2009)**

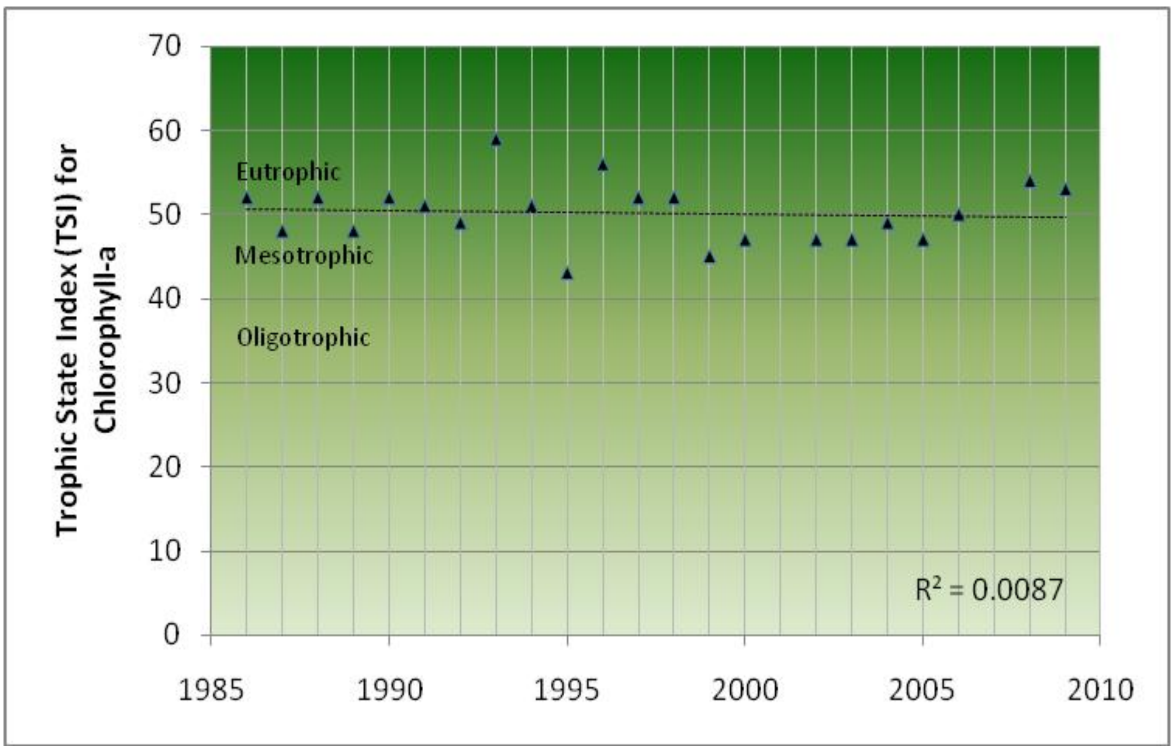



**Figure 36: TSI Based on Corresponding Chlorophyll-*a* Readings (1986-2009)**

## 4-11 WATER CLARITY

Clarity is only one facet of water quality, but it is an important one for both aesthetic and ecological reasons. People want to be able to observe fish, see to the bottom, and not have to think twice to swim with their eyes open. In fact, studies have shown that people are willing to pay a higher premium for properties located on clearer waterways (see Appendix C). Water clarity (also known as transparency) is necessary for the survival of many types of fish, submersed plants and other aquatic life. Clarity affects the ability of fish to find food, the depth to which plants can grow, and even the temperature and dissolved oxygen content of the water.

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. Clarity is generally highest after the spring thaw, reflecting a season of low productivity for algal populations, and lowest during peak algal production in the summer. Clarity is also usually lower during and shortly after busy boating weekends when sediment on the lake bottom gets stirred up, or after heavy rainfall washes muddy runoff into the lake. Since clarity can fluctuate over the course of a single day and for various reasons, frequent and long-term monitoring is needed for the purpose of assessing trends.

Generally, sunlight can penetrate to a depth equal to 1.7 times the Secchi depth. The depth to which light is able to penetrate defines the lakes's photic zone, and 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 algal 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.

Lake Ripley summer mean Secchi-depth measurements and associated TSI values from 1973-2009 are illustrated in Figures 37 and 38 below. Over this timeframe, individual Secchi measurements ranged from 2.5 to 9.5 feet during the July-August period, with average and median "summer mean" values of 6.0 and 5.8 feet, respectively. These values generally reflect a meso-eutrophic system, with an average TSI of 52. There appears to be a trend toward increasing water clarity conditions over the roughly 36-year monitoring period.

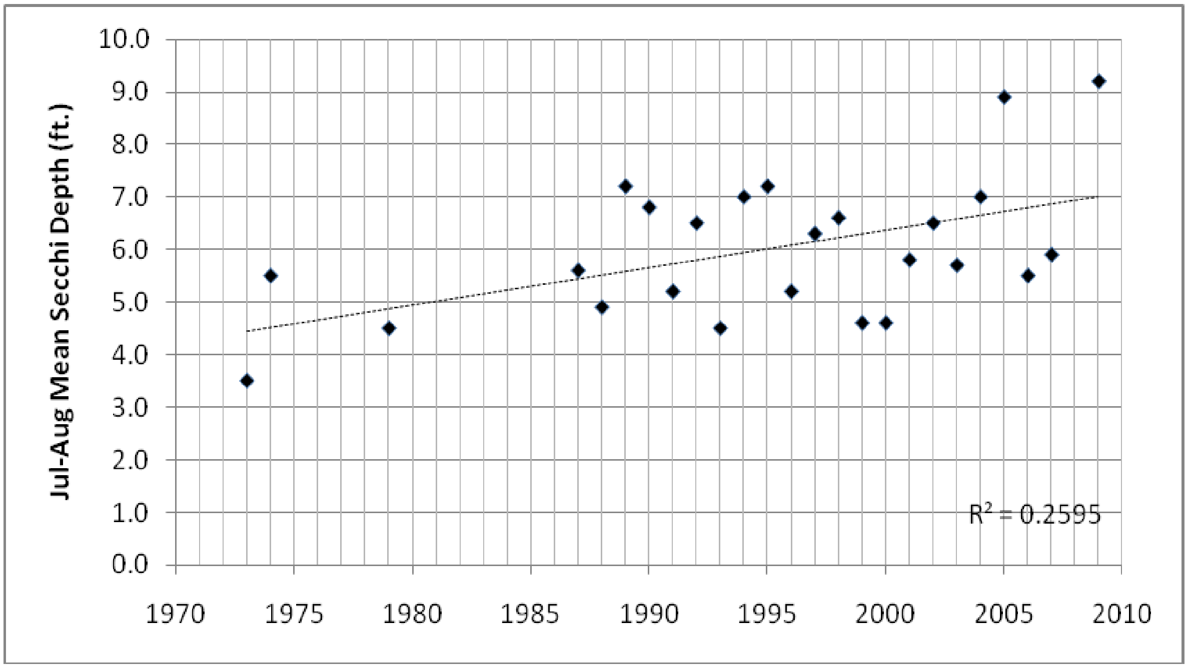



**Figure 37: Secchi Depth Measurements (1973-2009)**

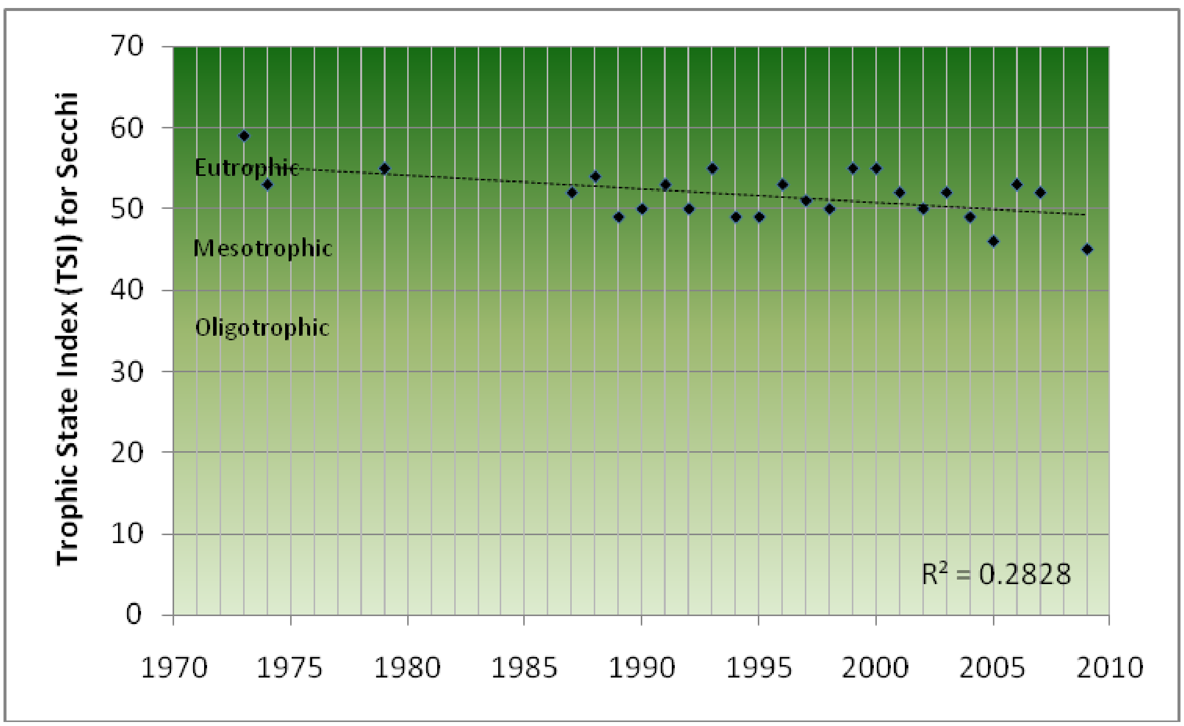



**Figure 38: TSI Based on Corresponding Secchi Depth Readings (1986-2009)**

Carlson's Trophic State Index is mostly intended as a predictor of algal biomass. Consequently, TSI for chlorophyll-*a* is a better predictor than either of the other two indices. However, useful insights can be gained by evaluating the interrelationships among all three indices, such as the identification of other environmental factors that may influence algal biomass. For example, when TSI for chlorophyll-*a* is greater than TSI for Secchi depth, large particulate algae may dominate in the lake. In contrast, when TSI for Secchi depth and total phosphorus are both greater than TSI for chlorophyll-*a*, light attenuation may be due to water color or turbidity, rather than algae. The interrelationships of the three indices are shown in Figure 39 below. The data plot suggests that large-particulate algae likely dominated in 1990, 1993, 1994, 1996, 1998 and 2009, while suspended sediment may have played a dominant role in 1987, 1995, 1999, 2000, 2002, 2003 and 2006.

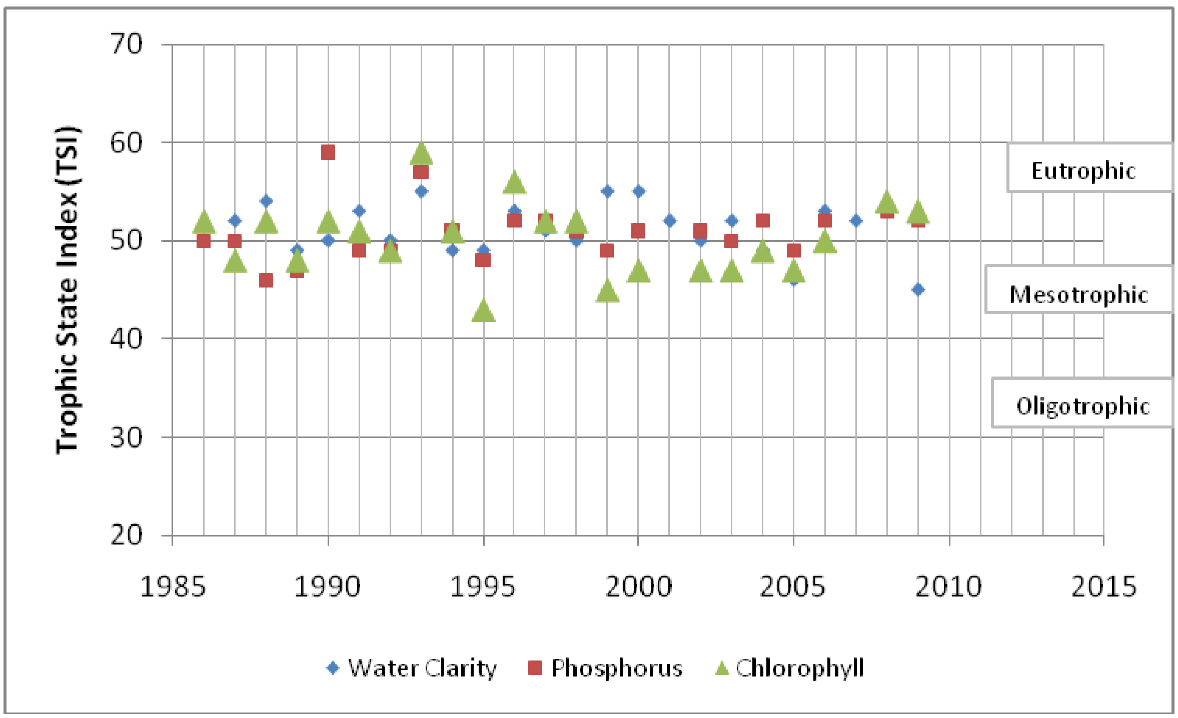



**Figure 39: TSI Chart of Combined Secchi Depth, Total Phosphorus and Chlorophyll-*a* Readings (1986-2009)**

## 4-12 WATER QUALITY INDEX

Lillie and Mason (1983) classified all Wisconsin lakes using a random data set collected in the months of July and August.[145] 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, total-phosphorus and chlorophyll-*a* concentrations were on average indicative of "good" water quality, while Secchi depths were on average indicative of "fair"

[145] Lillie, Richard A., and John W. Mason. 1983. Limnological Characteristics of Wisconsin Lakes. Wisconsin Department of Natural Resources. Technical Bulletin No. 138.

water quality. Table 16 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.

**Table 16: Water quality index for Wisconsin lakes based on total phosphorus, chlorophyll-*a* and Secchi depth values**

| Water Quality Index | Total Phosphorus (µg/L) | Chlorophyll-*a* (µg/L) | Secchi Depth (ft) |
|---|---|---|---|
| Excellent | <1.0 | <1.0 | >20.0 |
| Very good | 1.0-10.0 | 1.0-5.0 | 10.0-20.0 |
| Good | 10.0-30.0 | 5.0-10.0 | 6.5-10.0 |
| Fair | 30.0-50.0 | 10.0-15.0 | 5.0-6.5 |
| Poor | 50.0-150.0 | 15.0-30.0 | 3.3-5.0 |
| Very poor | >150.0 | >30.0 | <3.3 |

A number of biotic indices can also be used to make snapshot evaluations of localized water quality conditions. The lake's aquatic plants, fish and benthic macroinvertebrates (insects, insect larvae, crustaceans, snails and mussels living on the bottom) are excellent indicators of lake health. While some species are adaptable to a range of water quality conditions, others will only be present under the most favorable conditions due to varying sensitivities to pollution. For example, macroinvertebrate species that require good water quality include waterpenny beetle larva, mayfly nymph, gilled snail, caddis fly larva, stonefly nymph, dragonfly nymph, scud, panaria (flatworm), and various mussels. Conversely, those that can tolerate poor water quality include leech, midge larva, black fly larva, horsehair worm, and mosquito larva.

## 4-13 BACTERIA

High E. coli (*Escherichia coli*) bacteria counts are commonly used as an indicator of beach contamination, as they may be associated with the presence of dangerous pathogens. In addition, some strains of the bacteria can cause gastrointestinal illnesses in humans. E. coli are found in the intestines of warm-blooded animals, but can appear where untreated sewage, pet waste, cow manure and goose droppings enter waterways. Evidence also indicates that this type of bacteria does not always come from harmful, land-based sources, but can be naturally present in beach environments. Consequently, samples taken on windy days or after heavy beach use can lead to high bacteria counts due to sediment disturbance.

The Jefferson County Health Department monitors the Ripley Park beach for bacteria on a weekly basis throughout the summer. When advisory levels set by the U.S. Environmental Protection Agency are reached (235 colony forming units per 100 m/l), the health department notifies the beach manager. The beach manager may then post warning signs or can decide to temporarily close the beach. Beach closings are generally recommended when bacteria levels exceed 1,000 cfu per 100 m/l. Table 17 lists bacteria levels documented at the Lake Ripley Park beach over the last three years. Since point sources for bacterial contamination have not been identified, readings that exceed advisory levels may be the result of geese activity or high runoff events that can wash pet waste, manure and other nonpoint source pollutants into the lake.

### Table 17: Lake Ripley Beach E. coli bacterial counts[146]

| Date and Time | E Coli Value | E Coli Units |
|---|---|---|
| 08/24/2009 12:55 | 22 | PER 100 ML |
| 08/17/2009 10:40 | 222 | PER 100 ML |
| 08/11/2009 13:00 | 2400 | PER 100 ML |
| 08/04/2009 11:45 | 1 | PER 100 ML |
| 07/31/2009 11:30 | 184.2 | PER 100 ML |
| 07/24/2009 11:15 | 276 | PER 100 ML |
| 07/14/2009 11:45 | 61 | PER 100 ML |
| 07/08/2009 11:20 | 38 | PER 100 ML |
| 07/02/2009 13:35 | 276 | PER 100 ML |
| 06/29/2009 13:15 | 649 | PER 100 ML |
| 06/26/2009 11:43 | 2419 | PER 100 ML |
| 06/16/2009 10:50 | 83.9 | PER 100 ML |
| 06/09/2009 11:00 | 16 | PER 100 ML |
| 06/04/2009 10:55 | 1 | PER 100 ML |
| 08/28/2008 10:20 | 5.1 | PER 100 ML |
| 08/19/2008 10:55 | 1 | PER 100 ML |
| 08/12/2008 10:25 | 39 | PER 100 ML |
| 08/05/2008 11:23 | 290 | PER 100 ML |
| 07/30/2008 11:08 | 80 | PER 100 ML |
| 07/22/2008 11:26 | 96 | PER 100 ML |
| 07/14/2008 11:09 | 27 | PER 100 ML |
| 07/10/2008 12:17 | 210 | PER 100 ML |
| 07/03/2008 10:20 | 49.5 | PER 100 ML |
| 06/23/2008 10:18 | 58 | PER 100 ML |
| 06/04/2008 11:03 | 1 | PER 100 ML |
| 08/28/2007 11:50 | 2419 | PER 100 ML |
| 08/21/2007 10:41 | 32 | PER 100 ML |
| 08/14/2007 11:15 | 88 | PER 100 ML |
| 08/07/2007 10:45 | 1986.3 | PER 100 ML |
| 07/31/2007 06:30 | 410 | MPN |
| 07/30/2007 11:57 | 980 | PER 100 ML |
| 07/25/2007 10:10 | 1050 | PER 100 ML |
| 07/18/2007 10:45 | 220 | PER 100 ML |
| 07/12/2007 12:43 | 2400 | PER 100 ML |
| 07/05/2007 12:40 | 6 | PER 100 ML |
| 06/29/2007 11:28 | 75 | PER 100 ML |
| 06/22/2007 10:22 | 1203.3 | PER 100 ML |
| 06/12/2007 11:07 | 20 | MPN |
| 06/07/2007 13:30 | 613 | MPN |

[146] Jefferson County Health Department online records (www.wibeaches.us)

# -5-
# AQUATIC PLANTS

*"A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise."*

-- Aldo Leopold, Wisconsin conservationist and author

## 5-1 INTRODUCTION

The state of Wisconsin, through Section 23.24 of the Wisconsin Statutes, encourages the development of aquatic plant management (APM) plans to promote the long-term sustainability of lakes. An approved APM plan is also a prerequisite for obtaining various state grants and permit approvals, including those related to controlling nuisance weed growth through mechanical harvesting and lake-wide herbicide applications.

**Submersed aquatic plants seen growing just below the surface in Lake Ripley's shallow South Bay.**

This chapter is designed to guide the District in its efforts to control nuisance weed growth while protecting beneficial plant communities that contribute to good water quality and optimal habitat conditions. A 2007 Lake District opinion survey revealed that respondents generally perceived aquatic weed growth to be slightly excessive in certain areas of the lake, but with wide-ranging opinions on the subject. The survey results also showed strong preferences for maintaining a healthy aquatic plant community and an abundance of fish and wildlife habitat.

This chapter is further intended to document past and present plant conditions, identify trends, and outline the most cost-effective strategies for addressing plant-related challenges and opportunities. It is meant to provide a framework for future management action, with the flexibility to adjust to inter-annual variability in the aquatic plant community.

## 5-2 VALUE AND ROLE OF AQUATIC PLANTS

A thriving and diverse native plant community is the foundation of a healthy and high-functioning lake ecosystem. Aquatic plants are vital for maintaining ideal water quality and habitat conditions. Plants keep algae in check by influencing nutrient dynamics, cover and stabilize lake-bottom sediment, protect against shoreline erosion, oxygenate the water during photosynthesis, provide cover and spawning sites for fish, create shelter for zooplankton (algae grazers), and serve as food sources for waterfowl and other wildlife.

The relative abundance, distribution and types of rooted aquatic plants (also called macrophytes) can be used as an indicator of lake quality. Ideally, healthy lakes will have at least moderate levels of native plant growth that is characterized by high species diversity. Evidence of lake-wide degradation or localized disturbance can include too much or too little aquatic vegetation, or if the plant community becomes increasingly dominated by non-native, invasive “weeds.” Disturbances can come in many forms, including polluted runoff and sedimentation, propeller damage from motor boats, sun-blocking algal blooms, and the over-harvesting or eradication of beneficial plant beds.

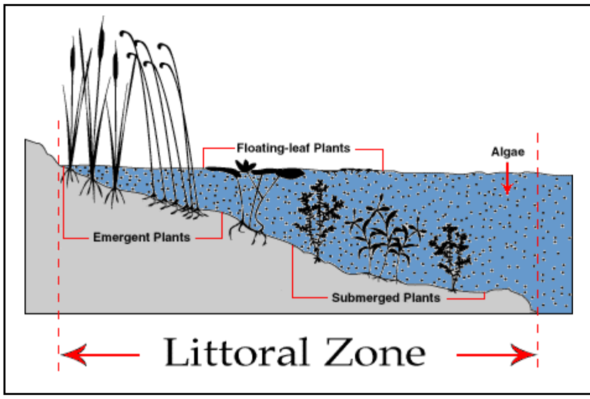
An absence of vegetation and associated habitat can lead to declines in native fish and wildlife, while favoring more tolerant “rough fish” like carp. It can also lead to increased algal blooms and higher turbidity, resulting in a loss of water clarity that is likely to further suppress plant growth. This higher algal growth and turbidity is generally the result of multiple factors, including the increased re-suspension of unanchored lake-bottom sediment, and a reduction in vegetative-induced trapping and settling of suspended particulate matter. However, it is important to note that rooted plants (macrophytes) derive most of their phosphorus requirements from the sediment, whereas algae (phytoplankton) absorb phosphorus from the surrounding waters. Therefore, macrophytes and phytoplankton do not compete for nutrients through their normal growth cycles as much as might be expected.[147]

A different set of problems occurs when non-indigenous aquatic weeds gain dominance and become overly abundant. This situation can create single-species monocultures of low habitat value, impede recreational use of the water, stunt fish growth, and contribute to dramatic fluctuations in dissolved oxygen levels that can stress aquatic life. Aside from depleting the water of life-sustaining oxygen, the decomposition of excessive plant biomass can, in turn, contribute to late-season algal blooms. The algae thrive on the release of nutrients that were previously tied up in the living plant tissues. It is well accepted that maintaining native plant beds is an effective line of defense against the spread of non-native, nuisance species.

## 5-3 EXTENT OF PLANT GROWTH

Aquatic plant abundance and plant-community composition are affected by a host of environmental variables. These include the depth and clarity of water and the type of lakebed substrate. Plant growth is most prevalent in shallow lakes with nutrient-rich bottom sediments and extensive littoral zones. The littoral zone is the shallow, biologically-productive portion of a lake that is able to support rooted plant growth (see Figure 40). 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. Clear and uniformly shallow lakes will have the most extensive littoral areas. However, deeper lakes that have irregular shorelines with lots of small bays and narrow channels may also support expansive littoral zones.

[147] Loucks, O.L. 1981. The littoral zone as a wetland and its contribution to water quality. In Selected proceedings of the Midwest conference on wetland values and management, ed. B. Richardson, pp. 125-138. St. Paul, MN: Minnesota Water Planning Board.



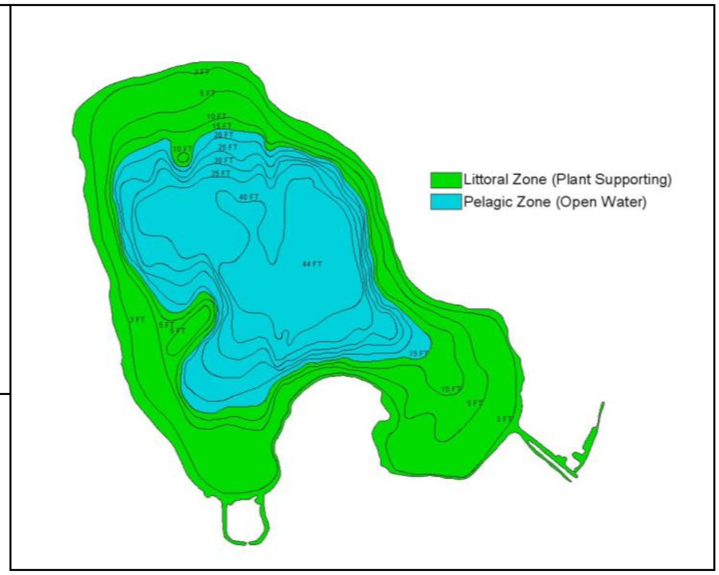




**Figure 40: Lake Ripley's Littoral Zone**

Lake Ripley's summer (July-August) water clarity has ranged from 2.5 to 9.5 feet during the 1973-2007 period of record, with an average summer mean clarity of 5.9 feet. Sunlight can typically penetrate the water column to a depth of 1.7 times the Secchi depth (called the photic zone). Rooted aquatic plant growth usually occurs in areas where the lake bottom intersects the photic zone, which can vary each year depending on prevailing water clarity conditions. Lake Ripley has a littoral zone that generally extends down to about 15 feet, covering about 54% of the lake in terms of surface area.

Lake Ripley's littoral areas support a variety of flora and fauna, including some rare, threatened and endangered species. Some of these species were discovered during a 1994 survey, and include the giant carrion beetle (*Nicrophorus americanus*), least darter (*Etheostoma microperca*), lake chubsucker (*Erimyzon sucetta*), cuckoo flower (*Cardamine pratensis*), pugnose shiner (*Notropis anogenus*) and blanding's turtle (*Emydoidea blandingi*).[148] Shoreline development, stormwater pollution, and habitat loss threaten such sensitive species. These species rely on good water quality, functioning wetlands and a diverse aquatic plant community for their survival.

## 5-4 OVERVIEW OF PLANT COMMUNITY

Lake Ripley can be described as a shallow lake when viewed in the context of its littoral area. As mentioned earlier, rooted aquatic plant growth is generally found in 0-15-ft. water depths, covering over half the lake's surface area. The most recent aquatic plant inventory, completed in 2006, documented 31 different species of plants found growing in and around the lake. Most of these species are native and provide excellent habitat for fish and other aquatic life.

[148] Wisconsin Department of Natural Resources, and Lake Ripley Management District. 1994. Lake Ripley Water Resources Appraisal.

Examples of high value plants include water lilies, bulrushes and native pondweeds. The major concentrations of aquatic plants are found covering the bottom of both bays, with species like pondweeds (*Potamogeton* sp.), water celery (*Vallisneria americana*), muskgrass (*Chara vulgaris*) and spiny naiad (*Najas marina*) found distributed throughout the lake. In addition to rooted plants, there are also free-floating duckweed, filamentous algae and planktonic algae in the lake.

Eurasian watermilfoil (*Myriophyllum spicatum*), which is common in Lake Ripley, is one of two nuisance species found in the lake that are not native to Wisconsin. The other is curly-leaf pondweed (*Potamogeton crispus*), but this species continues to represent a small fraction of the overall plant community. It is unknown how or when these common lake weeds were first introduced to Lake Ripley. They were first documented in 1976 when the lake's first comprehensive plant inventory was conducted. General problems related to plant growth, however, were reported as early as 1961.[149] Under the right conditions, non-native weeds can pose a problem by out-competing native plants and forming monotypic stands of dense vegetation. Such prolific growth can eventually reduce biological diversity and restrict recreational use of the water.

The infestation and rapid proliferation of Eurasian watermilfoil was among the initial driving forces behind the establishment of the Lake Ripley Management District in 1991. Two years earlier, peak milfoil growth reduced the lake's useable surface area by roughly 40%, contributing to user conflicts and increasing the potential for boating hazards within the remaining 60%.[150] Since 1991, the prevalence of Eurasian watermilfoil in the lake has declined precipitously. This trend is likely the combined result of an ongoing mechanical harvesting program, continued efforts to reduce sediment and nutrient loading into the lake, slow-no-wake protections that limit lakebed disturbances, and the cyclical nature of invading milfoil populations.

## 5-5 RESULTS OF PAST INVENTORIES

Comprehensive inventories of Lake Ripley's aquatic plant community were conducted in 1976, 1989, 1991, 1996, 2001 and 2006. The 1989-2001 inventories involved sampling along the same 15 transects, with the 2001 inventory incorporating an additional eight transects in an attempt to better characterize the plant community. The original 1976 inventory was based upon significantly different transects and sampling methodology, making it less suitable for year-to-year comparisons. The most recent 2006 inventory employed the point-intercept method, representing the latest sampling methodology utilized by the Wisconsin DNR. The only other documented aquatic plant survey of Lake Ripley was performed in 1953, but it cannot be considered comprehensive since only six dominant species were studied.

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[149] Burris, John E. 1971. A Study of Man's Effects on Lake Ripley. University of Wisconsin-Madison. Zoology 518 Report.
[150] Wisconsin Department of Natural Resources. 1990. Aquatic Plant Control Reconnaissance Report for Lake Ripley.

Findings from prior inventories were used to develop aquatic plant management plans in 1992 and 2001. These earlier plans were used to assess the health of the aquatic plant community, evaluate long-term trends, and set forth recommendations for future management. The 1992 plan was authored by the Wisconsin DNR.[151] It was used for several years to help guide mechanical weed-harvesting activities, and was significantly expanded and updated by the District in 2001.[152] The current plan builds upon these earlier efforts, namely by incorporating findings and analysis from the 2006 inventory.

The following is an abbreviated summary of inventory findings from prior years. Statistical summaries from each inventory are presented for 14 aquatic plant species. Statistical measures for each species consist of frequency of occurrence, average density, relative frequency of occurrence, and importance value. Each of these measures is defined below.

***Frequency of occurrence*** is the number of occurrences of a species divided by the number of sampling points within the defined littoral zone. It is the percentage of times a particular species occurred within areas capable of supporting plant growth. This measure is used to describe how widely distributed a particular species is found throughout the lake's littoral zone.

***Relative frequency of occurrence*** is derived by dividing a particular species' frequency of occurrence by the sum total frequency of all species inventoried. The sum of the relative frequencies is equal to 100% when all documented species are included. This measure provides an indication of how the plants occur throughout the lake in relation to each other.

***Average density*** is the sum of the density ratings for a species divided by the number of sampling points where vegetation was found. Density ratings are based on a 1-4 rake-fullness scale for the 1989-2001 transect surveys, and a 1-3 rake-fullness scale for the 2006 point-intercept survey. This measure provides an indication of how abundant the growth of a particular plant is throughout the lake.

***Importance value*** is the product of the relative frequency and the average density, and is expressed as a percentage. This measure provides an indication of the dominance of a species within a community, and is based on both frequency and density values. It also somewhat addresses the challenge of comparing plants that have different physical statures.

**1953**

A limited survey was performed to monitor seasonal changes of six dominant species, consisting of muskgrass (*Chara contraria*), bushy pondweed (*Najas flexilis*), Illinois pondweed (*Potamogeton illinoensis*), sago pondweed (*Potamogeton pectinatus*), water celery (*Vallisneria americana*), and Fries' pondweed (*Potamogeton friesii*). Summary results are not presented due to the limited scope and narrow focus of this early survey.

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[151] Wisconsin Department of Natural Resources. 1992. Lake Ripley Aquatic Plant Management Plan.
[152] Lake Ripley Management District. 2002. Lake Ripley Aquatic Plant Inventory and Management Plan.

## 1976

The first comprehensive plant survey was conducted on Lake Ripley. A total of 11 species of aquatic plants were reported, including two unidentified *Potamogeton* and *Naiad* species. Muskgrass (*Chara vulgaris*) and water celery (*Vallisneria americana*) were the dominant species reported. Eurasian watermilfoil (*Myriophyllum spicatum*), coontail (*Ceratophyllum demersum*) and sago pondweed (*Potamogeton pectinatus*) were also frequently observed in the aquatic plant community at this time. Table 18 presents a list of plant species and statistical relationships from the 1976 inventory.

**Table 18: 1976 plant inventory findings**

| Species | Frequency of Occurrence (%) | Average Density (1-4 scale) | Relative Frequency | Importance Value |
|---|---|---|---|---|
| Ceratophyllum demersum (coontail) | 20.6 | - - | 9.6 | - - |
| Chara vulgaris (musk grass) | 69.1 | - - | 32.2 | - - |
| Elodea candensis (waterweed) | 2.9 | - - | 1.4 | - - |
| Heteranthera dubia (water star grass) | 0.0 | - - | 0.0 | - - |
| Myriophyllum spicatum (Eurasian watermilfoil) | 27.9 | - - | 13.0 | - - |
| Najas flexilis (bushy pondweed) | 0.0 | - - | 0.0 | - - |
| Najas marina (spiny naiad) | 0.0 | - - | 0.0 | - - |
| Potamogeton gramineus (variable pondweed) | 0.0 | - - | 0.0 | - - |
| Potamogeton crispus (curly-leaf pondweed) | 1.5 | - - | 0.7 | - - |
| Potamogeton pectinatus (Sago pondweed) | 17.6 | - - | 8.2 | - - |
| Potamogeton natans (floating-leaf pondweed) | 14.7 | - - | 6.8 | - - |
| Potamogeton zosteriformis (flat-stem pondweed) | 0.0 | - - | 0.0 | - - |
| Utricularia sp. (bladderwort) | 8.8 | - - | 4.1 | - - |
| Vallisneria americana (water celery) | 36.8 | - - | 17.1 | - - |

## 1989

This survey reported 12 species of aquatic plants. Eurasian watermilfoil (*Myriophyllum spicatum*) was by far the most abundant and frequently observed plant, with Illinois pondweed (*Potamogeton illinoensis*), small pondweed (*Potamogeton pusillis*) and spiny naiad (*Najas marina*) also commonly represented. Eurasian watermilfoil was observed throughout the lake and at all depths sampled. Plant growth was generally present down to a depth of about 15 feet, with no growth reported from depths in excess of 18 feet. Subsequent surveys revealed similar findings in relation to the depth of plant growth. Table 19 presents a list of plant species and statistical relationships from the 1989 inventory.

**Table 19: 1989 plant inventory findings**

| Species | Frequency of Occurrence (%) | Average Density (1-4 scale) | Relative Frequency | Importance Value |
|---|---|---|---|---|
| Ceratophyllum demersum (coontail) | 5.0 | 3.0 | 2.5 | 8 |
| Chara vulgaris (musk grass) | 11.7 | 1.3 | 5.8 | 8 |
| Elodea candensis (waterweed) | 0.0 | - - | 0.0 | - - |
| Heteranthera dubia (water star grass) | 0.0 | - - | 0.0 | - - |
| Myriophyllum spicatum (Eurasian watermilfoil) | 75.0 | 2.8 | 37.5 | 105 |
| Najas flexilis (bushy pondweed) | 11.7 | 1.1 | 5.8 | 7 |

| | | | | |
|---|---|---|---|---|
| Najas marina (spiny naiad) | 18.3 | 1.0 | 9.2 | 18 |
| Potamogeton gramineus (variable pondweed) | 3.3 | 1.0 | 1.7 | 2 |
| Potamogeton crispus (curly-leaf pondweed) | 1.7 | 1.0 | 0.8 | 8 |
| Potamogeton pectinatus (Sago pondweed) | 5.0 | 1.0 | 2.5 | 7 |
| Potamogeton natans (floating-leaf pondweed) | 13.3 | 1.1 | 6.7 | 8 |
| Potamogeton zosteriformis (flat-stem pondweed) | 0.0 | - - | 0.0 | - - |
| Utricularia sp. (bladderwort) | 0.0 | - - | 0.0 | - - |
| Vallisneria americana (water celery) | 11.7 | 1.6 | 5.8 | 9 |

## 1991

Eleven (11) aquatic plant species were documented in the survey, including one unidentified *Potamogeton* species. Eurasian watermilfoil (*Myriophyllum spicatum*) was again the most abundant and frequently observed plant, followed by spiny naiad (*Najas marina*), coontail (*Ceratophyllum demersum*), muskgrass (*Chara vulgaris*) and sago pondweed (*Potamogeton pectinatus*). Eurasian watermilfoil was less prevalent compared to the 1989 survey, although the weed continued to be reported at all depths sampled. Table 20 presents a list of plant species and statistical relationships from the 1991 inventory.

**Table 20: 1991 plant inventory findings**

| Species | Frequency of Occurrence (%) | Average Density (1-4 scale) | Relative Frequency | Importance Value |
|---|---|---|---|---|
| Ceratophyllum demersum (coontail) | 21.1 | 2.5 | 11.9 | 30 |
| Chara vulgaris (musk grass) | 20.0 | 2.3 | 11.3 | 26 |
| Elodea candensis (waterweed) | 2.2 | 1.0 | 1.3 | 1 |
| Heteranthera dubia (water star grass) | 0.0 | - - | 0.0 | - - |
| Myriophyllum spicatum (Eurasian watermilfoil) | 53.3 | 3.0 | 30.0 | 89 |
| Najas flexilis (bushy pondweed) | 13.3 | 2.6 | 5.0 | 13 |
| Najas marina (spiny naiad) | 41.1 | 2.5 | 23.1 | 58 |
| Potamogeton gramineus (variable pondweed) | 0.0 | - - | 0.0 | - - |
| Potamogeton crispus (curly-leaf pondweed) | 0.0 | - - | 0.0 | - - |
| Potamogeton pectinatus (Sago pondweed) | 13.3 | 2.3 | 7.5 | 18 |
| Potamogeton natans (floating-leaf pondweed) | 0.0 | - - | 0.0 | - - |
| Potamogeton zosteriformis (flat-stem pondweed) | 0.0 | - - | 0.0 | - - |
| Utricularia sp. (bladderwort) | 2.2 | 1.5 | 1.3 | 2 |
| Vallisneria americana (water celery) | 7.8 | 1.6 | 4.4 | 7 |

## 1996

A total of 12 aquatic plant species were documented in the survey, including one unidentified *Potamogeton* species. Eurasian watermilfoil (*Myriophyllum spicatum*) continued to be among the more dominant species, but remained less widespread compared to earlier surveys. Other dominant species included spiny naiad (*Najas marina*), muskgrass (*Chara vulgaris*), coontail (*Ceratophyllum demersum*) and sago pondweed (*Potamogeton pectinatus*). Greater uniformity of plant growth was observed among the several dominant species in relation to prior surveys. Table 21 presents a list of plant species and statistical relationships from the 1996 inventory.

**Table 21: 1996 plant inventory findings**

| Species | Frequency of Occurrence (%) | Average Density (1-4 scale) | Relative Frequency | Importance Value |
|---|---|---|---|---|
| Ceratophyllum demersum (coontail) | 23.3 | 1.9 | 10.8 | 21 |
| Chara vulgaris (musk grass) | 25.6 | 2.2 | 11.9 | 26 |
| Elodea candensis (waterweed) | 1.1 | 1.0 | 0.5 | 1 |
| Heteranthera dubia (water star grass) | 0.0 | - - | 0.0 | - - |
| Myriophyllum spicatum (Eurasian watermilfoil) | 58.9 | 2.6 | 27.3 | 70 |
| Najas flexilis (bushy pondweed) | 12.2 | 2.2 | 5.7 | 12 |
| Najas marina (spiny naiad) | 51.1 | 2.3 | 23.7 | 54 |
| Potamogeton gramineus (variable pondweed) | 0.0 | - - | 0.0 | - - |
| Potamogeton crispus (curly-leaf pondweed) | 0.0 | - - | 0.0 | - - |
| Potamogeton pectinatus (Sago pondweed) | 20.0 | 2.0 | 9.3 | 19 |
| Potamogeton natans (floating-leaf pondweed) | 0.0 | - - | 0.0 | - - |
| Potamogeton zosteriformis (flat-stem pondweed) | 0.0 | - - | 0.0 | - - |
| Utricularia sp. (bladderwort) | 2.2 | 1.5 | 1.5 | 2 |
| Vallisneria americana (water celery) | 11.1 | 1.4 | 1.4 | 7 |

## 2001

Fifteen (15) species of aquatic plants were reported, including a large stand of water bulrush (*Scirpus subterminalis*) observed growing on the northeastern shore. Muskgrass (*Chara vulgaris*) was slightly more frequently observed in the samples compared to Eurasian watermilfoil (*Myriophyllum spicatum*). Spiny naiad (*Najas marina*), water celery (*Vallisneria americana*), sago pondweed (*Potamogeton pectinatus*) and bushy pondweed (*Najas flexilis*) were the next most frequently observed plants. Eurasian watermilfoil continued to be observed throughout the lake, but overall plant diversity and uniformity of growth continued to increase. Plant growth was mostly concentrated in those areas where water depth was less than 12 feet. Table 22 presents a list of plant species and statistical relationships from the 2001 inventory.

**Table 22: 2001 plant inventory findings**

| Species | Frequency of Occurrence (%) | Average Density (1-4 scale) | Relative Frequency | Importance Value |
|---|---|---|---|---|
| Ceratophyllum demersum (coontail) | 5.6 | 3.4 | 2.4 | 8 |
| Chara vulgaris (musk grass) | 50.0 | 3.0 | 21.5 | 66 |
| Elodea candensis (waterweed) | 3.3 | 1.3 | 1.4 | 2 |
| Heteranthera dubia (water star grass) | 3.3 | 3.0 | 1.4 | 4 |
| Myriophyllum spicatum (Eurasian watermilfoil) | 45.6 | 2.1 | 19.6 | 42 |
| Najas flexilis (bushy pondweed) | 14.4 | 1.9 | 6.2 | 12 |
| Najas marina (spiny naiad) | 38.9 | 2.4 | 16.7 | 41 |
| Potamogeton gramineus (variable pondweed) | 8.9 | 1.5 | 3.8 | 6 |
| Potamogeton crispus (curly-leaf pondweed) | 1.1 | 1.0 | 0.5 | 0 |
| Potamogeton pectinatus (Sago pondweed) | 22.2 | 2.0 | 9.6 | 19 |
| Potamogeton natans (floating-leaf pondweed) | 1.1 | 1.0 | 0.5 | 0 |
| Potamogeton zosteriformis (flat-stem pondweed) | 13.3 | 2.2 | 5.7 | 13 |
| Utricularia sp. (bladderwort) | 1.1 | 1.0 | 0.5 | 0 |
| Vallisneria americana (water celery) | 23.3 | 2.0 | 10.0 | 20 |

## 2006

This survey employed the point-intercept method in accordance with Wisconsin DNR's revised protocols. This represents a change from previous surveys where the Jessen and Lound transect-sampling technique was used.[153] By 2006, the reported number of aquatic plant species had jumped from a previous low of 11 to a high of 19. (This number increases to 31 species if visual observations from a follow-up boat survey are included). Muskgrass (*Chara vulgaris*) was found to be the most dominant species, followed by spiny naiad (*Najas marina*), sago pondweed (*Potamogeton pectinatus*) and coontail (*Ceratophyllum demersum*). Eurasian watermilfoil (*Myriophyllum spicatum*) continued to show signs of significant decline, and now represents a much smaller component of the overall plant community compared to earlier surveys. Plant growth remained fairly uniform among dominant species. While overall plant diversity appears to have increased, this finding may have been influenced by the change to a point-intercept sampling methodology. Plant growth was found in water depths down to 17 feet.

Tables 23-25 present plant species and statistical relationships from the 2006 inventory. Figure 41 depicts the sample locations where the non-native Eurasian watermilfoil (*Myriophyllum spicatum*) and curly-leaf pondweed (*Potamogeton crispus*) were found. Finally, a 30-year comparative analysis for the 1976-2006 monitoring period is provided in Tables 26-29 and Figure 42 below. During the 30-year period of record, the trend toward an increasing number of documented plant species is not considered significant. These results may reflect inter-annual variability, differences in sampling technique, and the influence of seasonality in plant growth consequent to the time of year during which the surveys were conducted.

**Table 23: 2006 plant inventory findings**

| Species | Frequency of Occurrence (%) | Average Density* (1-3 scale) | Relative Frequency | Importance Value |
|---|---|---|---|---|
| Ceratophyllum demersum (coontail) | 12.2 | 1.4 | 6.9 | 9.7 |
| Chara vulgaris (musk grass) | 53.1 | 1.5 | 30.1 | 45.2 |
| Elodea candensis (waterweed) | 0.8 | 1.0 | 0.5 | 0.5 |
| Heteranthera dubia (water star grass) | 4.3 | 1.1 | 2.5 | 2.8 |
| Myriophyllum spicatum (Eurasian watermilfoil) | 6.8 | 1.3 | 3.8 | 4.9 |
| Najas flexilis (bushy pondweed) | 1.1 | 1.0 | 0.6 | 0.6 |
| Najas marina (spiny naiad) | 33.3 | 1.0 | 18.9 | 18.9 |
| Potamogeton gramineus (variable pondweed) | 0.0 | -- | 0.0 | -- |
| Potamogeton crispus (curly-leaf pondweed) | 1.4 | 1.2 | 0.8 | 1.0 |
| Potamogeton pectinatus (Sago pondweed) | 16.8 | 1.0 | 9.5 | 9.5 |
| Potamogeton natans (floating-leaf pondweed) | 0.0 | -- | 0.0 | -- |
| Potamogeton zosteriformis (flat-stem pondweed) | 0.0 | -- | 0.0 | -- |
| Utricularia sp. (bladderwort) | 0.0 | -- | 0.0 | -- |
| Vallisneria americana (water celery) | 3.0 | 1.0 | 1.7 | 1.7 |

* Average Densities and corresponding Importance Values are based on a 1-3 rake-fullness scale, versus a 1-4 scale used in prior inventories. This change is due to switching to the point-intercept method which uses a different scaling system.

[153] Jessen, Robert and Richard Lound. 1962. An Evaluation of a Survey Technique for Submerged Aquatic Plants. Minnesota Department of Conservation. Investigational Report No. 6.

**Table 24: Statistical summary for all plant species documented in the 2006 inventory**

| Aquatic Plant | Number of Sites Found | FREQ[a] [0-17'] (%) | FREQ[b] [Veg. Sites] (%) | RFREQ[c] (%) | ADEN[d] (1-3 scale) | IV[e] | C[f] |
|---|---|---|---|---|---|---|---|
| Muskgrass<br>*Chara* sp. | 196 | 53.1 | 61.6 | 30.1 | 1.5 | 45.2 | 7 |
| Spiny naiad<br>*Najas marina* | 123 | 33.3 | 38.7 | 18.9 | 1.0 | 18.9 | NA |
| Sago Pondweed<br>*Stuckenia pectinata* | 62 | 16.8 | 19.5 | 9.5 | 1.0 | 9.5 | 3 |
| Coontail<br>*Ceratophyllum demersum* | 45 | 12.2 | 14.2 | 6.9 | 1.4 | 9.7 | 3 |
| Fries' pondweed<br>*Potamogeton friesii* | 27 | 7.3 | 8.5 | 4.1 | 1.1 | 4.5 | 8 |
| *Eurasian Watermilfoil<br>*Myriophyllum spicatum* | 25 | 6.8 | 7.9 | 3.8 | 1.3 | 4.9 | NA |
| Illinois Pondweed<br>*Potamogeton illinoensis* | 18 | 4.9 | 5.7 | 2.8 | 1.0 | 2.8 | 6 |
| Unknown watermilfoil<br>*Myriophyllum sp.(sibiricum/spicatum)* | 17 | 4.6 | 5.4 | 2.6 | 1.1 | 2.9 | NA |
| Water Stargrass<br>*Heteranthera/Zosterella dubia* | 16 | 4.3 | 5.0 | 2.5 | 1.1 | 2.8 | 6 |
| Northern Watermilfoil<br>*Myriophyllum sibiricum* | 14 | 3.8 | 4.4 | 2.2 | 1.1 | 2.4 | 7 |
| Water Celery, or Eel Grass<br>*Vallisneria americana* | 11 | 3.0 | 3.5 | 1.7 | 1.0 | 1.7 | 6 |
| Spatterdock<br>*Nuphar variegata* | 7 | 1.9 | 2.2 | 1.1 | 2.2 | 2.4 | 6 |
| White Water Lily<br>*Nymphaea odorata* | 6 | 1.6 | 1.9 | 0.9 | 1.2 | 1.1 | 6 |
| *Curly-leaf Pondweed<br>*Potamogeton crispus* | 5 | 1.4 | 1.6 | 0.8 | 1.2 | 1.0 | NA |
| Small Duckweed<br>*Lemna minor* | 4 | 1.1 | 1.3 | 0.6 | 1.0 | 0.6 | 5 |
| Slender Naiad, or Bushy Pondweed<br>*Najas flexilis* | 4 | 1.1 | 1.3 | 0.6 | 1.0 | 0.6 | 6 |
| Common Waterweed<br>*Elodea canadensis* | 3 | 0.8 | 0.9 | 0.5 | 1.0 | 0.5 | 3 |
| Leafy pondweed<br>*Potamogeton foliosus* | 3 | 0.8 | 0.9 | 0.5 | 1.0 | 0.5 | 6 |
| Forked Duckweed<br>*Lemna trisulca* | 1 | 0.3 | 0.3 | 0.2 | 1.0 | 0.2 | 6 |
| Small Pondweed<br>*Potamogeton pusillus* | 1 | 0.3 | 0.3 | 0.2 | 1.0 | 0.2 | 7 |
| Water sedge<br>*Carex aquatilis var. altior* | GS | GS | GS | GS | GS | GS | NA |
| Spotted water-hemlock<br>*Cicuta maculata* | GS | GS | GS | GS | GS | GS | NA |
| Swamp loosestrife<br>*Decodon verticillatus* | GS | GS | GS | GS | GS | GS | NA |
| Needle spikerush | GS | GS | GS | GS | GS | GS | 5 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Eleocharis acicularis* | | | | | | | |
| Smooth horsetail<br>*Equisetum laevigatum* | GS | GS | GS | GS | GS | GS | NA |
| Southern blue flag<br>*Iris virginica* | GS | GS | GS | GS | GS | GS | NA |
| *Reed canary grass<br>*Phalaris arundinacea* | GS | GS | GS | GS | GS | GS | NA |
| Willow<br>*Salix sp.* | GS | GS | GS | GS | GS | GS | NA |
| Hardstem bulrush<br>*Schoenoplectus/Scirpus acutus* | GS | GS | GS | GS | GS | GS | 5 |
| Softstem Bulrush<br>*Schoenoplectus/Scirpus tabernaemontani* | GS | GS | GS | GS | GS | GS | NA |
| Bittersweet nightshade<br>*Solanum dulcamara* | GS | GS | GS | GS | GS | GS | NA |
| Cattails<br>*Typha sp.* | GS | GS | GS | GS | GS | GS | 1 |
| filamentous algae | 59 | 16.0 | 18.6 | 9.1 | 1.1 | 10.0 | NA |
| freshwater sponge | 3 | 0.8 | 0.9 | 0.5 | 1.0 | 0.5 | NA |

* = Species not native to Wisconsin

GS = species observed during general boat survey

[a]FREQ [0-17’] = Frequency of Occurrence within depth zone defining extent of plant growth. The number of occurrences of a species divided by the number of sampling points in the 0-17’ depth range.

[b]FREQ [Veg. Sites] = Frequency of Occurrence within sites where plants were collected. The number of occurrences of a species divided by the number of sampling points with documented plant growth.

[c]RFREQ = Relative Frequency of Occurrence.

[d]ADEN = Average Density. The sum of the density ratings for a species (1-3 rake fullness scale) divided by the number of sampling points with vegetation.

[e]IV = Importance Value. The product of the relative frequency (RFREQ) and the average density, expressed as a percentage.

[f]C = Coefficient of Conservatism. Used to compute Floristic Quality Index. Values range from 0-10, with higher values indicative of plant species intolerant of habitat modification or water quality impairment caused by human disturbance.

### Table 25: Statistical descriptions based on all plants inventoried (2006)

| | |
|---|---|
| [a]Total Number of Points Sampled | 398 |
| [b]Number of Points Sampled within Depth Range of Potential Plant Growth (0-17’) | 369 |
| [c]Number of Points with Vegetation | 318 |
| [d]Maximum Depth of Plant Growth | 17 ft |
| [e]Number of Species in Lake | 31 |
| [f]Frequency of Occurrence of Vegetation within Range of Plant Growth (0-17’) | 86 |
| [g]Simpson Diversity Index | 0.85 |

| | |
|---|---|
| [h]Species Richness | 23 |
| [i]Floristic Quality Index (FQI) | 22.75 |
| [j]Mean Coefficient of Conservatism (C) | 5.69 |
| Average Number of Species Sampled Per Site (0-17’) | 1.76 |
| Average Number of Species Sampled Per Site (Veg. Sites Only) | 2.05 |
| Average Number of Native Species Sampled Per Site (0-17’) | 1.52 |
| Average Number of Native Species Sampled Per Site (Veg. Sites Only) | 2.00 |

[a]Does not include sample points in depths beyond 17 ft. where plant growth could not be documented

[b]Includes all sample points within the 0-17-ft. littoral zone that was shown to support plant growth

[c]Includes all sample points where vegetation was found after taking a rake sample

[d]Represents deepest point where vegetation was sampled. This depth will fluctuate from year to year depending on changes in water clarity conditions. Plants may be found at depths of over 20 ft. in clear lakes, but only in a few feet of water in stained or turbid lakes. While some species can tolerate very low light conditions, others are only found near the surface. In general, the diversity of the plant community decreases with increased depth.

[e]Includes plant species documented in the lake and along the zero-depth shoreline margin using both the point-intercept method and a general boat survey.

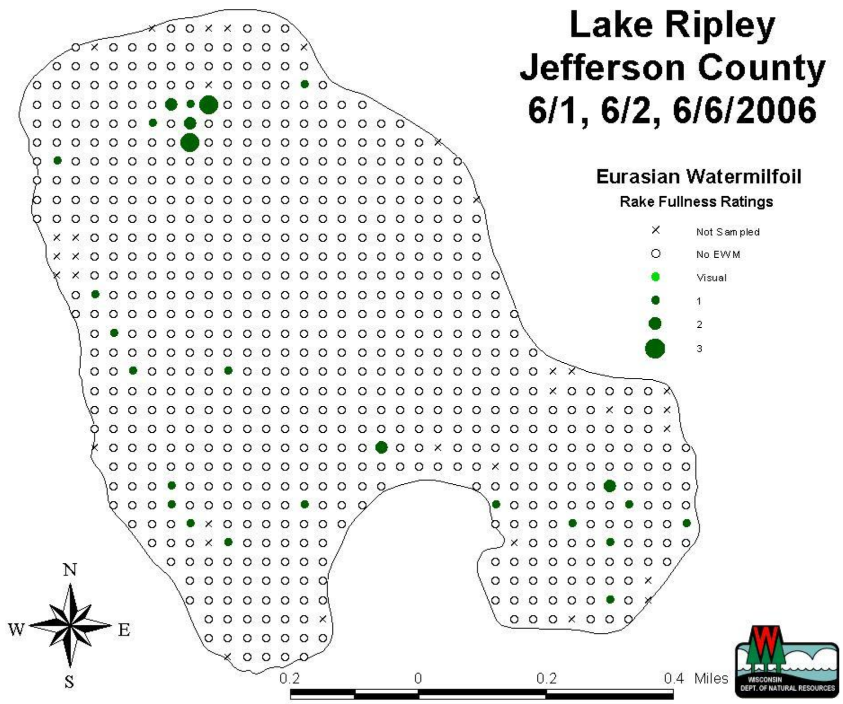
[f]Percentage of occurrence that vegetation would be sampled within the 0-17-ft. littoral zone

[g]Simpson Diversity Index: One minus the sum of each of the relative frequencies squared ($SDI = 1 - \sum(RFREQ^2)$). The closer the SDI value is to one, the greater the diversity is between communities being compared. The index allows the plant community at one location to be compared to the plant community at another location. It also allows a single location’s plant community to be compared over time. The index value (on a scale of 0-1) represents the probability that two individuals (randomly selected) will be different species. The greater the index value, the higher the diversity in a given location. Plant communities with high diversity are usually representative of healthier lakes, and also tend to be more resistant to invasion by exotic species.

[h]Indicates the number of different plant species found in and directly adjacent to the lake (on the waterline). Species richness only counts those plants documented as part of the point-intercept data. It includes filamentous algae, freshwater sponge, and unidentified *Myriophyllum* and *Najas* species.

[i]Measures the impact of human development on a lake’s aquatic plant community. Species in the index are assigned a Coefficient of Conservatism (C), which ranges from 3.0 to 44.6 in Wisconsin. The higher the value, the more likely the plant is negatively influenced by human activities that affect water quality or habitat. Plants with low values are tolerant of human disturbances, and often exploit these impacts to the point where they may crowd out other species. The FQI is calculated by averaging the conservatism value for each species found in the lake, and then multiplying that value by the square root of the number of species ($FQI = meanC\sqrt{N}$). Consequently, a higher index value indicates a healthier macrophyte community.

[j]Mean Coefficient of Conservatism (C) among species documented during point-intercept survey. Does not include species observed during the follow-up boat survey.



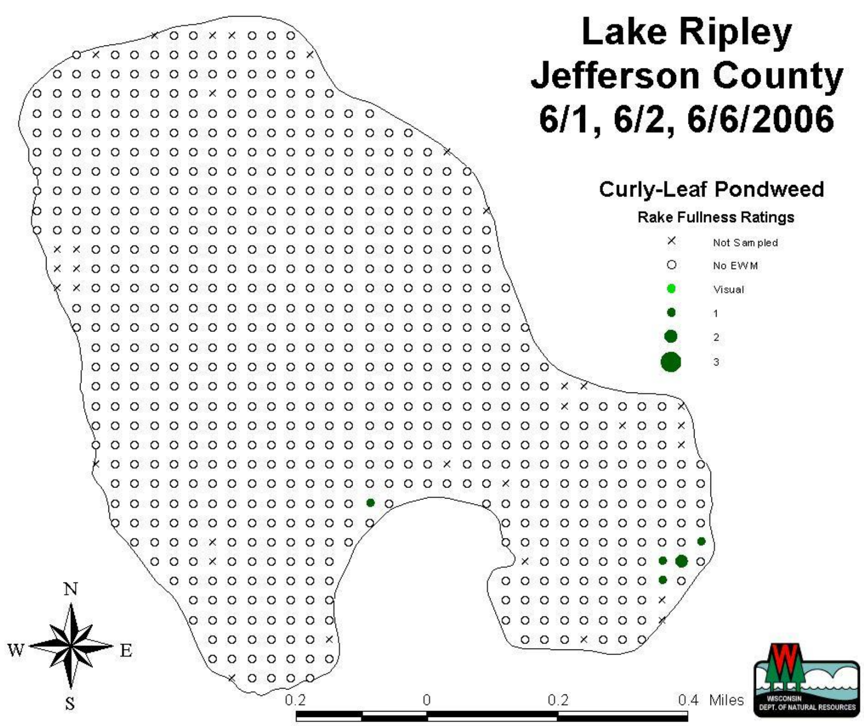




**Figure 41: Distribution of the Non-Native Eurasian Watermilfoil and Curly-Leaf Pondweed (2006)**

**Table 26: Number of littoral-zone sample sites where each species was found (1976-2006)**

| Species | Year | | | | | |
|---|---|---|---|---|---|---|
| | **1976** | **1989** | **1991** | **1996** | **2001** | **2006*** |
| Muskgrass | 47 | 7 | 18 | 23 | 45 | 196 |
| Eurasian watermilfoil | 19 | 45 | 48 | 53 | 41 | 25 |
| Spiny naiad | 0 | 11 | 37 | 46 | 35 | 123 |
| Water celery | 25 | 7 | 7 | 10 | 21 | 11 |
| Sago pondweed | 12 | 3 | 12 | 18 | 20 | 62 |
| Bushy pondweed | 0 | 7 | 8 | 11 | 13 | 4 |
| Flatstem pondweed | 0 | 0 | 0 | 0 | 8 | 0 |
| Variable pondweed | 0 | 2 | 0 | 0 | 8 | 0 |
| Coontail | 14 | 3 | 19 | 21 | 5 | 44 |
| Water bulrush | 0 | 0 | 0 | 0 | 4 | 0 |
| Common waterweed | 2 | 0 | 2 | 1 | 3 | 3 |
| Water star grass | 0 | 0 | 0 | 0 | 3 | 16 |
| Curly-leaf pondweed | 1 | 1 | 0 | 0 | 1 | 5 |
| Floating-leaf pondweed | 10 | 8 | 0 | 0 | 1 | 0 |
| Illinois pondweed | 0 | 13 | 0 | 1 | 0 | 18 |
| Small pondweed | 0 | 13 | 0 | 0 | 0 | 1 |
| Northern watermilfoil | 0 | 0 | 2 | 1 | 0 | 14 |
| Bladderwort | 6 | 0 | 2 | 2 | 1 | 0 |
| *Potamogeton* spp. | 7 | 0 | 5 | 7 | 0 | 0 |
| *Naiad* spp. | 3 | 0 | 0 | 0 | 0 | 0 |
| Leafy pondweed | 0 | 0 | 0 | 0 | 0 | 3 |
| Forked duckweed | 0 | 0 | 0 | 0 | 0 | 1 |
| Small duckweed | 0 | 0 | 0 | 0 | 0 | 4 |
| Fries' pondweed | 0 | 0 | 0 | 0 | 0 | 27 |
| Spatterdock | 0 | 0 | 0 | 0 | 0 | 7 |
| White water lily | 0 | 0 | 0 | 0 | 0 | 6 |
| Total Number of Species Documented: | 11 | 12 | 11 | 12 | 15 | 19 |

* 2006 had a higher number of sample sites compared to previous years due to use of the point-intercept method

**Table 27: Percent frequency of occurrence of aquatic plant species (1976-2006)**

| Species | Year | | | | | |
|---|---|---|---|---|---|---|
| | 1976 | 1989 | 1991 | 1996 | 2001 | 2006 |
| Muskgrass | 69.1 | 11.7 | 20.0 | 25.6 | 50.0 | 53.1 |
| Eurasian watermilfoil | 29.9 | 75.0 | 53.3 | 58.9 | 45.6 | 6.8 |
| Spiny naiad | 0.0 | 18.3 | 41.1 | 51.1 | 38.9 | 33.3 |
| Water celery | 36.8 | 11.7 | 7.8 | 11.1 | 23.3 | 3.0 |
| Sago pondweed | 17.6 | 5.0 | 13.3 | 20.0 | 22.2 | 16.8 |
| Bushy pondweed | 0.0 | 11.7 | 8.9 | 12.2 | 14.4 | 1.1 |
| Flatstem pondweed | 0.0 | 0.0 | 0.0 | 0.0 | 8.9 | 0.0 |
| Variable pondweed | 0.0 | 3.3 | 0.0 | 0.0 | 8.9 | 0.0 |
| Coontail | 20.6 | 5.0 | 21.1 | 23.3 | 5.6 | 12.2 |
| Water bulrush | 0.0 | 0.0 | 0.0 | 0.0 | 4.4 | 0.0 |
| Common waterweed | 2.9 | 0.0 | 2.2 | 1.1 | 3.3 | 0.8 |
| Water star grass | 0.0 | 0.0 | 0.0 | 0.0 | 3.3 | 4.3 |
| Curly-leaf pondweed | 1.5 | 1.7 | 0.0 | 0.0 | 1.1 | 1.4 |
| Floating-leaf pondweed | 14.7 | 13.3 | 0.0 | 0.0 | 1.1 | 0.0 |
| Illinois pondweed | 0.0 | 21.7 | 0.0 | 1.1 | 0.0 | 0.0 |
| Small pondweed | 0.0 | 21.7 | 0.0 | 0.0 | 0.0 | 0.3 |
| Northern watermilfoil | 0.0 | 0.0 | 2.2 | 1.1 | 0.0 | 3.8 |
| Bladderwort | 8.8 | 0.0 | 2.2 | 2.2 | 1.1 | 0.0 |
| Potamogeton spp. | 10.3 | 0.0 | 5.6 | 7.8 | 0.0 | 0.0 |
| Naiad spp. | 4.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Leafy pondweed | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 |
| Forked duckweed | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 |
| Small duckweed | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 |
| Fries' pondweed | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7.3 |
| Spatterdock | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.9 |
| White water lily | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 |

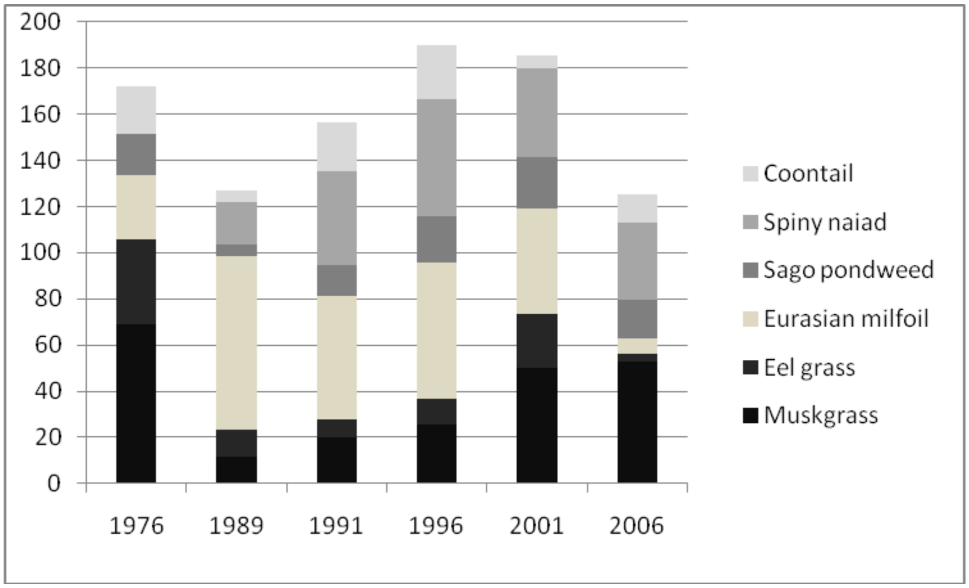



**Figure 42: Frequency of Occurrences for Six Dominant Aquatic Plant Species Found Among Littoral-Zone Sample Sites (1976-2006)**

**Table 28: Percent relative frequency of occurrence of aquatic plant species (1976-2006)**

| Species | Year | | | | | |
|---|---|---|---|---|---|---|
| | 1976 | 1989 | 1991 | 1996 | 2001 | 2006 |
| Muskgrass | 32.2 | 5.8 | 11.3 | 11.9 | 21.5 | 30.1 |
| Eurasian watermilfoil | 13.0 | 37.5 | 30.0 | 27.3 | 19.6 | 3.8 |
| Spiny naiad | 0.0 | 9.2 | 23.1 | 23.7 | 16.7 | 18.9 |
| Water celery | 17.1 | 5.8 | 4.4 | 5.2 | 10.0 | 1.7 |
| Sago pondweed | 8.2 | 2.5 | 7.5 | 9.3 | 9.6 | 9.5 |
| Bushy pondweed | 0.0 | 5.8 | 5.0 | 5.7 | 6.2 | 0.6 |
| Flatstem pondweed | 0.0 | 0.0 | 0.0 | 0.0 | 3.8 | 0.0 |
| Variable pondweed | 0.0 | 1.7 | 0.0 | 0.0 | 3.8 | 0.0 |
| Coontail | 9.6 | 2.5 | 11.9 | 10.8 | 2.4 | 6.9 |
| Water bulrush | 0.0 | 0.0 | 0.0 | 0.0 | 1.9 | 0.0 |
| Common waterweed | 1.4 | 0.0 | 1.3 | 0.5 | 1.4 | 0.5 |
| Water star grass | 0.0 | 0.0 | 0.0 | 0.0 | 1.4 | 2.5 |
| Curly-leaf pondweed | 0.7 | 0.8 | 0.0 | 0.0 | 0.5 | 0.8 |
| Floating-leaf pondweed | 6.8 | 6.7 | 0.0 | 0.0 | 0.5 | 0.0 |
| Illinois pondweed | 0.0 | 10.8 | 0.0 | 0.5 | 0.0 | 0.0 |
| Small pondweed | 0.0 | 10.8 | 0.0 | 0.0 | 0.0 | 0.2 |
| Northern watermilfoil | 0.0 | 0.0 | 1.3 | 0.5 | 0.0 | 2.2 |
| Bladderwort | 4.1 | 0.0 | 1.3 | 1.0 | 0.5 | 0.0 |
| Potamogeton spp. | 4.8 | 0.0 | 3.1 | 3.6 | 0.0 | 0.0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Naiad spp. | 2.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Leafy pondweed | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 |
| Forked duckweed | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 |
| Small duckweed | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 |
| Fries' pondweed | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.1 |
| Spatterdock | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 |
| White water lily | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.9 |

**Table 29: Importance value of aquatic plant species (1976-2006)**

| Species | Year | | | | | |
|---|---|---|---|---|---|---|
| | 1976 | 1989 | 1991 | 1996 | 2001 | 2006 |
| Muskgrass | -- | 8 | 26 | 26 | 66 | 45 |
| Eurasian watermilfoil | -- | 105 | 89 | 70 | 42 | 5 |
| Spiny naiad | -- | 18 | 58 | 54 | 41 | 19 |
| Water celery | -- | 9 | 7 | 7 | 20 | 2 |
| Sago pondweed | -- | 3 | 18 | 19 | 19 | 10 |
| Bushy pondweed | -- | 7 | 13 | 12 | 12 | 1 |
| Flatstem pondweed | -- | -- | -- | -- | 7 | -- |
| Variable pondweed | -- | 2 | -- | -- | 6 | -- |
| Coontail | -- | 8 | 30 | 21 | 8 | 10 |
| Water bulrush | -- | -- | -- | -- | 6 | -- |
| Common waterweed | -- | -- | 1 | 1 | 2 | 1 |
| Water star grass | -- | -- | -- | -- | 4 | 3 |
| Curly-leaf pondweed | -- | 1 | -- | -- | 0 | 1 |
| Floating-leaf pondweed | -- | 8 | -- | -- | 0 | -- |
| Illinois pondweed | -- | 15 | -- | 1 | -- | 3 |
| Small pondweed | -- | 13 | -- | -- | -- | 0 |
| Northern watermilfoil | -- | -- | 1 | 1 | -- | 2 |
| Bladderwort | -- | -- | 2 | 2 | 0 | -- |
| Potamogeton spp. | -- | -- | 4 | 4 | -- | -- |
| Naiad spp. | -- | -- | -- | -- | -- | -- |
| Leafy pondweed | -- | -- | -- | -- | -- | 1 |
| Forked duckweed | -- | -- | -- | -- | -- | 0 |
| Small duckweed | -- | -- | -- | -- | -- | 0 |
| Fries' pondweed | -- | -- | -- | -- | -- | 5 |
| Spatterdock | -- | -- | -- | -- | -- | 2 |
| White water lily | -- | -- | -- | -- | -- | 1 |

## 5-6 CONDITION ASSESSMENT

The distribution of aquatic plants has become slightly less uniform and increasingly patchy over the 30-year period of record. This shift, however, may in part be the result of variations in sampling technique. Data since 1976 indicate that the aquatic plant flora of Lake Ripley has become somewhat more diverse and spatially balanced, suggesting a shift toward a healthier lake ecosystem. Muskgrass (*Chara vulgaris*), spiny naiad (*Najas marina*), sago pondweed (*Potamogeton pectinatus*) and coontail (*Ceratophyllum demersum*) are now the most commonly occurring species.

**A mixed community of aquatic plants is shown growing in Lake Ripley.**

The dominance of water celery (*Vallisneria americana*) and pondweeds (*Potamogeton* sp.) first documented in 1953 was largely replaced by the non-native Eurasian watermilfoil (*Myriophyllum spicatum*) during the 1980s. This milfoil was abundant since as early as 1976, and continued to be present in quantities that approximate between one-fifth and one-third of the aquatic plant flora of the lake through 2001. As of 2006, this invasive weed no longer appears to represent a dominant position within the overall plant community.

Compared to other Wisconsin lakes, Lake Ripley ranks slightly above average in terms of total plant-species diversity (2006 data), and is in the top 25% when compared to lakes throughout the Southeast Till Plains Ecoregion. The percentage of sample sites in which Eurasian watermilfoil was found has decreased from 75% in 1989 to less than 7% in 2006, revealing a precipitous decline in dominance by this non-native species. The relative frequency of occurrence for milfoil also decreased from 37.5% (highest of all species) in 1989 to 3.8% (10$^{th}$ highest) in 2006.

With respect to the Wisconsin Floristic Quality Index, Lake Ripley's computed value of 22.75 (2006) puts it just above the median for Wisconsin and the larger ecoregion (see Figures 43-44). The Floristic Quality Index (FQI) was developed to help assess lake quality by evaluating the number and types of aquatic plants that live in a lake. The FQI for Wisconsin ranges from 3.0 to 44.6, with a median of 22.2. The FQI is particularly valuable for comparing lakes around the state or looking at a single lake over time. Generally, higher FQI numbers indicate better lake quality that can support more pollution-sensitive plant species. Lake Ripley's 2006 FQI of 22.75 is a marked improvement over prior years when the FQI averaged 15.63 (1976: 12.85, 1989: 16.67, 1991: 14.85, 1996: 16.00, and 2001: 17.78).

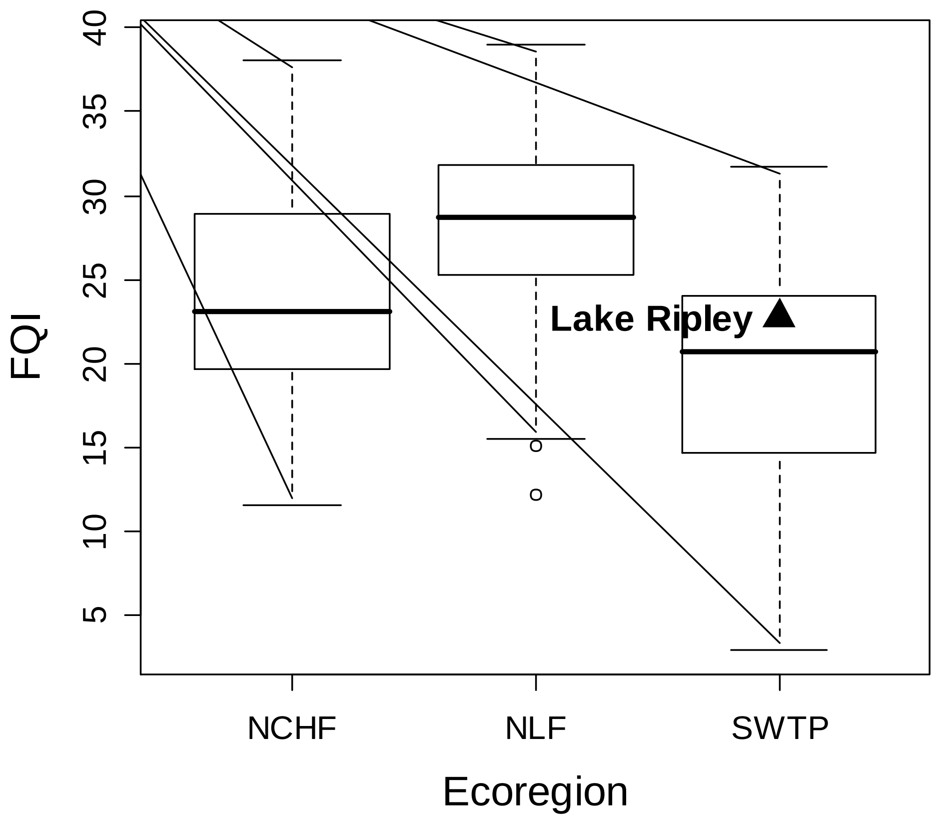



**Figure 43: Lake Ripley's Floristic Quality Index (FQI) Relative to All Lakes Inventoried in Ecoregion**

Box plot shows variation in FQI by region. Mean is center, box covers 50% of the data, whiskers indicate range, with outliers marked as open circles. Ecoregions are as follows: NCHF = North Central Hardwood Forests (triangular swath across north central Wisconsin from Marquette County north through Marathon), SWTP = Southeastern Wisconsin Till Plains (southeastern corner of Wisconsin: Green Bay south to Illinois and east to through Columbia County) and NLF = Northern Lakes and Forests (northern Wisconsin).[154]

[154] Graph produced by Alison Mikulyuk, Wisconsin Department of Natural Resources

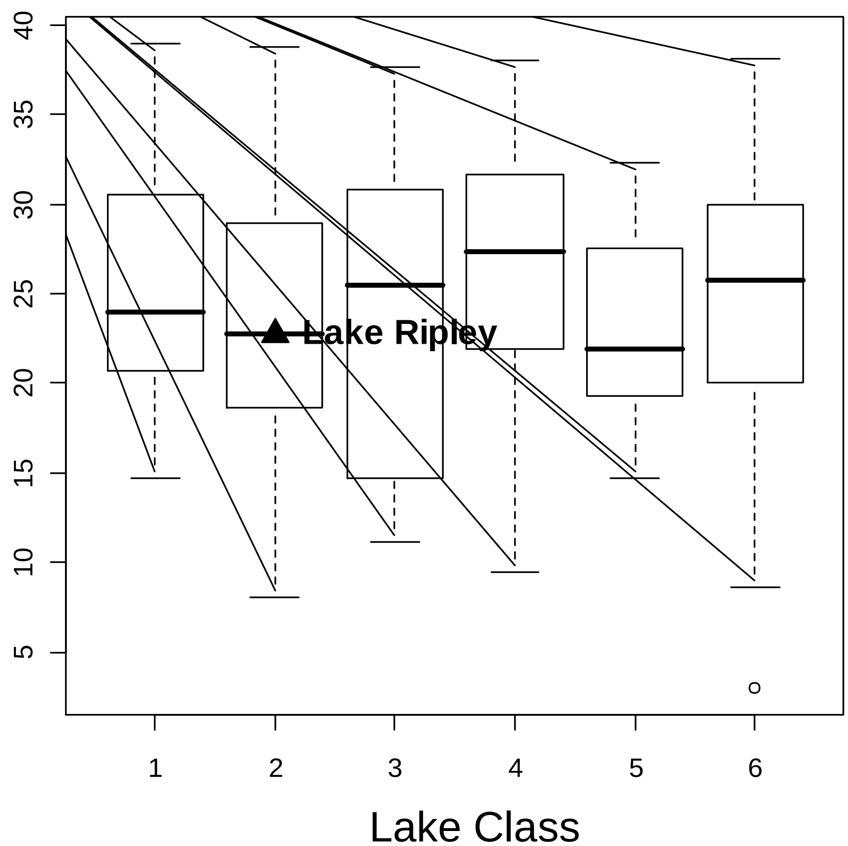



**Figure 44: Lake Ripley's Floristic Quality Index (FQI) Relative to All Lakes Inventoried by Lake Class**

Box plot shows variation in FQI by lake class. Mean is center, box covers 50% of the data, whiskers indicate range, with outliers marked as open circles. Lakes classes are as follows: 1 = shallow headwater drainage, 2 = deep headwater drainage, 3 = shallow lowland drainage, 4 = deep lowland drainage, 5 = shallow seepage, 6 = deep seepage.[155]

In terms of plant diversity, the Simpson Diversity Index has ranged from 0.82 to 0.86 (on a 0-1.00 scale) during the 30-year period of record. This suggests that the plant community has remained somewhat diverse throughout this period.

In terms of importance values, muskgrass (*Chara vulgaris*) and spiny naiad (*Najas marina*) remain the most commonly occurring species, while Eurasian watermilfoil has continued its steady decline in importance. Sago pondweed (*Potamogeton pectinatus*) and coontail (*Ceratophyllum demersum*) have also maintained relatively consistent importance values. The overall decline in importance values among the different plant species suggests a shift toward a

[155] Graph produced by Alison Mikulyuk, Wisconsin Department of Natural Resources

healthier lake ecosystem, with no one species becoming overly dominant. While the precise reasons for changes in the plant community are unclear, they are most likely related to a combination of factors. These factors include the implementation of aquatic plant management practices; changes in land use that affect nutrient supply and availability; alterations in lake-use patterns and behavior; climatic factors; and natural biological processes contributing to inter-annual variability among plant communities.

Recent inventory results are fairly encouraging, especially with respect to the overall decline in Eurasian watermilfoil dominance. Despite these positive observations, signs of degradation still remain and suggest there is still room for improvement. Evidence of degradation includes the continued presence of non-native vegetation, dominance of pollution/disturbance-tolerant species, and limited overall biodiversity. These conditions are likely to change for the better as recommendations contained within this plan are implemented over time.

## 5-7 CRITICAL HABITAT AREAS

In 1989, changes to Wisconsin DNR Administrative Code (NR 107) governing the Aquatic Plant Management Program went into effect. Recognizing that responsible management of aquatic plants can enhance water recreation was only one aspect of the program. NR 107 also underscored the value of native aquatic plants to water quality and lake ecology, and recognized the need to protect them.

Among several program changes, the Wisconsin DNR was required to identify ecologically sensitive areas (now called "Critical Habitat Areas") in lakes where aquatic plants are managed. These areas were designated to protect water quality, high-value native aquatic plants, critical fisheries and wildlife habitat, and shorelines susceptible to erosion. On Lake Ripley, Critical Habitat Areas were first designated by Wisconsin DNR and incorporated into a Town pier ordinance in 1995 (see map in Appendix D).[156] They were most often associated with relatively undeveloped shorelines and wetlands within South and East Bay, and were found to support excellent biodiversity. Water lilies, bulrush stands, and lakeshore wetlands that are important for shoreline protection, habitat for fish and wildlife, and water quality protection are among the features that commonly characterize these area designations. Water celery (*Vallisneria americana*) and several submersed pondweeds (*Potamogeton* sp.) were also identified as deserving protection, but it was noted that these plants occur in low densities and are widely dispersed throughout the lake. Consequently, these species cannot be protected within defined areas.

Historically, important near-shore aquatic habitats were abundant around the lake, but have largely disappeared as a consequence of wetland drainage and shoreline development. The few remaining Critical Habitat Areas along the southern shoreline are protected, and herbicide treatments, dredging, and sand blankets are prohibited within those locations. A Town of Oakland ordinance currently prohibits the placement of piers, wharves and swimming rafts

[156] Town of Oakland. 1995. Ordinance No. 42: An Ordinance to Regulate the Location of Piers, Wharves and Swimming Rafts on Lake Ripley.

within designated "sensitive" areas without a DNR permit.[157] Town ordinance also provides for slow-no-wake buoyed restricted zones in each bay, a 200-feet-from-shore no-wake zone, and a prohibition on motor use of any kind in Vasby's Channel. These ordinances are intended, in part, to better protect Critical Habitat Areas from frequent motor boat disturbance.[158] While mechanical harvesting is allowed in accordance with Wisconsin DNR permit conditions, operations are governed by a harvesting plan that largely targets the invasive milfoil in high-traffic navigational corridors. The weed-harvesting plan is incorporated into this document and can be referenced in chapter 5-13 and 5-14.

The Wisconsin DNR, in partnership with the Lake District, is currently in the process of re-evaluating and re-mapping Critical Habitat Areas on Lake Ripley. When completed, any key findings, re-delineations and recommendations from this effort shall be considered a part of this Lake Management Plan. A draft Critical Habitat Areas map is included as Figure 45. It should be noted that these mapped locations will be subject to public review and comment, and therefore may be adjusted depending on the input received.

[157] Ibid.
[158] Town of Oakland. 1995. Ordinance No. 2: An Ordinance to Create Section 4.AMN of Ordinance No. 2 to Create an Additional "Buoyed Restricted Area" in the South Bay of Lake Ripley.

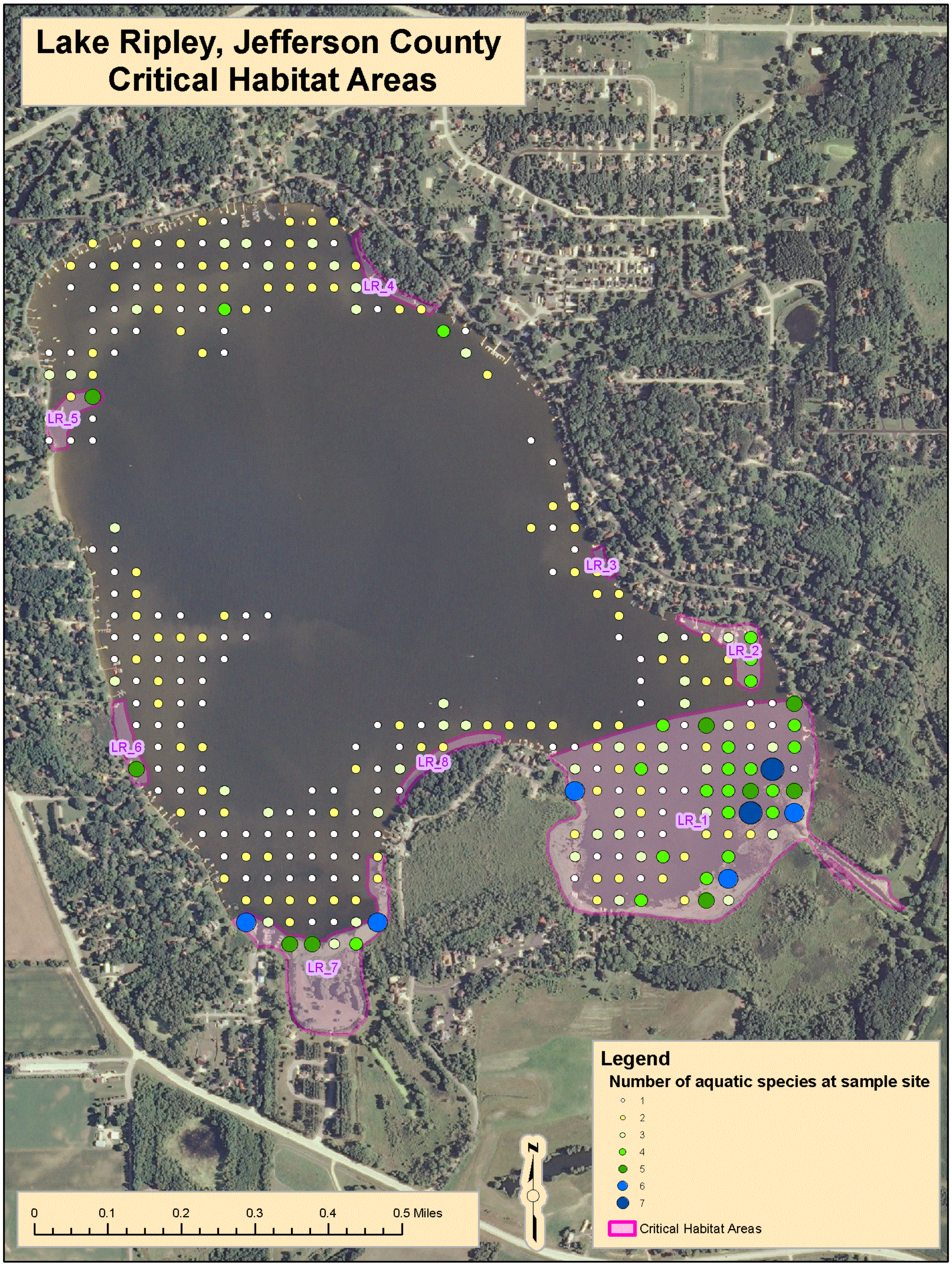



**Figure 45: Critical Habitat Areas on Lake Ripley (DRAFT)**[159]

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[159] Draft map produced by Wisconsin DNR (2008)

## 5-8 LAKE RIPLEY PLANT DESCRIPTIONS

Aquatic plants, also called macrophytes, include all macroscopic plants (observable with the naked eye) found in aquatic environments. They are represented by a diverse group of aquatic and wetland plants, including flowering vascular plants, mosses, ferns and macroalgae. Aquatic vegetation is naturally present to some extent in all lakes, and represents an important component of a healthy ecosystem. There are four basic plant types: emergent, free-floating, floating-leaf and submersed.

Emergents (e.g. cattail and bulrush) are rooted in water-saturated or submerged soils, but have stems that grow above the water surface. These plants most often grow in shallow-water areas along lakeshore margins and within riparian wetlands. Free-floating plants (e.g. duckweed) are not rooted in the lake bottom, but have extensive root systems that hang beneath floating leaves. They obtain most of their required nutrients from the surrounding water column. These plants are often quite small, and may completely cover the water surface in small, fertile water bodies. Floating-leaf macrophytes (e.g. water lilies) have leaves that float on the lake surface with a long rooted stem anchored to the lake bottom. Because the leaves of these plants are delicate and easily torn by wave action, they are typically found only in quiet, sheltered bays. Submersed plants (e.g. milfoil, water celery and Illinois pondweed) grow entirely under the water surface in areas where there is sufficient sunlight penetration. They may or may not be rooted to the lake bottom.

Aquatic plants can also be described in terms of their regional nativity. Native species are those that were historically found in a particular geographic region. On the other hand, non-native or "exotic" species evolved outside the region of interest and are frequently referred to as weeds. These transplanted species are no longer controlled by their native predators, and can sometimes take over an entire water body, forming large monotypic colonies. This prolific and uncontrolled growth can threaten biodiversity, water quality and the recreational value of the invaded water body.

The following aquatic plants were identified in Lake Ripley during prior inventories. Descriptions and illustrations of each species are provided below.[160]

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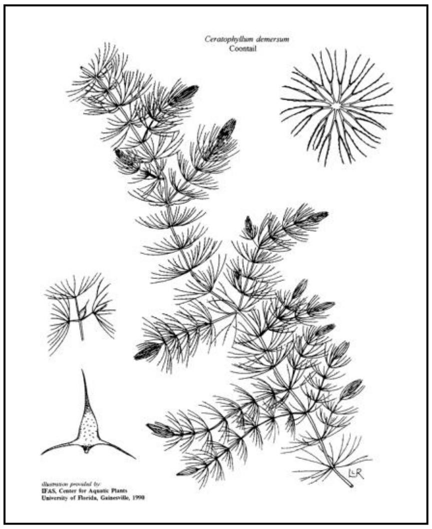
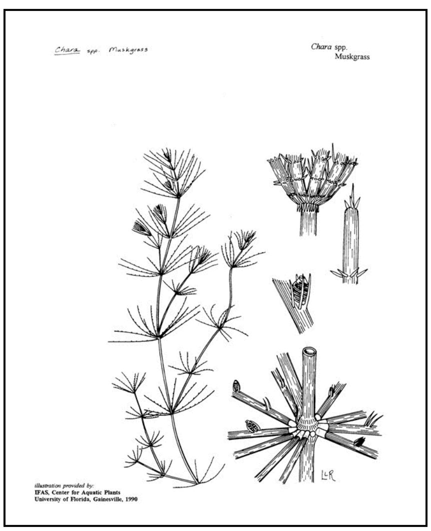
[160]Nichols, Stanley A. 1999. Distribution and Habitat Descriptions of Wisconsin Lake Plants. Wisconsin Geological and Natural History Survey.
Welsch, Jeff. 1992. Guide to Wisconsin Aquatic Plants. Wisconsin Department of Natural Resources. PUBL-WR-173 92rev.
Borman, Susan, Robert Korth and Jo Temte. 1997. Through the Looking Glass… A Field Guide to Aquatic Plants. Wisconsin Lakes Partnership. DNR Publication No. FH-207-97.




Common Name: **Coontail**
Scientific Name: ***Ceratophyllum demersum***
Plant Type: Submersed
Duration: Perennial
U.S. Nativity: Native

Coontail typically grows in clear water up to 15 feet deep. It is found over a broad range of water chemistries, prefers soft substrates, and is tolerant of turbid waters. New plants are formed primarily by stem fragmentation because seeds rarely develop. This plant has long trailing stems that lack true roots, but may be loosely anchored to the sediment by pale modified leaves. Because it is not rooted, it can drift between depth zones. Coontail can tolerate cool temperatures and low light conditions. These qualities allow it to overwinter as an evergreen plant, continuing photosynthesis at a reduced rate under the ice.

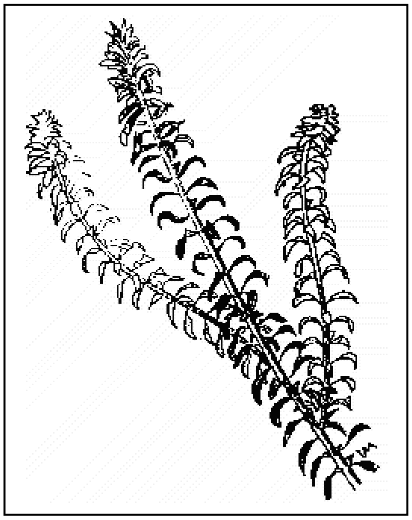
Although coontail has the capacity to grow at nuisance levels, it should not be entirely eliminated from a water body since it offers good habitat for fish and invertebrates. The plant is often found on drop-offs, producing tree-like cover for bluegills, perch, largemouth bass and northern pike. Bushy stems of coontail harbor many invertebrates and provide important shelter and foraging opportunities for fish. Both foliage and fruit of coontail are grazed by a variety of waterfowl. Coontail is also effective at removing phosphorus from the water column.




Common Name: **Muskgrass**
Scientific Name: ***Chara vulgaris***
Plant Type: Submersed (Macroalgae)
Duration: Perennial
U.S. Nativity: Native

Muskgrass is actually an unusual type of algae, but has a growth form that resembles a higher plant. This plant is simple in structure and has rhizoids rather than true roots. It ranges in size from ankle-high to knee high, and grows entirely below the water surface. The main branches of muskgrass have ridges that are often encrusted by calcium carbonate, giving the plant a harsh, crusty feel. Muskgrass is usually found in hard waters, and prefers muddy or sandy substrate. It can often be found in deeper water than other plants, and its dense growth is capable of covering an entire lake bottom.

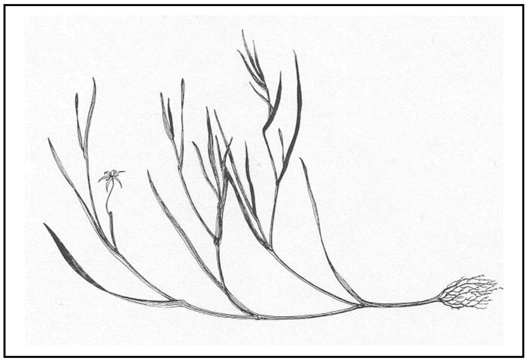
Muskgrass has several ecological benefits. It is a favorite food for waterfowl. It also supports algae and invertebrates that provide additional grazing. Beds of muskgrass are considered valuable fish habitat, offering cover and food for young largemouth and smallmouth bass. As far as enhancing water quality, the rhizoids of muskgrass slow the movement and suspension of sediments. It is a good bottom stabilizer and is often the first plant to colonize open areas. It also softens water by removing lime and carbon dioxide. This plant is best left alone since it grows close to the bottom and generally doesn't interfere with water uses.



Common Name: **Common waterweed**
Scientific Name: ***Elodea canadensis***
Plant Type: Submersed
Duration: Perennial
U.S. Nativity: Native

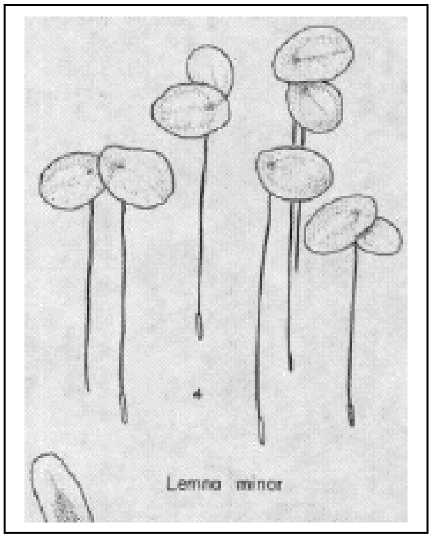
Common waterweed prefers soft, silty substrate, and is tolerant of turbid, low-light water conditions. This plant grows in a range of water depths, but prefers cool, nutrient-rich waters. It has a broad but generally alkaline pH distribution and moderate conductivity and alkalinity distributions. Common waterweed lives entirely underwater with the exception of small white flowers that bloom at the surface and are attached to the plant by delicate stalks. In the fall, leafy stalks will detach from the parent plant, float away, root, and start new plants. This is its most important method of spreading, with seed production playing a relatively minor role.

This plant generally over-winters as an evergreen, allowing photosynthesis to continue at a reduced rate under the ice. The branching stems of this plant provide excellent habitat for fish and invertebrates, but dense stands can obstruct fish movement and become a nuisance. The plant provides food for muskrats and waterfowl.



Common Name: **Water stargrass**
Scientific Name: ***Heteranthera/Zosterella dubia***
Plant Type: Submersed
Duration: Annual/Perennial
U.S. Nativity: Native

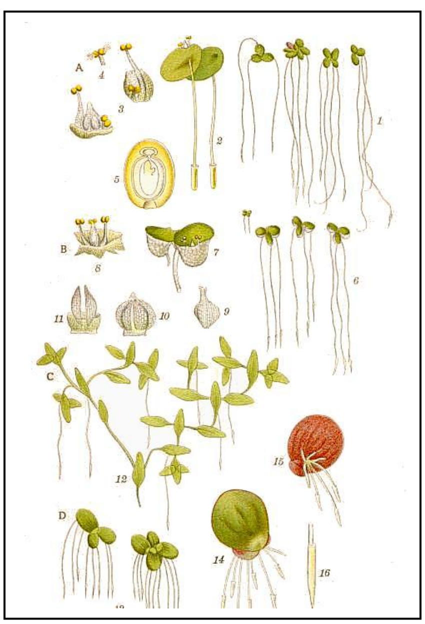
Water stargrass is found in water depths to 10 feet, shows no substrate preference, and is tolerant to turbidity. It grows over a moderate and somewhat alkaline pH range, and moderate conductivity and alkalinity ranges. This plant can be a locally important source of food for geese and ducks. It also offers good cover and foraging opportunities for fish.




Common Name: **Small duckweed**
Scientific Name: ***Lemna minor***
Plant Type: Free-floating
Duration: Perennial
U.S. Nativity: Native

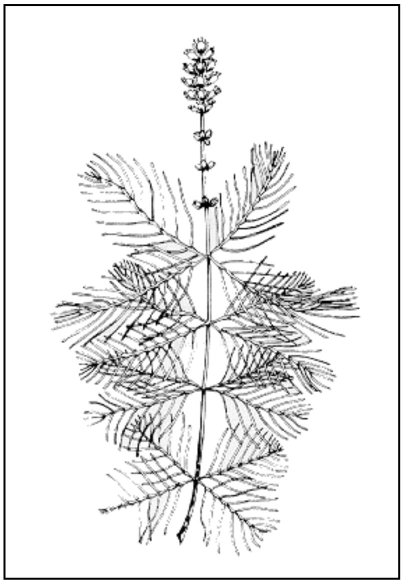
These tiny, free-floating plants grow in bays and quiet areas protected from wind and wave action. Small duckweed drifts with the wind or current and is not dependent on depth, sediment type or water clarity. It is found over a moderate pH range and broad ranges of alkalinity and conductivity. Duckweed is often associated with eutrophic conditions, and can become a nuisance in stagnant, fertile water bodies. It has the ability to rapidly reproduce in nutrient-rich water, doubling in population within three to five days. Since the plant is free-floating, it must obtain all of its nutrition from the water by absorbing nutrients through dangling roots and leaf undersurface. In fact, it is capable of removing large amounts of nutrients from the water in this way.

Rafts of small duckweed provide shade and cover for fish and invertebrates, but may shade out larger, submersed plants. Small duckweed does not provide ideal fish habitat due to excessive shading and poor food value. The plant is a food source for waterfowl and marsh birds (providing up to 90% of the dietary needs for a variety of ducks and geese), and does supports insect valuable as food for fish. It is also consumed by muskrat, beaver and fish. Conventional physical removal and chemical control are usually ineffective. Limiting growth of duckweed is best accomplished through nutrient-reduction strategies.



Common Name: **Forked duckweed**
Scientific Name: ***Lemna trisulca***
Plant Type: Free-floating
Duration: Perennial
U.S. Nativity: Native

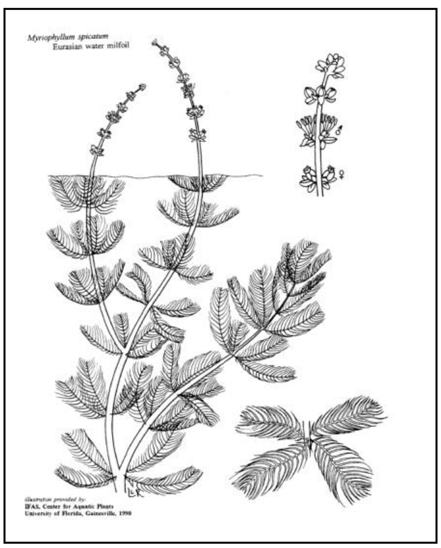
Forked duckweed differs from other duckweed species by the stalk-like, “rowboat and oars” shape of the fronds and olive green color. This species is often found just beneath the surface of quiet water. It drifts with the wind or current and is not dependent on depth, sediment type or water clarity. However, there must be sufficient nutrient content in the water to sustain growth. Like other temperate-climate duckweeds, this species overwinters by producing winter buds that rest on the sediment. In spring, the buds become buoyant and float to the surface where plant growth continues through the summer. Forked duckweed is a good food source for waterfowl, and provides cover for fish and invertebrates.



Common Name: **Northern/spiked watermilfoil**
Scientific Name: ***Myriophyllum sibiricum***
Plant Type: Submersed
Duration: Perennial
U.S. Nativity: Native

This species is easily confused with the non-native Eurasian watermilfoil (*Myriophyllum spicatum*). The plant can grow in water more than 13 feet deep, prefers soft sediment, and is sensitive to turbidity. It grows over a broad alkalinity range and moderate conductivity and pH ranges. Since it is sensitive to reduced water clarity, this plant has been shown to decline in lakes that become increasingly eutrophic. Stems emerge in spring and can produce flower spikes by early to midsummer that stick out of the water.

Leaves and fruit of northern watermilfoil are consumed by a variety of waterfowl. The feathery foliage traps detritus and provides invertebrate habitat. Beds of northern watermilfoil offer shade, shelter and foraging opportunities for fish.




Common Name: **Eurasian watermilfoil**
Scientific Name: ***Myriophyllum spicatum***
Plant Type: Submersed
Duration: Perennial
U.S. Nativity: Non-native

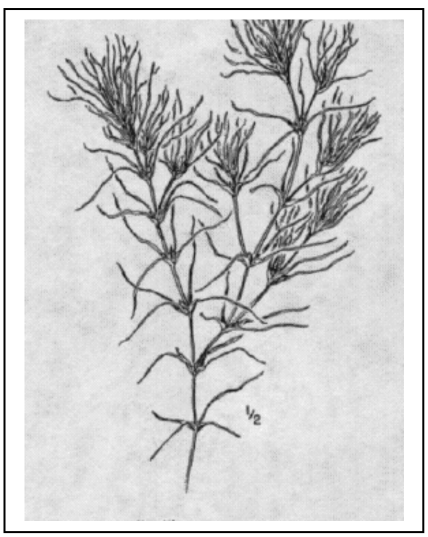
This plant is not native to the U.S., and is considered a nuisance weed in many lakes. It can grow in water depths of over 13 feet deep, and is found over broad alkalinity, moderate conductivity, and moderate but high pH ranges. The average fruiting date is middle to late summer; however, it can flower and fruit twice, once in early summer and once in late summer. The late flowering can be prolonged and fruiting plants can be found into early November. Flower stalks do not develop until the stems reach the surface.

In the spring, shoots begin to grow rapidly in response to rising water temperatures (starting at about 59°F). As shoots grow, lower leaves drop off in response to shading. When the plant reaches the surface, shoots branch profusely to form a dense, floating canopy above leafless vertical stems. Plants then reproduce by flowering at the surface and through fragmentation. Both broken stems and plant fragments are able to regenerate into new plants.

Dominance by this species is often established early in the growing season, owing to a combination of high over-wintering biomass and rapid spring growth. Conditions of low light and high water temperature, characteristics of many eutrophic environments, stimulate shoot elongation and canopy formation. It grows most poorly on highly organic sediments and coarse substrates like sand and gravel, and best in finely textured, inorganic sediment. Shallow, moderately turbid lakes with nutrient-rich sediments will experience the most severe problems.

Eurasian watermilfoil is an invasive, pioneer species that quickly colonizes disturbed areas of the lake bottom. Disturbances may be in the form of sediment deposition, plant removal, water level fluctuations, or bottom scouring caused by motor boats. Once introduced to a water body, milfoil can quickly out-compete and displace other species. Milfoil boom and bust growth cycles are well documented in other lakes, and are characteristic of ecosystems dominated by only a few species. Excessive milfoil growth primarily affects recreation by interfering with swimming and boating following canopy formation, by reducing the quality of sport fisheries, and by reducing the aesthetic appeal of water bodies. As for ecological value, this species provides limited cover for fish when poor water clarity prevents broad-leaved pondweeds and other species from growing. Waterfowl graze on fruit and foliage to a limited extent. Milfoil beds also provide invertebrate habitat, but studies have shown mixed stands of pondweeds and wild celery have higher invertebrate numbers and diversity.[161]

Eurasian watermilfoil is commonly treated with aquatic herbicides such as 2,4-D early in the summer before plants flower. However, there are a number of negative consequences that can occur following chemical treatments. These include dissolved oxygen depletion and nutrient releases from the resulting plant decay, as well as the creation of "disturbance" areas that can be re-colonized by other milfoil. Most control efforts have been directed toward maintenance (e.g. mechanical harvesting), since eradication of this particular species is rarely if ever likely to succeed due to its aggressive growth and propagation characteristics. Since growth usually covers large areas, treatment efforts should be directed at well-defined areas where they will produce the greatest benefits.

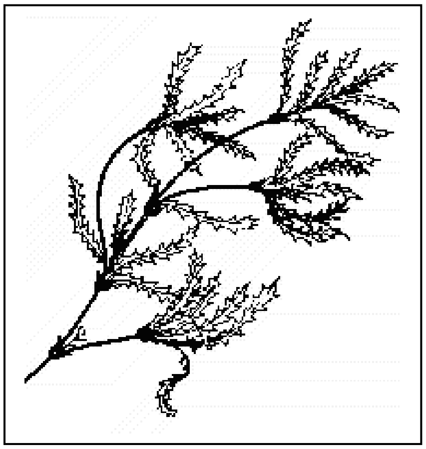



Common Name: **Bushy pondweed, slender naiad**
Scientific Name: ***Najas flexilis***
Plant Type: Submersed
Duration: Annual
U.S. Nativity: Native

This plant grows at a wide range of depths, prefers hard substrates like sand and gravel, and is not sensitive to turbidity. It is an annual plant that often acts as a pioneer species by invading open or disturbed areas. It can tolerate broad alkalinity and conductivity ranges and a moderate pH range. Bushy pondweed is firmly rooted and has slender, bright green leaves that are crowded near the tip. Fruits or seeds appear as tiny swellings at the base of the leaves. It usually grows in clumps or beds among other species.

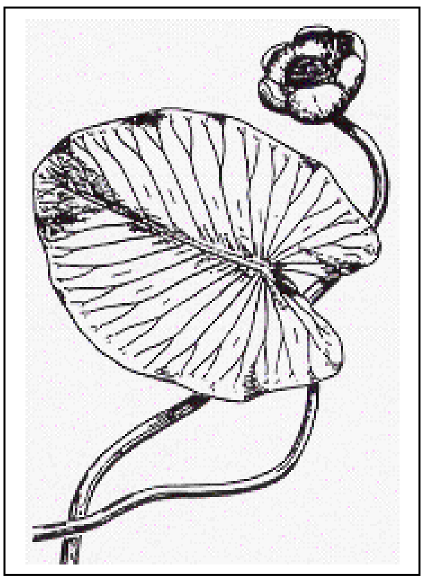
[161] Engel, Sandy. 1990. Ecosystem Responses to Growth and Control of Submerged Macrophytes: A Literature Review. Wisconsin Department of Natural Resources. Technical Bulletin No. 170.

Bushy pondweed is an important plant for waterfowl, marsh birds and muskrats. Stems, leaves and seeds are all consumed by a wide variety of ducks. It is also a good producer of food and shelter for fish. Bushy pondweed is often best left alone since it's a low-growing plant that usually does not overpopulate an area.



Common Name: **Spiny naiad**
Scientific Name: ***Najas marina***
Plant Type: Submersed
Duration: Annual
U.S. Nativity: Native

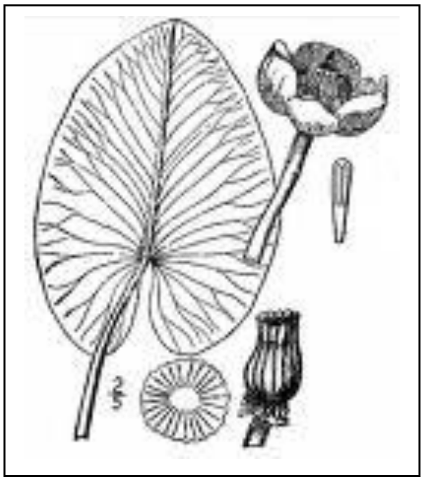
This annual, naturalized plant is found in high alkalinity, high conductivity and high pH waters. It prefers soft substrate and can grow up to about 10 feet deep. Spiny naiad is tolerant of higher than normal chloride concentrations, and often grows were concentrations exceed 10 mg/L. It is not shown to associate with any other species. Spiny naiad provides food and shelter for fish, and is a food source for waterfowl. Its leaves and seeds are consumed by a wide variety of ducks.



Common Name: **Yellow water lily**
Scientific Name: ***Nuphar advena***
Plant Type: Floating-leaf
Duration: Perennial
U.S. Nativity: Native

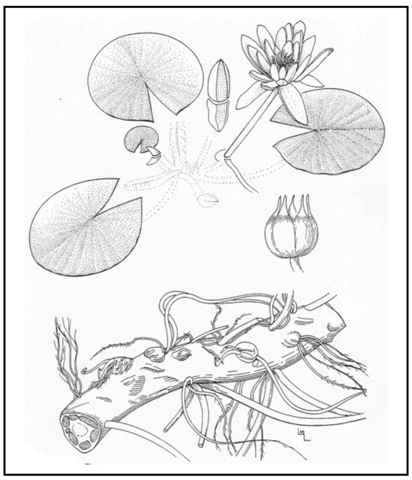
This plant usually grows in shallow, soft sediment areas of lakes, ponds or slow-moving streams. It is found in water 6.5 feet or less deep. Turbidity tolerance is not a consideration since the plant has floating leaves that quickly reach the water surface in the spring. Most of the leaves are emergent, growing at an assortment of angles above the water's surface. It can grow in sun or shade, but flowering is more abundant in good light.

In addition to their aesthetically pleasing yellow flowers, water lilies provide good shade and shelter for fish as well as habitat for invertebrates. The insects that grow under the leaves are a food source for fish. Waterfowl and marsh birds eat the seeds, muskrat and beaver eat the rhizomes, and deer graze on the leaves, stems and flowers.



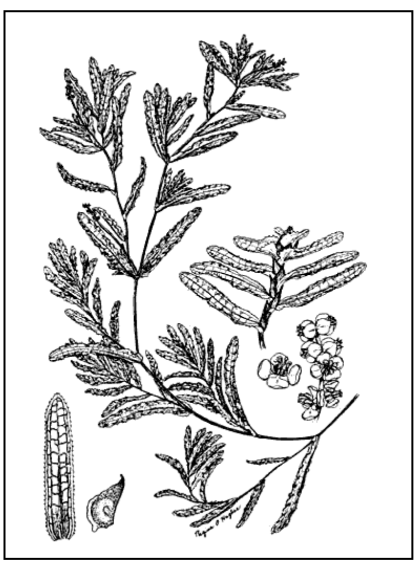
Common Name: **Bullhead pond lily, spatterdock**
Scientific Name: ***Nuphar variegata***
Plant Type: Floating-leaf
Duration: Perennial
U.S. Nativity: Native

This species is usually found in ponds or slow-moving streams. It can grow in sun or shade, and shows a preference for soft sediment and water depths less than 6.5 feet. Flowering occurs throughout the summer, with the flowers rising above the floating leaves. Later in the summer, the sepals drop and the central flower structure develops into a fleshy, well-rounded fruit. This plant provides seeds for waterfowl. The leaves, stems and flowers are grazed by deer. Muskrat and beaver are known to eat the rhizomes. The floating leaves offer shade and shelter for fish as well as habitat for invertebrates.



Common Name: **White/fragrant water lily**
Scientific Name: ***Nymphaea odorata/tuberosa***
Plant Type: Floating-leaf
Duration: Perennial
U.S. Nativity: Native

This species is found over moderate alkalinity and conductivity ranges and a wide pH range. It grows at a median depth of about 3-3.5 feet, and shows no substrate or turbidity preference. Leaves and stems are round, with most of the leaves floating on the water's surface. White water lily is usually found in quiet water of lakes or ponds. Waterfowl eat the seeds of this plant, while deer, muskrat, beaver and moose eat the rhizomes. The leaves offer shade and shelter for fish.

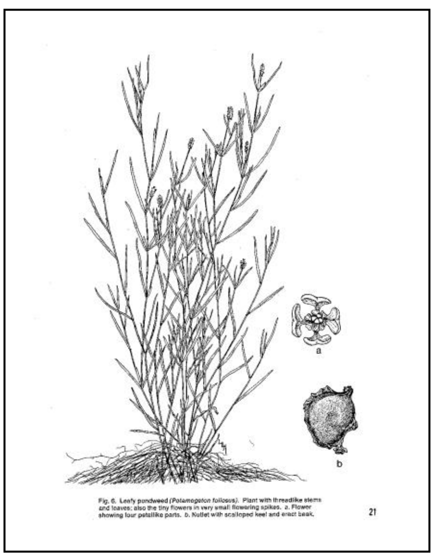


Common Name: **Curly-leaf pondweed**
Scientific Name: ***Potamogeton crispus***
Plant Type: Submersed
Duration: Perennial
U.S. Nativity: Non-native

This plant is not native to the U.S., and has a tendency to become a nuisance weed in many lakes. It is usually one of the first plants visible in the spring, and may cause temporary problems due to its early, rapid growth. It has wavy and finely serrated leaves that help distinguish it from other pondweeds. The plant can grow under the ice while most plants are dormant, but declines by early to mid-July when other species are realizing peak growth. In the spring, curly-leaf pondweeds produce flower spikes that stick up above the water surface. It typically grows in soft sediments and shallower water depths up to 12 feet. It can tolerate cool temperatures and low light, and will grow in turbid water. Curly-leaf is found over a broad conductivity range, and moderate pH and alkalinity ranges.

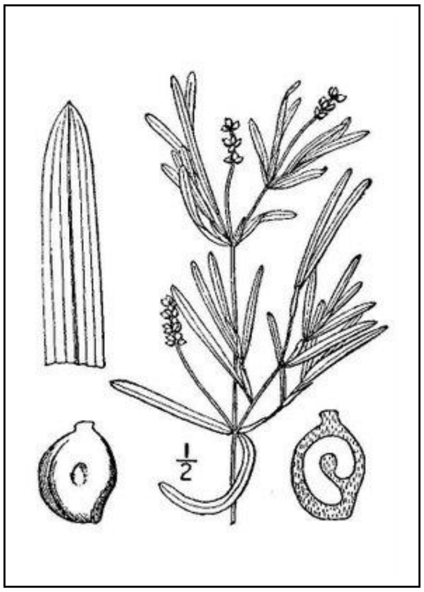
Young curly-leaf plants emerge from the sediments during fall, remain dormant during winter, and grow rapidly after ice-out, forming dense surface mats over expansive meadows. This growth cycle allows curly-leaf pondweed to out-compete other species for nutrients, sediment area and light. It grows especially well in areas where mechanical harvesting or herbicides were used inappropriately and without careful planning. The dead vegetation tends to either wash onto the lakeshore or sink to the lake bottom. Plant decay can deplete dissolved oxygen levels, eliminating habitat and causing the internal release of phosphorus from sediments on the lake bottom. Curly-leaf pondweed provides food and shelter for some fish and invertebrates, especially in the winter and spring when most other aquatic plants are reduced to rhizomes and winter buds. However, the midsummer die-off creates a sudden loss of habitat and releases nutrients into the water column that can trigger algal blooms and create turbid water conditions.

Early seasonal control during the initial stages of growth is recommended, allowing plants to be controlled before the population collapses after full growth. Chemical treatment of the young plants during fall or spring may prevent formation of nuisance mats and depletion of oxygen while allowing other native macrophyte species to re-vegetate those areas. Protection and restoration of native species, and improving water clarity can help keep this plant in check without the use of aquatic herbicides.




<u>Common Name</u>: **Leafy pondweed**
<u>Scientific Name</u>: ***Potamogeton foliosus***
<u>Plant Type</u>: Submersed
<u>Duration</u>: Perennial
<u>U.S. Nativity</u>: Native

Leafy pondweed can grow in a wide variety of habitats and water quality conditions. It is most often found in shallow water, and shows a preference for soft sediments. This plant is tolerant to eutrophic water conditions. It overwinters by rhizomes and winter buds. The early-season fruit of leafy pondweed can be a locally important food source for geese and a variety of ducks. It may also be grazed by muskrat, deer, beaver and moose. The bushy form of this pondweed offers good surface area for invertebrates and cover for juvenile fish.



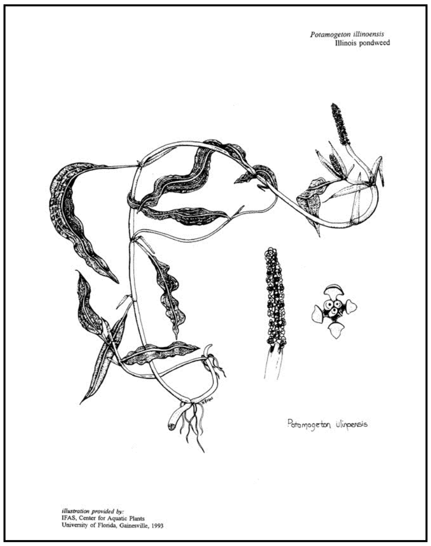

<u>Common Name</u>: **Fries' pondweed**
<u>Scientific Name</u>: ***Potamogeton friesii***
<u>Plant Type</u>: submersed
<u>Duration</u>: Perennial
<u>U.S. Nativity</u>: Native

Closely related to and often confused with small pondweed, this plant will tolerate turbid conditions. It is found in both shallow and moderately deep water. This plant overwinters by rhizomes and winter buds. Seeds and vegetation provide food and cover for a variety of aquatic life, including fish, ducks, geese, muskrats and beavers.

<u>Common Name</u>: **Variable-leaf pondweed**
<u>Scientific Name</u>: ***Potamogeton gramineus***
<u>Plant Type</u>: Submersed
<u>Duration</u>: Perennial
<u>U.S. Nativity</u>: Native

This plant is an extremely variable species that has a number of varieties that may be the result of habitat differences. It also hybridizes with most broad-leaved pondweeds. It is found over broad alkalinity and pH ranges, and a limited conductivity range. Variable pondweed grows at a median depth of about 3.5 feet, prefers firm substrate, but shows no turbidity preference. It is often found growing in association with muskgrass (*Chara spp.*), slender naiad (*Najas flexilis*) and wild celery (*Vallisneria americana*).

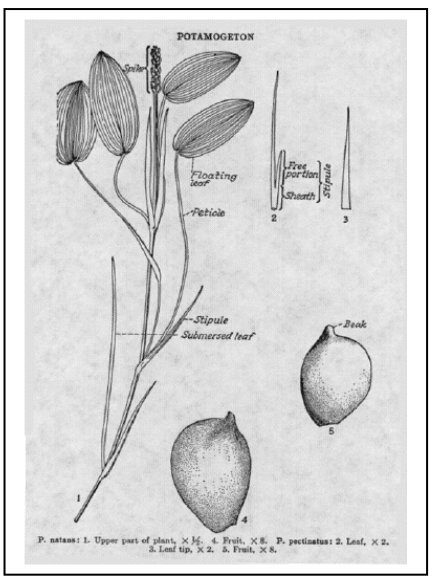
The fruits and tubers of variable pondweed are grazed by a variety of waterfowl, including geese and wood duck. Muskrat, beaver, deer and moose may also eat the foliage and fruit. This plant provides cover for panfish, largemouth bass, muskellunge and northern pike, as well as nesting grounds for bluegill. An extensive network of leafy branches offers invertebrate habitat and foraging opportunities for fish.



Common Name: **Illinois pondweed**
Scientific Name: ***Potamogeton illinoensis***
Plant Type: Submersed
Duration: Perennial
U.S. Nativity: Native

This plant is found over a broad alkalinity range, a moderate and high pH range, and a moderate conductivity range. It flowers and fruits in midsummer and shows no substrate preference. Illinois pondweed is not turbidity tolerant and is probably becoming increasingly rare where water clarity has decreased. It is commonly found in water less than 6.5 feet deep, but its maximum depth distribution is greater than 10 feet.

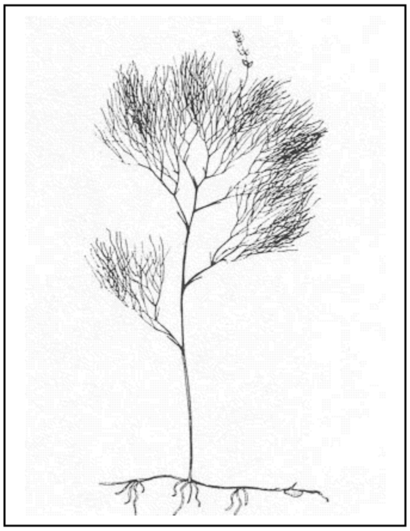
The fruit produced by Illinois pondweed can be a locally important food source for a variety of ducks and geese. Muskrat, deer, beaver and moose are known to consume this plant. This pondweed offers excellent shade and cover for fish such as panfish, largemouth bass, muskellunge and northern pike, and provides nesting grounds for bluegills. The large leaves offer good surface area for invertebrates.




Common Name: **Floating-leaf pondweed**
Scientific Name: ***Potamogeton natans***
Plant Type: Submersed & floating-leaf
Duration: Perennial
U.S. Nativity: Native

This plant shows no substrate preference and is most commonly found in water less than 5 feet deep. It can grow in highly turbid water, but shows no turbidity preference. It is found over a broad range of water chemistries. Floating-leaf pondweed has firmly rooted thick stems, and can have both submersed and floating leaves. Submersed leaves are typically thin and slender, while floating leaves are oval shaped. Flower or seeds may extend above the water surface.

The fruit of floating-leaf pondweed is held on the stalk until late in the growing season. This provides valuable grazing opportunities for ducks and geese. Muskrat, beaver, deer and moose may also consume portions of the plant. Floating-leaf pondweed is considered good fish habitat as it provides shade, cover and foraging opportunities.

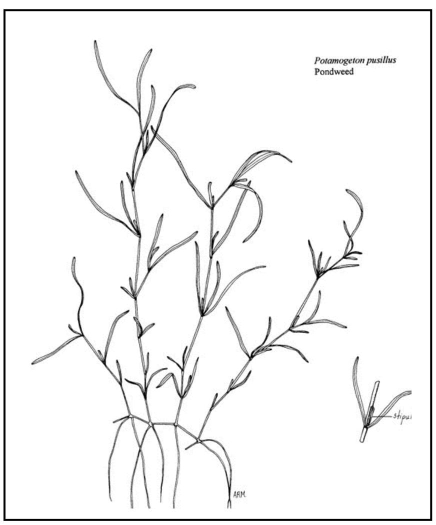


Common Name: **Sago pondweed**
Scientific Name: ***Potamogeton pectinatus***
Plant Type: Submersed
Duration: Perennial
U.S. Nativity: Native

Sago pondweed grows below the water surface at depths greater than 13 feet, although it is most common in 3-7-foot water depths. It grows in a variety of sediment types and a wide range of water conditions. In fact, it is often the last surviving rooted plant in very turbid water. It has a broad alkalinity range and moderate conductivity and pH ranges. Flowers and fruit are produced on a slender stalk that may be submersed or floating on the water surface.

Sago's rapid growth rate allows it to quickly occupy large areas and smother potential competitors. It is also very pollution tolerant and can rapidly colonize unoccupied habitats. This may be one reason why the plant is typically not found with a diversity of other species, but tends to occur in discrete beds in stressed environments. Sago pondweed is firmly rooted and has branched, slender stems and grass-like narrow leaves.

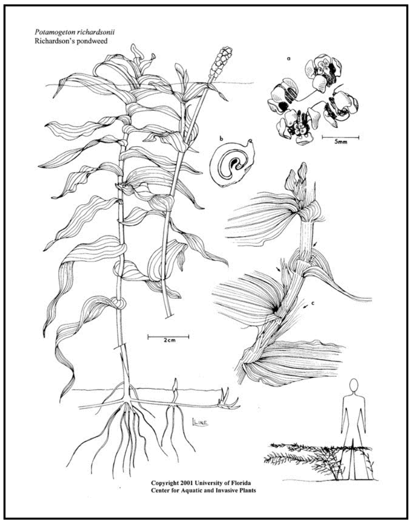
This plant provides limited cover for bluegills, perch, northern pike and muskellunge, and is good cover for walleye. It supports insects valuable as food for fish and ducklings, and is considered one of the top food producers for waterfowl. Both the fruit and tubers are heavily grazed and are considered critical for a variety of migratory waterfowl. Sago communities also provide escape cover for invertebrates, thus allowing them to thrive in the presence of small fish.




Common Name: **Small pondweed**
Scientific Name: ***Potamogeton pusillus***
Plant Type: Submersed
Duration: Perennial
U.S. Nativity: Native

Small pondweed is found over moderate ranges of alkalinity and pH, and a limited conductivity range. It grows in soft substrate to a depth of about 9 feet, and is tolerant to turbid water conditions. The plant grows below the surface, but may have flowers or seeds extending out of the water. It is firmly rooted to the bottom, and has branched, slender stems and grass-like narrow leaves.

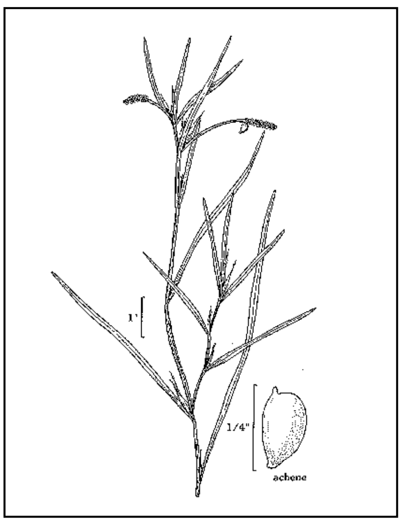
This plant can be a locally important food source for a variety of ducks and geese. It provides some cover for bluegills, perch, northern pike and muskellunge, and good cover for walleyes. It also supports insects valuable as food for fish and ducklings.




<u>Common Name</u>: **Richardson's/clasping-leaf Pondweed**
<u>Scientific Name</u>: ***Potamogeton richardsonii***
<u>Plant Type</u>: Submersed
<u>Duration</u>: Perennial
<u>U.S. Nativity</u>: Native

This plant shows no turbidity or substrate preference and can withstand environmental disturbance. It is many times the only broad-leaf pondweed found in degraded water. Clasping-leaf pondweed is found over moderate ranges of water chemistries and in water depths to 13 feet. It is often found growing with coontail (*Ceratophyllum demersum*) and small pondweed (*Potamogeton pusillus*).

The fruit produced by clasping-leaf pondweed can be a locally important food source for a variety of waterfowl. Muskrat, deer, beaver and moose may also eat the plant. The leaves and stem are colonized by invertebrates and offer foraging opportunities and cover for fish.




<u>Common Name</u>: **Flat-stem pondweed**
<u>Scientific Name</u>: ***Potamogeton zosteriformis***
<u>Plant Type</u>: Submersed
<u>Duration</u>: Perennial
<u>U.S. Nativity</u>: Native

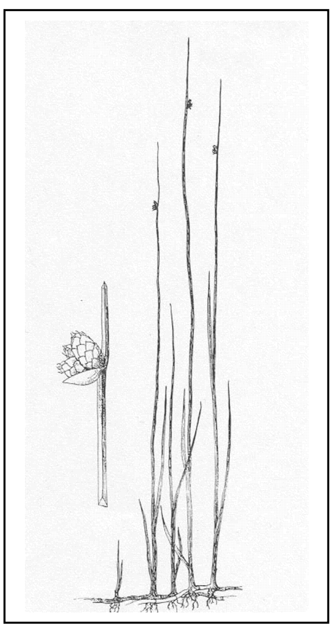
This plant grows in soft sediment, below the water surface, and in a variety of water depths up to about 13 feet. It is found over broad alkalinity and pH ranges and a moderate conductivity range. Because of its sensitivity to turbidity, the plant does not do well in lakes with poor water clarity. It is firmly rooted with branched, slender stems and grass-like narrow leaves.

Flat-stem pondweed provides limited cover for bluegills, perch, northern pike and muskellunge. It also provides good cover for walleye, and supports insects valuable as food for fish and ducklings. Flat-stem pondweed is a food source for waterfowl, muskrat, deer and beaver.

Common Name: **Arrowhead, duck potato**
Scientific Name: ***Sagittaria latifolia***
Plant Type: Emergent
Duration: Perennial
U.S. Nativity: Native

This plant grows above the surface in shallow water up to 4 feet deep, and shows no substrate or turbidity preference. It is found over broad pH and alkalinity ranges and a moderate conductivity range. Reaching about 3-4 feet tall, the plant has individual leaves that can be more than a foot long. Leaves are usually arrow-shaped with backward-pointing lobes, but vary in shape and may be long, linear, and grass-like. White flowers are about an inch in diameter, with three rounded petals, growing from the thick stem in whorls of three. Arrowhead's horizontal roots have short, thick stems or tubers at their tips in autumn.

Arrowhead protects shorelines from wave erosion. It is also one of the highest value aquatic plants for wildlife. It provides cover for waterfowl and young fish, and spawning areas for northern pike. Muskrats, beaver, and other wildlife eat the tubers. Geese and ducks eat both seeds and tubers, giving this plant the name "duck potato." Arrowhead is capable of rapidly removing phosphorus from sediments and can store high levels in its leaf tissue.



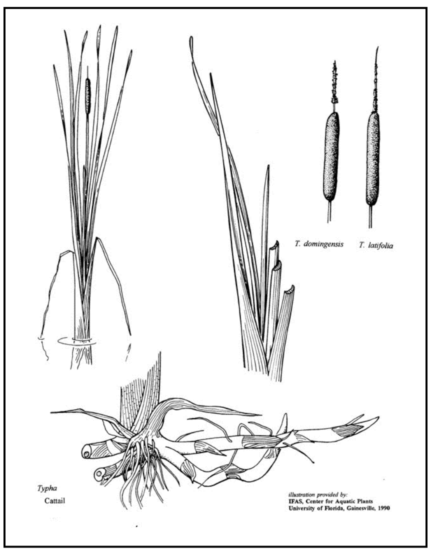
Common Name: **Three-square bulrush, chairmaker's rush**
Scientific Name: ***Scirpus americanus***
Plant Type: Emergent
Duration: Perennial
U.S. Nativity: Native

Three-square bulrush grows in deep and shallow marshes and along lakes and streams. It is found in higher pH waters than many other species, and grows in moderate conductivity and alkalinity ranges, but with low median values. It is found in water depths to 6 feet, shows no substrate preference, and is not tolerant of turbidity. This plant has moderately tall (up to 5 feet), sharply triangular stems that emerge from a firm rhizome. Short, inconspicuous leaves sheath the base of each stem.

Rigid stems survive winter and provide important spawning areas for northern pike and cover for other fish in early spring. This plant is known to attract marsh and song birds. A wide variety of ducks rely on three-square bulrush as a food source. It is heavily grazed by muskrat and provides cover for waterfowl and other shallow marsh wildlife.

Common Name: **Water bulrush**
Scientific Name: ***Scirpus subterminalis***
Plant Type: Submersed
Duration: Perennial
U.S. Nativity: Native

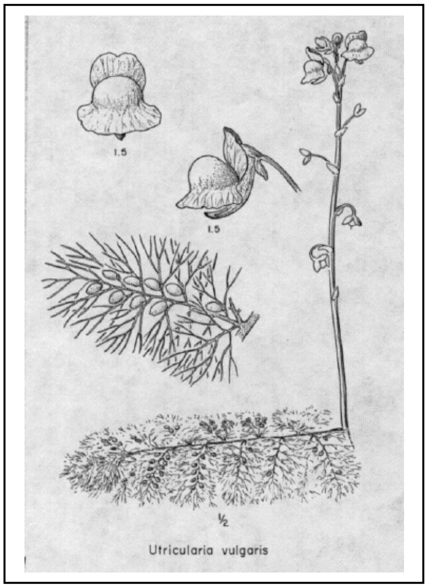
Water bulrush is mostly submersed with only the tips of fertile stems poking above surface. This plant is found over a moderate range of pH, conductivity and alkalinity conditions. It is found growing in shallow water and on a variety of substrates, including sand, marl, muck and peat. Slender, limp stems (to more than 3 feet in length) extend from a fine rhizome. The stems float in water along with hair-like leaves that arise near the base. Grass-like meadows of water bulrush provide invertebrate habitat and shelter for fish.




Common Name: **Narrow-leaf & broad-leaf cattail**
Scientific Name: ***Typha angustifolia & Typha latifolia***
Plant Type: Emergent
Duration: Perennial
U.S. Nativity: Native

These plants grow 3-10 feet tall above the water surface in marshes, along shorelines, and in quiet water up to 2.5-3 feet deep, often in disturbed areas. They are found over broad alkalinity and pH ranges and a moderate conductivity range. Narrow-leaf is more tolerant of chloride and alkalai than broad-leaf cattail.

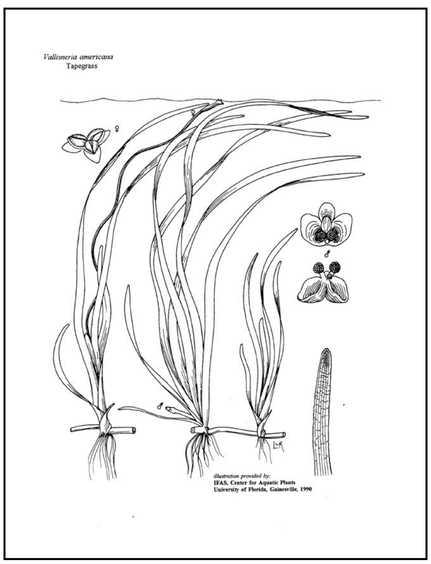
Cattails help stabilize marshy borders of lakes, protect shorelines from wave erosion, provide spawning sites for northern pike, and provide cover and nesting sites for marsh birds and waterfowl. Muskrat and beaver eat the stalks and roots. Cutting stalks under water during the early summer before the "cattail" appears works best to control growth. Cutting under water just before the lake freezes is also effective.




Common Name: **Common/great bladderwort**
Scientific Name: ***Utricularia vulgaris***
Plant Type: Free-floating
Duration: Perennial
U.S. Nativity: Native

Bladderwort is a carnivorous, free-floating plant that prefers soft substrate, tolerates turbid water, and grows in water depths from only a few inches to about 8 feet. It is found over a broad pH range, including some acid water with a pH of less than 5. Its alkalinity range is moderate and conductivity range is limited. This plant is most successful in still water where the bladders that trap prey can function properly, and where the finely divided stems are not torn by wave action.

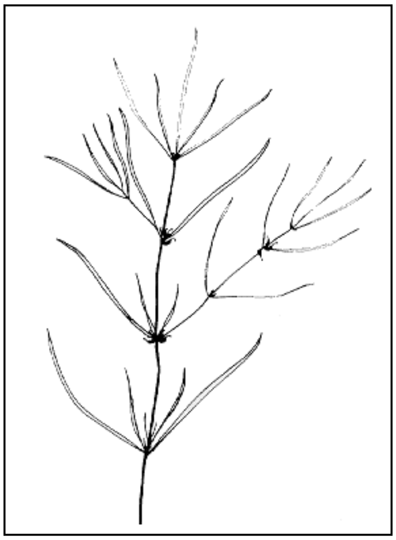
The trailing stems of common bladderwort provide food and cover for fish. Because it is free-floating, the plant can grow in areas with very loosely consolidated sediment. This provides needed fish habitat in areas that are not readily colonized by rooted plants.




Common Name: **Eel/tape grass, water/wild celery**
Scientific Name: ***Vallisneria americana***
Plant Type: Submersed
Duration: Perennial
U.S. Nativity: Native

This species prefers semi-hard substrate, is turbidity tolerant, and grows in water depths up to 10-15 feet. It is found over broad pH and alkalinity ranges and a moderate conductivity range. Flowering occurs in late summer on a coiled stalk. It spreads by rhizomes and tuberous tips that, along with the fruits, are relished by waterfowl. Wild celery often grows in beds near pondweeds such as bushy pondweed.

Wild celery is a premier source of food for waterfowl, especially for canvasback ducks in the fall. All portions of the plant are consumed, including foliage, rhizomes, tubers and fruit. This plant is also important for marsh birds and shore birds, including rail, plover, sand piper and snipe. Muskrats are also known to graze on it. Beds of wild celery are considered good fish habitat providing shade, shelter and feeding opportunities. Wild celery is usually best left alone unless excessive growth in shallow water presents a problem.



Common Name: **Horned Pondweed**
Scientific Name: ***Zannichellia palustris***
Plant Type: Submersed
Duration: Annual
U.S. Nativity: Native

Horned pondweed has long, narrow leaves and slender stems that emerge from an equally slight rhizome. This annual species is found in high alkalinity, high pH, and high conductivity water. It is turbidity tolerant and prefers hard substrate. Horned pondweed is commonly found in water less than 12 feet deep, and is often partly buried in silt or mud. Waterfowl eat the fruit and foliage of horned pondweed. It is also considered a fair food producer for trout.

Several varieties of algae are found in Lake Ripley, including green, bluegreen and filamentous algae. Brief descriptions are provided below.[162]

Filamentous algae *(Cladophora, Spirogyra)*: This type of macroalgae consists of single cells that are connected end-to-end. It appears as green-colored thin threads, branched filaments or an interwoven net. Filamentous algae do not have roots, stems or leaves. It begins growing along the shoreline or on the lake bottom, and later buoys to the surface forming green mats that frequently attach to rocks or other plants. Abundant growth identifies lakes polluted with excessive nutrients. Although filamentous algae provide cover for insects valuable as fish food, it is often viewed as an unsightly nuisance. Preventative actions that reduce the flow of nutrients into the lake are the best means of control.

Planktonic algae: These are microscopic, single-celled organisms that may form multi-cellular colonies or filaments. Common varieties include green algae, bluegreen algae and diatoms. Abundant growth results in “blooms” that color water green or brown. Surface scums of bluegreen algae may form on the water surface during the summer. Abundant growth identifies lakes polluted with excessive nutrients such as nitrogen and phosphorus. Planktonic algae provide food for zooplankton and some food for fish fry. Preventative actions to reduce the flow of nutrients into the lake are the best means of control.

## 5-9 FACTORS CONTROLLING PLANT GROWTH

A few of the major factors affecting the abundance and distribution of aquatic plants in Lake Ripley are light and nutrient availability, water chemistry, sediment type, and the amount of wind and wave energy.

[162] Welsch, Jeff. 1992. Guide to Wisconsin’s Aquatic Plants. Wisconsin Department of Natural Resources. PUBL-WR-173 92rev.

Light availability: Light availability, which is directly linked to water clarity, regulates the maximum depth of plant growth. The amount and spectral quality of light at the lake bottom diminishes as water clarity decreases, generally as a result of increasing water depth. Submersed aquatic plants typically grow to a depth of about two times the Secchi depth. Other factors that influence light availability are phytoplankton (algae) concentrations, water color, and the concentration of suspended particulate matter, also called turbidity. Turbidity may be caused by runoff entering the lake, or through sediment re-suspension caused by boat traffic, wind mixing, and biotic factors such as carp-feeding activities. The extent of the littoral zone, or the area that can support rooted aquatic plant growth, will fluctuate based on these and other photosynthesis-limiting factors.

Nutrient availability: Plant growth can be limited if at least one nutrient that is critical for growth (e.g. phosphorus or nitrogen) is in short supply. However, nutrients supplied from bottom sediments combined with those in solution are generally adequate to meet nutritional demands of rooted aquatic plants, even in nutrient-poor (oligotrophic) systems. Rooted plants usually fulfill most of their phosphorus and nitrogen requirements by direct uptake from sediments, although the preferred source of some nutrients such as potassium, calcium, magnesium, sulfate and sodium appears to be the open water. Oligotrophic lakes generally maintain less total biomass of aquatic plants and usually different species than eutrophic lakes.

Water chemistry: Water chemistry is another environmental factor that can control plant growth. For instance, some species are very tolerant of acidic conditions while other species are very intolerant of these conditions. Most plants prefer slightly alkaline water chemistries as opposed to acidic environments. Lake Ripley is considered a hardwater, alkaline lake that is capable of supporting an abundance of aquatic vegetation.

Sediment type: Variations in the quality and quantity of bottom sediment play a significant role in controlling the distribution and growth of rooted aquatic vegetation. Rocky, sandy, silty and mucky substrates will each favor different plants. The distribution of different substrate types along the lake bottom is dictated by a number of factors. For instance, wave action and currents allow coarse material to remain in shallow water (a higher energy environment) while finer material is transported to deeper water where a lower energy environment prevails. The strength and direction of the wind in conjunction with the morphology of the lake basin will play a large role in determining where the substrates will move. In general, points and shallows where wind and wave energy are highest tend to be swept clean, while bays and deep areas in a lake tend to fill with sediment.

Wind and wave energy: Finally, high-energy environments caused by wind, water current and/or wave action can significantly limit plant growth. These and similar disturbances, if frequent, will prevent vegetation from being able to take root in the substrate, especially if the substrate is unsuitable for most plants due to scouring. As noted above, these factors are usually greatest in unprotected and wind-swept shallows.

## 5-10 FACTORS AFFECTED BY PLANT GROWTH

The preceding section dealt with some of the main factors that can control the amount and type of plant growth in a particular lake. This section describes how the resulting plant growth (or lack thereof) can impact the overall ecosystem. The presence or absence of plant growth can have a dramatic effect on the aquatic environment. A number of these plant-induced, ecosystem impacts are discussed briefly below.

<u>Littoral Zone Productivity</u>: The littoral zone is the shallow portion of a lake that is able to support rooted aquatic plant growth. Small and irregularly shaped lakes usually have more miles of shoreline per acre of lake surface area, so they have greater potential for a more productive littoral zone. The accumulation of organic sediments from the decay of plant matter causes expansion of this littoral zone and filling in of the lake.

<u>Water Clarity</u>: Rooted aquatic plant growth and water clarity are inextricably linked. As rooted plant abundance increases in a lake, the abundance of suspended particulate matter (e.g. algal cells, organic matter and clay particles) decreases, and vice versa. This relationship exists because aquatic plants act as water quality filters, help cover and therefore stabilize bottom sediments, and compete for the same nutrients that fuel algal blooms.

<u>Water Temperature/Circulation</u>: Shading and reduced water circulation caused by dense stands of aquatic plants produces vertical temperature gradients as steep as 18°F over three feet of water depth. Reduction in water flow through plant beds also enhances trapping and deposition of fine sediment and organic matter. This process improves water clarity and increases the accumulation of sediments or organic material in shallow areas. The reduction in water circulation, if significant, can limit the ability of the lake to naturally aerate.

<u>Dissolved Oxygen</u>: Heavy plant growth is shown to cause large fluctuations in dissolved oxygen concentrations. The water column can become supersaturated with dissolved oxygen when peak photosynthesis occurs during daylight hours. Anoxia (oxygen depletion) is likely to follow as respiration exceeds photosynthesis during non-daylight hours, especially in the absence of sufficient water circulation, or when microbial decomposition increases as a result of a plant die-off. Whenever anoxic conditions are produced, the survivability of oxygen-dependent aquatic organisms is compromised. Dense growths of floating vegetation can exacerbate the situation by restricting atmospheric oxygen exchange at the water surface and limiting light penetration.

<u>pH</u>: Changes in pH of up to two standard units are known to occur within a 24-hour period due to the metabolic processes of submersed plants. A high degree of primary productivity can cause the pH of a water body to increase significantly, and vice versa.

<u>Phosphorus Availability</u>: Sediment re-suspension is shown to be a mechanism for introducing phosphorus into the water column. The root systems of plants help stabilize loose bottom sediment to prevent this from happening. Aquatic vegetation also influences nutrient cycles by assimilating phosphorus from the sediments during the growing season, and releasing phosphorus during death and decay. This means fewer nutrients are available for algae growth

during the growing season, resulting in better water clarity. If nutrients are then released in the fall during decomposition of plant matter, water temperatures are usually cool enough to prevent noxious algae blooms from occurring. Those that do occur will generally pose fewer problems since the peak recreational period has passed. If anoxic conditions are caused as a result of plant decomposition, phosphorus may be released from the bottom sediment into the surrounding water column, fueling additional algal blooms.

Habitat and Water Quality: Too few plants generally do not provide enough cover for fish and aquatic life, while too many plants may lead to stunted panfish populations and poor gamefish growth. The latter is caused by an overabundance of structural habitat for small fish, allowing these smaller fish to escape predation and achieve high population densities. This means there is not enough food available for the existing fish, so both panfish and gamefish become size stunted. The Trophic Cascade Hypothesis predicts that water quality is linked to the success of certain fish species, which can cause a "cascading" effect down the food chain. Simply stated, water quality improves as larger gamefish (piscivores) become more successful at feeding on the smaller panfish (planktivores). As planktivore populations are diminished, there is less consumption of the microscopic animals (zooplankton) that graze on algae (phytoplankton). The amount and quality of the vegetative habitat usually plays a sizeable role in determining the outcome of this process. A moderate amount of high quality aquatic vegetation with plenty of edge habitat is generally the most conducive to larger fish populations and better water quality.

## 5-11 MANAGEMENT IMPLICATIONS

The first step toward implementing a successful aquatic plant management program is to recognize the important functions and values of a healthy plant community. A diversity of emergent and submersed native aquatic vegetation provides critical habitat for fish and wildlife, primarily in the form of structural refuge and spawning substrate. Fish and wildlife also rely on plants as a source of food. Some plant varieties are consumed directly, while others support large populations of invertebrates that form the base of the food chain. Through photosynthesis, aquatic vegetation produces the aerobic conditions that oxygen-dependent organisms rely upon for their survival. Aquatic plants also stabilize loose bottom sediment, trap suspended particles, protect against shoreline erosion, provide refuge for zooplankton (algae consumers), and compete for the same nutrients that fuel algal blooms—each of which is vitally important for maintaining optimal water quality.

Fertile lakes with nutrient-rich bottom sediment, shallow water depths, and relatively clear water generally support the most abundant plant growth. This growth occurs in the littoral zone—the most biologically diverse and productive part of the lake—that extends from the shoreline out to about the 15-foot water depth in Lake Ripley. Unfortunately, this critical area is also the most vulnerable to the affects of shoreline development, runoff pollution, motor boating impacts and other recreational pressures. As a result, ecologically valuable but sensitive plant species are often displaced by less desirable species that are more tolerant of disturbances and poor water quality. These "weeds" may aggressively out-compete native, beneficial plants until the entire plant community is dominated by only one or two species. Without proper management intervention, such changes could lead to a host of water quality, habitat and recreational impairments. Clogged boating lanes, reduced species diversity and habitat value, stunted fish growth, dramatic fluctuations in dissolved oxygen concentrations, and boom-and-bust plant growth cycles are just some of the problems that may be experienced.

Control methods should be employed that do not significantly disrupt native, beneficial plant communities that provide critical fish and wildlife habitat and water quality protection benefits. Maintaining these more desirable plant communities should prevent the continued spread of the more aggressive, nuisance species such as Eurasian watermilfoil. In most instances, the control of native aquatic plants should be discouraged or limited to only high-use areas like public swimming beaches and motor boat access channels.

Algae and rooted aquatic plant growth are inversely related given that each depends upon and competes for similar nutrients and available sunlight. This relationship allows for two alternate states of equilibrium: a lake that is clear and has an abundance of vegetation, and one that is murky and frequented by thick algal blooms. Consequently, a large-scale, plant-eradication effort could potentially trade a clear and "weedy" lake for a turbid, algae-covered and plant-barren lake with little nutrient buffering capabilities or aquatic habitat.

## 5-12 PRIOR PLANT-CONTROL MEASURES

According to *Webster's*, a weed is defined as "any plant growing where it is not desired." This loose definition does not make value distinctions among different plants, nor does it clarify who or what user group gets to determine level of desirability. Consequently, some early plant-control efforts on Lake Ripley were relatively aggressive and reactionary, particularly with respect to the use of chemical applications.

Herbicide use was first documented in 1977, and was discontinued by 1990. In contrast to many lakes in southern Wisconsin, Lake Ripley is not reported to have been subject to the use of sodium arsenite as an aquatic plant control measure.[163] Likewise, although some copper sulfate use was reported on Lake Ripley in the past, there are few records of the widespread use of this algaecide in the lake.[164] The chemical treatment history on Lake Ripley is summarized in Table 30, and is based on Wisconsin DNR permit records dating back to 1950.

**Table 30: Chemical treatment history on Lake Ripley (1950-Present)**

| Date | Acres Treated | Herbicides | Quantity | Target Species |
|---|---|---|---|---|
| 7-77 | 1.65 | Hydrothol 47 | 150 lbs. | Wild celery |
| 8-81 | 0.13 | Aquathol granual | 20 lbs. | Milfoil |
| 5-82 | 0.16 | Aquathol granual | 50 lbs. | Milfoil |
| 6-83 | 0.03 | Aquathol granual | 50 lbs. | Milfoil |
| 6-86 | 26.00 | Cu, Diquat, Aquathol K | 26 gals. | Milfoil |
| 6-88 | 10.00 | Same | 22 gals. | Milfoil |

[163] L.A. Lueschow. 1972. Biology and Control of Aquatic Nuisances in Recreational Waters. Wisconsin Department of Natural Resources Technical Bulletin No. 57.
[164] Ibid.

| | | | | |
|---|---|---|---|---|
| 6-89 | 9.00 | Same | 15 gals. | Milfoil |
| 6-89 | 0.04 | Aquathol granual | 37 lbs. | Milfoil |
| 6-90 | 0.04 | Aquathol granual | 30 lbs. | Milfoil |
| 6-90 | 3.60 | 2,4-D | 11 gals. | Milfoil |

From about 1989 to the present, mechanical harvesting has been used as the primary method for controlling nuisance weed growth. The District currently uses an Aquarius Systems Model HM-420 mechanical harvester with a 7.0-foot cutting width and a 5.5-foot cutting depth. Ancillary equipment include a 28.5-foot shore conveyor, 1977 GMC Sierra Series 6000 dump truck, and a 42-foot Aquarius Systems harvester trailer with electric winch. Most mechanical weed harvesting is currently confined to East Bay, and particularly out from the inlet where expansive milfoil and curly-leaf pondweed beds are the densest.

## 5-13 MANAGEMENT RECOMMENDATIONS

### MONITORING

- Monitor land-use changes and promote watershed Best Management Practices (BMPs) to prevent sediment and nutrient runoff from reaching the lake.

- Repeat the aquatic plant inventory for Lake Ripley at least every 5-6 years. Inventories are used to track changes in the aquatic plant community over time. They are also used to monitor harvesting impacts on species diversity, distribution and densities within management zones.

- Monitor the lake's carp population to make sure carp numbers do not increase or start to dominate the fish community. Carp are known to uproot plants and muddy the water, and can have a deleterious impact on native vegetation that is sensitive to water clarity changes or lakebed disturbances.

### MANAGEMENT INTERVENTION

- Employ management strategies that promote a diverse and thriving native plant community—both on shore and throughout the lake's littoral zone—to protect water quality and enhance fishery habitat.

- Provide technical, permitting and cost-share assistance to lakefront property owners willing to establish native lakeshore buffers or restore aquatic plant beds. The right types of native plants can be planted to increase species diversity, attract certain wildlife, promote fish spawning, retard shoreline erosion, improve water clarity, enhance natural property aesthetics, and prevent the continued spread of nuisance species. Well-vegetated shorelines also provide important overwintering habitat for a native weevil (*Euhrychiopsis lecontei*) that provides a biological control on Eurasian watermilfoil.

- Selectively control non-native weed beds while minimizing disturbances to native and mixed-species plant communities. Target control efforts in a priority-driven manner that 1) recognizes the root causes of nuisance weed growth; 2) preserves important ecological values of the larger plant community; 3) facilitates reasonable public access and navigation within high-traffic boating lanes, and 4) balances the needs of competing recreational uses.

- Support plant-control programs and policies that support moderate amounts of vegetative cover (at least 15-20% aerial cover). Plant growth should be sufficient to provide habitat and water quality benefits. However, unusually high densities of plant growth can restrict predator-prey dynamics, cause fish stunting, and contribute to excessive respiration and dissolved oxygen depletion during non-daylight hours.

- Use mechanical harvesting to manage non-native, nuisance weed growth in approved locations. Mechanical harvesting is recommended as an effective method for removing Eurasian watermilfoil canopies, establishing edge habitat for fish, and opening boating lanes to improve access to open-water areas. It is also considered an environmentally-sound technique for controlling milfoil in large, off-shore areas. Finally, the District already has a significant investment in the capital equipment and trained staff necessary for carrying out a successful mechanical-harvesting program.

- If warranted, mechanical harvesting may be complimented with spot herbicide treatments in approved locations. Herbicides are best used to suppress isolated colonies of invasive species that cannot be controlled by other means, and where chemical drift will pose a limited threat to non-target plant and animal species. [Note: Endothall, diquat and copper are contact herbicides that may be effective on annuals. Dichlobenil, 2,4-D, fluridone and glyphosphate are more species-specific, systemic herbicides that may be effective on perennials. The herbicide 2,4-D (2,4-dichlorophenoxyacetic acid) is probably most commonly and effectively used to control Eurasian watermilfoil.] Herbicides are not advocated as a lake-wide control method due to non-target toxicity concerns, as well as problems associated with the resulting decomposing plant biomass. The most appropriate potential use of herbicide at this time is to suppress curly-leaf pondweed (*Potamogeton crispus*) beds in East Bay. Considerable caution is warranted given the location of these weed beds in relation to mapped Critical Habitat Areas.

**PUBLIC OUTREACH**

- Build public support and cooperation by clearly communicating the goals and objectives for managing aquatic plants, and the steps required to achieve desired outcomes. Public-awareness campaigns should focus on the value of native aquatic plants, how to identify and control problem species, local and state rules related to the protection or control of aquatic plants, and the role and limitations of management programs.

- Advocate for lake-use and zoning policies that help protect shallow, ecologically-sensitive areas from unnecessary motor boat disturbance and degradation. By dividing a lake into separate and distinct user zones, competing recreational interests can be more equitably accommodated and at greater densities. Lake zoning also allows for more effective targeting of plant-control efforts, depending on the specific need and level of management intensity required by the particular lake-use zone. Lake Ripley's current no-wake and no-motor policies appear to be accomplishing these objectives.

- Encourage lakefront property owners to properly manage nuisance weed growth that occurs around their own piers, boatlifts and swimming rafts. Lakefront residents should also be encouraged to remove floating plant debris that washes to shore. Floating plant debris may include Eurasian watermilfoil fragments that can re-root and grow into new weeds. Decomposing plant debris also releases phosphorus and other nutrients that can contribute to algal blooms.

## 5-14 MECHANICAL HARVESTING GUIDANCE

### OVERVIEW

Mechanical harvesting should be viewed as a long-term commitment where operational intensity may vary from year to year depending on actual need. An effective harvesting program involves maintaining, storing and deploying multiple pieces of equipment. It also involves administering permits; training and supervising machine operators; carrying appropriate insurance coverage; locating disposal areas for harvested plant material; recordkeeping; and maintaining public relations. However, once the capital equipment is acquired and a program is established, significant cost savings and other benefits are generally realized.

A load of cut weeds is being inspected on the weed harvester by two employees of the Lake District.

The role of a mechanical harvester is to cut and collect aquatic vegetation growing within a few feet of the water surface. Root systems remain in place after harvesting, allowing plants to quickly regenerate. About one acre of lake surface can typically be harvested per hour, and relief can last as little as several days or up to three months depending on growing conditions.

Harvesting exhibits both selective and non-selective impacts on aquatic plants. Non-selectivity is demonstrated by the removal of all plant species that fall within the reach of the cutter bars. Some species selectivity is achieved by targeting monotypic stands of nuisance vegetation, operating at specific times during the growing season, and altering the depth of cut. It may be possible for harvesting to alter the composition of a plant community by encouraging the success of shorter-growing and disturbance-tolerant species, and by allowing additional sunlight to reach the understory.

### PERMIT AUTHORITY

The District carries out its mechanical harvesting program in accordance with an operating permit issued by the Wisconsin DNR. This permit must be renewed every five years at a cost of $300, and is currently set to expire on 12/31/2011. The permit grants authority to the District to conduct harvesting operations under Section 23.24, Wisconsin Statutes, and Administrative Code NR 109. Harvesting is only allowed in approved locations and using approved methods. Annual reports must be submitted to the Wisconsin DNR by November 1st of each year. At a minimum, these reports should describe hours worked, locations harvested, total acres harvested, amount of plant material removed, and the types and relative amounts of each species harvested.

NOTE: A Wisconsin DNR permit is not currently required for manual cutting and raking if the area of plant removal is kept to a contiguous, maximum width of 30 feet along the shoreline and is not located within a designated sensitive area. Any piers, boatlifts, swim rafts, and other recreational devices must be located within the 30-foot zone. All cut plants must be removed from the water. A permit is presently required if the plant removal area is more than 30 feet wide along the shoreline, or if the area is within a designated sensitive area.

## EQUIPMENT

The District currently owns and operates a 1993 Aquarius Systems' Model HM-420 mechanical harvester with a 7.0-foot cutting width, 5.5-foot cutting depth, 10.8-19.8" draft, and a 440 cubic feet capacity (8,500 lbs.). It was purchased new for $66,000 with the help of a 50% matching grant through the Wisconsin Waterways Commission.

The harvester is constructed upon a low-draft barge controlled by side-mounted paddle wheels, and is equipped with one horizontal and two vertical cutter bars that can be hydraulically positioned to a depth of 5.5 feet. Hydraulic conveyors built into the harvester hoist cut plant debris onto the deck of the barge. When full, the plant material can be transported back to shore to be off-loaded into an awaiting dump truck using a shore-conveyor system.

Ancillary equipment presently includes a 28.5-foot shore conveyor, 1977 GMC Sierra Series 6000 dump truck, and a 42-foot Aquarius Systems' harvester trailer with mounted electric winch. The shore conveyor and dump truck are quite old and have started to require increasing levels of maintenance. These two pieces of equipment will likely need to be replaced in the near future.

At the close of each season, all equipment is cleaned, inspected, lubricated and winterized for storage purposes. The equipment is currently stored in a cold-storage shed located at the Oakland Town Hall. Table 31 lists storage dimensions for each piece of equipment. The District has a 10-year storage-lease agreement with the Town of Oakland that expires on December 31, 2015. This arrangement was purchased for an upfront cost of $8,000 as stipulated in a Memorandum of Understanding dated 12/27/05.

**Table 31: Storage dimensions for harvester and accessory equipment**

| | Length | Width | Height |
|---|---|---|---|
| Harvester (on trailer) | 42 ft. | 14.2 ft. (with paddles)<br>9 ft. (without paddles) | 9 ft. |
| Harvester (off trailer) | 39 ft. | Same | Same |
| Conveyor | 28.5 ft. | 6.5 ft. (at wheels) | 9.5 ft. (max.)<br>6.7 ft. (min. – center pivot) |

| | | | |
|---|---|---|---|
| Dump truck | 21 ft. | 8 ft. | 7.5 ft. |

**STAGING AREA**

The mechanical harvester is launched and removed from the lake using the Town of Oakland boat landing on Island Lane. Launching and removal of the harvester remains problematic due to the absence of an adequately sized turnaround. The turnaround should be a minimum of 60x60 feet since the trailer cannot be rotated at greater than a 90° angle when hitched. Consequently, the trailer must be slowly backed into position starting from Forested Road.

During summer operations, the harvester, shore conveyor and dump truck are parked at the Hoard-Curtis Scout Camp (approximately mid-June to late-October). The District currently rents the Camp property for $150/month during the operating season.

**WEED DISPOSAL**

Many farmers are more than willing to accept aquatic plants since they are used as a source of nutrients (2.5% nitrogen, 0.6% phosphorus, and 2.3% potassium) and can add valuable, seed-free organic matter to the soil. Locating a disposal site in close proximity to the off-loading conveyor station is one of the keys to managing costs and increasing program efficiency. Harvested plant material is currently trucked to the Rude Farm at W9156 USH 12 in Cambridge for composting. This location is ideal since it is only about a mile from the staging area. The property owner does not currently charge for this convenience.

**STAFFING**

Weed-harvesting staff currently consists of two operators who are trained and supervised by the District's Lake Manager. These part-time, seasonal employees are in charge of operating and maintaining the machinery on an as-needed basis. They are paid on an hourly wage basis, and are covered by Workers' Compensation Insurance. The established starting wage rate is currently $10/hour, with $1/hour annual raises for returning employees up to a maximum $15/hour wage rate. Any specialized mechanical work beyond routine equipment maintenance is reimbursed at a rate of $18/hour.[165] Operators are required to comply with a "Weed Harvesting Operations Plan" that was adopted in 2008 and is presented in its entirety below.[166]

[165] Lake Ripley Management District, 05/12/07 meeting minutes
[166] Lake Ripley Management District, 04/12/08 meeting minutes

Weed Harvesting Operations Plan
Adopted: 04-12-08

Operations Period: June 15th – October 1st on as-needed basis

Staffing Levels: Two, part-time operators shall be hired to work in concert during the conduct of actual harvesting. A two-person operating team is recommended for both safety and logistical reasons (i.e., response to injury/mechanical breakdowns, off-loading coordination, etc.). A third employee shall be hired *only* if a consistent and compatible scheduling arrangement cannot be worked out between the two primary employees.

Compensation: As adopted by the Board in 2007 (and amended on 9/26/09), employees shall start out earning a $10/hour wage rate to operate and maintain the harvesting equipment. A $1/hour raise shall be awarded to returning employees at the start of each subsequent operating season, until the current $15/hour cap is reached. Any specialized mechanical work beyond routine equipment maintenance shall be reimbursed at a rate of $18/hour. Routine maintenance tasks are those that can be performed with very little to no mechanical expertise (i.e., greasing, lubricating and power-washing machine parts, replacing batteries, inspecting hoses, checking fluid levels, etc.). Specialized mechanical work requires a level of training or experience that cannot be performed by the average employee (i.e., engine diagnostics and repairs, replacement of bearings, oil changes, bodywork, etc.). Wage adjustments as a result of inflation, employee performance, local market rates and other factors shall be considered by the Board every two years, or as deemed appropriate.

Minimum Qualifications: Operators should be at least 18 years old; possess a valid commercial driver's license (CDL) ***or*** have competence in driving a dump truck and operating heavy equipment; perform occasional heavy lifting; conduct basic equipment maintenance; and be able to follow an aquatic plant management plan and permitting requirements.

Training: All operators shall complete a minimum of 3 hours of on-the-water training under the direction of the Lake Manager. Operators must be able to demonstrate a strong work ethic, and competence in both running the equipment and identifying nuisance weed conditions. In addition, operators must have reviewed and be able to follow all operating guidelines contained in the latest version of the Lake Ripley Aquatic Plant Management Plan and DNR Harvesting Permit.

Scheduling: Operators must be generally available to work during established time blocks throughout the harvesting period. Weekly time blocks shall be 7:30-11:00 a.m. Monday through Friday, corresponding with the slow-no-wake period. This provides, if needed, a maximum of 17.5 hours per week of harvesting time. By noon on Friday, operators shall propose a joint work schedule for the upcoming week to the Lake Manager. Proposed schedules shall be based on the latest assessment of weed-growth conditions and other needs, and may be adjusted later if such conditions change. Any proposed scheduling changes must be approved in advance by the Lake Manager.

Timesheet Reporting: Operators shall be responsible for filling out their timesheets at the end of each work day. Operators shall accurately document start/finish times; estimated percentage of time spent harvesting vs. operational-support tasks; approved out-of-pocket expenses for supplies and authorized mileage; descriptions of the specific work tasks performed; lake areas harvested; the number of harvester loads removed from the lake; and number of machine hours logged on the harvester meter on a bi-weekly basis. Timesheets shall be delivered to the Lake Manager by 12:00 p.m. on the first and third Friday of each month. The Lake Manager shall then review and forward the timesheets to the Board Treasurer for payment. Two weeks shall be allowed for payroll processing following receipt of the timesheets.

Oversight: Operators shall immediately notify the Lake Manager of any alterations to the approved work schedule. At least every three weeks, an oversight committee shall perform brief visual inspections to assess operator performance and help identify new problem areas. The oversight committee shall consist of the Lake Manager and at least one LRMD Board member. If possible, one of the operators should accompany the oversight committee. The oversight committee shall investigate citizen complaints regarding specific weed-related concerns, and forward any appropriate follow-up instructions to the operators.

Board Reporting: The Lake Manager shall provide a brief harvesting report at each Board meeting during the operating period. The report shall include the schedule of operations since the last meeting; general harvesting locations; number of loads harvested; any significant problems encountered; status of the equipment; general assessment of nuisance weed-growth conditions, and a summary of actions/recommendations by the oversight committee.

*I have read and agree to comply with the Operator requirements outlined in the above* Weed Harvesting Operations Plan *as a condition of my employment with the Lake Ripley Management District:*

__________________________________ ____________
Signature of Operator Date

## COSTS

Operating costs are highly variable but generally average around several thousand dollars per year. Costs include fuel, equipment storage, maintenance/repairs, payroll and insurance. Actual operating expenses depend on the number of people employed to operate the equipment, the nature of their employment (volunteer, part-time or full-time), and the hours of operation. The Lake District should recognize that it takes dedicated and skilled individuals to properly maintain and operate the equipment. Appropriate compensation incentives must be provided to maintain a qualified operating crew and to avoid a high, staff turnover rate each year. An activity report summarizing program details over the last several years is presented in Table 32.

**Table 32: Harvesting program summary report (2001-2009)**

| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|
| Launch/ removal date | 6/28–10/17 | 6/20–11/13 | 6/25–10/20 | 6/24–10/19 | 6/20–10/20 | 6/29–9/26 | 6/27–10/22 | 6/24-10/06 | 6/15-10/05 |
| Operators | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| Total hours[1] | 82.5 | 125.5 | 209.5 | 245 | 83 | 221.5 | 160 | 228.5 | 266 |
| Total expenses[2] | $3,554 | $5,404 | $4,009 | $5,656 | $3,111 | $6,597 | $3,474 | $6,749 | $6,027 (as of 11/7/09) |
| % supplies, repairs, fuel | 41% | 39% | 9% | 15% | 10% | 52% | 17% | 38% | 27% |
| % storage, shore rental | 38% | 33% | 28% | 22% | 44% | 4% (winter storage lease not included) | 12% (winter storage lease not included) | 8% (winter storage lease not included) | 9% (winter storage lease not included) |
| % operator wages | 21% | 28% | 63% | 63% | 46% | 44% | 62% | 54% | 64% |
| Extra-ordinary expenses | $719 for winch | $1,641 for truck repairs | $1,345 for conveyor repairs | | | $2,600 for harvester repairs | $330 permit fee | $900 for truck repairs; $1,000+ for harvester repairs | |
| Machine hours at end of season[3] | NA | NA | NA | 2423 | 2502 (79 hrs) | 2721 (219 hrs) | 2921 (200 hrs) | 3115 (194 hrs) | 3523 (408 hrs) |
| # harvester loads[4] | 11.5 | 18 | 18 | 17 | 7 | 19 | 18 | 18.5 | 33 |

[1] All employee hours, including combined shifts to operate harvester and "off-season" equipment maintenance. Note that a significant number of hours are devoted to non-cutting activities (i.e., off-loading, dumping, weed surveying, equipment maintenance/repair, fuel/part-supply runs).

[2] Does not include approximately $3,000 in insurance costs.

[3] Machine hours are recorded on a meter and refer to the total amount of time the engine has been operating.

[4] A full harvester load is equal to about 300-440 cubic feet of wet plant material

## OPERATIONS CHECKLIST

**Prior to Start of Season**

1. Review prior year expenses and adjust budget as needed
2. Hire and train operators as needed
   (Establish wage rate; complete payroll tax-reporting forms; sign operations plan; supply timesheets; and review safety, maintenance and operational procedures)
3. Schedule launch date and confirm arrangements with interested parties
   (Contact insurance agent, harvester operators, off-season and summer storage providers, disposal site manager, and Town of Oakland)
4. Ensure that all equipment is serviced and in sound operating condition
   (Check batteries, tire pressure, fluid levels, filters, hydraulics, lubricated fittings, spark plugs, bearings, hoses, etc.)
5. Inspect launch facility and off-loading area
6. Provide certificate of liability insurance to Scout Camp

**Equipment Mobilization**

1. Finalize launch date and re-activate insurance for dump truck
2. Coordinate with operators and storage provider to move harvesting equipment back to the lake
   (Gather supplies such as tire blocks, work gloves, waders, gate/harvester/truck keys, two-way radios, emergency tools, 12-volt battery, first aid kit, road barricades, rope, pruning saw, etc.)
3. Place signs at entrance to public landing announcing date and time that landing will be closed
4. On the date of the move, barricade entry to the public landing and disassemble pier
5. Transport harvester to the public landing, launch and park at the Scout Camp
   (Cover operator's console to protect against weather, and tie harvester to nearest tree)
6. Return the harvester trailer to the Town Hall storage shed
7. Transport and park the shore conveyor at the Scout Camp
   (Cover tires and engine to protect against weather)

**Summer Operations**

1. Provide operators with gate/harvester/truck keys, two-way radios, work gloves, pitch forks, small ladder, hand tools, extra timesheets, polarized sunglasses, sun protection, PFDs, etc.
2. Review safety protocols, operating procedures, and equipment-maintenance requirements
3. Perform boat survey of lake to identify problem areas as they develop
4. Maintain detailed records on hours worked, tasks performed, locations harvested, and number of loads removed from the lake.

**Off-Season Tasks**

1. Schedule equipment removal date following removal of Town pier
   (Contact insurance agent, harvester operators, off-season and summer storage providers, disposal site manager, and Town of Oakland)
2. Return all equipment to the Town Hall; clean and lubricate prior to storage
3. Gather keys and supplies from the operators; pay Scout Camp rental fee
4. Review off-season maintenance needs with mechanic/storage provider
6. Deactivate insurance on the dump truck

## SAFETY PRECAUTIONS

There are numerous safety precautions that should be taken when operating heavy machinery. The following safety measures will help prevent personal injuries and damage to the harvesting equipment and other property. This is not an exhaustive list, and should be used only as a guide.

- Operators shall be experienced and have sufficient training on the safe and proper use of the machinery.
- Operators shall be trained in how to respond in the event of a system malfunction or other emergency.
- Operators shall posses a coast guard approved personal floatation device.
- Operators shall not drink alcohol, smoke, wear headphones, or operate the machinery when tired or sick.
- Operators shall wear the proper, weather protective gear (polarized sunglasses, hat, etc.).
- Operators shall abide by all equipment safety and operational rules.
- No swimming or fishing shall be allowed to occur in the area of the harvester.
- No person shall be allowed within the immediate vicinity of the harvester during operations.
- Harvesting shall be postponed during inclement weather conditions or when boat traffic is excessive.
- The equipment shall not be operated after dark or in high winds.
- The equipment shall not be operated in less than 3-foot water depths, or around piers and other structures.
- The harvester shall be equipped with the proper safety equipment (first aid kit, fire extinguisher, etc.)
- No pets or extra people shall be allowed on the harvester during operations.
- The harvester shall not be overloaded with plant material at any time.
- The harvester engine shall be shut off before any repairs are made, or before any obstructions are cleared.
- The harvester engine shall never be allowed to idle unattended.
- Regular inspections shall be performed to ensure all mechanical parts are in proper operating condition.

## GENERAL OPERATING PROCEDURE

Operators shall be trained on how to safely and properly use and maintain the equipment. It is imperative that operators understand their objective, and that they are able to identify targeted, non-native plant species. Operators should also become familiar with the locations of nuisance weed beds, potential underwater obstructions, shallow water depths, and any areas that might be off limits to mechanical harvesting (i.e., critical spawning habitat, high quality plant beds, confined channel areas, etc.).

Selective harvesting shall be performed in accordance with Wisconsin DNR permit conditions and within guidelines set forth in this chapter. Selective harvesting involves reshaping as much habitat as lake users need, and leaving the rest for aquatic communities. Cutting intensity will vary depending on the extent of weed growth and the management requirements of the particular user zone. This approach is recommended for Lake Ripley as a planned approach to multiple lake use.

Operations should commence no sooner than mid-June to allow time for the vegetation to grow within reach of the harvester, as well as to avoid most of the fish-spawning season. Cutting is to be performed during calm and clear weather conditions, and during weekdays when there is minimal boat traffic, preferably during the morning no-wake period. The actual amount of time needed for harvesting each season can vary dramatically, making scheduling difficult at best.

| | |
|---|---|
| Approved Locations: | • Water depths greater than 3.0 ft.<br>• At least 10 ft. from private piers, boat hoists, swim rafts, and other structures<br>• Permit-approved locations dominated by non-native, invasive plant species growing at or near the surface<br>• Permit-approved navigational lanes that route motor boat traffic to open water areas and that conform to surface zoning objectives |
| Advantages: | • Direct, physical cutting and removal of problem weeds<br>• Immediate relief from nuisance weed conditions<br>• Targets growth within five feet of the surface where it is most problematic<br>• Quicker and more efficient than manual harvesting<br>• Minimum health and safety risk to lake users<br>• Limited interference imposed on most lake uses<br>• Some species selectivity achieved due to timing and location of cutting<br>• May favor slower and lower growing species<br>• Effectively clears boating lanes and provides edge habitat through dense weed beds<br>• Reduces the potential for floating plant debris caused by motor boat "prop chop" and high winds<br>• Avoids the need for chemicals that can affect sensitive aquatic organisms<br>• Most harvested plant material is efficiently removed from the lake<br>• Lower long-term costs and environmental impacts compared to other strategies |
| Disadvantages: | • Short-term effectiveness as weeds regenerate<br>• Requires repeated implementation throughout growing season<br>• High initial cost for the acquisition of capital equipment<br>• Involves annual costs for operator wages, insurance, equipment maintenance and storage<br>• Not as effective on fast growing and non-rooted plant species<br>• Minimum species selectivity achieved in areas with mixed plant communities<br>• May benefit disturbance-tolerant species |

| | |
|---|---|
| | • Not appropriate within less than three-foot water depths and in confined areas<br>• Potential to remove small fish and other organisms along with the cut plant material<br>• Overuse could eliminate critical aquatic habitat<br>• Improper operation could disturb the lake bottom and stir up sediment, increasing the likelihood of colonization by invasive species<br>• Collection of all floating plant debris may not be possible<br>• Attacks symptoms rather than root cause of nuisance weed growth<br>• Requires DNR permit<br>• Requires the use and maintenance of multiple pieces of heavy machinery |

Operator performance shall be based on proficiency in operating and maintaining the equipment, ability to target approved areas and plant species, and ability to respond to weed-growth conditions as they fluctuate throughout the season. The amount of lake surface area covered, number of plant loads collected, or hours spent on the lake harvesting is often irrelevant to a successful program and should not be used to gauge success. These factors are also subject to vary depending on the operational status of the equipment. Furthermore, changes in plant abundance and rate of growth are influenced by a number of variables independent of a harvesting program. Instead, operators should simply focus their efforts on safely and efficiently harvesting nuisance weed growth within approved locations, while avoiding high quality native plant beds.

Some areas may need to be cut multiple times per season during heavy growth. Exotic plant species such as Eurasian watermilfoil should be harvested when they are at high densities and visible at the surface within designated target areas. Mechanical harvesters work best in waters that are three to six feet deep, and where nuisance vegetation begins to canopy at the surface. To avoid disturbing bottom sediments, no harvesting is performed any closer than one foot from the bottom of the lake or in water less than three feet deep. Loose, mucky or silty substrates in shallow areas should be avoided to prevent the re-suspension of bottom sediments or damage to the machinery.

Operators shall monitor the number and types of fish picked up by the harvester. If feasible from a safety perspective, larger fish and turtles should be safely and expeditiously returned to the lake upon capture. When large numbers of fish are encountered, harvesting shall be temporarily stopped in that area until the fish have moved on. Known spawning beds are to be avoided entirely during the early part of the season. Operators can return to these areas later in the season when spawning has ended.

While harvesting, all floating plant debris shall be immediately removed from the water. The operator should make every effort to pick up floating plant fragments when making turns and during trips to and from the loading site. However, attempts should not be made to recover widely scattered plant fragments, especially those that cannot be easily captured or were not produced as a result of harvesting activities. Lakefront property owners are to be encouraged to manage weed growth and collect floating plant debris around their own piers, boatlifts and swimming rafts. Operating a large weed harvester in such tight, shallow areas is hazardous given the risk of damaging the equipment or private property. Although many people associate floating plant debris with harvesting, other factors are usually to blame. These factors include "prop chop" from motor boats, severe weather, and auto-fragmentation of certain plant species.

Operators will be asked to submit detailed timesheets and harvesting logs. Harvesting logs are a good way of documenting program activities, keeping track of costs, estimating downtime, and identifying weed growth patterns. A typical harvesting log will ask for name, date, start/finish times, description of areas harvested, number of loads collected/disposed, plant types harvested, machine hours logged, equipment maintenance performed, expenses incurred, and any problems encountered.

# -6-
# FISHERY

*"I never drink water because of the disgusting things fish do in it."*

-- W.C. Fields, American comedian and actor

## 6-1 VALUE AND ROLE OF FISHERY

Fisheries play a central role in maintaining a healthy lake ecosystem through their interactions with other biological communities. They are important not only for recreation, but as biotic indicators of environmental quality. For example, declines in native fish populations can be an early sign of water quality or habitat degradation, and are often accompanied by declines in other wildlife species. Water quality changes, non-native species introductions, and loss of natural habitat are common factors leading to such declines. These ecological disruptions can, in turn, create food-web imbalances and cascading effects that can materially alter the structure and composition of the entire fishery.

**Bluegill (above) are preyed upon by bass and other large gamefish. They can easily over-populate, become stunted, and even contribute to algal blooms in the absence of this predator-prey dynamic.**

Fishery composition and behavior can influence a lake's condition, and vice versa. Normal predator-prey dynamics, for example, function to keep populations in check, which controls overcrowding and over-competition that causes fish stunting and other problems. Changes in the amount and type of available plant cover can favor certain species over others, thereby affecting growth rates and the redistribution of nutrients and food resources. For instance, a lake dominated by small bluegill might signify the absence or reduced effectiveness of top predators, like bass or walleye.

Excessive gamefish harvests, reduced water clarity, or overly dense plant beds that favor small bluegill are among the plausible factors that would precipitate such a situation. As a result, bluegills might overgraze on zooplankton (the tiny organisms that feed on algae), depleting the fish's own food stock while eliminating the lake's natural control on algal growth. Bluegills then become stunted, while algal blooms begin to occur with greater frequency and intensity. Recognizing these types of interrelationships is a critical first step in diagnosing problems and finding solutions, especially in the context of larger management goals. It is also the basis for the following discussion and subsequent recommendations.

## 6-2 HABITAT REQUIREMENTS

The principal feature of a healthy fishery is the availability of suitable habitat, and each fish species has different requirements. Therefore, ideal habitat is that which supports the various life-cycle needs of native fish populations. Important habitat components include water chemistry, clarity, temperature levels, dissolved oxygen concentrations, spawning or foraging substrate, cover from predators, and access to sufficient food resources.  If any one of these requirements is found to be in short supply, habitat quality is reduced and the lake's fish community can be negatively affected, beginning with the most sensitive or habitat-specific species.

All else being equal, lakes with good water quality, well-vegetated shorelines, and thriving native aquatic plant communities are usually best positioned to support healthy fish populations. Alternatively, problems are often quick to develop in lakes with poor water quality, heavily developed watersheds and shorelines, and an absence of quality shoreland and aquatic vegetation.

**Lakes with well vegetated shorelines and an abundance of coarse woody habitat (top) tend to support healthier fisheries than lakes without these features (bottom).**

A 2005 Lake Ripley study found significant shading under piers and a corresponding reduction in aquatic plant abundance, as well as a shift in community composition to one dominated by shade-tolerant species (see Figure 46).  Shading and the resulting loss of plant habitat under piers translated into a reduction in macroinvertebrates (a source of food for young fish), and declines in the catch rates of a number of small fish species.  Results suggest that the proliferation of piers and other near-shore structures may be contributing to the degradation of littoral zone habitat and biological diversity.[167]

**A diverse mix of native aquatic plants offer important habitat for fish.  Plants provide shelter, food, oxygen and other necessities.**

[167] Cicero, Patricia, Dearlove, P., Garrison, P., Marshall, D., and Stremick-Thompson, L.  2005.  Effects of Pier Shading on Littoral Zone Habitat.  Wisconsin Department of Natural Resources, Lake Ripley Management District, and Jefferson County Land & Water Conservation Department.

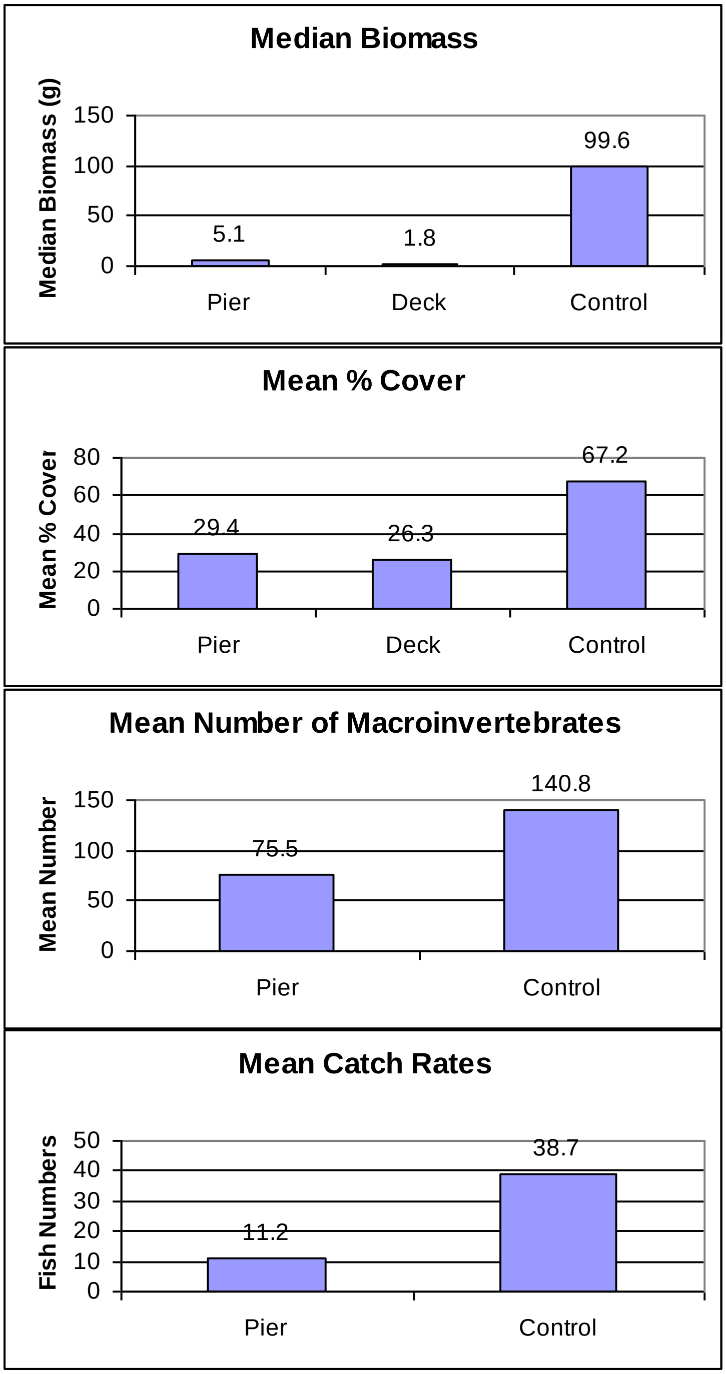



**Figure 46: Impacts of Pier-Shading on Lake Ripley Aquatic Plants, Macroinvertebrates and Fish**

## 6-3 HISTORICAL OVERVIEW

In 1927, northern pike, walleye, largemouth bass and “calico” (white) bass were all reported to be native to Lake Ripley, while bluegill, sunfish, catfish, yellow perch, bowfin, gar and carp were thought to have been either introduced or had worked their way up the Koshkonong Creek.[168] It was further reported that extensive stocking of largemouth bass, perch eggs and walleye fry occurred from 1937-1945, in addition to the stocking of 17,000 “walleyed pike” fry in 1929.[169]

A 1946 survey by the former Wisconsin Conservation Department (WCD) showed bluegill, walleye, northern pike, largemouth bass, yellow perch, crappie, and bullhead as major contributors to the sport fishery.[170] Sunfish, rock bass, longnose gar, bowfin, common sucker, bluntnose minnow, and top minnows were also documented in the lake at this time. During the 1950s and early 1960s, the former WCD removed native bowfin and longnose gar from Lake Ripley as “rough fish.” Fisheries managers have since come to appreciate the importance of these native species for maintaining aquatic diversity and controlling slow-growing panfish and young carp.[171]

A June 1970 survey obtained similar results as in 1946, except for the apparent disappearance of the black crappie (re-inventoried in later surveys) and a large increase in carp.[172] Rough fish, especially carp, have periodically been considered a problem in Lake Ripley, prompting state crews to come to the lake to periodically remove them. For example, an estimated 26,700 pounds of carp and 400 pounds of bowfin were removed from the lake between 1952 and 1956.[173]

Walleye fingerlings have been stocked in Lake Ripley about every two years since 1985 by the Wisconsin DNR (see Table 33). Stocking was not conducted in 2007 or 2008 due to the unavailability of DNR resources as a consequence of emergency VHS testing around the state. The objective of the walleye-stocking program is to supplement any natural reproduction (albeit extremely limited) and help control the stunting of the yellow perch population. However, recent electrofishing data suggest that perch remain undersized despite this attempt at biomanipulation. These data are summarized in the next section.

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168 Chase, Wayland and Lowell Noland. The History and Hydrography of Lake Ripley. Trans. Wisconsin Academy of Sciences, Arts and Letters, vol. 23, 1927.
169 Burris, John E. 1971. A Study of Man’s Effects on Lake Ripley. University of Wisconsin-Madison. Zoology 518 Report.
170 Mackenthun, Kenneth M. and Kenneth Flakas. 1946. A Biological Survey of Lake Ripley. Wisconsin Conservation Department. Fisheries Biology Section. Investigative Report No. 580.
171 Wisconsin Department of Natural Resources, and Lake Ripley Management District. 1994. Lake Ripley Water Resources Appraisal.
172 Druckenmiller, Howard S. 1970. Basic Inventory Survey of Lake Ripley. Wisconsin Department of Natural Resources.
173 Poff, R.J., R. Piening and C.W. Threinen. 1968. Surface Water Resources of Jefferson County. Wisconsin Department of Natural Resources.

**Table 33: Wisconsin DNR fish-stocking records for Lake Ripley (1985-2009)**

| Year | Species | Strain (Stock) | Age Class | Number Fish Stocked | Average Fish Length (Inches) |
|---|---|---|---|---|---|
| 1985 | SMALLMOUTH BASS | UNSPECIFIED | FINGERLING | 8,620 | 3.00 |
| 1985 | WALLEYE | UNSPECIFIED | FINGERLING | 28,104 | 2.00 |
| 1986 | WALLEYE | UNSPECIFIED | FINGERLING | 5,917 | 4.00 |
| 1987 | WALLEYE | UNSPECIFIED | FINGERLING | 63,270 | 2.00 |
| 1989 | WALLEYE | UNSPECIFIED | FINGERLING | 22,496 | 2.00 |
| 1995 | WALLEYE | UNSPECIFIED | FINGERLING | 3,808 | 5.00 |
| 1995 | WALLEYE | UNSPECIFIED | YEARLING | 400 | 5.60 |
| 1997 | WALLEYE | UNSPECIFIED | LARGE FINGERLING | 22,874 | 1.60 |
| 1997 | WALLEYE | UNSPECIFIED | SMALL FINGERLING | 45,748 | 1.60 |
| 1999 | WALLEYE | UNSPECIFIED | SMALL FINGERLING | 21,000 | 1.30 |
| 2000 | WALLEYE | UNSPECIFIED | SMALL FINGERLING | 21,000 | 1.40 |
| 2002 | WALLEYE | MISSISSIPPI HEADWATERS | SMALL FINGERLING | 21,000 | 1.40 |
| 2003 | WALLEYE | ROCK-FOX | SMALL FINGERLING | 23,784 | 1.30 |
| 2004 | WALLEYE | MISSISSIPPI HEADWATERS | SMALL FINGERLING | 10,250 | 1.20 |
| 2005 | WALLEYE | ROCK-FOX | SMALL FINGERLING | 1,350 | 2.70 |
| 2006 | WALLEYE | ROCK-FOX | LARGE FINGERLING | 4,180 | 7.70 |
| 2009 | WALLEYE | ROCK-FOX | SMALL FINGERLING | 14,630 | 1.00 |

## 6-4 RECENT TRENDS AND CURRENT STATUS

Lake Ripley has long been considered one of Wisconsin's finest largemouth bass lakes, and is famous for producing the state record in 1940. In addition to largemouth bass, a 1982 Wisconsin fish distribution study found the lake to support as many as 33 other fish species.[174] However, several of these species failed to turn up during recent seining surveys, indicating a possible loss in species richness since seining was originally performed in 1974.[175] The pugnose shiner (*Notropis anogenus*), a Wisconsin Threatened Species, and the least darter (*Etheostoma microperca*), a Wisconsin Species of Special Concern, are among those that appear to have disappeared from the lake. Both species are sensitive to turbidity and loss of native aquatic plant habitat. However, similar declines were seen on the other study lakes, despite often minimal changes in water quality conditions over the study period. For this reason, declines in these sensitive species are thought to be related to the removal or alteration of critical near-shore habitat as a consequence of shoreline development.

Shoreline fish seining was conducted in 1974 and again in 2004 to assess the status of non-game species and juvenile gamefish. These types of fish inhabit the shallow zones of the lake, and are often missed during fall electrofishing surveys. Declines of small darters and minnows can reveal problems in lakes before gamefish growth rates and abundance are impacted. Table 34

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[174] Fago, Don. 1982. Distribution and Relative Abundance of Fishes in Wisconsin: Greater Rock River Basin. Technical Bulletin No. 136. Wisconsin Department of Natural Resources.
[175] Lyons, John. 2004. A comparative analysis of fish-seining records from 1974 and 2004. Wisconsin Department of Natural Resources.

lists species type and total numbers collected during the 1974 and 2004 seining surveys, while Table 35 compares changes in species richness among all study lakes. Results reveal the change in status of native, rare and intolerant fish species over the course of the study period. Intolerant species are fish that are more sensitive to environmental changes than popular gamefish. Over the 30-year study period, seining results indicate a possible loss of seven native species (from 18 to 11), and declines in both rare and intolerant species (pugnose shiner, blackchin shiner, blacknose shiner and least darter).

### Table 34: Lake Ripley seining surveys (1974-75 and 2004)

Lake Ripley, Jefferson County, WDNR seining surveys - comparison of 1970's and 2004 surveys of same sites with same gear and effort. In the 1970's catch counts for a particular species at a particular site were truncated at 99; an asterisk indicates totals that include one or more truncated counts. In 2004 all captured fish were counted but for comparative purposes totals have been calculated with counts truncated at 99, indicated by an asterisk. The actual 2004 totals are given in parentheses.

| | Pooled catch, all sites | |
|---|---|---|
| Species | 1 June 1974; 13, 27 June, 6 July 75 | 23 July 2004 |
| **Lake Ripley (8 sites)** | | |
| Golden shiner | 17 | 3 |
| Pugnose shiner | 17 | 0 |
| Blackchin shiner | 15 | 0 |
| Blacknose shiner | 3 | 0 |
| Bluntnose minnow | 152* | 500* (1833) |
| Fathead minnow | 1 | 1 |
| Central mudminnow | 1 | 0 |
| Banded killifish | 45 | 0 |
| Brook silverside | 19 | 69 |
| Rock bass | 1 | 0 |
| Green sunfish | 3 | 0 |
| Pumpkinseed | 64 | 0 |
| Bluegill | 171 | 318* (324) |
| Smallmouth bass | 0 | 44 |
| Largemouth bass | 153* | 398* (783) |
| Black crappie | 58 | 60 |
| Unspecified crappie | 0 | 6 |
| Iowa darter | 0 | 25 |
| Least darter | 3 | 0 |
| Johnny darter | 2 | 17 |
| Yellow perch | 316* | 89 |
| Total native species | 18 | 11 |
| Total native fish | 1041* | 1528* (3252) |

## Table 35: Changes in selected fish assemblage variables from 1974 to 2004 for all fish-seining study lakes

Changes in selected fish assemblage variables from the 1970's to 2004 for the study lakes. Only data from sites sampled in both time periods are included, and catches of individual species from each site are truncated at 99 (totals with truncated catches are indicated by an asterisk). Data for Upper Phantom Lake and Lower Phantom Lake and for Upper Nemahbin Lake and Lower Nemahbin Lake are presented separately and for both the upper and lower lake combined (L + U). Intolerant species for this dataset are pugnose shiner, blackchin shiner, blacknose shiner, spottail shiner, mottled sculpin, rock bass, longear sunfish, smallmouth bass, rainbow darter, Iowa darter, and least darter. Rare species are pugnose shiner (threatened), pugnose minnow (special concern), lake chubsucker (special concern), cisco (special concern), banded killifish (special concern), starhead topminnow (endangered), longear sunfish (threatened), and least darter (special concern).

***NUMBER OF SPECIES***

| | Native species | | | Intolerant species | | | Rare species | | |
|---|---|---|---|---|---|---|---|---|---|
| Lake | 1970s | 2004 | Change | 1970s | 2004 | Change | 1970s | 2004 | Change |
| Beulah | 23 | 14 | -9 | 7 | 4 | -3 | 5 | 2 | -3 |
| Big Cedar | 12 | 9 | -3 | 2 | 2 | 0 | 1 | 0 | -1 |
| Camp | 21 | 18 | -3 | 3 | 5 | 2 | 3 | 4 | 1 |
| Geneva | 29 | 17 | -12 | 6 | 4 | -2 | 3 | 2 | -1 |
| Long | 16 | 15 | -1 | 6 | 4 | -2 | 1 | 2 | 1 |
| Nemahbin, Lower | 21 | 12 | -9 | 6 | 3 | -3 | 4 | 1 | -3 |
| Nemahbin, Upper | 13 | 12 | -1 | 4 | 4 | 0 | 2 | 0 | -2 |
| Nemahbin, L + U | 23 | 17 | -6 | 7 | 5 | -2 | 4 | 1 | -3 |
| Oconomowoc | 22 | 14 | -8 | 7 | 5 | -2 | 3 | 3 | 0 |
| Okauchee | 18 | 14 | -4 | 5 | 2 | -3 | 3 | 2 | -1 |
| Phantom, Lower | 17 | 7 | -10 | 1 | 1 | 0 | 2 | 0 | -2 |
| Phantom, Upper | 21 | 10 | -11 | 5 | 2 | -3 | 4 | 2 | -2 |
| Phantom, U + L | 23 | 13 | -10 | 5 | 2 | -3 | 4 | 2 | -2 |
| Pike | 11 | 14 | 3 | 6 | 4 | -2 | 3 | 2 | -1 |
| Ripley | 18 | 11 | -7 | 5 | 2 | -3 | 3 | 0 | -3 |
| Rock | 17 | 17 | 0 | 6 | 6 | 0 | 3 | 2 | -1 |
| Silver | 15 | 14 | -1 | 2 | 3 | 1 | 1 | 1 | 0 |

More recent inventories have been performed through electrofishing methods by the Wisconsin DNR. Sampling was limited to waters four feet deep or less, and within three sampling areas, comprising 14,000 feet or about 50% of the total lake shore. Areas sampled consisted of South Bay (from the scout camp to the marina, and including Vasby's Channel), East Bay (including the inlet), and the lake's northeast shore. Each area was representative of different bottom substrates and degrees of aquatic plant growth.

Between 1992 and 2009, fall electrofishing surveys revealed an average species-richness of 16.9. Species diversity was found to range from a 1993 low of 10 to a 2009 high of 23, but without any clear trends during the period of record (see Figure 47). Table 36 lists the 28 different species of fish that were documented during one or more of the fall surveys. The timing and method of capture of these surveys can affect results, leaving a reasonable probability that some species may have been present but overlooked during sampling.

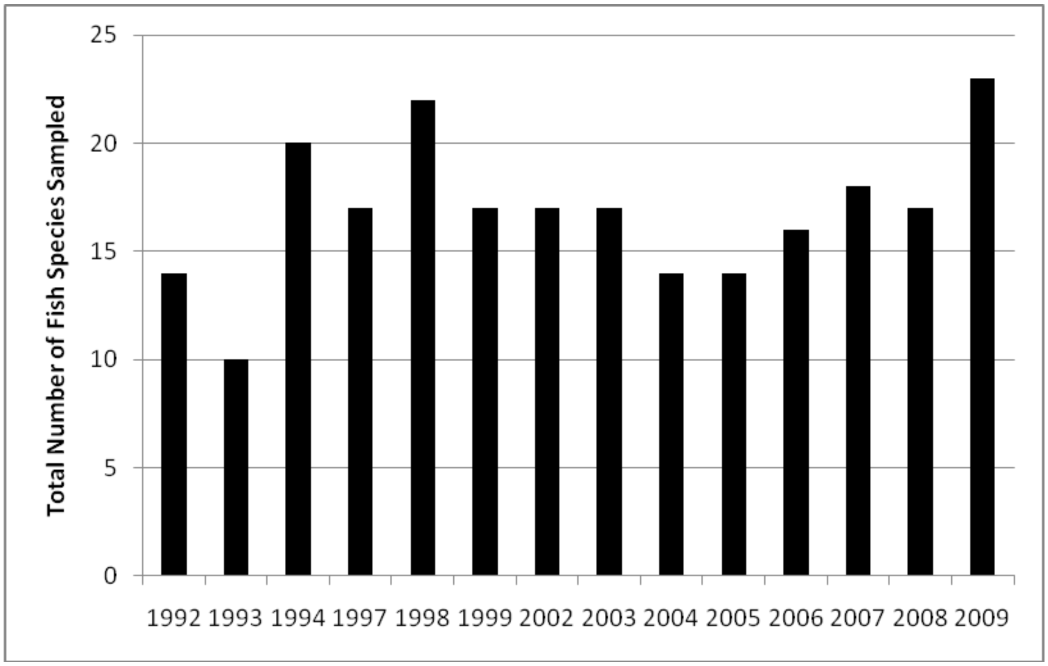



**Figure 47: Species Richness as Determined by Fall Electrofishing Results (1992-2009)**

**Table 36: Documented fish species (1992-2009 fall electrofishing surveys)**

| Species | Fall 1992 | Fall 1993 | Fall 1994 | Fall 1997 | Fall 1998 | Fall 1999 | Fall 2002 | Fall 2003 | Fall 2004 | Fall 2005 | Fall 2006 | Fall 2007 | Fall 2008 | Fall 2009 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Longnose gar<br>*Lepisosteus osseus* | X | X | X | X | X | X | X | X | X | X | | X | X | X |
| White crappie<br>*Pomoxis annularus* | | | | | | | | | | | | | X | |
| White sucker<br>*Catostomus commersoni* | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Carp<br>*Cyprinus carpio* | X | | X | X | X | X | X | | X | | X | X | | X |
| Bigmouth buffalo<br>*Ictiobus cyprinellus* | | | | | | | | | | | | | | X |
| Brook silverside<br>*Labidesthes sicculus* | X | X | X | X | X | X | X | X | | X | X | X | X | X |
| Yellow bullhead<br>*Ameiurus natalis* | | | X | X | X | X | X | X | | | X | X | X | X |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Golden shiner<br>*Notemigonus crysoleucas* | X | X | X | | X | X | | | | | | | X | X |
| Common shiner<br>*Luxilus cornutus* | | | | | | | | | | | | X | | |
| Lake chubsucker*****<br>*Erimyzon sucetta* | X | X | X | | X | X | X | | | X | X | | | X |
| Green sunfish<br>*Lepomis cyanellus* | X | | X | | | X | | | | | X | X | | |
| Bowfin<br>*Amia calva* | | | X | X | X | X | X | X | X | X | | X | X | X |
| Bluntnose minnow<br>*Pimephales notatus* | X | | X | X | X | X | | | | | | | | X |
| Pumpkinseed sunfish<br>*Lepomis gibbosus* | X | | X | X | X | | X | X | X | | | X | X | X |
| White bass<br>*Morone chrysops* | | | X | X | X | | X | X | | | X | | | |
| Black bullhead<br>*Ameiurus melas* | | | X | | X | | | | | | | | X | X |
| Brown bullhead<br>*Ameiurus nebulosus* | | | | | | | | | | | | | | X |
| Grass pickerel<br>*Esox americanus vermiculatus* | | | X | | X | | X | | X | X | X | X | X | X |
| Rock bass<br>*Ambloplites rupestris* | | | | | | | | | X | X | X | X | | X |
| Central mudminnow<br>*Umbra limi* | | | | X | X | | | | | | | | | X |
| Johnny darter<br>*Etheostoma nigrum* | | | | X | X | | | | | | | | | |
| Emerald shiner<br>*Notropis atherinoides* | | | | | | X | | | | | | | | |
| Burbot<br>*Lota lota* | | | | | X | | | | | | | | | |
| Yellow perch<br>*Perca flavescens* | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Black crappie<br>*Pomoxis nigromaculatus* | | | X | X | X | X | X | X | X | X | X | X | X | X |
| Bluegill<br>*Lepomis macrochirus* | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Northern pike<br>*Esox lucieus* | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Walleye<br>*Stizostedion vitreum* | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Largemouth bass<br>*Micropterus salmoides* | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Smallmouth bass<br>*Micropterus dolomieui* | | | | | | | X | X | X | X | X | X | X | X |
| **Species diversity:** | 14 | 10 | 20 | 17 | 22 | 17 | 17 | 14 | 14 | 14 | 16 | 18 | 17 | 23 |

* = Wisconsin Special Concern Species. This species could become threatened or endangered.

Fall electrofishing survey results are summarized for largemouth bass, walleye, northern pike and bluegill in Figures 48-51 below. Graphs depict minimum, maximum and average lengths found during the 1992-2009 survey period, as well as the number of fish caught per hour of sampling, referred to as Catch Per Unit of Effort (CPUE, or CPE). Size-frequency distributions were representative of similar lakes found in Southern Wisconsin, and with no unusual trends evident.

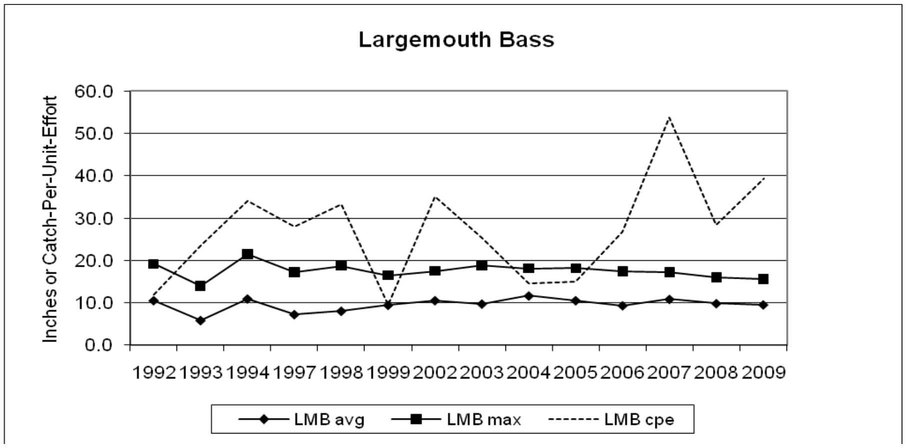



**Figure 48: Fall Electrofishing Results for Largemouth Bass (1992-2009)**

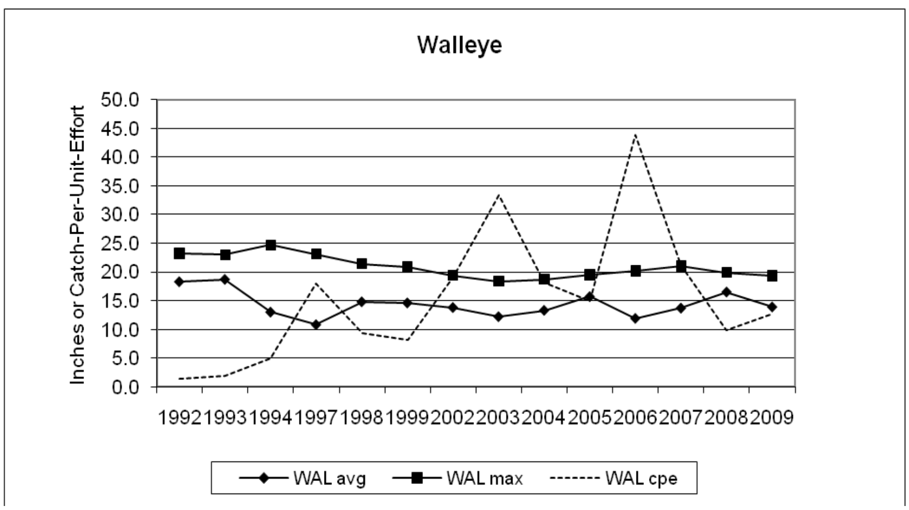



**Figure 49: Fall Electrofishing Results for Walleye (1992-2009)**

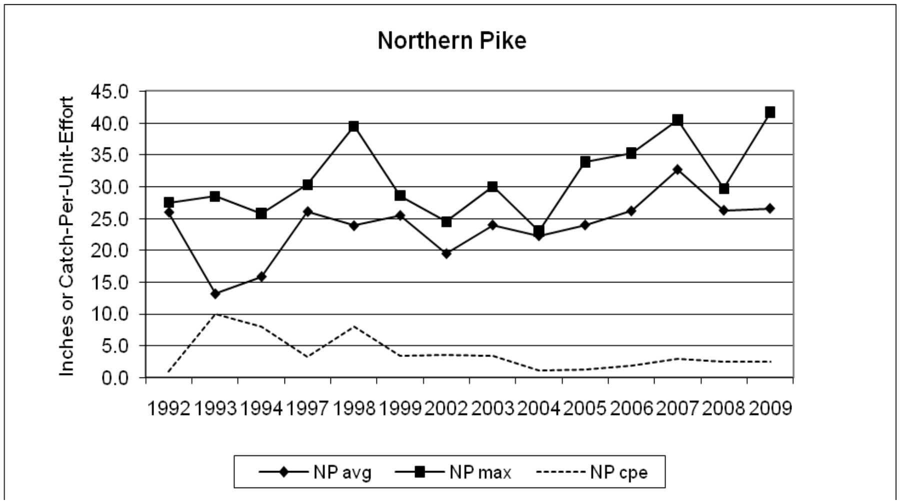



**Figure 50: Fall Electrofishing Results for Northern Pike (1992-2009)**

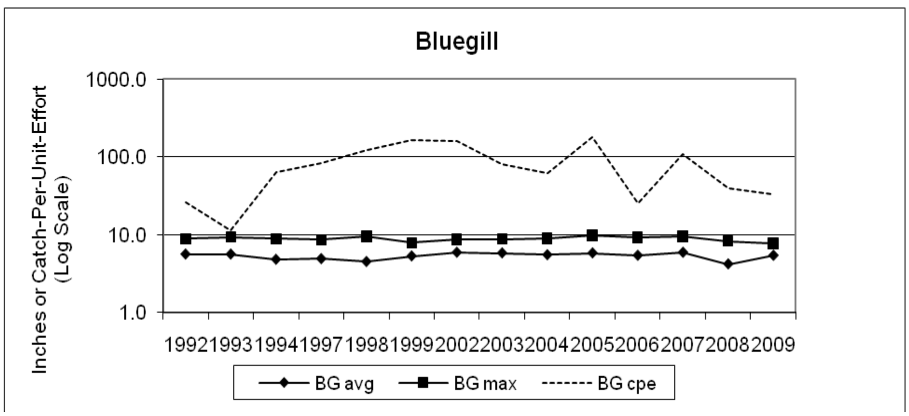



**Figure 51: Fall Electrofishing Results for Bluegill (1992-2009)**

Algis Byla, fisheries biologist with the Wisconsin DNR, analyzed mean lengths, catch per unit of effort (an estimate of relative population abundances), and proportional stock density (a measure of species size structure) of the largemouth bass and bluegill populations in Lake Ripley using data from 1994-2004. Because fluctuations in the three statistical measures are natural and to be expected, only long-term trends should be used for analysis purposes. Fluctuations can be caused by such variables as type of sampling gear and methods employed, as well as the weather which can make capturing certain species more or less difficult. As a result of the analysis, Byla concluded that there were no significant trends in any of three metrics that would indicate a noteworthy change in the status of these two dominant populations.

## 6-5 FISHES OF LAKE RIPLEY

Based on inventory data collected since the mid-1970s, a total of 39 different species of fish have been documented in Lake Ripley. Each species is described below, with most descriptions borrowed from the Fish of Wisconsin Field Guide.[176] Fish illustrations are mostly borrowed from http://pond.dnr.cornell.edu and are not to scale.

Common Name: **Banded killifish**
Scientific Name: ***Fundulus diaphanous***

Family: Killifish (*Cyprinodontidae*)
U.S. Nativity: Native
Habitat: Prefer the quieter portions of still water and slower-moving areas of streams; may dig into sandy or fine-gravel bottoms when threatened
Food: Killifish feed at the surface, mid-water and near the bottom on midge larvae and insects. The larger fish consume insects, mollusks and worms.
Reproduction: Spawns in water of about 70°F
Average Size: 2-4 inches


Common Name: **Black bullhead**
Scientific Name: ***Ameiurus melas***
Family: Catfish (*Ictaluridae*)
U.S. Nativity: Native
Habitat: Prefers shallow, slow-moving streams and backwaters; lakes and ponds; tolerates extremely turbid (murky) and low-oxygen conditions
Food: A scavenging opportunist that feeds mostly on animal material (living or dead), but will also eat plant matter; stirs up the lake bottom and uproots vegetation in search of food
Reproduction: Spawns between April and July when water temperatures reach 70-77°F; builds nest in shallow water with a muddy bottom
Average Size: 8-10 inches

Common Name: **Blackchin shiner**
Scientific Name: ***Notropis heterodon***
Family: Minnow (*Cyprinidae*)
U.S. Nativity: Native
Habitat: Found in cool, clear, and shallow sections of lakes and slow regions of streams with weedy vegetation, very little siltation, and a sandy substrate; appears to be intolerant of silt and salt, and is becoming uncommon over much of its range; an indicator of good water quality
Food: Feeds on a variety of prey, half of which is from open water and the other half from vegetation, the lake surface, and the bottom; may feed on

[176] Bosanko, Dave. 2007. Fish of Wisconsin Field Guide. Adventure Publications, Inc. Cambridge, MN.

cladocerans and flying midges taken from the surface of the water.
Reproduction: Spawn from May to the end of July
Average Size: 2-3 inches

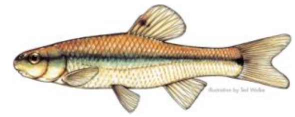
Common Name: **Black crappie**
Scientific Name: ***Pomoxis nigromaculatus***
Family: Sunfish (*Centrarchidae*)
U.S. Nativity: Native
Habitat: Prefers quiet, clear water of streams and mid-sized lakes; often associated with weed growth but may roam deep, open basins and flats, particularly during winter
Food: Small fish, aquatic insects, zooplankton
Reproduction: Spawns in shallow weed beds from May to June when water temperatures reach the high 50s; male sweeps out circular nest, typically on fine gravel or sand; can overpopulate a lake and become stunted
Average Size: 7-12 inches

Common Name: **Blacknose shiner**
Scientific Name: ***Notropis heterolepis***
Family: Minnow (*Cyprinidae*)
U.S. Nativity: Native
Habitat: Lives in small creeks and in the weedy shallows of lakes and ponds; becoming rare in many parts of its range due to loss of habitat and deterioriating water quality; requires clean, cool, well-oxygenated streams and lakes with abundant aquatic vegetation; intolerant of turbid water and pollution
Food: Small aquatic insects, crustaceans, midge larvae and algae; Feeds primarily along the bottom, and small individuals feed on vegetation
Reproduction: Spawns in early summer
Average Size: 2.5 inches

Common Name: **Bluegill**
Scientific Name: ***Lepomis macrochirus***
Family: Sunfish (*Centrarchidae*)
U.S. Nativity: Native
Habitat: Mid-size streams and most warm-water ponds, lakes and rivers with weedy bays or shorelines; can tolerate very warm water, but are susceptible to winterkill
Food: Insects, insect larvae, small fish, fish eggs, leeches, snails, zooplankton and algae; has acute daytime vision for feeding on small prey, but sees poorly in low light
Reproduction: Spawns from late May to early August, or as soon as water temperatures approach 67°F; male excavates nest in gravel or coarse sand, often in

shallow weeds, in colony of up to 50 other nests; can overpopulate a lake and become stunted due to dense cover or the absence of top predators

Average Size: 5-7 inches



Common Name: **Bluntnose minnow**
Scientific Name: ***Pimephales notatus***
Family: Minnow (*Cyprinidae*)
U.S. Nativity: Native
Habitat: Utilizes and tolerates a wide variety of habitat conditions; found in every water body capable of supporting fish life and thrive in turbid, nutrient rich waters; equally at home in small streams to the largest rivers and lakes; can become abundant in disturbed habitats when the numbers of competitor species more sensitive to increased turbidities, siltation of instream substrates, or increased water temperatures decline
Food: Algae, insect larvae, diatoms, small crustaceans, and rarely fish eggs or small fish
Reproduction: Spawns spring to late summer
Average Size: 1.5-3.5 inches

Common Name: **Bowfin**
Scientific Name: ***Amia calva***
Family: Bowfin (*Amiidae*)
U.S. Nativity: Native
Habitat: Deep waters associated with weed beds in warm-water lakes and rivers; an air breather that can survive in oxygen-depleted waters
Food: A voracious predator that prowls shallow weed beds for fish and crayfish; once thought harmful to game fish, it is now considered an asset in controlling rough fish and stunted game fish populations
Reproduction: When water warms past 61 degrees in spring, male removes vegetation on sand or gravel bottom; one or more females deposit up to 5,000 eggs in nest; male guards until young reach about 4 inches in length
Average Size: 12 to 24 inches

Common Name: **Brook silverside**
Scientific Name: ***Labidesthes sicculus***
Family: Silversides (*Atheridae*)
U.S. Nativity: Native
Habitat: Surface of clear lakes and large streams
Food: Aquatic and flying insects, spiders
Reproduction: Spawns in late spring and early summer in aquatic vegetation
Average Size: 3-4 inches

Common Name: **Brook stickleback**
Scientific Name: ***Culaea inconstans***
Family: Stickleback (*Gasterosteidae*)
U.S. Nativity: Native
Habitat: Shallows of cool streams and lakes
Food: Small aquatic animals and occasionally algae
Reproduction: Spawns in water temperatures from 50-68°F; male builds a golf ball-sized, globular nest of sticks, algae and other plant matter on submerged vegetation
Average Size: 2-4 inches

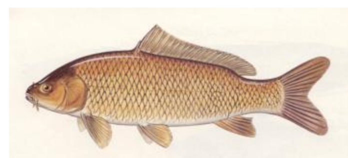
Common Name: **Brown bullhead**
Scientific Name: ***Ameiurus nebulosus***
Family: Catfish (*Ictaluridae*)
U.S. Nativity: Native
Habitat: Warm, weedy lakes and sluggish streams; can tolerate very turbid (murky) and low-oxygen water; prefers clean and weedy lakes with soft bottoms
Food: A scavenging opportunist; feeds mostly on insects, fish, fish eggs, snails and leeches, but will also eat plant matter; stirs up the lake bottom and uproots vegetation to find food
Reproduction: Spawns in early summer in shallow water with a sand or rocky bottom, and often in cover offering shade
Average Size: 8-10 inches

Common Name: **Bigmouth buffalo**
Scientific Name: ***Ictiobus cyprinellus***
Family: Sucker (*Catostomidae*)
U.S. Nativity: Native
Habitat: Prefers soft-bottomed shallows of large lakes, sloughs and oxbows; slow-flowing streams and rivers
Food: Small mollusks, insect larvae, zooplankton
Reproduction: Spawns in April or May in clear, shallow water when water temperatures reach the low 60s
Average Size: 18-20 inches

Common Name: **Burbot**
Scientific Name: ***Lota lota***
Family: Cods (*Gadidae*)
U.S. Nativity: Native
Habitat: Deep, cold and clear lakes and streams of the north
Food: A voracious predator; primarily feeds on small fish but will attempt to eat virtually anything, including fish eggs, clams and crayfish
Reproduction: Spawns in mid to late winter, under the ice, over sand or gravel bottoms,

| | |
|---|---|
| | usually in less than 15 feet of water |
| Average Size: | 20 inches |

| | |
|---|---|
| Common Name: | **Central mudminnow** |
| Scientific Name: | ***Umbra limi*** |
| Family: | Mud minnow (*Umbridae*) |
| U.S. Nativity: | Native |
| Habitat: | Prefer cool bogs and mashes, weedy ponds and ditches, and small, slow-moving streams that have soft bottoms (but not deep silt); can breathe air and may adapt to periods of low water by "burrowing" into soft sediments |
| Food: | A bottom feeder that preys on small snails and clams, copepods, water fleas, insect larvae, and even other small fish |
| Reproduction: | Spawns in the spring when water temperatures are 50-59° F, usually in flooded areas where there is plenty of vegetation |
| Average Size: | 3 inches |



| | |
|---|---|
| Common Name: | **Common carp** |
| Scientific Name: | ***Cyprinus carpio*** |
| Family: | Minnow (*Cyprinidae*) |
| U.S. Nativity: | Non-native |
| Habitat: | Warm, shallow, quiet and well-vegetated waters of both streams and lakes |
| Food: | Prefers insects, crustaceans and mollusks, but sometimes eats algae and other plants; stirs up the lake bottom and uproots plants in search of food |
| Reproduction: | Spawns from late spring to early summer in very shallow water at stream and lake edges |
| Average Size: | 16-18 inches |

| | |
|---|---|
| Common Name: | **Common shiner** |
| Scientific Name: | ***Luxilus cornutus*** |
| Family: | Minnow (*Cyprinidae*) |
| U.S. Nativity: | Native |
| Habitat: | Lakes, rivers and streams |
| Food: | Small insects, algae and zooplankton |
| Reproduction: | Spawning begins in late May; males prepares a nest of small stones and gravel at the head of a stream riffle |
| Average Size: | 4-12 inches |

| | |
|---|---|
| Common Name: | **Emerald shiner** |
| Scientific Name: | ***Notropis atherinoides*** |
| Family: | Minnow (*Cyprinidae*) |
| U.S. Nativity: | Native |
| Habitat: | A mid-water or near-surface species that usually lives in large- or moderate-sized schools; found near the surface at night and retreats to |

deeper water during the day; does not appear to use or have any preference for a particular type of substrate; avoids areas with dense vegetation

Food: Zooplankton, insects, insect larvae, small fish

Reproduction: Spawns in the late spring or early summer, sometimes as late as mid-August, when water temperatures are around 75°F

Average Size: 2.5-4 inches

Common Name: **Fantail darter**

Scientific Name: ***Etheostoma flabellare***

Family: Perch (*Percidae*)

U.S. Nativity: Native

Habitat: Riffle areas of streams where there are cobbles and gravel; can tolerate low oxygen levels for short periods

Food: Midge larvae, isopods, amphipods and other aquatic insects

Reproduction: Spawns late April to mid-June when water temperatures reach 60°F

Average Size: 2 inches

Common Name: **Fathead minnow**

Scientific Name: ***Pimephales promelas***

Family: Minnow (*Cyprinidae*)

U.S. Nativity: Native

Habitat: Streams, ponds and lakes, particularly shallow, weedy or turbid areas lacking predators; a hardy species that can tolerate low oxygen levels

Food: Primarily herbivorous, but will eat insects and copepods

Reproduction: Spawns in spring through August when water temperatures reach 60°F; male prepares nest under sticks and rocks

Average Size: 3-4 inches

Common Name: **Golden shiner**

Scientific Name: ***Notemigonus crysoleucas***

Family: Minnow (*Cyprinidae*)

U.S. Nativity: Native

Habitat: Prefers quiet, clear waters of lakes, ponds, sloughs and ditches; infrequently found in the quietest parts of rivers; often found near dense mats of vegetation; can tolerate pollution, turbidity, low oxygen and very warm water temperatures

Food: Zooplankton, insects, crustaceans, plants and algae

Reproduction: Spawns in the spring when water temperatures reach about 70°F and ceases when temperatures exceed 80°F

Average Size: 3-5 inches

Common Name: **Grass pickerel**
Scientific Name: ***Esox americanus vermiculatus***
Family: Pike (*Esocidae*)
U.S. Nativity: Native
Habitat: Most common in clear waters with an abundance of dense aquatic vegetation; found in slow moving streams, permanent wetlands, and natural lakes; intolerant of turbidity (muddy water) and areas that have been extensively channalized or ditched for drainage purposes
Food: Primarily eats fish, but also crayfish, frogs and insect larvae
Reproduction: Spawns in the spring when water temperatures range from 43 to 53°F; will migrate upstream, sometimes long distances, in search of shallow backwaters with dense vegetation
Average Size: 6-10 inches

Common Name: **Green sunfish**
Scientific Name: ***Lepomis cyanellus***
Family: Sunfish (*Centrarchidae*)
U.S. Nativity: Native
Habitat: Warm, weedy, shallow lakes and the backwaters of slow-moving streams; very tolerant of high siltation and low oxygen levels
Food: Aquatic insects, crustaceans, small fish
Reproduction: Spawning begins in May when water temperatures are between 60-80°F; male fans out nest on gravel bottom, often in less than one foot of water, near weeds or other cover beneath overhanging limbs; highly prolific and can overpopulate a lake and become stunted
Average Size: 5 inches

Common Name: **Iowa darter**
Scientific Name: *Etheostoma exile*
Family: Perch (*Percidae*)
U.S. Nativity: Native
Habitat: Prefers cool, clear to slightly turbid (cloudy), slow-moving vegetated brooks and weedy portions of glacial lakes, marshes and ponds
Food: Copepods, water fleas and midge larvae
Reproduction: Spawns late April to early June in shallow water among submerged vegetation
Average Size: 2 inches

Common Name: **Johnny darter**
Scientific Name: ***Etheostoma nigrum***
Family: Perch (*Percidae*)
U.S. Nativity: Native
Habitat: Found in most rivers, streams and lakes

Food: Water fleas, insect larvae
Reproduction: Spawns in May and June; males migrate to shorelines to establish breeding areas
Average Size: 2-4 inches

Common Name: **Lake chubsucker***
Scientific Name: ***Erimyzon sucetta***
Family: Sucker (*Catostomidae*)
U.S. Nativity: Native
Habitat: Prefers clear, quiet or sluggishly flowing waters of all types; most abundant where the bottom is soft and organically rich, and in areas of dense aquatic vegetation; intolerant of turbid (murky) and silty waters
Food: Aquatic insects, fish eggs, crustaceans, algae and other plants found on the lake bottom
Reproduction: Spawns in small tributary streams from mid-May to early July when water temperatures are between 59-72°F
Average Size: 8-10 inches

Common Name: **Largemouth bass**
Scientific Name: ***Micropterus salmoides***
Family: Sunfish (*Centrarchidae*)
U.S. Nativity: Native
Habitat: Warm, shallow, fertile, weedy lakes and river backwaters; found in thick weed beds, shallow woody cover and around docks; not usually found in water deeper than 20 feet; susceptible to winterkill
Food: Small fish, frogs, crayfish, insects and leeches; often feeds near the surface
Reproduction: Spawns from late April until early July when water temperatures reach 60°F; male builds large, solitary nest in shallow water, usually on firm bottom in weedy cover
Average Size: 12-20 inches

Common Name: **Least darter**
Scientific Name: ***Etheostoma microperca***
Family: Perch (*Percidae*)
U.S. Nativity: Native
Habitat: Found in clear, quiet and well-vegetated lakes, headwaters, pools, creeks and streams
Food: Midge larvae, small crustaceans
Reproduction: Spawns starting in late April when water temperatures reach 56-60°F
Average Size: 1-1.5 inches

Common Name: **Longnose gar**
Scientific Name: ***Lepisosteus osseus***
Family: Gar (*Lepisosteidae*)
U.S. Nativity: Native
Habitat: Floodplain lakes and backwaters of large rivers; can breathe air at the surface through a modified swim bladder, allowing it to survive in hot, oxygen-poor shallows; prefers warm, deep water but will school near the surface
Food: Minnows and small fish; an efficient predator that controls rough fish populations
Reproduction: Spawns in weedy shallows of lakes or tributaries when water temperatures reach the high 60s
Average Size: 24-36 inches

Common Name: **Northern pike**
Scientific Name: ***Esox lucius***
Family: Pike (*Esocidae*)
U.S. Nativity: Native
Habitat: Lakes, ponds, streams and rivers; often found near weeds; small pike tolerate water temperatures up to 70°F, but larger fish prefer cooler water, 55°F or less
Food: Small fish, crayfish, and occasionally frogs
Reproduction: Spawns in late March or early April in shallow tributaries and marshes at 34-40°F water temperatures
Average Size: 18-24 inches

Common Name: **Pugnose shiner**
Scientific Name: ***Notropis anogenus***
Family: Minnow (*Cyprinidae*)
U.S. Nativity: Native
Habitat: An increasingly rare species that prefers clear, weedy shoals of glacial lakes and streams of low gradient over sand, mud, gravel or marl; extremely intolerant to turbidity (muddy water), siltation, and vegetation removal
Food: Grazes on plants, consuming filamentous algae and cladocerans
Reproduction: Spawns mid-June through mid-July
Average Size: 1-1.5 inches

Common Name: **Pumpkinseed sunfish**
Scientific Name: ***Lepomis gibbosus***
Family: Sunfish (*Centrarchidae*)
U.S. Nativity: Native
Habitat: Weedy ponds, clear lakes, reservoirs and slow-moving streams; prefers

cover, like aquatic vegetation or submerged brush, and slightly cooler water than bluegill; often schools around docks and sunken logs

Food: Insects, insect larvae, snails, crustaceans, mollusks, small fish, leeches and small amounts of vegetation; feeds along deep weed beds during the day and settles to the bottom at night

Reproduction: Spawns late May to August starting when water temperatures reach 55-63° F; male builds nest on gravel bottom among weeds in shallow water; can become overly abundant and stunted due to dense vegetation or lack of top predators

Average Size: 6-8 inches

Common Name: **Rock bass**

Scientific Name: ***Ambloplites rupestris***

Family: Sunfish (*Centrarchidae*)

U.S. Nativity: Native

Habitat: Vegetation on firm to rocky bottom in clear-water lakes and medium-size streams

Food: Prefers crayfish, but eats aquatic insects and small fish

Reproduction: Spawns in spring at water temperatures from high 60s to 70s; solitary nester; male fans out a nest on coarse gravel bottom in weeds less than three feet deep

Average Size: 8-10 inches

Common Name: **Smallmouth bass**

Scientific Name: *Micropterus dolomieu*

Family: Sunfish (*Centrarchidae*)

U.S. Nativity: Native

Habitat: Clear, swift-flowing streams and rivers; clear lakes with gravel or rocky shorelines

Food: Small fish, crayfish, insects and frogs

Reproduction: Spawns in May and June when the water temperature reaches the mid to high 60s; male sweeps out nest in gravel bed, typically in 3-10 feet of water near a log or boulder

Average Size: 12-20 inches

Common Name: **Walleye**

Scientific Name: ***Stizostedion/Sander vitreus***

Family: Perch (*Percidae*)

U.S. Nativity: Native

Habitat: Clear to fertile lakes and streams; abundant in very large lakes and rivers; prefers cooler water

Food: Mainly small fish, but also eats insects, crayfish, leeches and other small prey as opportunity permits; a nocturnal feeder that can feed in low-light conditions
Reproduction: Spawns between mid-April and early May in tributary streams, flooded wetlands, or rocky lake shoals when water temperatures reach 45-50°F
Average Size: 14-17 inches

Common Name: **White bass**
Scientific Name: ***Morone chrysops***
Family: Temperate bass (*Moronidae*)
U.S. Nativity: Native
Habitat: Large lakes, rivers and impoundments with relatively clear water; fish school in large groups near the surface
Food: Small fish
Reproduction: Spawns in late spring to early summer at water temperatures of 55-79°F, and in open water over gravel beds or rubble 6-10 feet deep
Average Size: 18 inches

Common Name: **White crappie**
Scientific Name: ***Pomoxis annularus***
Family: Sunfish (*Centrarchidae*)
U.S. Nativity: Native
Habitat: Slightly silty rivers, streams and mid-size lakes; prefers warmer, less weedy, deeper and more turbid water than black crappie; usually found in open water
Food: Aquatic insects, small fish and zooplankton; actively feeds at night and during the winter
Reproduction: Spawns on firm sand or gravel bottom in May and June when water temperatures are between 61-68°F; builds nest colonies in deeper water than other sunfish; can overpopulate a lake and become stunted
Average Size: 6-12 inches

Common Name: **White sucker**
Scientific Name: ***Catostomus commersonii***
Family: Sucker (*Catostomidae*)
U.S. Nativity: Native
Habitat: All permanent waterbodies that can sustain fish; widespread and tolerant of a range of water conditions
Food: Insects, crustaceans and plant matter
Reproduction: Migrates up tributaries in April and May to spawn in riffles; spawning may occur along shoreline shallows over gravel or coarse sand bottoms in larger lakes
Average Size: 12-18 inches

Common Name: **Yellow bullhead**
Scientific Name: ***Ameiurus natalis***
Family: Catfish (*Ictaluridae*)
U.S. Nativity: Native
Habitat: Warm, weedy lakes and sluggish streams
Food: A scavenging opportunist; feeds on insects, crayfish, snails, small fish and plant material; locates food by following chemical trails through the water
Reproduction: Spawns late spring to early summer; males and females build nests in shallow water with some vegetation and a soft bottom; less likely than other bullheads to overpopulate a lake and become stunted
Average Size: 8-10 inches

Common Name: **Yellow perch**
Scientific Name: ***Perca flavescens***
Family: Perch (*Percidae*)
U.S. Nativity: Native
Habitat: Found in most glacial lakes, ponds and streams; prefers clear and fertile Water with moderate vegetation, but can adapt to a variety of conditions, including turbidity and a wide temperature range; can survive low oxygen
Food: Small fish, insects, zooplankton, snails, leeches and crayfish
Reproduction: Spawns at night in shallow, weedy areas after ice-out when water warms to 44-52°F; can become stunted in smaller inland lakes where top predators are overfished or due to over-competition for food
Average Size: 7-10 inches

## 6-6 FACTORS AFFECTING MANAGEMENT DECISIONS

Adding or removing species, instituting fish-harvest limits, and altering or enhancing habitat to benefit a particular fish community can each be used to manipulate fisheries. On Lake Ripley, one of the main objectives of management is to sustain a healthy largemouth bass population, which is considered the primary gamefish in the lake. Management efforts are also directed toward protecting shoreland wetlands to enhance northern pike spawning. In addition, mechanical harvesting is used by the District to control Eurasian watermilfoil and other invasive weeds that threaten to displace native plant beds. Harvesting activities predominantly target dense, monotypic stands of milfoil, and may be used to create edge habitat and fish-cruising lanes in approved locations.

According to past fishery inventories, the most diverse species assemblage is consistently found in Lake Ripley's South Bay area. This particular area is also believed to provide the best largemouth bass habitat in the lake.[177] It is characterized by a relatively diverse native plant community and comparatively less shoreline development than other parts of the lake. It is also

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[177] Bush, Donald M. 1994. Electrofishing Report: Lake Ripley, Jefferson County, Wisconsin. Wisconsin Department of Natural Resources.

largely protected from motorboat disturbance through slow-no-wake and no-motor regulations. The presence of submersed, floating-leaved and emergent vegetation is a key element providing cover, spawning sites and structure for fish. Water lilies are particularly abundant within the bay, with rhizomes providing the firm substrate needed for bass nesting.

Due in part to these unique, high-quality habitat features, most of South Bay is designated as a Critical Habitat Area by the Wisconsin Department of Natural Resources. "Attempts to protect the plant community of [South Bay] and its attending fishery by limiting development and imposing 'no wake' ordinances etc. are justified. This justification is based on a judgment that a disruption of the fishery community of this bay may upset the balance in the bass population and ultimately change the fishery resource of the entire lake."[178] Similar designations can be found in East (Inlet) Bay, and along a small stretch of wetland-dominated shoreline on the lake's southwest side. Conversely, Lake Ripley's more developed and sparsely vegetated northeast shore was found to generally support fewer numbers of fish and at lower species diversity.

The condition of the landscape draining to the lake is another important factor affecting the condition of the fishery. Development and land-use activities have the potential of generating polluted runoff that can bury fish-spawning sites in sediment. Polluted runoff can also supply excess phosphorus to the lake that fuels algal blooms and nuisance weed growth. Studies show that watersheds with as little as 10-12% connected impervious surface (i.e., roads, parking lots, rooftops, etc.) generally start to experience fish species declines and other problems.[179] The Lake Ripley watershed is currently at this critical threshold.

Shoreline development, in particular, often results in the systematic removal of near-shore, aquatic vegetation—the same vegetation for which species like largemouth bass are intimately linked. In fact, the level of shoreline development largely dictates largemouth bass and black crappie nesting success. It also contributes to the proliferation of seawalls, patios, sand beaches, piers, swim rafts and boat-docking stations which can alter, fragment or eliminate natural fish habitat.

Unlike bass, carp are frequently associated with a relative absence of vegetation. Carp are known to negatively impact water clarity and native aquatic plant growth, namely through their feeding habits that stir up the lake bottom and recycle nutrients for algal growth. As a lake's Trophic State Index (TSI) increases, due in part to carp activity, total number of species (and particularly fish species sensitive to water quality changes) eventually declines after an initial increase. The percentage of gamefish also decreases with increasing TSI, while carp abundance actually increases until the lake becomes hypereutrophic. The occurrence of northern pike, largemouth bass, walleye and yellow perch all decline starting at a TSI of about 50.[180] These

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[178] Ibid

[179] Wang, L., J. Lyons, P. Kanehl, and R. Bannerman. 2001. Impacts of Urbanization on Stream Habitat and Fish Across Multiple Spatial Scales. Springer Series in Environmental Management, Vol. 28, No. 2, pp. 255-266.

Clausen, J.C., G. Warner, D. Civco, and M. Hood. 2003. NEMO Impervious Surface Research – Final Report. University of Connecticut Department of Natural Resources Management and Engineering.

[180] Schupp, D.H. 1992. An Ecological Classification of Minnesota Lakes with Associated Fish Communities. Minnesota Department of Natural Resources, Division of Fisheries. Completion Report, F-29R(P)-11, Study 4, Job 417.

findings are of concern for Lake Ripley, which has a mean summer TSI that is hovering at this exact level.

## 6-7 MANAGEMENT RECOMMENDATIONS

### MONITORING

- Support the continuation of long-term trends monitoring on Lake Ripley by the Wisconsin Department of Natural Resources. This includes regular monitoring of water quality, fish populations and aquatic plant conditions.

- Continue using Wisconsin DNR electrofishing surveys and other methods to track fish recruitment (or the number of fish surviving to a certain size or age each year). Evaluate potential causes of variability, including weather during the spawning period, availability and quality of nursery cover, condition of the forage base, water quality changes, and harvest pressure.

- Continue tracking the status of the lake chubsucker (*Erimyzon sucetta*), a Wisconsin Species of Special Concern. In addition, continue monitoring for the pugnose shiner (*Notropis anogenus*) and least darter (*Etheostoma microperca*), two Wisconsin Threatened Species that appear to have disappeared from the lake. Another rare and sensitive species that appears to have disappeared from the lake is the banded killifish (*Fundulus diaphanous*). Rediscovery of these species using effective capture methods could be an early indicator of water quality improvements or successful habitat recovery.

- Examine length-frequency trends for northern pike using spring fyke netting to determine the effect of 1995 length limit changes.[181]

- Assess the resident carp population and determine if the Koshkonong Creek outlet is a source of recruitment.

- Evaluate the smallmouth bass population to see if it is increasing in size, to identify the conditioning factor in these fish, and to learn if the fish are affecting the forage base.[182]

- Monitor changes to the lake's aquatic plant community, particularly with respect to problem species like milfoil and curly-leaf pondweed.

- Continue monitoring shoreline development activities, especially those that could impact Critical Habitat Areas. Use video documentation to track changes over time and to support necessary enforcement actions.

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[181] Byla, Algis B. 2005. A Decade of Centrarchid Data from Lake Ripley, Wisconsin. Wisconsin Department of Natural Resources' summary report for the period 1994-2004.
[182] Ibid

## MANAGEMENT INTERVENTION

- Work with DNR fisheries biologists to determine if the Koshkonong Creek outlet is a source of carp recruitment. If so, investigate the feasibility of obtaining a Chapter 30 permit and installing a carp gate or similar barrier. Possible locations are where the outlet crosses through the Ripley Road or STH 18 culverts. An experimental, temporary barrier can be considered to help expedite the Chapter 30 permit approval process.

- Continue working with lakefront property owners to restore native shoreline and aquatic vegetation, and to install "treefalls" at the lake edge to serve as coarse woody habitat. Utilize outreach programs, cost-sharing incentives, demonstration projects, and technical/permitting guidance to encourage landowner participation.

- Continue conducting erosion- and pollution-control projects within the watershed in accordance with approved management plans. Higher clarity after nutrient input reduction or inactivation may allow gamefish predators to more effectively forage on prey species, favorably changing the size distribution of both over time.

- Continue using mechanical weed harvesting in accordance with state permit conditions and approved management plans. Harvesting should target dense stands of Eurasian watermilfoil and other non-native, invasive species, while avoiding high-quality native plant beds.

- Consider use of spot herbicide treatments to suppress isolated colonies of invasive weeds that are not yet widely distributed throughout the lake. Avoid lake-wide plant control projects that have limited probability of eliminating invasive weeds, but pose a risk to damaging non-target plants or animals.

- Since natural reproduction is minimal, continue the walleye-stocking program sponsored by the Wisconsin DNR.[183] Walleye has become a popular sport fish that can help keep panfish (planktivore) populations in check, and without displacing or negatively impacting other gamefishes.

- Protect designated Sensitive Areas, now called Critical Habitat Areas, by supporting the Town of Oakland's pier and boating ordinances that affect these locations.

- Work with DNR to revisit bag and size limits for bass, northern pike and walleye to ensure that current policies are maintaining appropriate size distributions.

## PUBLIC OUTREACH

- Use multiple media outlets (i.e., newsletters, e-mail bulletins, newspaper articles, signs, website, local cable TV, etc.) to raise awareness about lake and fishery-related issues.

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[183] Ibid

- Utilize public meetings and opinion surveys to assess public perceptions and concerns pertaining to the lake and its fishery.

- Educate boaters and other lake users about aquatic invasive species through postings at the boat landings, and by using the media outlets referenced above. When possible, train and coordinate volunteer groups to monitor the boat landings and conduct watercraft inspections.

- Educate residents and lake users about fish-harvest limits, Critical Habitat Areas, mechanical weed-cutting objectives, shore restorations, fish stocking, aquatic invasive species, fish kills caused by columnaris infections, and other issues that affect the health of the fishery. The public should be made aware that long-term fishery health is ultimately dependent on the availability of good habitat and water quality, whereas stocking and harvest regulations are often short-term fixes that fail to address underlying problems.

- Inform residents and lake users of any fish-consumption advisories due to mercury (if applicable). There are currently no lake-specific advisories in effect for Lake Ripley. However, statewide testing has shown that most of Wisconsin's fish contain at least 0.05 ppm of mercury which has prompted general consumption advisories for at-risk populations. Consumption advice will vary with the species and age of fish, and the person eating the fish.

# -7-
# LAKE DISTRICT PRESERVE

*"When one tugs at a single thing in nature, he finds it attached to the rest of the world."*

-- John Muir, Sierra Club founder and former Wisconsin resident

## 7-1 BASIS FOR PRESERVE PLAN

This chapter builds upon the "Lake District Preserve Management Plan" produced by the Lake Ripley Management District in 1998. A new plan was warranted for several reasons. These include evolving landscape conditions and management needs, the successful implementation of property-improvement measures, and the expansion of Preserve boundaries due to recent land acquisitions. The following chapter is intended to describe the history and present status of the Preserve, and to set forth recommendations for future management action.

## 7-2 STRATEGIC VALUE OF THE PRESERVE

Wetlands and undeveloped natural areas in the watershed are valuable resources that often contribute directly to Lake Ripley's water quality and ecosystem health. Wetlands act as natural sponges that absorb and then slowly release storm runoff, thereby reducing the severity of downstream flooding, shore erosion, and high-water impacts. A similar function is served by woodlands and other natural areas that help intercept, infiltrate and evapo-transpire rainfall. Properly functioning wetlands not only offer tremendous water-storage capacity, but are able to filter and trap sediment and other pollutants headed toward the lake. The lush vegetation found in wetlands also provides wildlife habitat for many different species, and is used by fish for spawning and nursery areas when connected to surface waters.

In 1903-08, the U.S. Geological Survey mapped approximately 1,500 acres of wetlands within the Lake Ripley watershed, which at the time represented about 29% of the total watershed area. Many of these wetlands had already experienced significant agricultural land clearing and drainage alterations at the time they were originally mapped. In 1986, the Wisconsin DNR was only able to map 540 acres (11.5% of total watershed area) as functioning or partly functioning wetlands, reflecting a 60% wetland reduction. Today, no more than one-third of the watershed's original wetland acreage still remains in a functioning or partly functioning state.[184]

Alert to the value and vulnerability of these important landscapes, the Lake District has long targeted them for protection and restoration as a key component of its overall lake-management strategy. Such efforts have resulted in both fee-simple acquisitions and the negotiation of land-protection agreements (via conservation easements) with willing landowners. In particular, the Lake District was early to recognize the strategic value and high restoration potential of the

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[184] Wisconsin Department of Natural Resources, Wisconsin Department of Agriculture, Trade and Consumer Protection, Lake Ripley Management District, and Jefferson County Land Conservation Department. 1998. Nonpoint Source Control Plan for the Lake Ripley Priority Lake Project. Wisconsin Nonpoint Source Water Pollution Abatement Program. Publication WT-512-98.

former Probst Farm. This property, now owned and managed by the Lake District, consisted largely of farmed wetlands located at the inlet to Lake Ripley. It is now undergoing a remarkable transformation back to functioning wetlands and restored prairie areas. Today, this land not only helps protect the quality and quantity of water entering Lake Ripley, but provides unique opportunities for outdoor recreation.

## 7-3 PROPERTY DESCRIPTION

The 167-acre Lake District Preserve is located less than one-half mile east of Lake Ripley in the Town of Oakland. Area topography is rolling, ranging from flat in valley bottoms to wooded hills with 7% slopes. Much of the soils are characterized as Houghton muck—an organic, level and very poorly drained soil found in depressions of old lake basins and subject to frequent flooding. Land cover in the Preserve consists predominantly of stream-corridor wetlands (covering over half the property) and adjoining uplands, including a 21-acre woodlot. Currently, approximately 26 acres of the adjoining agricultural uplands remain as actively farmed cropland under a two-year, tenant-farming lease. These 26 acres will be planted to native prairie in late 2010 or early 2011.

Lake Ripley's only inlet stream runs east to west through the southeastern and southwestern portions of the Preserve. This unnamed, perennial stream has been degraded from a long history of dredging, channelization, and siltation caused by upstream and adjacent agricultural activities. Degradation is evidenced by macroinvertebrate data collected in 1993 at the lake's inlet. These data, when compared to standard biotic indices, revealed fair to poor water quality in the inlet stream.[185] During this same period, regular water quality monitoring at the inlet found high nutrient levels and low dissolved oxygen concentrations. Such findings are consistent with impacts associated with manure and fertilizer runoff.

Connecting to the inlet are two drainage ditches which cross through the Preserve. While their channels are still evident, both ditches were plugged by the Lake District in partnership with the U.S. Fish and Wildlife Service. Thick beds of watercress observed growing in and around the east ditch are indicative of significant groundwater seepage. Efforts were made to avoid any groundwater-discharge areas (springs) at the time of ditch plugging. Such areas are important for supplying clean water and maintaining year-round, open-water habitat for fish and wildlife.

## 7-4 WILDLIFE AND HABITAT VALUES

Whitetail deer, eastern wild turkey, red fox, ring-necked pheasant, muskrat, great blue heron, sandhill crane, white egret, northern pike and a wide variety of frogs, turtles and ducks are among the many common wildlife sightings at the Lake District Preserve. Federally-designated, "priority migratory waterfowl species" observed within or near the Preserve area include wood duck, mallard, northern pintail, American black duck, American wigeon, and the lesser and

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[185] Wisconsin Department of Natural Resources, and Lake Ripley Management District. 1994. Lake Ripley Water Resources Appraisal.

greater scaup. The Preserve directly benefits these particular species by increasing the extent and quality of their desired habitats. In particular, the northern pintail will benefit from the establishment of upland grassland areas adjacent to the wetlands which can be used for nesting. The lesser and greater scaup will benefit from year-round open water areas around the creek, springs and nearby lake that offer excellent migrational habitat. The restoration and protection of adjacent woodland and grassland areas will further benefit many of these species, namely by ensuring adequate nesting, cover and foraging sites.

Non-game, migratory waterfowl species observed in and around the Preserve area include black tern, sandhill crane, blue-winged teal, bobolink, northern harrier, eastern meadowlark, sedge wren and Virginia rail. Since some of these wetland-dependent birds are grassland species that nest in adjacent uplands, they will directly benefit from the outcome of prairie-restoration efforts, including the eventual conversion of adjacent cropland to native tall-grass prairie. Furthermore, the addition of the 21-acre woodlot will serve as prime nesting and foraging habitat for wood ducks.

The Preserve is also likely to directly or indirectly benefit endangered, threatened and special-concern species as identified by the Wisconsin DNR. Prior inventories have documented the following such species within a one-mile radius of the Preserve: Blanding's turtle, black tern, bullfrog, giant carrion beetle, least darter, lake chubsucker, pugnose shiner, and cuckoo flower.

**Blanding's Turtle found near the Preserve in 2008 by LRMD staff.**

When fully restored, the Preserve will consist of approximately 100 acres of stream-corridor wetlands, 23 acres of woodlands, and 43 acres of native prairie. It represents the only place of its kind within Lake Ripley's seven-square-mile watershed.

## 7-5 ACQUISITION HISTORY AND JUSTIFICATION

In late 1997, the Lake District acquired its first 99 acres of the former Probst Farm. The property consisted of 55 acres of farmed wetlands drained by ditches, 40 acres of non-farmed but degraded wetlands, and four acres of farmed uplands. While large sections of the non-cropped wetland areas were found to contain dense stands of reed canary grass, much of the wetland was found to support a fairly diverse and healthy plant community. The purchase of this property was made possible through a Wisconsin DNR Lake Protection Grant and donations from various contributors. As a result of a naming contest, these conservation lands were later coined the "Lake District Preserve" by former Board Commissioner Jim Rank.

In 2001, two additional acres that adjoined the Preserve's northeast side were acquired by condemnation for the purpose of plugging an existing agricultural drainage ditch. A map of the Preserve as it existed between 2001 and 2008 is shown in Figure 52. Then, in late 2008, another 66 acres of the original Probst Farm were purchased from the Johnson Family. An aerial photograph depicting the full extent of today's Preserve in relation to the lake, inlet, and a 40-acre wetland parcel owned by the State of Wisconsin is provided as Figure 53.

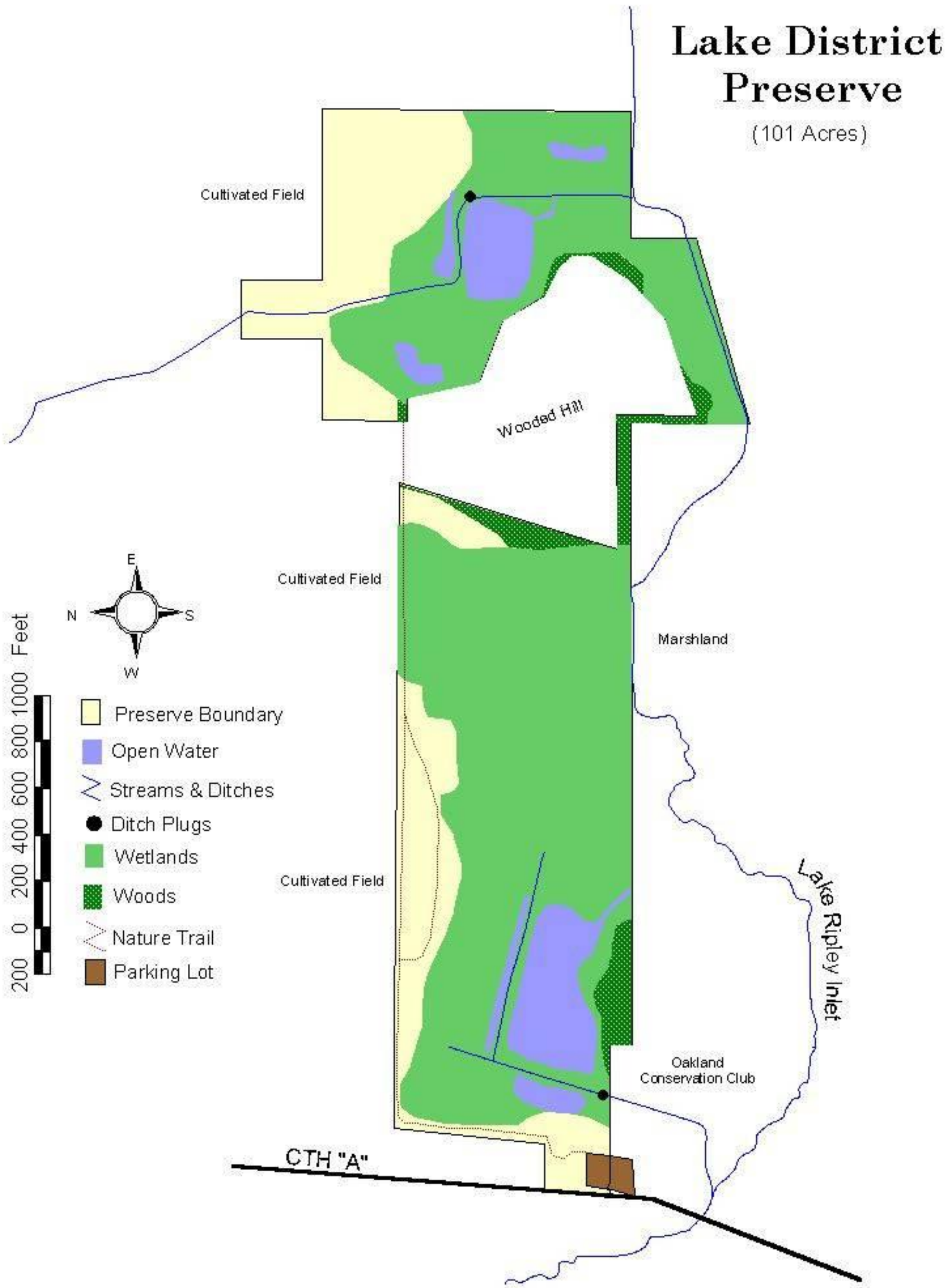


**Figure 52: Map of Original, 101-acre Lake District Preserve**

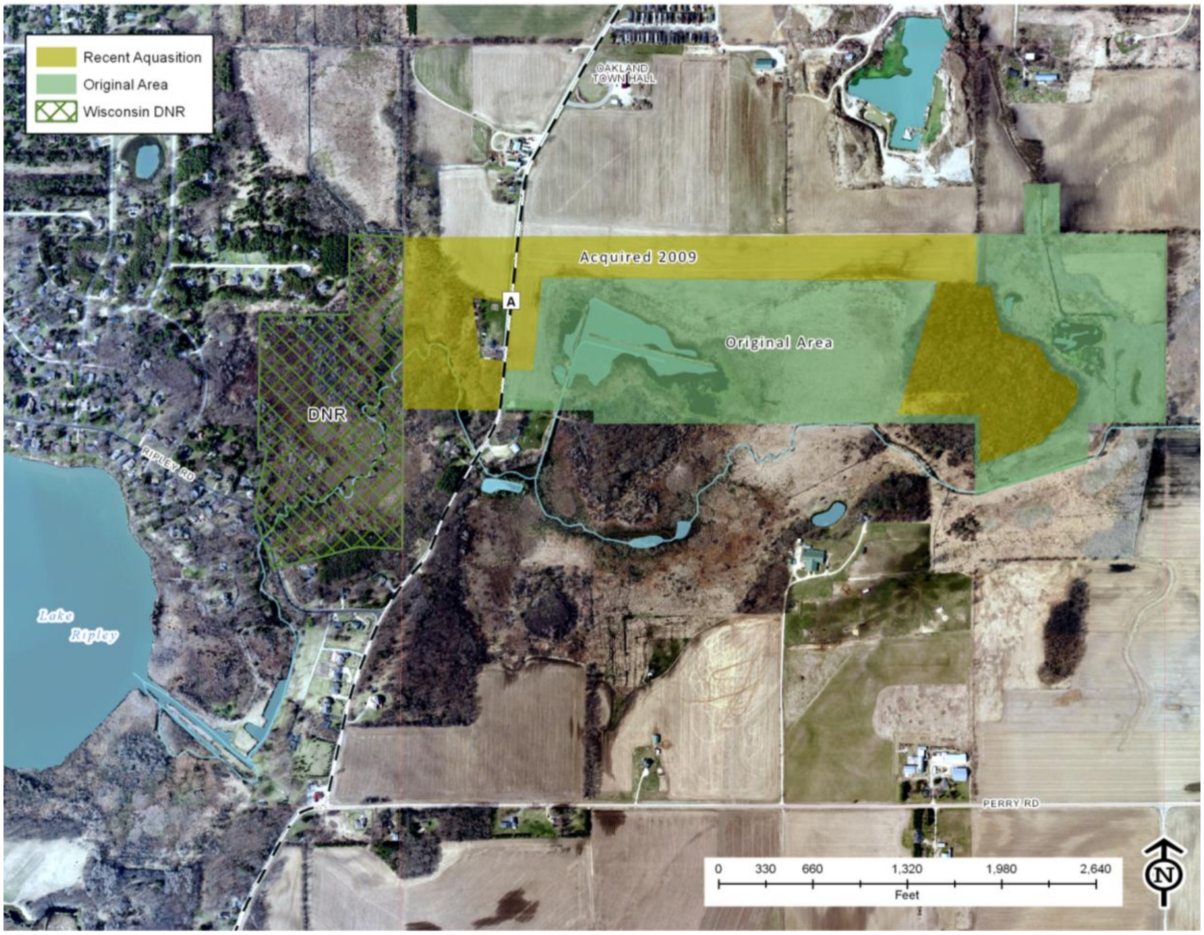


**Figure 53: Aerial photograph showing acquired Lake District Preserve parcels in relation to Lake Ripley, its inlet tributary, and a wetland parcel owned by Wisconsin DNR**

The latest acquisition includes a segment of the inlet tributary, and consists of a mix of farmland, woodlands and riparian wetlands. Protection of these particular lands was specifically identified as a recommendation in the Jefferson County Parks, Recreation and Open Space Plan,[186] as well as the draft Feasibility Study, Master Plan, and Environmental Impact Statement for the Proposed Glacial Heritage Area.[187] It is also generally supported in the Jefferson County Land and Water Resource Management Plan,[188] Town of Oakland's Comprehensive Growth Plan,[189] the Lake District's Lake Ripley Management Plan,[190] and the Nonpoint Source Control Plan for

[186] LanDesign by Margaret Burlingham, LLC. 2005. Jefferson County Parks, Recreation and Open Space Plan (2005-2010). Prepared for Jefferson County Parks Committee.
[187] Wisconsin Department of Natural Resources. 2009. Feasibility Study, Master Plan, and Environmental Impact Statement for the Proposed Glacial Heritage Area (Draft). DNR Publication No. LF-050.
[188] Jefferson County Land and Water Conservation Department. 1999. Jefferson County Land and Water Resource Management Plan (2000-2005).
[189] MSA Professional Services. 2008. Town of Oakland Comprehensive Growth Plan.
[190] Lake Ripley Management District. 2001. Lake Ripley Management Plan.

the Lake Ripley Priority Lake Project.[191] In addition, a Lake District Board-appointed citizen advisory committee recently issued a report identifying the acquisition as a top priority for improving the existing Preserve.

Aside from increasing the acreage of the Preserve by 65%, the latest acquisition will be instrumental in allowing the Lake District to better control soil erosion while establishing permanent protective buffers around stream-corridor wetlands. It also will allow for greatly improved access to critical headwater lands for the purpose of ongoing habitat restoration and water quality management work. Finally, it will provide for a larger refuge for migratory waterfowl and other wildlife, while linking the property to a 40-acre wetland parcel owned by the State of Wisconsin. In addition to its conservation and inlet-protection benefits, the combined 167-acre property offers the community an abundance of educational and outdoor recreational opportunities. Allowable activities include hiking, hunting, trapping, birding, cross-country skiing, and nature exploration.

The expanded Preserve is part of a larger environmental corridor that will likely attract more diverse numbers of wildlife species, and gives the Lake District greater access and control over tributary waters flowing into Lake Ripley. According to Jefferson County's Land and Water Conservation Plan, environmental corridors are known for their unique natural features and environmentally-sensitive areas. These include floodplains, wetlands, public parks and recreation lands, conservancy lands, at least 10 acres of contiguous woodlands, and land with a greater than 20% slope. A map showing the 167-acre Preserve in relation to the Lake Ripley Management District and watershed boundaries is included as Figure 54.

[191] Wisconsin Department of Natural Resources, Wisconsin Department of Agriculture, Trade and Consumer Protection, Lake Ripley Management District, and Jefferson County Land Conservation Department. 1998. Nonpoint Source Control Plan for the Lake Ripley Priority Lake Project. Wisconsin Nonpoint Source Water Pollution Abatement Program. Publication WT-512-98.

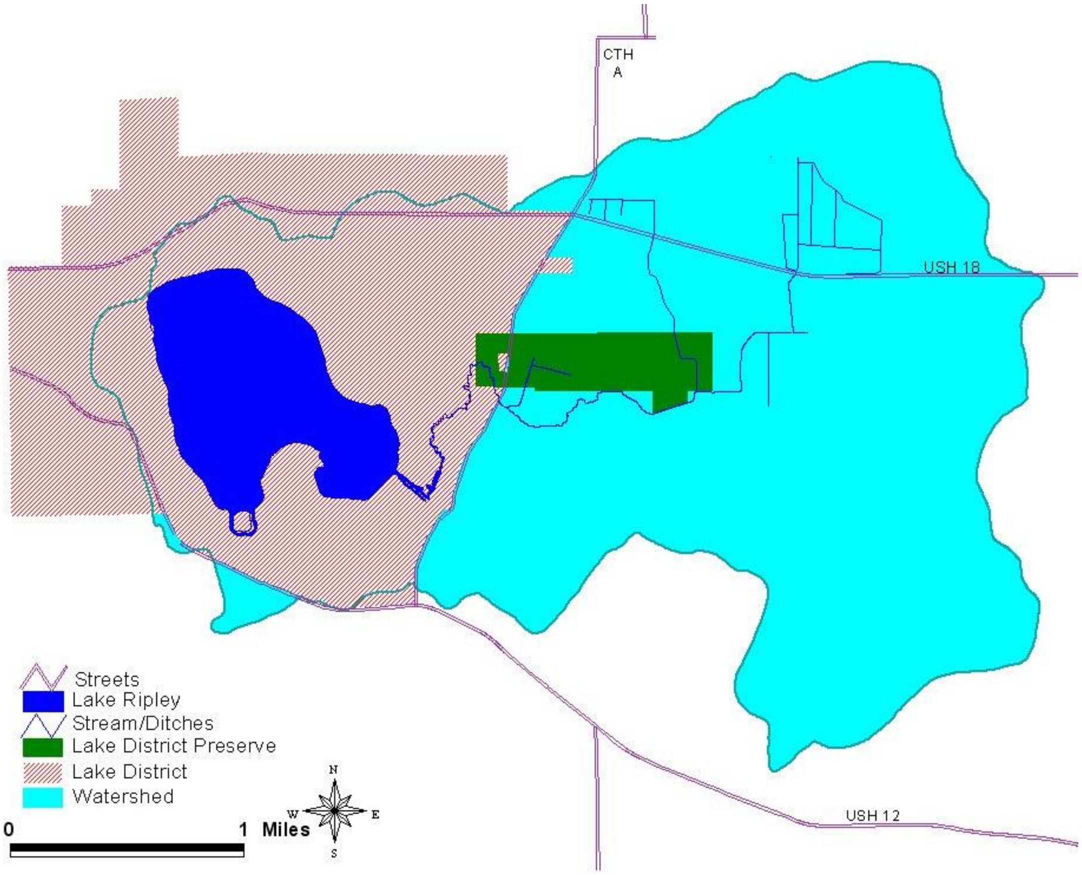


**Figure 54: 167-acre Lake District Preserve in relation to Lake Ripley Management District and watershed boundaries**

## 7-6 MANAGEMENT GOALS

### *A. Primary Goals:*

1. Improve and protect the quality of water flowing into Lake Ripley through its only inlet.
2. Create and restore quality fish and wildlife habitat.

### *B. Secondary Goals:*

1. Reduce downstream flooding and high-water impacts by restoring wetland function.
2. Provide low-impact opportunities for public outdoor recreation.
3. Develop site facilities that increase the public's understanding and appreciation of the Preserve and its resource values.
4. Promote watershed conservation practices and the permanent protection of wetlands and high-value natural areas.

## 7-7 MANAGEMENT HISTORY (1998-2009)

### PRAIRIE RESTORATION

About 45 acres of native prairie was first planted in June of 1998 to take advantage of the existing soybean cover, absence of aggressive weeds, and friable soil condition. Roundup was sprayed to kill weeds that germinated prior to planting. Approximately 35 acres of mesic prairie was planted using a seed drill, while another 10 acres of wet prairie was planted by hand-broadcasting native seed.

Due to limited project funding and the high demand for prairie seed, most of the mesic prairie seed was purchased from Osenbaugh Grass Seeds, a large seed distributor headquartered in Iowa. Ideally, grass seed should be purchased from local distributors to ensure that strains are suited to local conditions. Future plantings should incorporate seeds from local sources whenever possible. The prairie seed mix contained the following species: big bluestem, Indian grass, switch grass, black-eyed Susan, purple coneflower, and purple prairie clover. In addition, the Wisconsin DNR provided about 90 pounds of pure live seed to supplement the mix, containing about 22 different species. Forbs were planted at an average rate of one to three ounces per acre. Grasses were planted at the following rates: big bluestem at three pounds per acre, Indian grass at two pounds per acre, and switch grass at one pound per acre.

The following species were planted in wet prairie areas with little existing natural vegetation: bluejoint, cord grass, stiff goldenrod, big bluestem, switchgrass, New England aster, culver's root, prairie blazingstar, rosinweed, and bergamot. Due to the wetness of the ground, this seed was planted entirely by hand broadcasting. Planting was focused on areas with exposed soil and very little existing weed competition. Specifically, seed was planted along the margins of the existing wetland and the wet areas between the wooded hill and the existing wetland (approximately 10 acres total).

The planted areas were mowed in August of 1998 during the initial growing season. Mower blades were set at 8 inches to cut the taller weeds and allow sunlight to reach the sprouting prairie vegetation. Planted areas were mowed again during the spring of 1999. At that time, mower blades were set at 6 inches. The prairie has since been maintained by periodic burning and the hand-pulling of invasive species. These early-maintenance procedures were repeated in subsequent land-acquisition and restoration areas.

### WETLAND SCRAPES

Wetland-restoration activities began in late summer of 1998, starting with the excavation of two, half-acre wetland scrapes on the east side of the property. Although scrapes are not considered "true" wetland restorations, these features provide excellent spring wildlife habitat and can help trap sediment from upland runoff. The two scrapes were excavated to a depth of 12 to 24 inches in the middle, with spoils placed on the adjacent uplands. All necessary permits were obtained prior to restoration, and construction plans were developed to meet NRCS specifications for wetland restorations. Wetland vegetation was not planted since it was assumed that there was still a viable seed bank present in the soil. A third wetland scrape was created on the west side of the property during the plugging of a drainage ditch in 1999. Excavated soil from the scrape area was used to plug the ditch.

## DITCH PLUGS

Flooded wetland area at the Preserve located next to a ditch plug. Picture was taken during a 2008 flood event.

Wetland restoration work included the plugging of both drainage ditches located on the property. A ditch plug involves collapsing or filling in a section of the ditch so that water is then forced to back up and pool in low-lying areas, creating conditions suitable for wetland habitat. Project designs allow water to reconnect via a spillway to the inlet channel during large storm events, thereby preventing flooding of adjacent properties. Ditch plugs are commonly used to restore wetland hydrology and trap sediment previously carried by the ditches. All ditches on the Preserve were privately owned and able to be manipulated as long as adjacent properties would not be adversely impacted.

The Preserve's west ditch was plugged in 1999, resulting in about a 17-acre pool of up to one foot deep. The east ditch (which also drained lands extending north of USH 18) was plugged in late 2001. Prior to plugging, some sections of the existing ditch banks were re-shaped to a more stable 3:1 slope and seeded to prairie grass. Both ditches, totaling 1.7 miles (9,000 linear feet), were plugged in partnership with the U.S. Fish and Wildlife Service. Channelized drainage and agricultural runoff is now able to be diverted back into wetland areas where it can be absorbed and cleansed, thereby reducing flooding and improving downstream water quality.

A three-foot-high spoil bank runs east-west along the west ditch. Although an unnatural feature, it was allowed to remain on the site to help maintain a wetland pool, thereby enhancing shallow-water wildlife viewing opportunities and site aesthetics. Most of the trees on this bank were cut in August, 1998. However, due to ground wetness and time constraints, a few trees were left remaining at that time. A subsequent effort was made to remove trees growing along the old ditch banks in late 2004. Most of the trees were densely-clustered willow colonies that were encroaching into the wetlands. While the bank may provide for excellent wildlife viewing, public access is restricted along most of it to limit human disturbance to the wetland. Restricted bank access also prevents trampling of bank vegetation, minimizing its appeal to large numbers of Canada geese, which are attracted to open areas near water. Trees were also growing along the banks of the east ditch, but were mostly removed or left as habitat in the channel when the ditch was plugged in 2001.

## INVASIVE SPECIES CONTROL

The control of invasive species at the Preserve has primarily consisted of employing prescribed burns. Burns are conducted every 2-4 years, and are typically performed in early spring or late fall when weather conditions permit. Adequate fire breaks (or mowed clearings) are maintained along property lines and around no-burn areas prior to a burn to maintain fire control. The Lake District commissions a team of experienced burn managers to oversee the operation. Other strategies for controlling invasive species have included mechanical brush clearing, mowing, and the hand pulling of isolated weed colonies.

**A prescribed burn at the Preserve is used to control weeds and encourage native seed germination.**

During initial restoration efforts, care was taken to prevent the establishment of several biennial and perennial problem species in the prairie. These included white and yellow sweet clover, wild parsnip, and leafy spurge. Attempts were made to pull these plants as soon as they appeared. In the wetlands, reed canary grass has been managed with prescribed burning, but with limited success in some areas. The U.S. Fish and Wildlife Service can assist with future control efforts.[192] Monitoring continues for purple loosestrife infestations, but this weed has not yet been discovered. If observed, this weed will be immediately pulled or controlled using an approved herbicide. Encroaching shrubs and trees will be cut as needed, and the stumps will be treated with an herbicide to control their spread on ditch banks and other areas of concern.

The Preserve will continue to undergo periodic burning to control the spread of reed canary grass, shattercane, ragweed, sweet clover, smooth brome, Queen Anne's lace, quack grass, woody vegetation and other invasive weeds. Spring burns will help weaken early season weeds and warm the soil to stimulate seedling growth. Restored prairie areas will be burned starting the second spring after planting or as soon as sufficient fuel is present on the ground surface. These areas will then be burned on a three- to five-year recurrence interval, depending on need and the availability of resources. To preserve nesting cover and wildlife habitat, no more than one-third of the Preserve should be subjected to a burn in any given year.

The Preserve will be delineated for burning purposes into discrete management zones. Existing landscape features and plant-community types will help define these zones, and fire breaks will be maintained as needed to ensure proper fire containment. Local burning ordinances will be followed, and neighbors and local police will be notified prior to burning.

## WILDLIFE HABITAT ENHANCEMENTS

Habitat enhancements at the Preserve are predominantly associated with the restoration of prairie and wetland plant communities. Previously farmed wetlands and cropped monocultures have been replaced with restored wetland and tall-grass prairie communities. By establishing a diverse and permanent cover of native plant species, an increasing abundance and variety of wildlife can be expected and have been observed frequenting the area. Permanently-protected habitat improvements should also benefit several endangered, threatened and special-concern species that have been documented in the vicinity of the Preserve. To a limited degree, natural

[192] 2009 personal communication with Art Kitchen, U.S. Fish and Wildlife Service

habitat has been supplemented with artificial, including the installation of a number of wood duck and bluebird nesting boxes.

## PUBLIC ACCESS IMPROVEMENTS

A small, gravel parking lot was installed east and adjacent to County Highway A in 1998. The parking area provides safe access to and from the Preserve, and allows enough room for school bus parking. A split rail fence demarcates the parking area and precludes vehicle access to the Oakland Conservation Club property and the Preserve's natural areas. The Oakland Conservation Club holds a lease to park vehicles on the site during two or three annual fundraising events. Club members are allowed to park along a 70-foot strip extending east from County Highway A towards the west ditch. In accordance with Wisconsin DNR guidelines, parking is not permitted within 50 feet of any ditches or standing water.

Also in 1998, a welcome sign and information kiosk were first erected near the parking area at the main entrance. The welcome sign identified the site and acknowledged major project donors at the time. This sign was since replaced with a new sign in 2009, following a successful expansion of the Preserve. The trailhead kiosk is positioned at the east end of the parking lot and currently includes a site map, user rules, and some basic background information about the Preserve. The information kiosk is currently being replaced with a newer and somewhat larger kiosk. Several interpretive signs were installed along the nature trail in 2005, mainly to enhance the educational value of the site. The 18x24-inch, pedestal-style signs feature pictures and information about prairie and wetland ecology, and call attention to the different types of plants and animals that inhabit the Preserve.

**Informational signage at the Preserve includes a new welcome sign at the main entrance (left), an identifying sign for the west side of County Rd. A (middle), and several interpretive trail signs (right).**

Other access amenities include an elevated boardwalk that spans a wetland scrape and connects to a gravel loop trail located at the west ditch plug. The wooden boardwalk and gravel trail were constructed in 2003, and link to a five-foot wide, 3/4-mile-long, grass walking trail. The grass trail was estab1ished in 1999, and currently extends to the large woodlot. Before reaching the woodlot, the trail leads visitors to a hillside nature-viewing platform overlooking the marsh that was built in 2007. The trail was sited primarily on drier soils, but some portions had to be routed through seasonally wet areas. Re-routing of the trail to higher ground is recommended now that the adjoining uplands have been acquired. The trail was originally planted with a mix of side oats grama, hairy grama and Pennsylvania sedge. It is mowed several times per year as necessary. A number of interpretive signs, as well as both bluebird and wood duck nesting boxes, provide additional interest for trail users.

Future trails will be located on 0-5% slopes whenever possible and constructed according to Wisconsin DNR trail-construction guidelines. In addition, short stretches of boardwalk may be constructed into saturated or seasonally saturated areas to provide some additional access to wetland areas. Any such construction would be limited so as not to unnecessarily disturb fragile plants or sensitive wildlife. Construction would also likely require special permit approval since the activity would take place near or within wetlands. If completed, efforts should be made to select construction methods and materials that reduce impacts to wetland plants and hydrologic conditions.

**66-ACRE JOHNSON ACQUISITION**

Acquisition lands west of County Road A were rezoned from "A-1 Exclusive Agriculture" to "Natural Resources" as a requirement of the sale. Due to the rezoning, continued farming of the approximately 4.5 acres of cropland is no longer permitted. Grant monies are allowing this area, which was previously planted in soybeans, to be seeded to native prairie. This work was started in spring of 2009. An abandoned automobile was removed from the site prior to the start of seeding. Seeding was performed using a seed drill, and was followed by a mowing during the fall of the same year. A second mowing will occur next summer to help suppress weed growth.

Long-term plans include converting all previously cropped areas to tall-grass prairie. These areas will then serve as conservation buffers that will help stabilize eroding soils, expand grassland habitat, capture and absorb runoff, and help protect adjacent wetlands. For the next two years prior to restoration (2009 and 2010), the Lake District will participate in a tenant-farming arrangement on the 26 acres of cropland east of County Road A. Temporary farming is permitted under the Lake Protection Grant contract used for the land purchase, and will allow the District to generate rental income that can help offset future restoration costs. Farming will also help maintain effective weed control before restoration is implemented.

The use of conservation tillage practices, such as no-till plowing, will be required while the property is being farmed. The planned crop rotation will be corn followed by soybeans. In addition, significant gully erosion is evident and will be targeted for repair prior to site restoration. The main gully forms 650 feet east of County Highway A, and has been measured up to 500 feet in length. Much of the erosion originates and is located on the adjacent property to the north. If cooperation can be secured with the adjoining landowner, the gully will be reshaped and seeded to a grass-swale waterway. Installation will be based on a design and seed mix approved by the Jefferson County Land and Water Conservation Department. Plans are to seed the entire 26-acre field to prairie beginning in the fall of 2010 or spring of 2011, and following the removal of any crops. The U.S. Fish & Wildlife Service has agreed to donate and help plant the requisite seed mix.[193]

The recently acquired, 21-acre woodlot will remain as such, but will be managed to enhance its wildlife value. This will be accomplished through selective tree thinning, native tree planting, and the removal of invasive species. A pile of discarded tires on the north edge of the woodlot

[193] Ibid.

was removed by the seller during the spring of 2009. Abandoned hunting stands were also removed at that time. According to a 2009 walk-through survey,[194] the woodlot was found to be comprised of a mixture of red maple, black cherry, shagbark hickory, elm, basswood, black and white oak, bur oak, box elder and white mulberry. Red maple and elm were found to be the dominant species. Oaks and other high-value timber appeared to have been logged from the property some time ago. A considerable amount of young desirable central hardwoods in the sapling and poletimber size classes were observed. However, there was also a significant amount invasive exotic species, including buckthorn, white mulberry, garlic mustard, multi-flora rose, dames rocket and barberry.

The above-described species will be the target of future control efforts. Any cut trees can be removed, burned, or left in place as brush piles for wildlife as long as quantities are not excessive and not allowed to smother native groundcovers. It is recommended that any tree thinning be conducted in consultation with a qualified arborist or Wisconsin DNR forester. As much of this work as possible should be performed prior to restoring adjoining croplands which will serve as equipment access to the woodlot.

Wetland and riparian areas will be the subject of water quality and habitat-enhancement efforts. These efforts will include the stabilization of eroding stream banks, and the establishment of native wetland plant communities wherever feasible. They will also involve the identification and control of any invasive species before they can spread and cause further problems.

Extending and/or re-routing existing walking trails and adding more interpretive signs may be warranted for improved public-access and education purposes, and to better protect sensitive areas. In particular, the existing trail should be re-routed around seasonally wet areas so they can be more easily used and maintained. No public access trails west of County Highway A are planned at this time in deference to maintaining the privacy of the neighboring residents. If trails are considered in the future, it is advised that they direct foot traffic away from this property. All Preserve lands must and shall remain open (with limitations) to public hunting, trapping, bird-watching, fishing, nature exploration and other low-impact recreational uses.

Simple, low-profile markers, such as wood posts or sections of split railing, will be installed to help demarcate the new Preserve boundaries. A property surveyor will be commissioned to assist with the accurate marking of these boundaries. Care will be taken to install markers that will not unnecessarily complicate adjoining farming operations, or result in a visual intrusion that interrupts the Preserve's natural aesthetics.

## LONG-TERM MANAGEMENT CAPACITY

The Lake District Board and its employees will direct all management activities at the Preserve with assistance from volunteers and qualified contractors. The District will also continue to solicit donations and project grants to help facilitate ongoing restoration activities. Management responsibilities will entail publicizing the property's availability to the public, engaging in habitat-restoration work, coordinating volunteer stewardship activities, conducting educational

[194] November 18, 2009 report by Randy Stampfl, Wisconsin DNR Forester

tours, gathering visitor feedback via surveys, and performing long-term monitoring of restored habitats and resident wildlife populations. Technical expertise, labor, funding and other assistance will be sought from the Wisconsin DNR, U.S. Fish and Wildlife Service, Cambridge Public Schools, and volunteer groups like the Friends of the Preserve on an as-needed basis.

## 7-8 MAJOR PARTNERS AND CONTRIBUTORS

The Lake District is proud of the many partnerships that were instrumental in the purchase and restoration of Lake District Preserve lands. Past and current partners include: Wisconsin Department of Natural Resources ($320,000 in Lake Protection Grants), North American Wetland Conservation Act grant program ($75,000), Cambridge Foundation ($50,000), Ducks Unlimited ($20,000), Foundation of Faith ($10,000), Oakland Conservation Club ($5,500), Jefferson County Chapter of Pheasants Forever ($5,500), Fort Atkinson Wisconservation Club ($5,000), U.S. Fish and Wildlife Service ($4,000), Cambridge State Bank ($3,500), Superior Services of Fort Atkinson ($2,000), Badger Bank ($1,000), Natural Resources Foundation -- C.D. Besadny Grant program ($1,000), John Probst & Sons (4-acre land donation), and all our individual donors whose contributions totaled many thousands of dollars. The Lake District also acknowledges citizen volunteer groups—including the Friends of the Preserve, local scout troops and school environmental clubs—that have assisted with various restoration and stewardship projects over the years.

## 7-9 RECOMMENDATIONS

### MONITORING

- Public access facilities and designated walking paths will be routinely monitored for unintended environmental impacts and to evaluate their condition. Impacts might include erosion or overgrowth of the trails, littering and improper waste dumping, wildlife feeding or harassment, disturbance of protected plant communities, and the illegal harvesting of plants, seeds or animals. Potential management responses could consist of improving the content and positioning of signage, creating added barriers to protect sensitive areas, and re-designing or temporarily closing trails and access facilities found to be in disrepair. The Friends of the Preserve and similar volunteer groups will be approached to assist with regular monitoring.

- The property will be divided into discrete management zones. These zones may be delineated using such factors as landscape/cover type, plant community composition, ecological sensitivity, invasive species types and locations, and degree or type of management intervention required. Once the property is inventoried to assess these factors, management zones will be mapped and linked with recommended action strategies that address restoration and public access objectives.

- Plant-community and invasive-species inventories will be performed at least every two years. Inventory methods may involve a combination of qualitative visual inspections or more quantitative line-transect or quadrat surveys. Photo-monitoring stations may also be used to track seasonal and inter-annual changes in vegetative communities. The purpose of these inventories is to track the status of restoration objectives, and to make sure that invasive species (i.e., reed canary grass, buckthorn, gypsy moths, etc.) are quickly identified and controlled to the maximum extent feasible. Volunteers who have at least a basic level of plant-identification expertise will be solicited to assist with this work. Volunteers will also be used to help document the types and numbers of different wildlife species that frequent the Preserve.

- Bluebird, wood duck and other nesting boxes will be monitored, cleaned, repaired, repositioned and replaced as needed.

- Lake District Preserve user-opinion surveys will be regularly conducted to ascertain public attitudes regarding their Preserve experiences. The purpose of these surveys is twofold. First, they will help identify and address concerns before they have a chance to develop into larger problems. Second, they will assist in the development of educational, public-access and resource-protection improvements. If feasible, it is recommended that on-site surveys be made available to more effectively gather user opinions and suggestions.

## MANAGEMENT INTERVENTION AND FINANCING

| Item or Activity | Proposed Timing or Recurrence | Estimated Cost (Professional Rates) | Grant or Donor Potential |
|---|---|---|---|
| Trail grooming | Several times/summer | $500-750/year | Very Low |
| Management zone mapping/planning | 2010 | $1,000-3,000 | Medium |
| Development of woodland-management plan | 2010 | Implement via state forester | NA |
| Prescribed burning rotation | Every 3-5 years | $2,000-4,000/burn | Low |
| Snow plowing (parking lot) | Several times/winter | $150-250 | Very Low |
| Maintenance of nesting boxes | Annual | <$100 | Very Low |
| Repayment of bank loan used for purchase | 2009 - Completed | $41,000 (+interest) | Completed; covered by grant award |
| Surveying and boundary markers | 2010 | $750-2,500 | Very Low |
| 4.5-acre prairie restoration (cropland west of CTH A) | 2009 | $3,500-4,500 | Completed; covered by grant awards |
| 34-acre restoration (east of CTH A and woods) | 2010 or later | $13,000-17,500 | Medium-High |
| 21-ac woody invasives mgmt. (east of CTH A) | 2010 or later | $11,000-14,500 | Low-Medium |
| Gypsy moth surveys | Annually | NA | County match for eradication |

| | | | |
|---|---|---|---|
| Invasive brush clearing in wetland areas | 2010 or later | $1,500-3,000 | Low |
| 26-acre prairie restoration (cropland east of CTH A) | Fall 2010 or Spring 2011 | $14,000-15,000 | High |
| New welcome sign | 2009 - Completed | $2,700 | Completed |
| New visitor information kiosk | 2009 - Completed | $1,700 | Completed |
| Re-routing/extension of grass walking trail | Fall 2010 or later | $0.20/sq. ft. | Medium |
| Additional trail kiosks (3-5) and display materials | Fall 2010 or later | $750-1, 500 | Medium |
| Purchase of used ATV to facilitate management access | 2010 or later | $5,000-8,000 | Low |
| Selective logging of woodlands | TBD | TBD | TBD |

Potential revenue sources other than local tax dollars and outside grants include the following:

1. Farm rental income ($150/acre or $3,915/year applied to 26.1 acres; 2-year lease)
2. Sale of logged timber as a result of woodland-management activities
3. Sale of harvested prairie seed (up to $2,500/acre)

## PUBLIC ACCESS AND OUTREACH


Grade-school kids collecting aquatic insects in a small pond at the Lake District Preserve

- The Preserve provides a rare opportunity to help people cross the line from passive observers to active participants in conservation. A personal connection with nature combined with knowledge leads to the conservation commitment necessary to preserve wildlife and wild places. Our goals are to offer:

1. Positive nature- and wildlife-viewing experiences that limit disturbances to wildlife and their habitats;
2. Controlled access through carefully-planned and aesthetically-inviting walking trails, boardwalks and viewing platforms/blinds so visitors can enjoy different parts of the Preserve in a safe and sustainable manner;
3. Site development facilities that blend into the landscape and enhance the overall function of the Preserve, and that are located, scaled, screened and maintained so as to avoid harming resident plant and animal communities;
4. Recreation such as hunting and fishing when conducted in accordance with state and local rules;
5. Interpretive signs that encourage self-discovery and ongoing learning on topics ranging from wetland and wildlife ecology to water quality management;
6. Occasional guided tours and educational events to showcase restoration challenges and conservation improvements;
7. A recreation access schedule that defines where visitors can go and what activities are appropriate in each month of the year, depending on wildlife activity and site conditions; and

8. Youth exploration, stewardship and learning through partnerships or collaborations with local schools.

- Rules are needed to limit the potential for user conflict and to avoid unnecessary damage to the resource. The following rules shall be prominently posted at all public entry points:

  **Hours**: The Preserve is open for public use from sunrise to sunset. Vehicular parking is allowed in the gravel parking area during these hours.
  **Dogs**: Dogs are allowed if leashed and restricted to established trails. Pet owners shall immediately collect any pet waste and properly dispose of such waste off-site.
  **Bicycles/vehicles**: To prevent damage to the trails and restored plant communities, the use of motorized vehicles and bicycles is not allowed beyond the parking area.
  **Trail use**: Visitors are asked to confine their activities to established trails to minimize wildlife disturbance and trampling of restored vegetation.
  **Littering/vandalism**: It is illegal to litter or deface, destroy or vandalize any structure, sign or natural growth.
  **Hunting**: Hunting is permitted with a valid license and during legal hunting seasons, and hunting dogs may accompany their owners. Preserve users are asked to wear bright clothing during hunting seasons. Only portable blinds and deer stands are permitted, and must be removed at the end of each day.
  **Trapping**: Restricted trapping privileges are granted through an annual lottery system, and the payment of an application fee. Preserve trapping rules, the required application materials, and harvest-reporting forms are available from the Lake District (see Addendum 1 in Appendix E).
  **Feeding of wildlife**: The feeding of any wildlife is not allowed within the Preserve.

- Well-designed trails and boardwalks encourage visitors to leave their vehicles and engage in low-impact nature exploration. Design recommendations include:


A view from an observation deck located along the Preserve trail.

1. Use grass walking trails whenever feasible that compliment the natural landscape and involve limited maintenance;
2. Use trails and access features to concentrate traffic where it is most appropriate;
3. Incorporate loops and twists that take advantage of natural landscape features and that keep visitors wondering what surprises lie beyond the next turn;
4. Position benches, viewing platforms and interpretive signs at overlooks or quiet alcoves to invite visitors to pause and let nature come to them;
5. Take advantage of natural vegetative screening and route trails so they lead visitors well clear of sensitive plants and wildlife;
6. Keep wildlife corridors intact as much as possible by limiting stream and wetland crossings, and by avoiding bisecting undisturbed areas;
7. Avoid locating paths on steep slopes that can contribute to safety and erosion concerns;
8. If necessary, use boardwalks in wet areas to keep visitors from trampling fragile wetlands and to allow wildlife to adjust to predictable use;

9. Use ramps, handrails and other methods to improve safety and to comply with applicable ADA regulations;
10. Provide interpretive signs that inform visitors about the history of the Preserve, its unique watershed functions, the diversity of flora and fauna that can be found there, and tips on how to get the most out of your visit;
11. Monitor levels and types of recreational use that can affect Preserve function and user enjoyment; and
12. Modify trail design and use restrictions to protect wildlife and people as changes dictate.

#### SUPPLEMENTAL RECOMMENDATIONS

In 2007, the Lake District Board appointed a citizen advisory task force to help set short- and long-term management goals for the Lake District Preserve. This process occurred immediately prior to the recent 66-acre land acquisition, and culminated in an advisory report which is incorporated into this plan (see Addendum 2 in Appendix E). One recommendation was to explore the feasibility of plugging or diverting the flow of the main ditch channel to further utilize the water-cleansing functionality of on-site wetlands. Feasibility would depend on being able to resolve a number of legal and technical hurdles (i.e., drainage district law preventing ditch closures, potential flooding impacts to adjoining properties, Chapter 30 permits relating to modification of navigable waterways, flooding capacity of available wetland areas, etc.).

## 7-10 EXPECTED OUTCOMES OF MANAGEMENT ACTION

Anticipated outcomes of ongoing restoration and site-improvement work include the following:

1. Greater numbers of people from throughout the region using and enjoying the property for recreational and educational purposes;
2. Increased quality of wetland function;
3. Increased diversity and numbers of wildlife from improved habitat conditions;
4. Stabilization of eroding soils on previously cropped areas; and
5. Improved water quality conditions in the inlet that feeds surface drainage to Lake Ripley.

These expected outcomes will be monitored through user surveys, plant community and wildlife inventories, sediment-delivery modeling, and continued water quality monitoring.

# -8-
# SUMMARY OF MAIN PROBLEMS AND THREATS

*"Any people can fall into the trap of overexploiting environmental resources, because of ubiquitous problems…. That the resources seem inexhaustibly abundant; that signs of their incipient depletion become masked by normal fluctuations in resource levels between years or decades; that it's difficult to get people to agree on exercising restraint in harvesting a shared resource (the so-called tragedy of the commons); and that the complexity of ecosystems often makes the consequences of some human-caused perturbation virtually impossible to predict even for a professional ecologist."*

-- Jared M. Diamond, American scientist and author

## 8-1 INTRODUCTION

Our activities both on and around Lake Ripley can easily impair the resource and its contribution to our local quality of life. While these impacts are mostly cumulative in nature, it takes only one careless or misguided individual or activity to negatively impact the lake forever, such as by introducing an aquatic invasive species. Consequently, many factors can negatively influence the health and condition of the lake. Irresponsible watershed development, shoreline disturbances, wetland drainage, hydrologic alterations, 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 causing instability in the ecosystem and producing a variety of unwelcome consequences.

Separating the root causes of particular problems from their more observable symptoms is the key to a successful lake management program. Listed below are some common and readily apparent *symptoms* of larger, underlying *problems*.

- Beach closings
- Murky water
- Excessive weed growth
- Blue-green algal blooms
- Stunted fish populations
- Mucky lake bottom
- Crowding and user conflicts
- Noise and safety concerns
- Fish-consumption advisories
- Loss of natural scenic beauty
- Loss of fish and wildlife diversity
- Flood damage
- Extreme water-level fluctuations
- Groundwater depletion/contamination
- Rising cost of management
- Falling real estate values

According to a recent public opinion survey, the top factors most often blamed for lake-use impairments included zebra mussels, development pressure, lake weeds, crowding and algae.[195] This marks a change from earlier surveys when boat traffic, poor water clarity and noise were

[195] Lake Ripley Management District. 2007. Lake Ripley Property Owner Opinion Survey.

given higher rankings as issues of concern.[196] Possible reasons for the change in attitude include the infestation of zebra mussels around the time of the last survey, the adoption of new lake-use policies that increased slow-no-wake zones within 200 feet of shore, and perhaps a more consistent and effective law-enforcement presence during the boating season. As far as the lake's biggest threats, 2007 survey respondents largely pointed to invasive plant and animal species, polluted runoff, overcrowding, overdevelopment, and the overuse of fertilizers and pesticides.

In dealing with these problems, we must recognize that Lake Ripley is not a static feature on the landscape. Rather, it is a dynamic and evolving product of the hydrologic cycle. Aside from hydrologic influences, the lake is defined and affected by variables such as its size, shape, depth, watershed area, geology, biota and water chemistry. Like a giant settling basin with a long-term memory, the lake both reflects and reacts to everything happening on the surrounding landscape.

We must also recognize that cause and effect are not often predictable, nor are they necessarily close in time and space. Many stressors can occur slowly and almost imperceptibly over time (i.e., the incremental loss of habitat), while others can occur in sudden but infrequent pulses (i.e., changes in pollutant loadings due to flood or drought events). Inter-annual variability often masks long-term trends, creating a tendency for people to want to overreact to short-term and often cyclical conditions. In fact, water quality trends may require at least 20-30 years of monitoring data to see beyond the background noise of natural, year-to-year variability. For these reasons, our management perspective must be broad in geography and long in chronology, with attention given to how actions and events can ripple throughout an interrelated ecosystem. Consistent monitoring and routine evaluation are also needed to measure success or failure over short and long time periods, and should be tailored to the specific management actions or questions being addressed.

## 8-2 HARMFUL LAND-USE PRACTICES AND HYDROLOGIC MANIPULATIONS

### SHORELAND DEVELOPMENT IMPACTS

Development near water generally leads to increased stormwater runoff, which in turn results in increased sediment and phosphorus loads that impair water quality. In addition, related land-clearing activities contribute to the removal of natural habitat essential for sensitive fish and wildlife species. A number of Wisconsin studies have documented the decline of shoreline plants, songbirds, green frogs and sensitive fish species in shoreland areas due to the impacts of building and development.[197] For example, green frogs represent indicator species which largely disappear on lakes with more than 30 lakefront homes per mile.[198] Tree-falls, emergent and

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[196] University of Wisconsin-Whitewater. 1992. Lake Ripley Management District: Lake Resident Study. Lake Ripley Management District. 1999, 2005. Lake Ripley Property Owner Opinion Surveys.

[197] Meyer, M., J. Woodford, S. Gillum, and T. Daulton. 1997. Shoreland zoning regulations do not adequately protect wildlife habitat in northern Wisconsin. U.S. Fish and Wildlife Service, State Partnership Grant P-1-W, Segment 17, Final Report, Madison, Wisconsin.

[198] Woodford, J. E., and M. W. Meyer. 2003. Impact of Lakeshore Development on Green Frog Abundance. Biological Conservaton 110: 277-284.

floating-leaved plants, shoreline bank cover, species diversity, and largemouth bass nesting success are also shown to decline with increasing lakeshore development. [199] Lake Ripley has already surpassed this housing-density threshold, with a current lakeshore building density of about 39 lakefront homes per mile. While we may not be able to reverse today's development status, there is still ample opportunity to mitigate its impact and control its future direction.

## LAND USES CONTRIBUTING TO LAKE EUTROPHICATION

Most lake impairments are the result of accelerated eutrophication, arguably one of the single largest problems still affecting Lake Ripley today. Eutrophic waters are those that are impacted by excessive nutrient enrichment and high productivity in the form of weed and algal growth. Surface waters located within larger watersheds that are urbanized, intensively farmed, or that face strong development pressures are at the highest risk of exhibiting eutrophication problems. These lakes receive a larger share of their water as surface runoff, which frequently contains pollutants such as sediment and phosphorus. Resulting symptoms may include frequent algal blooms, excessive weed growth, poor water clarity, mucky lake bottoms, and a dominance of rough-fish populations.

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. For Lake Ripley, computer modeling and other evidence suggests that the vast majority of phosphorus loading is coming from row-cropped agricultural land within the watershed. The urbanized component of the watershed is also shown to be a significant contributor of phosphorus loads. While in-lake phosphorus recycling occurs to a lesser degree, it may have the effect of delaying the lake's response to watershed-based nutrient reductions.

Although typical water quality conditions have not significantly limited recreation in most years, intense residential development near the lake and widespread agricultural land uses throughout the watershed pose real and ongoing threats to Lake Ripley. Sediment cores taken from the lake bottom as part of a paleoecological study suggest that these types of land uses have consistently degraded the lake over time, particularly in the absence of proper erosion-control measures. Results of long-term water quality monitoring support these findings. The rate and amount of runoff can increase by a factor of 10 with the onset of development that increases water-

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[199] Woodford, James E. and Michael W. Meyer. 2003. Impact of Lakeshore Development on Green Frog Abundance. Biological Conservation 110 (2003) 277–284.
Christensen, D.L., B.R. Herwig, D.E. Schindler, and S.R. Carpenter. 1996. Impacts of Lakeshore Residential Development on Coarse Woody Debris in North Temperate Lakes. Ecological Applications 6, 1143–1149.
Jennings, M.J., M.A. Bozek, G.R. Hatzenbeler, E.E. Emmons, and M.D. Staggs. 1999. Cumulative effects of incremental shoreline habitat modification on fish assemblages in north temperate lakes. North American Journal of Fisheries Management 19, 18–27.
Schindler, D.E., S.I. Greib, and M.R. Williams. 2000. Patterns of fish growth along a residential development gradient in north temperate lakes. Ecosystems 3, 229–237.

impervious surfaces, which is greatest in high-density residential areas.[200] Studies have also consistently shown that watersheds experience damage as imperviousness increases, with some research showing a threshold of noticeable damage once 10-12% of a watershed becomes impervious.[201]

## DITCHING AND STREAM CHANNELIZATION

Drainage ditching through wetlands, stream dredging and channelization, and other drainage modifications have occurred in and around Lake Ripley over the prior decades. Such hydrologic manipulations can create a number of problems, some of which are well documented from paleoecological studies that analyzed sediment cores of the lake bottom. These studies showed that widespread ditching and the channelization of the inlet around 1940 dramatically increased pollutant loads to the lake, causing significant declines in water quality.[202]

In addition, the soils associated with farm drainage ditches in the watershed are highly prone to erosion and require regular maintenance. Soil eroding from these ditch banks has reduced the functional values of adjoining and downstream wetlands, and has contributed to the bulk of sediment loading to the lake. Ditches also act as conduits of pollutants, allowing an easy path for dirty runoff to reach the lake in a rapid and unfiltered fashion. There are approximately 45,000 feet of ditched drainage channels in the Lake Ripley watershed. In the mid-1990s, eroding drainage ditches were estimated to account for 2,654 tons or 75% of the total annual sediment contribution to adjoining wetlands and Lake Ripley.[203]

## WETLAND CONVERSION

The impacts of agricultural development and related wetland loss on Lake Ripley cannot be overstated. Neighboring Rock Lake offers a good basis of comparison. Rock Lake and Lake Ripley share many physical, chemical, biological and hydrologic characteristics. Each has similar watershed-to-lake ratios, soil and geologic features, and land-use representation. Each was also the subject of "Priority Watershed Project" efforts to control non-point sources of pollution. One of the major differences, however, is that Rock Lake has slightly better water quality and trophic condition. A reasonable explanation for this difference is the fact that Rock Lake's watershed is comprised of considerably more wetland acreage in relation to its

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[200] Graczyk, D.G., R.J. Hunt, S.R. Greb, C.A. Buchwald, and J.T. Krohelski. 2003. Hydrology, Nutrient Concentrations, and Nutrient Yields in Nearshore Areas of Four Lakes in Northern Wisconsin, 1999-2001: U.S. Geological Survey. Water-Resources Investigations Report 03–4144, 64 p.

[201] Wang, L., J. Lyons, P. Kanehl, and R. Bannerman. 2001. Impacts of Urbanization on Stream Habitat and Fish Across Multiple Spatial Scales. Springer Series in Environmental Management, Vol. 28, No. 2, pp. 255-266.

[202] Wisconsin Department of Natural Resources. 1993. Lake Ripley Paleolimnological Study.
Garrison, Paul J., Pillsbury, R. 2009. Paleoecological Study of Lake Ripley, Jefferson County. Wisconsin Department of Natural Resources, Bureau of Science Services, and University of Wisconsin-Oshkosh, Department of Biology. PUB-SS-1062 2009.

[203] Wisconsin Department of Natural Resources, Wisconsin Department of Agriculture, Trade and Consumer Protection, Lake Ripley Management District, and Jefferson County Land Conservation Department. 1998. Nonpoint Source Control Plan for the Lake Ripley Priority Lake Project. Wisconsin Nonpoint Source Water Pollution Abatement Program. Publication WT-512-98.

agricultural component.  Other factors being equal, this difference is likely to drive the lake's comparatively better water quality and trophic status.

<u>**GROUNDWATER WITHDRAWAL**</u>

Finally, the threats associated with excessive water diversions, particularly through increased groundwater pumping, should not be ignored.  Groundwater is estimated to be a significant contributor to Lake Ripley's hydrologic budget.  It represents a relatively clean and steady source of water that supplies baseflow to the lake's inlet and helps protect overall water quality. As development and related groundwater pumping increase around Lake Ripley, the more the lake's hydrologic budget will change as this source water is extracted and discharged as wastewater outside of the watershed.  Future threats include the potential for new, high-capacity wells to be located where they could negatively impact the lake.  These types of wells pump at least 100,000 gallons per day, are most often associated with municipal or industrial applications.

## 8-3 POLLUTED RUNOFF

According to the Wisconsin Association of Lakes, polluted runoff is Wisconsin's number one water quality problem, degrading or threatening an estimated 90% of the state's inland lakes. Phosphorus is the limiting nutrient that drives eutrophication in most lakes, including Lake Ripley.  In fact, the Minnesota DNR has estimated that one pound of phosphorus delivered to a lake can produce up to 500 pounds of algae.  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 11:1, the watershed will always exhibit a great influence on overall lake conditions.

Extra phosphorus enters Lake Ripley predominantly as stormwater runoff from lawns, farm fields, construction sites, roads and other hard-surface or disturbed-soil areas.  This nonpoint source pollution results from the influx of eroded soil, fertilizers, organic debris and other materials that wash into the lake from the surrounding watershed.  Many of these pollutants are able to reach the inlet tributary and lake through a combination of farm ditch laterals and roadside swales that serve as conveyance systems for overland flow.  Most of this runoff is transported rapidly with no "pretreatment" or only slight filtering before it enters the lake.  Once in Lake Ripley, elevated levels of phosphorus can cause algal blooms, decreased water clarity, and impairments to recreational lake use and lakeshore property values.

Poorly managed construction sites, soil-disturbing farming practices, irresponsible fertilizer applications, vegetative clear-cutting, and unstable shorelines and drainage ditches are just a few of the mechanisms that can increase inputs of problem nutrients and contaminants to the lake. This is especially true in the absence of proper measures that control runoff and soil erosion.  In particular, lawns can be large sources of fertilizers and pesticides.  Rooftop areas, which may be directly or indirectly connected to the storm drainage system, are known to be sources of zinc and various atmospheric pollutants.  Streets and parking lots are generally sources of heavy metals (i.e., lead and cadmium), oil, grease, sediment, salt and bacteria, depending on their condition and traffic volume.

Increased water-impervious surfaces in the watershed cause increased water volumes, pollutant loads and lake temperatures. In fact, paved surfaces and rooftops generate 16-times more stormwater runoff than the fields they replace.[204] Ironically, the same paved surfaces can also cause streams to run dry and lake levels to fall precipitously at other points of the year by preventing groundwater recharge. As a result of polluted runoff, more and more communities are finding local beaches closed, and activities like swimming and fishing restricted due to declining aquatic populations and public health advisories. They are also dealing with the increased frequency and severity of flash flooding. Adjusted for inflation, communities are now spending five times more money every year on flood damage than they did 50 years ago.[205] Increased stormwater pollution has always been a cost of development, but it is a cost that has been traditionally pushed on the public in the form of resource degradation and flood damage.

Protecting and managing the watershed is paramount to maintaining the health and quality of Lake Ripley. 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.

## 8-4 IN-LAKE RECYCLING OF PHOSPHORUS

The major source of phosphorus to the lake is runoff from the watershed. However, phosphorus is also internally recycled through plant uptake, through decomposition of plants and other lake organisms, through the breakdown of animal wastes (i.e. geese droppings), and through the re-suspension of lake-bottom sediments.[206] Phosphorus exits the lake through lake outlets, the physical removal of fish and plants, and particle settling. Overall, phosphorus inputs from external (watershed-based) sources or in-lake recycling can often greatly exceed losses.

### ANOXIC HYPOLIMNION

In-lake phosphorus recycling, also called internal nutrient loading, occurs when phosphorus is released from the lake bottom or by the life cycles of aquatic plants and organisms. There are multiple mechanisms that can trigger in-lake phosphorus recycling. One, well-documented mechanism is a lack of dissolved oxygen (called anoxia) at the sediment-water interface of the lake bottom. This condition frequently occurs in the hypolimnion of deep (>20 feet), eutrophic lakes where the decomposition of organic matter depletes the available supply of dissolved oxygen. In this situation, phosphorus that was previously bound to calcium, iron and aluminum as insoluble particles in the bottom sediments is chemically converted to a soluble state and

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[204] Wisconsin Department of Natural Resources. 2000. Creating an Effective Shoreland Zoning Ordinance: A Summary of Wisconsin Shoreland Zoning Ordinances, Section 5: Impervious Surface Area, p. 5-B-1.

[205] American Rivers, *supra* note 7 at 3

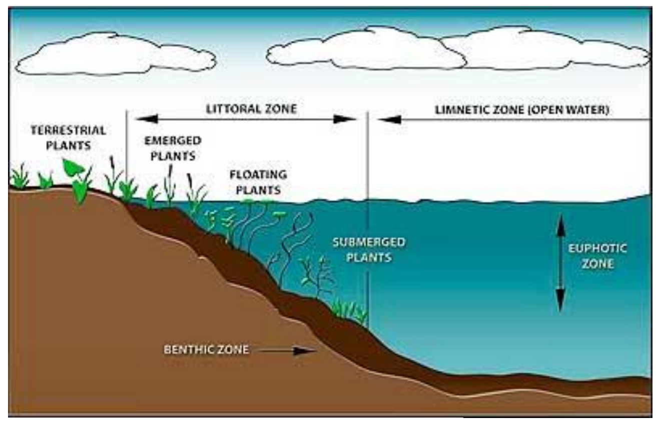
[206] Armstrong, D.E., R.F. Harris, and J.K. Seyers. 1971. Plant Available Phosphorus Status of Lakes. Technical Completion Report OWRR B-022-WIS. Madison, WI: University of Wisconsin Madison, Water Resources Center, Hydraulic and Sanitary Laboratory.

released into the surrounding water. Anoxic sediment has been shown to release phosphorus as much as 1000 times faster than oxygenated sediments.[207]

Severe algal blooms can materialize if this phosphorus-rich water migrates toward the well-lit surface waters where algal populations are abundant. This migration typically occurs during spring and fall turnover when lake-wide mixing takes place in dimictic water bodies. It tends to be a bigger problem in lakes with small watersheds and long hydraulic retention times, and when mixing occurs during the summer recreational period. Fortunately, Lake Ripley is thermally stratified for much of the year, meaning little of the released phosphorus can get mixed into the water column to fuel summer algal growth.

**<u>LITTORAL ZONE</u>**

The anoxic hypolimnion is not the only area known to experience in-lake phosphorus releases. The shallow, littoral zone may also contribute to internal phosphorus recycling. This can be caused by anoxia, sediment disturbance, the decay of plants and organic matter, carp activity,[208] increased water temperature, and elevated pH in dense plant beds or during intense algal blooms.[209]




**Source: Wisconsin Lakes Partnership**

Anoxic conditions are known to develop in shallow, weedy areas during non-daylight hours when respiration exceeds photosynthesis. This can prove problematic if the littoral sediments are high in phosphorus. Lakebed disturbances can lead to the re-suspension of nutrient-rich sediment into the water column, and is most often caused by wind and wave action, carp activity, and turbulence from motor boats. As far as pH levels, they may increase as carbon dioxide concentrations are depleted during photosynthesis. Aside from these factors, in-lake phosphorus recycling can even be driven by large congregations of geese and other waterfowl through the excretion of phosphorus-rich waste products.

Rooted aquatic plants can also be a significant contributor of dissolved inorganic phosphorus to the water. In fact, dense colonies of Eurasian watermilfoil (*Myriophyllum spicatum*) have been shown to effectively move phosphorus from the bottom sediments to the overlying water column.[210] Milfoil gets 70-100% of its phosphorus from the sediments.[211] Each square meter of

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[207] Horne, A.J. and C.R. Goldman. 1994. <u>Limnology</u>. Second Edition. New York: McGraw-Hill. 576 pp.
[208] Chumchal, M.M. and R.W. Drenner. 2004. <u>Interrelationships between phosphorus loading and common carp in the regulation of phytoplankton biomass</u>. *Arch. Hydrobiol.* 161:147-158.
[209] Holdren, G.C. 1977. <u>Factors affecting phosphorus release from lake sediments</u>. Ph.D. thesis, Department of Water Chemistry, University of Wisconsin-Madison. 172 pp.
[210] Smith, C.S. and M.S. Adams. 1986. <u>Phosphorus transfer from the sediments by Myriophyllum spicatum</u>. *Limnology and Oceanography* 31(6): 1312-1321.
Carpenter, S.R., A. Gurevitch, and M.S. Adams. 1979. <u>Factors causing elevated biological oxygen demand in the littoral zone of Lake Wingra, Wisconsin</u>. *Hydrobiologia* 67(1): 3-10.

milfoil can remove 3 grams of phosphorus from the sediment per year, which is stored in the plant's shoots. The nutrient does not leach from healthy milfoil shoots, but when the shoots decay, almost the entire amount that was removed from the sediments (2.8 grams per square meter of milfoil per year) is released to the water.

Zooplankton also play a role in phosphorus cycling. Since the rate of phosphorus release is inversely related to zooplankton body size, size-selective predation by bluegills and other planktivores results in an increase in phosphorus released per unit biomass of zooplankton.[212] Therefore, changes in the lake ecosystem that affect zooplankton populations and size may, in turn, affect phosphorus cycling in the system.

## EVALUATION OF LAKEBED SEDIMENTS

Knowledge of the phosphorus content of sediment in various locations along the lakebed is useful in identifying potential "hot spots." 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 and produce the desired results. Sediment cores are generally taken at certain locations in a lake to better characterize the depth and distribution of potentially nutrient-rich bottom sediments. In addition, total phosphorus concentrations at the top and bottom of the water column can be compared. These measurements would indicate whether phosphorus is actually collecting in the anoxic hypolimnion from sediment releases during the summer stratification period.

Sediment nutrient levels were measured in Lake Ripley's littoral zone in 1992 (Table 37).[213] These values are not considered to be unusually high relative to lakes with known in-lake phosphorus recycling problems.

**Table 37: Lake Ripley littoral zone sediment nutrient levels (1992)**

| | $NH_3$ (mg/kg) | Total P (mg/kg) | % moisture |
|---|---|---|---|
| Maximum | 65 | 580 | 89 |
| Minimum | 5 | 110 | 53 |
| Mean | 22.8 | 373.8 | 76.9 |
| Standard Deviation | 15.6 | 145.7 | 9.8 |

## OVERALL PROBLEM ASSESSMENT

Although in-lake nutrient recycling does occur to some degree in Lake Ripley, its relative significance has not yet been thoroughly quantified. Over its deepest point near the lake bottom,

211 Loucks, O.L. 1981. The littoral zone as a wetland and its contribution to water quality. In *Selected proceedings of the Midwest conference on wetland values and management*, ed. B. Richardson, pp. 125-138. St. Paul, MN: Minnesota Water Planning Board.
212 Bartell, S.M. and J.F. Kitchell. 1978. Seasonal impact of planktivory on phosphorus release by Lake Wingra zooplankton. *Verh. Internat. Verein. Limnol*. 20:466-474.
213 Wisconsin Department of Natural Resources, and Lake Ripley Management District. 1994. Lake Ripley Water Resources Appraisal.

Lake Ripley's summer mean total phosphorus concentration (based on limited data) is 70 µg/L. This compares to a summer mean total phosphorus concentration of 20 µg/L at the surface. These findings suggest sediment phosphorus release is occurring within the deep-water anoxic zone and accumulating there during summer stratification.

However, relative to other lakes with confirmed nutrient recycling problems, the deep-water phosphorus accumulation in Lake Ripley is comparatively small. This may, in part, be the result of calcium carbonate deposits that help keep phosphorus bound to the sediments. Lake Ripley's deep-water, summer mean phosphorus concentration (70 µg/L) was found to be slightly higher than what has been recorded for neighboring Rock Lake (46 µg/L), but much lower than meso-eutrophic Fish Lake in Dane County (300 µg/L). When comparing phosphorus levels in the littoral zone sediments, Lake Ripley's 374 mg/kg mean concentration was less than both Rock Lake's (592 mg/kg) and Fish Lake's (1,142 mg/kg).[214] It is unlikely that Lake Ripley's hypolimnetic phosphorus concentrations, as measured, would be sufficient to warrant redirecting management attention away from external, watershed-based sources.

Given the various sources and mechanisms for in-lake phosphorus recycling, attempts to manage a single source may not prove effective, even if internal loading is ultimately found to be a problem worth addressing. 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. Techniques used to control internal nutrient loading include phosphorus precipitation and inactivation (via alum treatments), hypolimnetic withdrawal, artificial circulation, hypolimnetic aeration, sediment removal (via dredging), carp removal, geese control, and dilution/flushing strategies. Some of these options could be applicable to Lake Ripley, while others would not.

## 8-5 AQUATIC INVASIVE SPECIES

Organisms that get introduced to an ecosystem without having evolved there can dominate native species, sometimes to the point of exclusion. They do this by achieving a competitive advantage over indigenous organisms, which rarely have any natural mechanisms to combat these foreign species suddenly occupying the same niche. The end result can be a lake ecosystem completely thrown out of balance as the invading organisms multiply unchecked, displacing native flora and fauna and the important roles they once served.

### GENERAL RISK ASSESSMENT

To assess risk, lakes may be viewed as islands with varying degrees of vulnerability to possible invasions and subsequent species turnover. Risk is primarily dependent on proximity and connectivity to source waters, and the degree to which recreational boat traffic moves to and from these infested waterways. The Great Lakes and Mississippi drainage systems represent large species pools that can be moved to nearby lake "islands." At last count, 185 non-native aquatic species had been documented in the Great Lakes alone. Many of these species are highly

[214] Marshall, David. 1993. Nutrient Levels in Littoral Zone Sediments from Lake Ripley and Fish Lake. Wisconsin Department of Natural Resources.

prolific, invasive and problematic, and can be easily spread to other water bodies. According to University of Notre Dame professor David Lodge, the Great Lakes are directly connected to 12% of the world's ports, and 99% of the world's ports are within just two stops from the Port of Green Bay or any other commercial dock in the Great Lakes.[215]

Once an infestation occurs, abundance of the invasive species typically peaks before eventually declining as a result of predation, disease and food-source depletion. The actual nuisance level of a particular species is determined by native extinctions and lake-function disruptions that negatively impact users. Aquatic invasive species are notoriously difficult to eradicate or even control due to their ability to reproduce, even after their populations are suppressed. Increased public awareness emphasizing self-inspection and removal, combined with the implementation of an early-detection and rapid-response program, seem to be the most promising defenses against invasive species threats.[216] These measures will become increasingly necessary as new invasive species continue to be discovered in neighboring waterways (i.e., spiny waterfleas found this summer in the Madison lakes). The following are the major aquatic invasive species currently found in Lake Ripley.

## EURASIAN WATERMILFOIL AND CURLY-LEAF PONDWEED

Eurasian watermilfoil (*Myriophyllum spicatum*) and curly-leaf pondweed (*Potamogeton crispus*) are both submersed aquatic weeds. Over the last couple decades, Eurasian watermilfoil, in particular, has been the most obvious factor affecting recreation and ecological balance in Lake Ripley. This invasive lake weed was first discovered in North America in the 1940s. It has since invaded nearly every U.S. state and at least three Canadian provinces. After finding its way into Lake Ripley, it reached its peak in 1989 when it was reported that over 40% of the lake surface was covered with milfoil canopies.

**Eurasian watermilfoil (*Myriophyllum spicatum*). Source: Wisconsin DNR**

Milfoil is known to form thick mats that crowd out and out-compete the lake's native flora, thereby reducing aquatic plant diversity and the quality of fishery habitat. It can also severely restrict recreational use of the lake by entangling swimmers and boat propellers, and by reducing the availability of open-water space. Large weed colonies are even shown to deplete dissolved oxygen levels and supply nutrients for algal growth during plant senescence and decay. Mechanical weed harvesting has been used to suppress the milfoil population and facilitate navigation and general lake use. Careful attention is given to collecting and removing all harvested plant material since weed fragments can re-root and grow into new plants.

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[215] Report given at the 2009 Wisconsin Lakes Convention by Professor David Lodge of the University of Notre Dame.

[216] May 17, 2008 memorandum from Douglas Jensen, Minnesota Sea Grant 's Aquatic Invasive Species Program Coordinator, concerning assessment of public boat-washing facilities as a means of controlling aquatic invasive species,

Curly-leaf pondweed has the potential to create similar problems as mifoil, but has so far maintained a relatively modest presence within the overall plant community. This species has mostly been documented in portions of East Bay near the lake's inlet. It is usually more prevalent earlier in the growing season, whereas milfoil reaches peak growth rates later in the growing season. As with mifoil, curly-leaf pondweed is also presently managed through mechanical weed harvesting. Because it is not yet widespread throughout the entire lake, the weed may be a good candidate for targeted herbicide treatments or even hand-pulling.

For controlling either of these invasive species through nutrient reduction, it is important to recognize that most of their required nitrogen and phosphorus are derived from the sediment.[217] In most cases, nitrogen in the form of ammonium is the limiting nutrient for rooted plant growth.[218] However, phosphorus can be transported from the sediment to the water column through macrophyte uptake, death and decay. Milfoil can potentially mobilize enough phosphorus from the sediments to affect the overall phosphorus budget on some lakes.[219] Repeated harvesting, therefore, may effectively remove a major source of nitrogen and phosphorus from the lake.

## COMMON CARP

The common carp (*Cyprinus carpio*) is a fast-growing bottom feeder that uproots aquatic plants and churns up sediment that muddies the water. Carp spawn from late spring to early summer in warm, shallow water found along lake and stream edges. Spawning adults are easily spotted due to their energetic splashing close to shore. The common carp is native to Asia and has been introduced throughout the world for food and sport. In 1880, seventy-five carp were brought from Washington D.C. to the Nevin Hatchery in Madison for the purpose of stocking as a sport fish. Carp have since become the most widespread large fish in the state.

Lake Ripley fishery surveys performed by Wisconsin DNR suggest that the carp population has remained fairly stable in recent years and, at the present time, does not represent a major issue of concern. However, their numbers should be closely monitored since any significant increase can lead to declines in water quality and other problems. The lake's outlet, which connects to Koskkonong Creek and the Rock River, is likely to be a source of some degree of carp recruitment. A study may be warranted to determine the extent of such recruitment for purposes of controlling the resident population through carp barriers or other measures.

## ZEBRA MUSSEL

The first, barnacle-like zebra mussel (*Dreissena polymorpha*) was discovered in Lake Ripley in 2005. In 2007, Lake Ripley was listed as an infested waterway after multiple adults had been found and water samples came back testing positive for the free-swimming larvae, called

[217] Barko, John W., R. M. Smart, M. S. Mathews and D. G. Hardin. 1982. Sediment-Submersed Macrophyte Relationships in Freshwater Systems. APCRP Technical Report A-82-3.
[218] Barko, John W. and R. M. Smart. 1986. Sediment-Related Mechanisms of Growth Limitation in Submersed Macrophytes. Journal of Ecology. 67 (5) 1328-1340.
[219] Smith, Craig S. and J. W. Barko. 1990. Ecology of Eurasian Watermilfoil. Journal of Aquatic Plant Management. 28: 55-61.

veligers. Native to the Baltic and Caspian Seas of Europe, the invasive mollusk was transported to the Great Lakes in the mid 1980s in the ballast water of ocean-going ships. Since then, zebra mussels have spread at an alarming rate throughout North America. The mussels can survive for days out of water, and spread primarily by attaching to boat hulls, aquatic plants and fishing equipment that then get moved from lake to lake. They can also spread as microscopic larvae in contaminated bait buckets, live wells and bilge water.


Zebra mussels look like small clams with a yellowish-brown "D"-shaped shell that has alternating light and dark stripes (hence the name "zebra"), and with a flat edge on one side. They are generally less than an inch long, and typically form dense colonies. Zebra mussels are the only freshwater mollusks that firmly attach to solid objects like dock pilings, boat hulls, and submerged rocks and stumps. Juveniles are difficult to see, but will feel like grit on any solid surface they may inhabit.

Zebra mussels are prolific breeders capable of producing tens of thousands of young mussels each summer. In fact, a single female can produce 30,000 to one million eggs in one year. Because they are an introduced species with few natural predators, the mussels can multiply unchecked, disrupting food webs and throwing entire ecosystems out of balance. As filter feeders, large populations of zebra mussels can decimate plankton and zooplankton communities (tiny plants and animals) that young fish rely on for food. However, since they do not consume blue-green algal species, their feeding behavior can actually favor and thus intensify blue-green algal blooms. They also are blamed for pushing contaminants up the food chain by bio-accumulating toxins. Furthermore, the destructive mollusks have been shown to displace native mussels, and deplete oxygen levels needed for fish and other aquatic life. Finally, zebra mussels can clog boat engines and intake pipes, encrust boat hulls, piers and lifts, and cut the feet of swimmers with their sharp shells.

Unfortunately, there is no known treatment or control strategy for managing zebra mussel populations at the present time. Public-awareness campaigns, "illegal-to-transport" laws, and the careful inspection and decontamination of boating and fishing equipment are currently used as the principal strategies to prevent their continued spread to other waterways.

**[CANADA GOOSE]**

The Canada goose (*Branta Canadensis maxima*), while actually native and not truly "aquatic," is often considered a nuisance species that may congregate in large groups on the lake and along the immediate shoreline. The giant Canada goose is one of 11 recognized subspecies of geese in North America. It was thought to be extinct in the first half of the $20^{th}$ century. While extensive management efforts resulted in a dramatic recovery, populations became increasingly adapted to urban and suburban environments. Migrating populations join these resident urban populations, which apparently serve as "decoys" that attract migrants to urban areas occupied by resident geese. Highest population densities are typically observed in the fall when migrating and resident geese comingle.

Although native to Wisconsin, Canada geese are often considered invasive because they have stopped migrating. They prefer to graze on short grasses in shoreland areas where they can keep a watchful eye out for potential predators. Geese start reproducing at two or three years of age, live over 10 years, and raise an average of four young per year. Problems include increased nutrient loading and bacterial contamination from goose droppings, overgrazing of grass and ornamental plants, attacks on humans and pets by aggressive birds, and damage to beaches, lawns and golf courses that can lead to soil erosion. Geese are also known carriers of the parasite that causes Swimmer's Itch. They have been known to number in the hundreds and thousands on lakes that are of similar size to Lake Ripley.

Geese droppings are a nuisance for park and beach users, and can contribute to bacterial and nutrient contamination of lakes. Grassy areas of Vilas Park (Madison, WI) heavily populated by geese averaged about 600 pounds per acre of feces (wet weight, as collected) in fall, with some areas receiving more than three times this amount. Surveys indicate that people do not generally consider Canada geese populations of less than 25 individuals to be a nuisance in a particular park. A population this small is also not likely to inflict serious landscape damage or contribute significantly to health or water quality problems. Geese have been successfully managed at sites throughout the country with programs approved by the Humane Society and other wildlife organizations.[220]

## 8-6 HABITAT LOSS

Habitat is more than the place where you might encounter a particular fish, plant, animal or insect. The ideal habitat serves multiple functions for a range of different species: a refuge from predators; a source of food; a place to nest, spawn or raise young; ample space to live and grow; suitable climate or water temperature; and adequate oxygen – just to name a few. Habitat is considered degraded, or less than optimal, when it fails to serve the needs of multiple life functions and stages.

Shoreline development is associated with many alterations to lake habitats and ecosystems, including eutrophication, loss of coarse woody structure (downed trees), removal of submersed and emergent vegetative cover, and reductions in fish growth. The removal of natural habitat features is of particular concern to the health of the lake's biota. For example, the delivery of coarse wood from shoreland forests provides critical habitat structure for fish and other aquatic life. The surfaces and detritus associated with submerged timber are also used as feeding grounds for macroinvertebrates. Furthermore, tree-falls provide vertical profiles that fish and amphibians use to attach their eggs so they remain in well-oxygenated water off the lake bottom.

Submerged timber is not the only type of habitat that is disappearing from many of our lakes. The amount and type of vegetation—both in and adjacent to the water—is also undergoing considerable change. Vegetation on shore provides habitat for terrestrial insects, which can be an important source of food for fish. However, the native trees, shrubs and groundcovers that are

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[220] Friends of Lake Wingra. Spring/Summer 2005. Wingra Watershed News.

found along the shore are often replaced by houses, lawns, beaches and ornamental trees as a consequence of development. With the decline of terrestrial insects, fish must expend more energy seeking less energetically valuable sources of food from pelagic (open water) and benthic (lake bottom) habitats.

Submerged, floating-leaf and emergent aquatic vegetation is also routinely subjected to human disturbance and destruction. Aquatic vegetation is important for providing oxygen, food, cover and spawning sites for fish, absorbing the nutrients that fuel algal blooms, protecting water quality by anchoring lakebed sediments, and preventing shoreline erosion by muffling wave energy. Unfortunately, much of this vegetation becomes fragmented or eliminated entirely through a combination of activities related to pier development, beach grooming, shoreline armoring, and shallow-water motor boating.

Habitat loss is also a problem throughout the larger watershed where harmful land-use and development practices have eliminated most of the wetlands, woodlands and prairies that once helped safeguard lake quality. While these landscapes may be located off the lake, they can have a tremendous influence on habitat conditions within the lake itself. Many fish and wildlife species rely on intact stream corridors and adjoining uplands for part of their life stages. These landscapes, in their natural condition, also influence the hydrologic cycle which can ultimately affect the quality and quantity of water reaching the lake.

## 8-7 LAKE-USE PRESSURES AND CONFLICTS

Lake Ripley is a popular and accessible water body that supports a wide array of lake uses. While many of these lake uses are somewhat compatible and complimentary, some are not. Conflict arises when mutually-exclusive activities compete for time and space on the water, or when excessive crowding limits the enjoyment of even the most compatible recreational pursuits. At some point, the degree of conflict becomes unacceptable to particular users or user groups, and the lake is said to have reached its recreational carrying capacity.

Carrying capacity thresholds can be estimated in terms of social or environmental impacts, or a combination of the two. The degree of interference experienced by two competing users or user groups illustrates conflict or pressure from a social dimension. Motor boating encroachment into shallow, sensitive areas due to crowding is an example of pressure from an environmental perspective. Regardless of how carrying capacity is defined and estimated, its value in optimizing lake-use conditions through policy enactment cannot be overstated. Multi-use management is possible as long as swimmers understand that a lake is not a swimming pool, power boaters are willing to steer clear of shallow water, and anglers recognize a desirable limit on plant density. For more information pertaining to recreational conflict and related problems, see Chapter 3.

## 8-8 WEATHER AND WATER QUANTITY CONCERNS

### WATER LEVELS


Water pours through the Lake Ripley outlet and floods the adjoining property following a 2008 high-water event.

Lake-level changes are important because they affect how we access the lake, what we can do around the lake, and the quality of water in the lake. Water levels typically respond to natural seasonal variations in precipitation, with higher levels in the spring and fall, and lower levels in the summer and winter. Water levels are also influenced by building and development within the watershed. Conversion of the landscape to water-impervious surfaces (i.e. roofs, roads, parking lots, etc.) increases stormwater runoff volumes and discharge rates, causing lake levels to rise faster and higher during larger storm events. During drought conditions, wells and related groundwater pumping can cause lake levels to fall even faster and lower.

While some variation in lake levels is both natural and ecologically valuable, extreme fluctuations caused by droughts and flood events can be a source of problems. High lake levels may cause flood damage to low-lying properties, increase the rate of shoreline erosion, degrade water quality, and limit recreational use during emergency slow-no-wake periods. Low lake levels are usually associated with less runoff and better water quality, but can increase the amount of lake bottom covered by rooted aquatic plant growth, and can restrict boat access to the water as necessary launching depths disappear around public boat landings and private piers. The degree to which lake levels fluctuate will determine the types of plants and animals that can survive in and near the lake. Depending on shoreline slope and depth of the lake, water level fluctuations may be dramatic (like on gradually-sloped shorelines), or barely noticeable (like on steeply-sloped shorelines).

Unfortunately, our ability to directly control regional and global drivers of lake change—like the weather—is often limited or entirely impractical. As a result, planning must involve the design of watershed Best Management Practices (BMPs) that account for potentially larger storm events at increased recurrence intervals, and with the goal of achieving greater watershed resiliency. The good news is that Lake Ripley is an open-basin drainage lake with both an inlet and outlet that help naturally stabilize water levels. It is also classified as a headwater lake due to its relatively high position in the landscape. The lake's high landscape position, relatively small watershed, significant groundwater component, and large storage capacity help to further moderate lake-level fluctuations.

### CLIMATE CHANGE

Climate-change models predict that Wisconsin's weather is likely to get warmer and slightly dryer, but produce more intense storm events. Warming speeds up the hydrologic cycle, resulting in more severe rainfall events in terms of frequency and intensity. This situation is likely to lead to increased flooding, floodplain expansion, higher variability in stream flows and velocities, and the delivery of large pulses of nutrients, pathogens and toxins to the lake.

The prediction of warmer and dryer summers will result in higher water temperatures and more time for the lake's hypolimnion to become oxygen deficient, which adds more stress to cool water fishes such as walleye, white suckers and northern pike. Warmer water not only holds less dissolved oxygen, but can also foster harmful algal blooms and increase the toxicity of some pollutants. As waters become warmer, the aquatic life they now support will be replaced by other species better adapted to the warmer water. This process, however, will occur at an uneven pace, disrupting aquatic system health and possibly favoring non-indigenous, invasive species.

The Wisconsin Initiative on Climate Change Impacts (WICCI) was formed in response to questions raised by a bipartisan committee of state legislators who wanted to know how climate change could impact their districts and constituents. More than 40 scientists from the University of Wisconsin, Wisconsin Department of Natural Resources and other agencies and institutions met in June 2007 to explore ways to identify and measure the impacts of climate change at local and regional scales. The WICCI came up with the following conclusions:

- Except for northeastern Wisconsin, most of Wisconsin has warmed since 1950. Averaged across the state, the warming has been +1.1°F, with a peak warming of 2-2.5°F across northwest Wisconsin. Wisconsin is becoming "less cold," with the greatest warming during the winter-spring period, and nighttime temperatures increasing more than daytime temperatures. Modeling scenarios project that Wisconsin will warm by 4-9°F by the middle of this century. Northern Wisconsin is projected to warm the most, while the least warming is expected along Lake Michigan. The mean projected warming rate is about four times greater than what has been observed since 1950.

- Typically, daily high temperatures exceed 90°F roughly 12 times per year in southern Wisconsin and only 5 times per year in northern Wisconsin. By the mid-21st century, one modeling scenario predicts the frequency of such hot days may double to about 25 times per year in the south and triple to about 12 times per year in the north. This consists of 1.5 to 4 more weeks each year with daily high temperatures exceeding 90°F.

- Typically, heavy precipitation events of at least two inches occur roughly 12 times per decade (once every 10 months) in southern Wisconsin and 7 times per decade (once every 17 months) in northern Wisconsin. By the mid-21st century, one modeling scenario predicts that Wisconsin may receive 2-3 more of these extreme events per decade, or roughly a 25% increase in their frequency.

If climate-change modeling scenarios prove correct, answers to a number of questions will be needed. Will pollutant loading from the watershed increase due to increased storm runoff volumes, or will there be a dilution effect? Is total pollutant load more important than concentration, or vice versa? How will the timing of these loading events affect the lake's biotic response in terms of algal growth? How will climate change impact species turnover and the trophic cascade of life within Lake Ripley? At a minimum, management decisions such as the design of BMPs should be made in the context of possible climate-change scenarios.

## 8-9 MERCURY CONTAMINATION

A new U.S. Environmental Protection Agency (EPA) study shows concentrations of toxic chemicals in fish tissue from lakes and reservoirs in nearly all 50 U.S. states. For the first time, EPA is able to estimate the percentage of lakes and reservoirs nationwide that have fish containing potentially harmful levels of chemicals such as mercury. The data show mercury concentrations in game fish exceeding EPA's recommended levels at 49 percent of lakes and reservoirs nationwide. Burning fossil fuels, primarily coal, accounts for nearly half of mercury air emissions caused by human activity in the U.S., and those emissions are a significant contributor to mercury in water bodies. Emissions of mercury into the air decreased by 58 percent from1990 through 2005, but it still represents the largest source of mercury contamination for the nation's lakes.

Results from the four-year *National Study of Chemical Residues in Lake Fish Tissue* show that mercury is widely distributed in U.S. lakes and reservoirs. Mercury was detected in all of the fish samples collected from the nationally representative sample of 500 lakes and reservoirs in the study. Because these findings apply to fish caught in lakes and reservoirs, it is particularly important for recreational and subsistence fishers to follow their state and local fish-consumption advisories.

## 8-10 CHLORIDE CONTAMINATION

Based on available monitoring data, chloride concentrations are not currently a problem in Lake Ripley. However, the use of rock salt (NaCl) on U.S. roads has skyrocked in the last 70 years. While road salting is widely viewed as necessary for maintaining public safety, excessive amounts of salt contribute to greater corrosion of automobiles and the premature degradation of roads and bridges. More importantly from a lake-management perspective, this extra salt can leach into groundwater aquifers or easily wash into area streams and lakes during spring snowmelt. Toxic chloride concentrations are commonly found near storm water outfalls in urban lake settings. Chloride concentrations often do not return to normal levels after the road-salting season since salt concentrations can build up over many years and remain perpetually high in the soil and groundwater.[221]

At sufficient concentrations, chloride-related problems can include toxicity to plants and fish, groundwater contamination, and human health interactions related to salt intake and hypertension. Long-term studies have found a logarithmic relationship between the proportion of pavement in a watershed and the mean annual chloride concentration in streams. Above 15% impervious cover, chloride concentrations were shown to be strong enough to damage some plants, and, above 40%, the study streams crossed the 250 mg/L U.S. EPA contaminant level for freshwater aquatic life.[222]

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[221] Kaushal, S.S., P.M. Groffman, G.E. Likens, K.T. Belt, W.P. Stack, V.R. Kelly, L.E. Band and G.T. Fisher. (2005) Proc. Natl. Acad. Sci. USA. 102, 13517-13520.
[222] Ibid

Every effort should be made to keep chloride concentrations in Lake Ripley well below the 395 mg/L chronic toxicity and 757 mg/L acute toxicity levels established by the Wisconsin DNR (Administrative Code NR 105). For potable water, NR 140 establishes a groundwater preventative action limit of only 125 mg/L for chloride, and an enforcement standard of 250 mg/L. As far as sodium (Na), the U.S. Environmental Protection Agency recommends that drinking water levels not exceed 20 mg/L.

## 8-11 POTENTIAL FOR PUBLIC APATHY AND COMPLACENCY

One of the biggest threats to the future of Lake Ripley may be a failure of the general public to act with urgency on its behalf. It is vitally important that area property owners and lake users fully understand and appreciate what it will take to bring about real, positive change at a watershed scale. There needs to be a collective recognition that the solutions to our challenges cannot wait until we find ourselves faced with the next crisis. Government programs alone will not be enough, regardless of budget. Rather, every individual must be called upon to make the sustained investments and adopt the specific behavior changes that will be required. Only then can we expect to witness the significant, cumulative transformations that are well within our reach. In the end, successfully protecting and rehabilitating the resource will require the participation and shared sacrifice of the larger community. It will require nothing short of an informed and actively engaged public to focus political will and leverage available resources. Anything less will be remembered as a missed opportunity to preserve the very things that contribute to our local quality of life here on Lake Ripley.

Human behaviors and activities are at the root of almost every challenge facing Lake Ripley. Additionally, most resource managers agree that without incentives, and unless required by regulation, landowners adopt new BMPs or behaviors they perceive as being in their best interest. If we do not account for this social dimension, our efforts to protect and enhance the lake will fall short. Consequently, there is a need to develop new and more effective ways to motivate meaningful behavior changes, especially among targeted watershed residents and property owners. This becomes especially critical when the success of many management efforts relies on the voluntary action of area property owners. Disseminating information and simply asking people to do the right thing is not enough. Even the offering of cost-share incentives can fail to generate the level of participation that is needed to achieve the desired change.

To overcome these challenges, community-based social marketing (CBSM) programs were developed in partnership with the U.W.-Madison's Department of

**2007 photo showing U.W.-Madison and Lake District representatives who contributed to the development of CBSM programs for Lake Ripley.**

Urban and Regional Planning.[223] These programs set forth a procedure for selecting behaviors that are environmentally meaningful, and that are amenable to CBSM tools of change that go beyond educational or standard "marketing" approaches. Social indicators are then used to evaluate program effectiveness. The CBSM programs follows protocols established by Doug McKenzie-Mohr in his seminal 1999 publication: *Fostering Sustainable Behavior – An Introduction to Community-Based Social Marketing*.

[223] Cipiti, M., P. Heiberger, N. Hunt, J. Keeley, B. Panke and E. Sievers. 2007. Rain Gardens for Lake Ripley Watershed: How a Community-based Social Marketing Program Can Promote Rain Gardens. Human Behavior and Environmental Problems course report, University of Wisconsin-Madison.

Fogarty, E., J. Huston, R. Maskin, B. Van Belleghem and S. Vang. 2007. Phosphorus Free for Lake Ripley: A Community-based Social Marketing Program to Use Phosphorus-free Lawn Fertilizer. Human Behavior and Environmental Problems course report, University of Wisconsin-Madison.

# -9-
# MANAGEMENT GOALS AND EXPECTATIONS

*"We have met the enemy, and he is us."*

-- Pogo (a cartoon character created by Walt Kelly)

## 9-1 RECONSTRUCTION OF HISTORIC LAKE AND WATERSHED CONDITIONS

### PALEOECOLOGICAL METHOD

**A sediment core is extracted from the bottom of Lake Ripley in 2007.**

Understanding Lake Ripley's past can provide clues as to what kind of future we might expect, and what level of improvement might be possible. The lake's water quality has changed through time as a result of changing watershed conditions and land use. This history is well preserved within the deep-water sediment profile of the lake. By extracting and analyzing a sediment core from the lake bottom, a great deal of information can be revealed about trends related to water quality, nutrient loading, watershed erosion rates, sediment infilling, and changes in aquatic plant and algal communities. Paleoecology is the branch of science that analyzes lake-bottom sediment to reconstruct past changes in the lake ecosystem.

Lake Ripley acts like regional settling basin, trapping particles delivered from its watershed or created in the lake itself. Lake sediments then entomb a selection of fossil remains that are more or less resistant to bacterial decay or chemical dissolution. These remains may include diatom frustules, the silica-based cell walls of certain algal species, and subfossils from aquatic plants. In addition to the fossil records, sedimentation rates and certain types of pollution indicators 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, lead-210.

A sediment core was first taken from the bottom of Lake Ripley in 1991, which marked the first year of operation for the Lake District.[224] A second core was taken in 2007, signifying the year after the Priority Lake Project officially ended.[225] These two sediment cores were used to reconstruct the lake's paleoecological history from 1800-2007.

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[224] Wisconsin Department of Natural Resources. 1993. Lake Ripley Paleolimnological Study.
[225] Garrison, Paul J., Pillsbury, R. 2009. Paleoecological Study of Lake Ripley, Jefferson County. Wisconsin Department of Natural Resources, Bureau of Science Services, and University of Wisconsin-Oshkosh, Department of Biology. PUB-SS-1062 2009.

## WATERSHED EROSION AND SEDIMENTATION

Key findings indicate that water quality degradation began around the mid- to late-1800s as a result of European settlement and subsequent farming and wetland drainage throughout the watershed. By about 1900, watershed erosion and sediment loading to the lake had dramatically accelerated, causing a corresponding increase in plant and algal production (see Figure 55). An even more dramatic peak in erosion and sedimentation rates occurred around 1940. These two peaks are likely to have been caused by a combination of land-clearing activity, wetland ditching, and stream dredging/channelization that was occurring during those timeframes.

Watershed erosion rates began to stabilize around 1950, and even declined beginning around 1960. This was most likely due to the widespread implementation of soil conservation practices. Around 1970, sediment runoff to the lake and associated nutrient loading increased once again, most likely from residential development, and the lake's water quality again declined. By 1990, water quality had somewhat improved along with declines in watershed erosion, but the lake still remained much worse than it was prior to settlement.

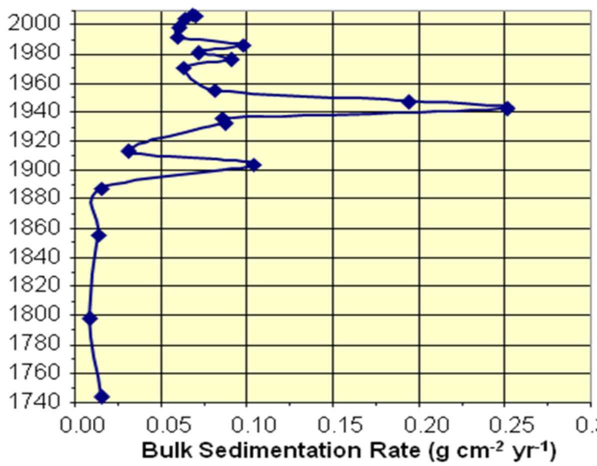


**Figure 55: Lake Ripley Sediment Accumulation Rate (1740-2007)**

A second sediment core was extracted in 2007 for the purpose of evaluating the impacts of the Priority Lake Project (1993-2006) and other Lake District efforts. Results show clear evidence of water quality improvements and further reductions in watershed-erosion and sedimentation rates over the prior 16 years. In 1990 and 2007, the mean sedimentation rates were 0.074 g $cm^{-2}$ $yr^{-1}$ and 0.069 g $cm^{-2}$ $yr^{-1}$, respectively. Lake Ripley's mean mass sedimentation rate for the last 200 years (of which half this time was characterized by pre-settlement conditions) was 0.067 g $cm^{-2}$ $yr^{-1}$. This value is at the higher end of rates that have been measured in 52 Wisconsin lakes (see Figure 56). It may be, in part, due to the fact that Lake Ripley is a marl lake in which calcium carbonate is precipitated during part of the year. Nonetheless, the Priority Lake Project appears to have been successful in reducing erosion rates to their lowest levels since about 1900.

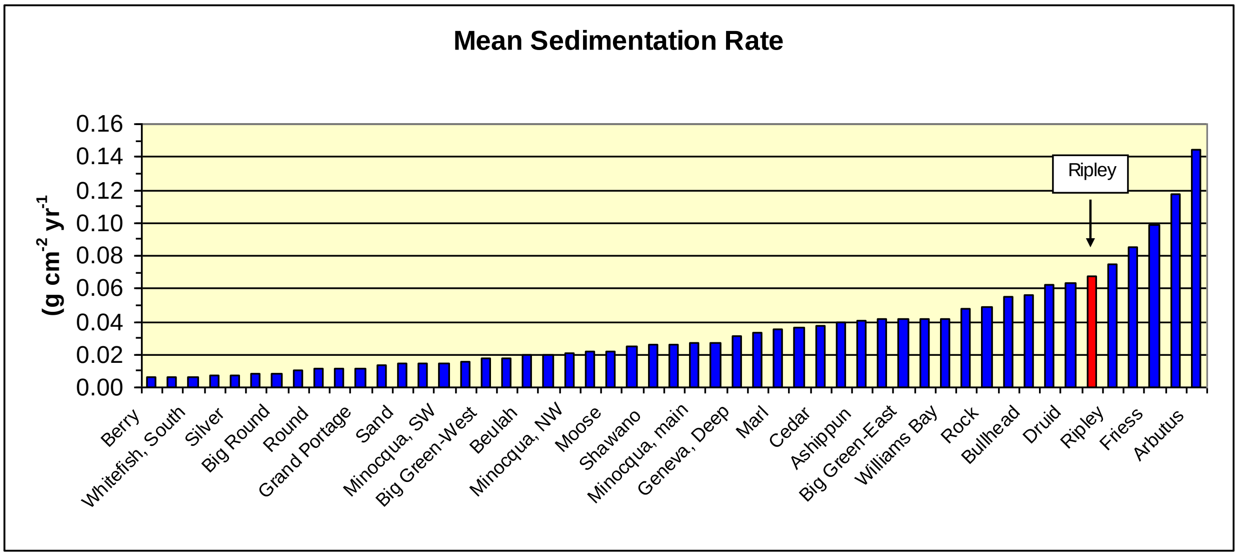


**Figure 56: Mean Sedimentation Rate for the last 150 years for 52 Wisconsin Lakes**

## CHANGES IN NUTRIENT LEVELS

The study also showed a decrease in phosphorus and nitrogen levels (among other geochemical elements) since the mid-1950s and following the 1940 peak, and even further decreases since 1990 (Figure 57). The apparent increase in phosphorus and nitrogen at the top of the core does not indicate an increase in deposition in the last few years but, instead, that diagenesis is ongoing. Diagenesis is the conversion of organic material to other forms. These other forms may be volatile so that the element leaves the system. Phosphorus and nitrogen reductions, however, were not as significant in recent years compared to reductions in soil erosion. Since 1950 and even after 1990, productivity in the form of algal and/or plant growth appears to have increased. This may be the result of generally increasing water clarity combined with nutrient levels that remain elevated compared to pre-settlement times.

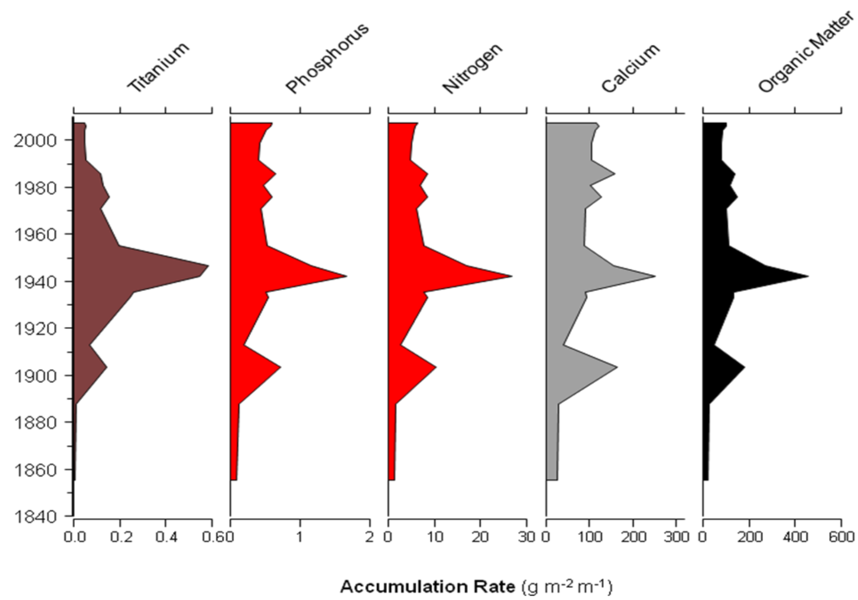


**Figure 57: Accumulation Rate Profiles of Selected Geochemical Elements for Lake Ripley (1840-2007)**

The diatom community (a type of algae) was used to estimate changes in the summer phosphorus levels throughout the core (Figure 58). Pre-1860, phosphorus levels remained low and stable at about 12-13 µg/L, which translates into a pre-settlement TSI of 40. There was a sudden and significant increase around 1900, which corresponds with an early episodic sedimentation event. Phosphorus levels continued to increase and reached their highest points during the period 1940-1990.

The large spike in phosphorus levels in the 1940s was depositional in nature, and most likely related to the dredging and straightening of stream channels during this period. It appears that more phosphorus was delivered to the lake at this time from the watershed, but this did not result in an episodic increase in phosphorus levels within the water column. Much of this increase in phosphorus deposition may have happened over a relatively short time and been in the form of sediment particles that quickly settled to the lake bottom. Diatom evidence suggests that in-lake phosphorus concentrations probably peaked in the 1970s. Since 1990, levels have declined, although they are not as low as pre-settlement estimates. The diatom-estimated phosphorus concentrations at the top of the core (representing the most recent period) are 17-19 µg/L, which closely approximates observed values.

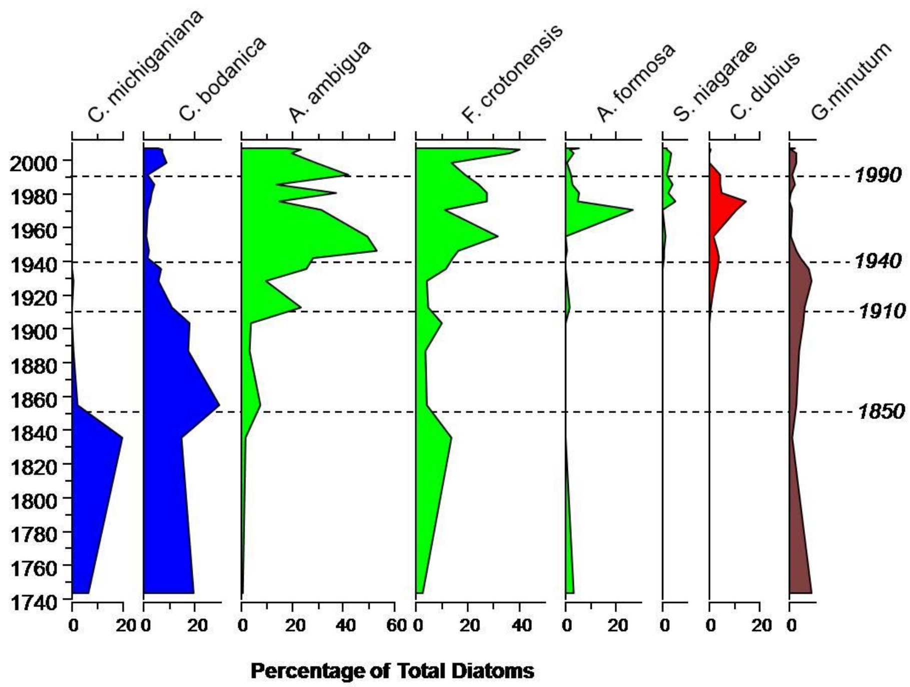


**Figure 58: Profiles of Common Diatoms Found in the 2007 Lake Ripley Sediment Core (1740-1997)**

Diatoms in blue are indicative of low nutrients, green suggest moderate nutrient levels, and red represent higher nutrient levels. The brown diatom is the only one shown which grows attached to plants. The other diatoms float in open water.

## CONCLUSIONS

Study findings show that Lake Ripley has been significantly impacted by actions in the lake's watershed. The biggest water quality declines followed periods of major watershed disturbance, while the biggest improvements followed the widespread implementation of soil-conservation and erosion-control practices. Since large portions of the watershed have been permanently altered, it is not feasible for the lake to return to pre-settlement conditions. These conditions were characterized by in-lake total phosphorus concentrations of about 12-13 µg/L, and a corresponding Trophic State Index (TSI) of around 40. However, at a minimum, the lake can be protected from further degradation by limiting those watershed disturbances that cause sediment and phosphorus loading to the lake. At best, loadings could be reduced to the point where the lake shifts to a somewhat lower trophic state, which would lead to increased water clarity conditions and improved lake health.

## 9-2 POLLUTANT-LOADING AND LAKE-RESPONSE MODELING

### METHODOLOGY

Establishing water quality goals requires understanding the relationship between watershed nutrient loading and in-lake phosphorus concentration. This relationship is best described by applying a lake phosphorus response model. Basic computer modeling was used on Lake Ripley to assess existing water quality and its potential for improvement. The Wisconsin Lake Modeling Suite (WiLMS) was selected to estimate phosphorus content, phosphorus loading, and lake trophic response based on various input parameters.[226] WiLMS is a collection of empirical models developed from statistical analyses of regional lake and reservoir systems. It was first used on Lake Ripley as part of a 1994 Water Resources Appraisal conducted by the Wisconsin DNR.[227]

Fixed input variables and model calculations consisted of the following hydrologic and morphometric data: tributary drainage area minus lake-surface area (4,262 acres); lake-surface area (423 acres); lake volume (7,561 acre-feet); lake mean depth (17.9 feet); precipitation minus evaporation calculation (2.8 inches); total unit runoff calculation based on built-in default data for Jefferson County (7.2 inches); hydraulic loading calculation (2,656 acre-feet/year); annual runoff plus baseflow volume calculation (2,557 acre-feet); aerial water load calculation (6.3 feet/year); lake flushing rate calculation (0.35/year); water residence time calculation (2.85 years); observed spring overturn total phosphorus (24.4 μg/L); and observed growing season mean phosphorus (19.8 μg/L).

Other input variables included estimated acreages of different land-use categories within the watershed: row-crop agriculture (2,179 acres); mixed agriculture (142 acres); pasture/grass (189 acres); 1/8-acre, high density urban (126 acres); 1/4-acre, medium density urban (684 acres); > 1-acre, rural residential (90 acres); wetlands (568 acres); forest (284 acres); and lake surface (423 acres). This information was used by the model to generate estimates for non-point source phosphorus loadings. Point-source loadings from septic tanks, storm sewer outfalls, etc. were not identified and would not be considered significant. This is because most of the lake area is served by a municipal wastewater treatment facility, rather than private septic systems, and there are no major storm sewer outfalls or other point-source discharges to the lake.

### PREDICTED PHOSPHORUS LOADING AND IN-LAKE CONCENTRATIONS

Estimated phosphorus loading to the lake from the watershed was predominantly from agricultural sources, and particularly from row-cropped fields (70.3%). Urbanized areas were estimated to contribute 17.4% of total phosphorus loads, and mostly from higher-density residential land uses. Total annual phosphorus loading from both urban and rural areas ranged from an estimated low of 648 kg to a high of 3,312 kg, with a “most likely” value of 1,254 kg. While the relative percent loadings from different land uses are probably fairly representative,

[226] Wisconsin Lake Modeling Suite (WiLMS), Version 3.3.18.1
[227] Wisconsin Department of Natural Resources, and Lake Ripley Management District. 1994. Lake Ripley Water Resources Appraisal.

the actual mass-loading estimates should be considered crude approximations within a typical range of possibilities built into the model. More rigorous modeling would be needed to generate more refined numbers for advanced planning purposes.

The impact of a hypothetical, but reasonably probable, land-use-change scenario was also evaluated. This scenario involved the theoretical conversion of 200 acres of cropped agricultural land—representing the approximate acreage of large, open tracts of developable land still remaining within the urban service area—to high-density residential land use. Running this hypothetical land-use scenario resulted in a "most likely" increase in the predicted annual phosphorus loading of 5.6%. Interestingly, converting the same row-cropped areas to rural residential land use resulted in a "most likely" decrease in annual loadings of 3.4%. If this cropped agricultural land was instead planted to forest or converted to wetland, predicted annual phosphorus loading would "most likely" decrease by about the same amount (3.6%). These modeling results highlight the degree to which different land uses and the relative amount of impervious area influence annual loading scenarios, even on relatively small scales.

The Reckow (1979) natural lake model within WiLMS was the closest to predicting the observed phosphorus concentration in Lake Ripley. This phosphorus-prediction model is based on information from 47 north temperate lakes from the EPA-Natural Eutrophication Survey. It predicted an in-lake total phosphorus concentration of 33 μg/L, which is somewhat higher than observed values. Based on the Reckow model and using the Phosphorus Predictions and Uncertainty Analysis module in WiLMS, an estimated total annual phosphorus loading of 471 kg/year was back calculated from the observed growing season mean phosphorus concentration of 19.8 μg/L. This represented a significantly lower annual loading value than what was estimated above.

Back calculations were also performed for mean lake phosphorus concentrations of 24 μg/L (571 kg/yr) and 16 μg/L (381 kg/yr). This exercise was intended to estimate the load increase and reduction that might translate into these in-lake concentrations. Results indicate that a 21% (100 kg/yr) annual loading increase would translate into a 4 μg/L increase in in-lake phosphorus concentration, while a 19% (90 kg/yr) loading reduction would translate into a 4 μg/L decrease. The latter finding gives an idea of a total annual load reduction that could be targeted through future BMP implementation to achieve a corresponding TSI below 50.

The Lake Eutrophication Analysis Procedure (LEAP) in WiLMS was also investigated. LEAP is a computer program designed to predict eutrophication indices in lakes based upon watershed area, lake depth and ecoregion. It can be used to compare Lake Ripley to similar, undisturbed lakes within the same Southeast Wisconsin Till Plain ecoregion. Ecoregion is used to predict runoff and average stream phosphorus concentration. The program is intended primarily to estimate conditions in the lake with minimal input data to identify "problem" lakes. It should be noted that the model acknowledges that individual lakes may deviate greatly from regionally-defined patterns.

LEAP predicted a total annual phosphorus load to the lake of 408 kg, and an average total phosphorus inflow concentration of 100 μg/L. This compares to 1993 observed values from the inlet stream of 1,073 kg and 198 µg/L, respectively.[228] Since this time period pre-dates the implementation of major watershed-conservation measures, current values are likely to be much lower, although they have not been re-measured. The LEAP analysis predicted an in-lake total phosphorus concentration of 32 µg/L (observed: 20 µg/L), a chlorophyll-*a* concentration of 10.6 µg/L (observed: 8.6 µg/L), and a Secchi clarity of 6.2 feet (observed: 6.0 feet). It also estimated chlorophyll-*a* interval frequencies (nuisance frequencies) for both observed and predicted lake conditions. Based on observed conditions, the model estimated that a chlorophyll-*a* concentration of 10 µg/L, representing visible algal blooms, would be exceeded 29% of the time (3 out of every 10 days). This increased to about 45% (4.5 out of every 10 days) under predicted conditions. Lake Ripley fell within the average ecoregion TSI ranges for all three trophic variables.

Wisconsin regional predictive equations allow the model user to predict in-lake chlorophyll-*a* concentration from Secchi depth, as well as Secchi depth and chlorophyll-*a* from in-lake total phosphorus concentration. Modeling results for observed in-lake phosphorus levels ranging from a low of 12 µg/L to a high of 24 µg/L are as follows:

12 µg/L phosphorus = 7.5-ft. Secchi depth and 5.4 µg/L chlorophyll-*a*
16 µg/L phosphorus = 6.2-ft. Secchi depth and 7.7 µg/L chlorophyll-*a*
20 µg/L phosphorus = 5.6-ft. Secchi depth and 10.0 µg/L chlorophyll-*a*
24 µg/L phosphorus = 4.9-ft. Secchi depth and 12.5 µg/L chlorophyll-*a*

Modeling results for observed chlorophyll-a values ranging from a low of 4 µg/L to a high of 13 µg/L are as follows:

4 µg/L chlorophyll-*a* = 8.5-ft. Secchi depth
7 µg/L chlorophyll-*a* = 6.6-ft. Secchi depth
10 µg/L chlorophyll-*a* = 5.6-ft. Secchi depth
13 µg/L chlorophyll-*a* = 4.9-ft. Secchi depth

## PREDICTED ALGAL RESPONSE

Algal nuisance frequency was estimated using the Trophic Response Module within WiLMS. Input parameters included a 3-24 µg/L range of summer mean chlorophyll-*a* values, which represented the range of mean values observed over the 1986-2009 monitoring period. They also included the chlorophyll-*a* temporal coefficient of variation (standard deviation divided by the mean) of 0.56. Based on a 10 µg/L nuisance algal condition threshold, the chance the lake might exceed this threshold at any given time is presented below for the range of observed, summer mean chlorophyll-*a* values (in µg/L):

[228] Ibid

| | | | | |
|---|---|---|---|---|
| 3 = 0.8% | 8 = 24.9% | 13 = 57.5% | 18 = 77.9% | 23 = 88.6% |
| 4 = 2.8% | 9 = 32.0% | 14 = 62.6% | 19 = 80.7% | 24 = 90.0% |
| 5 = 6.5% | 10 = 39.0% | 15 = 67.2% | 20 = 83.1% | |
| 6 = 11.7% | 11 = 45.6% | 16 = 71.2% | 21 = 85.2% | |
| 7 = 18.0% | 12 = 51.8% | 17 = 74.8% | 22 = 87.0% | |

## SUMMARY OF MODEL OUTPUT

The following is a copy of the actual printout that was generated from the WiLMS analysis:

**Hydrologic and Morphometric Data**

Tributary Drainage Area: 4262.0 acre
Total Unit Runoff: 7.2 in.
Annual Runoff Volume: 2557.2 acre-ft
Lake Surface Area <As>: 423 acre
Lake Volume <V>: 7561 acre-ft
Lake Mean Depth <z>: 17.9 ft
Precipitation - Evaporation: 2.8 in.
Hydraulic Loading: 2655.9 acre-ft/year
Areal Water Load <qs>: 6.3 ft/year
Lake Flushing Rate <p>: 0.35 1/year
Water Residence Time: 2.85 year
Observed spring overturn total phosphorus (SPO): 24.4 mg/m^3
Observed growing season mean phosphorus (GSM): 19.8 mg/m^3

**NON-POINT SOURCE DATA**

| Land Use | Acre (ac) | Low | Most Likely | High | Loading % | Low | Most Likely | High |
|---|---|---|---|---|---|---|---|---|
| | | \|-- Loading (kg/ha-year) --\| | | | | \|-- Loading (kg/year) --\| | | |
| Row Crop AG | 2179 | 0.50 | 1.00 | 3.00 | 70.3 | 441 | 882 | 2646 |
| Mixed AG | 142 | 0.30 | 0.80 | 1.40 | 3.7 | 17 | 46 | 80 |
| Pasture/Grass | 189 | 0.10 | 0.30 | 0.50 | 1.8 | 8 | 23 | 38 |
| HD Urban (1/8 Ac) | 126 | 1.00 | 1.50 | 2.00 | 6.1 | 51 | 76 | 102 |
| MD Urban (1/4 Ac) | 684 | 0.30 | 0.50 | 0.80 | 11.0 | 83 | 138 | 221 |
| Rural Res (>1 Ac) | 90 | 0.05 | 0.10 | 0.25 | 0.3 | 2 | 4 | 9 |
| Wetlands | 568 | 0.10 | 0.10 | 0.10 | 1.8 | 23 | 23 | 23 |
| Forest | 284 | 0.05 | 0.09 | 0.18 | 0.8 | 6 | 10 | 21 |
| Lake Surface | 423 | 0.10 | 0.30 | 1.00 | 4.1 | 17 | 51 | 171 |

**TOTALS DATA**

| Description | Low | Most Likely | High | Loading % |
|---|---|---|---|---|
| Total Loading (lb) | 1427.5 | 2764.5 | 7300.8 | 100.0 |
| Total Loading (kg) | 647.5 | 1254.0 | 3311.6 | 100.0 |
| Areal Loading (lb/ac-year) | 3.37 | 6.54 | 17.26 | 0.0 |
| Areal Loading (mg/m^2-year) | 378.26 | 732.55 | 1934.57 | 0.0 |
| Total NPS Loading (lb) | 1389.8 | 2651.3 | 6923.4 | 100.0 |
| Total NPS Loading (kg) | 630.4 | 1202.6 | 3140.4 | 100.0 |

### Phosphorus Prediction and Uncertainty Analysis Module

Observed spring overturn total phosphorus (SPO): 24.4 mg/m^3
Observed growing season mean phosphorus (GSM): 19.8 mg/m^3
Back calculation for SPO total phosphorus: 0 mg/m^3
Back calculation GSM phosphorus: 19.8 mg/m^3
% Confidence Range: 70%

| Lake Phosphorus Model | Low Total P (mg/m^3) | Most Likely Total P (mg/m^3) | High Total P (mg/m^3) | Predicted -Observed (mg/m^3) | % Dif. |
|---|---|---|---|---|---|
| Walker, 1987 Reservoir | 37 | 72 | 189 | 52 | 263 |
| Canfield-Bachmann, 1981 Natural Lake | 47 | 72 | 130 | 52 | 263 |
| Canfield-Bachmann, 1981 Artificial Lake | 40 | 56 | 89 | 36 | 182 |
| Rechow, 1979 General | 27 | 53 | 139 | 33 | 167 |
| Rechow, 1977 Anoxic | 122 | 237 | 626 | 217 | 1096 |
| Rechow, 1977 water load<50m/year | 45 | 87 | 230 | 67 | 338 |
| Rechow, 1977 water load>50m/year | N/A | N/A | N/A | N/A | N/A |
| Walker, 1977 General | 85 | 165 | 435 | 141 | 578 |
| Vollenweider, 1982 Combined OECD | 53 | 90 | 201 | 68 | 308 |
| Dillon-Rigler-Kirchner | 50 | 96 | 254 | 72 | 295 |
| Vollenweider, 1982 Shallow Lake/Res. | 45 | 80 | 188 | 58 | 262 |
| Larsen-Mercier, 1976 | 74 | 142 | 376 | 118 | 484 |
| Nurnberg, 1984 Oxic | 49 | 94 | 249 | 74 | 374 |

| Lake Phosphorus Model | Confidence Lower Bound | Confidence Upper Bound | Parameter Fit? | Back Calculation (kg/year) | Model Type |
|---|---|---|---|---|---|
| Walker, 1987 Reservoir | 43 | 148 | Tw | 347 | GSM |
| Canfield-Bachmann, 1981 Natural Lake | 22 | 207 | FIT | 170 | GSM |
| Canfield-Bachmann, 1981 Artificial Lake | 17 | 161 | FIT | 175 | GSM |
| Rechow, 1979 General | 30 | 110 | FIT | 471 | GSM |
| Rechow, 1977 Anoxic | 144 | 487 | FIT | 105 | GSM |
| Rechow, 1977 water load<50m/year | 50 | 181 | P Pin | 285 | GSM |
| Rechow, 1977 water load>50m/year | N/A | N/A | N/A | N/A | N/A |
| Walker, 1977 General | 83 | 356 | FIT | 0 | SPO |
| Vollenweider, 1982 Combined OECD | 45 | 181 | FIT | 197 | ANN |
| Dillon-Rigler-Kirchner | 58 | 198 | P | 0 | SPO |
| Vollenweider, 1982 Shallow Lake/Res. | 40 | 164 | FIT | 259 | ANN |
| Larsen-Mercier, 1976 | 89 | 290 | P Pin | 0 | SPO |
| Nurnberg, 1984 Oxic | 50 | 200 | P | 263 | ANN |

## Expanded Trophic Response Module

**Cholorphyll a Nuisance Frequency**

Chla Mean Min: 3
Chla Mean Max: 24
Chla Mean Increment: 1
Chla Temporal CV: 0.56
Chla Nuisance Criterion: 10

| Mean | Freq % | Mean | Freq % | Mean | Freq % |
|---|---|---|---|---|---|
| 3 | 0.8 | 10 | 39.0 | 17 | 74.8 |

| | | | | | |
|---|---|---|---|---|---|
| 4 | 2.8 | 11 | 45.6 | 18 | 77.9 |
| 5 | 6.5 | 12 | 51.8 | 19 | 80.7 |
| 6 | 11.7 | 13 | 57.5 | 20 | 83.1 |
| 7 | 18.0 | 14 | 62.6 | 21 | 85.2 |
| 8 | 24.9 | 15 | 67.2 | 22 | 87.0 |
| 9 | 32.0 | 16 | 71.2 | 23 | 88.6 |
| | | | | 24 | 90.0 |

## 9-3 RESULTS OF PUBLIC OPINION SURVEYS

### PURPOSE

Lakes cannot be all things to all people, and there is bound to be conflict when a common resource is expected to support often conflicting interests. Opinion surveys have long been used by the Lake District to help evaluate public perceptions and priorities about lake use, as well as attitudes about general resource conditions, problems, and possible management solutions. Prioritization allows for the allocation of resources so that the benefits of management intervention out-weigh costs, the results are measurable, and the work is supported by the public. Surveys also facilitate public involvement, and can help educate residents and users about the lake ecosystem. It is believed that a greater understanding and awareness of Lake Ripley and its problems will generally lead to increased cooperation and a greater likelihood of program success.

The first comprehensive opinion survey was conducted in 1992 as part of a Creative Marketing Unlimited research project at the University of Wisconsin-Whitewater.[229] This initial effort was followed by comprehensive opinion surveys conducted in 1999, 2005 and 2007 by the Lake District.[230] These surveys were disseminated to area property owners to gauge general attitudes on a wide range of lake topics. Respondents were asked to share their opinions regarding the condition of Lake Ripley, the effectiveness of current management policies and programs, and what actions were believed to be needed to improve overall lake health.

### DEMOGRAPHICS

The most recent, 2007 survey (see Appendix F) placed the average age of the respondent at 57 years old. Male respondents outnumbered female respondents by a ratio of 1.5:1. Average household size was 2.8 individuals. Most reported living within one-quarter mile of the lake, with 37% of survey respondents owning lakefront property. Of all residential homeowners, 57% identified themselves as full-time residents and 43% as part-time residents. Part-time residency tended to increase as property ownership moved closer to the lake. Slightly more than half of those living off the lake claimed to have deeded lake-access rights. Length of property ownership near Lake Ripley varied widely, although a majority (58%) owned the property for over a decade. The above demographics patterns appear to be fairly consistent with those identified in earlier surveys.

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[229] University of Wisconsin-Whitewater. 1992. Lake Ripley Management District: Lake Resident Study.
[230] Lake Ripley Management District. 1999, 2005 and 2007. Lake Ripley Property Owner Opinion Survey.

## ACCESS, CROWDING AND GENERAL LAKE CONDITIONS

Respondents to the 2007 survey generally visited or used the lake on a routine basis, but there was an evident split between frequent and sporadic users. Most felt that adequate public access was provided with respect to boating. However, there were more mixed feelings in terms of the availability of shore fishing and swimming access, despite the addition of a public fishing and swimming pier at Beach Lane around the time of the survey. This seems to mark a shift from earlier surveys when public-access availability was overwhelmingly viewed as sufficient. The apparent shift may be the result of increasing lake-use demands, particularly from area property owners without private, lake-access rights. It does not account for the lack of awareness related to the recent installation of the new fishing and swimming pier.

In 2007, most survey respondents claimed not to feel a sense of crowding on the lake during summer weekdays, but felt at least moderately crowded on summer weekends. Average water clarity was generally viewed as being clear to somewhat cloudy, but weed growth was perceived as slightly excessive. The above perceptions seem to be fairly consistent with those documented in previous surveys.

## PREFERRED LAKE ATTRIBUTES AND USES

In descending order, the top four preferred lake-use activities included the enjoyment of peace and tranquility, swimming, observing wildlife, and walking or biking around the lake. Earlier surveys showed higher preferences for motor boating and fishing over the latter two activities. The top two attributes identified for their high “quality of life” value included safe water quality and natural scenic beauty. High marks were also given to peace and tranquility, clear water, a healthy aquatic plant community, abundant fish and wildlife habitat, and rule enforcement. These findings paralleled those of earlier surveys, with the exception that minimal boat traffic was previously held to a higher standing.

## PERCEIVED PROBLEMS AND THREATS

Zebra mussels (and Canada geese in 2005), development pressure, lake weeds, crowding and algae were most often blamed for limiting the use and enjoyment of the lake. This is a change over prior surveys that gave higher rankings to boat traffic, poor water clarity and noise. Possible reasons for the change include the infestation of zebra mussels around the time of the survey, the adoption of new lake-use policies that increased slow-no-wake zones within 200 feet of shore, and perhaps a more consistent law-enforcement presence during the boating season. As far as the lake’s biggest threats, top choices included invasive plant and animal species, polluted runoff, overcrowding, overdevelopment, and the overuse of fertilizers and pesticides. These perceived culprits have remained relatively consistent compared to prior surveys, but with invasive species gaining greater prominence.

## VIEWS ON CURRENT MANAGEMENT

The 2007 survey showed that a vast majority of respondents were very positive about their quality of life living near the lake. Most felt that local lake rules were fair and appropriate, and that rule enforcement was sufficiently aggressive. "Misguided lake-management programs" was ranked last as far as being a perceived threat to the lake. If fact, there was largely moderate to strong support for the various Lake District efforts employed to protect and improve Lake Ripley. Respondents generally felt well informed about the lake, its management, and the availability of landowner cost sharing, with the vast majority citing the Ripples newsletter as their preferred information source. While opinions varied, the amount of taxes collected to finance the protection and management of Lake Ripley was generally viewed as sufficient to slightly excessive.

## 9-4 STATUS OF PRIOR MANAGEMENT RECOMMENDATIONS

Below is a listing of prior management recommendations and their implementation status. Recommendations are listed under the appropriate planning documents from which they were derived. Latest publication dates are referenced in parentheses. Almost all of these earlier planning recommendations have since been acted upon, or are the target of ongoing management action.

**Legend**
■ Completed
◘ Ongoing with dedicated management program
□ Not Completed or unknown status (as of Plan date)

### NONPOINT SOURCE CONTROL PLAN FOR THE LAKE RIPLEY PRIORITY LAKE PROJECT (1998REV)

■ Reduce overall sediment delivered to Lake Ripley by 50% of inventoried load
■ Reduce overall phosphorus load by 30% (achieved through the above sediment reductions)
◘ Maintain Trophic State Index below 50 (variable status)
◘ Protect ecologically-sensitive areas in and around the lake
◘ Prevent further wetland loss or disturbance; protect wetland acres east of the lake as well as stream/lakeside buffer areas; increase total number of wetland acres through restoration measures
◘ Preserve natural shoreline areas as water quality buffers and wildlife refuges; enhance developed shoreline areas by planting native vegetation to serve as buffers
◘ Reestablish native aquatic plant communities, where feasible
◘ Protect the Lake Ripley largemouth bass fishery, aquatic diversity and endangered resources within the lake and watershed
◘ Protect groundwater resources; maintain groundwater contribution to the hydrologic budget by not building on groundwater-infiltration areas

## LAKE RIPLEY MANAGEMENT PLAN (2001)

■ Expand slow-no-wake zones to better incorporate shallow, near-shore areas
■ Develop emergency slow-no-wake policy addressing extreme flooding and high-water events
◘ Continue selective mechanical harvesting of milfoil; regularly update plant management plan
□ Determine extent of in-lake nutrient recycling from anoxic sediment phosphorus release
◘ Continue sport fishery enhancement programs through habitat protection, carp removal and limited fish stocking
◘ Continue intensive, long-term water quality monitoring program
■ Ensure proper lake-rule postings at all public access points
■ Raise public launch fee in accordance with State regulations to acquire additional funds for site maintenance and upkeep
■ Adopt local ordinance that prohibits the feeding of waterfowl, and implement other nuisance waterfowl-control strategies
■ Complete 13-year Lake Ripley Priority Lake Project (a state-funded, pollution-abatement program)
■ Encourage the use of no-phosphorus lawn fertilizers within 200 feet of the lake
□ Propose shoreland zoning modification that regulates the type and placement of high-intensity lighting on piers, boathouses and shorelines
◘ Continue implementation of an intensive information and education campaign
◘ Continue to acquire and/or establish voluntary land-preservation agreements (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 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
◘ Continue litter cleanup projects to remove debris from area waterways and shorelines
◘ Support the continued funding of a summer lake patrol officer to maintain an enforcement presence on weekends and holidays throughout the boating season
◘ Continue implementation of the volunteer "Lake Watch" program to compliment law enforcement efforts

## LAKE RIPLEY AQUATIC PLANT MANAGEMENT PLAN (2002)

◘ Recognize the value of a diverse, native aquatic plant community and ecologically-significant "sensitive areas" prior to implementing any type of management program
◘ Focus control efforts on non-native, invasive species like Eurasian watermilfoil, while protecting native plant beds needed for water quality and habitat purposes
◘ Work to understand and address the root causes of excessive, symptomatic weed growth
◘ Use targeted mechanical harvesting as the primary weed-control strategy, with cutting intensity dictated by the specific habitat and recreational requirements of a particular location
◘ Focus mechanical harvesting on managing dense, monotypic stands of Eurasian watermilfoil just prior to or following canopy formation at the water surface. Priority control areas include high-traffic boating lanes and around weed-choked public access points.

◘ Employ strategies that are compatible with mechanical harvesting as warranted, and particularly in areas that are otherwise inaccessible to mechanical harvesting equipment
■ Use boating ordinances to divide the lake into distinct recreational user zones to support multiple, mutually-exclusive activities
◘ Increase management effectiveness by implementing strategies at specific times and in specific locations, depending on spatial and seasonal variations in plant growth, fish and wildlife behavior, recreational use of the water, and other factors
◘ Inform the public of the goals, objectives and limitations of aquatic plant management, and the responsibilities of lakefront property owners
◘ Conduct an aquatic plant inventory at least every several years for monitoring purposes, and adjust management approaches as appropriate

## 9-5 CURRENT GOALS, OBJECTIVES AND TARGETS

### OUR MISSION

The Lake Ripley Management District seeks to preserve and enhance Lake Ripley's water quality, its fish and wildlife communities, and its overall ecological health, while ensuring public access and use of the lake that is safe, fair and practical.

### A VISION FOR THE FUTURE

Scenic shorelands, good fishing, abundant wildlife and clean water are a part of our local culture. They are why many of us choose to live here, why tourists come to visit, and why area property values remain so strong. While our connections to and preferred uses of the lake vary greatly, all of us share in the responsibilities of its care. By investing in Lake Ripley's continued stewardship, we believe the community and future generations will be rewarded by a clearner, healthier lake and a higher quality of life than would otherwise be possible.

We envision Lake Ripley as a clean and naturally scenic water body that improves regional property values and economies, provides opportunities for outdoor recreation, and contributes positively to our collective quality of life. Specifically, we consider the following to be realistic expectations that we should strive to fulfill. Taken together, they represent an ambitious but practical vision for the future of Lake Ripley.

- High-quality aquatic plants and shoreland habitats support a lake ecosystem that is rich in native flora and fauna.

- The lake and its surroundings abound with opportunities to view a diversity of native species and natural features that inspire learning, nature appreciation and outdoor exploration.

- Recreation occurs in a shared manner that equitably balances the competing demands and expectations found among diverse user groups.

- The mix of lake uses is compatible with the general public interest, identified community priorities, and the lake's ecological and sociological carrying capacities.

- The lake is safe and attractive for swimming, and there are no beach closings due to high bacteria levels or potentially toxic blue-green algal blooms.

- The watershed that drains surface water to the lake contains high-functioning wetlands and protected natural areas that help safeguard water quality and general lake health.

- Local development and associated land-use practices incorporate effective conservation measures that control soil erosion, preserve wetlands and groundwater-recharge areas, and generally minimize adverse impacts to the lake.

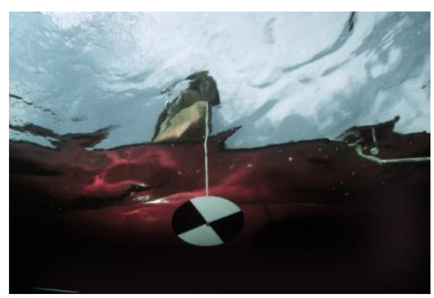
- Residents, property owners, local government entities and other stakeholders are aware of Lake Ripley's environmental, economic, recreational and cultural value to the community.

- The public maintains a vested interest in the lake's long-term protection and rehabilitation, and is committed to making the necessary investments for the benefit of future generations.

- There is broad understanding and support of ongoing management designed to address problems and threats through cost-effective action.

To achieve our mission and vision for the future, we have set forth five goals for which the Lake District is committed to pursuing. These goals are: 1) **Clean, clear water**; 2) **Thriving, native aquatic life**; 3) **Safe, fair and responsible lake use**; 4) **Cost-effective management action**; and 5) **A well-informed and engaged citizenry**. A brief status report is provided for each goal, as well as the objectives necessary for attaining the goal. Also included are some specific, representative metrics (or health indicators) combined with realistic targets for what we hope to achieve that we can use to continually track and evaluate our progress.

## GOAL #1: CLEAN, CLEAR WATER



A Secchi disk being lowered from a boat to measure water clarity. Photo credit: UW-Extension

**Status:**

Landscape condition and land uses within a 7-square-mile watershed affect Lake Ripley's water quality. How we live on the land dictates the amount of stormwater runoff and pollutants delivered to the lake. In fact, the fossilized evidence in sediment cores extracted from the lake bottom indicate much better water quality prior to 1870, which was when the land was first cleared for agriculture and early European settlement. Water quality then rapidly declined in response to increased watershed-erosion rates. It was not until the 1950s when erosion rates and lake conditions first began to stabilize, primarily due to improved agricultural practices. Further improvements were made after 1990, following the start of the Lake Ripley Priority Lake Project and implementation of watershed-conservation measures. Recent lake modeling estimates that the main sources of continued phosphorus loading—the drivers of algal growth—include row-cropped agriculture

(70%) and higher-density urban areas around the lake (17%).

Water quality monitoring reveals that Lake Ripley routinely exceeds its desired Trophic State Index (TSI). TSI is a water quality index ranging from 1-100, with values less than 50 being desirable for most lakes. The index is used as a well-accepted indicator of overall lake health. TSI is based on the lake's phosphorus concentrations (plant nutrient), chlorophyll concentrations (algal pigment) and water clarity. A combination of high phosphorus, high chlorophyll and low water clarity translates into poor water quality for lakes. Monitoring records show that Lake Ripley's water quality has ranged from very good to poor, with TSI values frequently in the 50s, particularly during high-runoff periods. Prior to 1870, TSI values were closer to 40 and representative of less eutrophic conditions. Lake modeling that was done as part of a 1994 Water Resources Appraisal predicted further water quality declines if pollutant-loading rates at the time remained unchanged.

**Objectives:**

5. Reduce the delivery of pollutants to the lake, especially phosphorus and sediment originating from construction sites, existing urban areas, and row-cropped farm fields within the outlying watershed.
6. Minimize lakebed disturbances—such as carp activity and aggressive motor boating in shallow-water areas—that contribute to the re-suspension of bottom sediment and mobilization of phosphorus into the water column.
7. Permanently protect and restore groundwater-recharge zones, wetlands, and shoreland buffers that improve the quantity and quality of stormwater runoff.
8. Maximize the capacity of the 167-acre Lake District Preserve to absorb runoff and protect Lake Ripley's only inlet tributary stream.

**Metrics:**

1. Trophic State Index (TSI)

   Targets:
   - TSI < 50 (mesotrophic conditions)
   - Summer mean total phosphorus < 24.0 µg/L (ideal: < 20 µg/L; best case: 12 µg/L)
   - Summer mean chlorophyll-*a* < 7.3 µg/L
   - Summer mean Secchi clarity ≥ 6.5 ft

2. E. coli (*Escherichia coli*) bacteria levels

   Target: < 235 cfu/100 ml (or no beach closings)

3. Macroinvertebrate diversity

   Target: Macroinvertebrate populations in the inlet and outlet streams are comprised of diverse species, particularly those intolerant to pollution and poor water quality.

4. Watershed landscape condition

   Targets:
   - Rural watershed land uses are retained outside the Town's urban service boundary (east of County Rd. A).

- Well-vegetated shoreland buffer areas are increased along all shoreline, stream and drainage-ditch corridors.
- Remaining wetland acreage is permanently protected around the lake, and filled or drained wetland acreage is restored whenever feasible.
- Agricultural acreage under conservation farming practices is increased, including acreage subject to no-till cropping and nutrient-management planning.
- Number of rain gardens and rain barrels used in residential areas is increased.
- Eroding drainage ditches that connect to the inlet tributary stream are repaired or, preferably, plugged.
- Total annual phosphorus loading is reduced by at least 19% through the implementation of watershed Best Management Practices (BMPs) in order to maintain a TSI below 50.

## GOAL #2: THRIVING, NATIVE AQUATIC LIFE

A pair of bluegills is seen guarding a nest. Photo credit: UW-Extension

**Status:**

Lake Ripley is home to a diverse assemblage of aquatic plants, fish and animals. Some indigenous species documented in and around Lake Ripley are listed as rare or endangered, while other species are classified as non-native and invasive. All require particular habitat conditions and demonstrate varying sensitivities to pollution, habitat loss and other disturbances. A species-rich community of native aquatic plants and fish is an indicator of good lake health, whereas their absence or displacement by non-native species is often a sign of trouble.

Wetlands and near-shore littoral areas are particularly important for sustaining much of the aquatic life found in Lake Ripley. Since the early 1900s, over a third of the wetlands around Lake Ripley have been lost due to drainage and filling. Loss of wetlands causes hydrologic instability, reduces spring flow to the lake, increases the rate of runoff and pollutant delivery, and reduces vital habitat for fisheries, wildlife and endangered resources. The quality of the lake's biologically-rich littoral zone (shallow, near-shore area) is of equal importance in sustaining aquatic life, but remains threatened by the ongoing effects of shoreline development, beach grooming, motor boating and other recreational-use pressures.

Lake Ripley is currently plagued with the non-native Eurasian watermilfoil, curly-leaf pondweed, zebra mussel and common carp. Aquatic plant inventories indicate that Eurasian watermilfoil has been on the decline since it peaked in the late 1980s, while curly-leaf pondweed continues to maintain a limited but potentially-expanding presence. Sediment and nutrient loading has favored these tolerant, weedy species while reducing overall biodiversity. As for the lake's fishery, field surveys show fairly stable populations of all species, with carp currently comprising a small component of the overall community. Zebra mussels were a relatively recent introduction to the lake, and are still sustaining high numbers after their apparent peak in 2008. Other invasive species that pose immediate threats due to their close geographic proximity to Lake Ripley include the spiny waterflea, quagga mussel and New Zealand mudsnail—among others. Many of these species enter the Great Lakes through transoceanic shipping, and spread to inland lakes primarily through transient, recreational boat traffic.

**Objectives:**

4. Protect and restore native fish and wildlife habitat found in and around the lake.
5. Reduce the potential for the introduction and spread of aquatic invasive species.
6. Manage existing biological communities (plants, fish, etc.) in a manner that supports identified management goals and priorities.

**Metrics:**

1. Aquatic plants

   Targets:
   - Stable or increased *native* species richness (total number of species).
   - Eurasian watermilfoil and other non-native species comprise a small and decreasing fraction of overall plant community.
   - The aerial extent of bulrush and lily pad beds is maintained or expanded.
   - No further fragmentation or disturbance of identified "Critical Habitat Areas."

2. Fish

   Targets:
   - Stable or increased *native* species richness (total number of species).
   - Sustained presence of previously inventoried sensitive species, including the lake chubsucker (*Erimyzon sucetta*), least darter (*Etheostoma microperca*) and pugnose shiner (*Notropis anogenus*).
   - Carp represent a small and decreasing fraction of the overall fishery.
   - Desired size-frequency distributions are maintained for sport fish populations.
   - Increased number of littoral tree-drops to serve as coarse woody habitat.
   - Increased number of native trees growing near the shoreline for cover and a source of food, and for future recruitment of coarse woody habitat to the lake.
   - Maintenance of water quality conditions sufficient to sustain pollution-sensitive biota.

3. Wetlands

   Targets:
   - No further loss of existing wetland acreage.
   - Existing wetlands are protected and restored to their fullest functional value.
   - Wetland acreage and function are returned (when feasible) to areas subjected to past hydrologic manipulation.

## GOAL #3: SAFE, FAIR AND RESPONSIBLE LAKE USE

Anglers enjoying the morning slow-no-wake period on Lake Ripley.

**Status:**

While Lake Ripley is of modest size, it is both a popular and accessible recreational destination that can support a range of activities. This popularity has created challenges as different user groups compete for time and space on the lake. Public opinion surveys consistently reveal that boat traffic and congestion routinely interfere with people's use and enjoyment of the lake. According to a 2003 recreational boating study, Lake Ripley's estimated carrying capacity was regularly exceeded during summer weekends and other peak-use times.

Such high-intensity lake use, combined with the expansion of private and public access facilities, can create a host of safety and environmental problems. A number of lake-use and lakeshore-development policies are in effect at the state and local level to help address these concerns. These pertain to slow-no-wake times, slow-no-wake areas, and shoreland zoning provisions that set permitting standards for certain development activities next to the lake.

**Objectives:**

3. Minimize the potential for user conflict by supporting policies that fairly balance competing recreational demands.
4. Promote recreational uses and intensities that are compatible with the lake's physical, ecological and social carrying capacities.

**Metrics:**

1. Public access

   Target: The current level of public access is maintained with no expansion or increase in the number of public boat-access facilities.

2. Private pier development

   Targets:
   - Pier sizes, densities and number of mooring spaces meet Wisconsin DNR standards (NR 326).
   - No further pier development—except for the repair, maintenance or replacement of existing piers—in designated "Critical Habitat Areas" (formerly called "Sensitive Areas"), unless it can be shown that impacts will be fully mitigated.

3. Boating densities

   Target: Boating does not exceed estimated carrying-capacity thresholds as per the formula described in *Lake Ripley Watercraft Census and Recreational Carrying Capacity Analysis* (LRMD, 2003).

4. Law enforcement

   Target: Lake rules are enforced through regular Town of Oakland police patrols during the boating season, with emphasis on summer weekends and other peak lake-use periods.

5. Public survey input

   Target: Opinion survey results reflect favorable reviews regarding the lake's overall recreational atmosphere (i.e., fairness of rules, perceived compliance levels, degree of crowding, adequate enforcement, etc.).

## GOAL #4: COST-EFFECTIVE MANAGEMENT ACTION

**Dennis McCarthy, a Lake District board member and volunteer lake monitor, inspects a zebra mussel plate sampler on Lake Ripley.**

**Status:**

In 1991, the Lake Ripley Management District began operations under authority of Chapter 33 of the Wisconsin Statutes. It is a local, special-purpose unit of government that serves property owners living around the lake. The mission of the District is to preserve and enhance Lake Ripley's water quality, its fish and wildlife communities, and its overall ecological health, while ensuring safe, fair and practical lake use. To accomplish this mission, the District engages in a number of tax- and grant-supported programs in accordance with approved management plans and operating permits. A seven-member board of directors is responsible for directing the affairs of the District with the help of a full-time lake manager and two part-time weed-harvesting employees.

**Objectives:**

6. Management actions advance stated planning goals.
7. Management programs are appropriately targeted and cost-effective as set forth in approved guidance documents.
8. Monitoring is routinely conducted to evaluate resource conditions and management progress.
9. Funding and staffing resources are sufficient to implement recommended management actions.
10. The latest scientific information, strategy guidance and technological innovations are fully utilized as they become available.

**Metrics:**

1. Management-planning directives

   Target: Plan recommendations are regularly reviewed, implemented and updated according to an approved schedule.

2. Lake District operating budget

   Target: The Lake District budget provides for sufficient resources to implement, on a timely basis, recommended management activities necessary to achieve identified goals.

3. Public survey input

   Target: Realistic management expectations are maintained, and programs are viewed as effectively addressing community priorities.

4. Monitoring-data archives

Targets:

- The lake's shoreline is videotaped every few years to document changes in shore conditions and development activities.
- An annual census of piers, boat lifts, rafts and moored watercraft is maintained to document resident boating facilities and lake-use potential.
- Documentation of on-lake boat counts and lake-use observations is maintained during each boating season to track trends over time.
- Secchi depth measurements are taken at least twice per month (May to September).
- Basic water chemistry (total phosphorus, chlorophyll-*a*, etc.) is evaluated at least three times per year (after spring turnover, during mid-summer stratification, and after fall turnover).
- Invasive species information (locations, population estimates, etc.) is collected as per Wisconsin DNR guidance.
- Documentation of cost-shared conservation measures and estimated pollutant reductions is maintained as projects are completed.
- Aquatic plant inventories are performed every 4-5 years.
- Annual weed harvesting reports are maintained that document staff hours, cutting areas, number of loads harvested, and plant species collected.
- Public opinion solicitations are conducted every 5-7 years to track awareness and general attitudes associated with ongoing management challenges and their proposed solutions.

## GOAL #5: A WELL-INFORMED AND ENGAGED CITIZENRY

**Lisa Reas of LJ Reas Environmental Consulting Corporation shows Lake Ripley residents how to design and build their own rain gardens in this 2008 photo.**

**Status:**

Results of public opinion surveys show that most respondents feel well informed of issues related to Lake Ripley and its management. The Lake District seeks to communicate with and solicit participation from its constituents using multiple media outlets. These include public meetings and hearings, dissemination of printed materials (such as newsletters), e-mail bulletins, local newspaper articles, educational workshops, Web postings, and lake and watershed tours—among others. Social-marketing strategies are now being tested as a way of increasing the effectiveness of these communications, and to improve participation rates in the Lake District's landowner cost-share program.

**Objectives:**

4. Maintain open lines of communication with Lake District constituents, watershed property owners, and affected stakeholders using diverse media outlets.
5. Use the *Ripples* newsletter as the primary means of information sharing.
6. Actively solicit community participation and involvement in protection and rehabilitation efforts.

**Metrics:**

1. Outreach tools

   Targets:
   - A minimum of three Ripples newsletters are disseminated each year.
   - E-mail bulletins are used as needed to distribute announcements and time-sensitive information to interested constituents.
   - The Lake District website is updated on at least a quarterly basis.
   - Welcome Wagon informational packets are mailed on at least a quarterly basis to new District and watershed property owners.
   - All meeting agendas and proposed operating budgets are posted and published on a timely basis.
   - Board meetings and public hearings are well publicized and aired on local cable television.
   - An informational boat tour is offered each year for the benefit of Town of Oakland Board members.
   - Community events (watershed tours, lake fairs, litter cleanups, etc.) are regularly used to educate and engage citizen volunteers.
   - Social-marketing strategies that target specific, meaningful behavior changes are incorporated into existing outreach programs.

2. Public survey input

   Target: Opinion survey results give favorable reviews for quality of outreach materials and effectiveness of communication strategies.

3. Volunteer and landowner participation

   Targets:
   - Mechanisms are in place for attracting and retaining volunteers to support ongoing programs.
   - A critical mass of targeted landowners adopt recommended conservation measures as a result of outreach and incentive programs.
   - School groups are solicited to participate in service-learning projects.

**Cambridge High School students display some of the trash collected around Lake Ripley during a litter cleanup.**

# -10-
# COMPREHENSIVE ACTION STRATEGY

*"We cannot fix our problems with the same thinking we used when we created them."*

-- Albert Einstein, Nobel physicist

## 10-1 GENERAL MANAGEMENT GUIDANCE

This Plan is intended to limit the risk of one person or a vocal minority from steering a lake management decision in the wrong direction. Before satisfying the proverbial squeaky wheel, it is incumbent upon policymakers to acknowledge priority uses and goals for the lake, and to then decide what is in the best interest of the overall lake community. When making management decisions, it is important that they be based on clearly-stated goals that acknowledge lake-use priorities, ecosystem constraints and scientific realities. They should also be made in the context of a long-term vision, with a recognition that information and our level of understanding are always evolving.

Every lake is inherently unique. This explains why lakes can look and behave so differently, and why they may not respond the same to management intervention. There are rarely quick, single-solution fixes for such large and complex systems. Solutions will likely require a multi-faceted approach. Equally significant is that any activity or event can create ripple effects throughout such an interconnected and interdependent ecosystem. Therefore, the potential repercussions of any proposed action will need to be thoroughly investigated prior to implementation. This risk-assessment calculus should also weigh the action against the costs and benefits of taking no action at all. A good rule of thumb is to first protect what you have before attempting to rehabilitate what has been lost. This is because resource protection is almost always more effective and less expensive than rehabilitation.

Experience has shown that effective watershed management is a necessary precursor to effective lake management. Nonetheless, it is not uncommon for significant delays, or lag times, to occur between implemented actions and observable consequences. This is due to the fact that it can take considerable time for lakes to respond to manipulation or intervention, and usually only after a certain threshold of pollution reduction or management action is reached. Management is therefore about understanding and overcoming such thresholds, and focusing on desired outcomes rather than mere process. In other words, patience and persistent are required as cause and effect will not always be close in time and space. Desired outcomes cannot be achieved unless public support, political will and adequate financing are sustained throughout a long-term rehabilitation program.

Ultimately, strategy recommendations for Lake Ripley were selected as long as they met certain basic tests. Many of the following tests were borrowed and modified from a countywide lake-enhancement effort initiated by the Jefferson County Land and Water Conservation Department.[231]

1. The recommended action adequately addresses a real problem that is capable of being resolved.
2. The recommended action is applicable to Lake Ripley, and will serve the larger public interest.
3. The problem represents a battle worth fighting, and it is one that no other group is already effectively addressing.
4. The proposed action and desired solution are both achievable in terms of local implementation.
5. The cost, level of effectiveness, and potential side effects of the proposed action are all well understood.
6. Adequate resources are available to fully study and implement the recommended action.

All major findings and recommendations contained within this Plan were presented for public comment at a hearing held on September 26, 2009. No material additions or changes were proposed at this time. The Lake District Board subsequently adopted the Plan by formal resolution on November 21, 2009.

In the end, the success of this Plan will depend on the Lake District's capacity to overcome the barriers to effective management. These can include social barriers (i.e., community norms, under valuing of the resource, loss of a shared long-term vision), political barriers (i.e., entrenched interests and priorities, reluctance to raise necessary capital for management), and technical barriers (i.e., improper data interpretation, misapplied management actions).

## 10-2 STRATEGY RECOMMENDATIONS

The following strategy recommendations are intended to further the Lake District's goals and objectives as outlined in Chapter 9-5. As a consequence of their implementation, the expected outcome would be a top-quality natural resource that strengthens area property values, provides unique outdoor recreational opportunities for the community, and enhances the overall quality of life of its residents. Complete commentary pertaining to each recommendation is provided in Chapter 10. To attain each goal, any necessary data collection and research should be performed to establish baseline conditions, identify trends, establish measures of success, and decide upon next steps in the planning and implementation process.

Recommended actions include measures aimed at protection and prevention, management control, restoration and rehabilitation, capacity building, and community outreach. Whether they are ongoing or one-time actions, all are designed in an attempt to cost-effectively address previously identified problems and threats affecting Lake Ripley. Ultimately, successful

[231] Jefferson County Land & Water Conservation Department. 2003. Shape the Future of Our Lakes: Jefferson County Lake Enhancement Project.

implementation will depend on interest level, political will, funding availability, workloads, and various other factors.

Note that, in most cases, recommendations pertain to actions that fall directly within the authority and capacity of the Lake District. Problems of significant magnitude and scale, however, are likely to warrant a combination of management approaches, including those that extend beyond the District's immediate control or authority. Approaches could range from simply increasing public awareness, to enacting voluntary incentive programs, to lobbying for mandatory regulation of harmful behaviors and activities.

## WATERSHED CONSERVATION

- **Continue the restoration and improvement of the Lake District Preserve.**

  The 167-acre Lake District Preserve is identified as an important public resource and restored natural area, and is strategically positioned to protect Lake Ripley's only inlet tributary stream. Management and restoration activities should be pursued at the Preserve that enhance its unique habitats, improve wetland function, protect inlet stream quality, maintain natural scenic beauty, and facilitate reasonable, low-impact public access and outdoor recreational opportunities. See Chapter 7-9 for a list of detailed recommendations relating to the future management and improvement of the Preserve.

- **Provide planning, design, permitting and cost-sharing assistance to targeted landowners for the implementation of eligible Best Management Practices (BMPs)**.

  Best Management Practices (BMPs) represent tools, devices or strategies that can be employed to control soil erosion, improve habitat value, and/or reduce stormwater runoff volumes or pollutant concentrations. They may involve the restoration of degraded wetlands or lakeshores, rain garden and rain barrel installations, soil erosion-control measures, littoral zone tree-drops, drainage ditch closures, conservation farming practices (i.e., grass-swale waterways, nutrient management planning, no-till planting, strip cropping, contour plowing, buffer strips along waterways, etc.), and the removal or disconnection of water-impervious surfaces.

  In selecting and targeting BMPs, priority shall be given to those that most effectively: 1) reduce active soil erosion, 2) provide source control of stormwater runoff, 3) focus on priority, high-loading areas, and 4) protect or enhance critical fish and wildlife habitats. Lake District resources shall be allocated in accordance with approved technical and cost-share standards and procedures. Appendix G contains current copies of the cost-share project scoring sheet, landowner participation guidelines, bidding standards, and contract templates.

  Note #1: Considerable resources have already been invested in protecting and repairing eroding shoreline and drainage ditch systems around the lake. In fact, much of what would be considered cost-share-eligible work in these particular areas has been largely completed. Consequently, future efforts should increasingly shift to other identified problem areas, or else focus on expanding or improving upon already completed BMPS. For residential areas around the lake, future work could involve further attempts to increase the number of functional rain gardens. For agricultural areas, attention could focus more on increasing the use of conservation farming practices, or negotiating additional land-preservation agreements pertaining to mapped critical areas.

Note #2: Given the many benefits associated with aquatic and shoreline vegetative buffers (i.e. increased habitat, runoff filtration, geese control, natural screening of buildings, etc.), consideration should be given to requiring their use as a condition to receiving cost-share assistance for any future shoreline-protection projects. A recent inventory found only a small handful of shoreline areas that remain cost-share eligible and in need of riprap protection.

Note #3: As far as possible ditch closures, future efforts should target channelized and ditched portions of the inlet tributary stream located between the Lake District Preserve and USH 18. All other ditches have either been repaired or plugged.

- **Partner with targeted landowners to protect identified "critical areas" and improve wetland function.**

  Critical areas represent unique but threatened habitat features and landscapes that are considered vital to the long-term health and condition of Lake Ripley. These areas are found both within the lake and throughout the watershed. The highest-priority critical areas are those that provide the greatest biophysical benefits or risks to the lake, and those that are most vulnerable to poor land-use management and degradation.

  The Lake District is advised to utilize a variety of land-preservation tools to help safeguard critical areas that offer valuable habitat and water quality benefits. Examples include negotiating voluntary land-use agreements, purchasing development rights, adopting environmental deed restrictions, and using fee-simple land acquisitions whenever appropriate. These measures will help ensure that such areas remain protected from future development or harmful land-use activities. Target areas should include wetlands, floodplain stream corridors, large woodlots or groundwater-recharge zones, and steeply sloped, highly erodible lands around the lake.

- **Encourage the planting of native trees throughout the watershed.**

  According to *American Rivers*, a mature, urban, forested area can reduce a drainage basin's peak stormwater runoff by 10-20%. Beyond the stormwater benefits, tree cover enhances area aesthetics, moderates air temperatures, reduces energy use, increases property values, and provides food and habitat for wildlife. Native tree planting is an inexpensive, long-term investment that should receive widespread public support. For maximum impact, trees should be located in areas that are best able to receive and absorb runoff. Outreach campaigns, cost-share incentives, and community tree-planting workshops can all be used effectively to increase the amount of trees growing in the watershed.

- **Consider providing free soil tests as a service to both residential and agricultural landowners.**

  The misuse of fertilizers can be a source of nutrient pollution to Lake Ripley. For example, even though only 20 ppm of phosphorus is needed to maintain a healthy lawn, most soils in our area are known to have concentrations that far exceed this amount. Storm runoff can easily transport fertilizer product and eroded soil into the lake where it can fuel algal blooms and nuisance weed growth. Despite a 2009 statewide ban on the sale and use of phosphorus lawn fertilizers, compliance rates have not been quantified, nor does the ban apply to phosphorus-based agricultural fertilizers. Soil testing is a relatively inexpensive means of measuring the phosphorus content of area soils. It can also be used to help inform property owners and farm operators on when additional fertilizer inputs are necessary, and when they are not.

## LAND-USE POLICY

- **Advocate for policies that reward developers who incorporate green infrastructure and low-impact development (LID) practices.**

  Building and development activities within the watershed can permanently alter the landscape and negatively impact downstream water quality. Fortunately, the Town of Oakland's urban service boundary presently confines a majority of these activities to areas west of County Road A, leaving much of the watershed in rural and agricultural land uses. For building activities within the urban service area, LID practices can be used as a means of limiting any negative effects to the lake.

  Conservation subdivision planning, reduced building footprints, impervious surface caps, narrower street widths, improved stormwater retention and various other methods should be encouraged or mandated through building and zoning policies. Some practices—such as rain barrels, rain gardens and the disconnection or redirection of roof downspouts—are so inexpensive and universally applied that they could be expected on all new residential sites. However, before advocating for the creation of new incentives and requirements to encourage LID, it is important to make sure the local zoning code allows for these efforts.

- **Advocate for policies at the Town and County levels that limit the amount of road salt applied on area streets.**

  Promising salt-reduction strategies exist and should be explored, both as a cost-saving measure and for purposes of long-term environmental protection. These include improved training of equipment operators, better designed salt-dispensing systems, use of sand-salt mixes, monitoring the amount of salt used per land mile, and the use of a long-lasting brine solution as an anti-icing agent applied to roads before an anticipated snow storm. While some of these strategies cost money, the expected payoffs would include improved environmental and public health combined with reductions in road-repair and replacement costs.

- **Advocate for policies at the Town and County levels that call for the use of grass swales, rain gardens and other measures to capture and treat street runoff, as opposed to the creation of curb-and-gutter systems that connect to storm sewer outfalls.**

  Connected impervious surfaces, such as traditional curb-and-gutter systems, provide limited opportunity for managing or treating excess storm runoff. Instead, these systems are designed to collect and move water as quickly as possible to a point of discharge—which usually takes the form of a lakeside or streamside storm sewer outfall. The end result is a greater volume, velocity and temperature of overland flow reaching the lake. This concentrated flow is better able to pick up and transport contaminants to the lake and with little to no pretreatment capability. Alternatively, roadways can be designed and pitched so they drain to grass-swale ditches and infiltration basins that are better able to absorb excess runoff.

- **Advocate for the adoption of a Town or County ordinance that would regulate or preclude the development of high-capacity wells where their operation could negatively affect Lake Ripley or its inlet tributary.**

  High-capacity wells pump at least 100,000 gallons per day, and have the potential to lower the groundwater table and alter regional lake levels and stream baseflows. Currently, high-capacity wells are weakly regulated by the state, but only if their operation would threaten municipal water supplies or Outstanding Resource Waters. The vast majority of lakes throughout Wisconsin, including Lake Ripley, do not enjoy the necessary legal protections to prevent harmful groundwater withdrawals. A local ordinance could help ensure that proposed projects involving high-capacity wells do not get approved unless it can be shown that their location and pumping rate would not be detrimental to lake health. There are currently no known high-capacity wells in operation near Lake Ripley, except for a high-capacity well that serves the Village of Cambridge.

- **Advocate for the development of multi-modal transportation options around Lake Ripley during street-reconstruction planning.**

  The most recent Lake District opinion survey reveals that walking and biking around Lake Ripley is among the most popular of activities enjoyed by local residents. Walking is how many people regularly access and enjoy the lake, and should be facilitated whenever possible. Currently, the lack of a lakeside pedestrian/biking path puts walkers and bikers at risk as they attempt to share the road with vehicular traffic. Supporting any future efforts to develop pedestrian paths around the lake and multi-modal transportation links to downtown Cambridge would help improve safety and reduce automobile dependence throughout the area.

- **Work with the Town of Oakland to explore the possibility of strengthening existing construction site erosion-control rules and enforcement standards.**

  Construction site erosion and sedimentation contributes to water quality problems throughout the Lake Ripley watershed. The close proximity of construction sites to ditches, swales, or other areas draining toward the lake can result in large sediment loads being delivered to the lake or its tributary. In fact, the Wisconsin DNR estimates that the average acre under construction is capable of delivering about 30 tons of soil per year to a lake or stream. This represents a soil erosion rate on a per area basis that can be 10 to 100 times greater than the rate of erosion from agriculture. According to the Nonpoint Source Control Plan for the Lake Ripley Priority Lake Project, construction erosion may have contributed about 450 tons per year of sediment to the lake from 1989-1993, or about 13% of the total estimated sediment load.

Enforcing state and local ordinances can be an effective means of reducing construction site erosion and its adverse water quality impacts. The Town of Oakland has adopted an erosion-control ordinance (Ordinance No. 36) that follows standards set forth in the Wisconsin Department of Commerce's Uniform Dwelling Code (UDC), which applies to one and two family dwellings. However, the UDC does not apply to multi-family dwellings, building repairs, moving of dwellings, or accessory buildings like detached garages, detached decks and farm buildings. Neither does it apply to many small-scale building projects that involve erosion-prone land disturbances. Another problem is that the frequency of inspections and the pursuit of enforcement actions has at times been lax, and can vary depending on the qualifications and availability of the building inspector. Without adequate monitoring and enforcement, construction site erosion will continue to be a significant source of sediment loading to Lake Ripley as corrective actions fail to occur on a timely basis.

- **Ensure that Lake District property annexed by the Village of Cambridge remains a part of and under the taxing authority of the District, and remains subject to shoreland zoning provisions.**

Future property annexations by the Village should not result in a reconfiguration of District taxing boundaries. Properties that were originally designated as being part of the District cannot separate from the District unless permitted as a result of established petitioning procedures, as per Chapter 33 of Wisconsin Statues. Otherwise, the effect of annexations is to create holes in the District. This process effectively removes benefiting properties from the District while shifting the tax burden to manage the lake to remaining property owners. As the Village annexes land, the land becomes incorporated and is no longer subject to county shoreland zoning rules that apply to unincorporated areas. This presents a potential problem as shoreland zoning rules are meant to protect lakes from harmful building practices.

- **Support the Town of Oakland's comprehensive growth plan (adopted 11-18-08) that places limits on the eastward expansion of the urban service area within the Lake Ripley watershed.**

Every effort should be made to confine future residential growth and development activities to the urban service area. This would help preserve the rural character and agricultural viability of areas lying east of County Road A. Preventing urban sprawl into these rural watershed areas would also limit the extent of water-impervious surfaces, while protecting the types of landscapes that are important for groundwater recharge. It is also important to note that the Town's revised growth plan contains recommendations relating to the protection of environmental corridors, important natural features, and local water quality. Strict adherence to these planning guidelines will go a long way toward maintaining the condition of Lake Ripley and its watershed.

## LAKE-USE POLICY

- **Maintain slow-no-wake and no-motor zoning ordinances in their current form.**

  Current no-wake times (7:30 p.m. – 11:00 a.m. daily) and no-wake zoning policies (200 ft. from shore and within portions of both shallow bays) are widely accepted by the public and appear to be achieving their intended objectives. These include an emergency no-wake rule that goes into effect during high-water events. Objectives of no-wake rules include separation of competing lake-use activities, keeping fast-moving traffic away from near-shore swimming areas, providing for quiet enjoyment of the lake, limiting the impact of boat wakes that cause shore erosion, protecting critical habitat areas, and reducing sediment re-suspension and lake-bottom disturbances caused by propeller turbulence. No-wake and other navigational marker buoys should be maintained in their current locations as per Wisconsin DNR permit. Additional buoys may be considered if needed to better demarcate these and other restricted areas. However, it should not be forgotten that an increased number of buoys requires greater installation and removal efforts, and may detract from the natural aesthetics of the lake.

- **Support Town of Oakland's lake-patrol program, and advocate for increased enforcement hours during peak-use boating times.**

  The enforcement of local lake rules is important for ensuring high compliance rates and maintaining safe lake use. Seasonal officers hired by the Town of Oakland currently work 35 hours per week during the boating season, and these hours primarily cover weekends. According to Chief Bruce Gondert, an average of one citation is issued for every seven hours of police time on the lake, with most citations related to slow-no-wake violations. Without a consistent law-enforcement presence, lake users become more prone to recreational conflicts and problems associated with repeat offenders. The District's volunteer Lake Watch program can be used to document observed lake-use violations and alert law-enforcement officials to potential problems. It can also help guide the scheduling of lake-patrol hours to reflect changes in observed violation patterns.

- **Discourage policies or actions that would increase motor boat access to the lake.**

  It was estimated that recreational carrying capacity is routinely exceeded during Lake Ripley's peak-use periods in terms of boat traffic. In addition, opinion surveys consistently indicate that adequate motor boat access is already available on the lake, and that many lake problems can be linked to traffic congestion.

  Expanding the existing boat landing or adding new boat-launch facilities would most likely increase crowding and reduce people's overall enjoyment of the resource. Parking rules at the public boat landing should be strictly enforced to prevent illegal parking, especially during peak-use periods when boating congestion is more likely to be a problem. Finally, launch fees should be maintained in accordance with Chapter 30.77, Wis. Stats., and may need to be periodically adjusted to stay consistent with rates charged at other area lakes. Revenues collected by the Town of Oakland related to the payment of these fees should be used specifically for the maintenance and improvement of the boat-launching facility.

- **Work with the Town of Oakland in advocating for and instituting an outdoor lighting ordinance, particularly if educational efforts prove ineffective at curbing unnecessary light pollution.**

  The natural beauty and aesthetic appeal of a darkened lake after nightfall is becoming increasingly threatened by the growing prevalence of light pollution. Many shoreland 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 and along the shoreline that project light out over the lake, onto neighboring properties, or into other areas where light is not needed. Excessive lighting also represents a wildlife concern, as certain nocturnal species may become disoriented or behaviorally disrupted by the intrusion of artificial light.

  By placing reasonable limitations on the use of such lighting systems, safety and security can be maintained without having to sacrifice this valued aesthetic attribute. Reducing bulb wattage, adjusting the location of lights, avoiding floodlights and pole-mounted lights, and using shades and covers to control the direction of light are all potential strategies that can be used to minimize the unwelcome effects of light pollution. The Town of Koshkonong (Jefferson County, WI) adopted an outdoor lighting ordinance in 2001. Language from this and other similar ordinances can be used as a model if this type of measure is ever considered for the Lake Ripley area.

## MANAGEMENT OF LAKE BIOTA

- **Use mechanical harvesting to cut and remove non-native, invasive lake weeds.**

  The Lake District should continue to us mechanical harvesting to manage non-native, nuisance weed growth in approved locations. Mechanical harvesting is recommended as an effective method for removing Eurasian watermilfoil canopies, establishing edge habitat for fish, opening boating lanes to improve access to open-water areas, and removing plant biomass that can deplete oxygen levels and release phosphorus if left in the lake to decay. It is also considered a relatively environmentally sound technique for the immediate (albeit temporary) control of milfoil in large, offshore areas. Finally, the District already has a significant investment in the capital equipment and trained staff necessary for carrying out a successful mechanical-harvesting program.

  Weed-harvesting activities should be performed in accordance with Wisconsin DNR permit conditions and harvesting guidelines specifically described in Chapter 5-13 and 5-14 of this Plan. Efforts should be focused on Eurasian watermilfoil and curly-leaf pondweed beds within approved locations. The disturbance of native, mixed-species plant beds should be avoided to maintain water quality protections and desirable fishery habitat.

- **Implement strategies that promote a diverse and thriving native plant community—both on shore and throughout the lake's littoral zone—to protect water quality and enhance fishery habitat.**

  Efforts should focus on selectively controlling non-native weed beds while minimizing disturbances to native and mixed-species plant communities. Control efforts should be targeted in a priority-driven manner that: 1) recognizes the root causes of nuisance weed growth; 2) preserves important ecological values of the larger plant community; 3) facilitates reasonable public access and navigation within high-traffic boating lanes; and 4) balances the needs of competing recreational uses.

  The District should implement plant-control programs and policies that support at least moderate amounts of vegetative cover (minimum 15-20% aerial cover). Native plant growth should be sufficient to protect water quality while providing habitat for indigenous fish and wildlife species, including rare, threatened or endangered resources. Encouraging and assisting lakefront property owners in planting aquatic emergent vegetation along their own shorelines would help advance this objective. Alternatively, excessive, non-native weed growth can be managed through mechanical harvesting so it does not unnecessarily restrict predator-prey dynamics, cause fish stunting, and contribute to excessive respiration and dissolved oxygen depletion during non-daylight hours.

- **Explore the feasibility of using spot herbicide treatments or hand pulling to more aggressively control curly-leaf pondweed in East Bay.**

  A relatively isolated colony of the non-native, invasive curly-leaf pondweed has been documented in East Bay, and was observed during the most recent (2009) harvesting season. Early and aggressive control of this weed bed may help slow its spread throughout the rest of the lake. However, because it is located within a Critical Habitat Area, it may not be possible to obtain the permit approvals needed to apply herbicides. Using SCUBA divers to hand pull small weed beds may be equally effective while reducing impacts to non-target species.

  Herbicides are not advocated as a lake-wide control method due to non-target toxicity concerns, as well as problems associated with the resulting decomposing plant biomass. Considerable caution is warranted given the location of these weed beds in relation to a Critical Habitat Area.

- **Support walleye stocking, carp-control efforts, and a thriving native aquatic plant community as "biomanipulation" tools that can positively influence water quality**.

  Reducing external nutrient loading is the key to long-term improvements in water quality. However, this alone is unpredictable as a restoration tool because of the effects of internal loading (recycling of phosphorus from the lake bottom). Biomanipulation can be used to improve water clarity by altering communities of aquatic organisms such as plants, algae, zooplankton and fish. Aquatic plants provide the basis for a clear-water trophic cascade since they promote predatory (piscivorous) fish populations, create shelter for zooplankton, compete to some degree with algae, and limit sediment re-suspension. Sediment re-suspension (which can be caused by carp) is a source of both algae-producing nutrients and turbidity. Experiments have shown that sediment re-suspension increases the rate of phosphorus release by up to 20-30 times greater than what can be expected from undisturbed sediment.

Since natural reproduction of walleye in Lake Ripley is minimal, the walleye-stocking program sponsored by the Wisconsin DNR should be continued to maintain a viable population. Walleyes have become a popular sport fish that can help keep panfish (planktivore) populations in check, and without displacing or negatively impacting other game fishes.

- **Protect designated Sensitive Areas, now called Critical Habitat Areas, by ensuring adequate enforcement of the Town of Oakland's pier and boating ordinances that affect these locations, and by advocating for additional protections if deemed necessary.**

  Critical Habitat Areas represent ecologically significant areas found in and around Lake Ripley. They are deemed important for sustaining native flora and fauna, and for preserving overall lake health. These areas were found to contain high-quality wetland and aquatic plant communities and other critical habitat features. Placing reasonable limitations on shoreline alterations, new pier development, and motorboat traffic within these specific locations will ensure that these unique natural assets are not unnecessarily damaged or destroyed.

  Critical Habitat Areas on Lake Ripley were originally mapped in the early-1990s, and were then subsequently incorporated into a Town of Oakland pier ordinance. A copy of the map that was created for purposes of the ordinance is included in Appendix D. In 2008, the Wisconsin DNR partnered with the Lake District to re-evaluate and re-map these areas based on a thorough assessment of current conditions. Although still considered to be in draft form, the present status of this updated map can be found in Chapter 5-7.

- **Partner with Wisconsin DNR to complete a re-evaluation and re-mapping of Lake Ripley's Critical Habitat Areas, a process that was started in 2008.**

  Aquatic plant communities and general shoreline conditions are in a constant state of flux, and their status has undoubtedly changed since Critical Habitat Areas (formerly called "Sensitive Areas) were first mapped in the early-1990s. Recognizing this fact, fieldwork was conducted by the Wisconsin DNR and Lake District during the summer of 2008 to identify and re-map critical habitat features in Lake Ripley. A draft report was subsequently prepared in 2009.[232] This process should be completed so that a final report can be issued by DNR and made available for public comment. In the event that any boundaries are materially

[232] Graham, Susan and Johnson, A. 2009. Critical Habitat Study Report, Lake Ripley, Jefferson County, Wisconsin (DRAFT). Wisconsin Department of Natural Resources.

adjusted, related boating and pier-development ordinances should be revisited to ensure that they continue to adequately protect these important areas.

- **Work with Wisconsin DNR in revisiting bag and size limits for bass, northern pike and walleye to ensure that current fish-harvest policies are meeting their objectives.**

  Bass, northern pike and walleye are arguably the most popular and sought after game fish on Lake Ripley. Aside from their obvious recreational value, they also represent important top predators that play a vital role in maintaining optimal lake health through their food-web interactions. Their feeding habits not only help curtail the overpopulation and stunting of panfish in the lake, but also effectively keep carp numbers in check. Fewer carp and panfish translates into improved water quality as a result of reduced sediment disturbance (also called "bioturbation") and less grazing on algae-consuming zooplankton. To sustain these food-web interactions, it is necessary that the resource not be subject to overharvesting. Promoting catch-and-release and setting appropriate bag and size limits are effective ways of maintaining a proper balance between these top predators and their forage base.

- **Investigate the feasibility and potential effectiveness of installing a carp barrier in the outlet stream channel.**

  Lake Ripley is hydraulically connected to Koshkonong Creek and the Rock River through its outlet channel. Consequently, carp have the ability to migrate back and forth between Lake Ripley and these larger drainage systems, particularly during high-water events. So far, Wisconsin DNR fish surveys show relatively small and stable populations of carp in Lake Ripley. To reduce carp recruitment in the lake, however, a carp gate or similar barrier may be helpful in limiting migration runs during the spring spawning season.

  This action would impact a navigable waterway and therefore require a Chapter 30 permit. The potential effectiveness of such barriers, and especially during high-water events, would have to be explored prior to permitting and implementation. Any investigation should examine the degree to which carp migrate back and forth through the outlet. Wiscosnin DNR fisheries biologists would be in the best position to carry out this type of investigation.

  In addition, it should also be noted that hosting community carp harvests can be used as a fun activity to help raise awareness while removing some carp from the lake. Such "carp-a-thons" have previously been organized by the Lake District, with most fish taken by bow after nightfall. Although these events are unlikely to make a significant dent in the lake's carp population, they involve little cost and can be used in combination with other efforts. Lake Ripley is not considered to be a good candidate for commercial harvesting due to low carp numbers in relation to lake size.

- **Assist targeted landowners in securing federal permits for the purpose of implementing egg-oiling efforts if necessary to control nuisance, non-migrating geese populations.**

  Giant Canada geese introduce bacteria and phosphorus to the lake in the form of goose droppings, although the actual amount relative to other sources has not been quantified.

Many of these geese no longer migrate and can quickly become a nuisance on the lake in larger numbers. Geese are also known to congregate as large flocks within certain areas, causing damage to shorelines and potentially displacing other wildlife. However, they are a protected species under the Federal Migratory Bird Act. In order to manage their numbers, it may be necessary to locate concentrated nesting areas and work with private landowners to engage in permitted egg-oiling efforts.

Egg oiling is considered a humane way of destroying the viability of a developing egg. When performed on a consistent basis, geese will usually leave in search of other more productive nesting areas. In addition to egg oiling, other geese-control strategies could include the creation of shoreline vegetative buffers, encouraging increased hunting in the area, using trained herding dogs or other harassment techniques, discouraging hand feeding, and limiting access to frequented foraging and nesting grounds. Each has its advantages and disadvantages in terms of effectiveness and degree of public acceptance.

Before pursuing any geese-control program, the Lake District will want to determine whether the magnitude of the problem warrants the necessary resources. Goose counts should be periodically performed to estimate population size and long-term trends, especially by monitoring known nesting and foraging sites around the lake. This type of monitoring would be helpful in determining whether current numbers are considered excessive.

## PUBLIC EDUCATION AND OUTREACH

- **Explore using additional incentive programs and community-based social marketing strategies to increase landowner participation rates relating to the implementation of watershed Best Management Practices (BMPs).**

  Water quality improvements are largely dependent on the voluntary implementation of BMPs and informed behavior change by landowners throughout the watershed. Consequently, the Lake District should investigate the feasibility of increasing the availability of cost-share grants, instituting special tax rebates (see Burnett County case study), offering green-development bonuses, hosting stewardship-recognition awards and events, or providing similar incentives to further motivate desired behavior changes.

  Also, most resource managers agree that without incentives, and unless required by regulation, landowners adopt new BMPs or behavior changes they perceive as being in their best interest. Social-marketing techniques should therefore be incorporated into existing outreach programs to better achieve required behavioral responses. Social capacity building goes beyond making individuals aware of a problem by ensuring that they have the knowledge, skills, ability and motivation to make meaningful behavior changes. Social-marketing programs that were developed for Lake Ripley relating to rain gardens and fertilizer use may be used as models.[233] If successful, these models should be expanded to other behaviors through the use of pilot projects.

[233] Cipiti, M., P. Heiberger, N. Hunt, J. Keeley, B. Panke and E. Sievers. 2007. Rain Gardens for Lake Ripley Watershed: How a Community-based Social Marketing Program Can Promote Rain Gardens. Human Behavior and Environmental Problems course report, University of Wisconsin-Madison.

In terms of project evaluation, “social indicators” can be used to fill the gap between BMP installation and documentable water-quality improvements. The logic behind social indicators is that water quality problems have accumulated over many decades and may well take decades to amend. Rather than measuring progress solely through changes in environmental indicators (like coliform bacteria counts, phosphorus concentrations, water clarity, etc.), or administrative indicators that say little about actual impact (like materials developed, meetings conducted, funds expended, etc.), social indicators provide information about people’s behaviors and the factors that influence them. Changes in these factors often precede water quality changes. Confirming that awareness and attitudes are changing and behaviors are being adopted in the watershed is one way to demonstrate progress toward water quality goals.[234]

- **Utilize multiple forms of media and social-marketing techniques to enhance the public’s ability to understand, evaluate and advocate for actions and policies that protect the lake.**

  The Lake District should focus on communicating “value,” “threats,” and “consequences of action or inaction” when conducting public outreach. It should also point out the connection between management investments and the enhancement of recreational opportunities and property values. The *Ripples* newsletter—which is consistently identified in opinion surveys as the preferred means of obtaining news about the lake—is recommended to serve as the primary mechanism for information sharing.

  Outreach efforts should be tailored according to the target audience the District is attempting to inform or influence. Topics of interest might include the purpose and status of ongoing management activities, an explanation of local lake rules and shoreland zoning policies, landowner cost sharing, invasive species prevention, home yard-care tips, and easy ways of staying informed and involved—among many others. Evaluation measures and procedures should be built into any outreach program to gauge its effectiveness. In addition to *Ripples*, other outreach tools should continue to include the following:

  - Lake District website (www.lakeripley.org)
  - Lake Ripley E-bulletins to disseminate time-sensitive announcements
  - “Welcome Wagon” mailings to new landowners
  - Public hearings on proposed policy changes
  - Televised Lake District Board meetings
  - Visits with homeowner associations
  - Articles in The Cambridge News
  - Educational programming on Cable TV 98
  - Community-service projects

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Fogarty, E., J. Huston, R. Maskin, B. Van Belleghem and S. Vang. 2007. Phosphorus Free for Lake Ripley: A Community-based Social Marketing Program to Use Phosphorus-free Lawn Fertilizer. Human Behavior and Environmental Problems course report, University of Wisconsin-Madison.

[234] Genskow, Ken, Linda Prokopy, and Rebecca Power. Fall 2008. Using Social Data in NPS Management. *LakeLine*. North American Lake Management Society.

- Informational workshops and seminars
- Signage and flyers (i.e. at public access points, Lake District Preserve, major street intersections near watershed boundaries)
- High-visibility demonstration projects for new BMPs
- Personal communications with landowners (i.e. phone calls, letters, site visits, etc.)
- Homeowner guides on various topics
- Public lake/watershed tours

Finally, inviting Town Board members on pontoon boat tours is an excellent way of increasing the awareness of local decision makers and building political support for coordinated management action.

- **Organize paid or volunteer watercraft inspectors to educate boaters about aquatic invasive species at boat launches.**

  Aquatic invasive species such as Eurasian watermilfoil and zebra mussels have already infested Lake Ripley. These and many other invasive species continue to spread inland from places like the Great Lakes, primarily as a result of transient recreational boat traffic. While it is currently illegal in Wisconsin to transport boating equipment with any attached plants or other organisms, additional policing and boater education is warranted to complement existing outreach programs. One or more boat inspectors can be stationed at the public boat landing and marina on busy summer weekends to help increase awareness and curb the threat of future of introductions. However, note that past attempts to solicit and train a sufficient number of volunteers was met with limited success. It may therefore be necessary to compensate workers or offer other incentives to sustain a viable program.

- **Maintain high-visibility informational signage at the public boat landing and other access locations.**

  At a minimum, boat-landing signage should contain lake maps and information that clearly inform the public about local lake ordinances, launch rules, documented aquatic invasive species, and preventative steps for controlling the spread of AIS. The placement of additional signs identifying the boundaries of the Lake Ripley watershed should also be considered. These types of signs can be used to increase public awareness about the geographic extent of the watershed, as well as the connection between land use and water quality. Existing signs that were developed as part of the Lake Ripley Priority Lake Project are currently located at the public boat landing and at the intersection of Park and Ripley Roads. Major street intersections near the boundaries of the watershed, particularly along County Highway A, offer other potential sign locations.

- **Ensure that the public is made aware of strategies or approaches to problems that the Lake District considers impractical, ill advised, of questionable impact, or beyond the District's charge and authority.**

  Identifying sound management strategies is as important as understanding why competing strategies may have been discounted. Potential solutions to different problems are always being proposed and investigated. Some perceived solutions may initially enjoy considerable public support, making it all the more challenging to temper public expectations and avoid getting sidetracked by ill-conceived management approaches. The following are just a few examples covering a range of different topics:

Drainage and flood relief: Most land-drainage and flood-control activities (i.e. drainage ditching, stream dredging, water diversions, etc.) fall outside of the Lake District's core mission, and even its legal authority. One exception would be the restoration of wetlands or the protection of groundwater recharge areas in which flood relief is a secondary benefit. Nonetheless, flood-control proposals can be common during unusually wet years when high water and widespread flooding increases the risk of property damage. While the Lake District may be able to offer guidance or connect property owners with the proper authorities, it is not legally or institutionally positioned to address such concerns.

Lake-level manipulation: Installing an outlet control structure as a means of moderating lake levels is regularly proposed, and has been the subject of prior investigations (see 10-17-05 Lake District meeting minutes). Unfortunately, a dam or similar structure would be of limited use in retaining water during severe drought conditions given the elevation of the outlet relative to the expected lake surface elevation. The use of such a structure to facilitate the release of floodwaters has its own set of challenges. For one, a Lake Ripley floodplain study showed that peak discharges at the outlet are substantially lower than the rate of inflow through the inlet. The study further showed that Park Road is the primary hydraulic control on Lake Ripley flood levels, and not the location of the existing outlet dam. Another complication is the relatively flat gradient of the outlet stream combined with the location of nearby homes in and around the floodplain. This situation makes increasing discharge volumes through the outlet problematic at best. Other concerns involve landowner-permission and permitting requirements, potential ecological and water quality impacts, cost, maintenance liability, and a low probability of significantly alleviating flooding problems. Instead, it is recommended that flood-reduction strategies be based on protecting and restoring wetland areas, reducing or infiltrating storm runoff, and keeping homes and other buildings out of the floodplain. If permitted repairs or improvements to the existing dam are ever contemplated, consideration could be given to a fixed-crest weir design that would be less prone to illegal manipulation.

Fish cribs: While seemingly beneficial as a habitat improvement, fish cribs can create more problems than they solve by concentrating game fish, focusing angling pressure, and increasing harvest rates. They also serve as a poor substitute for natural habitat features such as aquatic plant beds and downed timber along the shoreline margin.

Algacides and Herbicides: The use of chemicals to control nuisance weed and algal growth can contribute to a number of adverse side effects. Their long-term, environmental and public-health effects are often unknown, and it may be difficult if not impossible to minimize impacts to non-targeted species. In addition, these types of treatments fail to address the underlying cause of the problem, and can create entirely new problems as plant and algal material is left in the lake to decay. These problems may include dissolved oxygen depletion and the release of phosphorus that contribute to water quality impairments. However, limited herbicide use may be appropriate to prevent a lake-wide weed infestation, especially if a new weed is discovered to occupy only a small, discrete area.

Bans Based on Engine Size or Watercraft Type: Banning the use of watercraft by type, size or horsepower is routinely proposed as a means of correcting certain problems, particularly those that stem from aggressive motor boating behavior. However, such bans pose serious legal questions, and have been considered an arbitrary and unwarranted restriction of public rights in previous court rulings. These rulings were based chiefly on the Equal Protection clause of the U.S. Constitution and Wisconsin's Public Trust Doctrine. Unless it can be reasonably established that a certain watercraft or engine type, by nature of its design, is the cause of a particular problem, an outright ban may not be legally feasible. Bans may be construed as unfair or arbitrary, especially when such limits are not based on a scientifically defensible rationale. The Wisconsin DNR takes the position that ordinances regulating horsepower are overly restrictive and cannot be justified because they do not account for the fact that larger horsepower motors can be operated within established speed limits. Other control measures, such as slow-no-wake zoning, are likely to be more effective and will be perceived as being more equitable.

## EVALUATION AND ANALYSIS

- **Use computer modeling to identify realistic sediment/phosphorus-reduction targets on a watershed and subwatershed basis.**

  Computer models have been used for Lake Ripley in the past to try to quantify pollutant loading, estimate probable lake response, and establish reduction targets. Re-running these watershed-loading and lake-response models may be appropriate following major land-use change or the implementation of large-scale BMPs. Modeling output can and has been used to readjust goals and management efforts, thereby maintaining focus on the key watershed areas and land-use activities that contribute to larger problems.

  Note: While the Wisconsin Lake Management Suite (WiLMS) model was used for the purpose of this planning effort, re-running WINHUSLE other models could help derive a better understanding of site-specific sources and quantities of sediment and phosphorus loads to the lake. This, in turn, would aid in the targeting of BMPs.

- **Estimate the extent and sources of in-lake phosphorus recycling by developing more refined phosphorus and hydrologic budgets for the lake.**

  The effectiveness of external (or watershed-based) nutrient loading reductions may be limited due to in-lake phosphorus recycling. Current evidence suggests that while phosphorus recycling is occurring in Lake Ripley, it does not appear to be a significant problem in proportion to other sources. However, further study may be warranted to better quantify all sources of phosphorus loading, especially if long-term water clarity goals cannot be attained through the implementation of watershed practices alone. A phosphorus budget can also be used to estimate relative phosphorus loadings from geese droppings, or from the lake's only tributary. In 1993, monitoring of the inlet stream revealed consistently poor water quality and high phosphorus concentrations. This monitoring regimen could be repeated to assess the inlet's current condition.

Note: If deep-water phosphorus recycling is shown to be significant, the addition of aluminum sulfate (alum) could be considered as a possible management technique. Alum treatments are used to lower a lake's phosphorus content by producing a non-toxic, aluminum hydroxide "floc" that settles to the bottom and prevents the mobilization of phosphorus during anoxic conditions. Case studies suggest an average effectiveness timeframe of 7-10 years, but earlier cost estimates for Lake Ripley ranged from $150,000-200,000. Other *potentially* applicable options include hypolimnetic aeration or hypolimnetic withdrawal. The former attempts to oxygenate the hypolimnion during summer stratification, while the latter attempts to remove nutrient-rich, hypolimnetic water before it mixes with the entire water column by altering the depth at which water leaves the lake.

- **Assist the Wisconsin DNR and other permitting authorities to ensure a thorough and comprehensive permit evaluation of any future dredging proposals related to Lake Ripley's inlet channel or Vasby's Ditch.**

A group of property owners is currently pursuing the necessary permits and financing to re-dredge portions of the inlet channel, primarily to facilitate private motorboat access to the main water body. Given the potential scale, cost and range of impacts associated with such a large-scale dredging operation, the Lake District will need to ensure that the permit-review process is conducted in a complete and thorough manner. In particular, the District should review any proposed plans to verify that all water quality and ecological concerns are adequately addressed as a condition of approval. These concerns include ensuring that the proposed project will not adversely affect the lake or adjoining wetlands, which are mapped as designated "sensitive areas."

If it can be shown that dredging would achieve a beneficial objective in terms of the larger public interest, the Lake District may wish to consider supporting its implementation by providing cost sharing or technical assistance. However, before any funds are allocated, benefits should be clearly demonstrated and should significantly outweigh any potential negative impacts. The clearest benefit would go to the off-lake homeowners who would see improved motorboat access to the main water body. However, this would not constitute a public-access benefit, as the channel does not connect to a public boat landing. Any increased boating activity would result from boats accessing dredged portions of the channel from the main water body.

Depending on scope of work, public-interest benefits could *potentially* include: (1) enhanced sediment-detention capability through increased pooling and particulate settling; (2) removal of channel sediment that may prove to be a significant source of phosphorus loading --- assuming any high-phosphorus-content sediment is contained within the upper 1-1.5 feet of a sediment core, and that phosphorus release can be demonstrated to occur in significant quantities; (3) increased availability of open-water, pelagic fish habitat; and/or (4) post-dredging remediation that incorporates significant shoreland-habitat enhancements.

Alternatively, potential negative impacts could include: (1) increased turbidity and sediment-phosphorus release; (2) re-suspension of buried contaminants (if present); (3) loss of wetland-trapping function and habitat value from the re-establishment of an incised channel; (4) removal of beneficial aquatic/wetland plants and benthic organisms; (5) increased bank instability due to an artificial channel geomorphology; (6) disruption or permanent damage to Critical Habitat Areas; and (7) the need to repeat dredging at a recurrence frequency dependent on sediment-infilling rates. Finally, channelized streams tend to have more uniform flow velocities and substrates that are unsuitable for many forms of aquatic life. Each of these issues would also be pertinent to Vasby's Ditch, and would warrant serious scrutiny during permit review.

## CAPACITY BUILDING

- **Encourage board members and staff to attend continuing education seminars, conferences and workshops.**

  Attending lakes conferences, workshops and training seminars is a valuable way to network with other lake organizations and agency professionals. It is also a means of staying up to date on lake-related legislation, scientific research, new grant opportunities, and successful case studies relating to the design and implementation of management strategies. In-house training programs should also be explored. These efforts can be used to serve both new and experienced Board members, and could be modeled after successful programs sponsored by the Wisconsin Lake Leaders Institute. Potential educational topics could cover everything from lake district and open meetings law, to the science behind ongoing lake and watershed management efforts.

- **Utilize Board committees, citizen task forces, volunteer groups and student internships to increase the capacity of Lake District programs.**

  Lake District programs are limited by budget, staffing and time constraints. To expand the reach and effectiveness of District efforts, it may be possible to delegate certain activities to self-directed volunteers or interns. The Friends of the Preserve, Lake Watch volunteers, project interns, citizen advisory committees, and volunteer lake monitors are examples of groups and individuals who have donated their time and skills in the past.

- **Seek out grant opportunities and diverse partnerships to advance Lake District initiatives.**

  For every one dollar collected in taxes over the years to support lake-management work, over two dollars has been raised through various grants and in-kind donations. Local, state and federal grants have tremendously expanded the Lake District's operational capacity over the years. The same can be said of the strong professional relationships that are maintained with Town of Oakland, Jefferson County, Wisconsin DNR, U.S. Fish & Wildlife Service, University of Wisconsin, U.W.-Extension, Wisconsin Association of Lakes, and various other entities. Continued effort should be made to seek outside sources of funding, and to build new and diverse partnerships that advance mutual objectives.

The Jefferson County Land and Water Conservation Department, in particular, offers a cost-sharing program that is similar to the Lake District's program. For certain eligible projects, financial assistance can be coordinated to reduce the amount of the District's and/or landowner's cost-share match. While grants come from many sources, the Wisconsin DNR implements a number of funding programs that have been successfully utilized in the past. These grants have been used to finance efforts such as scientific research, lake-management planning, land and capital equipment acquisitions, lake-access improvements, and a number of watershed Best Management Practices (BMPs). Table 38 provides an abbreviated summary of the more relevant grant programs that could benefit the District in the future.

**Table 38: Grants available from the Wisconsin Department of Natural Resources**

| Grant | Awards | Application Deadline |
|---|---|---|
| Aquatic Invasive Species | 50% up to $10,000 or $75,000 depending on project | February 1 and August 1 |
| Lake Management Planning | 75% up to $10,000 for large-scale planning efforts | February 1 and August 1 |
| | 75% up to $3,000 for small-scale planning efforts | |
| Lake Protection | 75% up to $100,000 or $200,000 depending on project | May 1 |
| Recreational Boating Facilities | 50-90% depending on project | Ongoing; awards made up to four times per year |
| River Protection – Planning | 75% up to $10,000 | May 1 |
| River Protection – Management | 75% up to $50,000 | May 1 |
| Targeted Runoff Management | 70% up to $150,000 | April 15 |
| Urban Nonpoint Source and Stormwater Grants | 50% up to $150,000 for construction and $50,000 for land acquisition or easements | April 15 |

## LONG-TERM MONITORING

- **Maintain an updated inventory of completed projects and targeted properties that remain eligible for approved BMPs.**

The condition of previously implemented BMPs should undergo performance inspections at least every couple years. As for future projects, priority should be given to properties with a demonstrated need for corrective action, and those directly affecting or located in close proximity to the lake, major drainage routes, or identified critical areas such as wetlands. Inventoried properties and parcel-ownership records should be updated on a regular basis so outreach programs can be tailored to maximize landowner-participation rates. The availability of an interactive, web-based watershed map showing completed projects by type and location could help draw attention to cost-share efforts and promote further BMP investments.

- **Monitor changes in land-use conditions to identify potential problem areas and better target BMPs.**

  Water quality and lake health are greatly impacted by changes in watershed land cover and land use. Therefore, watershed activities and their affect on soil erosion and pollutant delivery should be closely monitored. This includes monitoring shoreline development activities, especially those that could impact Critical Habitat Areas. Active construction sites, agricultural cropping practices, livestock operations, shoreline/ditch conditions (i.e., type and amount of bank cover, evidence of erosion, structural improvements, etc.), and any significant landscape alterations should all be the focus of continued monitoring efforts. These efforts should involve regularly videotaping the shoreline and maintaining a photographic record of BMPs and Critical Habitat Areas.

- **Support the continuation of long-term trends monitoring on Lake Ripley by the Wisconsin DNR, including regular monitoring of water quality, fisheries and aquatic plant conditions.**

  Monitoring is an important part of watershed management that measures changes in watershed conditions and water quality. Identifying trends through long-term monitoring is critical to good lake planning and decision-making. It confirms progress toward stated goals, and reveals problems that require attention. Long-term trends monitoring has so far produced a wealth of information pertaining to Lake Ripley's past and present condition. This information has proved invaluable for assessing lake health, diagnosing problems, evaluating management programs, and distinguishing between real and perceived changes. Effective planning relies on the availability of this type of baseline data, and it provides the basis for informed management action.

- **Monitor water quality conditions by tracking a range of parameters and biotic indicators in accordance with recommended monitoring schedules (see Table 39).**

  Good water quality provides the basis for supporting all aquatic life in the lake, and is consistently cited as the most valued lake attribute by area property owners. There are many measures of water quality that can and should be used to track changes over time. Typical monitoring parameters taken over the deepest point in the lake include water clarity, chlorophyll-*a* concentrations (a measure of algae growth), total phosphorus concentrations (limiting nutrient that drives algae growth), and temperature/dissolved oxygen profiles. E. coli bacteria levels—which may indicate the presence of dangerous pathogens that can affect public health—are currently tracked on a weekly basis at the Ripley Park Beach by Jefferson County Health Department officials. Groundwater quality is also important to monitor, particularly to determine the extent of Atrazine and nitrate contamination caused by the widespread land application of fertilizers and herbicides. Finally, a number of biotic indictors (i.e., fish, plants and macroinvertebrates) can be used to evaluate water quality conditions.

Note #1: Concentrations of nutrients and other contaminants change as water moves through the watershed. Therefore, trends can be observed not only by long-term monitoring at a single point, but also by monitoring many points along a flow path.

Note #2: Adequate monitoring equipment is needed to maintain an effective lake-monitoring program. Equipment needs include a current meter for measuring stream flow, a temperature-dissolved oxygen probe, and a new staff gage for tracking changes in lake levels. Grants may be available to help defray costs.

- **Support annual electrofishing inventory and occasional fyke-net surveys by Wisconsin DNR fisheries biologists.**

  Fishery surveys are important for tracking fish recruitment (number of fish surviving to a certain size or age each year) and overall fishery health. The potential causes of variability should be evaluated, including weather during the spawning period, availability and quality of nursery cover, condition of the forage base, water quality changes, and harvest pressure. Data obtained from regular fishery inventories can be used to monitor the long-term health of different fish populations. Data can also be used to help identify a variety of lake-related problems. In many cases, changes in a lake's fishery can affect or be affected by changes in water quality and habitat availability through food-web manipulations. A database should continue to be maintained at the District office with updated fishery information.

  The Lake District should continue tracking the status of the lake chubsucker (*Erimyzon sucetta*), a Wisconsin Species of Special Concern. In addition, continued monitoring is recommended for the pugnose shiner (*Notropis anogenus*) and least darter (*Etheostoma microperca*), two Wisconsin Threatened Species that appear to have disappeared from the lake. The banded killifish (*Fundulus diaphanous*) is another rare and sensitive species that appears to have disappeared from the lake. Rediscovery of these species using effective capture methods could be an early indicator of water quality improvements or successful habitat recovery.

- **Conduct aquatic plant inventories at least every 4-5 years to evaluate changes in the plant community.**

  Different aquatic plants have different tolerance levels of environmental disturbance and degradation, making them excellent biotic indicators. A stable, diverse and thriving native aquatic plant community is a sign of good lake health. Alternatively, too much or too little plant growth is a sign of trouble, particularly when the plant community is dominated by only a few pollution-tolerant species. Plant inventories are used to track changes in the aquatic plant community over time. They are also used to monitor harvesting impacts on species diversity, distribution and densities within management zones.

- **Monitor lake use to track long-term changes in boating behavior and recreational-use patterns.**

  Lake Ripley is a popular but finite recreational resource. Space and other natural limitations somewhat control the types and intensity of lake activities. Boating ordinances and other lake-use policies also place limitations on these activities. Despite these limiting factors, a 2003 recreational boating study estimated that the lake's carrying capacity is regularly exceeded during peak-use periods. Lake-use patterns should be monitored each year to draw attention to potential problems related to crowding, and to better quantify long-term trends. Lake Watch volunteers may be used to document rule violations and conduct on-lake boat counts. In addition, annual counts of piers, boatlifts, rafts and parked boats should continue in order to track changes in the riparian boat fleet and related structures. This can be further documented through video documentation of the shoreline every 2-3 years. Finally, public opinion surveys that may be conducted in the future should include questions pertaining to lake use.

- **Survey the opinions of property owners and lake users at least every several years.**

  Comprehensive opinion surveys and targeted questionnaires are used to gauge public perceptions and attitudes on any number of issues related to the lake and its management. These efforts should be conducted at least every several years. It is important to assess the public's awareness and understanding of key management challenges, identify emerging concerns, and be able to re-evaluate community priorities. Examples of past opinion surveys can be found in Appendix F.

- **Synthesize and evaluate all available monitoring data at regular intervals to re-evaluate trends and diagnose emerging problems.**

  Continued data collection and information gathering is of critical importance to effective planning, problem diagnosis and strategy evaluation. Table 39 offers an overview of the suggested monitoring schedule for Lake Ripley.

**Table 39: Suggested Monitoring Schedule for Lake Ripley**

| Parameter or Information Type | April/May | June | July | August | September | October | Remarks |
|---|---|---|---|---|---|---|---|
| Secchi clarity | X | X | X | X | X | X | Every 10-14 days |
| Total phosphorus | X | X | X | X | | | 2 depths: 1 ft. below surface, and 2 ft. above lake bottom |
| Chlorophyll-*a* | | X | X | X | | | Lake surface; early and late season measurements optional |
| Temperature/dissolved oxygen profiles | X | X | X | X | X | | October measurement optional |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Complete water chemistry | X | | | | | | Spring turnover |
| Lake water levels | X | X | X | X | | | Every 10-14 days and during flood events from known elevation at W9073 Ripley Rd. (838.93' at top of steel plate on seawall 10' from west property line) |
| E. coli bacteria | | X | X | X | | | Weekly sampling at Lake Ripley Park beach by Jefferson County Health Department |
| Condition of inlet tributary stream | X | X | X | X | | | Flow, dissolved oxygen, phosphorus and ammonia as needed to evaluate changes since 1993 |
| Fish community | | | | | | X | Electrofishing surveys performed annually by Wisconsin DNR |
| Macroinvertebrates | | X | | | | | Collected from inlet and outlet streams to evaluate biotic indices |
| Aquatic plants | | | X | | | | Macrophyte surveys performed at least every 4-5 years |
| Zebra mussels | | X | X | X | | | Plate-sampler monitoring as appropriate to track trends |
| Phytoplankton (algae) and zooplankton | X | X | X | X | | | Optional; identify species and general abundance |
| On-lake boating | X | X | X | X | X | | On-lake, active boat counts taken randomly as volunteer time permits |
| Piers, boatlifts, swim rafts and parked watercraft | | | X | | | | Counts of individual piers, boatlifts, rafts, and moored or beached watercraft (by type) |
| Videotaping of shore conditions | | | X | | | | At least every 2 years |
| Groundwater contaminants | | | | | | | Area wells should be re-tested for chlorides, nitrates and triazine to identify land-use concerns that affect groundwater quality |
| Property owner opinion surveys | | | | | | | Every 4-6 years, or as needed for outreach development and program-evaluation purposes |
| Cost-shared BMPs | | | | | | | Inspect every 2 years or as needed; maintain information on location, ownership, BMP type, completion date, cost, and estimated impact |

- **Update management-planning findings and recommendations as needed.**

  This plan is intended to be continually updated, especially as new and applicable scientific research, technologies, case studies and management guidance become available. Consequently, the need to refine goals and objectives should be anticipated as management strategies are implemented and resource conditions change over the course of time. Any significant amendments or updates to the Plan shall be documented on a continual basis, preferably through an electronic-tracking system. Special document inserts or stickers can then be distributed to prior Plan recipients when deemed appropriate. At a minimum, recipients of this Plan shall include the Lake District Board, Town of Oakland Board, Jefferson County Land and Water Conservation Department, Wisconsin DNR, and Cambridge Library.

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# APPENDIX A

**LAKE RIPLEY MANAGEMENT DISTRICT**
**OPERATING AUTHORITY AND BY-LAWS**

## OPERATING AUTHORITY

The Lake Ripley Management District (hereinafter "District") is a local, special-purpose unit of government created by resolution of the Jefferson County Board, and under the authority of Chapter 33 of the Wisconsin Statutes, as a public inland lake protection and rehabilitation district. As such, the District, its officers and committees shall operate in accordance with Wis. Stats., Subchapters I-IV, Ch. 33.001-33.37 (Addendum 1); Wisconsin Open Meetings Law (Addendum 2); and any by-laws adopted by the Annual Meeting of the District electors. The adoption of by-laws or by-law amendments shall be listed below and documented in approved meeting minutes.

## BY-LAWS

Number of Commissioners: The Board of Commissioners shall be expanded from five to seven members as authorized by Ch. 33.28(2m). [08-20-94]

Nomination of Commissioners: The Board shall nominate candidates to fill all vacancies on the Board that may occur between annual meetings as provided in Ch. 33.28(2m)(7). Incumbent commissioners, whose terms are expiring and who wish to run for re-election, shall notify the secretary of their intentions at least 45 days prior to the annual meeting. Any three electors may nominate additional candidates by submitting written nomination papers to the secretary at least 45 days prior to the annual meeting. The names of all nominated candidates shall appear on the written and published notices of the annual meeting. Ballots printed for the election shall provide space for write-in candidates. [05-25-91]

Commissioner Stipends: Board commissioners shall receive a stipend of $50 per meeting attended as authorized by Ch. 33.30(4)(c). [08-22-98] The chair and treasurer shall each receive an additional $100 per month stipend. [08-17-02]

Elections Committee: The chair shall appoint three electors who are not running for the office of commissioner to serve as the elections committee. The committee shall distribute, collect, and count the ballots at the annual meeting and report the results to the annual meeting. [05-25-91]

Auditing Committee: The chair shall appoint three electors to serve as the auditing committee. The committee shall examine all financial records of the District and report its conclusions to the annual meeting. [05-25-91]

Other Committees: The chair may appoint other committees deemed necessary to further the interests of the District. Committee members shall serve at the pleasure of the chair, and shall receive no remuneration for service to the District. With prior approval from the Board, committee members may submit vouchers for actual and necessary expenses incurred while conducting the business of the District. [05-25-91]

Annual Meeting Voting: All votes shall be counted by a show of hands, unless otherwise specified by Statute. [05-25-91]

**ADENDUM 1**
**Wisconsin Governing Statutes**

Electronic reproduction of 2005−06 Wis. Stats. database, updated and current through February 29, 2008 and 2007 Wis. Act 54. Text from the 2005−06 Wis. Stats. database updated by the Revisor of Statutes. Only printed statutes are certified under s. 35.18(2), stats. Statutory changes effective prior to 4−2−08 are printed as if currently in effect. Statutory changes effective on or after 4−2−08 are designated by NOTES. Report errors at (608) 266−3561, FAX 264−6948, http://www.legis.state.wi.us/rsb/stats.html

# CHAPTER 33
# PUBLIC INLAND WATERS

SUBCHAPTER I
INTENT; DEFINITIONS; AND DEPARTMENTAL POWERS



SUBCHAPTER III
LAKE PROTECTION AND REHABILITATION PROJECTS



SUBCHAPTER IV
PUBLIC INLAND LAKE PROTECTION AND REHABILITATION DISTRICTS

SUBCHAPTER I

INTENT; DEFINITIONS; AND DEPARTMENTAL POWERS

**33.001 Findings and declaration of intent. (1)** The legislature finds environmental values, wildlife, public rights in navigable waters, and the public welfare are threatened by the deterioration of public lakes; that the protection and rehabilitation of the public inland lakes of this state are in the best interest of the citizens of this state; that the public health and welfare will be benefited thereby; that the current state effort to abate water pollution will not undo the eutrophic and other deteriorated conditions of many lakes; that current efforts to protect and rehabilitate the water quality of the navigable waters in Dane County, which receive intense urban, recreational and agricultural usage, are seriously handicapped by the fact that numerous governmental bodies have jurisdiction over the management of the watersheds in Dane County; that lakes form an important basis of the state's recreation industry; that the increasing recreational usage of the waters of this state justifies state action to enhance and restore the potential of our inland lakes to satisfy the needs of the citizenry; and that the positive public duty of this state as trustee of waters requires affirmative steps to protect and enhance this resource and protect environmental values.

**(2)** In accordance with sub. (1), the legislature declares all the following:

(a) It is necessary to embark upon a program of lake protection and rehabilitation, to authorize a conjunctive state and local program of lake protection and rehabilitation to fulfill the positive duty of the state as trustee of navigable waters, and protect environmental values.

(b) A state effort of research, analysis, planning and financing, and a local effort undertaken by districts, the Dane County Lakes and Watershed Commission and the Southeastern Wisconsin Fox River Commission of Planning and Plan Implementation are necessary and desirable and that the districts should be formed by persons directly affected by the deteriorated condition of inland waters and willing to assist financially, or through other means, in remedying lake problems.

(c) State efforts are needed to aid and assist local efforts, to ensure that projects are undertaken only if they promote the public rights in navigable waters, environmental values and the public welfare.

(d) State efforts are needed to administer a program of financial aids to support protection and rehabilitation projects with benefits to all state citizens.

**History:** 1973 c. 301; 1985 a. 332; 1989 a. 159, 324, 359; 1995 a. 349; 1997 a. 27.

**33.01 Definitions.** In ss. 33.001 to 33.37:

**(1c)** "Capital costs" means the cost of acquiring equipment and other capital assets, including sewerage system capital costs, for a program undertaken under ss. 33.001 to 33.37.

**(1g)** "Costs of operation" means all costs of a program undertaken under ss. 33.001 to 33.37, except capital costs.

**(2)** "Department" means the department of natural resources.

**(3)** "District" means a public inland lake protection and rehabilitation district.

**(4)** "Lake rehabilitation" means the improvement or restoration of lakes from an undesirable or degraded condition to a former, less deteriorated condition or to a condition of greater usefulness.

**(5)** "Municipality" means any city, village or town.

**(6)** "Program" means measures to effect lake protection and rehabilitation, including surveys of sources of degradation, treatment of aquatic nuisances, securing cooperation of units of general purpose government to enact necessary ordinances, undertaking of projects as defined in sub. (7) and any other necessary measures.

**(7)** "Project" means activities or works such as are described in s. 33.15 (4) which are subject to the procedures of subch. III.

**(8)** "Public inland lake" or "lake" means a lake, reservoir or flowage within the boundaries of the state that is accessible to the public via contiguous public lands or easements giving public access. "Lake" also includes any lake, reservoir or flowage within the boundaries of the state that is under the jurisdiction of a restructured district.

**(9)** "Owner", "property owner" or "landowner" means:

(a) For the purpose of receiving notice under this chapter, a person whose name appears as an owner of real property on the tax roll under s. 70.65 (2) (a) 1. that was delivered under s. 74.03 on or before the 3rd Monday in December of the previous year.

(am) For the purpose of petitioning under this chapter, any of the following:

1. A person whose name appears as an owner of real property on the tax roll under s. 70.65 (2) (a) 1. that was delivered under s. 74.03 on or before the 3rd Monday in December of the previous year.

2. The spouse of a person whose name appears as an owner of real property on the tax roll under s. 70.65 (2) (a) 1. that was delivered under s. 74.03 on or before the 3rd Monday in December of the previous year if the spouse is referred to on that tax roll.

(ar) For the purpose of voting at meetings of the district, a person who is a U.S. citizen and 18 years of age or older and who meets any of the following requirements:

1. The person's name appears as an owner of real property on the tax roll under s. 70.65 (2) (a) 1. that was delivered under s. 74.03 on or before the 3rd Monday in December of the previous year.

2. The person owns title to real property but the person's name does not appear as an owner of real property on the tax roll specified in subd. 1.

3. The person is the official representative, officer or employee who is authorized to vote on behalf of a trust, foundation, corporation, association or organization that owns real property in the district.

(b) For the purpose of holding office in the district, a person who is a U.S. citizen and 18 years of age or older and either:

1. Whose name appears as an owner of real property on the tax roll under s. 70.65 (2) (a) 1. that was delivered under s. 74.03 on or before the 3rd Monday in December of the previous year; or

2. Who owns title to real property but whose name does not appear as an owner of real property on the tax roll specified in subd. 1.

**(9g)** "Restructured district" means a district for a lake that results from a conversion under s. 33.235 (1m), a formation under s. 33.235 (2) or a merger under s. 33.235 (3).

**(9m)** "Sewerage system capital costs" has the meaning given for capital costs in s. 200.21 (1).

**(10)** "Valuation" or "equalized full value" means the assessed value of the property adjusted to reflect full value as determined by the department of revenue under s. 70.57.

**History:** 1973 c. 301, 336; 1975 c. 197, 198, 422; 1977 c. 391; 1979 c. 299; 1989 a. 159, 324; 1991 a. 39; 1993 a. 167; 1995 a. 349; 1997 a. 27; 1999 a. 150 s. 672.

**33.02 Department; powers and duties. (1)** RULES. (a) *Generally.* The department shall promulgate rules necessary to administer this chapter.

(b) *Financial aids.* These rules shall provide for the administration of financial aids to districts and shall prescribe data to be secured, methods of analysis and evaluation, duration of data gathering and other technical regulations for the efficient administration of the program and efficient intergovernmental organization.

(c) *Priorities for funding levels.* These rules shall establish priorities for different methods utilized in implementing lake protection and for lake rehabilitation based on cost−effectiveness and factors considered under s. 33.16 (4) especially s. 33.16 (4) (f).

(d) *Funding levels for different methods.* These rules shall establish differing levels for the share of state funds to be provided for financial assistance for implementation work depending on the methods to be utilized on the projects based on priorities established under par. (c).

(e) *Priorities when inadequate funds.* If the department does not have adequate appropriations to provide financial assistance under s. 33.16 for eligible projects, it shall establish priorities based on the type of project and methods to be utilized in implementing the projects and these priorities shall rank dredging, other than dredging to provide public access, as a low priority.

(f) *Dredging; sedimentation control.* These rules shall require that an application for financial assistance for the implementation of any project involving dredging include the identification of long−term controls which are being or will be undertaken to prevent sedimentation.

(g) *Algae abatement; nutrient control.* These rules shall require that an application for financial assistance for the implementation of any project involving algae or aquatic plant abatement programs include the identification of long−term controls which are being or will be undertaken to reduce or prevent nutrient pollution.

(h) *Guidelines for feasibility and implementation grants.* These rules shall establish guidelines for providing financial assistance for feasibility studies and implementation costs.

**(2)** STUDIES, INVENTORIES. The department shall undertake studies and inventories to assist the council in carrying out its duties.

**(3)** AIDS. The department shall administer a program of financial assistance to districts, using such funds as are appropriated by the legislature or made available from other sources.

**(4)** ASSISTANCE. The department shall assist districts seeking technical aid in any phase of lake protection or rehabilitation activity.

**(5)** CLEARINGHOUSE. The department shall serve as a clearinghouse for scientific data on lakes and information on accepted and experimental lake protection or rehabilitation techniques.

**History:** 1973 c. 301; 1975 c. 197; 1977 c. 26, 325; Stats. 1977 s. 33.02; 1979 c. 154; 1981 c. 317; 1985 a. 332 s. 251 (1).

**33.03 Cooperation by state agencies.** All departments and agencies of state government shall make available to the department such information and assistance as may be necessary to enable it to carry out its functions under this chapter.
**History:** 1973 c. 301; 1977 c. 26; Stats. 1977 s. 33.03.

## SUBCHAPTER III

## LAKE PROTECTION AND REHABILITATION PROJECTS

**33.11 Goals.** The primary goal of activity under this chapter shall be to improve or protect the quality of public inland lakes. In addition, compilation of basic scientific data on lakes of this state and assessment of experimental and innovative techniques of lake rehabilitation and protection shall be goals of the program. Districts may undertake protection and rehabilitation projects to achieve the purposes of such districts specified in s. 33.21. Projects may be undertaken in cooperation with the department, the University of Wisconsin System, and other government agencies, and public and private organizations. Projects shall be divided into study, planning and implementation phases.
**History:** 1973 c. 301; 1975 c. 197.

**33.12 Scope.** Any proposed activity by a district which does not involve an application for state aids or an application for a ch. 30 permit is exempt from subch. III. If a proposed activity by a district involves an application for state aids, subch. III applies. If a proposed activity by a district involves an application for a ch. 30 permit, subch. III shall apply only if the department determines that the activity requiring the permit is an integral part of a lake rehabilitation project.
**History:** 1973 c. 301.

**33.13 Feasibility study. (1)** Feasibility study work done through government agencies and public or private organizations shall include gathering data on the lake, drainage basin, sources of pollution or nutrients or other information necessary to determine the causes of degradation and remedial courses of action to prevent continued degradation or to determine potential causes of degradation and preventive courses of action. The department shall prescribe data to be secured, methods of analysis and evaluation, and duration of data−gathering to be used in feasibility studies.

**(2)** (a) The district may contract for feasibility study work with the lowest responsible bidder who submits a bid in the manner the district commissioners prescribe.

(b) In order to receive financial assistance for feasibility study work the district shall obtain the advice and approval of the department before entering a contract for feasibility study work and the department shall be made a party to the contract.

**(3)** Data gathered shall be forwarded to the department, which shall analyze it on an interdisciplinary basis.

**(4)** The department shall formulate suggested alternative methods, including cost estimates, of protecting or rehabilitating the water quality of the lake or portions thereof. Alternative protection schemes shall include steps necessary to maintain the water quality of the lake. Alternative rehabilitative schemes shall include steps necessary to abate continued degradation of the lake following implementation of a given rehabilitative plan.
**History:** 1973 c. 301; 1975 c. 197; 1981 c. 317.

**33.14 Plan preparation and adoption. (1)** PROPOSED PLAN. If specific lake protection and rehabilitation measures developed under s. 33.13 appear feasible and if financial assistance under s. 33.16 is sought, then the commissioners of the district shall develop a proposed plan based upon the recommendations of the department and the formulated alternatives or upon other technically valid bases.

**(2)** SUBMISSION OF PROPOSED PLAN. Prior to adopting a plan by formal resolution under s. 33.15, the commissioners shall:

(a) Forward a copy of the proposed plan to the department;

(b) Refer the proposed plan to the appropriate county land conservation committee and to the appropriate regional planning agency for the area, if any, for review and comment within 60 days of receipt; and

(c) Make application for any required permits and file an application for financial aid.

**(3)** DEPARTMENT REVIEW. Within 21 days after receipt of the proposed plan and applications the department shall advise the district if additional information is needed to conduct its technical and environmental review of the proposal. If an environmental impact statement is required, the department shall complete its environmental impact review before taking final action on the proposed plan.

**(3m)** NOTICE; HEARING. The department shall schedule a hearing on the proposed plan or follow the notice procedures under s. 31.06 (1).

**(4)** CONSIDERATIONS AT HEARING. If a hearing is conducted, the department shall consider the following:

(a) Compliance with s. 1.11;

(b) The issuance of permits which have been applied for;

(c) Whether the implementation of the plan is likely to cause long−range environmental pollution as defined in s. 299.01 (4);

(d) Comments made by the reviewing county land conservation committee and regional planning agency, if any; and

(e) Such other subjects as the department by rule deems necessary for making the order required by sub. (5).

**(5)** APPROVAL. Within 60 days following the hearing, the department shall by order either approve, approve with modification or disapprove the plan. The department shall concurrently rule on all permit applications.

**History:** 1973 c. 301; 1975 c. 197; 1979 c. 34 s. 2102 (39) (g); 1981 c. 20, 317; 1981 c. 346 s. 38; 1995 a. 227, 349.

**33.15 Implementation. (1)** No plan developed under this subchapter which involves financial assistance under s. 33.16 may be formally adopted for implementation by the district until the department approves the plans or whatever modifications it finds appropriate. If the department modifies an application by order, it shall clearly explain reasons why the modifications are being made.

**(2)** Following receipt of the department's order, the district may adopt the approved plan by resolution, in which case it shall forward a copy of the resolution and plan to the department.

**(3)** The district may then carry out the adopted plan of implementation.

**(4)** Implementation work may consist of any work in the lake or its watershed which will protect or enhance the opportunities for public enjoyment of the lake.

**History:** 1973 c. 301; 1975 c. 197; 1981 c. 20.

**33.16 Financial assistance program. (1)** Feasibility work contracted under s. 33.13 (2) (b) is eligible for financial assistance subject to guidelines established by rule by the department for funding feasibility studies. Receipt of financial assistance for feasibility work does not guarantee financial assistance for implementation costs and the department may not make this type of commitment for future financial assistance.

**(3)** A district desiring financial assistance shall apply to the department on forms provided by it and prescribing the information to be submitted.

**(4)** The department shall review all applications for financial assistance under this section. In the course of review of applications for financial assistance for implementation work the department shall consider, without limitation because of enumeration, the following factors where appropriate:

(a) Whether the citizens of the state will reasonably benefit from any improvements made or information obtained, and the degree of benefit;

(b) Whether sufficient long− and short−term benefits will be derived from the project, in relation to its cost;

(c) Whether the project is financially viable, given the resources of the district and the possibility of financial and non-monetary aid;

(d) Whether adequate steps have been or will be taken to ensure that the improved conditions resulting from the project will be sustained by adequate controls over potential sources of lake degradation including, where appropriate, control of sediments as suggested by the county land conservation committee;

(e) Whether experimental techniques involving a high risk of failure are being undertaken;

(f) Whether contamination from deleterious substances emitted by residential, municipal or industrial sources, sedimentation, siltation and nutrient fertilization from uncontrolled agricultural sources or septic tanks, groundwater, municipal and industrial wastes and other drainage sources, and any other sources responsible for lake degradation, are or will be substantially eliminated as a source of lake degradation, in order that any lake rehabilitated under this chapter may be protected or maintained in its protected or rehabilitated state;

(g) Whether the project involves dredging and, if it does, the expected useful duration of the proposed dredging, whether other techniques are available to provide relief from the problem to be solved by dredging and whether long−term controls are or will be undertaken to prevent sedimentation; and

(h) Whether the project involves algae or aquatic plant abatement programs and, if it does, whether long−term controls are or will be undertaken to reduce or prevent nutrient pollution.

**(5)** The department may not approve any application for financial assistance for the implementation of any project which involves dredging if the expected useful duration of the dredging
is less than 50 years. The department may not approve any application for financial assistance for the implementation of any project which involves dredging if the state funding provided by the department under the financial assistance program would provide more than 50% of the funding necessary for dredging other than dredging to provide public access. The department may not approve any application for financial assistance for the implementation of dredging if the amount of the financial assistance to be provided for dredging for a single project exceeds 10% of the funds available for all projects in the biennium. The department may not approve any application for financial assistance for the implementation of dredging unless no other reasonable alternative is available to provide relief from the problem to be solved by dredging.

**(6)** The department shall act upon each application for financial assistance within 60 days following plan approval and issuance of permits unless lack of adequate funding or the need to invoke a priority system dictates a delay in determination. Plan disapproval, delay in funding or other action not approving the application shall be explained by the department to the district in writing.

**(7)** (a) *District share.* The department may not grant financial assistance for implementation work in an amount which reduces a district's share of the project cost to less than 10%, except that up to 100% funding may be allowed on high−risk experimental projects where eventual results are highly uncertain.

(b) *Grant limit.* No grant for financial assistance under this section may exceed 25% of state funds available in the biennium.

(c) *Dredging limit.* No grant for financial assistance under this section may provide for funding for dredging in an amount which exceeds 10% of the funds available in the biennium.

(d) *Renewal.* The department may not renew a grant for financial assistance under this section in future bienniums unless the council finds that a special situation exists and recommends renewal of the grant.

(e) *North−south split.* The department shall grant financial assistance under this section so that not less than 25% of the moneys granted in any fiscal year are granted to districts north of a line running east−west across the state and commencing at the southernmost point on the southern boundary of the city of Stevens Point, except that this subsection does not preclude the full utilization of available funds if all applications north of this line aggregate less than 25% of the annual appropriations.

(f) *Level of funding; priorities.* The department shall grant financial assistance under this section with the appropriate level of state funding based upon rules promulgated under s. 33.02 (1)

(d). The department may deny financial assistance under this section based upon priorities promulgated by rule under s. 33.02 (1)(e).

**(8)** The department may evaluate or contract with the University of Wisconsin System to evaluate projects receiving financial assistance under this section.

**History:** 1973 c. 301; 1975 c. 197; 1981 c. 20, 317; 1981 c. 346 s. 38; 1981 c. 391; 1987 a. 27.

**33.17 Unfunded application to continue.** **(1)** Aid applications approved but unfunded because of a lack of funds remain eligible for future funding, subject to updating as the department may require. A lack of funding under this subchapter does not preclude a district from implementing all or part of an approved plan with funding from any other source but these projects are not eligible for retroactive financial assistance.

**(2)** The department shall return rejected applications to the district with a concise statement of the reasons for rejection.

**History:** 1973 c. 301; 1975 c. 197; 1981 c. 20.

**33.18 Use of tax incremental financing prohibited.** A district may not apply for or utilize tax incremental financing to fund an inland lake protection and rehabilitation program or project.

**History:** 1981 c. 317.

SUBCHAPTER IV

PUBLIC INLAND LAKE PROTECTION AND
REHABILITATION DISTRICTS

**33.21 Public inland lake protection and rehabilitation districts; purposes.** Districts may be created for the purpose of undertaking a program of lake protection and rehabilitation of a lake or parts thereof within the district.
**History:** 1973 c. 301; 1995 a. 349. A district may rehabilitate part of a lake only if the entire lake lies within the district. Kaiser v. City of Mauston, 99 Wis. 2d 345, 299 N.W.2d 259 (Ct. App. 1980).

**33.22 District; powers. (1)** Any district organized under this chapter may select a name for the district, sue and be sued, make contracts, accept gifts, purchase, lease, devise or otherwise acquire, hold, maintain or dispose of property, disburse money, contract debt and do any other acts necessary to carry out a program of lake protection and rehabilitation. All contracts in excess of $2,500 for the performance of any work or the purchase of any materials shall be let by the commissioners to the lowest responsible bidder in the manner they prescribe.

**(2)** The district may require that a contracting party give adequate security to assure performance of the contract and to pay all damages which may arise from inadequate performance.

**(2m)** Any district may create, operate and maintain a water safety patrol unit, as defined in s. 0.79 (1) (b) 2.

**(3)** (a) 1. Except as provided in par. (b) 1., any district organized under this chapter may have the powers of a town sanitary district under ss. 60.77 and 60.78, other than the power under s. 60.77 (6) (b), that are authorized by resolution of the board of the town having the largest portion by valuation of the district.

2. The board of commissioners of a district that has the powers of a sanitary district under subd. 1. shall possess the powers of town sanitary district commissioners under s. 60.77 that are authorized by resolution of the town board that adopts the resolution under subd. 1.

(b) 1. Beginning on April 9, 1994, any district organized under this chapter may assume the powers of a town sanitary district under ss. 60.77 and 60.78, other than the power under s. 60.77 (6) (b), that are authorized by resolution by the annual meeting of the district.

2. The board of commissioners of a district that assumes the powers of a sanitary district under subd. 1. shall possess the powers of town sanitary district commissioners that are authorized by resolution by the annual meeting of the district.

**(4)** Districts shall not exercise the town sanitary district powers authorized under sub. (3) within the boundaries of an incorporated municipality unless the governing body of the municipality consents. In addition, districts shall not exercise town sanitary district powers in any territory included in an existing town sanitary district except by contract under s. 66.0301 or unless the sanitary district merges under s. 33.235 (3).

**(4m)** A district may undertake projects to enhance the recreational uses of a lake within its jurisdiction, including recreational boating facilities as defined under s. 30.92 (1) (c).

**(4r)** If authorized by an annual meeting of a district, the district may appropriate money for the conservation of natural resources or for payment to a bona fide nonprofit organization for the conservation of natural resources within the district or beneficial to the district.

**(5)** Nothing in this chapter shall limit the authority of the department to establish town sanitary districts under s. 60.72.

**History:** 1973 c. 301; 1975 c. 197; 1977 c. 391; 1983 a. 532 s. 36; 1989 a. 159; 1991 a. 316; 1993 a. 167; 1995 a. 349; 1999 a. 150 s. 672.
A low bidder under s. 33.22 who is apparently a "responsible" bidder has standing to seek a permanent injunction against the award of a contract to any other bidder. Aqua−Tech v. Como Lake Protection & Rehabilitation District, 71 Wis. 2d 541, 239 N.W.2d 25 (1976).

**33.23 Municipalities may establish district. (1)** The governing body of a municipality may by resolution establish a district if the municipality encompasses within its boundaries all the frontage of the public inland lake within this state. Except as provided under sub. (3), the governing body of the municipality which establishes the district shall perform the function of the board of commissioners. For purposes of this subsection, "district" does not include a restructured district.

**(2)** Establishment of districts by towns under this section shall conform to the procedures of ss. 33.25 and 33.26 except that the town clerk shall perform the functions of the county clerk and the town board shall perform the functions of the county board and in addition shall hold the hearing.

**(3)** Districts established by municipalities under this section may adopt the form of governance provided under s. 33.28 by petition to the governing body of the municipality. Upon presentation of a petition conforming to

the requirements of s. 8.40 requesting the change and signed by at least 20% of the property owners within the district, the governing body of the municipality shall provide for the necessary election of commissioners. The election shall be held by secret ballot at the next annual or special meeting, whichever occurs first, of the district and the change becomes effective at that time unless a challenge to the results of that election is initiated in circuit court within 14 days after the election. The court shall stay the change pending the decision on the challenge.
**History:** 1973 c. 301; 1975 c. 197; 1977 c. 141, 391; 1981 c. 18, 229; 1989 a. 159, 192, 359; 1995 a. 349.

**33.235 Restructured districts; conversion and merger of town sanitary districts. (1)** In this section:

(a) "Lake" means a lake, reservoir or flowage within the boundaries of the state.

(b) "Lake district" means a public inland lake protection and rehabilitation district that does not include a restructured district.

**(1m)** A town board by resolution may convert a town sanitary district which encompasses all the frontage of a lake within its boundaries into a restructured district. The town sanitary district commissioners shall serve as the initial board of commissioners until the first annual meeting of the restructured district, at which time the commissioners shall be selected under s. 33.28. Conversion shall not affect any preexisting rights or liabilities of the town sanitary district. All such rights or liabilities shall be assumed automatically by the restructured district.

**(2)** The commissioners of a town sanitary district that does not encompass all the frontage of a lake within its boundaries may, with approval of the town board, petition under s. 33.25 for the formation of a restructured district to include the territory of the existing sanitary district and any additional frontage on the lake that is deemed appropriate by the commissioners. The commissioners may sign the petition for the landowners in the sanitary district. If necessary to meet the requirements of s. 33.25, signatures of owners of land lying outside the sanitary district shall be obtained. Formation of a restructured district that includes such additional territory shall not affect any preexisting rights or liabilities of the town sanitary district, and all these rights and liabilities shall be assumed automatically by the restructured district. The method by which these rights and liabilities are apportioned within the restructured district shall be determined by the county board, and set out in the order issued under s. 33.26 (3) forming the restructured district.

**(3)** A town sanitary district having boundaries coterminous or contiguous to a lake district may merge into the lake district. Merger is effected by approval of an identical merger resolution by a Two−thirds vote of the commissioners of the town sanitary district and the lake district, followed by ratification by a majority of those voting at an annual or special meeting of the lake district and a majority of those voting in a referendum of the town sanitary district under s. 60.785 (2). Merger may not become effective unless the town board which created the sanitary district approves the merger. The Commissioners of the town sanitary district and the district shall act jointly until the next annual or special meeting, whichever occurs first, of the restructured district at which time the board of the restructured district shall be created subject to the requirements under s. 33.28. Merger does not affect the preexisting rights or liabilities of the town sanitary district or the lake district. All these rights and liabilities are assumed automatically by the restructured district, but the method of discharging these rights or obligations shall be set out in the merger resolution.

**(4)** Any restructured district shall have all powers granted to districts under this chapter and to town sanitary districts under ch. 60, except the taxation power under s. 60.77 (6) (b). Such powers shall be exercised using the procedures and methods set out in this chapter.
**History:** 1975 c. 197; 1979 c. 299; 1983 a. 532 s. 36; 1989 a. 159; 1995 a. 349.

**33.24 County board may establish district. (1)** Notwithstanding s. 33.01 (3), in this section, "district" does not include a restructured district.

**(2)** The county board of any county may establish districts within the county if the conditions stated in s. 33.26 are found to exist. Before a district that includes any portion of a city or village may be formed under authority of this section, the city council or village board must have previously approved the inclusion of its territory within the boundaries of a proposed district.
**History:** 1973 c. 301; 1995 a. 349.

**33.25 Petition. (1)** WHO TO MAKE. (a) Before a county board may establish a district under s. 33.235 or 33.24, a petition requesting establishment shall be filed with the county clerk, addressed to the board and signed by persons constituting 51% of the landowners or the owners of 51% of the lands within the proposed district. Governmental subdivisions, other than the state or federal governments, owning lands within the proposed district are eligible to sign such petition. A city council or village or town board may by resolution represent persons owning lands within the proposed district who are within its jurisdiction, and sign for all such landowners.

(b) For a landowner that is a trust, foundation, corporation, association or organization, a petition under par. (a) shall be signed by an official representative, officer or employee who is authorized to do so by that landowner.

**(2)** CONTENTS. The petition shall set forth:

(a) The proposed name of the district;

(b) The necessity for the proposed district;

(c) That the public health, comfort, convenience, necessity or public welfare will be promoted by the establishment of the district and that the lands to be included therein will be benefited by such establishment; and

(d) The boundaries of the territory to be included in the proposed district.

**(3)** VERIFICATION, PLAT. The petition shall be verified by one of the petitioners, and shall be accompanied by a plat or sketch indicating the approximate area and boundaries of the district.

**(4)** PRESUMPTION. Every petition is presumed to have been signed by the persons whose signatures appear thereon, until proved otherwise.

**(5)** WITHDRAWING FROM PETITION. Any landowner who is considered to have signed the petition under sub. (1) may withdraw from the petition if the landowner files a written notice of the withdrawal with the county clerk at least 10 days before the date of the hearing under s. 33.26.

**History:** 1973 c. 301; 1975 c. 197; 1993 a. 167, 246; 1995 a. 349. The requirements for a verification under sub. (3) are that it is made under oath and carries the jurat of a notary public. Every person giving the oath is considered to have been lawfully sworn. Use of the word “certify” rather than “verify” is irrelevant. Nielsen v. Waukesha County Board of Supervisors, 178 Wis. 2d 498, 504 N.W.2d 621 (Ct. App. 1993).

**33.26 Hearings, time, notice, boundaries, approval, limitations. (1)** Upon receipt of the petition the county board shall arrange a hearing to be held not later than 30 days from the date of presentation of the petition, and shall appoint a committee to conduct the hearing. At the hearing all interested persons may offer objections, criticisms or suggestions as to the necessity of the proposed district as outlined and to the question of whether their property will be benefited by the establishment of such district. Any person wishing to object to the organization of such district may, before the date set for the hearing, file objections to the formation of such district with the county clerk.

**(2)** Notice announcing the hearing and stating the boundaries of the proposed district shall be published in a paper of general circulation in the county in which the proposed district is located as a class 1 notice, under ch. 985, and shall be mailed by the county board to the last−known address of each landowner within the proposed district.

**(3)** The committee shall report to the county board within 3 months after the date of the hearing. Within 6 months after the date of the hearing, the board shall issue its order under this subsection. If the board finds, after consideration of the committee’s report and any other evidence submitted to the board, that the petition is signed by the requisite owners as provided in s. 33.25, that the proposed district is necessary, that the public health, comfort, convenience, necessity or public welfare will be promoted by the establishment of the district, and that the property to be included in the district will be benefited by the establishment of the proposed district, the board, by order, shall declare its findings, shall establish the boundaries and shall declare the district organized and give it a corporate name by which it shall be known. Thereupon the district shall be a body corporate with the powers of a municipal corporation for the purposes of carrying out this chapter. If the board does not so find, the board, by order, shall declare its findings and deny the petition.

**(5)** The department shall be notified in writing of the hearing for the creation of the district at the time the hearing date is set.

**(6)** In establishing the district, the county board may change the boundaries from those originally proposed. However, lands not originally proposed for inclusion may not be included until a public hearing is held under this section.

**(7)** Any person aggrieved by the action of the board may petition the circuit court for judicial review. A verified petition shall be presented to the court not more than 30 days after the decision of the board, and shall specify the grounds upon which the appeal is based.

**History:** 1973 c. 301; 1979 c. 34 s. 2102 (39) (g); 1981 c. 20; 1991 a. 316; 1993 a. 167; 1995 a. 227; 2003 a. 275. Although not specified, the right to review under sub. (7) is by statutory certiorari. Donaldson v. Board of Commissioners of Rock−Koshkonong Lake District, 2004 WI 67, 272 Wis. 2d 146, 680 N.W.2d 762, 01−3396.

**33.265 Notice, filing and recording requirements.** If a district is created or its boundaries altered, the board of commissioners shall record the authorizing document, including a legal description of the boundary, with the

register of deeds in each county where the district is situated, and file the document and legal description with the department of natural resources and the department of revenue.
**History:** 1981 c. 20; 1993 a. 301.

**33.27 Initial district board of commissioners. (1)** The county board shall, at the time of making the order establishing a district, appoint 3 owners of property within the district, at least one of whom is a resident of the district, to serve as commissioners until the first annual meeting of the district, and shall also make the appointment required under s. 33.28 (2).

**(1m)** If no resident is willing to serve as required under sub. (1), the residency requirement shall be waived for the initial district board of commissioners.

**(2)** Within 30 days following the county board's order establishing the district, the governing body of the town, city or village having the largest portion by valuation within the district shall appoint one of its members to the district board under s. 33.28 (2).

**(3)** At any time following the making of the order establishing a district, but no later than 60 days following the expiration of time for appeal to the circuit court, or, if appealed, no later than 60 days following the final judgment in any appeal, the district board shall hold an organizational meeting, shall select officers to serve until the first annual meeting, and may commence conducting the affairs of the district.

**(4)** The board may make an initial assessment of all taxable property within the district to raise funds to pay organizational costs and operate the district until the receipt of the tax voted by the first annual meeting. The manner of making the assessment shall be within the discretion of the board.
**History:** 1973 c. 301; 1975 c. 197; 1979 c. 299; 1993 a. 167.

**33.28 District board of commissioners. (1)** Management of the affairs of the district shall be delegated to a board of commissioners.

**(2)** The board of commissioners shall consist of:

(a) One person appointed by the county board who is a member of the county land conservation committee or is nominated by the county land conservation committee and appointed by the county board;

(b) One member of the governing body of the town, village or city within which the largest portion by valuation of the district lies, appointed by the governing body and owning property within the district if possible; and

(c) Three electors or owners of property within the district elected by secret ballot by the qualified electors and property owners within the district, for staggered 3−year terms. At least one of the elected commissioners shall be a resident of the district.

**(2m)** (a) An annual meeting may permanently increase the number of members of the board of commissioners to be elected under sub. (2) (c) from 3 to 5.

(b) If no resident is willing to be elected as required under sub. (2) (c) for a given term, the residency requirement shall be waived until the end of that term.

**(3)** Three commissioners shall constitute a quorum for the transaction of business.

**(4)** The board shall select a chairperson, secretary and treasurer from among its members.

**(5)** Commissioners shall be paid actual and necessary expenses incurred while conducting business of the district, plus such compensation as may be established by the annual meeting.

**(6)** The board shall meet at least quarterly, and at other times on the call of the chairperson or the petition of 3 of the members.

**(7)** If a vacancy occurs in the membership of the board under sub. (2) (a) or (b), the appointing authority shall appoint a person to fill the vacancy. If a vacancy occurs in the membership of the board under sub. (2) (c), the chairperson of the board shall appoint a person to fill the remainder of the unexpired term, subject to approval by a majority vote of the board.
**History:** 1973 c. 301; 1975 c. 197; 1977 c. 391; 1979 c. 299; 1981 c. 18, 346; 1989 a. 159, 359; 1991 a. 32; 1993 a. 167.

**33.285 Property owning requirements.** Any requirement under s. 33.27 (1) or 33.28 that a person own property within the district to be eligible for membership on the board of commissioners is satisfied if a person is an official representative, officer or employee of any trust, foundation, corporation, association or organization which is an owner of property within the district.
**History:** 1975 c. 197; 1979 c. 299.

**33.29 Board of commissioners; officers; powers and duties. (1)** The board shall be responsible for:

(a) Initiating and coordinating research and surveys for the purpose of gathering data on the lake, related shorelands and the drainage basin;

(b) Planning lake protection and rehabilitation projects;

(c) Contacting and attempting to secure the cooperation of officials of units of general purpose government in the area for the purpose of enacting ordinances deemed necessary by the board as furthering the objectives of the district;

(d) Adopting and carrying out lake protection and rehabilitation plans and obtaining any necessary permits therefor; and

(e) Maintaining liaison with those officials of state government involved in lake protection and rehabilitation, and providing the department with the names and addresses of the current commissioners.

(f) Scheduling the annual meeting of the district.

(g) Preparing the proposed annual budget for presentation at the annual meeting of the district. The proposed annual budget shall include all of the following:

1. A list of all existing indebtedness and all anticipated revenue from all sources during the ensuing year.

2. A list of all proposed appropriations for each department, activity, and reserve account during the ensuing year.

3. The actual revenues and expenditures for the preceding year.

4. The actual revenues and expenditures for not less than the first 6 months of the current year.

5. The estimated revenues and expenditures for the balance of the current year.

6. For informational purposes by fund, all anticipated unexpended or unappropriated balances and surpluses.

**(2)** The board shall have control over the fiscal matters of the district, subject to the powers and directives of the annual or a special meeting. The board shall annually at the close of the fiscal year cause an audit to be made of the financial transactions of the district, which shall be submitted to the annual meeting.

**(3)** The board, immediately after each annual meeting, shall elect a chairperson, secretary and treasurer, whose duties shall be as follows:

(a) The chairperson shall preside at the annual meeting, at all special meetings and meetings of the board and at all public hearings held by the board.

(b) The secretary shall keep minutes of all meetings of the board and hearings held by it. The secretary shall prepare and send the notices required for the annual meeting, any special meeting, and any meeting of the board.

(c) The treasurer shall receive and take charge of all moneys of the district, and pay out the same only on order of the board.

**History:** 1973 c. 301; 1989 a. 159, 359; 2003 a. 275.

**33.30 Annual meeting of district. (1)** Every district shall have an annual meeting. Each annual meeting shall be scheduled during the time period between May 22 and September 8 unless scheduled outside those dates by majority vote of the previous annual meeting.

**(2)** (a) The annual meeting shall be preceded by written notice mailed at least 14 days in advance of the meeting to all electors within the district whose address is known or can be ascertained with reasonable diligence, to all owners of property within the district at the owner's address as listed in the tax roll, and to the department. The district board of commissioners may substitute a class 2 notice, under ch. 985, in lieu of sending written notice to electors residing within the district.

(b) No absentee ballots or proxies are permitted at the annual meeting.

**(2m)** The notice of the annual meeting under sub. (2) shall include all of the following:

(a) The proposed annual budget required under s. 33.29 (1) (g).

(b) A list of each item proposed for consideration at the annual meeting in addition to the proposed annual budget.

(c) A list of any items proposed for consideration at the annual meeting by persons eligible to vote at the annual meeting if all of the following conditions are met:

1. The item relates to an issue that is within the district's authority.

2. Each item is submitted by a petition to the board at least 30 days before the annual meeting.

3. The petition is signed by persons who are eligible to vote at the annual meeting.

4. The number of persons signing the petition equals or exceeds 20 percent of the number of parcels located in the district that are subject to the property tax.

**(3)** At the annual meeting, electors and property owners who attend the meeting shall do all of the following:

(a) Elect by secret ballot one or more commissioners to fill vacancies occurring in the elected membership of the district board.

(b) Approve a budget for the coming year. The electors and property owners may consider and vote on amendments to the budget before approving that budget. The budget shall separately identify the capital costs and the costs of operation of the district, shall conform with the applicable requirements under s. 33.29 (1) (g) and shall specify any item that has a cost to the district in excess of $10,000.

**(4)** At the annual meeting, electors and property owners may do any of the following:

(a) Vote by majority a tax upon all taxable property within the district. That portion of the tax that is for the costs of operation for the coming year may not exceed a rate of 2.5 mills of equalized valuation as determined by the department of revenue and reported to the district board. The tax shall be apportioned among the municipalities having property within the district on the basis of equalized full value, and a report shall be delivered by the treasurer, by November 1, by certified statement to the clerk of each municipality having property within the district for collection.

(b) Take up and consider such other business as comes before it.

(c) Establish compensation to be paid the district board commissioners.

(d) Create a nonlapsible fund to finance specifically identified capital costs and for maintenance of capital equipment.

**History:** 1973 c. 301; 1975 c. 197; 1977 c. 142, 391, 447; 1979 c. 299; 1981 c. 18, 20; 1989 a. 159; 1993 a. 167; 1995 a. 349; 2003 a. 275, 327.

**33.305 Special meetings of district. (1)** The board of commissioners of a district may schedule a special meeting of the district at any time. The board of commissioners shall schedule a special meeting upon receipt of a petition signed by at least 10% of the electors and property owners in the district.

**(2)** Written notice of a special meeting shall be given to the same persons and in the same manner required under s. 33.30 (2) (a).

**(3)** At a special meeting, electors and property owners may take any action that is required or allowed to be taken at an annual meeting, except they may not do any of the following:

(a) Approve an annual budget but they may consider and vote on amendments to the annual budget.

(c) Consider the dissolution of the district or dissolve the district.

(d) Consider a matter that was resolved during another special meeting that was held since the previous annual meeting.

**(4)** No absentee ballots or proxies are permitted at a special meeting.

**History:** 1989 a. 159; 1995 a. 349; 2003 a. 275.

**33.31 Power to finance. (1)** Every district may borrow money and use any other financing method prescribed by law. In utilizing financing powers, the commission shall follow the procedures required by statute for the selected financing methods so far as they are applicable and not in conflict with this subchapter.

**(2)** Any district, when in temporary need, may borrow money under s. 67.12.

**(3)** The district shall levy an annual, irrepealable tax to pay the principal and interest of the indebtedness incurred under subs. (1) and (2) when they are due. The district shall levy this tax without limitation as to rate or amount on all taxable property within the district. The tax shall be reported in accordance with s. 33.30 (4) (a) and may not be included nor includable in the operations tax limit of s. 33.30 (4) (a).

**(4)** At an annual or special meeting, the district may not consider or approve any borrowing or any tax to pay the indebtedness incurred under sub. (1) or (2) unless the meeting notice under s. 33.30 (2) (a) or 33.305 (2) includes a statement that borrowing or a tax levy to pay the indebtedness will be considered at the meeting.

**History:** 1973 c. 301; 1975 c. 197; 1977 c. 391; 1983 a. 207; 1989 a. 159; 1993 a. 167; 2003 a. 275.

**33.32 Special assessments and special charges. (1)** Special assessments for the purpose of carrying out district protection and rehabilitation projects, or for other lake management or sanitary service activities undertaken by the district, may be levied by the commissioners as an exercise of the district's police powers in the following manner:

(a) Upon approval of plans for any work by the annual or by a special meeting of the district, the commissioners shall determine the entire cost to the district of the work to be done.

(b) The commissioners shall then apportion the special assessment within the district, other than state or federal lands, on a reasonable basis. In apportioning the special assessment, the commissioners shall examine each parcel and determine the benefits to each parcel from the project, considering such factors as size, proximity to the lake and present and potential use of the parcel, including applicable zoning regulations. After benefits to each parcel are determined, assessments shall be made in an aggregate amount equal to the cost to the district of the project. Such assessments shall be made in accordance with s. 66.0703, so far as it is applicable and not in conflict with this subchapter.

(c) The commissioners shall file in the office of the county clerk a report of the assessments made. Notice shall be given to each owner, mortgagee, lessee or other person having an interest in an affected parcel that the report is open for review at a specified place within the district for 30 days after the date of the notice and that on a day named therein, which shall not be more than 3 days after the expiration of the 30 days, the commissioners will hear objections that may be made to the report. Notice shall be by mail to each person whose post−office address is known or can be ascertained with reasonable diligence, accompanied by a statement of the assessment, and shall also be published as a class 2 notice, under ch. 985, in a newspaper having general circulation within the district.

(d) At the time specified for hearing objections to the report, the commissioners shall hear parties interested who may appear for that purpose and may review, modify and correct the report as they deem just and at the conclusion of the hearing shall make a final determination of assessments. No assessment may be increased without additional notice to affected persons and provisions for hearing objections to such increases.

(e) When a final determination of assessments has been made, the secretary shall publish a class 1 notice, under ch. 985, within the district that a final determination has been made, and shall notify by mail each person entitled to notice under par. (c) of the amount assessed against the affected parcel.

(f) An owner, mortgagee, lessee or other person having an interest in any parcel affected by the determination who feels aggrieved thereby may, within 40 days after the date of mailing of notice, appeal therefrom to the circuit court of the county in which the district is located by causing a written notice of appeal to be served upon the secretary of the district. The secretary in case such appeal is taken shall make a brief statement of the proceedings had in the matter and shall transmit the same with all papers in the matter to the clerk of the circuit court. Such appeal shall be tried and determined in the same manner as cases originally commenced in said court.

**(2)** The commissioners of any district may provide that special assessments levied may be paid in annual installments, not more than 10 in number, in the manner provided in s. 66.0715 (3).

**(2m)** Any delinquent special assessment or special charge that is collected under s. 66.0627 (4) or 66.0703 (13) shall be levied without limitation as to rate or amount on all taxable property within the district, shall be reported in accordance with s. 33.30 (4) (a) and shall not be included or includable in the operations tax limit of s. 33.30 (4) (a).

**(3)** (a) County and municipally owned real estate within a district shall be subject to special assessments.

(b) If a county or municipality fails to pay a special assessment levied by a district, the clerk of the district may certify this fact to the department of administration, and shall state the amount due. The department, at the time of making the next scheduled distribution under s. 79.03, shall deduct the amount claimed from the payment due the county or municipality, and shall forward it to the district.

**(4)** Outstanding unpaid assessments on privately owned lands shall be paid in full by any public body, including the state, which purchases such lands.

**(5)** Sewerage system service charges imposed by districts with town sanitary district powers shall be in conformance with s. 66.0821. Special charges may be imposed for other services identified in the annual budget adopted under s. 33.30 (3) (b). The special charges may not exceed the rate of $2.50 per $1,000 of assessed valuation. The special charges may be certified by the district secretary to the clerk of each municipality having property within the district for collection and settlement in the same manner as provided under ch. 74. The commissioners shall allocate the charges to the property served in a manner prescribed by them unless the manner is specified by a resolution of the annual or of a special meeting. Delinquent special charges shall be governed by s. 66.0627 (4).

**History:** 1973 c. 301; 1975 c. 197; 1977 c. 391; 1983 a. 27 s. 2202 (45); 1989 a. 159; 1991 a. 316; 1993 a. 167; 1997 a. 35; 1999 a. 150 s. 672; 2001 a. 30; 2003 a. 275.

**33.33 Merger, attachment, detachment. (1)** MERGER. Any district may be merged with a contiguous district by resolution passed by a four−fifths vote of all the members of each board of commissioners. At the next annual or special meeting, whichever occurs first, the electors and property owners shall vote on whether to ratify the merger. If a majority of the electors and property owners present and voting in each district endorse the merger, it takes effect. Following ratification, the boards of commissioners of merging districts shall act jointly until the next annual or special meeting whichever occurs first, at which time the board of the merged district shall be conformed to the requirements specified in s. 33.28. The governing body of the county, town, village or city having the largest portion by valuation within the district shall make the appointments under s. 33.28 (2).

**(2)** ATTACHMENT. Contiguous territory may be attached to a district upon petition by the owner or motion of the commissioners.

(a) *Petition.* A petition by an owner, directed to the district and requesting attachment, may be accepted by majority vote of the commissioners, upon which the attachment shall become effective.

(b) *Motion.* If the commissioners by motion initiate attachment proceedings, they shall notify the owners of the territory contemplated for attachment and the county board. The county board shall schedule a hearing on the motion, using the procedure of s. 33.26 as far as is applicable. Following the hearing, the board shall make a finding on the necessity of attachment of territory, using the standards of s. 33.26 (3), and shall declare the territory to be either attached or not. Appeals of the board's decision shall be taken under s. 33.26 (7).

**(3)** DETACHMENT. Territory may be detached from the district following petition of the owner or motion of the commissioners. Proposals for detachment shall be considered by the commissioners, and territory may be detached upon a finding that such territory is not benefited by continued inclusion in the district. Appeals of the commissioners' decision may be taken under s. 33.26 (7).

**History:** 1973 c. 301; 1975 c. 197; 1981 c. 20; 1989 a. 159; 2003 a. 275. It is not always necessary for the petitioner in a detachment proceeding to prove that there has been a change in circumstances since the district was created. The finding of benefit to property required under s. 33.26 (3) in forming a district is not the same as the finding that the property is not benefited required under under s. 33.33 (3) to detach a property form the district. The s. 33.26 (3) finding is general and predictive. Section. 33.33 (3) requires an individualized evaluation of property under present circumstances. Donaldson v. Board of Commissioners of Rock−Koshkonong Lake District, 2004 WI 67, 272 Wis. 2d 146, 680 N.W.2d 762, 01−3396. Although not specified, the right to review under sub. (3) is by statutory certiorari. Donaldson v. Board of Commissioners of Rock−Koshkonong Lake District, 2004 WI 67, 272 Wis. 2d 146, 680 N.W.2d 762, 01−3396.

**33.35 Dissolution of districts.** A petition to dissolve an existing district created under this chapter may not be considered at an annual meeting of the district unless an elector within the district or a property owner within the district notifies the district board of commissioners in writing at least 90 days before the annual meeting that the elector or property owner intends to petition for dissolution at that annual meeting. The notice of the annual meeting must include a statement that a petition to dissolve the district will be considered. The district may be dissolved upon a two−thirds vote of the electors and property owners present at the annual meeting. The county board shall by order dissolve the district following receipt of the petition if the county board finds that one or more of the standards for the creation of a district under s. 33.26 (3) are not met. The order for dissolution shall be conditioned upon proper petition to the circuit court and appointment of a receiver to administer the winding up of the district under the supervision of the court and a final order of the court. The attorney general shall represent the state and shall be a party to every dissolution proceeding where state money is involved.

**History:** 1973 c. 301; 1989 a. 159.

**33.36 Alteration of districts. (1)** Whenever any territory that contains an entire district is incorporated as a city or village, consolidated with a city or village or annexed to a city or village, the district shall survive and shall be subject to s. 33.23.

**(2)** Whenever any territory containing less than an entire district is incorporated as a city or village, consolidated with a city or village or is annexed to a city or village, the district shall survive, and the district shall continue to operate under this chapter, subject to the following modifications:

(a) The district shall exercise only those powers granted under this chapter. Sanitary district powers shall not be exercised unless consent for such exercise is obtained in advance from the governing body of the city or village.

(b) The governing body of the city, village or town having the largest portion by valuation of the district within its jurisdiction shall make the appointment under s. 33.28.

(c) Ownership of any water or sewerage system shall be determined according to s. 60.79 (2) (d).

**History:** 1975 c. 197; 1983 a. 532 s. 36; 1989 a. 159.

**33.37 Districts in more than one county. (1)** Where the proposed district is in more than one county, the county board of the county within which the largest portion, by valuation, of the proposed district lies shall have jurisdiction under ss. 33.24 to 33.28.

**(2)** The county within which the largest portion, by valuation, of a district lies shall have jurisdiction on motions for attachment under s. 33.33 (2) (b) and on petitions for dissolution under s. 33.35.

**History:** 1977 c. 391

# ADENDUM 2
# Wisconsin Open Meetings Law

**Wisconsin Open Meetings Law**
**Wis. Stat. § 19.81-19.98**

**19.81 Declaration of policy.**

**(1)** In recognition of the fact that a representative government of the American type is dependent upon an informed electorate, it is declared to be the policy of this state that the public is entitled to the fullest and most complete information regarding the affairs of government as is compatible with the conduct of governmental business.

**(2)** To implement and ensure the public policy herein expressed, all meetings of all state and local governmental bodies shall be publicly held in places reasonably accessible to members of the public and shall be open to all citizens at all times unless otherwise expressly provided by law.

**(3)** In conformance with article IV, section 10, of the constitution, which states that the doors of each house shall remain open, except when the public welfare requires secrecy, it is declared to be the intent of the legislature to comply to the fullest extent with this subchapter.

**(4)** This subchapter shall be liberally construed to achieve the purposes set forth in this section, and the rule that penal statutes must be strictly construed shall be limited to the enforcement of forfeitures and shall not otherwise apply to actions brought under this subchapter or to interpretations thereof.

**19.82 Definitions.**

As used in this subchapter:

**(1)** "Governmental body" means a state or local agency, board, commission, committee, council, department or public body corporate and politic created by constitution, statute, ordinance, rule or order; a governmental or quasi-governmental corporation except for the Bradley center sports and entertainment corporation; a local exposition district under subch. II of ch. 229; any public purpose corporation, as defined in s. 181.79 (1); a nonprofit corporation operating the Olympic ice training center under s. 42.11 (3); or a formally constituted subunit of any of the foregoing, but excludes any such body or committee or subunit of such body which is formed for or meeting for the purpose of collective bargaining under subch. I, IV or V of ch. 111.

**(2)** "Meeting" means the convening of members of a governmental body for the purpose of exercising the responsibilities, authority, power or duties delegated to or vested in the body. If one-half or more of the members of a governmental body are present, the meeting is rebuttably presumed to be for the purpose of exercising the responsibilities, authority, power or duties delegated to or vested in the body. The term does not include any social or chance gathering or conference which is not intended to avoid this subchapter, any gathering of the members of a town board for the purpose specified in s. 60.50 (6), any gathering of the commissioners of a town sanitary district for the purpose specified in s. 60.77 (5) (k) or any gathering of the members of a drainage board created under s. 88.16, 1991 stats., or under s. 88.17, for a purpose specified in s. 88.065 (5) (a).

**(3)** "Open session" means a meeting which is held in a place reasonably accessible to members of the public and open to all citizens at all times. In the case of a state governmental body, it means a meeting which is held in a building and room thereof which enables access by persons with functional limitations, as defined in s. 101.13 (1).

**19.83 Meetings of governmental bodies.**

**(1)** Every meeting of a governmental body shall be preceded by public notice as provided in s. 19.84, and shall be held in open session. At any meeting of a governmental body, all discussion shall be held and all action of any kind, formal or informal, shall be initiated, deliberated upon and acted upon only in open session except as provided in s. 19.85.

**(2)** During a period of public comment under s. 19.84 (2), a governmental body may discuss any matter raised by the public.

**19.84 Public notice.**

**(1)** Public notice of all meetings of a governmental body shall be given in the following manner:

(a) As required by any other statutes; and (b) By communication from the chief presiding officer of a governmental body or such person's designee to the public, to those news media who have filed a written request for such notice, and to the official newspaper designated under ss. 985.04, 985.05 and 985.06 or, if none exists, to a news medium likely to give notice in the area.

(2) Every public notice of a meeting of a governmental body shall set forth the time, date, place and subject matter of the meeting, including that intended for consideration at any contemplated closed session, in such form as is reasonably likely to apprise members of the public and the news media thereof. The public notice of a meeting of a governmental body may provide for a period of public comment, during which the body may receive information from members of the public.

**(3)** Public notice of every meeting of a governmental body shall be given at least 24 hours prior to the commencement of such meeting unless for good cause such notice is impossible or impractical, in which case shorter notice may be given, but in no case may the notice be provided less than 2 hours in advance of the meeting.

**(4)** Separate public notice shall be given for each meeting of a governmental body at a time and date reasonably proximate to the time and date of the meeting.

**(5)** Departments and their subunits in any university of Wisconsin system institution or campus and a nonprofit corporation operating the Olympic ice training center under s. 42.11 (3) are exempt from the requirements of subs. (1) to (4) but shall provide meeting notice which is reasonably likely to apprise interested persons, and news media who have filed written requests for such notice.

**(6)** Notwithstanding the requirements of s. 19.83 and the requirements of this section, a governmental body which is a formally constituted subunit of a parent governmental body may conduct a meeting without public notice as required by this section during a lawful meeting of the parent governmental body, during a recess in such meeting or immediately after such meeting for the purpose of discussing or acting upon a matter which was the subject of that meeting of the parent governmental body. The presiding officer of the parent governmental body shall publicly announce the time, place and subject matter of the meeting of the subunit in advance at the meeting of the parent body.

**19.85 Exemptions.**

**(1)** Any meeting of a governmental body, upon motion duly made and carried, may be convened in closed session under one or more of the exemptions provided in this section. The motion shall be carried by a majority vote in such manner that the vote of each member is ascertained and recorded in the minutes. No motion to convene in closed session may be adopted unless the chief presiding officer announces to those present at the meeting at which such motion is made, the nature of the business to be considered at such closed session, and the specific exemption or exemptions under this subsection by which such closed session is claimed to be authorized. Such announcement shall become part of the record of the meeting. No business may be taken up at any closed session except that which relates to matters contained in the chief presiding officer's announcement of the closed session. A closed session may be held for any of the following purposes:

(a) Deliberating concerning a case which was the subject of any judicial or quasi-judicial trial or hearing before that governmental body.

(b) Considering dismissal, demotion, licensing or discipline of any public employe or person licensed by a board or commission or the investigation of charges against such person, or considering the grant or denial of tenure for a university faculty member, and the taking of formal action on any such matter; provided that the faculty member or other public employe or person licensed is given actual notice of any evidentiary hearing which may be held prior to final action being taken and of any meeting at which final action may be taken. The notice shall contain a statement that the person has the right to demand that the evidentiary hearing or meeting be held in open session. This paragraph and par. (f) do not apply to any such evidentiary hearing or meeting where the employe or person licensed requests that an open session be held.

(c) Considering employment, promotion, compensation or performance evaluation data of any public employe over which the governmental body has jurisdiction or exercises responsibility.

(d) Except as provided by rule promulgated under s. 304.06 (1) (em), considering specific applications of probation or parole, or considering strategy for crime detection or prevention.

(e) Deliberating or negotiating the purchasing of public properties, the investing of public funds, or conducting other specified public business, whenever competitive or bargaining reasons require a closed session.

(ee) Deliberating by the council on unemployment compensation in a meeting at which all employer members of the council or all employe members of the council are excluded.

(eg) Deliberating by the council on worker's compensation in a meeting at which all employer members of the council or all employe members of the council are excluded.

(em) Deliberating under s. 157.70 if the location of a burial site, as defined in s. 157.70 (1) (b), is a subject of the deliberation and if discussing the location in public would be likely to result in disturbance of the burial site.

(f) Considering financial, medical, social or personal histories or disciplinary data of specific persons, preliminary consideration of specific personnel problems or the investigation of charges against specific persons except where par. (b) applies which, if discussed in public, would be likely to have a substantial adverse effect upon the reputation of any person referred to in such histories or data, or involved in such problems or investigations.

(g) Conferring with legal counsel for the governmental body who is rendering oral or written advice concerning strategy to be adopted by the body with respect to litigation in which it is or is likely to become involved.

(h) Consideration of requests for confidential written advice from the ethics board under s. 19.46 (2), or from any county or municipal ethics board under s. 19.59 (5).

(i) Considering any and all matters related to acts by businesses under s. 560.15 which, if discussed in public, could adversely affect the business, its employes or former employes.

(j) Considering financial information relating to the support by a person, other than an authority, of a nonprofit corporation operating the Olympic ice training center under s. 42.11 (3), if the information is exempt from disclosure under s. 42.115 or would be so exempt were the information to be contained in a record. In this paragraph, "authority" and "record" have the meanings given under s. 19.32.

**(2)** No governmental body may commence a meeting, subsequently convene in closed session and thereafter reconvene again in open session within 12 hours after completion of the closed session, unless public notice of such subsequent open session was given at the same time and in the same manner as the public notice of the meeting convened prior to the closed session.

**(3)** Nothing in this subchapter shall be construed to authorize a governmental body to consider at a meeting in closed session the final ratification or approval of a collective bargaining agreement under subch. I, IV or V of ch. 111 which has been negotiated by such body or on its behalf.

**19.86 Notice of collective bargaining negotiations.**

Notwithstanding s. 19.82 (1), where notice has been given by either party to a collective bargaining agreement under subch. I, IV or V of ch. 111 to reopen such agreement at its expiration date, the employer shall give notice of such contract reopening as provided in s. 19.84 (1) (b). If the employer is not a governmental body, notice shall be given by the employer's chief officer or such person's designee. This section does not apply to a nonprofit corporation operating the Olympic ice training center under s. 42.11 (3).

**19.87 Legislative meetings.**

This subchapter shall apply to all meetings of the senate and assembly and the committees, subcommittees and other subunits thereof, except that:

(1) Section 19.84 shall not apply to any meeting of the legislature or a subunit thereof called solely for the purpose of scheduling business before the legislative body; or adopting resolutions of which the sole purpose is scheduling business before the senate or the assembly.

(2) No provision of this subchapter which conflicts with a rule of the senate or assembly or joint rule of the legislature shall apply to a meeting conducted in compliance with such rule.

(3) No provision of this subchapter shall apply to any partisan caucus of the senate or any partisan caucus of the assembly, except as provided by legislative rule.

(4) Meetings of the senate or assembly committee on organization under s. 71.78 (4) (c) or 77.61

(5) (b) 3. shall be closed to the public.

**19.88 Ballots, votes and records.**

**(1)** Unless otherwise specifically provided by statute, no secret ballot may be utilized to determine any election or other decision of a governmental body except the election of the officers of such body in any meeting.

**(2)** Except as provided in sub. (1) in the case of officers, any member of a governmental body may require that a vote be taken at any meeting in such manner that the vote of each member is ascertained and recorded.

**(3)** The motions and roll call votes of each meeting of a governmental body shall be recorded, preserved and open to public inspection to the extent prescribed in subch. II of ch. 19.

**19.89 Exclusion of members.**

No duly elected or appointed member of a governmental body may be excluded from any meeting of such body. Unless the rules of a governmental body provide to the contrary, no member of the body may be excluded from any meeting of a subunit of that governmental body.

**19.90 Use of equipment in open session.**

Whenever a governmental body holds a meeting in open session, the body shall make a reasonable effort to accommodate any person desiring to record, film or photograph the meeting. This section does not permit recording, filming or photographing such a meeting in a manner that interferes with the conduct of the meeting or the rights of the participants.

**19.96 Penalty.**

Any member of a governmental body who knowingly attends a meeting of such body held in violation of this subchapter, or who, in his or her official capacity, otherwise violates this subchapter by some act or omission shall forfeit without reimbursement not less than $25 nor more than $300 for each such violation. No member of a governmental body is liable under this subchapter on account of his or her attendance at a meeting held in violation of this subchapter if he or she makes or votes in favor of a motion to prevent the violation from occurring, or if, before the violation occurs, his or her votes on all relevant motions were inconsistent with all those circumstances which cause the violation.

**19.97 Enforcement.**

**(1)** This subchapter shall be enforced in the name and on behalf of the state by the attorney general or, upon the verified complaint of any person, by the district attorney of any county wherein a violation may occur. In actions brought by the attorney general, the court shall award any forfeiture recovered together with reasonable costs to the state; and in actions brought by the district attorney, the court shall award any forfeiture recovered together with reasonable costs to the county.

**(2)** In addition and supplementary to the remedy provided in s. 19.96, the attorney general or the district attorney may commence an action, separately or in conjunction with an action brought under s. 19.96, to obtain such other legal or equitable relief, including but not limited to mandamus, injunction or declaratory judgment, as may be appropriate under the circumstances.

**(3)** Any action taken at a meeting of a governmental body held in violation of this subchapter is voidable, upon action brought by the attorney general or the district attorney of the county wherein the violation occurred. However, any judgment declaring such action void shall not be entered unless the court finds, under the facts of the particular case, that the public interest in the enforcement of this subchapter outweighs any public interest which there may be in sustaining the validity of the action taken.

**(4)** If the district attorney refuses or otherwise fails to commence an action to enforce this subchapter within 20 days after receiving a verified complaint, the person making such complaint may bring an action under subs. (1) to (3) on his or her relation in the name, and on behalf, of the state. In such actions, the court may award actual and necessary costs of prosecution, including reasonable attorney fees to the relator if he or she prevails, but any forfeiture recovered shall be paid to the state.

**(5)** Sections 893.80 and 893.82 do not apply to actions commenced under this section.

**19.98 Interpretation by attorney general.**

Any person may request advice from the attorney general as to the applicability of this subchapter under any circumstances.

# APPENDIX B

## LAKE RIPLEY MANAGEMENT DISTRICT
## 2010 BUDGET

| | 2008 ACTUAL | 2009 JAN-JUNE ACTUAL | 2009 JAN-DEC ESTIMATED | 2010 PROPOSED BUDGET |
|---|---|---|---|---|
| **Revenues:** | | | | |
| Real Estate Tax Levy | $ 110,211 | $ 71,608 | $ 110,517 | $ 112,888 |
| Grants | 240,830 | - | 75,000 | - |
| Interest Income | 5,695 | 337 | 837 | - |
| Carry-over | 2,700 | 1,572 | 1,572 | 4,000 |
| Other | 1,107 | 2,048 | 4,006 | - |
| Restricted Funds Transferred | 117,523 | 10,250 | 10,250 | - |
| Total Revenues | 478,066 | 85,815 | 202,182 | 116,888 |
| **Projects:** | | | | |
| Staff Payroll/Fringes/Taxes | 60,448 | 31,679 | 63,359 | 64,598 |
| Landowner Cost Sharing | 7,304 | 13,635 | 28,635 | 10,000 |
| Weed Harvesting | 6,749 | 1,506 | 5,314 | 5,775 |
| Lake District Preserve | 1,710 | 50 | 2,000 | 3,000 |
| Special Programs | 72 | 33 | 250 | 250 |
| Conservation Easements | - | - | - | - |
| Grant Expenses | 6,595 | - | - | - |
| Preserve Restoration/Development | - | 2,800 | 2,800 | - |
| **Insurance:** | | | | |
| General Liability | 1,879 | - | 1,956 | 2,000 |
| Marine & Truck | 1,053 | - | 1,149 | 1,300 |
| Worker's Compensation | 923 | 918 | 918 | 950 |
| **Operations:** | | | | |
| Legal Counsel | 574 | - | - | 3,000 |
| Dues & Conferences | 501 | 80 | 510 | 1,400 |
| Office & Community Outreach | 6,897 | 1,532 | 5,424 | 6,415 |
| Contingency | 1,000 | - | 1,500 | 1,500 |
| Commissioner Stipends | 4,700 | 2,450 | 4,900 | 4,900 |
| Rent | 1,800 | 1,050 | 1,800 | 1,800 |
| Capital Reserve, Land/Equipment Acquisition | 408,254 | 674 | 10,000 | 10,000 |
| Total Dibursements | 510,459 | 56,407 | 130,515 | 116,888 |
| Balance | $ (32,393) | $ 29,408 | $ 71,667 | $ - |

| Non-lapsible Fund: | Capital Reserve, Land & Equipment Acquisition | F.K. Elson Memorial | Friends of the Preserve | Floodplain Study | Lake Planning Grant | Preserve Restoration & Development |
|---|---|---|---|---|---|---|
| Est. Balance (12/31/08) | $ 120,045 | $ 198 | $ 1,792 | $ 82 | $ 12,722 | |
| Add. 2008 activitity: | | | | | | |
| Increase | 288,209 | 5 | | | | |
| Decrease | -408,254 | | | -82 | -3 | |
| Final Balance (12/31/08) | 0 | 203 | 1,792 | 0 | 12,719 | |
| 2009 Est. Additions | 92,250 | | | | | $ 3,000 |
| 2009 Est. Interest | 50 | 1 | 9 | | | |
| 2009 Est. Expenditures | -42,524 | | | | -12,719 | -2,800 |
| Est. Balance (12/31/09): | $ 49,776 | $ 204 | $ 1,801 | $ - | $ - | $ 200 |

| Date | Prior-Year Equalized Valuation | Change | Mill Rate | Change | Tax Levy | Change | Budget* | Change | |
|---|---|---|---|---|---|---|---|---|---|
| 2010 | 237,284,218 | (1.4%) | 0.48 | 4.3% | 112,888 | 2.1% | 116,888 | 4.3% | |
| 2009 | 240,597,096 | 2.9% | 0.46 | (2.1%) | 110,517 | 0.3% | 112,089 | (0.7%) | |
| 2008 | 233,918,588 | 14.7% | 0.47 | 42.4% | 110,211 | 63.1% | 112,911 | 6.0% | |
| 2007 | 204,002,100 | 2.9% | 0.33 | 50.0% | 67,570 | 55.7% | 106,570 | 26.0%** | |
| 2006 | 198,347,907 | 8.6% | 0.22 | (15.4%) | 43,400 | (7.0%) | 84,550 | 4.2% | DNR Priority Lake Project funding |
| 2005 | 182,720,733 | 9.9% | 0.26 | (23.5%) | 46,650 | (17.5%) | 81,150 | (2.1%) | " |
| 2004 | 166,197,547 | 5.0% | 0.34 | (2.9%) | 56,550 | 2.0% | 82,850 | 6.2% | " |
| 2003 | 158,231,434 | 4.5% | 0.35 | 40.0% | 55,450 | 44.8% | 78,000 | 12.1% | " |
| 2002 | 151,474,387 | 11.1% | 0.25 | 8.7% | 38,300 | 24.6% | 69,600 | 5.0% | " |
| 2001 | 136,358,296 | 10.1% | 0.23 | (20.7%) | 30,750 | (13.1%) | 66,300 | 0.3% | " |
| 2000 | 123,832,425 | 8.5% | 0.29 | 3.6% | 35,400 | 9.4% | 66,100 | 9.5% | " |
| 1999 | 114,107,532 | 11.1% | 0.28 | (33.3%) | 32,350 | (25.1%) | 60,350 | 13.4% | " |
| 1998 | 102,664,360 | 9.1% | 0.42 | 121.1% | 43,200 | 137.4% | 53,200 | NA | " |
| 1997 | 94,120,742 | 19.8% | 0.19 | (26.9%) | 18,200 | (10.8%) | NA | | " |
| 1996 | 78,590,199 | 19.1% | 0.26 | (3.7%) | 20,400 | 12.4% | NA | | " |
| 1995 | 66,009,539 | 12.4% | 0.27 | (10.0%) | 18,152 | 3.0% | NA | | " |
| 1994 | 58,732,838 | 16.5% | 0.30 | 20.0% | 17,619 | 37.4% | NA | | " |
| 1993 | 50,402,776 | NA | 0.25 | NA | 12,824 | NA | NA | | DNR Priority Lake Project funding |
| 1992 | N/A | | | | | | | | |
| 1991 | N/A | | | | | | | | |

* Yearly budgets do not account for grant- and donor-funded expenses

** Change due, in part, to use of LRMD grant-transition funds accumulated over prior budget years

Note: In the early 1990s, Lake Ripley Priority Lake Project activities were administered out of Jefferson County Land & Water Conservation Department

# APPENDIX C

# The Economics of Lake Protection and Rehabilitation

A Literature Review prepared by the Lake Ripley Management District

A growing body of research demonstrates a significant and positive correlation between lake health and regional property values and economic activity. The many benefits of a healthy lake and watershed include: 1) improved water clarity and quality, 2) a thriving and diverse fish and wildlife community, 3) increased tourism and associated local business activity, 4) higher property values, 5) greater resilience to pollution and climate change, 6) enhanced natural scenic beauty and recreational capacity, and 7) more effective flood regulation. Alternatively, recreation suffers, property values fall, and long-term management costs can dramatically increase when lakes are allowed to degrade,

> *"Property owners around a lake can respond in two ways when the quality of that lake begins to break down. They can take action collectively, such as by forming lake associations that govern lake use, or they can take action privately by moving off the lake."* -Bill Provencher, UW-Madison Environmental Economist

Property Values and Tax Base

- Although the Lake Ripley Management District accounts for about 7% of the total land area in the Town of Oakland, it contains most of its population and represents 68% of the town's total assessed valuation [1].

- A 2005 UW-Whitewater study attempted to quantify the local economic impact of a Delavan Lake (WI) rehabilitation effort. It found that the lake contributed $77 million annually to the economy and generated 812 jobs. The rehabilitation of water quality raised average lakeshore property values by about $177,000 between 1987 and 2003. Increased lakeshore property values reduced real estate tax bills for non-lake property owners by $178 per year. Improving Eurasian watermilfoil management was estimated to increase economic activity by $6-8.5 million annually. Finally, degradation of water quality to pre-restoration levels would reduce economic activity by $5-6 million annually [2].

- The value of shoreline frontage in Vilas and Oneida Counties (WI) increased an average of 7-12% when town zoning required a minimum 200 feet of water frontage for lots. This was the finding of a University of Wisconsin study that evaluated data collected on 892 vacant lakefront properties from 1986-1995. The study concluded that the zoning requirement—by preserving clean water, natural scenic beauty, and peace and quiet—generated an economic gain that more than offset the economic loss resulting from the constraints of development [3].

- A 2004 University of Wisconsin-Madison study of more than 1,100 Vilas County (WI) lakefront property sales from 1997-2001 showed that more restrictive shoreland zoning regulation generally had a positive influence on property values. The researchers concluded that lakefront homeowners value environmental preservation by showing a willingness to exchange rights and money to live on a healthier lake [4].

- The loss of property value due to lake water clarity declining below the regional average was estimated to be $256 to $512 million for 191 Maine lakes. This was the finding of a 2001 study by the University of Maine. Property value declines ranged from $3,000 to $9,000 per lot. The same study was used to determine potential future tax losses in one Maine township where 60% of the $211 million property tax valuation is from lakefront property. A 3-ft. decline in average minimum water clarity would cause a loss of $10.5 million, roughly 5% in total property value [5].

- An improvement of 3 feet in water clarity depth translated into an increase of $11 to $200 more per foot of shoreline property value. Likewise, declining water clarity accounted for a 10-20% drop in selling price. This was the finding of a 5-year Maine study that looked at 900 lakefront properties on 34 lakes [6]. The study methods were repeated in the Mississippi headwaters region of Minnesota where strong links between lake clarity and land value were further documented. 1,205 residential property sales were examined from 1996-2001, with lake property values on one lake with improved clarity rising $423 for each foot of frontage. For a 40-ft. lakefront lot, nearly $17,000 was gained in increased property value. The opposite was true in situations where water clarity had declined [7].

- A study of 1,200 home sales from 1988-1990 on two lakes near Austin, Texas showed that both lakes exert a significant economic impact on surrounding residential properties. Sale prices for lakefront homes ranged from $80,000 to $100,000 more than the sale prices for comparable non-lakefront properties. The study also showed that the economic impact of lake proximity on property values extended landward by approximately 2,000 feet from the lakeshore [8].

- A 1996 Colorado State University study showed California homes near stream restoration projects had a 3-13% higher property value than similar homes along un-restored streams. Most of the perceived value of the restored stream was due to the enhanced buffer, habitat, and recreation afforded by the restoration [9].

- A 1998 study examined land values before and after the Maryland Critical Area and New Jersey Pinelands land-use regulations were imposed. The regulations were found to have no impact on the volume of construction activity, and slightly improved the local tax base with land values appreciating 5-25%. The researchers noted that residents benefited from the knowledge that public actions were taken to protect the environmental amenity in which they had already invested [10].

- A 2001 report by the Center for Watershed Protection (VA) documented significant economic benefits associated with nonpoint source pollution control and other environmental protection and land conservation programs [11].

<u>Desired Lake Amenities, Tourism and Economic Activity</u>

- A 2005 survey of Lake Ripley Management District and watershed landowners revealed that the top lake amenities that contributed to their property-purchase decision were natural scenic beauty, water-sport opportunities, quiet recreation, and water clarity, respectively. Respondents indicated that clear water and natural scenic areas were lake qualities of greatest importance to them. 60% of the respondents owned property off the water and more than 1/4-mile from the lake [12].

- A 2007 survey of Lake Ripley Management District and watershed landowners revealed that most respondents ranked “presence of the lake” as one of the top factors contributing to their quality of life as a local property owner. High marks were also given to safe water quality and natural scenic beauty, among other factors [13].

- 400 Wisconsin business executives surveyed in 2000 gave Wisconsin its highest rankings relative to other states for its quality of life, government services, and loyalty to area. Availability and quality of water were the highest ranked quality of life topics [14].

- Scenic beauty and relaxation were the top reasons tourists gave for visiting Wisconsin and spending $11.4 billion in the state in 2001. Tourism supported 380,000 full-time jobs and generated nearly $1.8 billion in revenues for state and local governments. Without state and local revenues from travel expenditures, each household would have to pay an additional $932 in taxes to maintain existing services [15].

- Each year more than 1.5 million anglers spend 17 million fishing days fishing in Wisconsin. They spend $1.1 billion directly on fishing related expenses which generates more than $2.1 billion in economic activity. Sport fishing supports 30,000 jobs and generates more than $75 million in tax revenues for the state [16].

For a summary of the latest economic research, also see the following Web link:

http://www.uwsp.edu/cnr/uwexlakes/economicsofwater/

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# APPENDIX D

# Lake Ripley Recreational Rules Summary

**Slow-No-Wake Boating Times and Locations**

- No person shall operate a motor boat faster than slow-no-wake speed between 7:30 p.m. and 11:00 a.m. daily. "Slow-no-wake" means the slowest possible speed so as to maintain steerage control.
- No person shall operate a motor boat or personal watercraft faster than slow-no-wake speed within 200 feet of any shoreline.
- No person shall operate a motor boat or personal watercraft faster than slow-no-wake speed within buoyed restricted areas located in South Bay and East Bay.
- No person shall operate a *motor boat* faster than slow-no-wake speed within 100 feet of piers, docks, rafts, and marked swimming areas.
- No person shall operate a *personal watercraft* faster than slow-no-wake speed within 100 feet of piers, docks, rafts, marked swimming areas, or another boat or personal watercraft.

**No-Motor Areas**

- No person shall operate a motor of any kind (including trolling motors) within the horseshoe channel known as Vasby's Ditch in South Bay.

**Public Boat Launch**

- No person shall use the public boat landing on Island Lane from May 1 through September 30 without first paying the required launching and removal fee. All persons shall display a permit decal as proof of payment of such fees. Daily permit fee is $7.00. Seasonal passes are $20.00 for senior citizens and residents/landowners of the Town of Oakland, and $30.00 for all other users.
- No person shall use the public boat-launching ramps or piers for purposes of fishing or swimming.
- No person shall use the public boat landing from one hour after sunset to one hour before sunrise.
- No person shall engage in power loading (using the thrust of a motor to load or unload watercraft to or from a trailer) when using the public boat landing pier.

**Buoys**

- No person shall place or remove a regulatory buoy in Lake Ripley without prior approval from the Town of Oakland and Wisconsin DNR.
- No person shall move, remove, or in any way interfere with posted buoys marking any areas.
- No person shall place a mooring buoy in a location where it unnecessarily obstructs navigation, or is not entirely confined to the landowner's riparian zone.

**Water Skiing, Tubing, Aquaplaning, etc.**

- No person shall operate a motor boat towing a person on water skis, aquaplane, or similar device unless there is a competent observer in the boat in addition to the operator.
- No person shall engage in water skiing, tubing, aquaplaning, or similar activities without wearing a Coast Guard approved life preserver.
- No person shall operate or use any boat, or manipulate any water skis in a careless, negligent,

or reckless manner so as to endanger anyone's life or property.

- No person shall operate a motor boat engaged in water skiing, aquaplaning, or similar activity within 100 feet of any occupied anchored boat, personal watercraft, marked swimming area, or public boat landing.
- No person shall operate a motor boat towing a person on water skis, aquaplane, or similar device during the 7:30 pm to 11:00 am. slow-no-wake period.
- No person shall direct or participate in any boat race, regatta, water ski meet, or other water sporting event or exhibition unless authorized by the Town of Oakland.

**Evening Boating Hours**

- No person shall operate a personal watercraft from sunset to sunrise.
- No person shall operate a boat of any type from sunset to sunrise, and during periods of restricted visibility, without the use of proper navigation lights.

**Age Requirements**

- No person under 10 years of age shall operate a motor boat.
- No person under 12 years of age shall operate a personal watercraft.
- No person between 10 and 12 years of age shall operate a motor boat unless accompanied by an adult, or unless that person has successfully completed a Wisconsin DNR-prescribed boating safety course and possesses a safety certificate.
- No person between 12 and 16 years of age shall operate a personal watercraft unless that person has successfully completed a Wisconsin DNR-prescribed boating safety course and possess a safety certificate.

**Other Boating Rules**

- No person shall operate a motor boat or personal watercraft at a speed that is greater than reasonable and prudent, or in a manner that creates a hazardous wake.
- No person shall operate a motor boat while any passenger sits or rides on the gunwales, tops of seats, backs or sides or on the decking over the bow unless such person is inboard of guards or railings (except for anchoring, mooring, or cast off).
- No person shall operate any boat that is over the safe carrying capacity of passengers or cargo, or shall equip a boat with propulsion in excess of its safe power capacity, taking into consideration existing operating conditions.
- No person shall operate a motorboat or personal watercraft, or use water skis, aquaplane, or similar device while intoxicated. Furthermore, no person shall permit an individual who is intoxicated or under the influence of a controlled substance to be a passenger in a boat operated by that person except in cases of emergency.
- No person shall unnecessarily activate any sound-producing device while on a boat.
- No person shall operate a boat that is not displaying a valid certificate of number issued by the Wisconsin DNR.
- No person shall operate a personal watercraft unless that person is wearing an approved personal floatation device.
- No person shall operate any boat or pull a water skier within 100 feet from any diver's flag or any swimmer unless the boat is part of the diving operation or is accompanying the swimmer.
- No person shall operate contrary to any posted municipal boating ordinances.

**Swimming**

- No person shall swim from an unoccupied boat.
- No person shall swim more than 150 feet from the shore unless in a designated swimming zone or when accompanied by a competent person in a boat.
- No person shall swim more than 150 feet from the shore between sunset and sunrise.

**Snorkel/Skin/Scuba Diving**

- No person shall engage in underwater skin diving, scuba diving, or swimming with the use of swimming fins beyond 150 feet from shore unless the location of such activity is marked by a diver's flag or is a marked swimming area.
- No person diving or swimming shall interfere with someone engaged in fishing.

**Boat Launching and Transport with Attached Aquatic Organisms**

- State law prohibits launching or transporting any boat, boat trailer, or boating equipment if there are any aquatic plants or other organisms attached.
- To prevent the spread of nuisance aquatic species: remove plants, animals, and mud before leaving water access; drain water from boat, motor, bilge, live wells, and bait containers before leaving water access; dispose of unwanted bait in trash; and either rinse boats and recreational equipment with high pressure or hot tap water (> 104° F), or allow the boats and equipment to dry for at least 5 days.

**Fishing**

- No person 16 years of age or older shall fish without possessing a current Wisconsin fishing license.
- No person shall use more than three hooks (lines), baits, or lures while fishing.
- No person shall leave a line unattended, possess live crayfish, or release unused bait into the lake.
- No person shall engage in motor trolling while fishing on Lake Ripley.
- No person shall engage in fish sorting. Any fish taken into your possession that is not immediately released is part of your daily bag limit.
- No person shall possess a fish that does not meet legal size requirements. Furthermore, no person shall possess a quantity of fish that exceeds the daily bag limit for the particular species caught.

**Size and Daily Limits**

| Species | Season | Min. Length | Daily Limit |
|---|---|---|---|
| Bass | ** | 14 inches | 5 in total |
| Northern Pike | ** | 26 inches | 2 |
| Bluegill, sunfish, crappie, perch | All Year | None | 25 in total |
| Walleye | ** | 15 inches | 5 in total |
| Bullhead, rough fish, rock bass, yellow & white bass | All Year | None | None |

**1st Saturday in May to March 1st

**Littering**

- No person shall leave, deposit, place, or throw on the water, ice, shore, or upon public or private property any cans, bottles, debris, refuse, solid waste material, or fish parts.

**Ice Safety**

- No person shall leave a hole in the ice greater than 12 inches in diameter unless it is clearly marked.

**Piers, Docks, Rafts, Trampolines and Decks**

- No person shall place a new or expanded pier or other structure within designated "sensitive areas" without a Wisconsin DNR permit. Sensitive shoreline areas on Lake Ripley include mainly portions of South Bay and East Bay.
- No person other than a riparian landowner may place a pier or wharf. Although piers are private property of the riparian, someone wading along the shoreline may portage around a pier by the shortest route practicable on private property.
- No person shall place a pier, dock or raft in a location where it unnecessarily obstructs navigation, or is not entirely confined to the owner's riparian zone.
- No person shall place a pier in a manner that obstructs the free flow of water, or includes any features that trap or accumulate aquatic plants or sediment.
- No person shall place a pier without a permit that exceeds allowable size and boat-mooring standards defined by Wisconsin DNR (Ch. NR 326, Wis. Admin. Code). Limits two boat slips for the first 50 feet of lake frontage owned, and no more than one boat slip for each additional 50 feet of shoreline. May not extend further than the 3-foot water depth, or to the depth necessary to moor a boat. Pier cannot exceed 6 feet in width, with the exception of a loading platform that is no more than 8 feet wide by 8 feet long.
- No person shall construct roofs, canopies, decks, water slides or similar structures on a pier or dock that is not essential for mooring watercraft.
- No person shall place or maintain any raft that is greater than 150 feet from shore.
- No person shall place or maintain any raft or trampoline with a surface greater than 200 square feet or a height greater than 38 inches without a permit.

**Reporting Violations**

Violations can be reported to the Jefferson County Sheriff Department (920-674-7310), Wisconsin DNR (1-800-847-9367), and Town of Oakland Police (608-423-7415). Include the following items when reporting a violation: boat certificate of number, violation, location, and time and date of incident.

## Summary of Jefferson County Shoreland Zoning Rules for Lake Ripley

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Shoreland zoning applies to unincorporated lands located within 1,000 feet of a lake or 300 feet of any river or stream. Activities taking place below the Ordinary High Water Mark generally fall under Wisconsin DNR permitting authority. The laws listed below are not comprehensive, are believed to be current as of the date of this printing, and may vary according to which entity or entities have jurisdiction. The following was adapted from a summary prepared by the Jefferson County Land and Water Conservation Department in 2006.

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**SHORELAND LOT REQUIREMENTS**

| | |
|---|---|
| Lot Dimensions: | Varies depending on zoning |
| Shoreland Setback: | State, County: 75 feet from ordinary high water mark (OHWM). Boathouses, piers, and boat hoists are exempt from setback. County: Permit required for reduced setback. Reduced setback allowed if at least 5 buildings within 500 feet of proposed building site are within the required setback. Reduced setback is the average of setbacks of buildings on each side of proposed building site; or if no building on one side, the setback is average of existing building setback and 75 feet. Minimum setback is 35 feet. Vegetated buffer must be planted. |
| Sideyard Setback: | Varies depending on zoning |
| Keyhole Lake Access: | Town: Keyhole subdivisions, which grant private lake access to off-lake lots via a common shoreline area, are prohibited on Lake Ripley. |

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**ACCESSORY STRUCTURE REQUIREMENTS**

| | |
|---|---|
| Access Ramp: | County: Permit required. Only one per lot, and not to exceed 8 feet in width or length. Must be located in Viewing and Access Corridor and above OHWM. Only for use by riparian owner. Constructed only using vegetation or vegetated turf block. Designed to not cause erosion and to minimize storm water runoff. Erosion control shall be used during construction. |
| Boathouse Standards: | State: Permit required for repair/maintenance of existing boathouse below OHWM. Boathouses are only for storage of boats and related equipment. Human habitation is prohibited. County: Permit required. Placing a boathouse below OHWM is prohibited. Must be located in Viewing and Access Corridor. Only one per lot. Maximum 10 feet tall and ≤400 square feet in size. Roof slope is required. Vegetated buffer must be planted. |
| Fence Standards: | County: Classified as structures and must be setback 75 feet from OHWM, except for open fences for agricultural practices. |
| Open Sided and Screened Structures: | County: Permit required. Minimum setback of 35 feet from OHWM. Total floor area of all structures in shoreland setback area shall not exceed 200 square feet (excluding boathouse). Structure must be ≤10 feet in |

| | |
|---|---|
| | height and have no sides, open sides, or screened sides. Vegetated buffer must be planted. |
| Patio: | County: Must be setback 75 feet from OHWM. |
| Retaining Walls: | County: Setback 75 feet from OWHM except if Zoning Administrator deems necessary for erosion control (permit is then required). |
| Stairway/Walkway/ Lift Standards: | State, County: Any path or road within 35 feet from water shall be constructed and surfaced to effectively control erosion. County: Permit required. Maximum 4 feet wide stairs, landings must be ≤40 square feet with no more than one landing every 10 feet of elevation change. Only one stairway or walkway allowed except a lift may be allowed as a second access adjacent to stairway or walkway. |

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**PRESERVATION OF SHORE COVER REQUIREMENTS**

| | |
|---|---|
| Shoreland Buffer: | County: A 35 foot strip of vegetation running parallel to OHWM and extending inland from the OHWM. Dead and diseased trees and shrubs, and noxious and invasive trees, shrubs, and plants may be removed and must be replaced with native vegetation or cultivars of natives within 30 days of removal. Routine pruning is allowed, but excessive pruning that jeopardizes the health of trees or shrubs is prohibited. Landscaping and lawns that extend into the shoreland buffer area prior to March 2005 may be maintained until restoration is required. Existing lawns and landscaping cannot be extended into the buffer area. |
| Viewing and Access Corridor: | County: A vegetated strip of land extending through the shoreland buffer that provides access to the water and a filtered view of the water. Not to exceed 30 feet wide for lots ≥100 feet in width. Not to exceed 30% of the lot width for lots <100 feet in width. Not designated in an area where 75% or more of the trees and shrubs exist within the shoreland buffer. Selective cutting allowed – removal of selected trees and shrubs throughout the range of sizes at regular intervals, either singularly or in small groups, but not to exceed 75% of existing trees and shrubs, leaving uniform distribution of trees and shrubs. County: Greater cutting than detailed above may be permitted through a Conditional Use Permit and a Zoning Permit. Submission of a Special Cutting and Restoration Plan that follow technical standards is required. |
| Cutting More Than 35 Feet Inland: | County: Cutting of trees and shrubs from the inland edge of the 35 feet strip to the outer limits of the shoreland is allowed when done using accepted forest management practices and sound soil conservation practices which protect water quality. |
| Restorations: | County: Restoration of a shoreland buffer of 35 feet from the OHWM, excluding the viewing and access corridor, is required for the following: 1. Zoning permit for land disturbance within 75 feet from the OHWM. 2. Zoning permit for setback averaging of a new structure or addition to existing structure. 3. Zoning permit for repairs, alterations, or additions to |

an existing structure that is closer than 75 feet from the OHWM if the total lifetime repairs, alterations, or additions exceed 50% of the equalized assessed value of structure. A variance is necessary to exceed 50%. 4. Zoning permit for the construction of a new boathouse. When buffers are required, existing non-conforming accessory structures that do not comply with the ordinance, excluding existing boathouses, must be removed as part of shoreland buffer restoration. The restoration must follow technical standards and a restoration plan must be submitted.

---

**DISTURBANCE ON LAND ABOVE AND BELOW HIGH WATER MARK**

**Land Disturbance Above OHWM:** State: DNR permit required for grading or removal of topsoil of ≥10,000 square feet from the bank. County: Permit required if grading within 500 feet of ordinary high water mark sloping to water if (1) slope is ≥20%, (2) >1,000 square feet on 12-20% slope, or (3) >2,000 square feet on <12% slope. Vegetated buffer must be planted.

**Disturbance Below OHWM:** State: DNR permits required for removal, filling, or grading of material from below the ordinary high water mark or the bed of the lake. This includes rock riprap or similar material.

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**NONCONFORMING STRUCTURE STANDARDS**

**Principle Structure:** State, County: Nonconforming structures shall not be extended, enlarged, reconstructed, moved or structurally altered (includes maintenance, additions) in excess of 50% (includes all cumulative projects) of its current fair market value.

**Accessory Structure:** State, County, City: A nonconforming structure shall not be extended, enlarged reconstructed, moved or structurally altered in excess of 50% of its current fair market value.

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**WETLANDS**

**Wetland Protection:** Filling, draining, excavating, dredging, and lagooning of wetlands is prohibited except for wetland enhancement projects. Consult Corps of Engineers (262-547-1876), DNR, and County for requirements.

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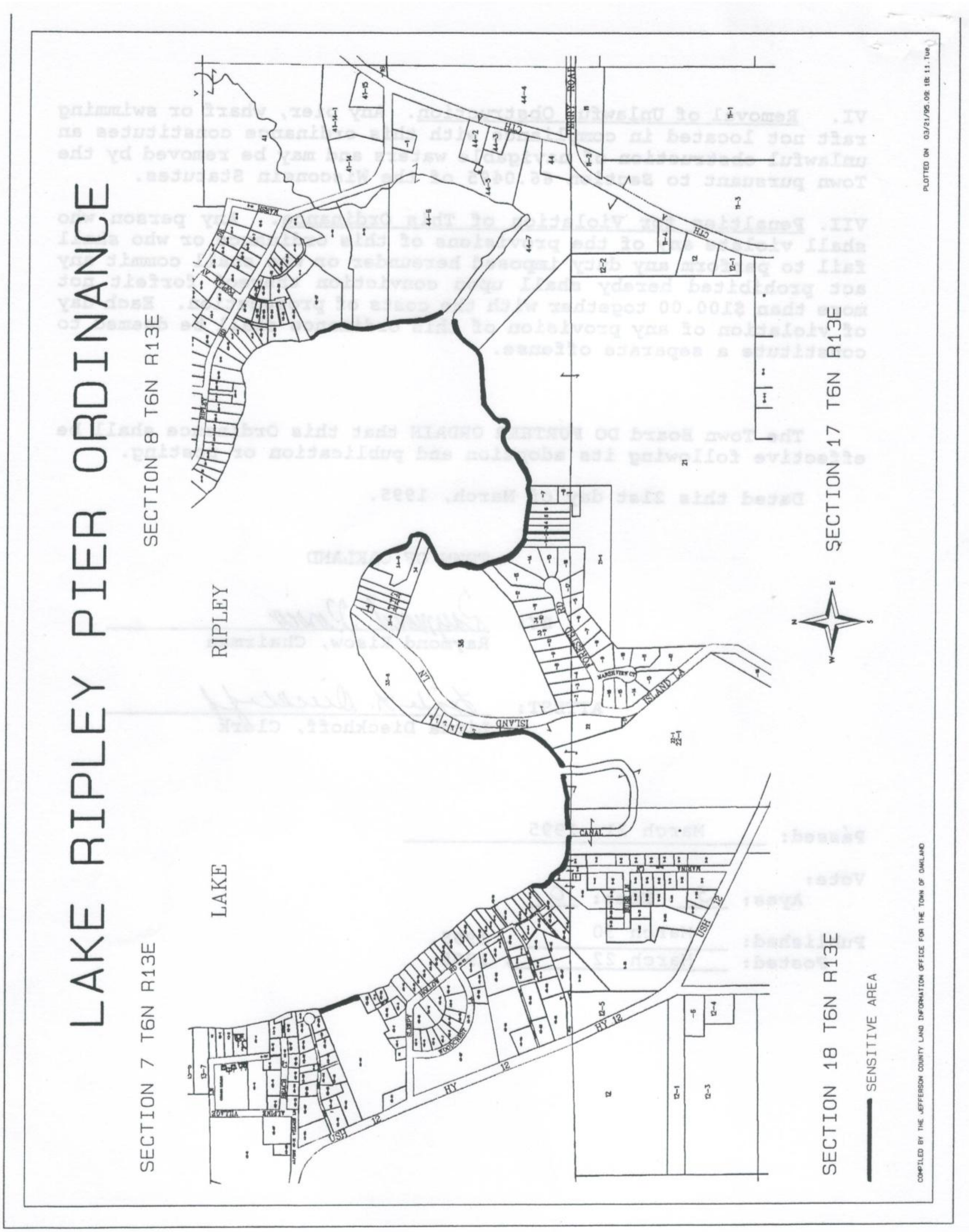
**MISCELLANEOUS**

**Floodplain:** Floodplain properties are subject to Federal, State and County regulations.

**Waterfowl:** Town: The intentional feeding of ducks, geese and other waterfowl is prohibited on and around Lake Ripley.

**Yard Waste:** Town: The burning of yard waste is prohibited within 25 feet of Lake Riplely or any channel or ditch that continuously drains water to the lake. Burning is further prohibited in streets, curbsides and ditches in Town of Oakland right-of-ways located with the Town Sanitary District.

**LAKE RIPLEY SENSITIVE AREAS MAP** (from Town of Oakland Ordinance No. 42)



# APPENDIX E

**LAKE DISTRICT PRESERVE**
**TRAPPING RULES**

1. Limited trapping allowed by special permit only. Due to space constraints, permission will be granted to one (1) trapper per season based on a lottery system. Applications must be received by the Lake Ripley Management District on or before September 10th. The winner of the lottery will be required to pay a $50.00 trapping fee for the privilege to trap at the preserve. For applications and additional information, contact:

   Lake Ripley Management District
   N4450 County Road A
   Cambridge, WI 53523
   (608) 423-4537
   ripley@charterinternet.com

2. Trappers must possess a valid Wisconsin trapping license, and must follow all applicable rules and regulations.

3. Only trapping of **muskrat**, **mink**, **raccoon**, **opossum** and **skunk** allowed. All incidental catches may be kept providing that the rules set forth herein and for the State of Wisconsin have been followed, and that the species taken is within a lawful season. Any such catch must be reported within 24 hours to the regional conservation warden for the Wisconsin Department of Natural Resources, at (920) 674-5880.

4. Trapping in wetland areas is restricted to water sets with leg-hold traps sized 1 ½ or smaller, and #110 or #120 conibear traps (or equivalent). Land sets are restricted to #220 conibear traps (or equivalent) or smaller, and must be used in recessed cubby sets.

5. No traps may be placed within ten (10) feet of any walking path or property boundary.

6. Traps must be set up and inspected during primary daylight hours (sunrise to sunset).

7. Trappers must submit a “Harvest Reporting Form” to the Lake Ripley Management District within 30 days of the close of the season.

   The Lake Ripley Management District Board reserves the right to refuse access to any participant for violation of these rules. Further, the Board reserves the right to amend, delay or cancel any trapping season at their discretion for good cause. Participants affected by the changes will be offered the option of a refund or deferral to the next season.

# TRAPPING APPLICATION FORM

**<u>Instructions</u>:**

1. Refer to the attached document titled <u>Lake District Preserve Trapping Rules</u> for information on trapping restrictions and reporting requirements.
2. Please print the requested information on the form below.
3. Sign, date and return the completed application on or before **September 10th**.

Your name will be included in a lottery for which one (1) trapper will be randomly selected to trap during the upcoming season. The winner of the lottery will be required to pay a $50.00 trapping fee made payable to the Lake Ripley Management District.

FULL NAME:________________________________________________

MAILING ADDRESS:____________________________________________

CITY:____________________ STATE:________ ZIP CODE:_____________

COUNTY:__________________________________________________

DAYTIME PHONE:__________________ EVENING PHONE:_________________

DATE OF BIRTH:_____________________________________________

DNR TRAPPING LICENSE #:_______________________________________

SPECIES YOU PLAN TO TRAP:______________________________________

TRAP TYPES YOU PLAN TO USE:___________________________________

DATES YOU PLAN TO TRAP:_______________________________________

SIGNATURE:________________________ DATE:_______________

**<u>Mail or deliver completed form to</u>:**

**Lake Ripley Management District**
**N4450 County Road A**
**Cambridge, WI 53523**
**(608) 423-4537**

**HARVEST REPORTING FORM**

**Instructions:**

1. Contact your Wisconsin DNR Conservation Warden (608-275-3266) to report any unintended, incidental catches.
2. Please provide the requested information on the form below.
3. Sign, date and return the completed form within 30 days of the close of the trapping season.

Reporting information will be used to track harvest rates for wildlife management purposes.

**Contact Information**

REPORTING DATE:________________________________________________________________

FULL NAME:_____________________________________________________________________

MAILING ADDRESS:_______________________________________________________________

CITY:______________________________ STATE:____________ ZIP CODE:____________________

DAYTIME PHONE:__________________________ EVENING PHONE:_________________________

***Trapping Results***

| **Species Harvested (check all that apply)** | **Number of Males** | **Number of Females** | **Average Size (inches) Nose to tip of tail** | **Average Weight (to the ounce)** | **Date(s) Harvested** |
|---|---|---|---|---|---|
| □ Muskrat | | | | | |
| □ Mink | | | | | |
| □ Opossum | | | | | |
| □ Raccoon | | | | | |
| □ Skunk | | | | | |
| □ Incidental Catch<br>Species:________________<br>Reported to DNR?:________ | | | | | |

**Mail or deliver completed form to:**

**Lake Ripley Management District**
**N4450 County Road A, Cambridge, WI 53523**
**(608) 423-4537**

# Lake District Preserve Planning Committee

**Advisory Recommendations to LRMD Board**
**October, 2007**

Committee members consisted of Pam Dollard (Chair), Georgia Gomez-Ibanez (Secretary), Terri Baker, Kent Brown, Jim Rank and Jeff Spindler. The committee met on a biweekly basis from August 20, 2007 through October 10, 2007. The following mission statement for the committee was adopted:

> *"To formulate a plan for the maintenance, improvement and enhancement of the Lake District Preserve through education, communication, and exploration of external resources."*

The following mission statement was also developed, to guide LRMD's management and improvement of the Preserve:

> *"To enhance Lake District Preserve wetland function, native habitat quality, and low-impact public access and educational opportunities to (1) protect the health and condition of Lake Ripley, and (2) to promote community awareness of watershed-conservation issues through exploration and interaction with restored natural areas."*

The Committee presents the following list of recommended actions:

I. Immediate Actions

A. Assess/address possible conflicts between Preserve trail users and Oakland Conservation Club shooters.

1. Evaluate placement of targets and direction of shooting for safety purposes
2. Assess whether shooting rules are being respected and enforced
3. Post hunting seasons and advise wearing blaze orange on welcoming sign

B. Set up information booths at upcoming community events: Fall Fest (October) and Friends of the Library Craft Fair (November).

1. Assemble existing educational materials on lake-friendly yard care, rain gardens, Preserve information, etc. (from DNR and UW-Extension)
2. Utilize volunteers to staff the booths

C. Conduct stewardship work along the Preserve trail with help from 4th Grade Environmental Club.

1. Trim and remove encroaching woody vegetation
2. Seed area around observation deck with colorful prairie forbs
3. Clean out bluebird houses and wood duck nesting boxes

II. Near-Term Actions

A. Explore ways to increase the Preserve's ability to protect Lake Ripley's water quality.

1. Investigate conservation easement on and/or purchase of upland woods (or other properties if considered critical to LRMD's mission and objectives)

2. Investigate feasibility of plugging the main ditch channel
    a) Contact DNR, drainage district board and other authorities to see if permits could be issued
    b) Perform a hydrological assessment (involve U.S. Fish & Wildlife Service) to determine if Preserve wetlands or adjoining properties could absorb additional water
    c) Contingent on the findings of the hydrologic assessment, communicate with Oakland Conservation Club and other area landowners whose properties would be critical to the successful plugging of the main ditch

NOTE #1: We regard the protection of the upland woods from development and the possible plugging of the remaining major ditch as the most important activities for the LRMD to pursue. We understand that, at the present time, it may not be legally or hydrologically feasible to plug the ditch. However, in recognition that the ditch is a major source of continued sediment contamination of the lake, serious consideration of this possible action is recommended.

NOTE #2: As properties come up for sale or as opportunities arise over the long term, we recommend considering further land acquisitions (or conservation easements) which would help the overall health of Lake Ripley.

B. Educate the public and get the watershed/water quality message out.

1. Improve new property owner information packets with rain barrel and rain garden materials (as well as previously-used DNR and UW-Extension materials and other general materials) to educate on proper watershed property care.

2. Expand and update LRMD website.
    a) Include more information about the Preserve; publicize availability of websites containing wetlands information (DNR, Wisconsin Wetlands Association, etc.)
    b) Establish links with Cambridge Chamber of Commerce and Jefferson County websites.

3. Arrange for information packets and volunteers for "how to be a good watershed citizen" information booth at community events (using DNR and UW-Extension materials). Examples of events include:

| | | |
|---|---|---|
| May? | Renaissance Fair | Ripley Park |
| June | London Bridges Art Fair | Village Square |
| June | Pottery Festival | Ripley Park |

| | | |
|---|---|---|
| August | Maxwell Street Days | Downtown Cambridge |
| September | Heather's Car Show | Ripley Park |
| October | Fall Fest | Downtown Cambridge |
| October | Family Wellness Fair | Downtown Cambridge |
| November | Friends of Library Craft Fair | Cambridge High School |

NOTE: These first three recommendations seem fairly easy to accomplish, especially #1-2. We suggest trying #3 for a year and get feedback on whether this booth concept, which dispenses information in a personal way, works well enough to generate both interest and actual behavior changes.

4. Publish articles about the Preserve in Ripples and the Lake Ripley Edition of the Cambridge News (July)

5. Explore feasibility of conducting public educational events.
   a) Annual public tour at the Preserve after July LRMD Board meeting
   b) Attend area homeowner association meetings to discuss wetlands, watersheds, water quality and good watershed-citizen property care
   c) Watershed workshop for community in conjunction with Friends of Cam-Rock Park (Koshkonong Creek Watershed), possibly at Amundson Center
   d) Explore using library as an additional information resource in the community about the Preserve and the Lake Ripley watershed (we could have the "how to be a good watershed citizen" materials to hand out, or a binder with handouts)
   e) Explore improving the educational value of the Preserve trail using signage.

NOTE: Recommendation 5E should be considered only if there seems to be more use of the Preserve after implementing 5A-D. This item would probably not be costly, but would take some time and effort. Our primary suggestion would be to make two of the existing signs (birds and plants) more like handy field guides (i.e., more pictures of species and less text, and the possible addition of one sign near the boardwalk).

C. Improve Preserve trail for public use.

1. We recommend that no additional trails be built at this time, unless needed for the purpose of conducting stewardship activities. The existing trails provide a sufficiently interesting walk without much disturbance of habitat or wildlife. We recommend only low-impact public use of the Preserve.
2. The addition of two small directional signs is suggested to reassure first-time walkers (i.e., "this way to observation deck" and "this way to boardwalk")
3. Improved trail maintenance is suggested to restrain encroaching willows and to remove any fallen trees from trail. This type of work could be done regularly if we had a Friends of the Preserve volunteer work group.
4. It has been suggested that the Preserve sign at Hwy A be moved perpendicular to the road for greater visibility. We recommend no change to the sign at this time.

D. Evaluate public use of Preserve.

1. Place a brief questionnaire and comment box at the welcome sign. This could be a simple postcard format with questions such as: Where is your home? How did you learn about the Preserve? What did you enjoy while visiting the Preserve? What can be done to improve your use and enjoyment of the Preserve? Include multiple-choice check boxes.
2. Have a sign or cards available which state, e.g. "Want more information about the preserve? Have a comment or suggestion? Visit www.lakeripley.org
3. Include on-line comment form on LRMD website

E. Improve wildlife habitat at the Preserve by evaluating or seeking advice about the costs and benefits of controlling/eradicating reed canary grass. We understand that this may not be immediately feasible due to the inherent challenges of controlling this invasive species.

F. Publicly recognize good stewardship by community members.

1. Recognize those who actively contribute to the Preserve by maintaining the trail, bird houses, etc.
2. Recognize those who have donated conservation easements, done shoreline restorations, made agricultural improvements, etc. (possibly in Ripples)
3. Establish an annual recognition "ceremony" or conservation "prize," or award perhaps as part of the Annual Meeting (we are imagining recognition, more than something monetary)

G. Involve the schools.

1. Involve school kids in stewardship work (trail work, seeding prairie with donated seeds, bluebird trail, etc.)
2. Use the Preserve to teach about watersheds, wetlands and water quality
3. Provide informational CDs, or guest speakers for classroom instruction.

H. Evaluate the need for and sources of outside funding, and/or work help

1. Is the $2,000 in LRMD budget enough for routine annual maintenance (i.e., mowing trail, prescribed prairie burns, updating sign information, etc.)?
2. Explore possible funding sources:
   a) Cambridge Foundation might fund the improvement of signage
   b) WEEB and C.D. Besadny Grants for public school stewardship activities/projects
   c) U.S. Fish & Wildlife Service, Ducks Unlimited and Pheasants Forever might fund wetlands/habitat improvements
   d) "Friends of the Preserve" (a possible 501c3) for direct donations (publicize this!), and as a source of volunteers for work parties to help with stewardship and maintenance activities. Perhaps an article about

this in the Cambridge News with an invitation to meet after an upcoming LRMD meeting. Include on LRMD website.

e) Explore partnerships with UW-Madison. The Preserve could be a place for graduate students to do wetland studies, long-term monitoring, etc. which would be mutually beneficial.

f) Explore additional partnerships with local groups such as school clubs, senior groups, Lions Club, Scout leaders, 4-H, FFA, etc., as a source for volunteers, stewardship and other activities.

In summary, it seems clear that it is important to protect and enhance the ability of the Preserve itself to protect the water quality of Lake Ripley. In addition, education of citizens in the watershed is important as each property, whether a small yard or a farm, contributes to the health of our lake. Hundreds of small but appropriate landscaping improvements could add up to a major benefit to the lake.

We recognize that LRMD has one staff person and limited funding. We suggest exploring collaborations, grants and donations, and a small but dedicated group of volunteers, to achieve some of our recommendations. It also seems important to try some new ways of getting the watershed message out. This will mean an extra amount of work for some people for a one-year trial period, but the potential benefit might make that time investment worthwhile.

This committee felt privileged to provide this input and to express our concerns regarding the future of the Lake District Preserve and Lake Ripley. We request that this group be recognized as the "Friends of the Lake District Preserve Advisory Group", an ongoing body serving as the core of a group of volunteers which we hope will grow in numbers in the near future. We hope to learn of the results of the Board's consideration of our recommendations on an ongoing basis and we plan to reconvene in mid-March.

The committee wishes to thank the Lake Ripley Management District Board for this opportunity and we look forward to future cooperative efforts.

Respectfully submitted,

Pam Dollard, Chair
Georgia Gomez-Ibanez, Secretary
Terri Baker
Kent Brown
Jim Rank
Jeff Spindler

# APPENDIX F

# Property Owner Opinion Survey (Summer 2007)

| | | |
|---|---|---|
| **Response rate:** | 225 | (23%) |
| **Average age:** | 57 | |
| **Average household size:** | 2.8 | |
| **Male respondents:** | 124 | |
| **Female respondents:** | 82 | |

**Property location**

| | | |
|---|---|---|
| Lakefront: | 79 | (37%) |
| LRMD only: | 38 | (18%) |
| Watershed only: | 18 | (8%) |
| LRMD + Watershed: | 77 | (36%) |

**Property type**

| | | |
|---|---|---|
| Permanent residential home: | 124 | (57% of residential homes) |
| Part-time residential home: | 92 | (43% of residential homes) |
| Agricultural land: | 6 | |
| Vacant/undeveloped: | 6 | |
| Business/commercial: | 2 | |
| Renter: | 1 | |

| | | |
|---|---|---|
| **Off-lake landowners w/ access rights:** | 70 | (53%) |

**Years of property ownership**

| | | |
|---|---|---|
| < 1 year: | 7 | (3%) |
| 1-3 years: | 27 | (12%) |
| 4-10 years: | 59 | (26%) |
| 11-20 years: | 59 | (26%) |
| 21-30 years: | 25 | (11%) |
| 30+ years: | 47 | (21%) |

**Property use during summer**

| | | |
|---|---|---|
| Never: | 3 | (1%) |
| 1-3 days/mo | 9 | (4%) |
| 4-6 days/mo | 10 | (5%) |
| 7-10 days/mo | 22 | (10%) |
| 10+ days/mo | 50 | (23%) |
| Every day: | 126 | (57%) |

NOTE: The next section of the survey included a series of gradient-type questions. Responses could fall anywhere along a 6-point scale between two opposing positions (i.e., always cold 1 2 3 4 5 6 always hot). For each question, the average response is shown as the first column of numbers, and then graphically on the right-hand side of the page. The second column of numbers indicates the amount of variance around the average, called standard deviation. Lower numbers signify more variable responses (low agreement), while higher numbers indicate that responses were clustered around the average (high agreement).

| | Average (1-6 scale) | Standard Deviation | 1 | | 2 | | 3 | | 4 | | 5 | | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency you visit/use lake:** (not at all – every day) | 3.9 | 11.3 | | | | | | ■ | | | | | |

**<u>Perceptions about Lake Ripley</u>**

| | | |
|---|---|---|
| Water clarity: (completely clear – completely murky) | 3.2 | 32.6 |
| Plant growth: (overly sparse – overly weed-choked) | 4.1 | 27.7 |
| Weekend crowding: (calm – overly crowded) | 4.5 | 26.5 |
| Weekday crowding: (calm – overly crowded) | 2.0 | 36.1 |
| Public boating access: (too little – too much) | 3.8 | 20.8 |
| Public swimming access: (too little – too much) | 3.2 | 34.2 |
| Public shore fishing access: (too little – too much) | 2.6 | 19.3 |
| Local lake rules: (inadequate – overly restrictive) | 3.5 | 23.1 |
| Local lake rules: (very unfair – very fair) | 4.4 | 18.5 |
| Law enforcement: (inadequate – overly aggressive) | 3.7 | 15.5 |
| Quality of life near lake: (very negative – very positive) | 5.0 | 36.6 |

**What value do (or would) you place on each of the following as far as contributing to your "quality of life" as a local property owner?**

(not important – very important)

| | | |
|---|---|---|
| Presence of lake: | 5.3 | 56.1 |
| Good fishing: | 4.0 | 13.6 |
| Peace and tranquility: | 5.2 | 44.6 |
| Natural scenic beauty: | 5.3 | 50.1 |
| Clear water: | 5.2 | 44.4 |
| Safe water quality: | 5.5 | 59.0 |
| Slow-no-wake boating policies: | 4.6 | 26.5 |
| Unique and diverse wildlife: | 4.7 | 30.3 |
| Access to public beach: | 3.8 | 9.9 |
| Access to public boat launch: | 3.8 | 11.7 |
| Access to public shore fishing: | 3.1 | 14.4 |
| Access to walking/biking paths: | 4.2 | 19.5 |
| Access to Lake District Preserve: | 3.7 | 11.6 |
| Healthy aquatic plant community: | 4.9 | 33.4 |
| Abundant fish and wildlife habitat: | 4.9 | 36.8 |
| Minimal boat traffic: | 4.2 | 18.7 |
| Enforcement of rules: | 4.8 | 30.9 |

**What activities do (or would) you and your family most enjoy while on Lake Ripley?**

(least enjoy – most enjoy)

| | | |
|---|---|---|
| Swimming: | 4.8 | 34.8 |
| Fishing: | 4.1 | 16.0 |
| Enjoying peace and tranquility: | 5.3 | 46.6 |
| Observing wildlife: | 4.6 | 26.1 |
| Slow, motorboat cruising: | 4.2 | 19.9 |
| Jet skiing: | 1.9 | 53.1 |
| Sailing or wind surfing: | 2.6 | 23.9 |
| Paddling or canoeing: | 3.8 | 10.5 |
| Water skiing or tubing: | 3.4 | 12.6 |
| Speed boating: | 2.6 | 28.5 |
| Walking/biking around lake: | 4.5 | 25.2 |
| Visiting Lake District Preserve: | 3.4 | 11.3 |
| Visiting Lake Ripley Park: | 3.8 | 13.6 |

| | | |
|---|---|---|
| Ice skating: | 2.8 | 18.0 |
| Ice fishing: | 2.5 | 27.5 |

**How does each of the following currently limit your use and enjoyment of Lake Ripley?**

(not a concern – big problem)

| | | |
|---|---|---|
| Water clarity: | 3.4 | 11.6 |
| Algae: | 3.8 | 11.1 |
| Lake weeds: | 4.0 | 12.2 |
| Fish/wildlife habitat: | 2.8 | 17.9 |
| Crowding: | 3.8 | 13.4 |
| Lake rules: | 2.8 | 16.9 |
| Access to lake: | 2.4 | 27.5 |
| Litter: | 3.1 | 15.9 |
| Quality of fishing: | 2.9 | 17.5 |
| Carp: | 3.3 | 5.9 |
| Building and development: | 4.1 | 13.9 |
| Conflicts with other users: | 3.0 | 11.5 |
| Water levels: | 2.9 | 17.0 |
| Zebra mussels: | 4.3 | 19.0 |
| Pier-related issues: | 3.2 | 8.1 |
| Canada geese: | 3.6 | 6.4 |
| Noise: | 3.2 | 14.0 |
| Lack of natural scenic beauty: | 2.6 | 20.9 |

**Which of the following do you feel are currently Lake Ripley's biggest threats?**

(not an issue – big threat)

| | | |
|---|---|---|
| Overuse of lawn fertilizers/pesticides: | 4.3 | 19.1 |
| Overuse of agricultural fertilizers/pesticides: | 4.5 | 22.1 |
| Non-native, invasive plants/animals: | 4.7 | 28.6 |
| Loss of habitat: | 4.2 | 17.9 |
| Polluted runoff: | 4.7 | 27.4 |
| Over-development: | 4.5 | 24.0 |
| Over-crowding: | 4.5 | 23.1 |
| Groundwater depletion: | 3.7 | 15.7 |
| Lake-rule violations: | 3.4 | 16.5 |
| Uninformed public: | 3.8 | 14.2 |
| Lake-level fluctuations: | 3.2 | 17.3 |
| Poor land-use planning: | 3.7 | 10.3 |
| Misguided lake-management programs: | 2.8 | 15.6 |

**How informed do you feel about issues affecting Lake Ripley and its management?**

(not at all - very informed)

| | | |
|---|---|---|
| | 4.5 | 23.7 |

**How do you prefer to receive your Lake Ripley news and information?**

(least – most preferred)

| | | |
|---|---|---|
| Ripples newsletter: | 5.4 | 54.7 |
| E-mail bulletins: | 3.7 | 20.5 |
| Attend Lake District meetings: | 2.5 | 22.6 |
| *Cambridge Cable TV 12*: | 2.4 | 27.8 |
| *Cambridge News* articles: | 3.8 | 9.5 |
| Lake District website: | 3.1 | 10.6 |

| | | |
|---|---|---|
| Library: | 2.1 | 35.3 |
| Community workshops/events: | 2.6 | 20.5 |
| Friends and neighbors: | 3.5 | 8.5 |

**Are you aware that eligible landowners may receive 50% cost-sharing and technical assistance for projects that benefit Lake Ripley (i.e., rain gardens, shoreline restorations, etc.)?**

(not at all – very aware)

| | | |
|---|---|---|
| | 4.5 | 27.7 |

**How do you feel about the following Lake District efforts?**

(strongly oppose – strongly support)

| | | |
|---|---|---|
| Landowner cost sharing for eligible projects: | 4.3 | 21.6 |
| Project design/permitting assistance: | 4.4 | 22.0 |
| Development of management plans: | 4.7 | 27.1 |
| Mechanical weed harvesting: | 5.1 | 40.1 |
| Water quality monitoring: | 5.5 | 54.3 |
| Lake-use monitoring: | 5.1 | 42.2 |
| Control of invasive plants/animals: | 5.5 | 53.8 |
| Negotiating land-conservation agreements: | 4.9 | 33.8 |
| Lake District Preserve: | 4.9 | 31.5 |
| Citizen “Lake Watch” patrols: | 4.4 | 22.2 |
| Litter cleanups: | 5.3 | 47.0 |
| Ripples newsletter: | 5.3 | 50.0 |
| Lake Ripley E-Bulletins: | 4.5 | 26.7 |
| Lake District website: | 4.4 | 20.0 |
| Pursuing funding through grants: | 5.5 | 57.0 |
| Acquisition of conservancy areas: | 5.0 | 40.1 |
| Lake research to diagnose problems: | 5.2 | 47.1 |
| Lobbying for lake-protection policies: | 5.0 | 39.9 |
| Public meetings/forums: | 4.6 | 26.7 |
| Property owner surveys: | 4.9 | 33.7 |

**How do you feel about the portion of your tax bill that finances the protection and management of Lake Ripley ($53 per $100,000 of assessed valuation)?**

(insufficient – excessive)

| | | |
|---|---|---|
| | 3.8 | 22.1 |

**What about Lake Ripley or its management do you appreciate the most?** (10+ mentions)

65: Proactive/concerned management
16: Maintaining clear and clean water quality
14: Public information/education/awareness
12: Natural scenic beauty
11: Community/citizen activism

**Is there anything about Lake Ripley or its management you find most concerning?** (10+ mentions)

29: “No”
10: Management’s agenda or approach to decision making

**What specific actions are needed to better protect and manage Lake Ripley?** (10+ mentions)

15: Limit lake access to control crowding
14: Cut more weeds
13: Continue current management efforts

**What topics would you like to learn more about in future newsletters or articles?** (10+ mentions)

10: Homeowner tips relating to yard care and lake-protection strategies

# Property Owner Opinion Survey (Summer 2005)

Distribution: Questionnaires were sent on 10/06/05 to the mailing addresses of all property owners located within the boundaries of the Lake Ripley Management District and/or Lake Ripley watershed

Number of households receiving a survey: 948

Number responding: 220

Response rate: 23%

---

1. **What type of property do you own? Check all that apply.**
   45%: Single-family home (Seasonal residence)
   49%: Single-family home (Permanent residence)
   6%: Vacant/Undeveloped
   1%: Agricultural
   3%: Rental property
   1%: Condominium
   1%: Business/Commercial

2. **Approximately how far from the lake is your property located?**
   40%: On the water
   47%: 1/4 mile
   7%: 1/2 mile
   2%: 3/4 mile
   4%: 1 or more miles

3. **How long have you owned property near Lake Ripley?**
   28%: 0-5 years
   18%: 6-10 years
   11%: 11-15 years
   9%: 16-20 years
   34%: 20+ years

4. **If you are a seasonal or part-time resident, please answer the following questions.**
   A) **On average, how many days per month do you use your home?**
      11%: 0-3 days
      15%: 4-6 days
      24%: 7-9 days
      20%: 10-12 days
      30%: 12+ days

   B) **Do you have plans to make this home your permanent residence?**
      38%: Yes
      62%: No

5. **What about Lake Ripley contributed to your decision to buy property near Lake Ripley? List the letters of your top three choices.**
   (1st choices = 3 points, 2nd choices = 2 points, 3rd choices = 1 point)
   91 pts: Lake not a consideration
   54 pts: Size/depth
   34 pts: Level of use
   130 pts: Water clarity
   11 pts: Weed/algae conditions
   20 pts: Public accessibility
   62 pts: Fishery

31 pts: Level of development
240 pts: Natural scenic beauty **(1st)**
26 pts: Lake-bottom condition
170 pts: Water-sport opportunities **(2nd)**
142 pts: Quiet recreation **(3rd)**
38 pts: Regional center of activity

**6. If you boat on Lake Ripley, please answer the following questions.**

A) **What types of watercraft do you use? Check all that apply.**
30%: Row/paddle boat
8%: Sailboat
11%: Jet Ski
11%: <30HP fishing boat
12%: >30HP fishing boat
27%: Speed boat
36%: Pontoon boat

B) **How do you access the lake? Check all that apply**.
31%: Public boat landing
15%: Marina
49%: Private lakefront access

C) **Do you use your boat on other waters besides Lake Ripley**?
22%: Yes
78%: No

D) **If you answered "Yes" above, are you aware of how to inspect, identify and clean your boating equipment of invasive species (i.e., zebra mussels, Eurasian milfoil, etc.)**?
91%: Yes
9%: No/not sure

**7. If you are an angler, please answer the following questions.**

A) **Which types of fish do you prefer to try to catch on Lake Ripley? Rank 1-5, with 5 being least important**. (Rank 1 = 5 points, rank 2 = 4 points,… rank 5 = 1 point)
403 pts: Largemouth Bass **(1st)**
314 pts: Walleye **(3rd)**
197 pts: Northern pike
331 pts: Bluegill/Sunfish **(2nd)**
144 pts: Yellow perch
35 pts: Other

B) **Compared to other lakes, how is the fishing on Lake Ripley in terms of fish sizes and numbers**?
7%: Excellent
35%: Good
47%: Fair
11%: Poor

C) **How often do you practice "catch-and-release"**?
56%: Always
39%: Sometimes
5%: Never

**8. How do you feel about the current availability of public access on Lake Ripley?**
24%: Too much
66%: Sufficient
10%: Not enough

9. **Overall, how would you describe Lake Ripley's water clarity?**
   67%: Clear
   26%: Cloudy
   7%: Murky
   0%: Pea soup

10. **Overall, how would you describe Lake Ripley's aquatic plant growth? Please explain why you feel this way.**
    6%: Too sparse
    69%: Acceptable
    25%: Overly abundant

11. **What activities do you or members of your household most enjoy while on Lake Ripley? List letters of your top three choices.** (1st choices = 3 points, 2nd choices = 2 points, 3rd choices = 1 point)
    32 pts: Don't use the lake
    191 pts: Slow, motorboat cruising **(2nd)**
    40 pts: Speed boating
    178 pts: Fishing **(3rd)**
    41 pts: Jet skiing
    137 pts: Water skiing/tubing
    270 pts: Swimming **(1st)**
    5 pts: Diving/snorkeling
    42 pts: Paddling
    119 pts: Enjoying natural scenery
    15 pts: Sailing/wind surfing
    95 pts: Enjoying quiet solitude
    27 pts: Spotting wildlife
    8 pts: Snowmobiling
    6 pts: Cross-country skiing
    14 pts: Other

12. **How crowded do you generally feel when on the lake?**
    WEEKENDS:
    6%: Not crowded
    16%: Slightly crowded
    44%: Moderately crowded
    34%: Extremely crowded
    WEEKDAYS:
    71%: Not crowded
    19%: Slightly crowded
    8%: Moderately crowded
    2%: Extremely crowded

13. **How do you feel about rule enforcement on Lake Ripley?**
    16%: Not sufficient
    64%: Adequate
    20%: Overly aggressive

14. **What lake qualities are of greatest importance to you? Rank as follows: 2 = very important, 1 = moderately important, 0 = little or no importance**
    268 pts: Minimal boat traffic **(6th)**
    246 pts: Fish/wildlife refuges **(7th)**
    272 pts: Few to no problem weeds **(4th)**
    162 pts: Big fish **(13th)**
    223 pts: Abundant fish **(10th)**
    294 pts: Natural scenic areas **(2nd)**
    244 pts: Rule compliance/enforcement **(8th)**

269 pts: Quiet solitude **(5th)**
362 pts: Clear water **(1st)**
205 pts: Unique and diverse aquatic life **(11th)**
190 pts: Ease of navigation **(12th)**
289 pts: Safe beaches **(3rd)**
243 pts: Minimal shore development **(9th)**
126 pts: Public access opportunities **(14th)**
14 pts: Other **(15th)**

**15. Do any of the following routinely impair your ability to enjoy Lake Ripley? Check all that apply.**

14%: Poor water clarity **(7th – tie)**
19%: High or low water levels **(5th – tie)**
31%: Aquatic "weed" growth **(2nd)**
10%: Small fish sizes **(9th)**
14%: Low fish numbers **(7th – tie)**
40%: Overcrowding **(1st)**
22%: Algae **(4th – tie)**
5%: Insufficient public access **(12th)**
19%: Boating conflicts **(5th – tie)**
7%: Lack of fish/wildlife habitat **(11th)**
15%: Rule violations **(6th)**
22%: Noise **(4th – tie)**
9%: Burdensome lake-use policies **(10th)**
12%: Litter **(8th – tie)**
14%: Shore development **(7th – tie)**
12%: Pollutant-level concerns **(8th – tie)**
25%: Canada geese **(3rd)**
14%: Other **(7th – tie)**

**16. What do you feel are the biggest threats to Lake Ripley's future? List the letters of your top three choices.** (1st choices = 3 points, 2nd choices = 2 points, 3rd choices = 1 point)

183 pts: Misuse of lawn/garden/farm chemicals **(3rd)**
208 pts: Invasive species **(1st)**
18 pts: Groundwater pumping
105 pts: Soil erosion and polluted runoff
171 pts: Boating pressure
18 pts: Fishing pressure
200 pts: Development pressure **(2nd)**
49 pts: Fluctuating water levels
38 pts: Poor farming practices
28 pts: Uninformed public officials
47 pts: Uninformed citizenry
58 pts: Habitat destruction
61 pts: Misguided management priorities
13 pts: Other

**17. Do you feel that you are kept reasonably informed of important matters regarding Lake Ripley?**

90%: Yes
10%: No

**18. How do you obtain, or prefer to obtain, your Lake Ripley-related news and information? Check all that apply.**

20%: Watch or attend meetings
90%: The Ripples newsletter
42%: Local news articles
18%: Website
1%: Library archives
29%: Friends/neighbors

5%: Other

**19. Which of the following topics would you like to learn more about? Check all that apply.**

13%: Rain gardens **(11th – tie)**
23%: Lake-friendly lawn care **(5th – tie)**
10%: Conservation easements **(12th – tie)**
19%: Aquatic plant management **(7th)**
16%: Fisheries management **(9th)**
26%: Invasive species I.D./control **(3rd)**
27%: General lake ecology **(2nd)**
18%: Shoreline vegetative buffers **(8th)**
25%: Shoreline erosion control **(4th – tie)**
10%: Construction site erosion control **(12th – tie)**
9%: Conservation farming practices **(13th – tie)**
8%: Drainage ditch repair **(14th)**
29%: Lake rules **(1st)**
20%: Wetland restoration **(6th)**
13%: Nutrient/pesticide management planning **(11th – tie)**
5%: Composting **(15th)**
14%: Polluted runoff **(10th)**
9%: Water conservation **(13th – tie)**
23%: Shoreland zoning rules **(5th – tie)**
25%: Lake Ripley trivia **(4th – tie)**
3%: Other **(16th)**

**20. What do you think is the most positive aspect of Lake Ripley? Please explain.**
Top 3 comments: Water quality (56); natural beauty (36); peacefulness (26)

**21. What do you think is the most negative aspect of Lake Ripley? Please explain.**
Top 3 comments: Overcrowding/boat traffic (50); jet skis (22); overdevelopment (21)

**22. What actions would you like to see taken to better protect and manage Lake Ripley?**
Top 3 comments: Boating restrictions on numbers/sizes/horsepower/speed (28); better lake-access controls (19); continued management efforts (19)

**23. Do you have any concerns or questions that were not addressed as part of this survey?**
Overwhelming majority indicated “no” or made no comment

# Property Owner Opinion Survey (Summer 1999)

Surveys mailed:  800 (Lake District and watershed landowners)
Surveys returned:  307
Response rate:  38%

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1. **What type of property owner are you?  Check all that apply.**
   **(96%)** Residential  **(1%)** Rural/Ag.  **(1.7%)** Commercial  **(3.6%)** Vacant  **(1%)** Renter

2. **Are you a member of the Lake Ripley Management District?**
   **(55.6%)** Yes  **(29.8%)** No  **(13.6%)** No Response

3. **How far from Lake Ripley is your property located?**
   **(36.1%)** On the water  **(43.7%)** ¼ mile  **(7.9%)** ½ mile  **(6.3%)** ¾ mile  **(4%)** 1+ miles
   **(1%)** No Response

4. **What is your residency status?**
   **(57.9%)** Year-round/Permanent  **(39.4%)** Seasonal/Part-time  **(2.6%)** No Response

5. **If you are a seasonal/part-time resident, please answer the following questions.**
   A) **What season(s) do you most often spend time on Lake Ripley?**
      **(37.8%)** Spring [Mar – May]  **(95%)** Summer [Jun – Aug]  **(47.1%)** Fall [Sept – Nov]
      **(11.8%)** Winter [Dec – Feb]

   B) **How many days per month (on average) do you spend time on Lake Ripley?**
      **(11)** AVERAGE; **(10)** MEDIAN; **(7.5)** MEAN

   C) **In which state and county are you a permanent resident?**
      **(44.8%)** Wisconsin  **(46%)** Illinois  **(9.2%)** Other

6. **How many years have you owned property on or near Lake Ripley?**
   **(24.8%)** 0-5 years  **(14.9%)** 6-10 years  **(13.6%)** 11-15 years  **(6.6%)** 16-20 years  **(37.4%)** 20+ years
   **(1.7%)** No Response

7. **List the top three reasons why you chose to own property on or near Lake Ripley?** Units are in percent.

| | 1st | 2nd | 3rd |
|---|---|---|---|
| A. Recreational activities | **21.2** | **10.3** | **8.9** |
| B. Cost of the property | **5.3** | **8.9** | **3.3** |
| C. Distance from home | **7.9** | **7.6** | **8.3** |
| D. Lake size | **1.3** | **2.3** | **2.0** |
| E. Lake quality | **6.3** | **7.6** | **5.0** |
| F. Peace/tranquility | **14.6** | **15.6** | **14.6** |
| G. Quality of fishery | **1.0** | **1.0** | **3.0** |
| H. Small community environment | **10.6** | **18.5** | **19.9** |
| I. Friends or family on lake | **6.3** | **7.0** | **5.6** |
| J. Family tradition or inheritance | **9.9** | **4.0** | **4.0** |
| K. Real estate investment | **2.6** | **5.6** | **5.3** |
| L. Business purposes | **1.3** | **1.3** | **0.0** |
| M. Entertaining | **0.7** | **0.0** | **3.3** |
| N. Other | **6.3** | **1.6** | **4.3** |

| | | | |
|---|---|---|---|
| No Response | **3.6** | **7.6** | **11.6** |

Rankings after adding percentages across all three ranking categories: 1st **H** 2nd **F** 3rd **A**
(Frequent responses for "other": Close to work; liked property/house; Lake Ripley not a factor)

**8. If you own lakefront property, what structures exist on this property?**
**(5%)** Vacant **(67.2%)** Winterized house **(24.4%)** Summer cottage **(1.7%)** Boathouse
**(80.7%)** Dock/Pier **(14.3%)** Swimming raft **(41.2%)** Detached garage/Storage shed
**(42%)** Deck/Patio **(8.4%)** Boat launch **(2.5%)** Other

**9. If you own lakefront property, which of the following best describes your lake frontage?**
**(38.9%)** Mowed lawn **(6.8%)** Concrete/wood/metal retaining wall **(20.1%)** Natural vegetation
**(26%)** Stabilizing rocks **(8.2%)** Sand beach

**10. How many of each type of watercraft do you use on Lake Ripley? Please write the number of each watercraft that you own in the spaces provided.**
**(57)** Rowboat/Paddle boat **(77)** Canoe/Kayak **(33)** Sailboat **(18)** Personal watercraft
**(37)** Motor boat under 25HP **(113)** Motor boat over 25HP **(63)** Pontoon boat **(4)** Other

**11. If you are an angler, please answer the following questions.**

D) **Which of the following Lake Ripley fish species do you prefer to catch?**
(1 = most important, 3 = least important) Units are in percent.

| | 1 | 2 | 3 |
|---|---|---|---|
| Bluegill/Sunfish | **22.8** | **18.2** | **4.3** |
| Largemouth Bass | **33.4** | **7.6** | **1.7** |
| Walleye | **25.8** | **13.2** | **1.7** |
| Northern pike | **6.6** | **17.5** | **9.6** |
| Perch | **7.3** | **13.2** | **14.2** |

(Crappie, bullhead, gar and carp were also mentioned)

E) **What is the average size of each type of fish that you catch on Lake Ripley?** Units are in inches.

| | AVERAGE | MEDIAN |
|---|---|---|
| Largemouth Bass | **11.9** | **12** |
| Walleye | **13.3** | **14** |
| Northern Pike | **20.2** | **20** |
| Bluegill/Sunfish | **6.0** | **6** |
| Perch | **4.9** | **5** |

F) **Overall, how would you rate the quality of fishing on Lake Ripley?**
**(12.7%)** Poor **(27.4%)** Fair **(12.7%)** Good **(0.0%)** Excellent **(47.2%)** No Response

G) **Do you voluntarily practice "catch-and-release" when fishing?**
**(25.8%)** Always **(25.4%)** Sometimes **(2.3%)** Never **(46.5%)** No Response

**12. Do you feel Lake Ripley has adequate public access? If not, what type of access is most needed?**
**(81.9%)** Yes **(10.0%)** No **(8.0%)** No Response
(Frequent responses for type of access needed: One more boat launch at other end of lake; public shoreline access for fishing and swimming)

**13. What is your opinion regarding the use of fertilizers and/or weed killer to maintain lawns or crops around Lake Ripley? Check all that apply.**
**(9.4%)** needed on a frequent and regular basis *(two or more applications per year)*
**(11.7%)** needed on an infrequent, but regular basis *(less than two applications per year)*
**(38.5%)** needed occasionally, but should be used sparingly and only if absolutely necessary
**(14.7%)** not needed
**(32.4%)** should not be used without extreme caution due to health/environmental effects

14. **Overall, how would you describe the water clarity in Lake Ripley during the summer months?**
**(0.3%)** Crystal clear **(18.7%)** Clear **(44.8%)** Cloudy **(21.4%)** Murky **(4.0%)** Pea soup
**(10.7%)** No Response

15. **When is water clarity at its worse? Check all that apply.**

| | |
|---|---|
| **(3.0%)** Consistently bad | **(28.4%)** After heavy rains |
| **(3.3%)** Spring | **(62.5%)** After heavy motor boat & jet ski traffic |
| **(52.8%)** Summer | **(13.0%)** During abnormally high/low lake levels |
| **(6.0%)** Fall | **(6.7%)** Other (frequent response: During hot, sunny weather) |

16. **Overall, how would you describe Lake Ripley's aquatic plant growth?**
**(9.7%)** Too few plants **(42.5%)** Healthy amount of plant growth **(27.4%)** Too many plants

17. **What activities do you and the members of your household most enjoy while recreating on Lake Ripley? List the letters of your top three choices.** Units are in percent.

| | 1st | 2nd | 3rd |
|---|---|---|---|
| A. Fishing | **16.7** | **7.7** | **4.7** |
| B. Motor boating | **12.0** | **18.4** | **5.4** |
| C. Canoeing/Paddle boating | **2.3** | **5.7** | **2.3** |
| D. Sailing/Wind surfing | **1.3** | **5.7** | **1.3** |
| E. Jet skiing | **1.3** | **2.7** | **1.0** |
| F. Water skiing | **4.7** | **5.4** | **4.7** |
| G. Enjoying peace/ tranquility | **20.1** | **15.7** | **14.0** |
| H. Observing wildlife | **0.7** | **5.7** | **7.7** |
| I. Swimming/Snorkling | **21.1** | **10.7** | **11.4** |
| J Enjoying the view | **7.7** | **11.0** | **16.4** |
| K. Camping | **0.0** | **0.0** | **0.0** |
| L. Entertaining | **0.7** | **3.0** | **5.0** |
| M. Working on property | **0.7** | **0.7** | **7.4** |
| N. Cross-country skiing | **0.0** | **0.3** | **0.3** |
| O. Snowmobiling | **0.0** | **0.3** | **2.0** |
| P. Other | **2.7** | **0.3** | **1.3** |
| No Response | **8.0** | **11.4** | **15.4** |

Rankings after adding percentages across all three ranking categories: 1st **G** 2nd **I** 3rd **B**
(Frequent response for "other": None of the above – don't use the lake)

18. **Rank the following according to their level of importance to you (1 = most important, 14 = least important).** The following percentages represent those who responded with a 1, 2 or 3 for each option, indicating a high level of importance.

| | |
|---|---|
| **(59.5%)** Clear water | **(23.1%)** Sandy bottom |
| **(10.7%)** Moderate amount of aquatic plant growth | **(18.4%)** Natural shorelines |
| **(4.7%)** Little or no aquatic plant growth | **(40.1%)** Peace & tranquility |
| **(10.4%)** Large fish | **(25.8%)** Reduced boat traffic & congestion |
| **(20.7%)** Abundant fish | **(31.4%)** Overall, ecosystem health |
| **(21.4%)** Presence of wildlife/habitat | **(2.0%)** Tourism/Business |
| **(10.4%)** Law enforcement | **(5.0%)** Other |

(Frequent responses for "other": Need better lake access for those without lake rights; Marina should sell fuel; ability to use lake without excess restrictions; need to ban PWCs; need to limit motor size on lake)

19. **How have the following changed since you've lived on or near Lake Ripley?** Units are in percent.

| | BETTER | SAME | WORSE |
|---|---|---|---|
| Water clarity: | **17.7** | **30.4** | **37.1** |
| Fish size: | **2.3** | **34.1** | **27.4** |
| Fish abundance: | **3.0** | **28.4** | **34.4** |

| | | | |
|---|---|---|---|
| Nuisance “weed” growth: | **16.4** | **27.4** | **38.5** |
| Aquatic plant habitat: | **7.4** | **37.5** | **24.7** |
| Algae growth: | **9.0** | **27.8** | **40.1** |
| Floating plant debris: | **10.4** | **30.8** | **39.8** |
| Boat traffic: | **7.0** | **25.8** | **50.8** |
| Personal watercraft traffic: | **3.7** | **15.4** | **62.9** |
| Peace & tranquility: | **4.3** | **3.4** | **41.1** |
| Fishing pressure: | **3.7** | **39.5** | **18.1** |
| Natural shorelines: | **13.7** | **38.1** | **20.7** |
| Muckiness of lake bottom: | **4.3** | **39.8** | **29.1** |
| Lake-level fluctuations: | **4.7** | **57.2** | **9.0** |
| Rule compliance/enforcement: | **11.0** | **43.1** | **17.7** |

20. **On summer WEEKENDS, how crowded do you generally feel when you are on Lake Ripley?**
    **(5.4%)** Not crowded **(18.4%)** Slightly crowded **(41.5%)** Moderately crowded
    **(20.7%)** Extremely crowded **(14%)** No Response

21. **On summer WEEKDAYS, how crowded do you generally feel when you are on Lake Ripley?**
    **(61.5%)** Not crowded **(14.0%)** Slightly crowded **(8.0%)** Moderately crowded
    **(1.7%)** Extremely crowded **(14.7%)** No Response

22. **Do you feel that there is an adequate law enforcement presence on Lake Ripley?**
    **(56.2%)** Yes **(27.4%)** No **(16.4%)** No Response

23. **What is your opinion regarding the use and regulation of personal watercraft (e.g. jet skis) on Lake Ripley? Check all that apply.**
    **(8.7%)** They cause little or no problems
    **(32.8%)** They should be treated the same as other motor boats
    **(51.5%)** They are too noisy
    **(39.8%)** They are too dangerous
    **(30.1%)** They are too polluting/environmentally destructive
    **(43.5%)** They should be more strictly regulated
    **(35.8%)** They should be banned

24. **Would you be in favor of expanding “slow-no-wake” times and/or locations for the purpose of promoting safety and protecting sensitive habitat areas on Lake Ripley?**
    **(58.2%)** Yes **(30.1%)** No **(11.7%)** No Response

25. **Do you see a need for more pier regulation on Lake Ripley?**
    **(18.4%)** Yes **(64.2%)** No **(17.4%)** No Response

26. **What is your opinion regarding lake-use regulations on Lake Ripley in general?**
    **(7.4%)** Over regulated **(23.7%)** Under regulated **(53.5%)** Sufficiently regulated
    **(15.4%)** No Response

27. **How much does each of the following negatively impact your use or enjoyment of Lake Ripley (1 = biggest problem, 16 = smallest problem)?** The following percentages represent those who responded with a 1, 2 or 3 for each option, indicating a high level of importance.

    **(22.1%)** Nuisance algae growth
    **(29.8%)** Poor water clarity
    **(19.7%)** Excessive weed growth
    **(18.7%)** Floating plant debris
    **(11.0%)** Small fish size
    **(10.4%)** Loss of wildlife habitat (e.g. shoreline & aquatic vegetation)
    **(10.7%)** Small fish quantity
    **(8.7%)** Shoreline development
    **(1.0%)** Lake-level too high

**(34.4%)** Boat traffic/congestion
**(2.0%)** Lake-level too low
**(27.8%)** Noise
**(2.3%)** Too many fisherman
**(12.7%)** Lack of rule compliance/enforcement
**(4.0%)** Too many boating restrictions
**(11.0%)** Other
(Frequent responses for "other": Not enough access for LRMD taxpayers; motors too large; PWCs)

**28. What do you feel are the top three factors that contribute to problems on Lake Ripely? List the letters of your top three choices.** Units are in percent.

| | 1st | 2nd | 3rd |
|---|---|---|---|
| A. Fertilizer/pesticide use | **16.4** | **12.7** | **10.0** |
| B. Construction site erosion/runoff | **4.0** | **8.4** | **7.0** |
| C. Farm field erosion & runoff | **9.7** | **11.7** | **10.0** |
| D. Shoreline/stream bank erosion | **3.7** | **4.0** | **7.0** |
| E. Motor boat & jet ski traffic | **27.4** | **12.4** | **10.0** |
| F. Inadequate law enforcement | **2.3** | **5.0** | **3.0** |
| G. Lake-level fluctuations | **1.3** | **1.7** | **1.0** |
| H. Shoreline development pressures | **4.3** | **8.4** | **5.0** |
| I. Fishing pressure | **2.3** | **1.3** | **1.3** |
| J. Ineffective LRMD/LRPLP efforts | **2.3** | **1.7** | **5.4** |
| K. Wetland/wildlife habitat destruction | **5.4** | **9.0** | **9.7** |
| L. Other | **1.3** | **0.3** | **1.3** |

Rankings after adding percentages across all three ranking categories: 1st **E** 2nd **A** 3rd **C**

**29. Do you feel that you have a voice in decision-making matters regarding the management of Lake Ripley?**
**(44.8%)** Yes **(38.5%)** No **(16.7%)** No Response

**30. What is the best way for the Lake Ripley Management District to communicate with its members (Please rank: 1 = most effective, 6 = least effective)?** The following percentages represent those who responded with a 1 or 2 for each option, indicating a high level of importance.
**(20.1%)** Public meetings
**(55.2%)** Special mailers
**(67.9%)** Newsletters
**(35.1%)** Local newspaper articles
**(7.7%)** Local cable TV
**(1.7%)** Other
(Frequent response for "other": Personal contact via surveys and interviews)

**31. Do you feel that you are adequately informed of lake-management decisions? If not, what should be done to facilitate better communication?**
**(60.9%)** Yes **(24.7%)** No **(14.4%)** No Response

**32. What do you think is the most negative aspect of Lake Ripley or its management?**
(**Frequent comments**: Forcing people who don't use the lake to pay taxes; weed cutting; not enough weed cutting; too much boat/PWC traffic; not enough public access to shoreline for those without lake rights; boat motors are too large; apathy; lack of communication; not enough law enforcement; too many regulations; worsening water quality conditions; LRMD board does whatever it wants without asking residents)

**33. What do you think is the most positive aspect of Lake Ripley or its management?**
(**Frequent comments**: LRMD board is active and concerned about the lake; good communication with local residents; efforts being taken; doing a great job; existence of LRMD; this survey; purchase of wetlands; concerned and caring management; weed control; natural beauty of the lake and surrounding area; no wake times; protection of water quality)

**34. Indicate in order of importance the entities you think should be responsible for managing Lake Ripley. List the letters of your first three choices.** Units are in percent.

| 1st | 2nd | 3rd |
|---|---|---|

| | | | |
|---|---|---|---|
| A. Federal government | **0.7** | **0.3** | **3.0** |
| B. WDNR | **17.1** | **14.0** | **19.4** |
| C. Jefferson County | **2.3** | **6.0** | **14.7** |
| D. Oakland Township | **7.7** | **13.7** | **17.1** |
| E. Lake management district | **38.8** | **24.4** | **8.4** |
| F. Lake residents | **21.4** | **16.7** | **10.7** |
| G. General public (user fees) | **1.7** | **5.0** | **7.4** |
| H. Other | **0.3** | **0.7** | **1.0** |

Rankings after adding percentages across all three ranking categories: 1st **E** 2nd **B** 3rd **F**

**35. Indicate in order of importance the entities that should be responsible for financing the protection and management of Lake Ripley. List the letters of your first three choices.** Units are in percent.

| | 1st | 2nd | 3rd |
|---|---|---|---|
| A. Federal Government | **8.7** | **5.4** | **5.4** |
| E. Lake management district | **16.1** | **12.4** | **8.7** |
| B. WDNR | **31.8** | **8.7** | **13.4** |
| F. Lake residents | **8.4** | **9.4** | **10.4** |
| C. Jefferson County | **3.7** | **18.4** | **13.4** |
| G. General public (user fees) | **11.7** | **10.7** | **13.7** |
| D. Oakland Township | **7.7** | **13.7** | **17.1** |
| H. Other | **0.0** | **0.3** | **1.0** |

Rankings after adding percentages across all three ranking categories: 1st **B** 2nd **D** 3rd **E**

**36. Do you have other concerns or questions that were not addressed in this survey?**
**(Most respondents reiterated points made in questions #32 and 33)**

# APPENDIX G

# Scoring Sheet for Landowner Cost Sharing

Date:____________________ Names of Scorers:________________________________________
Landowner:________________________________________________________________________
Site Address:______________________________________________________________________
Project Scope:_____________________________________________________________________
Pre-Bid Cost Estimate:______________________________________________________________

Point categories: 2 = Yes
1 = Marginal/Questionable
0 = No

| | POINTS (20 possible) |
|---|---|
| Is the project currently listed as an eligible, approved practice? | ______ |
| Will the project address active soil erosion? | ______ |
| Will the project collect, filter or infiltrate storm runoff? | ______ |
| Will the project help protect or enhance habitat quality? | ______ |
| Will the project serve a public, lake management-related education benefit? | ______ |
| Will the project protect or improve ground/surface water quality? | ______ |
| Is the project cost-effective in terms of its scope and scale? | ______ |
| Does the project advance a recommendation from an approved management plan? | ______ |
| Is the project needed to repair a prior cost-share effort due to circumstances beyond the control and contractual obligations of the landowner? | ______ |
| Are there unique aspects about the project that increase its strategic importance? Specify:____________________________________________________________ | ______ |
| TOTAL SCORE: | ______ |

**Recommendation to Board:** ☐ **Approve** ☐ **Deny**

*NOTES: Projects shall score a minimum of eight (8) points before they are brought before the full Board. Final approvals are subject to funding availability and the completion of any landowner permitting or contractual obligations. The cost-share rate is 50% for all eligible practices.*

## Eligible Practices

| **Eligible Conservation Practices** | **Minimum Standards** |
|---|---|
| Conservation easements | Wetland and riparian properties; terms and conditions effective in perpetuity |
| Shoreline/stream bank/ditch bank protection (i.e., bank shaping, rock riprap, bioengineering, cattle fencing) | Clear evidence of soil erosion or risk of bank failure; 30 ft. for shorelines; NRCS technical standards |
| Shoreline plantings | 1,000 sq. ft. planting area; 20-ft. average planting depth from shore; shrub and herbaceous layers; LMRD-approved native species and planting densities |
| Aquatic plant re-establishment | 50 sq. ft.; LRMD-approved native species and planting densities |
| Near-shore tree-drops | Tree must be dead, diseased, pose an obvious safety/property hazard, or be recommended for removal by a certified forester |
| Building site runoff controls (i.e., rain gardens, rain barrels, infiltration basins, removal of water-impervious surfaces) | Rain garden: 100 sq. ft.; meets approved design standards (DNR Publication PUB-WT-776 2003) |
| Drainage ditch closure | [Contact U.S. Fish & Wildlife Service for possible grant assistance] |
| Public informational signage (i.e., lake rule postings, watershed signs, signage for demonstration sites) | Must be visible from publicly accessible areas; content of signage must advance LRMD goals |
| Wetland and prairie restorations (i.e., native planting/seeding, invasive species control) | 0.5 acre |
| Terraces | NRCS technical standards |
| Tree and shrub establishment | 10 acres; approved plan by DNR forester |
| Grassed waterways | NRCS Technical standards |
| Well closure | Completed by certified well driller; drilling logs submitted to DNR |
| Storm drain inlet protection | WDNR #1060 Conservation Practice Standard |
| Nutrient/pesticide management planning | [Refer landowner to Jefferson County Land & Water Conservation Department for higher cost-share rate] |
| Agricultural riparian buffers | [Refer landowner to Jefferson County Land & Water Conservation Department or NRCS for participation in CREP] |
| Barnyard runoff control system | [Refer landowner to Jefferson County Land & Water Conservation Department] |
| Manure storage system | [Refer landowner to EQIP] |
| Conservation farming practices (i.e., contour stripcropping, reduced tillage) | [Refer landowner to Jefferson County Land & Water Conservation Department] – flat rate per acre up to maximum acreage |

# Guidance for Landowner Cost-Share Participation

1. Landowner notifies LRMD of project intentions, and requests eligibility review and funding consideration.

2. Lake Manager performs preliminary site inspection and discusses project with the landowner (i.e., scope, options, cost-share eligibility, permit requirements, project-approval and cost-sharing procedures, etc.)

3. Lake Manager schedules and notices subcommittee meeting to evaluate and score the project using established ranking criteria. Landowner is contacted and invited to attend the meeting when scheduled.

4. Subcommittee meets to score the project. Project must: 1) involve eligible practices, 2) meet applicable design standards, and 3) rank high enough to be recommended to the full Board for funding consideration. Lake Manager provides technical advice and rough cost estimates, and records minutes.

5. LRMD Board reviews the recommendations of the subcommittee and votes to either reject or preliminarily approve cost sharing. Landowner must then obtain multiple contractor bids for review prior to final Board approval. The Board may also stipulate funding conditions at this time, including caps, special landowner obligations, or additional project requirements.

6. When project is either tentatively or fully approved by the Board, landowner has six (6) months to develop a scope of work, obtain multiple cost estimates based on required design specifications, and sign a cost-share agreement. The Lake Manager can assist the landowner in satisfying these requirements. Cost-share contracts shall be deed recorded if costs are estimated to exceed $1,000.

7. Upon final Board approval, landowner shall obtain any necessary permits with assistance from the Lake Manager, and hire a qualified contractor to perform the work. While cost-share reimbursements are calculated based on the lowest responsible bid, landowner may select a contractor of his or her choosing. Volunteer and in-kind contributions are gratefully accepted to reduce costs, but only third-party invoices for qualified expenses are eligible for cost sharing.

8. Landowner shall inform the Lake Manager when a contractor is selected so a pre-implementation meeting can be scheduled to finalize project details. The landowner must also notify the Lake Manager at least three (3) business days in advance of the start of any work to ensure proper oversight.

9. Landowner has one (1) year following the date of a recorded cost-share agreement to complete the project. A six (6)-month extension may be allowed by the Board if requested and justified in writing.

10. Permit-application and deed-recording fees are the responsibility of the landowner, and are not eligible for cost sharing. A cost-share agreement can be rescinded if the project is denied the requisite permits.

11. Cost-share reimbursement rates are 50% unless otherwise specified. Funding is allocated on a first-come, first-served basis. If two or more projects find themselves competing for the same funds, priority is given to the highest scoring projects. To help ensure adequate funding availability, landowner is responsible for keeping the Lake Manager fully informed of project status and anticipated timing of implementation.

12. Upon project completion, Lake Manager shall perform a final site inspection to verify that all required specifications are met. If the project passes inspection, the landowner will be instructed to pay any balances owed to the contractor.

13. Landowner shall submit receipts or other proof-of-payment documentation to the Lake Manager for reimbursement of qualified expenses. Cost-share grants are treated as "other income" by the IRS for tax-reporting purposes, requiring the issuance of 1099 forms.

14. Landowner is legally obligated to maintain any cost-shared practices for the required maintenance period specified in the contract, which is typically ten (10) years following the date of installation.

**I have read and fully understand the above procedures and requirements as they relate to my participation in the Lake Ripley Management District's landowner cost-sharing program.**

__________________________________ __________
**Signature** **Date**

# Contractor Bidding Standards

1. Landowner shall be responsible for obtaining multiple bids from qualified contractors for any projects receiving cost-share grants in excess of $500.00. This applies to any work that will be documented by cost-share-eligible, third-party invoices.

2. Bids must reflect any applicable project plans or specifications set forth by the Lake District (see examples on pg. 2).

3. Landowner shall make a reasonable effort to obtain not less than three (3) bids. The Lake District Board shall have the discretion to request that the landowner seek additional bids if deemed appropriate.

4. Landowner shall be solely responsible for soliciting contractor bids and making all hiring decisions. Any resulting contracts are between the landowner and the bidding contractor.

5. The Lake District may facilitate the bidding process by furnishing optional contractor lists (without endorsement), preparing any applicable technical specifications and bidding documents, and by reviewing submitted bids for completeness.

6. Both the landowner and Lake District shall maintain the confidentiality of contractor bids until the bidding process expires. Bidders may be asked to submit written cost amendments for any scope-of-work adjustments that will allow better comparisons among competing bids.

7. All bids shall be reviewed by the Lake District Board before final cost-share authorization is granted. The Board shall specify a cost-share amount based on what it considers to be the lowest responsible bid.

8. Responsible bids are those that: (1) are received from qualified contractors; (2) meet minimum project standards and technical specifications set forth by the Lake District; (3) propose methods and costs that are deemed appropriate and reasonable by the Board; and (4) contain sufficient information detailing the proposed work and associated costs.

9. Bid amounts for purposes of cost sharing may not be exceeded by more than 10% without prior approval by the Lake District. Site conditions, property boundaries, and applicable project specifications should be reviewed and verified by the bidder.

10. Amendments to bids are only allowed for additional implementation costs that were necessary for the project and unaccounted for in the original bid. All proposed amendments must be properly documented and receive prior approval by the landowner and Lake District. It is at the Lake District Board's discretion whether to approve additional funding as a result of any amendments.

## Project-Specific Minimum Requirements

**Rain Gardens**

- Minimum 100 sq. ft. area per rain garden
- Must utilize a soil ridge, depression or similar water-containment and infiltration feature
- Minimum 90% Wisconsin native plant species (See example list at http://dnr.wi.gov/runoff/rg/RaingardenPlantList.pdf) – No invasive or noxious species
- Herbaceous plants shall be in 2.5-inch or greater containers (2.5"x2.5"x3.5",32/flat), and exhibit robust health at time of planting
- Minimum of 5 different plant species with at least 30% grasses and/or sedges
- Average planting density of 1 herbaceous plant per every 2 square feet
- Minimum 2.0-inch mulch depth throughout planting area
- Design should conform to guidelines set forth in DNR Publication PUB-WT-776 2003 ("Rain Gardens: A How-To Manual for Homeowners"; www.dnr.state.wi.us/runoff/rg/rgmanual.pdf)
- Project plan that meets the above criteria and includes: location map and dimensions of rain garden; site-preparation method; name and quantity of each plant species proposed; quantity of mulch; cost breakdown for labor and materials)

**Lakeshore Buffers**

- Minimum 1,000 sq. ft. area (not applicable if required for shoreline rip-rap permit)
- Minimum 20-ft. average planting depth perpendicular to and along length of lake edge (min. 8-ft. average planting depth for cost-shared riprap projects approved without a standard buffer) – does not include access paths and pre-existing sand beach areas approved by the Lake District
- Minimum 90% Wisconsin native plant species (See example list at www.botany.wisc.edu/herb/countysearch.html, or http://uwarboretum.org/images/NativePlantsSoWis.pdf) – No invasive or noxious species
- Herbaceous plants shall be in 2.5-inch or greater containers (2.5"x2.5"x3.5",32/flat), and exhibit robust health at the time of planting
- The herbaceous cover layer shall be comprised of at least 30% grasses and/or sedges
- Minimum 2.0-inch mulch depth throughout planting area
- Minimum number of species and planting densities shall conform to Wisconsin Biology Technical Note 1: Shoreland Habitat (U.S. Department of Agriculture, Natural Resources Conservation Service; www.dnr.state.wi.us/org/water/wm/dsfm/shore/documents/NRCSBioTechNote.pdf)

Table 1. Shoreland Habitat Planting Densities

| | Woodland | | Wetland, Barrens, Dry/Wet Prairie | |
|---|---|---|---|---|
| Layer | Min. Species | Density | Min. Species | Density |
| Trees | 2 | 0.5-5 per 100 sq. ft. | 0 | 0-0.2 per 100 sq. ft. |
| Shrubs | 3 | 1-4 per 100 sq. ft. (If clumped, maintain min. 2-ft. spacing) | 2 | 0.2-0.5 per 100 sq. ft. (If clumped, maintain min. 2-ft. spacing) |
| Herbaceous Cover | | | | |
| Plant Plugs | 3 | 25-75 plants per 100 sq. ft. (Soil must be mulched) | 5 | 50-100 plants per 100 sq. ft. (Soil must be mulched) |
| Seeding | 3 | Grass/sedges: 4-8 oz. per 1,000 sq. ft. Forbs: 2-4 oz. per 1,000 sq. ft. | 5 | Grass/sedges: 4-8 oz. per 1,000 sq. ft. Forbs: 2-4 oz. per 1,000 sq. ft. |

- Project plan that meets the above criteria and includes: location map and dimensions of buffer; site-preparation method; name and quantity of each plant species proposed; quantity of mulch; cost breakdown for labor and materials

**NOTICE OF SOIL AND WATER CONSERVATION AGREEMENT AND CONSERVATION EASEMENT**

**This is a Notice of an Agreement and a Conservation Easement under Wis. Stat. § 700.40 and is not a conveyance under Wis. Stat. § 77.21(1) and is not subject to transfer return or fee pursuant to Wis. Admin. Code § TAX 15.**

Notice is given that the undersigned:

______________________________________________________

______________________________________________________

______________________________________________________

(hereinafter "Landowner") and the Lake Ripley Management District (hereinafter "District"), a municipal corporation formed under Chapter 33, Wisconsin Statutes have entered into a Soil and Water Conservation Agreement and in order to effectuate the purposes of that Agreement, the Landowner hereby grants to the District a conservation easement pursuant to Section 700.40 of the Wisconsin Statutes all as set forth herein.

Return to:
Lake Ripley Management District
N4450 County Hwy "A"
Cambridge, WI 53523

Tax Key No.: ___-_____-_____-___
___-_____-_____-___
___-_____-_____-___

**WITNESSETH:**

**WHEREAS**, Landowner is the owner in fee simple of certain real property in Jefferson County, Wisconsin, which is more particularly described in Exhibit A attached hereto (hereinafter the "Property"); and

**WHEREAS**, the District was created for the protection and rehabilitation of Lake Ripley and its watershed; and

**WHEREAS**, the Landowner and District have entered into a Soil and Water Conservation Agreement No. ______ dated ______________ (the "Agreement"), in order to establish certain land management practices on the Property, which is in the vicinity of Lake Ripley, in order to mitigate soil erosion, control sources of polluted runoff, improve Lake Ripley's water quality and habitat, and enhance other conservation values of great importance to the District; and

**WHEREAS**, the District and the Landowner desire, intend and have the common purpose of ensuring that the conservation practices specified in the Agreement are carried out and that the Property is managed in a manner consistent with the Agreement; and

**WHEREAS**, the common law of the State of Wisconsin and the Uniform Conservation Easement Act, Section 700.40 of the Wisconsin Statutes, provide for the creation and conveyance of conservation easements which impose restrictions on real property for purposes that include protecting natural resources and maintaining or enhancing water quality.

**NOW THEREFORE**, in consideration of the payment of cost-sharing funds by the District to the Landowner and the mutual terms and conditions set forth in the Agreement:

1. Landowner hereby voluntarily grants and conveys to the District a holder's interest in a Conservation Easement over the Property for a term expiring ten (10) years from the deed-recording date of this document, pursuant to the Uniform Conservation Easement Act, Section 700.40 of the Wisconsin Statutes, with terms and conditions set out herein.

2. In furtherance of the foregoing, the Landowner makes the following covenants, running with and binding the Property for the term of this Grant.

   (a) Landowner hereby covenants to and agrees to undertake, operate and maintain conservation practices on the Property in accordance with the terms, conditions, design specifications, timetables and restrictions as provided in the Agreement.

   (b) Landowner shall not undertake or authorize any activity on or use of the Property that may reduce or impair the effectiveness of the conservation practices specified in the Agreement.

   (c) Without limiting the foregoing, the following activities and uses are expressly prohibited: ______________________________________________________________________ ______________________________________________________________________

3. The Landowner hereby grants the District the following rights:

   (a) To access the Property to confirm that the conservation practices specified in the Agreement have been installed, maintained and operated consistent with the Agreement and to otherwise determine compliance with this Grant and the Agreement.

   (b) To enforce the terms of this Grant and the Agreement through actions in law or in equity in accordance with Wis. Stat. § 700.40 and other applicable laws.

**General Terms and Conditions.**

**A.** **Recording.** The District shall record this instrument with the Register of Deeds for Jefferson County, Wisconsin, and may re-record it at any time as may be required to preserve its rights herein.

**B.** **Severability**. If any provision of this Grant or the application thereof to any person or circumstance is found to be invalid, the remainder of the provisions of this Grant, or the application of such provision to persons or circumstances other than those as to which it is found to be invalid, as the case may be, shall not be affected thereby.

**C.** **Representation of Authority.**

1. The undersigned, _________________________, represents that he/she is an authorized agent of the Lake Ripley Management District, and that he/she has been authorized to execute this Grant by the District Board of Commissioners at a duly convened meeting on the _____ day of __________________, 20___.

2. The undersigned, ______________________________________________________ ________________________________________represent(s) that he/she or they are all of the owners of the Property, and have read and understand this Grant and the Agreement, have entered into them voluntarily, and have full authority to execute this Grant and the Agreement.

**D.** **Successors and Assigns.**. The covenants, terms, conditions, and restrictions of this Grant shall be binding upon, and inure to the benefit of the Landowner, his or her personal representatives, heirs, successors, and assigns, and shall continue as a servitude running with the Property during the term of this instrument.

**E.** **Interpretation.** Any general rule of construction to the contrary notwithstanding, this Grant shall be liberally construed in favor of the Grant to effectuate its purposes and the policy and purpose of the Wisconsin Conservation Easement Act. If any provision in this instrument is found to be ambiguous, an interpretation consistent with the purpose of this Grant that would render the provision valid shall be favored over any interpretation that would render it invalid.

**F.** **Notices.** Any notice, demand, request, consent, approval, or communication that either party desires or is required to give to the other shall be in writing and either served personally or sent by first class mail, postage prepaid, addressed as follows:

| To Landowner: | To Lake District: |
|---|---|
| ________________________ | N4450 County Rd. A |
| ________________________ | Cambridge, WI 53523 |

or to such other address as any party from time to time shall designate by written notice to the others.

**G:** **Property.** The property subject to this Notice of Soil and Water Conservation Agreement and Conservation Easement <u>is/is not</u> [strike one] homestead property.

**IN WITNESS THEREOF**, the undersigned Landowner(s) has/have executed this document this ____day of ________________, _______.

LANDOWNER(s):

| | |
|---|---|
| ______________________________________________ | ________________________________________ |
| (Signature) | (Signature) |
| ______________________________________________ | ________________________________________ |
| (Print Name) | (Print Name) |

**ACKNOWLEDGMENT**

STATE OF WISCONSIN )
) ss.
COUNTY Of JEFFERSON )

Personally appeared before me this ___________ day of ______________,______, ___________________ ___________________ (Landowner), to me known to be the person who executed the foregoing Notice of Soil and Water Conservation Agreement and Conservation Easement and acknowledged the same.

______________________________________________

_______________________________________
(Print Name)

Notary Public, State of Wisconsin
My commission expires: ________________

STATE OF WISCONSIN )
) ss.
COUNTY Of JEFFERSON )

Personally appeared before me this ___________ day of ______________, ______, ___________________ ___________________ (Landowner), to me known to be the person who executed the foregoing Notice of Soil and Water Conservation Agreement and Conservation Easement and acknowledged the same.

______________________________________________

_______________________________________
(Print Name)

Notary Public, State of Wisconsin
My commission expires: ________________

**ACCEPTANCE**

The District, by hereby accepts this Notice of Soil and Water Conservation Agreement and Conservation Easement as set forth herein.

LAKE RIPLEY MANAGEMENT DISTRICT

By: ________________________________________

Printed Name:__________________________________
Authorized Agent of Lake Ripley Management District

**ACKNOWLEDGMENT**

STATE OF WISCONSIN )
) ss.
COUNTY Of JEFFERSON )

Personally appeared before me this ___________ day of _____________________, ______, Paul Dearlove, to me known to be the Lake Manager of the LAKE RIPLEY MANAGEMENT DISTRICT who executed the foregoing Notice of Soil and Water Conservation Agreement and Conservation Easement and acknowledged that such acceptance is with the authority of the Board of Directors of said municipal corporation.

_______________________________________________

_________________________________________
(Print Name)

Notary Public, State of Wisconsin
My commission expires: _________________

<u>This document was drafted by</u>:
Attorney William Pray O'Connor
25 W. Main St., Ste. 801
Madison, WI 53703

# SOIL AND WATER CONSERVATION AGREEMENT
**NO. ________________**

| GOVERNMENTAL UNIT INFORMATION | |
|---|---|
| NAME OF GOVERNMENTAL UNIT<br><br>Lake Ripley Management District | TELEPHONE NUMBER<br><br>608-423-4537 |
| ADDRESS<br><br>N4450 CTH A | CITY, STATE, ZIP CODE<br><br>Cambridge, WI  53523 |
| NAME AND TITLE OF AUTHORIZED REPRESENTATIVE<br><br>Paul D. Dearlove, Project Manager | |

| LANDOWNER /GRANT RECIPIENT INFORMATION | |
|---|---|
| NAME OF LANDOWNER(S) (Individual, Government Unit, Corporation, Trust, Estate, Partnership, Homeowner's Association) | |
| MAILING ADDRESS | SOCIAL SECURITY NUMBER(S)* |
| CITY, STATE, ZIP CODE | TELEPHONE NUMBER |
| ADDRESS OF PROJECT SITE | |
| CITY, STATE, ZIP CODE | |

* The Lake Ripley Management District is required by the Internal Revenue Service to submit a 1099G for tax filing purposes. Information regarding income tax issues can be obtained at www.irs.gov or the IRS hotline # 1-800-829-1040.

| RECORDING DATA (if applicable) |
|---|
| Conservation Easement and Notice of Agreement recorded on ________________ in the Jefferson County Register of Deeds' office in Vol. ___, as Document No. _____________. |

**THIS AGREEMENT** is made and entered into on this ____ day of ____________, _____ by and between ____________________________________________________________________ (hereinafter “Landowner”) and Lake Ripley Management District (“District”), a municipal corporation formed under Chapter 33, Wisconsin Statutes.

**WHEREAS**, Landowner is the owner in fee simple of certain real property in Jefferson County, Wisconsin (hereinafter the "Property"), more particularly described by the following legal description:

______________________________________________________________________________

____________________________________________________________________

**WHEREAS**, the District was created for the purpose of undertaking programs for the protection and rehabilitation of Lake Ripley, and has established a Soil and Water Conservation Program aimed at managing the discharge of runoff and sedimentation into Lake Ripley and its tributary streams, improving habitat, and protecting water quality; and

**WHEREAS**, the District and the Landowner desire, intend and have the common purpose of implementing certain management practices on the Property as specified in this Agreement (the “Project”) in order to mitigate soil erosion, control sources of polluted runoff, improve water quality, restore fish and wildlife habitat, and/or enhance other conservation values of great importance to the District.

**NOW THEREFORE**, in consideration of payment by the District of cost-sharing funds as provided in the Practices, Estimated Costs and Installation Schedule attached hereto as Addendum 1 and the mutual covenants, terms and conditions herein, the Landowner agrees to install, maintain and operate the practices listed in Addendum 1 in accordance with the terms, conditions and requirements set forth below:

## I. LANDOWNER RESPONSIBILITIES

1. The Landowner shall implement, operate and maintain the conservation practices listed in Addendum 1 consistently with the plans, design specifications and timetables referenced or incorporated as part of this Agreement. Contracts for labor and materials shall be awarded to the lowest responsible bidder or as otherwise approved by the District.

2. Prior to seeking cost-share reimbursement from the District, the Landowner shall make all payments for which the Landowner is obligated under this Agreement. Proof of payment, as applicable, for third-party services, supplies, and practices performed or installed pursuant to this Agreement shall be in the form of receipts, cancelled checks, or invoices signed and dated as being paid in full.

3. Landowner shall maintain the cost-shared management practices under this Agreement for not less than ten (10) years following the certification of installation (the “Maintenance Period”), unless otherwise stated.

4. Upon the execution of this Agreement, Landowner shall execute a Notice of Soil and Water Conservation Agreement and Conservation Easement in a form approved by the District in order to provide a public notice of this agreement and to secure the obligations of the Landowner and its successors in interest.

5. Landowner shall immediately repay cost-share funds to the District upon failure to operate and maintain the cost-shared practice according to this Agreement. Repayment of cost-share funds shall not be required if the Project is rendered ineffective during the Maintenance Period due to circumstances beyond the control of the Landowner.

6. Landowner hereby understands and agrees:

    a. To notify the District at least three (3) days prior to the start of any cost-shared work.

    b. To comply with the performance standards, prohibitions, technical standards and practices necessary to meet the requirements under this Agreement.

    c. Not to discriminate against contractors because of age, race, religion, color, handicap, gender, physical condition, developmental disability, or national origin, in the performance of responsibilities under this Agreement.

    d. To allow the District access to the Property, upon reasonable notice to the Landowner, to verify Project installation, operation and maintenance.

    e. To refrain, during the Maintenance Period, from any actions that may reduce or impair the effectiveness of the cost-shared practices, and to follow any required operation and maintenance plans.

## II. DISTRICT RESPONSIBILITIES

1. The District agrees to provide assistance during the design, permitting, bidding, construction, and installation of the Project according to applicable technical standards.

2. The District shall comply with required reimbursement procedures to facilitate timely cost-share payments to the Landowner, including the submission of any appropriate certification forms documenting that cost-shared practices have been properly installed and paid for in accordance with this Agreement.

3. The District reserves the right to stop work or withhold cost-share payments if it is found that the Landowner, grant recipient, or contractor in their employ has violated a local, state or federal law or permit condition, or in any way breached this Agreement.

4. The District shall retain all Agreement-related documents regarding operation and maintenance, proof of certification of design and installation, change orders, receipts and payments, and other referenced materials for a minimum of three (3) years after the final cost-share payment to the Landowner, or for the duration of the Maintenance Period, whichever is longer. Payment records shall provide proof of payment in full for all cost-shared practices installed.

5. If the cost-share payments under this Agreement are estimated to exceed $1,000, the District shall record a Conservation Easement and Notice of Agreement setting forth the District's interest under the Agreement. Upon recording, this Agreement constitutes a covenant running

with the land, and is binding on subsequent owners, heirs, executors, administrators, successors, trustees, assigns, and users of the land for the period set forth in Addendum 1.

## III. GENERAL CONDITIONS

1. Cost-share funds shall be paid by the District to the Landowner, in the amounts specified in Addendum 1, within 30 days following verification that (i) the cost-shared Project was completed in accordance with this Agreement and any applicable technical standards, and (ii) the Landowner has made all payments for which the Landowner is responsible under the Agreement. The amounts set forth for each phase of the Project listed in Addendum 1 to this Agreement are estimates only. Cost-share reimbursement shall be based on eligible and approved expenditures paid for and substantiated by third-party invoices and receipts. Cost-share reimbursement is conditioned on proof, in a form satisfactory to the District, of the Landowner's best efforts to obtain not less than three (3) bids.

2. This Agreement is effective as of the date first written above through the end date of all operation and maintenance periods specified herein.

3. The Project shall be completed within one (1) year of the date of this Agreement, unless an extension is applied for and approved in writing by the District.

4. This Agreement may be amended prior to expiration by written agreement of the parties. The District Board of Commissioners must approve in writing any material changes in Project scope, estimated completion date, or estimated cost.

5. The District's obligations under this Agreement are contingent upon the Landowner's receipt of all required local, state and federal permit approvals for the activities described in Addendum 1.

6. This Agreement shall be considered void if, prior to project completion, the District determines that due to a material change in circumstances, the proposed Project will not cost-effectively serve its intended function.

7. Reimbursement shall be calculated according to the approved cost-share rate specified in Addendum 1, and based on the lowest responsible bid received for the Project.

8. The District will report the payment of cost share funds under this Agreement to the Internal Revenue Service and the Wisconsin Department of Revenue as required by law. The Landowner acknowledges that cost-share funds paid pursuant to this Agreement may be subject to state and/or federal income taxes, and that the Landowner is responsible for the reporting of such income and payment of any such taxes.

**IN WITNESS THEREOF,**

| | | | |
|---|---|---|---|
| ____________________ | ______ | ________________________ | _____ |
| Landowner Signature | Date | District Representative Signature | Date |
| ____________________ | ______ | | |
| Landowner Signature | Date | | |

**Addendum 1 – Practices, Estimated Costs, and Installation Schedule**

**The parties agree to the practices, specifications, estimated costs, estimated cost-share amounts, and installation schedule set forth below.**

| **CSA Number:** ___________ | **Est. Installation Period:** From (MM/YY) To (MM/YY)<br><br>(OR WITHIN 1 YEAR FOLLOWING DEED RECORDING OF THIS CONTRACT) | Applicable Technical Standard(s): |
|---|---|---|

| **Cost-Shared Practice Description** | **Quantity** | **Unit** | **Est. Unit Cost** | **Est. Total Cost** | **Cost-Share Rate** | **Est. Cost-Share Amount** | **Est. Year to be Installed** |
|---|---|---|---|---|---|---|---|
| | | | | | 50% | | |
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