FEBER

Report on Half Moon Lake Water Quality Improvements

Half Moon Lake Advisory Taskforce

City of Eau Claire, WI
November, 2002

HALF MOON LAKE ADVISORY TASKFORCE

Charge: The charge of the Half Moon Lake Advisory Taskforce is to establish the recommended water quality goals for the lake and then recommend a plan of action in order to reach these goals.

Membership:

Two Waterways and Parks Commission Members	Christine Schaaf and Bill Reabe
One member of the Ski Sprites	Steve Sletner or Ann Krautbauer or Neil Morley
One member of the Sierra Club	Jim Olson
One member of the UWEC Biology Department	Dr. Kristina Beuning
One youth member – Memorial High School	Danielle Johnson or Karl Welter
Member At-large	Glen Tamke
Member At-large	Susan Kaul
Buffington Neighborhood Association	Penny Von Haden
Historic Randall Park Neighborhood Association	Dr. Jerry Foote
West River Side Neighborhood Association	Pete Hestekin
Upper West Side Neighborhood Association	Will Fantle

Staff Support:

D.N.R.	-Buzz Sorge -Ken Schreiber -Pat Oldenburg
City of Eau Claire	-Ken Van Es, Parks & Recreation Dept. -Pat Ivory, Community Devel. Dept. -John Genskow, Public Works Dept.

Note: The Bass Masters and Delong Middle School originally each had one representative on the Taskforce, however these representatives chose to attend only the initial meetings.

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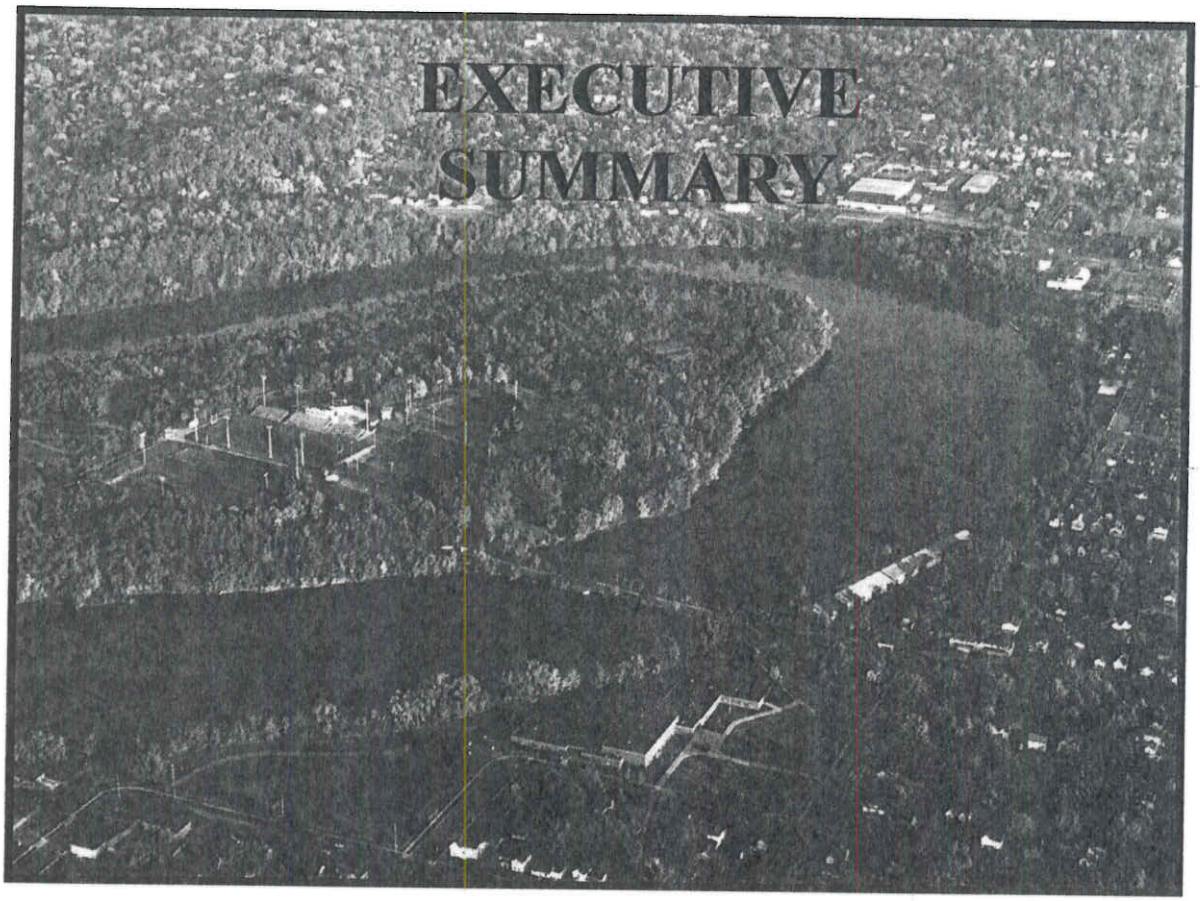

EXECUTIVE
SUMMARY

EXECUTIVE SUMMARY

The Half Moon Lake Advisory Taskforce of 2002 (Taskforce 2002) was appointed by the Eau Claire City Council in the fall of 2001 to prepare a report that would provide recommendations improving the water quality of Half Moon Lake. The primary focus of the recommendations is to reduce levels of phosphorus (P) within the lake, which is a primary factor in the growth of algae and excessive algae blooms that frequent the lake in late summer months. Specifically, the Taskforce was given the charge of "***establishing water quality goals for Half Moon Lake and recommending a plan of action needed to reach these goals.***"

Half Moon Lake has been on the Environmental Protection Agency's (EPA) "*Impaired Waters*" list, which includes lakes and rivers not meeting current State water quality standards. The Wisconsin Department of Natural Resources (DNR) indicated that the Half Moon Lake Advisory Taskforce 2002 would serve as a "partner group", assisting the DNR in the development of a program that would enable the lake to be removed from this listing.

Taskforce 2002 initiated their work by reviewing a number of studies that have been recently completed concerning the lake. These studies included:

- ***The Limnological Study of Half Moon Lake***, conducted by the U.S. Army Corps of Engineers, 1999,
- ***The Half Moon Lake Fisheries Study***, conducted by the Wisconsin DNR, 2001, and
- ***The Study on the Aquatic Plant Community of Half Moon Lake,*** conducted by the Wisconsin DNR, 2001.

In addition, Taskforce 2002 reviewed community-use surveys completed by the City of Eau Claire in 1999 and 2000. These surveys studied community use of the lake and citizens' perceptions about the lake's water quality. This Taskforce reviewed additional information relating to the lake including: Half Moon Lake's watershed characteristics, storm water drainage, sources and locations of erosion around the lake, land use, and the City's past efforts to stabilize and improve water quality.

To assist formulating specific water quality goals for Half Moon Lake, the Taskforce developed seven vision statements. These vision statements serve as the foundation for the recommendations as to how the lake should be improved and what needs to be in place within the next five year to attain these goals.

These vision statements include:

A. ***Improved Water Quality and Diverse Plant Community.***
Half Moon Lake's water quality will be significantly improved as a result in the reduction of chlorophyll (algae) levels and in the reduction, severity and number of algae blooms that occur during the summer. Improved water quality will also result

from a reduction in the dominance of *P. crispus* (curly leaf pondweed). With the reduction of this invasive species, the lake will have the opportunity to achieve improved water quality characteristics attainable through an indigenous aquatic plant community.

B. ***Self-sustaining Fishery.***
The Half Moon Lake fishery will be enhanced to not only improve the quantity and size of sport fish, but will become self-sustaining for angling enthusiasts to enjoy.

C. ***Clean, Healthy, Stable and Protected Shoreline.***
Half Moon Lake's shoreline will be free of litter, debris and trash, which in turn will promote a healthy and diverse plant ecosystem and improved aesthetics for the lake and Carson Park. Shoreline areas will be stabilized using natural means to eliminate erosion caused by run-off and wave action.

D. ***Minimized Motor Boat Impacts.***
Half Moon Lake will have minimal motorboat impacts to avoid the disturbance to lake bottom sediments and to sensitive aquatic and shoreline areas.

E. ***Improved Watershed Management.***
Storm water runoff into Half Moon Lake from the lake's watershed is minimized and when possible, filtered through the use of storm water controls and storm water best management practices (BMP's).

F. ***Multi-Faceted Recreational Opportunities.***
Opportunities for a variety of recreational activities will be created and encouraged within and around Half Moon Lake.

G. ***Educated, Involved Citizenry.***
Residents of the community will become educated and informed about Half Moon Lake, its natural environment, scenic beauty, and recreational opportunities in order to promote an appreciation for this resource and encourage involvement in its stewardship, utilization, and enhancement.

Thirteen (13) management strategies are recommended and set forth in this report. When implemented, these strategies will result in improved water quality for Half Moon Lake and removal of the lake from the EPA's "Impaired Waters" list. These recommendations include a specific water quality goal and actions that will educate and inform the community about the lake, its ecosystem and environment. Implementation of these strategies is designed to improve the health of the lake as well as the community's perceptions and appreciation for the lake.

Recommendations include:

A. Improve lake's water quality by reducing chlorophyll levels to 30 µg/l compared to the current baseline level of 82 µg/1. To achieve this goal, lake management will

target the internal sources of phosphorus that account for 79 percent of the growing seasonal load to the lake. (External sources account for 21 percent of the phosphorus load; these sources include: storm sewers, precipitation and water pumped into the lake from the Owen Park wells.) Specific actions targeting the internal phosphorus sources include:

1. In coordination with the DNR, an aluminum sulfate (alum treatment) treatment for the lake will be undertaken. An alum treatment will reduce the release of phosphorus from lake sediments, which contribute to 42 percent of the overall loading to the lake. Alum treatment costs are dependent upon the amount of phosphorus that is available for release from bottom sediments, and costs could range from $1,250 to $4,000 per acre. An estimated 100 acres of the lake would be treated; therefore, the overall cost for the alum treatment could range from $125,000 to $400,000.

   The alum treatment costs would be offset with a DNR lake grant. This grant could cover 75 percent of cost, with a maximum grant award of $200,000. Other grants such as the Urban Non-point Source Grant Program should also be pursued for this project.

2. Increase the weed harvesting operation that is currently undertaken by the City. Nutrient loading from seasonally decaying aquatic plants accounts for 20 percent of the growing season nutrient load to Half Moon Lake. Doubling the amount of biomass harvested should be the goal of the City. Increases in weed harvesting costs pertain to both personnel costs and the purchase of a second harvester. Additional personnel costs would be approximately $34,000 per year and a second harvester would cost approximately $105,000. Grant funds may be available to offset a portion of the harvester's purchase.

3. Eliminate the resuspension of phosphorus generated by motorboats by relocating the Ski Sprites from the lake to another site (body of water). Approximately 17 percent of the overall phosphorus load would be eliminated with the cessation of motorboat activity on the lake. Costs to relocate the Ski Sprites from the lake will need to be determined; direct costs to the City will also have to be determined. The City may choose to participate in a portion of these costs based on the strong community support that the Ski Sprite organization has developed over the years.

   The Army Corps of Engineers Limnological Study concluded that managing all three internal sources of phosphorus in the lake will be necessary in order to achieve significant reductions in phosphorus and noticeable reductions in chlorophyll levels.

   Additionally, it is recommended that one significant external source of phosphorus be addressed. The frequency of City street sweeping within the Half Moon Lake watershed should increase to a level resulting in a 10 percent

reduction in the phosphorus load that enters the lake by way of storm sewers. In order to determine what increase in the amount of street sweeping is required to benefit the lake, and to determine whether particular areas within the watershed could be targeted for maximum benefit, will require study. Presently, City street sweeping occurs within the watershed approximately every three weeks during the spring, summer and fall months. Its estimated cost is $1,200 per time to sweep streets within this area.

B. City Council appoints a committee to work and assist the Ski Sprites in their transition to a new location from Half Moon Lake.

C. City Council officially designates a City staff person who will assume a leadership role concerning Half Moon Lake.

D. City and DNR evaluate and address areas where shoreline erosion is occurring along the lakefront.

E. City and DNR will identify fishery habitats, unique and sensitive shoreline plants, and wildlife areas around the lake. Recommendations will be made about management strategies to improve and protect these areas.

F. Maintain the 1973 Half Moon Lake prohibition of motorboats and apply this prohibition to all boats once the Ski Sprites are relocated from this lake.

G. Electric trolling motors will be prohibited within the Braun's Bay portion of the lake ensuring protection of its unique aquatic environment.

H. City and DNR evaluate options pertaining to the timely harvesting of aquatic plants and the locations of such harvesting. This will optimize the removal of plant biomass. This practice is particularly critical as the City moves forward to increase the amount of harvesting compared to current harvesting.

I. Prepare a storm water management plan addressing storm water quality and run-off issues found within the watershed.

J. Promote regular shoreline cleanup through efforts of an annual "Clean-up Day;" consider forming "friends" groups to accomplish these tasks.

K. Initiate a multi-faceted educational program to educate and inform the community about the lake's natural environment, scenic beauty, and recreational opportunities. Through education and dissemination of information, people will gain a better appreciation for Half Moon Lake, encouraging more involvement in its stewardship, utilization, and enhancement. The Taskforce 2002 has identified a number of specific components for this educational program that are outlined in the report.

L. The City is encouraged to work with the DNR to enhance the fishery, to evaluate current fishing regulations and to study the lake's fisheries' habitats.

M. Waterways and Parks Commission (WPC) will prepare a recreational plan for the lake. Taskforce 2002 noted there are a number of opportunities available that will enhance the recreational potential for Half Moon Lake and its surrounding park areas, accommodating the future growth and needs of the community. Within this report, many opportunities are discussed and should be considered as a starting point in the development of the lake's recreational plan by the WPC.

Half Moon Lake, with its scenic beauty and natural environment, provides the City of Eau Claire with an invaluable resource. Few communities can boast of having a resource like Half Moon Lake; one that provides its residents with a variety of recreational opportunities, a very natural, relaxing and secluded scenic setting, an urban lake that includes habitat for wildlife, plants and is an excellent fishery. Indeed, our citizens are privileged to have this unique asset.

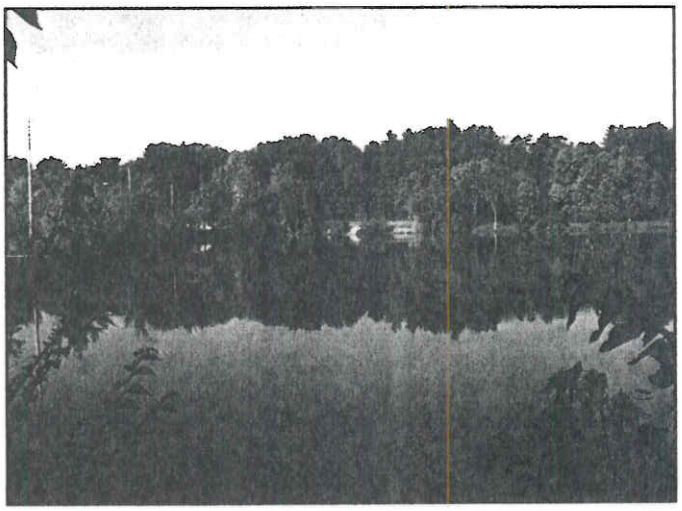
Community surveys taken in 2000 corroborate the fact that residents place the highest value on Half Moon Lake. These surveys confirm the significance and integral relationship and role the lake has with its citizens, and how the lake's varied attributes, its geographical location that is supported by City parklands, contribute considerably to Eau Claire's overall image. Surveys also indicate that citizens have supported past City efforts to improve the lake, that the City be strongly committed to continuation of their efforts, and to establishing future endeavors for resource improvements.

Half Moon Lake Taskforce 2002 recommendations contained herein establish water quality goals and give direction to the City as to how these goals may be accomplished, making it possible for this resource to be improved and enjoyed for future generations.

INTRODUCTION

INTRODUCTION

This report is being presented to the City of Eau Claire on behalf of the Half Moon Lake Advisory Taskforce in anticipation that recommendations set forth by the Taskforce will be a catalyst for improvements to the lake. These recommendations will improve water quality and encourage increased utilization and appreciation of this important resource within the City. The Half Moon Lake Advisory Taskforce was appointed by the Eau Claire City Council at the direction of the Eau Claire Waterways and Parks Commission. The Taskforce was given the charge of ***"establishing water quality goals for Half Moon Lake and recommending a plan of action needed to reach these goals".***



The Taskforce is a fourteen member committee that includes representatives from neighborhood associations located in the vicinity of the lake, the UWEC Biology Department, Waterways and Parks Commission, students, organizations actively using the lake and persons with various backgrounds and interests in the lake. The Taskforce received staff assistance from the Wisconsin DNR and the City of Eau Claire.

The Taskforce began their work in January of 2002 and has met regularly since then to complete the work outlined in their charge from the City Council. This report is divided into several sections that coincide with the discussions and work that has been undertaken by the Taskforce.

This report contains specific water quality goals for Half Moon Lake that the City and community should strive for. In order to achieve these goals, a number of recommendations have been suggested by the Taskforce. Some of these recommendations relate directly towards attaining the prescribed water quality goals, while others; relate to other issues such as educating the community to be better stewards of the lake and ensuring that the lake will continue to be a natural asset for future generations.

BACKGROUND

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Half Moon Lake is a 132-acre oxbow lake of the Chippewa River having an average depth of 6 feet, with a maximum depth of 9 feet. The lake was cut off from the Chippewa River prior to the 1800's and is now dependent for water from rainfall, storm water runoff and pumping of water from wells near the Chippewa River in order to maintain its current level.

The lake is unique in that it is located within an urban environment and provides a wide variety of recreational opportunities for the entire community. In addition, it provides a natural setting that is very scenic and relaxing as well as a tremendous natural resource and habitat for wildlife, plants and an excellent fishery.

The lake's watershed is approximately 577 acres in size and approximately 85% of the shoreline is owned by the City. The City has an established policy of purchasing properties abutting the lake when they become available and at the present time, only four privately owned properties remain along the shoreline.

Half Moon Lake has had a long history of water quality concerns dating back to the early 1900's and the City has been very active in attempting to address these water quality problems with the implementation of numerous lake management activities over several decades. Although many of these past management efforts have been very successful at managing specific aspects of water quality impairment in Half Moon Lake, frequent summer algae blooms and nuisance aquatic plant growth still persist. In order to address these current water quality concerns, a number of studies and lake planning activities have recently been completed to: determine pollutant sources causing the water impairments, assess the lake water quality response to nutrient loading decreases, assess the community's interest in the lake and develop management strategies to improve water quality in Half Moon Lake.

As the Taskforce has undertaken their charge, they have reviewed many of these studies and a substantial amount of documentation. A brief overview of the information considered by the Taskforce is as follows:

> **Limnological Study of Half Moon Lake.** A limnological study of Half Moon Lake was conducted by the U.S. Army Corps of Engineers during the spring and summer of 1999. Mr. Bill James from the Army Corps of Engineers was the lead person conducting the study and presented the study findings to the Eau Claire City Council in the spring of 2001.
>
> The study was authorized by the Eau Claire City Council and its objective was to identify and quantify the sources of phosphorus (P) into the lake and predict the impacts of reducing the different sources of P on the water quality of the lake.
>
> Eleven small watersheds drain into the lake. Three of these watersheds drain directly into the lake outside of the City's storm sewer system. Other sources of

water into the lake include ground water pumped into the lake from Owen Park and precipitation falling directly onto the lake.

Phosphorus is the nutrient that controls the growth of algae in a lake and it can come from the watershed or from the lake sediments. Each increment of P added to the water column results in incremental growth of algae. Much of the P in the lake sediments was added back in the late 1800's and early 1900's when the sawmills and other industries dumped their wastes into the lake. Because there is little flow through the lake, most of the P added into a lake is retained or stays in the lake over time.

The limnological study found that the P level in the lake was stable in the spring and early summer months, but increased in July and August. Chlorophyll (a measure of algae levels) in turn showed marked increases as P levels increased. Nutrient inputs into the lake were estimated for growing season inputs (June-August) from the watershed and sediments.

External sources of P into the lake include: storm sewers, water pumped into the lake from Owen Park and precipitation. These three sources result in 21 percent of the annual P loading for the lake (Figure 1).

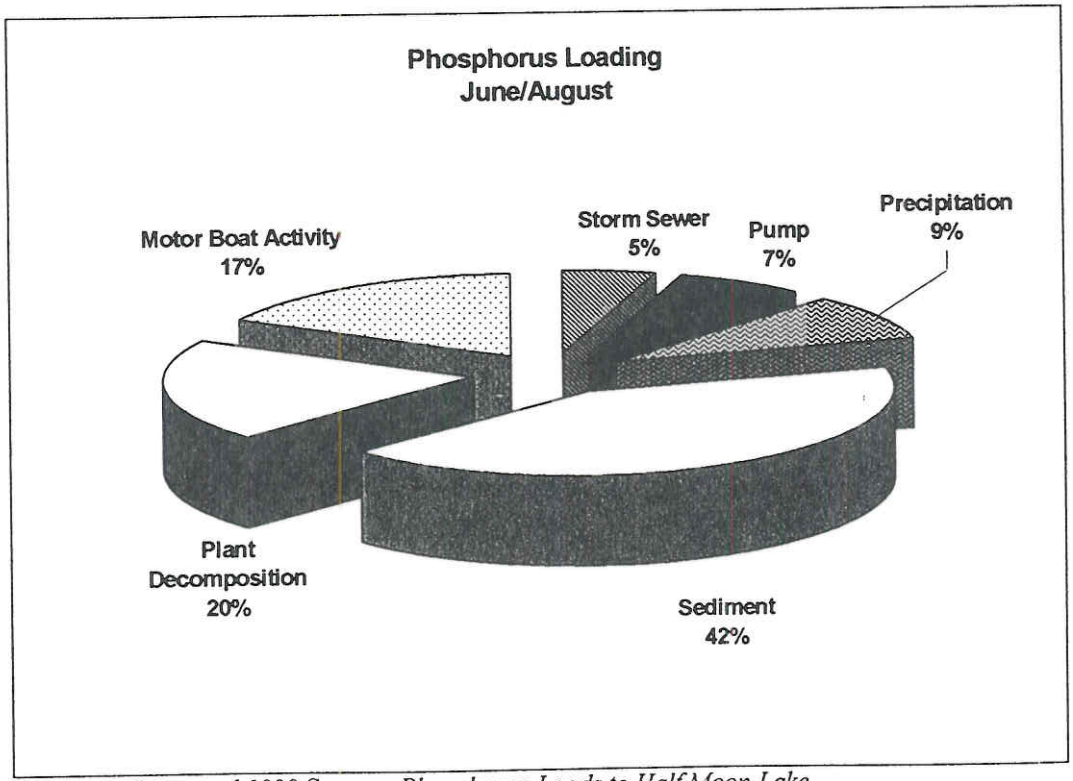


Figure 1. Estimated 1999 Summer Phosphorus Loads to Half Moon Lake.

Internal loading sources of P into the lake include: nutrient release from the sediments, decomposition of aquatic plants and motorboat activity. The lake bottom or sediment has high concentrations of P throughout the sediment column and represented the greatest source of P loading into the lake (42%.) The study noted that the lake intermittently stratifies during the summer; the lake then warms and stratifies when bacteria decomposition removes oxygen from the overlying water. When the oxygen levels become quite low, P is released from the sediments. The wind mixes the lake water column distributing the phosphorus released from the bottom sediments throughout the lake.

Lake pH levels were elevated during periods of photosynthesis, which also increases the release of phosphorus from the sediments. Half Moon Lake generally has relatively high pH levels during the summer.

The decomposition of plants also contributes a significant amount (20%) of P loading into the lake. The dominant plant in the lake is *Potamogeton crispus* (*P. crispus*) also known as curly leaf pond weed, which begins its life cycle in the fall and goes dormant during the winter. In the early spring, it begins to grow again and dies off in mid June. As the plant grows, it takes in P from the sediments and then releases it into the water when it dies and decomposes. The amount of phosphorus available from aquatic plant biomass for mixing into the water column is about 60 kg. This would be even greater, but the City weed harvesting operations removes approximately 30 kg of P on an annual basis. Leaching of phosphorus into the water column from decomposing plants is greatest within the first week of die-off.

Finally, the loading of P from motorboat activity on the lake was studied. Factors including water temperature, oxygen levels and P levels were monitored in the area where the Ski Sprites perform and compared to a control site. Study results concluded that boating on the lake contributes approximately 17% to the overall P loading.

The study outlined various management scenarios that would reduce P loading from external and internal sources. The study indicated that attempts to reduce P levels by addressing any one of the loading sources individually would only result in minimal reductions in P. However, managing several of the sources would result in a significant reduction in phosphorus (Figure 2).

Water quality is typically measured by the amount of algae or chlorophyll in a lake. Chlorophyll levels greater than 20 µg/l typically are considered high and people will commonly complain about a lake's water quality. Half Moon Lake has chlorophyll levels near 20 during the spring and early summer, but increase to

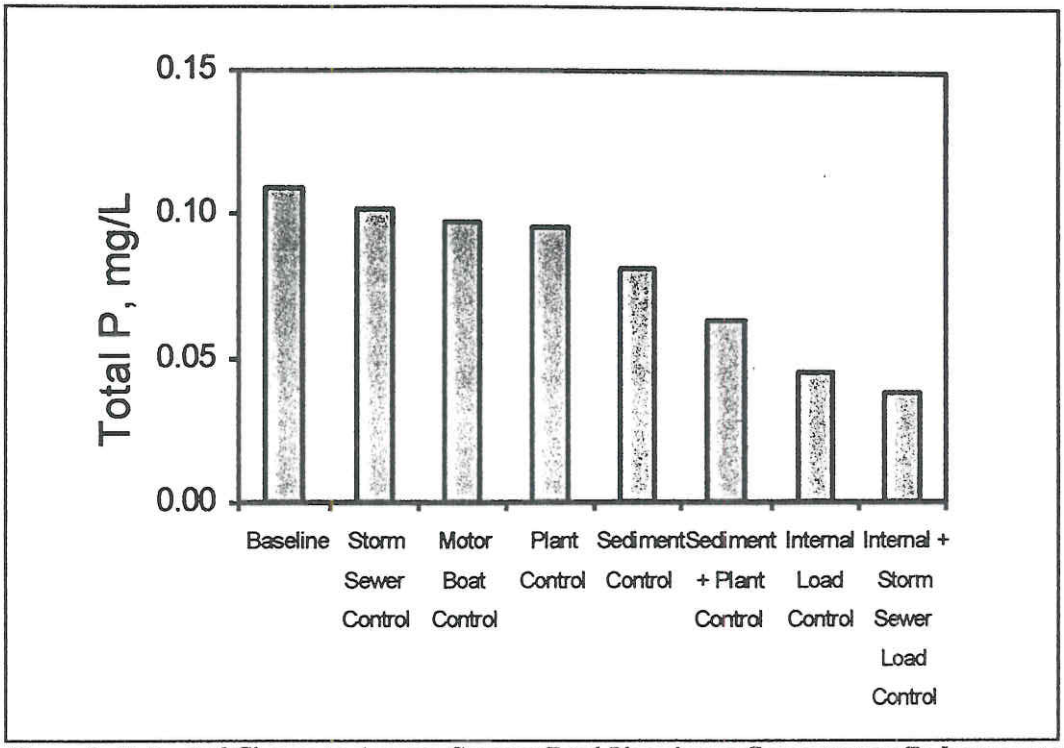


Figure 2. Estimated Change in Average Summer Total Phosphorus Concentration To Incremental Decreases in Phosphorus Loading.

100 to 150 by August. Community perception might be that the water quality at Half Moon Lake has improved as the weeds and algae that once were commonplace on the surface are gone. Now the algae is more distributed throughout the water column rather than at the surface.

The study noted that as the City looks at alternatives to manage P levels in the lake or set an optimum chlorophyll level for the lake that algae blooms will never be eliminated completely, but their frequency and severity could be reduced. The Army Corps of Engineers study found that algae and nutrient levels can be significantly reduced in Half Moon Lake if all of the internal and storm water sources of nutrients are significantly reduced. The water quality goal for Half Moon Lake is to significantly reduce phosphorus inputs to the lake, which will reduce the severity and frequency of algae growth.

Community Use Surveys of the Lake. A report was prepared in 2000 that provides an overview of the community's perceptions and use of Half Moon Lake. The report was prepared by a committee that was appointed by the Waterways and Parks Commission. The charge of the committee was to formulate lake use objectives for Half Moon Lake and their work was independent of the study being completed by the U.S. Army Corps of Engineers water quality study, which was occurring at the same time.

The report provides a summary of the uses of Half Moon Lake and findings from three surveys taken concerning the perceptions and attitudes of the community

regarding the lake and surrounding areas. The first survey was an on-site survey conducted during the summer of 1999. Some of the key findings from this survey as noted by the citizens group that worked on this project included:

- Fishing was the most common user activity (84 or 49.7%) of those surveyed. Other common activities included: picnicking, watching the Ski Sprites, walking and enjoying the scenery.
- The lake's convenient location to home was the most common reason why people go to the lake.
- Almost all of the people using lake and surrounding area use the lake on a frequent basis.
- Almost two thirds of those using the lake live in Eau Claire. Of the City residents surveyed, a somewhat greater percentage of the users live in the western side of the City.
- Comments about fish variety, quantity and quality were generally quite positive.
- Few of those using the lake or area expressed concerns about conflicting uses.
- Accessibility, perceived safety, parking and general aesthetics rated quite high.
- The most common concerns noted related to: water quality, weeds and algae or greenness of the water.
- People were supportive of the 1973 ordinance that prohibits outboard motors on the lake with the exemption for the Ski Sprites.
- The majority of the people familiar with the Ski Sprites were supportive of their use of the lake (61%.)
- Results were inconclusive as to whether people felt that water quality had improved.

The second survey was another on-site survey, but this one was conducted during the winter of 2000. Some of the key findings from this survey included:

- Comments about fish variety, quantity and quality were generally quite positive.
- Very few people (2 or 6%) noted any conflicting uses
- Ice fishing and walking were the two most common activities.
- 77% of those surveyed were from Eau Claire.
- Comments about aesthetics, vehicle access, parking, etc. were generally quite favorable.

The third survey was a mail-out survey, sampling community opinion about the lake. This was conducted during the spring of 2000 and involved the mailing of questionnaires to 1,000 randomly selected households within the City. Some of the key findings from this survey included:

- Over 85% of those surveyed indicated that they had been involved in some activity on or around the lake in the last two years.
- Picnicking, relaxing, walking, watching the Ski Sprites and fishing were listed as the most common activities.
- Results show a strong public commitment towards the City continuing to improve the lake (Figure 3).

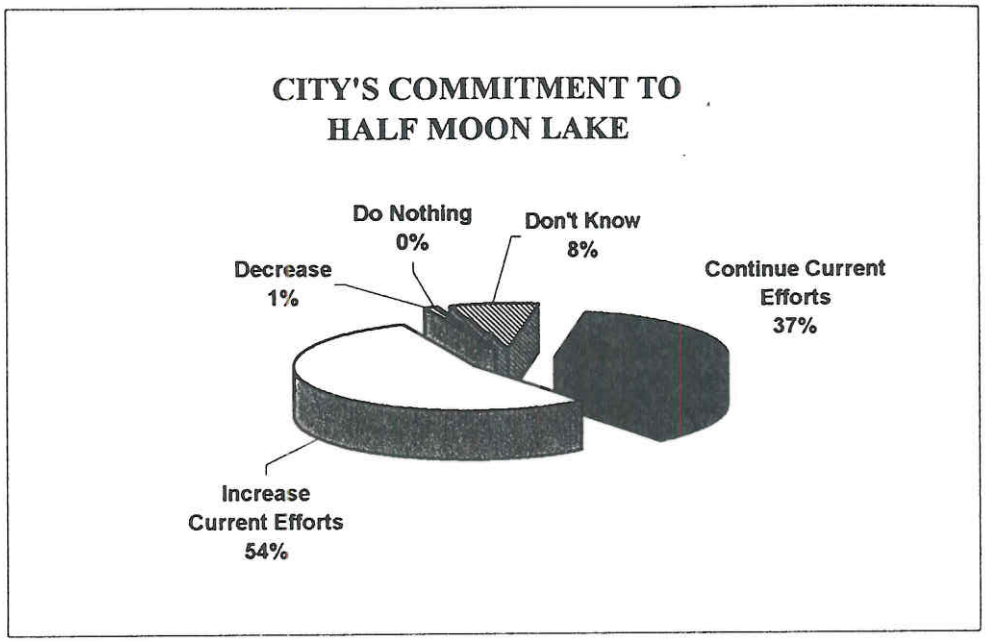


Figure 3. The Community's Feelings Towards the City's Efforts to Improve Half Moon Lake.

- Community opinion as to whether the lake is improving is mixed.
- Yet, the overall rating of the appearance of the lake was very high.
- There was strong support (over 65%) for the ordinance prohibiting outboard motors on the lake that includes an exemption for the Ski Sprites.
- Most people felt that the Ski Sprites had some impact on the lake.
- The survey showed significant support for the Ski Sprites use of the lake.
- Opinion was split about the level of utilization of the lake.
- Improving the water quality was the most common response about what improvement should be considered.
- There was support for re-opening the swimming beach.

Recommendations of the group that was appointed by the Waterways and Parks Commission included:

- Continue implementation of 1973 ordinance prohibiting use of internal combustion engines.
- The City should a least maintain its current level of commitment to improving and maintaining the lake. Increased efforts should also be considered.

- No additional private development along the lake. Continue acquisitions.
- Continue to permit the Ski Sprites to use the lake at their current level of use. Review this recommendation in conjunction with Army Corps study when completed and if needed obtain further public input.
- Periodically evaluate potential use conflicts on the lake.
- Maintain the current policy of allowing ice shanties and allowing snowmobiles in the winter. The Committee noted that winter clean up needs to be improved.
- Consider a fishing pier on the east portion of the lake.
- Consider a canoe and boat rental service.
- Encourage periodic shoreline clean-ups.
- Continue weed cutting and removal efforts.
- Extend the recreational trail around lake.
- Study the feasibility of re-opening Half Moon Beach.
- Consider another boat landing on the east end of the lake.

Summary of City Efforts to Improve Water Quality. Over the years, the City has undertaken numerous projects to stabilize the lake and improve water quality (see Appendix A). These efforts demonstrate the high priority the City has placed on preserving and improving this resource for the entire community to enjoy. Some of the work that has been undertaken has been very successful, while some has had limited benefit. Examples of projects undertaken include:

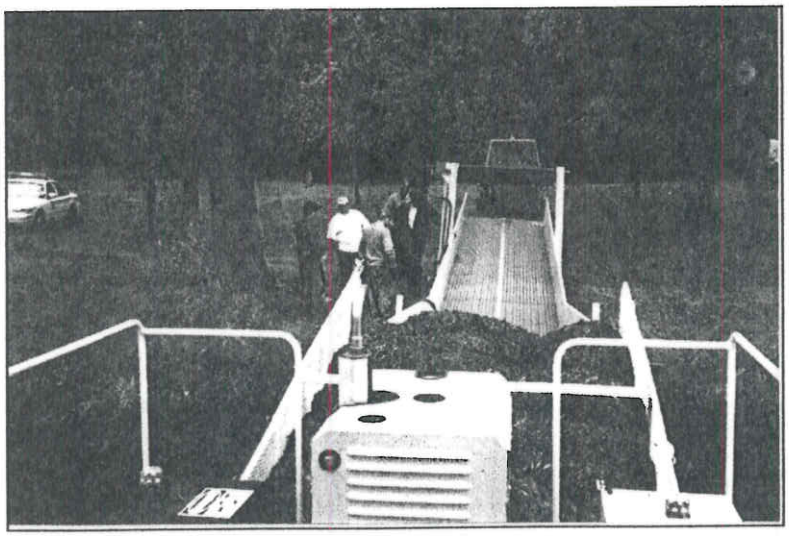
- Chemical treatments were undertaken for many years. This started as early as 1926 with the introduction of copper sulfate to control algae growth. These treatments continued on a regular basis until 1989. Other chemicals such as phygon (a fungicide), arsenic, chlorine, etc. were also applied to the lake. The use of chemicals stopped after 1989.
- A City and lakeshore owners formed an Inland Lake Protection and Rehabilitation District in 1974 and completed projects such as dredging the beach area, installing aeration systems and diverting water from Sherman Creek to the Chippewa River.
- The City initiated a program to purchase properties abutting the lake in order to provide greater public access to the lake and improve the control of storm water runoff into the lake.
- The Half Moon Lake Restoration Committee was appointed in 1971. The Committee completed a lake management plan in 1975.
- Aquatic plant harvesting started in 1979. The City purchased its own harvester in 1991 and then replaced this machine with a larger harvester in 1996.
- The City is implementing an aquatic plant management plan to improve fisheries habitat and recreational opportunities on the lake.
- The flow of Sherman Creek was diverted from the lake to eliminate its runoff, which was high in nutrients.

- Numerous storm sewers were diverted from the lake also to eliminate storm water containing high levels of phosphorus and other contaminants. Currently, eight storm sewers continue to drain storm runoff into the lake.
- An ordinance was adopted by the City Council in 1973 that banned all internal combustion engines on the lake with the exception of the Ski Sprites.
- Conservancy zoning regulations for properties around the lake were established in 1982.
- Several attempts to pump water into the lake were undertaken. Pumping from wells in Owen Park went into operation in 1982.
- Aeration equipment was purchased to aerate three sites within the lake. The current system was installed in 1992.

Aquatic Plant Community Study. The DNR completed a study concerning the aquatic plant community of Half Moon Lake between 1995 and 2000. A healthy aquatic plant community can provide may benefits to a lake including:

- providing important food and habitat for fish and wildlife.
- removing nutrients that otherwise would be available for algae blooms
- aiding in reducing the excessive growth of non-native plant species
- reducing erosion and turbidity by stabilizing shorelines and lake bottoms

The overall aquatic plant community in Half Moon Lake is characterized by fair to poor diversity. However, most of the diversity is found in Braun's Bay. The diversity index of the plant community in Braun's Bay indicates a very good diversity. The use of chemicals from 1926 to 1989 to control aquatic plants resulted in the disappearance of several sensitive plant species that provided valuable for habitat fish. The bulk of the lake is dominated by the exotic curly leaf pond weed (*P. crispus*), which was accidentally introduced into the lake in 1953.



P. crispus starts its growth during fall so that once the ice is off in spring, it can quickly reach the surface before other aquatic plant species have attained much growth. *P. crispus* suppress the growth of other species by shading them as they are just starting their growth. *P. crispus* starts to die-back in June, in doing so releases nutrients that fuel summer algae blooms (also see section on the

Limnological Study). Proper harvesting *P. crispus* can help counteract the impacts and result in improved water clarity and improved diversity of the aquatic community. City weed harvesting operations started in 1979. In 1991, the City purchased a weed harvester, which allowed the City to conduct the harvesting of *P. crispus* in a timelier basis. The study documented that City's current harvesting plan provides the following benefits:

- It creates open areas that allow light to penetrate to other more desirable plant species.
- It removes nutrients from the lake. In 1999 harvesting removed 33% of the phosphorus that was tied up in *P. crispus* plant tissue in Half Moon Lake. These nutrients are then not available to feed algae blooms.
- It eliminates the risks associated with chemical carry-over and residues. It reduces the abundance of *P. crispus*. The early season harvesting of *P. crispus* before the formation and release of winter buds (turions) results in better long-term control of *P. crispus* than chemical applications or harvesting after the turions have formed. Turions are the buds from which new growth starts in the fall.

Several management recommendations were contained in the study. The recommendations included:

- continue the weed harvesting program
- continue monitoring the growth of the *P. crispus* to determine the best time to begin harvesting each year
- discontinue the exemptions for the use of motors on the lake better protect certain areas of the shoreline from erosion

Half Moon Lake Fisheries Survey. The DNR completed a fisheries survey of Half Moon Lake in the fall of 1999 and the spring of 2000. Results from this survey indicated that the major fish species in the lake are large mouth bass, walleye, crappie and bluegill. The lake previously had a problem with carp, so in 1978, the lake was chemically treated to kill the fish and then was re-stocked with bass, walleye, crappie and bluegill. In 1989, a 15-inch minimum size limit was placed on walleye and in 1990; a 14-inch minimum size limit was placed on bass.

New aeration equipment installed in 1992 at three sites is used in the winter to increase oxygen levels to protect the fishery. The Half Moon Lake fishery is dependent upon the continued maintenance and operation of the aeration system. The lake would experience frequent winterkill conditions if not for the aeration system maintaining sufficient oxygen levels during the ice covered period of the year.

The study looked at numbers of fish, length, length-weight relationships, density and age for the four primary fish groups (large mouth bass, walleye, crappie and bluegill). The study found that the bass population has shown a steady

improvement in quantity and quality since the start of the 14-inch minimum size limit in 1990. The bass population seems to be very healthy, but the lake has the potential for larger fish (over 20 inches in length) if certain management practices are put into place.

The walleye-stocking program for the lake has been successful at providing good densities of legal-sized fish. It was suggested that the stocking program should continue along with the 15-inch minimum size limit. The walleye, like the bass feed on bluegill, which helps keep the bluegill population in check. A gravel bottom habitat would be needed to support the reproduction of walleyes in the lake.

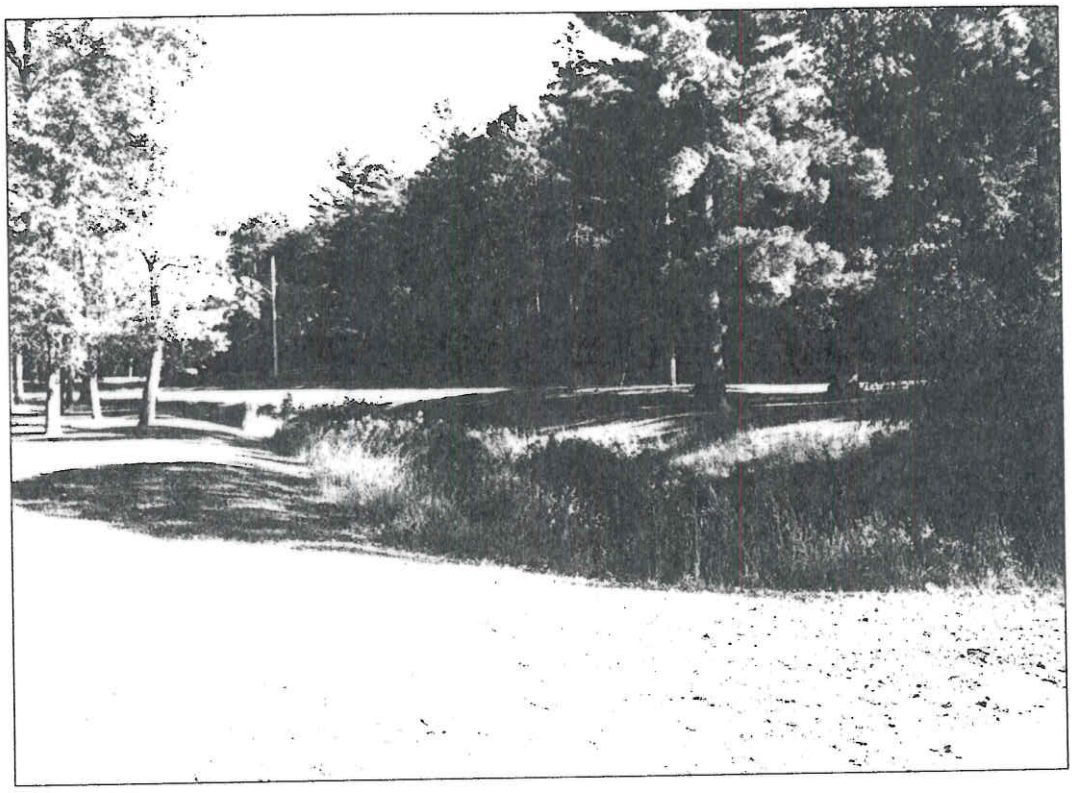
The bluegill fishery in the lake has also shown improvement in abundance and size between 1990 and 1999. The study indicated that plant harvesting may have benefited the bluegill size structure by increasing predation levels, but there was no direct evidence to confirm this.

Crappies showed normal length-weight ratios and 62% of the fish caught in the spring netting survey were in the 8-inch class. As bluegill and crappies grow into the size preferred by anglers, angler harvest becomes to overriding factor in limiting the numbers of larger fish. The study recommended considering a reduction in the panfish bag limit.

The study also reviewed statistics concerning fishing pressure on the lake and noted that fishing pressure was greatest during the winter months. It was estimated that the total fishing pressure on the lake during the 2-½ month winter period was 123 hours per acre. This is considered high for a Wisconsin lake.

Storm Water Runoff Into the Lake. The Taskforce was provided with information regarding storm water drainage issues pertaining to the lake. This included maps illustrating the boundaries of the Half Moon Lake Watershed, drainage basins within the watershed and storm water outfalls into the lake. Information was also reviewed concerning land use, property ownership and zoning within the watershed.

The Taskforce then reviewed methods used to reduce the amount of storm water runoff into the lake and methods used to remove some of the nutrients and impurities from the storm runoff before they reach the lake. These methods or techniques employed are called BMP's (best management practices). A number of the techniques involve the construction of grassy swales, ditches, rock islands where the storm runoff is directed. The runoff flows through these areas before it reaches a storm sewer inlet. Many of these practices result in reduced runoff and the water that does reach the storm sewers is cleaner.



Some examples of BMP's used within the Half Moon Lake Watershed include:

- Placement of drainage swales located to the east and west of Lakeshore School.
- Design of the front driveway at Lakeshore School to encourage runoff onto grassy areas.
- Construction of a drainage swale located to the west of the main parking lot at Carson Park.
- Construction of parking lot islands filled with river rock within some of the Luther Hospital parking lots. The islands trap some of the water's impurities as the water flows through the islands.
- Construction of grassy areas at the edge of parking lots at Luther Hospital.
- Placement of a drainage swale to the south of the Luther helicopter facility.
- Street sweeping to remove pollutants before they enter the storm sewers.

- Educational practices such as stenciling near storm sewer inlets.
- Paving the Charleston parking lot located to the north of the lake and directing surface drainage from the site away from the lake by the installation of a storm sewer to the site.

These types of practices are now required for most new development or land use changes. It is the responsibility of the property owner to maintain these facilities. If these BMP's can be designed for the typical one-inch rainfalls, this would address approximately 90% of the storm runoff into the lake.

Total Maximum Daily Load Program. Half Moon Lake has been included on the State and U.S. EPA "impaired waters" list. This list includes waters that are not currently meeting state water quality standards or designated uses. In response to this listing, the Wisconsin DNR is required to develop a Total Maximum Daily Load (TMDL) for the lake. The TMDL program targets water bodies with poor water quality and requires that a plan be prepared that includes recommendations to improve water quality sufficiently to be remove them from the list. High levels of nutrients and algae are key factors that placed Half Moon Lake on the impaired waters list.

The DNR has indicated that the Taskforce would serve as the "partner group" to assist the DNR in the development of the TMDL. The TMDL will primarily focus on phosphorus sources to the lake and may include some regulatory controls to assist in implementing the management plan. Recommendations from the Taskforce will provide the basis for the Half Moon Lake TMDL.

Erosion and Other Issues. The Taskforce discussed other issues concerning the lake ecosystem, water quality and siltation. To help illustrate some of the changes and problems, the Taskforce viewed a video of several film clips taken at the lake over the years. The film clips showed some historical and recent footage of the lake. Some of the concerns noted that were illustrated included:

- Erosion from storm runoff from an industrial lot located on Platt Street that has been carrying sand and silt from the lot into the lake. (This problem was corrected by the City and Charleston's in 2001.)
- Siltation within the northeast portion of the lake is occurring from the storm sewer outfall and from runoff from the Robert's Building property. This is occurring from the outfall out approximately 200 feet into to lake. Areas that once were 9 to 10 feet in depth are now 2 feet in depth.
- Erosion of the shoreline (in the vicinity of Bayview Park) and the subsequent siltation is occurring from wave action caused by the wind and Ski Sprite motorboats.
- Debris is along the shoreline. This debris is from ice fishing, littering, dumping, etc. that has accumulated over the years.

Ski Sprites Organization and Use of Half Moon Lake. The Ski Sprites Water Ski Organization was founded in 1960. The organization has grown from six skiers in their initial year to over 100 members, which include skiers and adult

volunteers. The Ski Sprites have utilized several locations on Half Moon lake over the years, including: north of the causeway area near Birch Pavilion, Rod and Gun Park, south of the causeway and the present site at Half Moon Beach.

The club practices at Half Moon Lake on Monday, Tuesday and Thursday evenings and has performances on Wednesday and Sunday evenings. They also sponsor special shows on the Fourth of July and Labor Day.

Equipment includes two MasterCraft ski boats, two Hydrodyne Ski boats, two safety boats and two pontoon boats used as floating docks for a number of the various acts.

The Ski Sprites have been investigating alternative sites for their practices and shows for the past three years. Representatives of the Ski Sprites organization reviewed different sites that have been studied and considered during this timeframe.

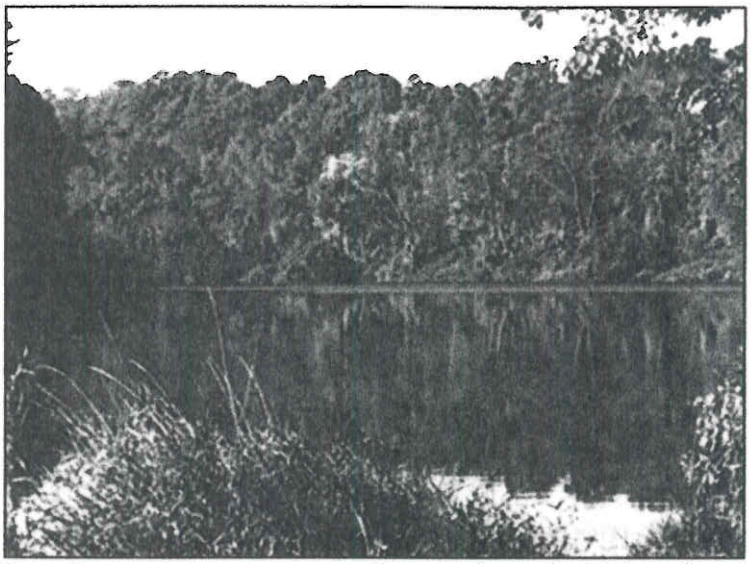
The Taskforce was informed that the Ski Sprites are willing and desire to relocate from the lake to another site as the group feels that a new site would benefit the club by providing an opportunity for continued growth. A new site would enable the Ski Sprites to be more flexible in the programs that they offer and could possibly initiate new programs such as a "learn to ski" program or expand upon current practices times or hours. In addition, a different site would give the club an opportunity to sponsor special ski events and competitions, which they have been unable to do at Half Moon Lake. Finally, a move from Half Moon Lake would eliminate the reoccurring conflicts that the Ski Sprites have encountered with other lake users and persons raising questions regarding their impact on the lake's water quality.

In looking at alternative sites, the Ski Sprites organization feels that the Dells Pond area in the vicinity of lower Mount Simon Park offers good potential for their club. A relocation to this site would require the cooperation and assistance of many groups and organizations such as the DNR, City, neighborhoods and park users.

Student Environmental Education. Memorial High School and Delong Middle School offer courses or programs related to environmental education that focus on the Half Moon Lake ecology. The Memorial High School program is an integrated Language Arts and Biology class that was initiated five years ago as a cooperative effort between the Biology and English departments at Memorial. The program is a sophomore level course that includes two consecutive hours of class time where Biology and English are taught together. The goal of the program is to give students opportunities to learn about the ecology of Half Moon Lake, collect scientific data, analyze this data, become familiar with water quality sampling technology and encourage a greater appreciation of Eau Claire's natural environment. To help get the program started, the City received a lake planning

grant from the DNR to assist Memorial in the purchase of testing equipment needed for the work and to assist in transportation costs.

The class gathers data in the fall, winter and spring relating to: phosphorus, nitrates, pH, dissolved oxygen, water temperature and a sampling of lake bottom organisms. The class is now also doing an analysis of the trees within portions of Carson Park.



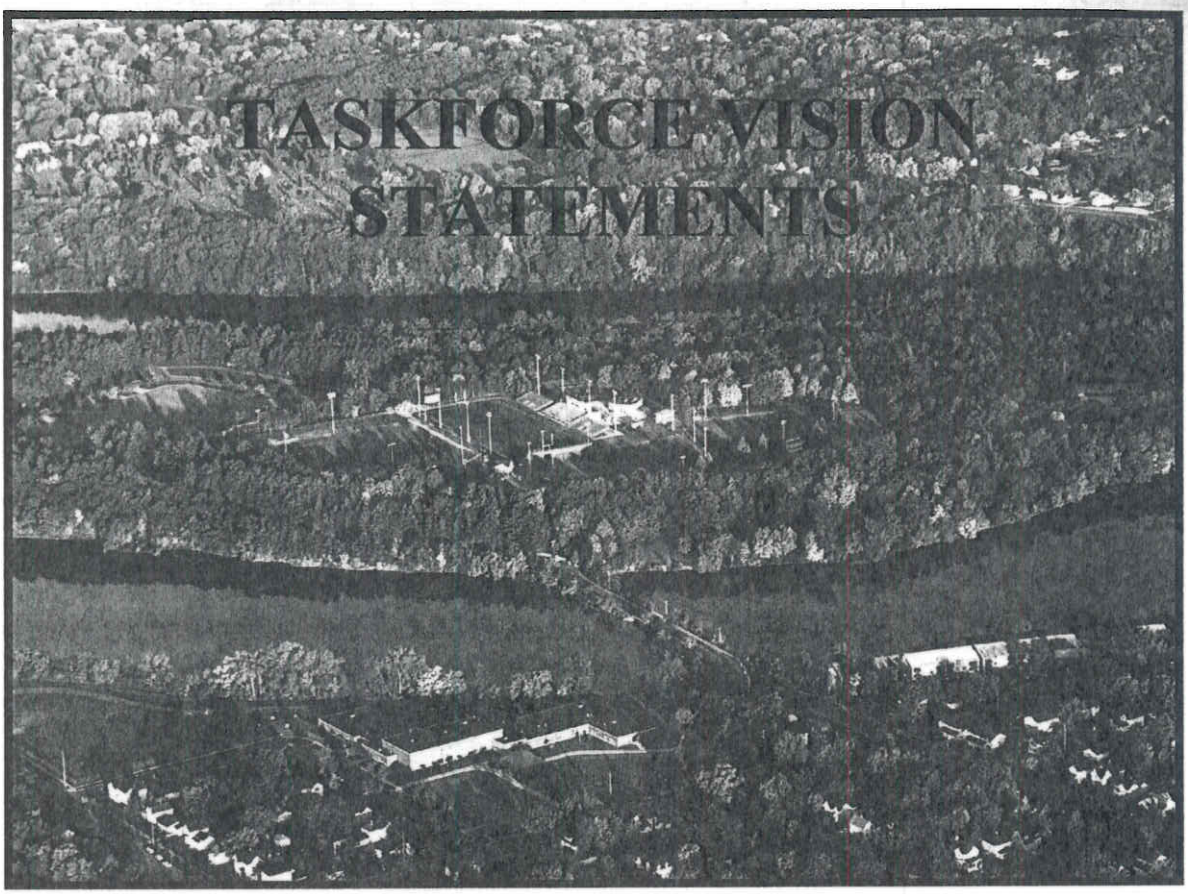
The objective of the programs at Delong Middle School is to provide direct experiences for the students with Half Moon Lake. Two separate programs have been created, one is for sixth grade students and the other is for seventh graders.

The sixth graders at Delong are divided into three groups or teams of approximately 100 students each. One team is selected to participate in a six-week program that involves a variety of educational projects at Half Moon Lake. The other two six-grade teams participate in other educational projects during the six-week period.

The purpose of the sixth grade program is to give the students an exposure to the natural environment and encourage an appreciation of the Half Moon Lake ecosystem. Projects that each student is involved in include: plant identification, measuring pond volumes, collection small biological organisms, water temperature measurements, canoeing and journaling. The program was initiated four years ago.

The seventh grade program involves all of the seventh grade students and provides them with an opportunity to go to Half Moon Lake for a minimum of three days in the spring of the year. The students get a general overview of the lake's ecology and select some type of lake related project that they must complete and then prepare a written report about the project.

The Delong program also collaborates with the teachers and students at Lakeshore Elementary School. Teachers and students at Lakeshore assist in taking water temperature samples for Delong.


TASKFORCE VISION
STATEMENTS

TASKFORCE VISION STATEMENTS

The Taskforce has had considerable discussion regarding its charge. As stated in the introduction, the Taskforce was charged with the responsibility of **"establishing water quality goals for Half Moon Lake and recommending a plan of action needed to reach these goals".**

In discussing the charge, the group noted that the lake is an important resource for the entire community. This importance became apparent in the community survey conducted by the Citizen's Taskforce Advisory Committee in 2000. The survey found that not only those that visit the lake on a regular basis value the lake as natural and scenic resource, but also those that seldom visit the lake or Carson Park recognize its importance to the community and strongly support the City's efforts to improve the lake.

The importance of the lake is well documented; a 1971 report by the Half Moon Lake Restoration Committee to the City Council stated, "The Carson Park-Half Moon Lake complex is probably the most important, single, publicly owned recreation asset in Eau Claire County and every reasonable effort should be made to upgrade the lake and it environs for this and future generations."

In light of the community's strong support for improving and maintaining Half Moon Lake, the Taskforce has developed a series of seven "vision statements" that address various aspects in establishing and implementing a plan to improve water quality at Half Moon Lake. These vision statements could also be considered overall goal statements that the Taskforce has used to develop specific recommendations to implement the charge. These vision statements were formulated based on discussions of the Taskforce when asked what they would like to see put in place five years from now to improve the lake.

A. ***Improved Water Quality and Diverse Plant Community.***
Half Moon Lake's water quality will be significantly improved as a result in the reduction of chlorophyll (algae) levels and in the reduction, severity and number of algae blooms that occur during the summer. Improved water quality will also result from a reduction in the dominance of *P. crispus* (curly leaf pondweed). With the reduction of this invasive species, the lake will have the opportunity to achieve improved water quality characteristics attainable through an indigenous aquatic plant community.

B. ***Self-sustaining Fishery.***
The Half Moon Lake fishery will be enhanced to not only improve the quantity and size of sport fish, but will become self-sustaining for angling enthusiasts to enjoy.

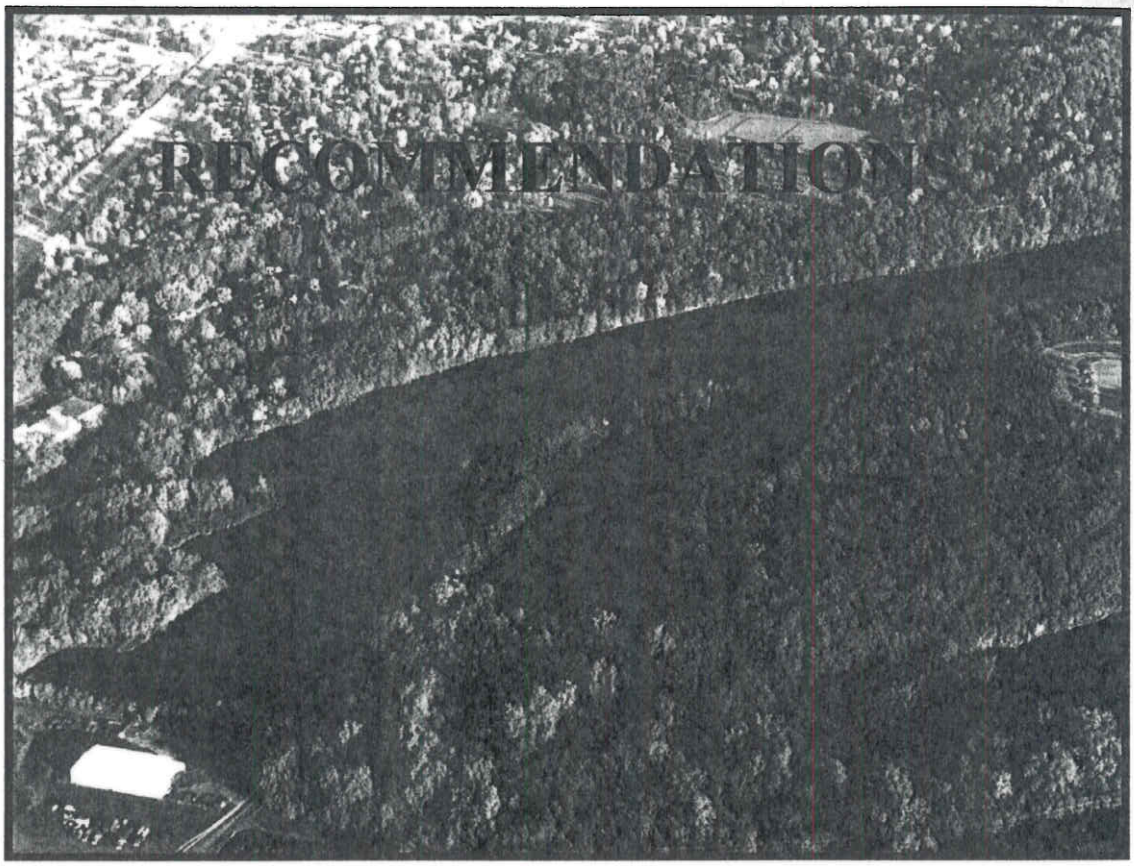
C. ***Clean, Healthy, Stable and Protected Shoreline.***
Half Moon Lake's shoreline will be free of litter, debris and trash, which in turn will promote a healthy and diverse plant ecosystem and improved aesthetics for the lake and Carson Park. Shoreline areas will be stabilized using natural means to eliminate erosion caused by run-off and wave action.

D. ***Minimized Motor Boat Impacts.***
Half Moon Lake will have minimal motorboat impacts to avoid the disturbance to lake bottom sediments and to sensitive aquatic and shoreline areas.

E. ***Improved Watershed Management.***
Storm water runoff into Half Moon Lake from the lake's watershed is minimized and when possible, filtered through the use of storm water controls and storm water best management practices (BMP's).

F. ***Multi-Faceted Recreational Opportunities.***
Opportunities for a variety of recreational activities will be created and encouraged within and around Half Moon Lake.

G. ***Educated, Involved Citizenry.***
Residents of the community will become educated and informed about Half Moon Lake, its natural environment, scenic beauty, and recreational opportunities in order to promote an appreciation for this resource and encourage involvement in its stewardship, utilization, and enhancement.


RECOMMENDATIONS

RECOMMENDATIONS

The recommendations and actions set forth in this report are in response to the "charge" given by the Eau Claire City Council and Waterways and Parks Commission. They were developed while considering many of the recent studies and documents pertaining to current conditions of the lake, particularly the findings outlined in both the limnological study conducted by the Army Corps of Engineers in 1999 and the community surveys taken in 1999 and 2000.

It is hoped that these recommendations will provide direction for the City as to how the water quality of Half Moon Lake can be improved and enable this resource to continue to be enjoyed for generations to come. In order to provide the City Council with a course of action as to which recommendations are most urgent, the recommendations have been prioritized by the Taskforce. A detailed summary of the overall rankings given the recommendations by the Taskforce is contained in Appendix B. The recommendations are discussed below in general order of importance, with those listed first being most urgent.

The implementation of the proposed recommendations will reduce phosphorous levels to approximately 50 percent of the current level. This in turn will reduce chlorophyll levels by about 60 percent (Figure 4). The goal discussed by the Taskforce is to reach a chlorophyll level in the range of 30 µg/l compared to the current baseline level of 82 µg/l. This goal will also become part of the TMDL for the lake to be submitted by the DNR to the EPA.

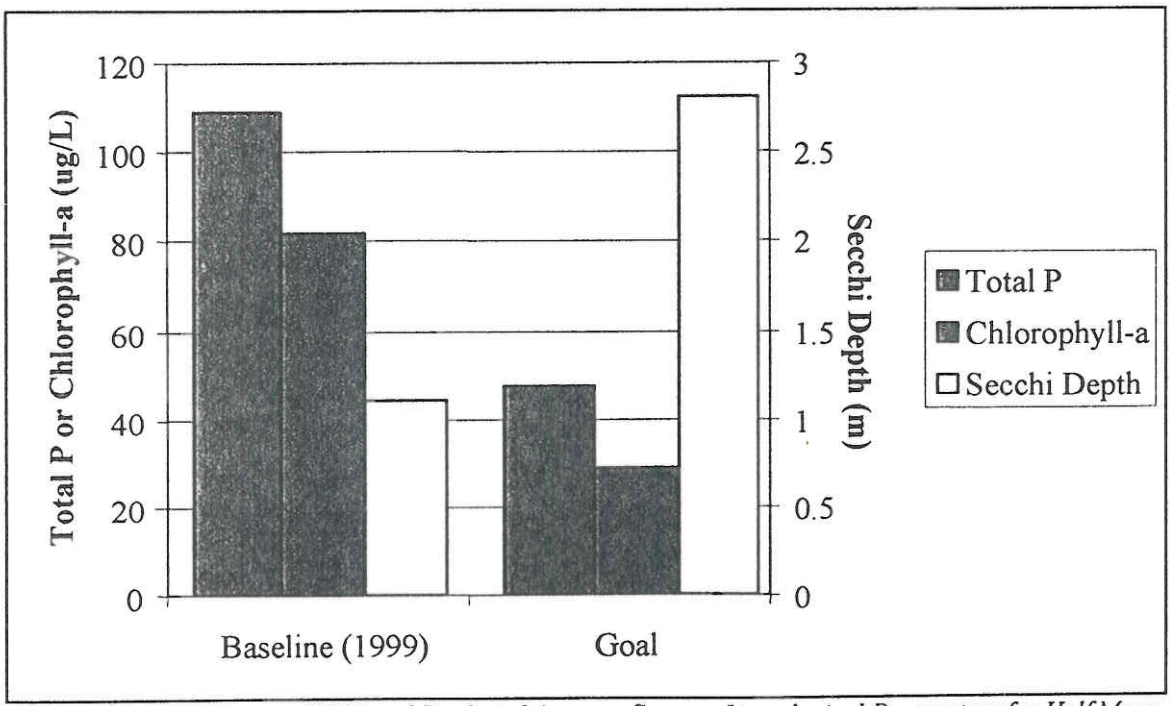


Figure 4. A Comparison of 1999 and Predicted Average Summer Limnological Parameters for Half Moon Lake.

A. **Improved Water Quality.** The water quality goal for Half Moon Lake is to significantly reduce the severity and frequency of algae blooms through the reduction of nutrient inputs to the lake. The Army Corps of Engineers Limnological Study concluded that water clarity can be improved through the reduction of chlorophyll by managing the levels of phosphorus (P) in the lake. The study concluded that 21% of the phosphorus comes from external sources such as precipitation, storm sewers and water pumped into the lake, while internal sources contribute 79% of the annual P load. These sources include lake bottom sediments, decomposition of plants and mixing caused by motorboat activity.

The study also concluded that reducing only one source of phosphorus would result in minimal reductions in chlorophyll levels. However, managing several sources would result in significant reductions in phosphorus in the lake and in turn, very noticeable reductions in chlorophyll levels would occur and water clarity would be improved.

Therefore, the Taskforce recommends that the City initiate a program to target the reduction of each of the following internal sources of phosphorus into the lake. This would include the following:

1. Reduce the release of phosphorus from lake bottom sediments. Sediments release about 42 % of the phosphorus load into lake. To address this major contributor of phosphorus, it is recommended that the City coordinate with the DNR to undertake an alum (aluminum sulfate) treatment for the lake. An alum treatment involves spreading alum over the surface of the lake and letting it settle to the bottom. Once on the bottom, the alum prevents the release of phosphorus that is contained within the sediments.

   The amount of alum applied to a lake is a factor of the available phosphorus in the sediments of that particular lake. A study of Half Moon Lake sediments to determine the proper dosage level needs to be conducted. It is anticipated that an alum treatment would decrease the internal load for phosphorus coming from the sediments by 75 to 90 percent. Alum treatments have been completed on a number of lakes in Wisconsin. Studies have shown no negative effects on the aquatic or wildlife environment nor to swimmers. Alum treatments have proven to be effective for several years. The longevity of the alum treatment is dependent upon the amount of sedimentation that occurs in the lake after the alum treatment has been completed.

   The cost of the alum treatment will be dependent upon to amount of phosphorus available for release from the bottom sediments and the cost could range from $1,250 to $4,000 per acre. It is estimated that approximately 100 acres of the lake would be treated; therefore, the overall cost for the alum treatment would range from $125,000 to $400,000.

   The cost of the alum treatment could be offset by grants from the DNR. A DNR lake grant would cover 75% of the cost, with a maximum grant award of $200,000. In addition to the lake grant program, this activity would also be eligible for cost share moneys from the Urban Non-point Source and Storm

Water and Targeted Runoff Management Grant Programs. Up to 70 % of the project costs would be cost sharable under these programs.

It is important to note that undertaking the alum treatment on Half Moon Lake is closely linked to the relocation of Ski Sprites from the lake. In order for the alum to prevent the release of P into the water column, it cannot be disturbed by the Ski Sprite's boating activity; otherwise, its effectiveness is greatly reduced. Conversely, if an alum treatment is not undertaken by the City, elimination of the Ski Sprites alone would not appreciably improve the water quality and therefore may not be necessary.

2. Reduce the phosphorus load occurring from plant decomposition by increasing the current weed harvesting operation. It is recommended that the City attempt to double the amount of weeds that are currently harvested. The mechanical harvesting program in Half Moon Lake should be designed to maximize long-term improvements in the lake. The City should:

   a. Concentrate harvesting efforts early in the year before *P. crispus* forms turions and senescences.
   b. Continue monitoring the growth of *P. crispus* to determine when the harvesting program should begin each year.
   c. Begin the harvesting program each year as soon as the harvester can remove sufficient nodes per stem to prevent turion formation on the *P. crispus.*

   This will result in a reduction in P load from plant decomposition by 50 to 90 percent. Another benefit of this action will be a potential shift in plant species away from the *P. crispus* (curly leaf pond weed).

   Costs associated with this increase in weed harvesting pertain to both personnel costs as well as the need to purchase a second harvester. Additional personnel costs would be approximately $34,000 per year and a second harvester would cost approximately $105,000. Grant funds may be available to offset a portion of the purchase of the harvester.

   The application of lime to the lake sediments is a new technology, which has demonstrated initial success to control *P. crispus* in lakes. This technology should be evaluated for use in Half Moon Lake. If this technology is applicable to the lake it is likely that increased harvesting would not be needed for the lake.

3. Relocate the Ski Sprites from the lake to another site. Approximately 17% of the overall P load to the lake would be eliminated though the cessation of motorboat activity. As discussed in the background section of this report, the Ski Sprites have indicated a willingness and desire to relocate to another site and feel such a move will not only benefit the lake, but will create a number

of opportunities for the Ski Sprites to grow and expand. (Also see recommendation B).

4. Implement watershed storm water management controls. Although external loading of phosphorus represents a much smaller component of loading into the lake, some sources of the external loading should also be addressed to help improve the water quality. One of these external loading sources of phosphorus is the water entering the lake from storm sewers. The Taskforce recommends that street sweeping be increased within the Half Moon Lake Watershed. This will result in an approximately 10 % reduction in P coming from the storm sewers. It is critical to insure that sediment and nutrient inputs into the lake from storm sewers are controlled, as this will extend the longevity of the alum treatment. In addition to the more immediate impacts of increased street sweeping, it is anticipated that loading from storm sewers will be reduced in the long term by increased use of best management practices as redevelopment occurs within the watershed (also see recommendation H).

   Street sweeping within the watershed will need to be studied in order to determine what increase in this service would benefit the lake and determine whether particular areas within the watershed could be targeted for maximum benefit. At the present time, the City sweeps the streets within the watershed approximately every three weeks during the spring, summer and fall. It is estimated that it costs $1,200 per time to sweep the streets within the watershed area. Additional sweeping around Half Moon Lake may necessitate some reductions in this service in other portions of the City.

Implementing these recommendations as outlined above will result in significant improvements in water clarity and fewer algae blooms (Figure 5). However, in a dynamic ecosystem such as Half Moon Lake, people need to recognize that when a specific water quality goal is proposed for the lake, the actual level of improvement could be quite variable.

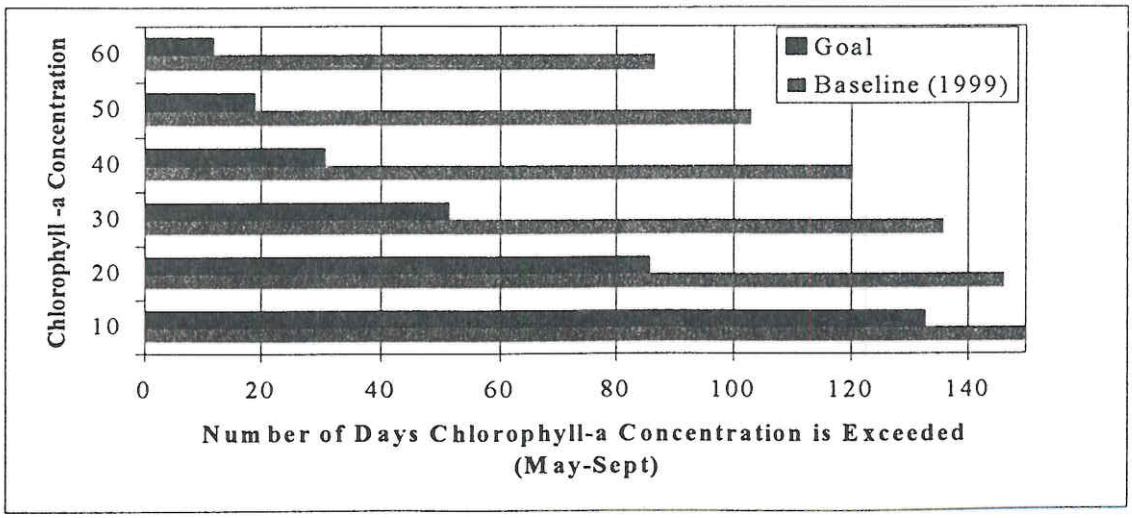


Figure 5. Algae Bloom Frequency During the 1999 Monitored Condition, With the Recommended Goal.

B. **Formation of Taskforce to Assist Ski Sprite Relocation.** As outlined above, the implementation of the recommendation outlined in Part A, proposes the relocation of Ski Sprites from the lake prior at the time that an alum treatment is undertaken. This is because the motorboats suspend the phosphorus into the water column by disturbing the phosphorus laden sediments. In addition, a successful alum treatment requires that the lake bottom not be disturbed by the motorboat's propellers. This means that the Ski Sprite organization must find a new location prior to the time that the City would initiate an alum treatment.

The Ski Sprites are interested in moving to a new site, as it would benefit the club by providing an opportunity for continued growth and possibly some new programs. However, finding a suitable location and making improvements to that site will be an involved process. The Taskforce noted that there is strong community support for the Ski Sprites, which was very apparent from the community surveys. The Taskforce also noted that a critical factor in implementing the recommendation in Part A is that the Ski Sprites not be forced from the lake without a new site to move to. It is very important that their organization continue to provide water skiing opportunities for the youth of the community and offer their ski show entertainment as they have since 1960. *

Therefore, a committee or taskforce should be appointed by the City Council to work with the Ski Sprites organization to assist them in their transition to another location. The committee would assist in locating a site, working with effected groups to gain consensus on the proposed site, assist in determining funding options and assist in facility design issues.

C. **City Leadership in Lake Related Issues.** The Taskforce strongly recommends that the City Council officially designate a City staff position that will take a leadership role concerning issues pertaining to Half Moon Lake. This staff position should serve as a "point person" regarding lake improvement projects outlined in this report and also the regular management, maintenance and upkeep responsibilities of the lake. In the past, the Director of the Parks and Recreation Department has assumed this leadership role. Having one individual such as the Parks and Recreation Director in this leadership role is very important in order that lake related issues not be over-looked and that they are addressed in a timely manner

D. **Evaluate and Address Erosion Concerns.** The City and DNR should identify the various erosion problems that are present around the lake and evaluate options to resolve these problems. Possible solutions may include the installation of bio stabilization measures along erosion prone areas of shoreline. Such measures include: live stakes, brush mattresses, rip rap with plantings, vegetated crib walls, etc.

E. **Shoreland and Lake Habitat Areas.** A study should be undertaken by the City and DNR that would identify the varying shoreland plant and wildlife habitats

around the lake and recommend management strategies for these areas. This study will ensure the best management and protection of the unique and sensitive shoreland habitat areas around the lake such as Braun's Bay, the southeast corner of the lake and north and northwest portions of the lake.

The study should also suggest methods to monitor, prevent and control the introduction or establishment of invasive plant species that would be detrimental to the aquatic and shoreline environment. In addition, the study should identify unique or sensitive habitat areas for the lake's fishery and wildlife and develop management recommendations for these areas.

F. **Motor Prohibitions.** The City ordinance adopted in 1973 prohibiting all internal combustion engines with the exception of the Ski Sprites should be continued. Once the Ski Sprites find a suitable location, the ordinance should then apply to all boats using the lake with the exception of the weed harvester or other related types of users.

G. **Braun's Bay.** To protect the unique aquatic environment of Braun's Bay; electric trolling motors should not be allowed to be used within this area. This area

contains a number of aquatic plants unique to the lake, which can easily be disturbed by the trolling motors.

H. **Aquatic Plant Harvesting.** The City has been harvesting aquatic plants from the lake since 1979 and purchased its own harvester in 1991. It currently harvests approximately 9,000 kg of plant material (30 kg of phosphorus) during the limited cutting season. The goal of the harvesting program has two major components. The first priority is to promote a shift in the aquatic plant community to a more diverse native community that provides increased quality of habitat. The other major goal is to reduce the amount of phosphorus released from P. *crispus* biomass as it dies back in the summer.

In order to optimize the benefit of harvesting *P. crispus* and enhance the fishery, the City and DNR should evaluate options pertaining to the timing of the harvesting and the locations within the lake where it should be occurring. This study would also assist the City in determining what means would be most feasible to increase the amount of *P. crispus* harvested as recommended in Part A.

I. **Prepare Storm Water Management Plan.** Several concerns related to storm water runoff within the Half Moon Lake Watershed were noted in the report, which could adversely be affecting water quality, shoreline areas and causing siltation. To address these issues in a comprehensive manner, a storm water management plan for the Half Moon Lake Watershed should be developed that addresses the following issues:

1. Adopt a grading and erosion control ordinance.
2. Address the runoff and erosion problem occurring behind the Robert's Farm Warehouse Building located at the north end of the lake. The plan should consider whether the City should acquire the building or propose a recommendation that would eliminate the erosion that is occurring from the runoff from the building.
3. Improve the Half Moon Beach parking lot.
4. Encourage the concept of "rain gardens" and other methods to increase infiltration within the watershed.
5. Encourage the use of storm water control funds for the installation of needed Best Management Practices (BMP's) to increase infiltration and treatment of storm water runoff.
6. Study the BMP's utilized for storm runoff from the Carson Park parking lots and determine if they should be upgraded to improve the water quality of runoff entering the lake from these areas.
7. Encourage the stenciling of storm sewers within the watershed by volunteer or civic groups.
8. Increase street sweeping within the Half Moon Lake watershed.
9. Distribute informational materials to property owners within the watershed regarding use of phosphorus free fertilizers and street cleaning.

J. **Shoreline Cleanup.** Responses from the community surveys noted that one of the chronic problems at Half Moon Lake is the general appearance of the shoreline due to the accumulation of litter, garbage and miscellaneous debris. To address this concern, the City should sponsor and promote an annual Half Moon Lake Cleanup Day and invite various civic groups and organizations representing youth, schools, neighborhoods, businesses, etc. to participate in cleaning up the debris along the shoreline. The City would then be responsible for the disposal of the debris that is collected. Possible grant assistance for such of an event should be pursued.

In addition, the City should encourage groups or organizations to participate in a "Friends of Half Moon Lake" or "Adopt a Shoreline" program to assist in the cleanup of the lake's shoreline, boat landings and other areas. This type of program would provide an on-going effort to keep litter and debris cleanup under control on a year-round basis.

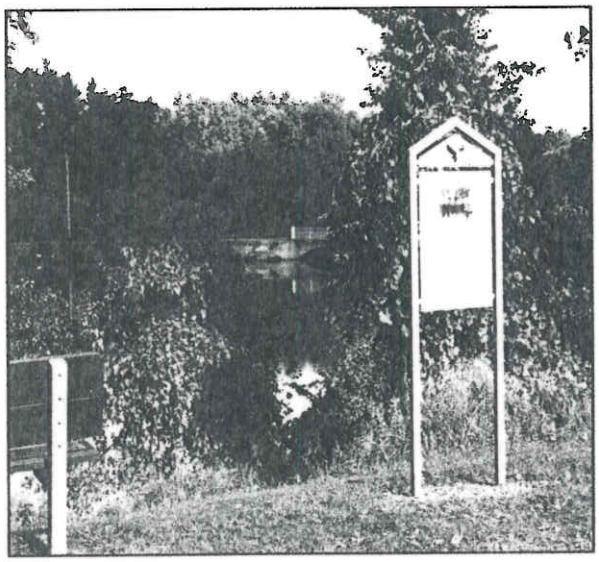
To further address the problem, additional trash containers should be provided around the lake. The Taskforce also noted that a portion of the litter and debris accumulates along the shoreline is attributable to the fisherman (summer and winter). Providing additional trash containers will partially address this concern, therefore, it is also recommended that organizations that regularly use the lake be contacted to request their assistance in encouraging better stewardship of the lake.

Finally, the Taskforce also feels that a change in attitude and perception about the lake needs to occur. Visitors to the area should not feel that it is appropriate to litter or dump their debris; rather, they should be better stewards of the lake and its surrounding environment. Although any change in attitudes will be difficult and any changes might seem small, it is important that efforts be made to address this concern. Many of the recommendations discussed in the following section focus on this issue.

K. **Education and Involved Citizens.** The Taskforce places a high priority on the education of the community to inform them about the lake's natural environment, scenic beauty and recreational opportunities. Through this education and dissemination of information, it is hoped that people will gain a better appreciation of the lake and encourage them to become more involved in its enhancement, stewardship and utilization. The recommendations set forth below strive for this goal.

1. Prepare an annual "State of the Lake" report that would be presented to the Waterway and Parks Commission and City Council. The staff person identified in Part C of this section would be responsible for the preparation of this report.
2. Expand the current lake ecology programs sponsored by the School District from Memorial High School and Delong Middle School to North and Regis High Schools and the City's other middle schools. The City and DNR should continue to be partners with the School District with these programs.

3. The City should work in partnership with the local media (newspaper, television, Public Access and radio) to have articles or features produced about Half Moon Lake to better inform the public about the lake and its importance in the community. Information sources such as the City Newsletter or newsletters of other organizations should also be utilized. In addition, work with the media to promote improvements and accomplishments as they occur, for example create a "thermometer" display to illustrate projects completed.
4. Promote Half Moon Lake as part of the Earth Day events. Consider incorporating field trips to various areas around the lake to discuss the ecology of that area as part of the activities
5. Establish a subcommittee of the Waterways and Park Commission to develop and implement a comprehensive educational and promotional program.
6. Hold an open house at a facility such as Lakeshore School to present and discuss the recommendations of the Taskforce. Notice of this open house should be sent to lake user groups, conservation clubs, neighborhood associations, etc.
7. Apply for funding from the DNR that could be made available to civic organizations to develop educational activities or programs related to the lake.



8. Initiate a "weeds to gardens" program to promote the weed-harvesting program.
9. The Waterways and Parks Commission sponsor a poster contest for elementary students having a theme pertaining to "helping the lake".
10. Encourage one of the lake ecology classes sponsored by the School District to develop a "traveling" display about the lake, its ecology and recreational uses. This display could be viewed at such locations as the library, airport, mall and Convention Tourism Bureau.
11. Develop an informational and directional signage system within Carson Park and around Half Moon Lake. A component of this signage system should focus on ecology and environmental aspects of the lake. Another component should include historic plaques providing historical information about the lake. A brochure should be prepared in conjunction with this interpretive signing illustrating the locations of the signs. This brochure should be disseminated at locations such as the Convention Tourism Bureau.
12. Develop an environmental education or interpretive facility that could be used by students, organizations, businesses and the City to provide an educational setting pertaining to lake, plant and wildlife ecology.

L. **Half Moon Lake Fishery**. The Half Moon Lake Fisheries Survey contained several recommendations to improve the fishery within Half Moon Lake.

Specifically, the City should:

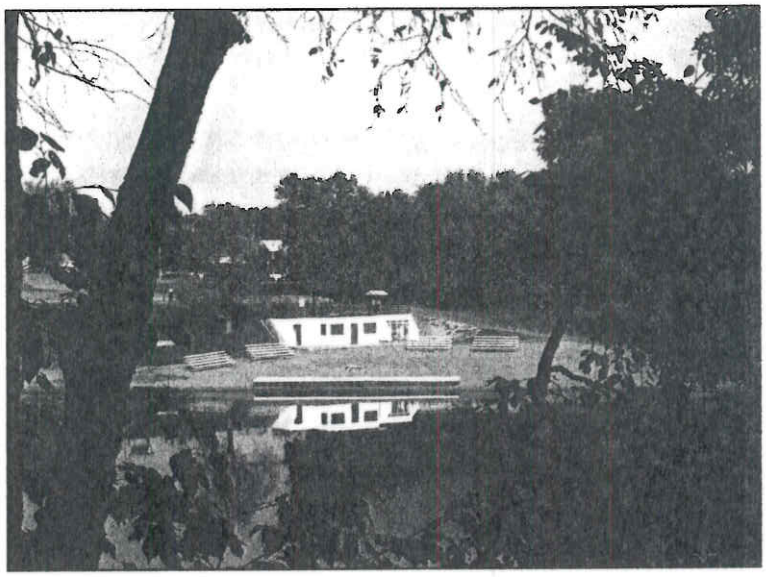
1. Request that the DNR evaluate the current fishing regulations for the lake and recommend changes to promote improved quantity and size of bass and bluegill.

2. Develop an educational fishing program to encourage individuals to practice catch and release for certain species and size of fish.
3. Request the DNR to study the feasibility of increasing walleye habitat in the lake to enable the walleye population to reproduce on a self-sustaining basis.

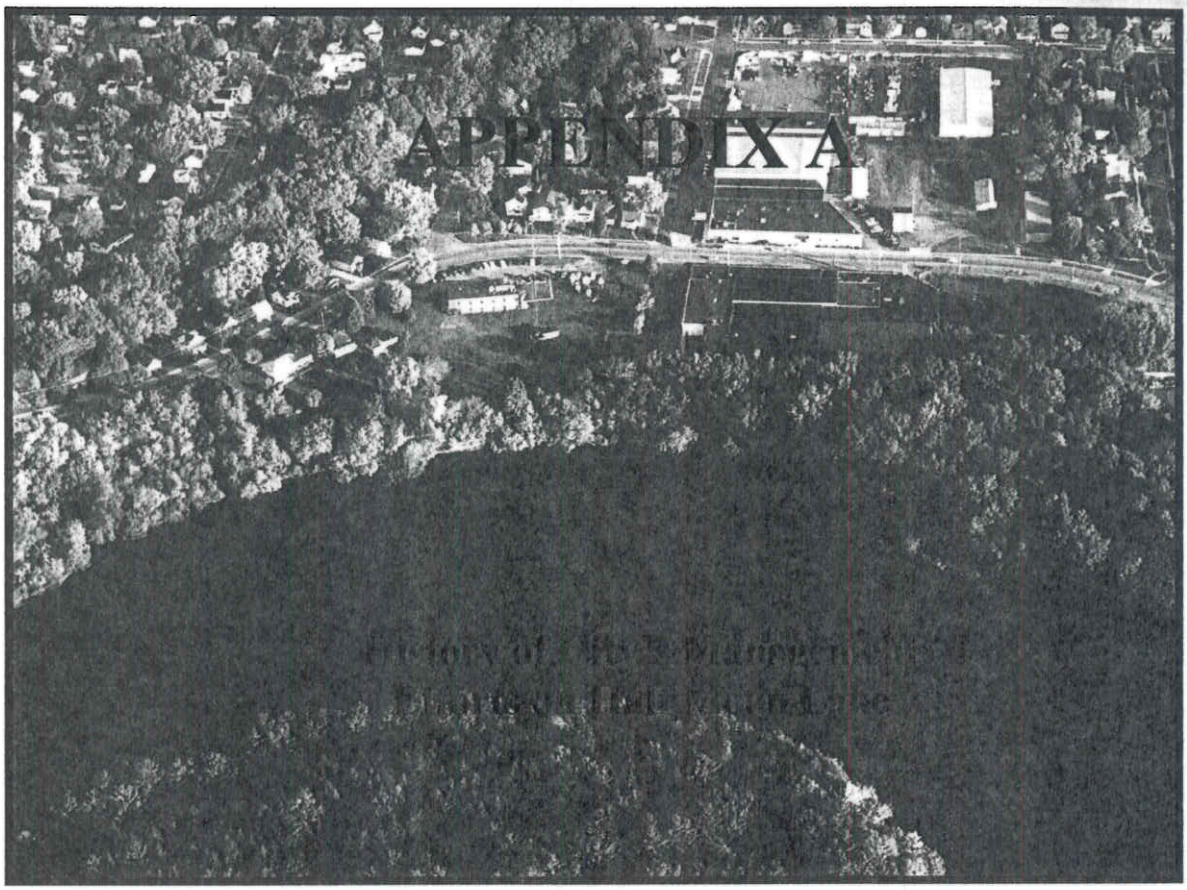
M. **Recreational Opportunities.** One of the vision statements included in this report emphasizes that recreational opportunities be provided within and around the lake and that people be encouraged to participate in these activities. Although this objective does not relate directly to the establishment of water quality goals for the lake or methods to attain these goals, it was felt that the recreational use and enjoyment of the lake is very important and needed to be considered by the Taskforce. To address this objective, it is recommended that the Waterways and Parks Commission develop a recreation plan for the lake and surrounding properties

in order to enhance the recreational potential of the lake and surrounding area and accommodate future needs as the water quality of the lake improves. This plan should incorporate the following:

1. Provide an improved boat landing for the southeast portion of the lake located south of Lakeshore Elementary School.
2. As water quality improves upon the implementation of the above-mentioned recommendations, the City should re-open and maintain the beach and encourage people to use the beach by promoting the improvements in water quality.
3. Install a handicap accessible fishing pier on the east side of the lake.



4. Construct a trail with overlooks around the lake to connect with the existing recreational trail on the east side of the lake. Placement of this trail should not be abutting the lake along the northern sensitive shoreline or below the bank adjacent the cemetery or within any area that would result in erosion or increased storm water runoff into the lake.
5. Develop a plan for the City's property north of Menomonie Street that would enhance the entrance to Carson Park and the lake.
6. Make park improvements to the City's parkland extending south of Rod and Gun Park along the southwest corner of the lake. Incorporate a picnic area and canoe and kayak put-in/take-out site within this area. An exercise trail within this area could also be considered.
7. Solicit a sponsoring group to organize an annual event for canoeing, kayaking or sailing that would utilize the lake.
8. Sponsor and promote instructional programs offered at the lake in canoeing, kayaking, sailing, etc.
9. Prepare an informational brochure/map that identifies recreational sites, interpretive signage and trails around the lake.
10. Develop a boat or canoe rental on the lake that is operated privately or by a non-profit organization.



APPENDIX A

APPE
Force Priorities

HALF MOON LAKE TASK FORCE
RECOMMENDATION PRIORITIES

VISION STATEMENT	RECOMMENDATION	COMMITTEE PRIORITY RANKINGS
Improved Water Qual.	Water Quality Goal of 30 ug/l	1.1
Fishery	Implement TMDL Water Quality Goals	1.1
Motor Boat Impacts	Task force to assist Ski Sprites relocation	1.2
Educated Citizenry	City leadership role	1.3
Clean/Healthy Shoreline	Evaluate erosion problems	1.5
Clean/Healthy Shoreline	Identify shoreland habitats and devel. Mgmt options	1.7
Watershed Mgmt	Storm water & erosion controls at north end of lake	1.7
Fishery	Evaluate weed cutting options	1.8
Watershed Mgmt	Develop storm water mgmt plan for lake	1.8
Clean/Healthy Shoreline	Provide waste containers	1.8
Educated Citizenry	Annual clean-up day	1.8
Educated Citizenry	Develop series of newspaper articles	1.8
Educated Citizenry	Encourage media to do features	1.8
Educated Citizenry	Utilize city newsletter	1.8
Fishery	Identify lake habitats and devel. Mgmt. options	1.8
Educated Citizenry	"State of the Lake" report	1.9
Educated Citizenry	Expand school programs	1.9
Motor Boat Impacts	Maintain existing ordinance	1.9
Watershed Mgmt	Investigate drainage problems on north side	1.9
Clean/Healthy Shoreline	Media promotion program for better stewardship	2.0
Clean/Healthy Shoreline	Signage for better stewardship	2.0
Educated Citizenry	Inform conservation clubs about report	2.0
Motor Boat Impacts	Place bio-stabilization measures along shoreline	2.0
Motor Boat Impacts	Prohibit electric trolling motors in Brauns Bay	2.0
Clean/Healthy Shoreline	Educational materials for north side owners	2.1
Clean/Healthy Shoreline	Winter user monitoring and clean-up	2.1
Educated Citizenry	Apply for DNR funds for educational activities	2.1
Watershed Mgmt	Education of p-free fertilizers and clean streets	2.1
Watershed Mgmt	Public education on littering impacts	2.1
Watershed Mgmt	Use storm water controls to filter runoff	2.1
Clean/Healthy Shoreline	Improve canoe/kayak access areas for erosion	2.2
Educated Citizenry	Promote lake as part of Earth Day Events	2.2
Watershed Mgmt	Improve detention ponds at Carson Park	2.2
Educated Citizenry	Educate City workers	2.3
Educated Citizenry	Prepare video segments	2.3
Clean/Healthy Shoreline	Develop "friends" program	2.3
Clean/Healthy Shoreline	Target fishing groups to stop littering	2.3
Clean/Healthy Shoreline	Monitor invasive plant species	2.4
Educated Citizenry	Sub-committee of Waterways Commission	2.4
Fishery	Evaluate fishing regulations and revise	2.4
Recreational Opport.	Develop recreation action plan	2.4
Educated Citizenry	Open house on recommendations	2.5
Recreational Opport.	Improve boat landing south of Lakeshore	2.5
Recreational Opport.	Re-open and maintain beach	2.5
Watershed Mgmt	Encourage rain gardens	2.5
Clean/Healthy Shoreline	Grading and erosion control ordinance	2.5
Clean/Healthy Shoreline	Repair eroded trail areas	2.6
Educated Citizenry	Develop environmental education facility	2.6
Educated Citizenry	Develop traveling display	2.6
Educated Citizenry	Environmental signage at key points	2.6
Educated Citizenry	Field trips for children and families	2.6
Recreational Opport.	Install handicap fishing pier on east side	2.6
Educated Citizenry	Poster contest	2.7
Educated Citizenry	Thermometer for lake improvements	2.7
Fishery	Education program for ice fisherman	2.7

Recreational Opport.	Promote improved water quality condition	2.7
Fishery	Study reduction or relocation of aquatic plants	2.7
Educated Citizenry	Develop lake ecology brochure	2.8
Watershed Mgmt	Acquire Roberts Building	2.8
Watershed Mgmt	Enact storm water and erosion control ordinance	2.9
Educated Citizenry	Informational and educ. Displays	2.9
Recreational Opport.	Construct trail	2.9
Educated Citizenry	Initiate "weeds to gardens" program	3.0
Watershed Mgmt	Storm water stenciling	3.0
Recreational Opport.	Develop Menomonie St entrance	3.1
Recreational Opport.	Develop picnic and park on southwest side	3.1
Recreational Opport.	Landing for canoes/kayaks on southwest side	3.1
Recreational Opport.	Organize annual event for canoeing/kayaking	3.1
Recreational Opport.	Offer low-cost instructional programs	3.2
Watershed Mgmt	Improve beach parking lot	3.2
Educated Citizenry	Promotional brochures to Tourism Bureau	3.3
Recreational Opport.	Install historic markers	3.3
Recreational Opport.	Create exercise trail	3.3
Recreational Opport.	Prepare map identifying recreational site on lake	3.3
Fishery	Develop walleye sandbar	3.4
Recreational Opport.	Boat/canoe rental	3.6

HALF MOON LAKE TASK FORCE RECOMMENDATION PRIORITIES

(green ranking form)

VISION STATEMENT	RECOMMENDATION	NUMBER OF TASKFORCE MEMBERS LISTING RECOMMENDATION AS ONE OF THEIR TOP 5 PRIORITIES
Improved Water Qual.	Water Quality Goal of 30 ug/l	12
Motor Boat Impacts	Task force to assist Ski Sprites relocation	10
Watershed Mgmt	Develop storm water mgmt plan for lake	6
Motor Boat Impacts	Maintain existing ordinance	4
Clean/Healthy Shoreline	Identify shoreland habitats and devel. Mgmt options	3
Educated Citizenry	City leadership role	3
Clean/Healthy Shoreline	Develop "friends" program	2
Educated Citizenry	Annual clean-up day	2
Educated Citizenry	Expand school programs	2
Fishery	Evaluate weed cutting options	2
Fishery	Implement TMDL Water Quality Goals	2
Clean/Healthy Shoreline	Media promotion program for better stewardship	1
Clean/Healthy Shoreline	Repair eroded trail areas	1
Educated Citizenry	"State of the Lake" report	1
Educated Citizenry	Develop traveling display	1
Educated Citizenry	Encourage media to do features	1
Educated Citizenry	Open house on recommendations	1
Educated Citizenry	Utilize city newsletter	1
Recreational Opport.	Develop picnic and park on southwest side	1
Watershed Mgmt	Enact storm water and erosion control ordinance	1
Watershed Mgmt	Use storm water controls to filter runoff	1
Clean/Healthy Shoreline	Educational materials for north side owners	
Clean/Healthy Shoreline	Evaluate erosion problems	
Clean/Healthy Shoreline	Grading and erosion control ordinance	
Clean/Healthy Shoreline	Improve canoe/kayak access areas for erosion	
Clean/Healthy Shoreline	Monitor invasive plant species	
Clean/Healthy Shoreline	Provide waste containers	
Clean/Healthy Shoreline	Signage for better stewardship	
Clean/Healthy Shoreline	Target fishing groups to stop littering	
Clean/Healthy Shoreline	Winter user monitoring and clean-up	
Educated Citizenry	Apply for DNR funds for educational activities	
Educated Citizenry	Develop environmental education facility	
Educated Citizenry	Develop lake ecology brochure	
Educated Citizenry	Develop series of newspaper articles	
Educated Citizenry	Educate City workers	
Educated Citizenry	Environmental signage at key points	
Educated Citizenry	Field trips for children and families	
Educated Citizenry	Inform conservation clubs about report	
Educated Citizenry	Informational and educ. Displays	
Educated Citizenry	Initiate "weeds to gardens" program	
Educated Citizenry	Poster contest	
Educated Citizenry	Prepare video segments	
Educated Citizenry	Promote lake as part of Earth Day Events	
Educated Citizenry	Promotional brochures to Tourism Bureau	
Educated Citizenry	Sub-committee of Waterways Commission	
Educated Citizenry	Thermometer for lake improvements	
Fishery	Develop walleye sandbar	
Fishery	Education program for ice fisherman	
Fishery	Evaluate fishing regulations and revise	
Fishery	Identify lake habitats and devel. Mgmt. options	
Fishery	Study reduction or relocation of aquatic plants	

Motor Boat Impacts	Place bio-stabilization measures along shoreline
Motor Boat Impacts	Prohibit electric trolling motors in Braun's Bay
Recreational Opport.	Boat/canoe rental
Recreational Opport.	Construct trail
Recreational Opport.	Create exercise trail
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Watershed Mgmt	Acquire Roberts Building
Watershed Mgmt	Education of p-free fertilizers and clean streets
Watershed Mgmt	Encourage rain gardens
Watershed Mgmt	Improve beach parking lot
Watershed Mgmt	Improve detention ponds at Carson Park
Watershed Mgmt	Investigate drainage problems on north side
Watershed Mgmt	Public education on littering impacts
Watershed Mgmt	Storm water & erosion controls at north end of lake
Watershed Mgmt	Storm water stenciling