

Update on the Half Moon Lake Water Quality Improvements

Half Moon Lake Implementation Taskforce
City of Eau Claire, WI
March, 2010

RESOLUTION

RESOLUTION ACCEPTING THE UPDATE ON THE “*HALF MOON LAKE WATER QUALITY IMPROVEMENTS*” REPORT BY THE HALF MOON LAKE IMPLEMENTATION COMMITTEE.

WHEREAS, the City of Eau Claire City Council, in the fall of 2001, appointed the Half Moon Lake Advisory Taskforce 2002 to prepare a report that would provide recommendations for improving the water quality of Half Moon Lake; and,

WHEREAS, the City of Eau Claire City Council, in October 2003, approved the formation of the Half Moon Lake Implementation Committee to act upon the recommendations made by the 2002 Taskforce; and,

WHEREAS, the Half Moon Lake Implementation Committee, comprised of representatives from the WI Department of Natural Resources, City of Eau Claire Public Works Department, City of Eau Claire Parks, Recreation and Forestry Department, the Friends of Half Moon Lake and the Ski Sprites, have updated progress on the 2002 Taskforce recommendations in a January 2010 report, and;

THEREFORE BE IT RESOLVED by the City Council of the City of Eau Claire accepts the “*Half Moon Lake Water Quality Improvements*” report of January 2010 and acknowledges the progress made by the Half Moon Lake Implementation Committee.

Adopted,

March 9, 2010

(SEAL)



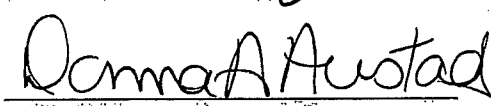
President Kerry J. S. Kincaid

(SEAL)



City Manager Mike Huggins

(ATTESTED)



City Clerk Donna A. Austad

Half Moon Lake Implementation Committee

Bill James	US Army Corps of Engineers
Bob Schneider	Waterways and Parks Commission
Bob Von Haden	Buffington Neighborhood/Friends of Half Moon Lake
Buzz Sorge	WDNR
Christine Schaaf	Friends of Half Moon Lake
Dan Zerr	UW-Extension
Dennis Eikenberry	Waterways and Parks Commission
Diane Paulsrud	Buffington Neighborhood/Friends of Half Moon Lake
Jim Olson	Community Member
Joe Kurz	WDNR
John Genskow	City Public Works Department
Jon Case	Waterways and Parks Commission
Joseph Rohrer	UWEC Biology Dept.
Katherine "Tinka" Mikelson	Buffington Neighborhood/Friends of Half Moon Lake
Leon Salander	Waterways and Parks Commission
Neil Trombly	WDNR
Pat Ivory	City Community Development Department
Penny Von Haden	Buffington Neighborhood/Friends of Half Moon Lake
Phil Fieber	City Parks, Recreation, and Forestry Department
Susan Kaul	Friends of Half Moon Lake

INTRODUCTION

This report is an update of the report prepared by the Half Moon Lake Advisory Taskforce in 2002, which has been used by the City as an action plan for the implementation of recommendations aimed at improving the water quality of Half Moon Lake. The recommendations set forth in the 2002 report were established in an effort to 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 was a fourteen member committee that included 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 report contained specific water quality goals for Half Moon Lake that the City and community should work towards. It also set forth a series of recommendations related to attaining the prescribed water quality goals, and making the community be better stewards of the lake and ensuring that the lake will continue to be a natural asset for future generations.

This document reviews the 2002 Report and actions taken since that time to determine the progress made in implementing the recommendations. Examples of some of the major accomplishments since 2002 include:

- Creation of the Friends of Half Moon Lake in 2003;
- Increased street sweeping within the watershed initiated in 2003;
- Adoption of an ordinance prohibiting the use of trolling motors in Braun’s Bay in 2004;
- Removal of the Robert’s Farm Warehouse Building and Valley Builder’s Building at the north end of the lake in 2006 and 2008 respectively and installation of several BMP’s as part of the construction of parking lots for Luther Hospital;
- Relocation of the Ski Sprites Ski Club to Lake Altoona in 2007;
- Completion of a lake sediment study by the University and preparation of a lake depth map in 2007;
- Application of Herbicides 2,4-D for Eurasian Water Milfoil, and Aquathol K for Curly Leaf Pond Weed in the spring of 2009.

This document also provides updated recommendations for the lake, based on the progress made in implementing the original recommendations.

This review and update was undertaken by a multi-disciplined group called the Half Moon Lake Implementation Taskforce that was formed to carry-on the charge of the Half Moon Lake Advisory Taskforce. This newly organized group that was formed in 2003 to oversee the implementation of the recommendations contained the Report on Half Moon Lake Water Quality Improvements. This Implementation Taskforce includes citizen members as well as representatives from the WI DNR, University of Wisconsin – Eau Claire, City Public Works Department, and City Parks, Recreation, and Forestry Department.

BACKGROUND

The 2002 report noted that Half Moon Lake is a 154.3-acre oxbow lake of the Chippewa River having an average depth of 6 feet, with a maximum depth of 13.8 feet. The lake was cut off from the Chippewa River prior to the 1800s 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 1900s and the City has been very proactive 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 water quality concerns, a number of studies and lake planning activities were considered prior to the preparation of the 2002 Report. Detailed overviews of each of these studies and activities were included in that report. A brief summary of each is provided below.

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 objective of the study 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.

The study found that sources of phosphorus came from both external sources (storm sewers, water pumped into the lake from Owen Park and precipitation) and internal loading sources including: nutrient release from the sediments, decomposition of aquatic plants and motorboat activity.

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.

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. The second was a similar survey, but taken during the winter of 2000. The final survey was a community-wide mail-out survey taken in the spring of 2000.

Review of City Efforts to Improve Water Quality. The Taskforce reviewed previous efforts of the City to stabilize the lake and improve water quality. 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.
- 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 in the early 1980s 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.

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- 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 water sub-basins 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. The study found that the overall aquatic plant community in Half Moon Lake is characterized by fair to poor diversity, except for within Braun's Bay where the index of the plant community was found to have very good diversity. 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. Proper harvesting *P. crispus* was found to help counteract the impacts and result in improved water clarity and improved diversity of the aquatic community.

Eurasian water milfoil (*Myriophyllum spicatum*) was found in the lake in 2007 and has quickly become one of the dominant plant species in the lake. The abundance of this exotic plant threatens the diversity of the native aquatic plant community by out competing native vegetation in a similar manner to curly leaf pond weed.

A large-scale control project began in 2008 to curb the excessive growth of curly leaf pond weed and Eurasian water milfoil. This multi-agency and citizen controlled project is slated to extend over the next three years.

Results will be used to assist in the design of property management decisions.

Half Moon Lake Fisheries Survey. The DNR completed a fisheries survey of Half Moon Lake in the fall of 1999 and spring of 2000. Results from this survey indicated that the major fish species in the lake are large mouth bass, walleye, crappie, yellow perch, and bluegill.

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.

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 also 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 providing enhanced infiltration.

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- Construction of Luther Hospital parking ramp to remove parking lot paved surfaces from exposure to rainfall.
 - Construction of grassy areas at the edge and central islands of parking lots at Luther Hospital to filter and infiltrate run-off.
 - Placement of a drainage swale and filter berm to the south of the former site of the Luther Hospital helicopter facility to the west of Whipple Street.
 - Street sweeping to remove pollutants before they enter the storm sewers.

Total Maximum Daily Load Program. Half Moon Lake was included on the State and U.S. EPA “impaired waters” list back in 2002. This list includes waters that are not meeting state water quality standards or designated uses. In response to this listing, the Wisconsin DNR was 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 in order to remove such lakes from the list. High levels of nutrients and algae are key factors that placed Half Moon Lake on the impaired waters list.

Ski Sprites Organization and Use of Half Moon Lake. The Taskforce reviewed the Ski Sprites Water Ski Organization use of the lake. The organization was founded in 1960 and had over 100 members, including skiers and adult volunteers. The Ski Sprites 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 last site at Half Moon Beach.

At the time of the 2002 Report, the Ski Sprites were looking at the feasibility of relocating to a different lake. Once the report was adopted the organization began an intensified search of a new location, with the assistance of the Half Moon Lake Implementation Task Force. Several sites were considered such with Dells Pond in the vicinity of Mount Simon Park receiving the most serious consideration. Consideration of that site was abandoned in 2006 and Lake Altoona was then given consideration.

The Eau Claire County Board gave the Ski Sprites approval to move their operation to Lake Altoona Beach and their first season on the lake was in 2007. The County Board has subsequently approved a three-year agreement with the Ski Sprites for use of the lake through 2011.

Student Environmental Education. Half Moon Lake has been used by the Eau Claire School District for environmental education. In 2002, Memorial High School and Delong Middle School offered courses or programs related to environmental education that focus on the Half Moon

Lake ecology. The Memorial High School program was an integrated Language Arts and Biology class that was initiated as a cooperative effort between the Biology and English departments at Memorial. The program is no longer offered.

The objective of the program 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 of small biological organisms, water temperature measurements, canoeing and journaling. The program was initiated in 1998.

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 have assisted in taking water temperature samples for Delong.

HALF MOON LAKE LONG-TERM GOALS

The 2002 Report emphasized the importance of the lake within the community. It was noted that not only those who visit the lake on a regular basis value the lake as natural and scenic resource, but also that those who 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 its environs for this and future generations."

In light of the community's strong support for improving and maintaining Half Moon Lake, 2002 Report on Half Moon Lake Water Quality Improvements includes a series of broad goal statements that address various aspects in establishing and implementing a plan to improve water quality at Half Moon Lake. These goal statements were formulated based on a vision of how the community would like to see the lake in the future. The Half Moon Lake Implementation Taskforce reviewed these goals statements at their May, 2009 meeting and updated them based on an analysis of efforts made to improve the lake since 2002.

The updated goals for the future improvement of the lake include:

A. *Improved Water Quality.*

Half Moon Lake's water quality will be significantly improved as a result of the reduction of phosphorus, chlorophyll (algae) levels and in the reduction of the severity and number of algae blooms that occur during the summer.

B. *Diverse Plant Community.*

Half Moon Lake will have a diverse aquatic plant community where invasive species including *P. crispus* (curly leaf pondweed) and Eurasian water milfoil are controlled to non-nuisance levels. With the reduction of curly leaf pondweed and managing the introduction of milfoil to the lake, the lake will have the opportunity to achieve improved aquatic life habitat and water quality attainable through an improved indigenous aquatic plant community.

C. *Self-sustaining Fishery.*

The Half Moon Lake fishery will be enhanced to protect and to improve, as necessary, the quantity and quality of sport fish, for anglers to enjoy.

D. *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 such as planting native plant species in order to eliminate erosion caused by run-off and wave action.

E. *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.

F. *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) that decrease phosphorus inputs.

G. *Multi-Faceted Recreational Opportunities.*

Opportunities for a variety of recreational activities will be created and encouraged within and around Half Moon Lake as the lake improves and is capable of sustaining such activities.

H. *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

The recommendations outlined below have been updated based on a review of the recommendations contained in the 2002 Report on Half Moon Lake Water Quality Improvements. These updated recommendations will provide direction for the City as to how the water quality of Half Moon Lake can continue to improve and enable the lake to be enjoyed for generations to come.

The objective of many of these recommendations is to reduce phosphorous levels within the lake to approximately 50 percent of dating back to the 1999 baseline. This in turn will reduce chlorophyll levels by about 60 percent (Figure 1). The phosphorus goal is a summer mean value of 52 ug/l which will result in a summer mean chlorophyll level of the 30 ug/l compared to the baseline level of 82 $\mu\text{g/l}$ (WDNR TMDL 2004 Report.)

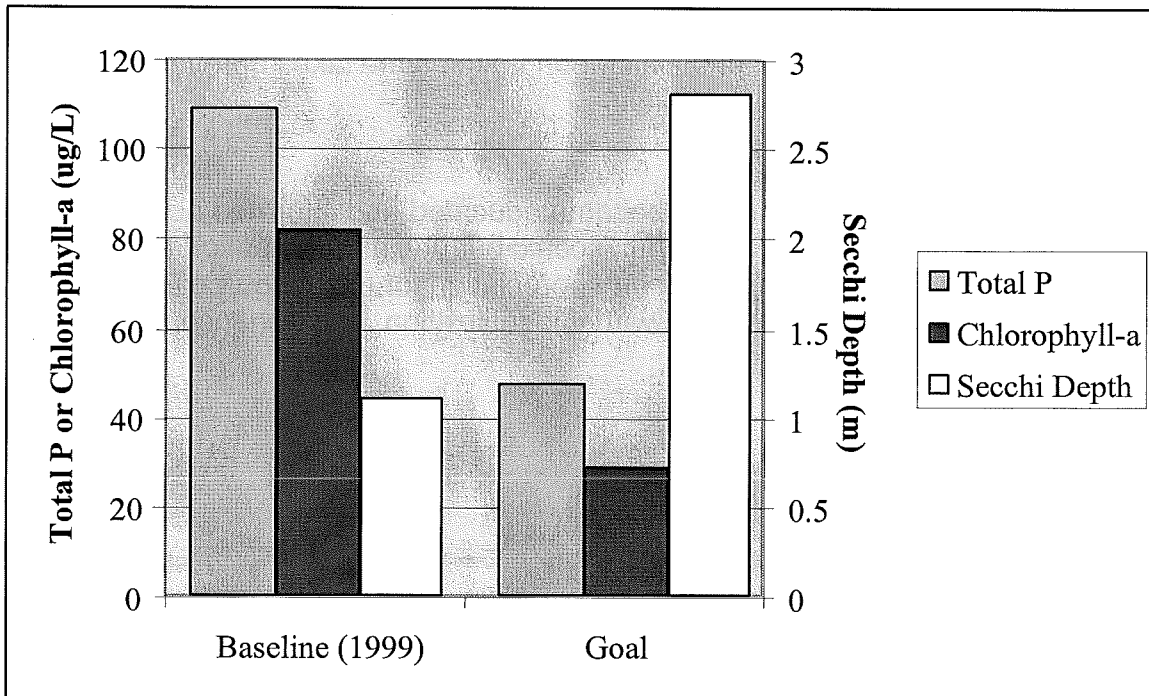


Figure 1. A Comparison of 1999 and Predicted Average Summer Limnological Parameters for Half Moon Lake.

A. Improved Water Quality. The water quality goal established in 2002 for Half Moon Lake was 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 could 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 2002 Report recommended that the City initiate a program to target the reduction of three internal sources of phosphorus into the lake, plus the primary external source. These include:

- Phosphorus from the lake bottom sediments.
- Phosphorus from plant decomposition.
- Phosphorus generated from suspension in the water from motor boats.
- Phosphorus from storm sewer runoff.

Upon review of the results of the implementation of the recommendations contained in the 2002 Report, the Half Moon Lake Implementation Task Force recommends the following regarding these four phosphorus sources:

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, the City should continue to work towards the application of an alum (aluminum sulfate) treatment for the lake as outlined in the 2002 Report. 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 undertaken by the Army Corps of Engineers of Half Moon Lake sediments was initiated in 2002 and is currently in the final phases of analysis to determine the proper dosage level. 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 study being completed by the Army Corps will also assist in determining the cost of the alum treatment. This treatment is dependent upon the

amount of phosphorus available for release from the bottom sediments. It is anticipated that the cost of the alum treatment will be offset by grants from the WDNR. The City of Eau Claire should plan on conducting the alum treatment in the spring of 2011 or 2012. Grant applications to conduct the alum treatment will be made in March 2010.

2. Reduce the phosphorus load occurring from plant decomposition.

The second source of internal phosphorous loading relates to plant decomposition. The 2002 Report recommended increasing the weed harvesting operation in order to double the amount of weeds that were harvested. By reducing the curly leaf pond weed biomass, the amount of phosphorus being released after senescence (plant death) would decrease. Harvesting was designed to coincide with the growth cycle of the curly leaf pond weed. This would maximize efforts of reducing turion production to decrease this plant's ability to grow, thus reducing biomass.

The City harvested in this manner for four years, however, the results were not as successful as anticipated. The City was not able to harvest enough acres of the pond weed to make a significant impact and the weed harvester could not get into the shallow areas where high amounts of the curly leaf pondweed (CLP) grew.

An experimental application of lime was applied to CLP in test areas within the lake in 2007, but upon study, the Army Corps determined in a report released on October 31, 2008, that this approach was not a feasible management alternative for the control of CLP in Half Moon Lake.

As an alternative approach to control plant growth, the City received an aquatic invasive species grant to undertake a three-year program of herbicide treatments for the control of CLP and Eurasian water milfoil. The first treatment occurred on April 22, 2009 and additional treatments are planned for 2010 and 2011. The application included Herbicide 2,4-D for Eurasian Water Milfoil and Aquathol K for curly leaf pondweed. The use of these herbicides has been shown to control CLP and Eurasian water milfoil.

Initial results of the treatment have been positive. It is recommended that these treatments continue in 2010 and 2011 under the guidance of the Army Corps of Engineers and WDNR as they conduct a comprehensive ecological assessment of the herbicide treatments. This study will be conducted for several years to assess the use of herbicides for managing invasive species. This assessment includes annual aquatic plant studies, residual herbicide monitoring, and water quality monitoring. The results will be used as a basis for future treatments and will be shared with the public and broader audience of agencies involved with lake management to advance the knowledge of sound AIS management across the State.

In addition, it is also recommended that weed harvesting be conducted as directed by the Army Corps of Engineers and WDNR. It is likely that aquatic plant harvesting will need to be conducted in the future to provide recreational opportunities and enhance the aquatic plant habitat.

Finally, it is also recommended that for future treatments that signs used to inform people about the treatments be posted in more visible locations. They also should provide a more clear explanation of the treatment and its effects.

3. Relocation of the Ski Sprites. The 2002 Report recommended that the Ski Sprites be relocated to another lake in order to eliminate the suspension of phosphorus in the water column caused by their motorboats. The 2002 Report noted that approximately 17% of the overall P load to the lake would be eliminated through the cessation of this motorboat activity.

As noted in the background section of this report, the Ski Sprites were successful in relocating away from Half Moon Lake. The Eau Claire County Board gave the Ski Sprites approval to move to Lake Altoona Beach and their first season on the lake was in 2007. The County Board has subsequently approved a three-year agreement with the Ski Sprites for use of the Lake through 2011. No additional work needs to be completed pursuant to this recommendation.

4. Storm water management controls. The 2002 Report noted that although external loading of phosphorus represents a much smaller component of loading into the lake, that water entering the lake from storm sewers was significant and should also be addressed to help improve the water quality. The report recommended that street sweeping be increased within the Half Moon Lake Watershed.

It was noted that the increased street sweeping would result in an approximately 10 % reduction in P coming from the storm sewers. This would also insure that sediment and nutrient inputs into the lake from storm sewers are controlled, as this will extend the longevity of the alum treatment. The increased street sweeping was implemented in 2003 with the City's water utility funding the cost.

In addition, several Best Management Practices (BMP's) have been implemented within the watershed to further limit phosphorus and suspended solids from entering the lake. The most recent being the removal of the Robert's Farm Warehouse and Valley Builder's buildings on the north side of the lake and construction of a parking lot for Luther Hospital employees that incorporates BMP's.

It is recommended that this policy of street sweeping within the watershed be continued and that BMP's be required for all development and redevelopment

within the watershed. In addition, the City's MS4 storm water permit was updated as of the spring 2009. This permit does include modeling of the installed BMPs to determine load reduction into the lake, and this modeling will be done by 2013. The permit also includes an educational component to encourage residents and businesses within the watershed to implement BMP's within their property to reduce runoff and improve the quality of the water that does become runoff. Examples include: rain gardens, rain barrels, pet waste removal, educational seminars to better inform people, etc.

B. Plan Implementation Taskforce. The 2002 Report recommended that a committee or taskforce should be appointed to work with the Ski Sprites organization to assist them in their transition to another location. This taskforce called the Half Moon Lake Implementation Taskforce was created and assisted the Ski Sprites in relocating to Lake Altoona. This taskforce was comprised of people from the original Half Moon Lake Taskforce, plus other persons interested in Half Moon Lake.

It is recommended that this taskforce continue to oversee the implementation of this plan. This taskforce should have representation from abutting neighborhoods, Friends of Half Moon Lake, the Wisconsin DNR, City staff, interested community members and several persons representing educational interests within the community such as the University of Wisconsin Eau Claire, and Eau Claire School District.

C. City Leadership in Lake Related Issues. The 2002 Report recommended that a City staff position take a leadership role concerning issues pertaining to Half Moon Lake. This staff position was to serve as a "point person" regarding lake improvement projects outlined in this report and also oversee the regular management, maintenance and upkeep responsibilities of the lake. The Director of the Parks, Recreation, and Forestry Department or his/her designee was recommended as such person. Upon acceptance of the 2002 Report by the City Council, the Director of the Parks, Recreation, and Forestry Department decided to serve in this role. It is recommended that the Director continue to oversee the implementation of recommendations in this updated report and oversee the regular management of the lake.

D. Evaluate and Address Erosion Concerns. The 2002 Report recommended that the City and WDNR identify the erosion issues that may have been present around the lake and evaluate options to resolve these problems. This was accomplished by Trombly, Faulkner, and Dyer from the University of Wisconsin – Eau Claire upon receiving a Lake Planning Grant from the Wisconsin DNR. Between 2006-2009, they completed a sediment mapping study of the lake that included an analysis of shoreline erosion issues. The results concluded that most erosion concerns along the shoreline have been addressed over the years and no critical concerns currently exist. It is recommended that the City and

DNR continue an on-going review of the shoreline to mitigate any problems that could develop.

Work of Trombly, Faulkner, and Dwyer produced a bathymetric survey of the lake, analysis of existing thickness of the sediments using ground penetrating radar, and development of the lake depth and sediment map,

E. Shoreland and Lake Habitat Areas. It was recommended in 2002 that a study should be undertaken by the City and DNR that would identify the varying shoreland plant and wildlife habitats around the lake and then recommend management strategies for these areas. To date, this study has not been undertaken, but is included in the DNR workplan for 2010. It is anticipated that the UWEC Biology Department will work with the DNR in critical habitat assessments for this study. Dr. Joe Rohrer at UWEC is the contact person regarding this study.

The goal of this study is to 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 and identify unique or sensitive habitat areas for the lake's fishery and wildlife and develop management recommendations for these areas.

Invasive species are an issue that will demand continuous attention. Mapping of locations of invasive species would help define the extent to which they are a problem. Such mapping could be done by the City through grants from DNR.

Garlic mustard was identified as one invasive terrestrial plant. In addition, one potentially sensitive shoreline area that should be studied is between the boat launch and handicapped fishing pier.

Community members will be educated about aquatic invasive species, especially Eurasian watermilfoil and curly-leaf pondweed, through the Clean Boats, Clean Waters volunteer training workshops, offered by Beaver Creek Reserve. Volunteers from the community, as well as summer interns with Beaver Creek Reserve, will conduct watercraft inspections at Half-Moon Lake boat landings whenever possible.

Finally, it was noted that the installation of a gradual curbing instead of the standard curbing along Park Ridge Drive, may be beneficial to turtle motility. This is in the area to the southwest of the lake. Modifying this curbing should be considered when street and/or trail construction takes place.

F. Motor Prohibitions. The City ordinance adopted in 1973 prohibiting all internal combustion engines with the exception of the Ski Sprites should be continued. With the relocation of the Ski Sprites find to Lake Altoona, this ordinance should now apply to all boats using the lake with the exception of the weed harvester or other users related to the management of the lake.

G. Braun's Bay. The City adopted an ordinance in 2004 to prohibit electric trolling motors within Braun's Bay in order to protect this unique aquatic environment. This area contains a number of aquatic plants unique to the lake, which can easily be disturbed by the trolling motors. Signs should be placed accordingly to inform boaters of this prohibition.

The City should also monitor the use of trolling motors within the remainder of the lake and evaluate any impacts on the lake.

H. Aquatic Plant Harvesting. Recommendations regarding the harvesting of aquatic plants have changed with the application of the herbicide treatment in the spring of 2009. As noted in Part A, results from the weed harvesting were not as successful as anticipated, therefore other options were undertaken, such as the herbicide treatment in order to address internal phosphorous loading related to plant decomposition. As noted in Part A, it is recommended that the herbicide treatments continue in 2010 and 2011 with an analysis of their effect on the lake used as a basis for future treatments. Weed harvesting will be suspended until further notice from the DNR and as directed by the Army Corps of Engineers to determine benchmarks for the effectiveness of the herbicide treatments. Harvesting may be initiated at a later date to keep boating lanes and fishing areas somewhat free of aquatic plants.

I. Prepare Storm Water Management Plan. In 2002, it was recommended that the City develop a storm water management plan for the Half Moon Lake Watershed in order to address the number of issues. The following is a listing and update of each:

1. Grading and erosion control ordinance. Development of a grading and erosion control ordinance is part of the City's MS4 storm water permit. A draft ordinance is being prepared for review.

2. Runoff and erosion concerns at north end of lake. The 2002 Report noted runoff and erosion concerns at the north end of the lake behind the Robert's Farm Warehouse and Valley Builder's buildings. These properties were acquired by Luther Hospital, the buildings demolished, and storm water management BMP's implemented. No further action is required with the exception that a large storm water culvert at the north end of the lake is transporting trash into the lake and efforts need to be made to stop this trash from entering this culvert.

3. Half Moon Beach parking lot. The 2002 Report recommended improvements to the Half Moon Beach Parking lot. Since that time, no significant improvements have occurred. Work needed includes paving, better organization of park spaces, and installation of stormwater BMP's. This project is included in the City's Capital Improvement Plan.

Vegetative planting along the slope extending down to the water's edge was also recommended in the 2002 report. This was completed in 2009 with the planting of 400 native plants as a cooperative effort between the City and Friends of Half Moon Lake.

4. Development of rain gardens. The City has included the installation of rain gardens and other practices to increase infiltration within the watershed as part of site plan approvals for development and redevelopment. This is an ongoing effort by the City.

5. Encouragement of BMP's. The City encourages 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. A demonstration rain garden was installed at the Lakeshore Playground. This is an ongoing effort by the City.

6. Study of the BMP's utilized for storm runoff from the Carson Park parking lots. This study was completed by the City with results indicating that sediment runoff into the lake is being addressed by the BMP's that have been installed. The City should periodically monitor the condition of these BMP's to ensure that they are operating properly.

7. Storm sewer stenciling. Stenciling of storm sewer inlets is recommended within the watershed as an educational tool to encourage property owners to be more cognizant of water runoff into the lake. The Ski Sprites have applied stencils to some of the storm sewer grates within the watershed, but the City needs to encourage other volunteer or civic groups to continue this effort. Note, that storm sewer grates are available with stenciling embedded in the grate. The City of Eau Claire construction specifications have been revised to require grates with the stencil embedded for standard curb inlets.

8. Increased street sweeping. The 2002 Report recommended additional street sweeping within the Half Moon Lake watershed. This increased street sweeping was implemented in 2003 with the City's water utility funding the cost. This will continue to be an ongoing effort by the City.

9. Distribution of informational materials. The 2002 Report emphasized the need to distribute informational materials to property owners within the watershed regarding such items as: use of rain barrels, rain gardens, lawn fertilizing, pet waste, etc. This needs to be an ongoing educational effort and

should focus on residents and properties within the watershed. Note that a State law goes into effect in 2010 to restrict the sale of fertilizers containing phosphorus. The City should also undertake regular training of City park employees to educate them regarding proper turf care within the parks. The City of Eau Claire has prepared a turf management plan that includes Carson Park and Lakeview Cemetery. City parks and recreation staff have been trained in implementing this plan throughout the City.

J. Shoreline Cleanup. Concerns related to the general appearance of the shoreline due to the accumulation of litter, garbage and miscellaneous debris was identified in original plan. This is an ongoing effort to address this issue by encouraging people to remove their garbage and also encourage volunteer groups to sponsor cleanups to address problem areas. The City has undertaken cleanups as part of Earth Day and the Amazing Eau Claire Cleanup. The City should continue to sponsor and promote cleanups and invite various civic groups and organizations representing youth, schools, neighborhoods, businesses, etc. to participate. Possible grant assistance for such events should be pursued.

In addition, the City should encourage groups or organizations to participate in a "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.

Finally, 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. Recommendations regarding such education are discussed below.

K. Education and Involved Citizens. The 2002 Report placed 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. These updated recommendations provide an ongoing effort to strive for this goal.

1. Annual Report. Continue to prepare an annual "State of the Lake" report presented to the Waterway and Parks Commission and City Council. Post this report on the City's website.

2. Ecology Programs. Expand the current lake ecology programs sponsored by the School District. The City and DNR should continue to be partners with

the School District with these programs and determine if the UWEC Geology, Geography, and Biology Departments could participate in these efforts.

3. Local Media. The City should work in partnership with the local media (newspaper, television, Community Television, 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. Contact the UWEC Journalism Department to determine whether cooperative projects are feasible.

4. Earth Day. 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. Use this opportunity to educate people about infiltration and runoff, and how it's more beneficial for water to soak into the ground versus running off streets and sidewalks.

5. Grant Funding. Continue to seek grant funding from the DNR and other sources that could be made available to civic organizations to develop educational activities or programs related to the lake.

6. Poster Contest. Contact schools to determine possible interest in sponsoring a poster contest for elementary students having a theme pertaining to "helping the lake".

7. Displays and Presentations. The "Friends" group has developed a "traveling" display about the lake, its ecology and recreational uses. This display should be shown at community events such as Earth Day and periodically placed on exhibit at such locations as the library, airport, mall and Convention Tourism Bureau. Development of a PowerPoint presentation about the lake should also be prepared for presentation to civic groups.

8. Informational and Directional Signage. Develop an informational and directional signage system within Carson Park and around Half Moon Lake. This has not been accomplished since 2002, but funding is included in the City's Capital Improvement Plan. A component of this signage system should focus on ecology and environmental aspects of the lake. A brochure should be prepared in conjunction with this interpretive signing illustrating the location of the signs. This brochure should be disseminated at locations such as the Convention Tourism Bureau.

Historical markers were placed in Carson Park in 2007 and sponsored by the Kiwanis Club. These markers discuss the history of Carson Park and Half Moon Lake.

9. Interpretive Facility. 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.

10. Historic and Archaeological Resources. Protect historic and archeological resources identified in the vicinity of the lake. Documented sites identified by the Wisconsin State Archeologist in the vicinity of Half Moon Lake include: Half Moon Beach Cave (47-EC-123), Consumer's Services ice harvesting site (47-EC-124), and Sherman Mill site, (47-EC-125).

L. Half Moon Lake Fishery. The 2002 Report contained several recommendations focusing on the fishery of the lake, these include:

1. Fishing Regulations. The 1999/2000 fisheries survey report recommended changes in the current fishing regulations for the lake to promote improved quality and size structure of bass and bluegill. Nothing has been done with this issue since the survey was completed. A fisheries survey of the lake is planned by the DNR in 2011. Existing fishing regulations administered by the Wisconsin DNR will be evaluated based on the fisheries population data gathered during this survey.

2. Educational Fishing Program. No work has been undertaken to develop an educational fishing program for the lake. The focus of such a program should be to teach interested individuals, especially youth, the art and enjoyment of angling.

3. Walleye Habitat. The 2002 Report recommended that the DNR study the feasibility of increasing walleye habitat in the lake to enable the walleye population to reproduce on a self-sustaining basis. Since that time, the DNR fisheries biologist has concluded that the lake cannot support a self-sustaining walleye population and therefore, efforts to pursue increasing the walleye habitat in the lake should not be undertaken. The lake will continue to be stocked with walleye on a biennial basis.

M. Recreational Opportunities. Half Moon Lake provides many recreational opportunities for both residents of the community and region (Refer to the City's 5-Year Parks and Open Space Plan for more detail.) One of the goal 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. To achieve this goal, it is recommended that the following recommendations be implemented 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.

1. Boat Landing. Develop an improved boat landing for the southeast portion of the lake located south of Lakeshore Elementary School.

2. Handicapped Fishing Pier. Develop a handicapped fishing pier in the southeast portion of the lake. This fishing pier could be developed in conjunction with the boat landing listed above.

3. Half Moon Lake Beach. As water quality improves within the lake, the City should re-open and maintain the beach and encourage people to use the beach by promoting the improvements in water quality.

4. Recreational Trail. Complete the construction of the recreational trail with overlooks around the lake to connect with the existing recreational trail on the east and south sides of the lake. The City should continue to acquire lakefront properties when they become available.

5. Menomonie Street Entrance to Park. The City sold land south of Half Moon Lake and west of Carson Park Drive to the YMCA in 2008. The City retained land along the lakefront for public use and the extension of the recreational trail. The City should work with the YMCA in the development of the site plan for their facility and develop a plan for the lakefront in this area.

6. Southwest Shoreline Area. Develop a plan for park improvements to the City's parkland extending south of Rod and Gun Park along the southwest corner of the lake. This land is currently zoned R-1 and a process has been started by the Task Force to rezone this area to protect it as public land.

7. Community Events. Encourage the opportunity for organizations to sponsor and organize instructional activities, events and competitions on Half Moon Lake for: canoeing, kayaking, sailing, and other similar activities. The City's Recreation Division currently sponsors sailing lessons each summer at Half Moon Lake.

8. Informational Brochure. Prepare an informational brochure/map that identifies recreational sites, interpretive signage and trails around the lake. A bathometric map was prepared by UWEC in 2007 and should be posted on the City's website.

9. Canoe/Boat Rental. Encourage the development of a canoe or boat rental operation on the lake that is operated privately or by a non-profit organization.

