Update of the Half Moon Lake Water Quality Management Plan

CITY OF EAU CLAIRE

City of Eau Claire, WI
January 28, 2020

No. 2020-46

RESOLUTION

RESOLUTION APPROVING THE UPDATE OF THE HALF MOON LAKE WATER QUALITY MANAGEMENT PLAN.

WHEREAS, Half Moon Lake, with its scenic beauty and natural environment, contributes to the overall image and form of the City of Eau Claire and provides an invaluable resource for the community to relax and enjoy; and

WHEREAS, the City of Eau Claire has successfully undertaken a number of projects over the years to improve the aquatic environment and water quality of Half Moon Lake, and great improvements in water quality and clarity have been achieved; and

WHEREAS, the Half Moon Lake Community Partnership Team comprised of representatives from the Wisconsin Department of Natural Resources, City of Eau Claire Community Services Department, Community Development Department, City/County Health Department, Eau Claire Area School District, Friends of Half Moon Lake, Historic Randall Park Neighborhood Association, Mayo Hospital and UW - Eau Claire have updated the progress, goals and recommendations from the 2010 report; and

WHEREAS, the Waterways and Parks Commission has reviewed the report and recommended its approval.

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Eau Claire that the City Council does hereby adopt the update of the Half Moon Lake Water Quality Management Plan as a guide for future water quality improvements for Half Moon Lake, and that the plan recommendations will be given consideration by the City Council in determining project priorities as part of the preparation of the City of Eau Claire annual program of services and capital improvement program.

BE IT FURTHER RESOLVED that copies of the plan shall be made available for inspection at the Community Services Department, Community Development Department and L.E. Phillips Memorial Public Library.

Adopted,
January 28, 2020

(SEAL) _____
President Terry L Weld

(SEAL) _____
City Manager Dale Peters

(SEAL) _____
City Clerk Carrie L. Riepl

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INTRODUCTION

This document is an update of the 2010 report prepared by the City of Eau Claire which is used by the City and community as a plan for the implementation of recommendations aimed at improving the water quality of Half Moon Lake. This document, similar to the previous update, provides direction for lake management activities for the upcoming years which help sustain and continue to improve water quality, aquatic habitats and recreational opportunities for Half Moon Lake, and the Eau Claire community. This plan update was prepared by the City of Eau Claire with guidance and oversight from the Half Moon Lake Community Partnership Team (see Appendix A). This update builds upon the lake management recommendations set forth in the initial 2002 Water Quality Plan and the update that was completed in 2010. A historical overview of improvements to the lake is provided in Appendix B.

The original plan and update set forth a series of recommendations to improve water quality and encourage increased utilization and appreciation of this important resource within the City. A citizen's taskforce was appointed by the Eau Claire City Council at the direction of the Eau Claire Waterways and Parks Commission to assist in the preparation of the plan and provide input on the update. The goal of the plan was to ***"establish water quality goals for Half Moon Lake and recommending specific actions needed to reach these goals".***

The 2010 plan contained updated water quality goals for Half Moon Lake that the City and community have been working 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 community asset for future generations.

This document reviews the 2010 plan and actions taken since that time to determine the progress made in implementing the recommendations and then sets forth new or updated recommendations to continue the progress in improving the water quality of the lake. Examples of some of the major accomplishments that occurred upon completion of the initial plan in 2002 include:

- Creation of the Friends of Half Moon Lake in 2003
- Increased street sweeping within the watershed initiated in 2003
- 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 Mayo 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


HALF MOON BEACH
BOAT LANDING
MAYO CAMPUS
CARSON PARK
LAKEVIEW CEMETERY
ROD & GUN PARK
LAKESHORE SCHOOL
FISHING PIER & BOAT LAUNCH
BRAUN'S BAY
LAKESHORE PARK
FISHING PIER
BOAT LANDING
BECCA CREEK AREA
LAKE OUTFALL
RECREATIONAL TRAIL
CHIPPEWA RIVER
N
HALF MOON LAKE
Map 1
City of Eau Claire

- Application of Herbicides 2,4-D for Eurasian Water Milfoil (only in 2009), and Aquathol K for Curly Leaf Pond beginning in the spring of 2009 and continuing through present annually each spring
- 2009 addition of various plants by the Friends of Half Moon Lake to the east of the beach and vicinity of Bayview Park.

With the update of the plan in 2010, the City continued efforts to improve the water quality of the lake, and promote the benefits of this resource within the community. Examples of improvements and activities since 2010 include:

- Whole lake alum treatment of lake sediment to control phosphorus release to lake conducted in 2011.
- Low dose alum treatment of the west arm of the lake which was conducted in 2017 to control sediment phosphorus release.
- Another low dose alum treatment of the west arm of the lake in 2019.
- Annual lake monitoring of water chemistry, lake sediments and aquatic plants evaluating the lake ecosystem improvements and status. Fisheries assessments were completed in 2011 and 2019.
- Fishing regulations were updated in 2014 to control the over population of largemouth bass within the lake and provide trophy fishery for largemouth bass.
- Fishery habitat improvements were undertaken by completing over 50 tree drops into lake which provide a significant increase in submerged woody habitat for the fishery and aquatic life.
- Adoption of an updated City Waterways Plan in 2012 that includes multiple policy statements regarding the importance of Half Moon Lake and the continued efforts to improve the lake.
- Reconstruction of the causeway in 2017 which resulted in improved fishing access and habitat, a safer space for pedestrians and bicyclists, and a much more pleasant park and open space along the lake for people to enjoy the magnificent views of the lake and shoreline.
- Conducted annual site specific aquatic plant harvesting using the City's weed harvester to improve native aquatic plant populations in the lake.
- Installed an additional fishing pier (second on the lake) south of Lakeshore School which provides improved public fishing access.
- The Eau Claire County Health Department has undertaken the regular monitoring of E. coli at Half Moon Beach.
- The City completed extensive renovations of Rod and Gun Park in 2015 that provided improved access of the public to the lower levels of the park and the lakefront.

- The City continued to acquire private properties abutting the shoreline. With recent acquisitions, there are now only two privately owned properties on the lake. Of the 5.3 miles of shoreline, 95.2% is now owned by the City.
- The City made upgrades to the Half Moon Lake beach house in 2016.
- The City continued to work with volunteer groups to remove invasive plants such as buckthorn and black locust along the shoreline.
- The identification of water loss occurring at the southeast corner of the lake. The outflow has been called Becca's Brook.

Half Moon Lake has experienced a growth in popularity as its water quality continues to improve. Numerous groups and organizations sponsor events at or on the lake. Examples include:

- Mayo Hospital's Dragon Boat Race
- Sailboat sailing lessons
- Triathlons that utilize Half Moon Lake for the swimming portion of their event.

- Paddle board yoga lessons held on the lake.
- Half Moon Beach has experienced increased numbers of swimmers
- Fishing Contests

In addition, community surveys regularly document the importance of Half Moon Lake for the entire community with City residents noting the value that the lake provides relating to its natural beauty, preservation of natural resources, quiet and serene environment, and recreational opportunities.

To continue to build upon past experiences and the progress made in implementing the previous recommendations, this document provides another update related to the lake and recommendations that the City should continue to implement and new strategies to consider. This review and update was undertaken by a multi-disciplined group called the Half Moon Lake Community Partnership Team that was asked to carry-on the charge of assisting in providing technical input into the implementation of the lake management strategies set forth within this plan. This technical committee met several

times in 2019 and included members from community organizations that routinely use the lake for community events, neighborhood groups, as well as representatives from the WI DNR, University of Wisconsin – Eau Claire, City/County Health Department and City Engineering, Community Development, and Community Services Departments.

BACKGROUND

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 groundwater, 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.

Map 2

The lake's watershed is approximately 577 acres in size and approximately 95% 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 two privately owned properties remain along the shoreline (see Map 2).

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 successful at managing specific aspects of water quality impairment in Half Moon Lake, summer algae blooms and nuisance aquatic plant growth used to be common on the lake.

In order to address these previous water quality concerns, a number of studies and lake planning activities were reviewed 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 to provide the reader with an appreciation of previous work completed to improve the lake. Continuation of several of these studies is also noted.

A. Limnological Assessment of Half Moon Lake Water Quality. 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 (currently UW Stout) 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 as well as existing water quality conditions.

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.

UW Stout (under contract with the City) has conducted ongoing annual water quality assessments evaluating water quality improvements associated with the relocation of the Ski Sprites, control of curly leaf pondweed, control of sediment phosphorus release, and watershed management activities. Water quality in Half Moon Lake has

dramatically improved as shown by the summer average phosphorus levels and decreased frequency and severity of summer algae blooms (see Figure 1).

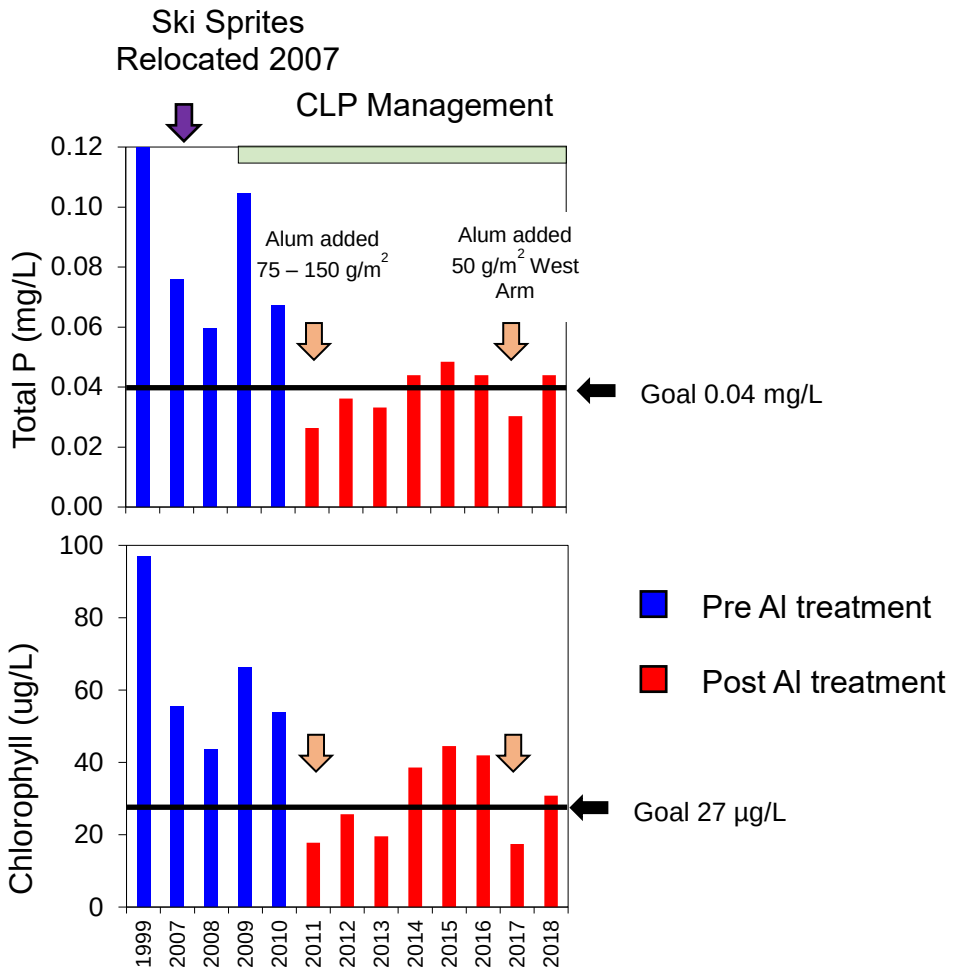


Figure 1. Summary of Water Quality Conditions: 1999 through 2018

The water quality conditions in Half Moon Lake have improved significantly since restricted motorboat activity, whole lake curly leaf pondweed treatments, and alum treatments have been conducted on Half Moon Lake. Total phosphorus levels within the lake are to be maintained near or at the water quality goal with ongoing low dose alum treatments. Algae levels as indicated by Chlorophyl levels have improved dramatically since 2011.

B. Community Use Surveys of the Lake. A report was prepared in 2000 that provided 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 provided 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. A copy of the report can be found on the City's website at:
https://www.eauclairewi.gov/home/showdocument?id=1142

The City conducted a community parks survey in 2016 and several questions were included relating to the community's perceptions of Half Moon Lake. Results demonstrate the importance of the lake to the residents and the need for continued commitment of the City to make additional improvements. The Figure 2 below is from the survey showing that Half Moon Lake is a priority in the community.

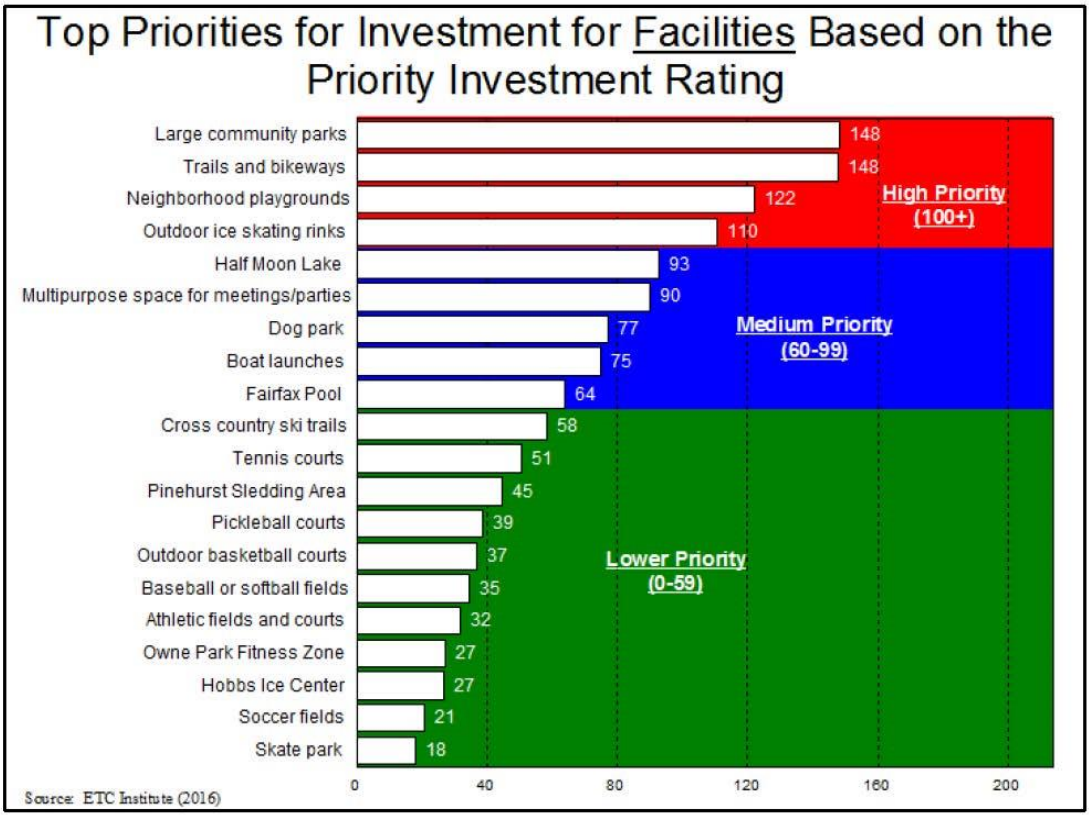


Figure 2

The 2016 Community Survey documented how well the various City parks and open space areas were meeting the current needs of the community. The table below shows that Half Moon Lake was rated very high with over 89% of the respondents noting that the lake met or most met their needs. See Figure 3 below.

The 2016 community survey had multiple questions that refer to the lake. A copy of the survey can be found at: https://www.eauclairewi.gov/home/showdocument?id=16224.

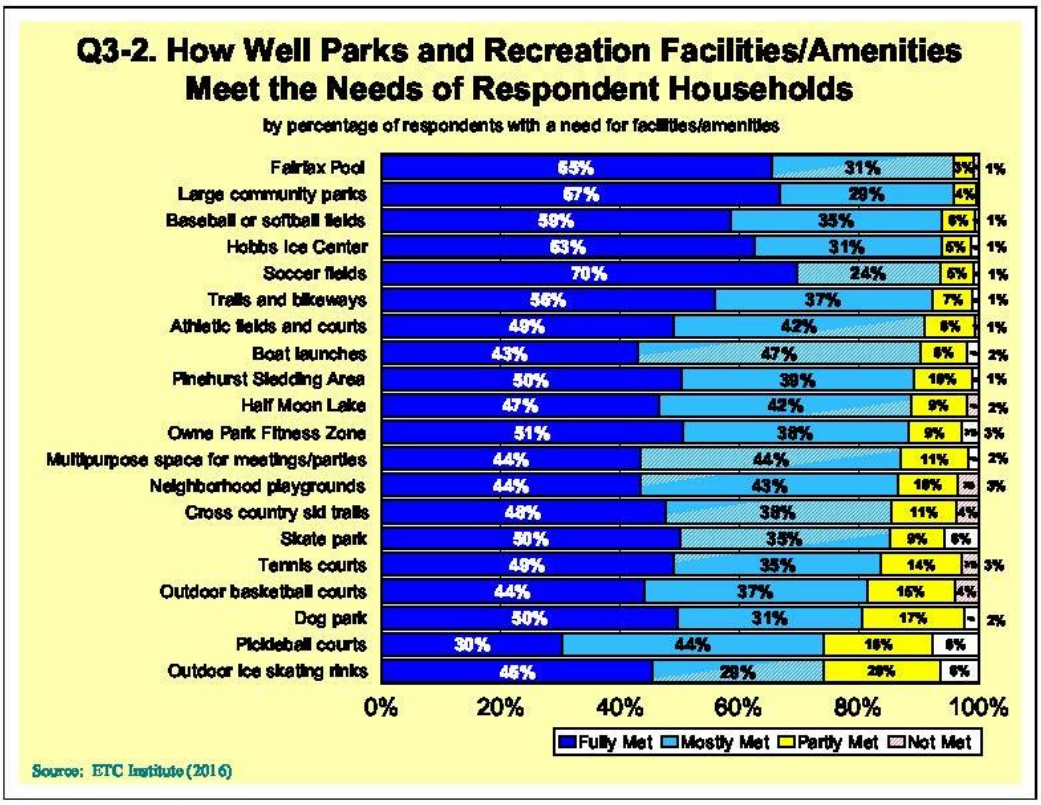


Figure 3

C. 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:

- Aquatic Plant chemical herbicide 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 in 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.
- 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.
- The City treated the lake with rotenone in 1978 to kill rough fish in the lake prior to restocking efforts.
- 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 and continues today. Approximately 1 million gallons of water are pumped into the lake daily.
- Aeration equipment was purchased to aerate three sites within the lake in circa. 1978. The current system was installed in 1992.

D. Aquatic Plant Community Study. The DNR completed a study concerning the aquatic plant community of Half Moon Lake between 1995 and 2000, and then annually in the spring and summer from 2008 to the present. The 1995 and 2000 studies found that the overall aquatic plant community in Half Moon Lake is characterized by fair to poor diversity, except within Braun's Bay where the index of the plant community was found to have very good diversity. It was found that the bulk of the lake was dominated by the invasive curly leaf pondweed (*P. crispus*), which was accidentally introduced into the lake in 1953.

P. crispus starts its growth during fall and continues over the winter 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* can 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 can fuel summer algae blooms.

Eurasian water milfoil (Myriophyllum spicatum) was found in the lake in 2007 and quickly became one of the dominant plant species in the lake. The abundance of this exotic plant can threaten the diversity of the native aquatic plant community by out competing native vegetation in a similar manner to curly leaf pondweed.

Whole lake aquatic herbicide treatments to control curly leaf pondweed and Eurasian water milfoil began in 2009. Eurasian water milfoil has not been found in Half Moon Lake since the 2009 treatment. The annual aquatic plant surveys conducted by WDNR have found that curly leaf pondweed is being controlled but not to the goal as stated in this plan. The whole lake herbicide treatment was not conducted in 2014 to see if curly leaf pondweed was under control. Analysis the following year found curly leaf pondweed increased significantly and produced an abundance of turions. Whole lake herbicide treatments were reinstated in 2015 and are recommended to continue until reduction goals for curly leaf pondweed are achieved.

E. Half Moon Lake Fisheries Survey. The DNR completes fisheries surveys for the lake every eight years, with previous surveys in the fall of 1999, and the spring of 2000, 2011, and 2019. Results from the most recent survey indicates that the major fish species in the lake are northern pike, largemouth bass, bowfin, black crappie, yellow perch, and bluegill. Surveys have indicated that the lake is not suited for walleyes, therefore walleye stocking stopped in 2009. Extended growth northern pike stocking started in 2012 and has continued on an annual basis at a rate of 10 fish per acre when the hatchery can meet the demand. Northern pike are active year-round and routinely feed during daylight hours making them a good fit for the user base of Half Moon Lake.

In 2014, the fishing regulations for size and limit requirements were changed for the lake. The fisheries survey conducted in 2011 indicated that there was a high-density largemouth bass population with poor size structure and slow growth. The bass regulations were then changed for the lake in 2014 to a three fish bag limit with a 14”-18” protected slot and only one fish over 18”. This regulation allows for harvest of bass smaller than 14”, which is intended to reduce density and improve size structure. In 2018, the bag limit was increased to five to allow for the additional harvest of small bass.

The fishing regulations for the rest of the species are the statewide regulations that can be found on the DNR website.
https://cida.usgs.gov/wdnr_regs/apex/f?p=wdnr_fishing_regulations:lake_regulations:0::NO:20:P20_WBIC:2125400#R770266518172521259

The City has undertaken several tree drops to improve the fisheries habitat of the lake. This includes one in the area along the east shoreline in the vicinity of Mayo Hospital in 2008 and a second tree drop in 2012 in the vicinity of the Chippewa Valley Museum. Several trees were also placed in the water in the vicinity of the causeway when it was reconstructed in 2017. During the upcoming winter of 2019-20, the City plans another tree drop in the vicinity of Lakeshore School.

New aeration equipment was installed in 1992 at three sites in the lake and is used in the winter to increase oxygen levels to protect the fishery. The lake's 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.

F. Storm Water Runoff Into the Lake.
Information was compiled 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.

Methods used to reduce the amount of storm water runoff into the lake and to remove some of the nutrients and impurities from the storm runoff before they reach the lake were also discussed. 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, etc. where the storm runoff is directed through these areas before it reaches a storm sewer inlet. The objective of these practices is to reduce runoff and have the water cleaner before it reaches the storm sewers.

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 Mayo Hospital parking lots. The islands trap some of the water's impurities as the water flows through the islands providing enhanced infiltration.
- Construction of Mayo 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 Mayo Hospital to filter and infiltrate run-off.
- Placement of a drainage swale and filter berm to the south of the former site of the Mayo Hospital helicopter facility to the west of Whipple Street.
- Street sweeping to remove pollutants before they enter the storm sewers.

G. Total Maximum Daily Load Program. Half Moon Lake was included on the State and U.S. EPA "impaired waters" list in 2002. This can be viewed at: https://dnr.wi.gov/topic/TMDLs/TMDLReports.html This list includes waters that are not meeting State water quality standards or designated uses. In response to this listing, the WDNR 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 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.

H. Ski Sprites Organization and Use of Half Moon Lake. The Taskforce reviewed the Ski Sprites Water Ski Organization use of the lake. The 2002 report found that nutrient resuspension associated with Ski Sprites usage of Half Moon Lake was a major source of nutrients contributing to the excessive algae growth in Half Moon. The Ski Sprites moved to Lake Altoona in 2007 and continue to use Lake Altoona with an agreement with Eau Claire County. Relocating the Ski Sprites resulted in reduced phosphorus inputs to Half Moon Lake by 17%, which was a very significant step towards achieving water goals.

I. Student Environmental Education. Half Moon Lake has been used by the Eau Claire School District for various environmental educational activities over the years.

One example is the program at Delong Middle School that provides programs for sixth and seventh grade students. 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 the 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 and 2010 lake management plans 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, the previous management plans have included a series of broad goal statements that address various aspects in establishing and implementing a plan to improve water quality of the lake. These goal statements were formulated based on a vision of how the community would like to see the lake in the future. These goals have now been updated in this plan based on the current and proposed management activities that are being implemented to improve and sustain water quality, fisheries, aquatic life habitats, and the diverse recreational opportunities.

The updated goals include:

A. Improved Water Quality.
Half Moon Lake's water quality will be protected and improved as a result of the reduction of in lake phosphorus concentrations. Chlorophyll (algae) levels will be maintained to provide excellent water clarity and summer algae blooms will be eliminated. Beach closures will be reduced to less than an average of 5 days per 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-detectable levels. With the reduction of curly leaf pondweed and having eliminated the re-introduction of milfoil to the lake, the lake will have the opportunity to achieve improved aquatic life habitat and water quality attainable through improving the native aquatic plant community.

C. Self-sustaining Fishery.
Half Moon Lake provides a self-sustaining fishery with excellent quality and size sport fish including: northern pike, bass, crappie, sunfish, and perch.

D. Natural, Clean, Healthy, Aesthetically Outstanding and Protected Shoreline.
Half Moon Lake's shoreline is aesthetically outstanding, dominated by natural and diverse plant communities, free of litter, debris and trash. It is the goal of the City to have the entire lake shoreline in public ownership.

E. Motor Boat Impacts.
No internal combustion motor boat activity will occur on the lake except for boats needed for management activities, research, monitoring, assessment of the aquatic ecological environment, and public safety. Boats utilizing electric trolling motors are restricted to no-wake operation.

F. Improved Watershed Management.
Storm water runoff into the lake from the lake's watershed is minimized and all other storm water that reaches the lake will be filtered with storm water best management practices (BMP's).

G. Multi-Faceted Recreational Opportunities.
Half Moon Lake enhances our quality of life for all in the community by providing a variety of recreational opportunities and activities within and around the lake.

H. Educated, Involved Citizenry Which is Engaged in assisting in the management of Half Moon Lake.
Residents of the community will be included, educated, and informed about the continued and ongoing management of Half Moon Lake, its natural environment, scenic beauty, and recreational opportunities in order to promote an appreciation for this resource. A community partnership will be maintained to encourage stewardship, sustained management, and improvement of the lake.

RECOMMENDATIONS

The updated recommendations outlined below are based on:

- evaluation of alum treatments conducted in 2011, 2017, and 2019
- aquatic plant management monitoring
- whole lake aquatic herbicide treatments
- bacterial monitoring at Half Moon Beach
- updated phosphorus loading assessment of storm sewers and Owen Park wells
- completion of the Half Moon Lake Watershed Plan 2018 and 9 Element Plan
- 2019 fisheries survey of the lake
- Previous hydrological water budget studies of the lake
- on-going lake water quality and bacteriological monitoring

These updated recommendations will provide direction for the Eau Claire community as to how the water quality, aquatic habitats, and recreational opportunities of Half Moon Lake can continue to improve and enable the lake to be enjoyed for current and future generations.

A. <u>Improved Water Quality</u>. The objective of this recommendation is to reduce phosphorous levels within the lake to approximately 50 percent of the level dating back to the 1999 baseline. This in turn will reduce chlorophyll levels by about 60 percent (Figure 4). The phosphorus goal is a summer mean value of 40 ug/l which will result in a summer mean chlorophyll level of the 27 ug/l compared to the baseline level of 82 μg/l as noted in the Wisconsin DNR TMDL 2004 Report.

The current water quality goals are to maintain clear water in Half Moon Lake, eliminate nuisance algae blooms, and reduce beach closures to an average of 5 days or less during the summer. Sustaining this water quality goal will insure that Half Moon Lake will provide high quality outdoor recreation experiences for all residents and lake users within the City of Eau Claire. Achieving and sustaining these water quality goals will require ongoing management of lake sediments, watershed management, assessment of the phosphorus in the water from the Owen Park wells, curly leaf pondweed, and ecoli bacteria sources. Sustaining these goals will be measured by not exceeding a July through September in lake mean phosphorus concentration of 40 ug/l, summer mean Chlorophyll concentration of 27 ug/l, and not exceeding E. coli bacteria water quality standards for more the 5 days during the summer.

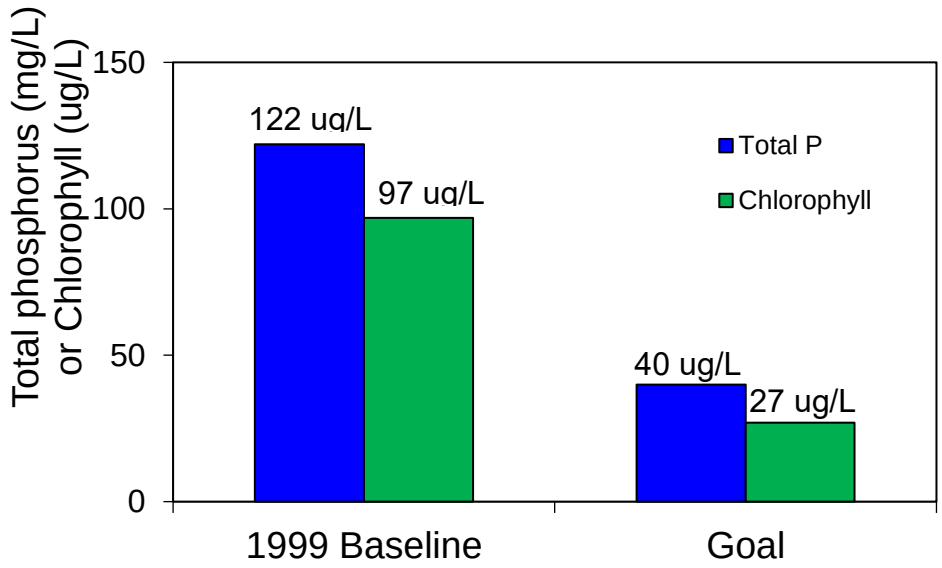


Figure 4. A comparison of 1999 and Predicted Average Summer Limnological Parameters for Half Moon Lake.

Specific strategies to reach this water quality goal include:

1. Continued alum treatment for lake bottom sediments. Sediments prior to 2011 released about 42 % of the phosphorus load into lake. Alum treatments in 2011 and 2017 have controlled phosphorus release from lake sediments in the East Arm of Half Moon Lake. Sediments in the west arm of Half Moon Lake will require alum treatments on 1-2 year intervals. The sediments in the west arm have extremely high levels of mobile phosphorus that continues to migrate upward and are sufficient to stimulate algae blooms. Continued alum treatments over the next several years will control this source of phosphorus. Current assessment of west arm lake sediments has shown that the amount of mobile sediment phosphorus has been significantly reduce by alum treatments in 2011, 2017, and 2019. The amount of alum applied to a lake is a factor of the available phosphorus in the sediments. The continued assessment of the lake's water quality and sediment phosphorus is critical to determine the success of the alum treatments. Funding water quality and sediment assessment will need to be conducted annually throughout the implementation of the plan. Biannual funding through WDNR lake protection grants and City of Eau Claire annual budgets will be necessary to implement this recommendation. It is currently estimated that $33,000 will be needed annually for assessment and implementation.

2. Reduction of the phosphorus load associated with the early summer decomposition of curly leaf pondweed. It is recommended that whole lake chemical herbicide treatments continue until the frequency of occurrence for

turions is non-detectable. Curly leaf pondweed was identified as the second major source of internal phosphorus input to Half Moon Lake. Curly leaf pondweed reaches maturity in early summer and then decomposes releasing phosphorus into the lake supplying phosphorus stimulating algae growth. Prior to 2009 curly leaf pondweed was the dominant aquatic plant in the lake. Whole lake chemical treatments to control curly leaf pondweed have been conducted annually since 2009 except for 2014. Figures 5 indicated that since whole lake chemical herbicide treatments began again in 2015 turion levels have been declining. Turions are the vegetative reproduction structure produced by the curly leaf pondweed plants. Dense growths of curly leaf pondweed have the ability to produce several thousand turions per square meter and turions can remain viable for several years.

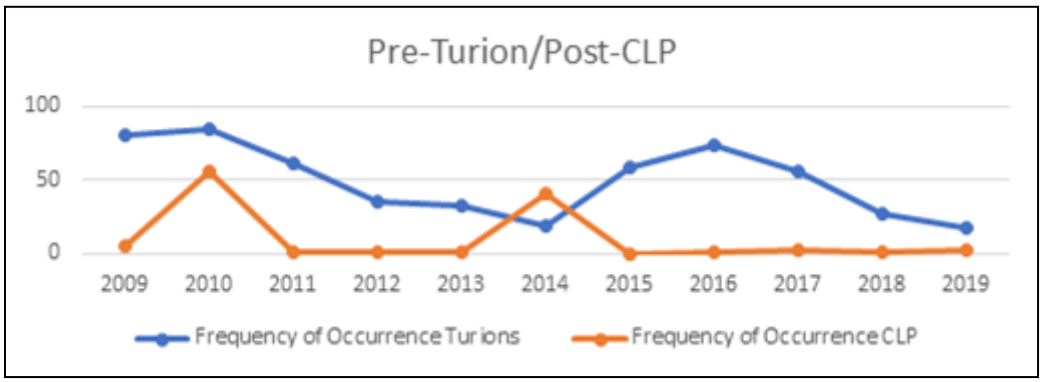


Figure 5. Comparison of the frequency of occrrence of *Potamogeton crispus* turions prior to the chemical treatment and *P. crispus* plants after the chemical treatment.

It is also recommended that aquatic plant harvesting of areas of dense growth of Elodea be initiated to promote the growth of a more diverse native aquatic plant community. This harvesting should occur weekly during May through June.

Finally, signs for the chemical herbicide treatments need to be displayed to inform people about the treatments. They should provide a clear explanation of the treatment and its effects.

It is estimated that approximately $60,000 will be needed annually to conduct whole lake aquatic herbicide treatments for the control of curly leaf pondweed. The City will work with WDNR to receive an Aquatic Invasive Species grant biannually until the aquatic plant management goal is achieved. The City will need to appropriate the matching funding to receive the WDNR grant and appropriate staff time to conduct aquatic plant harvesting.

The 2002 Report recommended increasing the aquatic plant harvesting operation in order to double the amount of material that was 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 pondweed. 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 pondweed to make a significant impact and the harvester could not get into the shallow areas where high amounts of the curly leaf pondweed grew.

An experimental application of lime was applied 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 curly leaf pondweed 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 pondweed and Eurasian water milfoil. The first treatment occurred on April 22, 2009 and annual treatments were conducted 2009 through 2013. Chemical treatment was not conducted in 2014 and pondweed plant and turion production increased significantly as shown in Figure 6. The 2009 application included Herbicide 2,4-D for Eurasian water milfoil and Aquathol K for pondweed. The use of these herbicides has been shown to control pondweed and Eurasian water milfoil. After the 2009 herbicide treatment, Eurasian water milfoil has not been found in Half Moon Lake.

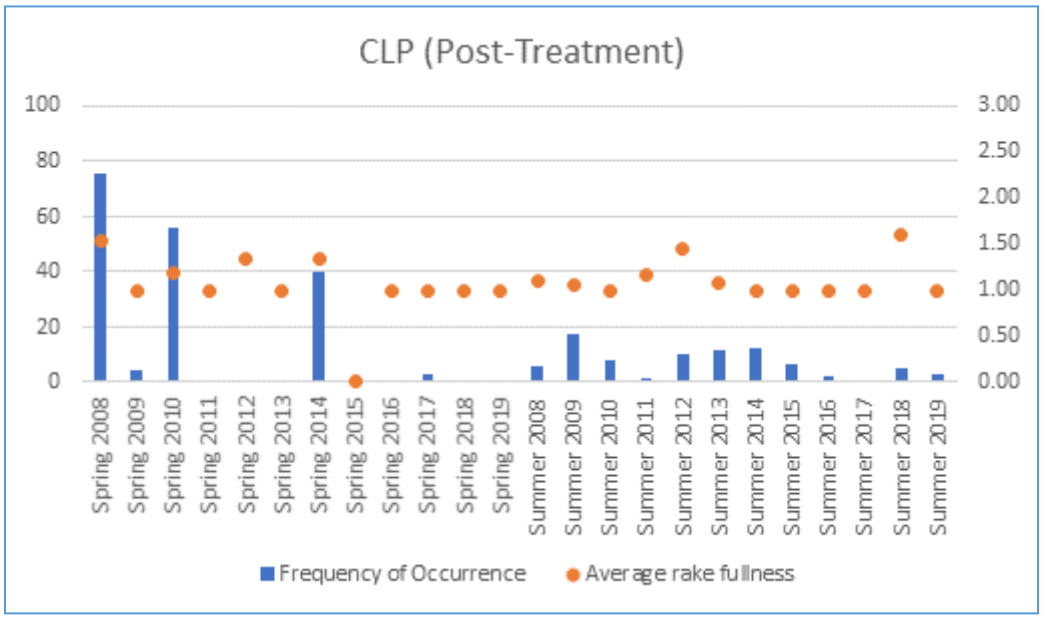


Figure 6. Frequency of occurrence and average rake fullness of *Potamogeton crispus* documented in aquatic plan surveys conducted twice annually from 2008 to 2018.

3. Motorboat prohibitions. The City should continue the prohibition of internal combustion engines on the lake, which dates back to the initial prohibition in

1973 and then the relocation of the Ski Sprites in 2007. Exceptions would be the use of the weed harvester, other management related users necessary for the lake, and public safety needs. This prohibition has aided in the reduction of the levels of phosphorus in the lake and is necessary to protect and stabilize the alum that has been added to the lake bed.

It should be noted, electric trolling motors have been permitted to be used on the lake with the exception of within Braun's Bay. Boats utilizing the electric trolling motors should be restricted to no-wake operation on the lake and their use should be monitored to evaluate any impacts.

4. Storm water management controls. The 2002 and 2010 Reports 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 is significant and should also be addressed to help improve the water quality. It was noted that the increased street sweeping results in an approximately 10 % reduction in P coming from the storm sewers. Because of this, it was recommended that the increased street sweeping within the Half Moon Lake Watershed implemented in 2003 be continued in 2010. This increased street sweeping is funded from the City's water utility. The street sweeping also insures 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, several Best Management Practices (BMP's) have been implemented within the watershed to further limit phosphorus and suspended solids from entering the lake. Examples of BMP's include: rain gardens, rain barrels, pet waste removal, educational seminars to better inform people, etc.

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

In addition, the City completed a comprehensive storm water management plan (SMP) in 2018. As part of the SMP, the City completed the Half Moon Lake Watershed Management Plan – Nine Element (319) Plan. The 9 Element Plan makes the following recommendations:

- Changes to BMP Design and Redevelopment Requirements
- Improve Water Quality of Owen Park Pumping
- Address Becca's Brook Short-Circuiting
- Goose Control / Address Beach Closings
- In-Lake Alum Treatment
- Lake Herbicide Treatment
- Improve Stormwater Treatment in SS1 Subwatershed
- Additional Community Engagement

A copy of the Half Moon Lake Watershed Management Plan – Nine Element (319) Plan can be viewed at: https://www.eauclairewi.gov/home/showdocument?id=28231.

5. Hydrogeological water budget for Half Moon Lake. Significant water loss from Half Moon is occurring out of the southeast end of Half Moon Lake via Becca Brook. A water budget, which identifies the amount of water that is currently being pumped into and entering the lake via groundwater and flowing out of the lake Becca Brook and groundwater should be conducted as soon as possible. This study should analyze water loss and suggest the most cost effective activities to maintain normal lake levels.

B. Public Ownership of the Shoreline. The City Waterways Plan recommends that the City continue to acquire land along the shoreline as it becomes available. If acquisition is not feasible, easements should be considered.

C. Community Partnership. It is recommended that a Half Moon Lake Community Partnership Team will advocate and promote in the implementation of the recommendations of this plan. The Half Moon Lake Community Partnership Team should have representation from abutting neighborhoods, Friends of Half Moon Lake, the Wisconsin D, City staff, community lake user groups leadership, and persons representing educational interests within the community such as the University of Wisconsin Eau Claire, and

Eau Claire School District. It will be important that the Half Moon Lake Community Partnership Team meet multiple times annually to review and assess lake management activities and goal accomplishments. The partnership team meeting will be organized and convened by the City of Eau Claire.

Successful implementation of the plan recommendations will require direction and advocacy by the Half Moon Lake Community Partnership Team to support the City of Eau Claire in continuing to include the management of Half Moon Lake as an annual priority for staffing and funding. This support will be important to continue to receive lake grants and annual City funding. The Half Moon Lake Community Partnership Team should meet at least six months prior to grant application deadlines, annual City of Eau Claire budget development, and be informed as to how City budgets are prioritized and approved.

D. <u>Continued Lake Assessment and Monitoring.</u> The City of Eau Claire and WDNR lake management grants staff will need to work in partnership to prepare grant applications as needed to sustain appropriate funding levels to continue alum treatments, to control curly leaf pondweed, Half Moon Lake water budget focusing on Becca Brook, and implementation of watershed management activities. Funding and staff time will also need to be appropriated annually to sustain water quality monitoring, monitoring tracking of sediment phosphorus dynamics, aquatic plant community assessment, E. coli bacterial monitoring, watershed assessment, fisheries community assessment, and fishery habitat improvements.

E. <u>City Leadership on Lake Related Issues</u>. This plan continues to recommend that a City staff position serve in a leadership role concerning issues pertaining to Half Moon Lake and oversee both lake improvement projects outlined in this report and the regular management, maintenance, and upkeep responsibilities of the lake. The Director of Community Services Department or his/her designee has served in this role in the past. 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. The City leadership team should meet a minimum of a quarterly basis to insure that funding and project management is being developed and conducted to insure that plan recommendations are being implemented.

F. <u>Evaluation of Erosion Concerns</u>. It is recommended that the City and WDNR continue an on-going review of the shoreline to mitigate any problems that could develop. In particular, issues with sand being deposited at the north end of the lake near and via the storm sewer at this end of the lake was noted as a problem. Sources of this sediment should be identified and eliminated. A storm water outlet in the vicinity of Lakeshore School should also be monitored.

G. <u>Shoreland and Lake Habitat Areas</u>. 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. 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 in the west side of the lake. In addition, community members need to be regularly educated about aquatic invasive species, especially Eurasian water milfoil 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, should conduct watercraft inspections at Half Moon Lake boat landings whenever possible. Grant opportunities should be considered for educational and research programs as well as activities to remove invasive species.

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.

H. 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 continue to be placed accordingly to inform boaters of this prohibition.

I. Half Moon Lake Fishery. The following recommendations aim to continue to improve the Half Moon Lake fishery and are based on the 2019 WDNR fisheries assessment of the lake.

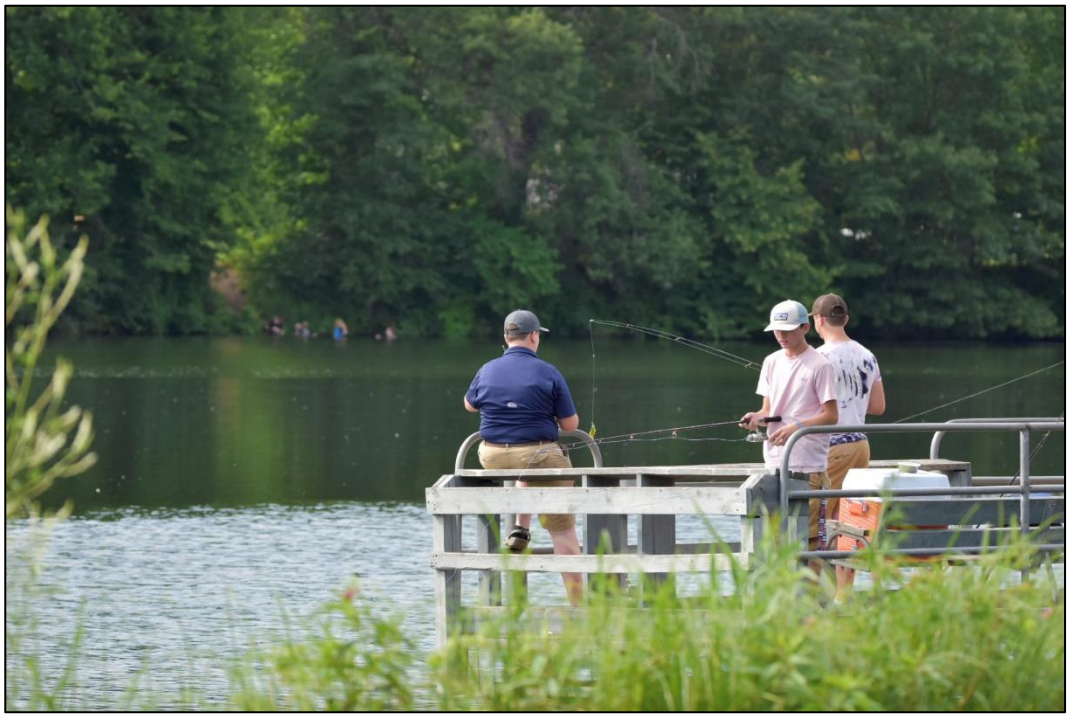
1. Fishing Regulations. Fishing regulations for largemouth bass were updated in 2014 and 2018 to promote the harvest of small large mouth with the goal of increasing growth rates and increasing the numbers of larger fish. Current fishing regulations for largemouth bass are a bag limit of 5, no minimum size, largemouth bass 14 to 18 inches may not be kept and 1 fish over 18 inches may be kept. Complete fishing regulations for Half Moon Lake may be found at: https://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2125400

2. Northern Pike. Natural reproduction of northern pike is low to nonexistent so stocking is necessary to maintain a fishable population. WDNR will continue to stock 8 to 10 inch extended growth fingerling northern pike annually in the fall at the rate of 10 fish per acre.

3. Fisheries Habitat. The recommended rate of course woody habitat in nearshore shallow water is 200+ per mile. Until this density is achieved tree drops should be conducted annually on a strategic and opportunistic basis in order to supplement the course woody habitat already in the lake. The City has placed over 50 trees nearshore for habitat. A tree drop project for the winter of 2019/20 is planned for the shoreline in the vicinity of Lakeshore School.

In addition, the opportunity to improve deep water habitat should be explored by determining the feasibility of installing traditional fish cribs in the deep water areas of Half Moon Lake. Deep water fish cribs at the appropriate density provide refuge from predation for juvenile game fish and forage fish especially

after the senescence of aquatic vegetation. It is recommended to place the fish cribs in clusters of at least five cribs to provide adequate cover for fish species.



4. Winter Aeration. It is absolutely critical that winter aeration be sustained annually in Half Moon Lake, therefore the City will continue to operate and maintain the aeration system in the lake. Aeration is needed to maintain winter dissolved oxygen levels needed to sustain the Half Moon Lake fishery. Half Moon Lake is a shallow lake ecosystem with a relatively low volume of water and highly organic lake sediments. Bacterial decomposition of lake sediments is ongoing continually in lake sediments consuming oxygen. The water column would soon be depleted of oxygen during ice and snow covered periods without aeration.

J. <u>Shoreline Cleanup</u>. The City has undertaken cleanups of the lake and shoreline since 2009 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. Grant assistance for such events has been established.

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. <u>Education and Involved Residents</u>. The 2010 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 Half Moon Lake Community Partnership, the Waterway and Parks Commission, and City Council. Post this report on the City's website. This report should summarize lake management activities and lake ecosystem health that has been completed and assessed in the previous year.

2. Ecology Programs. Expand the current lake ecology programs sponsored by the School District. The City and WDNR 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. Education and Marketing. The City should work in partnership with the local media and social media platforms to have articles, features, or posts produced about Half Moon Lake to promote its utilization and to better inform the public about the lake and its importance in the community. Work with 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 WDNR 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. Informational and Directional Signage. Develop interpretive signs focusing on management, 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 Visit Eau Claire.

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.

8. Interpretive Displays. Develop an environmental education or interpretive displays that could be used by students, organizations, businesses, and the City to provide an educational setting pertaining to lake, plant and wildlife ecology.

9. 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. <u>Recreational Opportunities</u>. Half Moon Lake provides many recreational opportunities for both residents of the community and region. One of the goals of this document is to encourage that recreational opportunities be provided within and around the lake and that people 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. 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. Examples include the City sponsorship of sailing lessons and Mayo's Dragon Boat races. Information about sponsoring a special event is available on the City's website. This information can be found at: https://www.eauclairewi.gov/recreation/special-events

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

3. ADA Accessible Fishing Pier. Since 2010, a second fishing pier was constructed along the shoreline. This pier was constructed along the eastern shoreline to the south of Lakeshore School. The City should work with local

organizations to fund and install a third fishing pier located at the south end of the west arm of the lake in the vicinity of the tennis center.

4. Half Moon Lake Beach. The City/County Health Department should continue to monitor beach bacteriological conditions to help insure that public health is protected. Recognizing that the water quality has improved substantially within the lake, the City should study the feasibility of developing programming at the beach.

5. Recreational Trail. Complete the construction of the recreational trail around the lake with overlooks 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.

6. 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.

7. 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.

APPENDIX A

Half Moon Lake Community Partnership Team

Penny Von Haden - Friends of Half Moon Lake/Buffington Neighborhood
Bob Von Haden – Friends of Half Moon Lake/Buffington Neighborhood
Susan Kaul – Friends of Half Moon Lake
Russ Kaul – Friends of Half Moon Lake
Diane Paulsrud – Friends of Half Moon Lake
Christine Schaaf – Friends of Half Moon Lake
Steve Duffenbach – Friends of Half Moon Lake
Lauren Lierman – Historic Randall Park Neighborhood
Andy Jepsen – UWEC
Lars Long – Eau Claire School District/Delong Middle School
Jason Craig – Mayo Hospital
Jodi Lepsch – Wisconsin DNR
Joseph Gerbyshak – Wisconsin DNR
Buzz Sorge – Wisconsin DNR (ret)
Bill James – UW-Stout
Matt Steinbach & Savannah Bergman - City/County Health Department
Jeff Pippenger – Community Services Department
Dave Solberg – Engineering Department
Steve Roscoe – Community Services Department
Todd Chwala – Community Services Department (ret)
Pat Ivory – Department of Community Development

APPENDIX B

HISTORICAL OVERVIEW OF CITY-RELATED ACTIVITIES FOR HALF MOON LAKE

Year		Event
1857	-	Constructed a canal from the Chippewa River to Half Moon Lake (Upper Race) for the purpose of using the lake for a log reservoir. A "Pocket Boom" was constructed along the north side of the River to divert the logs from the river channel. Logs were floated into the lake during high water.
1878	-	Constructed a Tunnel and Canal from the Dells Log Reservoir to Half Moon Lake. This was done in conjunction with the construction of the first Dells Dam.
1878-1926		Half Moon Lake used as a log reservoir to serve the sawmills.
1924	-	Flume to Half Moon Lake discontinued when the new Dells Dam was constructed.
1926	-	Some logs were still brought in to Half Moon Lake, by rail, until the Kaiser Mill burned down, in this year.
1926	-	New Dam constructed on the Second Race near the plant of Libbey, McNeill & Libbey. (see engineer report of 1926, following). The dam on the Daniel Shaw Company MillPond went out shortly before, draining the lake down about 4 feet.
1958	-	Well constructed on 10th Avenue to provide additional water to lake in anticipation that Sherman Creek would be diverted from the lake.
1959	-	Sherman Creek diverted from Lake through intervention by City – County Health Department who believed this was the source of high bacteria in lake. Swimming beach was traditionally closed part of each summer because of high bacteria levels.
1959	-	Placed well in operation – 2.5 mgd. capacity. Iron was over 15 mg./liter and thereby unacceptable for use in the lake.
1959	-	Set up pilot plant on well water under the supervision of Gruley & Hanson, Consultants. City took no action on their recommendations.
1962	-	Experimental Chlorination conducted at beach to reduce bacteria level.
June, 1963		Place chlorinator in operation at beach – has been continued to date. Beach has not been closed a single day because of high bacteria levels, since that time.
1969	-	Half Moon Beach Bathhouse reconstructed after a fire.
Sept. 8, 1971		City Manager appointed the Half Moon Lake Restoration Committee.

Oct. 5, 1971	Department of Natural Resources issued orders to remove all storm drainage from Half Moon Lake.
1972 -	Bayview Park established North of Beach.
Mar, 1973	Half Moon Lake Restoration Committee completed the report on their study of the lake and submitted copies to the City Council and to the DNR.
April, 1973	DNR rescinded the order to remove the storm sewers from the lake.
June, 1973	Installed circulation pump at beach to pump out polluted waters and discharge several hundred feet north thereof. Drastic reduction in both fecal and total coliform was experienced. (see chapter III)
Sept, 1973	Owen Ayres & Associates conducted a pilot plant study on the waters of well at 10th Avenue. Removal of iron from this well proved too costly.
Dec.1973	Purchased 3 rotary air compressors with ceramic diffusers from Clean Flo Laboratories, Hopkins, MN, and installed in area of lake south of causeway.
1973	City Council passes an ordinance banning internal combustion engines on the lake with the exception of the Ski Sprites.
May, 1974	U.S. Army Reserve Unit (397th) Engr. Combat Bn) installed Nature Trails in Wetland area south of the lake.
June, 1974	Owen Ayres & Associates completed design and report on the new overflow structure on S.W. part of lake, plus the proposed dredging project. Single bid received on dredging was rejected by the City and the overflow structure project was delayed, as it should be done concurrently with the dredging project.
Dec 11, 1974	City Council created the "Public Lake Inland Protection and Rehabilitation District of Eau Claire", involving landowners on Half Moon Lake. (see figure 1)
Dec., 1974	Shut down two of the three aerators for the winter because of new regulations requiring expensive protection of open portions of lakes.
Jan 3, 1975	Application submitted to DNR for Technical Assistance under the Public Lake Inland Protection and Rehabilitation Act.
Feb 5, 1975	Notification from DNR establishing the Normal (Historic), Maximum and Minimum levels of Half Moon Lake.
Mar 18, 1975	DNR conducted a hearing at County Court House on the proposed Park II of NR60, Wisconsin Administrative Code, setting forth requirements for plan adoption and approval as well as rules governing financial assistance for implementation of inland lake protection and rehabilitation.
May, 1975	Completed Lake Management Plan.

1977 - Dredging of Beach area and Southwest area of Lake completed.

1977 - Construction of overflow structure in Southwest area of lake completed.

1978 - DNR Completes restocking of total fishery

1979 - Aeration equipment purchased and installed.

1979 - Duck Colony relocated from area near causeway to West Side of lake.

1980 - New Bathhouse completed at Half Moon Beach.

1980 - West side storm sewer diverted to Chippewa River.

1982 - Owen Park wells begin operation.

1982 - June 15, 1982 Conservancy District establish for shoreline around the lake.

1987 - Half Moon Lake Advisory Committee established (effort failed).

1988 - Half Moon Beach closed to swimming due to budget cuts and low attendance.

1988 - City discontinues use of copper sulfate treatments for algae.

1990 - Barrier Free Fishing Pier established on West Side of lake.

1991 - City purchases weed harvester at $104,000, using a 50% grant from Wisconsin DNR.

1992 - New Aeration System installed in Half Moon Lake.

1992 - Barr Engineering Study completed to evaluate Lake Management alternatives.

1995 - David Brakke Study completed to evaluate the Thermal Structure, Trophic Status and Potential Impact of Boating on Nutrient Concentrations in Half Moon Lake.

1995 - Aquatic Plant Study Completed by DNR Staff Deborah Konkel and Susan Borman

1999 - U.S. Army Corp of Engineers begin limnological analysis.

1999 - A Citizen's Taskforce is appointed by the Waterways and Parks Commission to address the public's priorities for use of the lake.

2001 - Corp of Engineers' Limnological Analysis is completed and presented to the City Council with proposals to address the high phosphorus content in the lake.

2001 - The Taskforce Report is presented to the City Council showing strong support for fishing, the Ski Sprites and reopening the beach for supervised swimming.

2002 - Adoption of the 2002 Half Moon Lake Water Quality Plan.

2003 - Creation of the Friends of Half Moon Lake in 2003

2003 - Increased street sweeping within the watershed.

2004 - Adoption of an ordinance prohibiting the use of trolling motors in Braun's Bay.

2006 - Removal of the Robert's Farm Warehouse Building and Valley Builder's Building at the north end of the lake.

2007 - Relocation of the Ski Sprites Ski Club to Lake Altoona.

2007 - Completion of the lake sediment study by UWEC and preparation of a lake depth map.

2008 - Installation of several BMP's as part of the construction of parking lots for Mayo Hospital.

2008 - Tree drops in the vicinity of Mayo Hospital to improve the lake's fishery.

2009 - Application of Herbicides 2,4-D for Eurasian Water Milfoil (only in 2009), and Aquathol K for Curly Leaf Pondweed beginning in the spring of 2009 and continuing through present annually each spring.

2009 - Friends of Half Moon Lake work to add plantings in the areas east of the beach hillside and near Bayview Park.

2010 - Update of the Half Moon Lake Water Quality Plan.

2011 - Whole lake alum treatment of lake sediment to control phosphorus release to lake.

2011 - Fisheries assessment of the lake was conducted by the DNR.

2012 - Tree drops in the vicinity of the Chippewa Valley Museum to improve the lake's fishery.

2012 - Adoption of the update of the City's Waterways Plan that includes policy statements relating to the importance of Half Moon Lake.

2014 - Fishing regulations were updated to control the over population of largemouth bass.

2015 - Complete extensive renovations of Rod and Gun Park.

2016 - Completed upgrades to the Half Moon Beach bathhouse.

2016 - Identification of the water loss occurring at the southeast portion of the lake with the outflow called Becca's Brook.

2017 - Low dose alum treatment of the west arm of the lake to control sediment phosphorus release.

2017 - Reconstruction of the causeway with improved lake access, open space, and safety.

2017 - Tree drops in the vicinity of the causeway to improve the fishery.

2018 - Installation of a second fishing pier south of Lakeshore School.

2019 - Another low dose alum treatment of the west arm of the lake.

2019 - Fisheries assessment of the lake was conducted by the DNR.

Ongoing Activities:

- Conducting annual site specific aquatic plant harvesting using the City's weed harvester to improve native aquatic plant populations in the lake.
- Eau Claire County Health Department monitoring of E. coli at Half Moon Beach.
- Continued spring applications of herbicide Aquathol K for the control of Curly Leaf Pondweed.
- Continued acquisition of private properties abutting the shoreline. With recent acquisitions, there are now only two privately owned properties on the lake. Of the 5.3 miles of shoreline, 95.2% is now owned by the City.
- Continued work with volunteer groups to remove invasive plants such as buckthorn and black locust along the shoreline.
- Aeriation of the lake in the area near Lakeshore School.
- Continued pumping of water into the lake from the wells located in Owen Park.