State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Scott Walker, Governor
Dan Meyer, Secretary
Dan Baumann, Regional Director

Wisconsin Rapids Service Center
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Wisconsin Rapids, Wisconsin 54494
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September 7, 2018

Re: Lake Wausau Management Plan Approval

Dear Ms. Holly Kohl,

After several years of planning and research, the final Lake Wausau Management Plan is complete. It is extensive. It is one of the most comprehensive plans I have reviewed encompassing fisheries, water quality, land use management, hydrodynamic modelling and social surveys.

Please accept this letter as approval of the plan. I look forward to implementing this and the Wisconsin River TMDL with LWA.

Thank you.

Sincerely

Scott Provost
Statewide Aquatic Plant Management Coordinator
Water Resources Specialist
715.424.8378

cc: Tim Parks – Wausau
Mark Hazuga – Eau Claire
Karen Blodgett -Eau Claire
Nancy Turyk - Amherst

2018

Lake Wausau Protection and Improvement Plan

Prepared for Lake Wausau Association and
Wisconsin Dept. of Natural Resources
by Nancy Turyk
Center for Watershed Science and Education
University of Wisconsin-Stevens Point

Lake Wausau Association's Vision for the Lake

Protect and maintain the Lake for the entire community and to assure that this treasured resource remains healthy for current users and future generations. To have a working management plan to aid these efforts and serve as a foundation to involve all stakeholders and governmental units to reach this goal.

The purpose of this plan is to coordinate efforts to protect, maintain, and enhance environmental and recreational values on Lake Wausau and its surroundings.

This plan identifies aspects of the lake that are in good condition and ways to maintain this status. Current and potential problems are also identified along with solutions.

Communities working together will result in Lake Wausau continuing to contribute to the quality of life and economic prosperity in Central Wisconsin.

The Lake Wausau Association spearheaded the coordination and development of this plan through a partnership with the University of Wisconsin-Stevens Point and Wisconsin Department of Natural Resources. Funding for the studies and plan development were provided by the Town of Rib Mountain, Village of Rothschild, Cities of Wausau and Schofield, Marathon County, Dept. of Natural Resources, and the US Army Corps of Engineers.

The primary data and assessments used in this plan were collected between 2012 and 2017. Reports developed from these assessments are listed in the Reference section of this plan.

Aquatic Plant Survey, 2017: Golden Sands RC&D
Aquatic Plant Survey, 2012: UW-Stevens Point and Golden Sands RC&D
Bathymetric Map and Woody Habitat Assessment: UW-Stevens Point
Fishery: Dept. of Natural Resources
Hydrodynamic Model of Lake Wausau, 2017: US Army Corps of Engineers
Shoreland Assessment: UW-Stevens Point
Socio-Economic Survey: UW-Stevens Point
Water Quality
Citizen Lake Monitoring Network Data: Lake Wausau Association
Wisconsin River Water Quality Improvement Project: UW-Stevens Point and Dept. of Natural Resources

This plan was approved/adopted by:

Lake Wausau Association on June 6, 2018
Wisconsin Department of Natural Resources September 7, 2018

BOARD RESOLUTION TO ADOPT THE
2018 LAKE WAUSAU PROTECTION AND IMPROVEMENT PLAN

WHEREAS, Lake Wausau is an important resource used by the public for recreation and enjoyment of natural beauty; and

WHEREAS, a study and examination of the lake has been conducted to understand and promote the public health, comfort, convenience, necessity and public welfare of Lake Wausau for purposes of creating a lake protection and improvement plan; and

WHEREAS, we recognize the need for responsible and holistic long-range planning to better manage the lake, its watershed, and its use; and

WHEREAS, we recognize the need to provide information or education on the use of lakes or natural lake ecosystems, on the quality of water in lakes, or on the quality of natural lake ecosystems; and

WHEREAS, we are qualified to carry out the responsibilities of the lake protection and improvement plan in conjunction with the Lake Wausau Advisory Team that will be formed; and

WHEREAS, we understand the importance of a continuing management program for Lake Wausau.

NOW, THEREFORE, BE IT RESOLVED THAT the Lake Wausau Association, Inc. hereby approves the 2018 Lake Management and Implementation Plan (the "Plan") as prepared by Nancy Turyk of the Center for Watershed Science and Education University of Wisconsin-Stevens Point and as presented to the Board of Directors on June 6, 2018. The Plan will be reviewed annually by the Lake Wausau Advisory Team (once that team is formed) with representatives of the Lake Wausau Association Board of Directors. Until that time the Plan will be reviewed annually by the Lake Wausau Association Board of Directors. The annual review will include evaluating conditions in Lake Wausau and how the Plan is proceeding (sharing accomplishments and impediments), prioritizing goals and related strategies for the upcoming year, coordinating leadership of those goals and related strategies, identifying funding options, and making any necessary revisions or corrections to the Plan.

Adopted this 6th day of June, 2018 by unanimous vote.

LAKE WAUSAU ASSOCIATION BY:

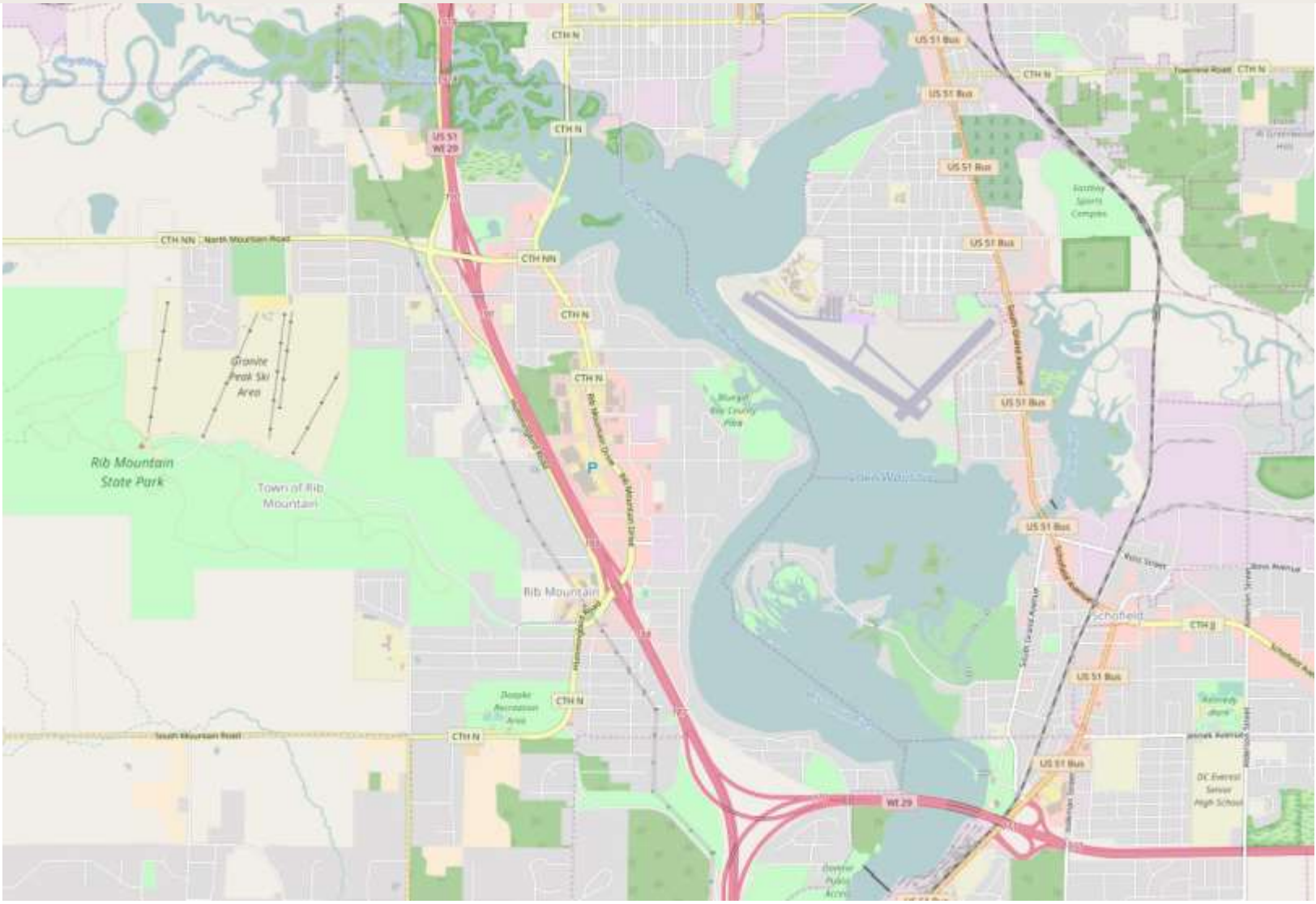
Sherri Wagner, Secretary

Contents

Lake Wausau lies in the heart of the greater Wausau region of central Wisconsin which include the cities of Schofield and Wausau, Village of Rothschild, and Town of Rib Mountain. The watershed includes additional municipalities.

Lake Wausau is created by a dam on the Wisconsin River which is owned by Domtar. The Rib River and Eau Claire River are its major tributaries.

Lake Wausau and Surrounding Communities



Developing the Lake Wausau Management Plan

The idea to develop this plan to address water quality and recreational challenges in portions of Lake Wausau came about in 2011, with the Lake Wausau Association (LWA) leading the charge.

Data collection began in 2012 and continued through 2017. During this time, public gatherings were held to discuss the results and obtain public input. The public gatherings culminated in late 2017 with the completion of the hydrodynamic modeling exercises conducted by the US Army Corps of Engineers (USACE). Public input was also obtained through a socio-economic survey which was conducted in 2013 (Thompson, et.al).

Understanding the Community

The success of this plan is dependent on the ability of the Lake Wausau partners to work together to achieve the goals. This will involve meeting at least annually to learn about accomplishments and impediments and prioritize the strategies for the upcoming years. The more the partners are able to support one another, the stronger the relationships, and hence, the liklihood of success.

Successful implementation of this plan will require the commitment and support by the listed partners and interested businesses and community members. Understanding the perceptions of community members will help to approach challenges by communicating in a meaningful way that resonates with their differing viewpoints. Information about the partners that have been participating in this planning process can be found in the final chapter of this document.

Opinions of the Lake Wausau Community

To obtain broad input from community members about Lake Wausau, a survey was conducted. The survey was sent to 836 residents representing lakefront and near-lake properties in Wausau, Schofield, Rothschild, and Rib Mountain. A response rate of 44.3% was obtained. Results of the survey have been incorporated throughout this plan and planning process. Additional details of the survey results can be found in the report *2015 Socio-Economic Assessment* by K. Floress, A. Thompson, and M. Vokoun (Appendix).

Common Perceptions by Survey Respondents

There is little doubt that Lake Wausau adds to the beauty of the community and is part of what makes the area attractive and helps to create its sense of place. The lake contributes to the quality of life which helps to attract new residents, employers, and visitors. Local funding to revitalize the lake was perceived as a good investment, yet it is also believed that community members should take an active role in the future of the lake while partnering with others, including the staff from the WDNR.

Lake Wausau adds to the beauty of the community
82%
strongly agree

While there are attributes about Lake Wausau that found agreement among the majority of survey respondents, perspectives about the lake differed among four primary groups. These groups were identified through the analysis of common responses to a number of questions. A small number of respondents (6.8%) did not fit into any of the four groups.

Understanding the different perceptions should help to guide communication associated with the management of Lake Wausau. Following is an overview of commonly held views for each group.

Group 1: At home on Lake Wausau (49.5%)

Residents who hold this view enjoy spending time on Lake Wausau. They recognize the breadth of outdoor recreational options and good fishing as some of the highlights of their time spent on the lake. For many, recreating at Lake Wausau is part of a tradition that keeps them coming back over and over again is a view that is commonly held.

They disagree with others who think the lake is dirty and getting worse and for most part, hold an opposing opinion that the water is safe for recreating and a willingness to eat the fish that are caught. These individuals believe that the parks on Lake Wausau represent some of the most beautiful places in the county and disagree that there is an unpleasant odor that would prevent them from recreating there.

When it comes to who is responsible, this group feels that both the WDNR and local government have a role in responding to the conditions of Lake Wausau.

Group 2: Hard working Lake Wausau (17.2%)

A couple of viewpoints are shared between residents who hold this view and individuals in Group 1; both groups believe that Lake Wausau provides an abundance of recreational opportunities and that the parks along the lake are some of the most beautiful places in the county.

Individuals in group 2 believe that Lake Wausau is important for the role it plays in supporting manufacturing within the community and are less motivated to provide fish and wildlife habitat than other groups. They enjoy outdoor recreation, but don't choose to spend their time on Lake Wausau. However, this slight to recreating there doesn't appear to be linked to concerns over odor or other water quality issues.

This group is the least likely to support stronger regulations to protect the enjoyment of the lake for all users and are the least supportive of the involvement of WDNR professionals in lake management efforts. When it comes to local funding, this group agrees with an investment for the future, but support is less than indicated by any of the other groups.

Group 3: When recreating, it's not on Lake Wausau (13.9%)

Negative experiences and perceptions about the recreational aspects of Lake Wausau dominate the views of individuals in this group. In particular, they view the lake as lacking recreational facilities and feel that there is too much competition or crowding, making it difficult to enjoy the lake. They view the parks as being less safe than those in the other group. In combination with the other factors, this may explain why this group chooses to spend their time elsewhere. The group does not view Lake Wausau as a good place

for recreating outdoors, citing poor fishing opportunities and frequent disruption from other users as reasons they go to other lakes. This group seems less connected to the lake, as they disagree that spending time here is a tradition or that the lake plays a role in building community between those that live and recreate here.

This group supports efforts to improve Lake Wausau, especially with a focus on the enhancement of fish and wildlife habitat. They feel that the condition of the lake is a reflection of local government not taking responsibility to manage the problems.

Group 4: It's dirty and the time has come to fix Lake Wausau (12.6%)

The defining feature of those who hold this view is a strong belief that Lake Wausau is dirty and seems to be getting worse. They are the only group who to disagree that water quality is improving and are the most likely to believe that the condition of the lake is so bad that it is only safe to look at the water. This view is supported by their perception that the lake has a strong odor and are the least likely to feel safe eating fish from the lake. Similar to group 3, members of this group see a lack of recreational facilities on the lake, but are largely motivated by the need to enhance fish and wildlife habitat.

They are the most critical of local government's response to the condition of the lake, but among the most supportive of WDNR's involvement in managing these issues.

Goals for the Protection and Improvement of Lake Wausau

The following goals and strategies were derived from the values and concerns of those interested in Lake Wausau, along with the known science about the lake and its tributaries, its ecosystem and the landscape within its watershed. A lake management plan is a living document that changes over time to meet the current needs and challenges in the lake and desires of its community. Implementing and regularly updating the goals and actions in this plan will ensure that the vision is supported and that changes or new challenges are incorporated into the plan. The following goals were identified to protect, maintain, and improve Lake Wausau. The priority strategies are identified with **.

Lead Organizations

Lead organizations and resources are identified for each strategy. The following table lists organization names and their associated acronyms used in this plan. This list should not be considered all-inclusive; assistance may also be provided by other entities, consultants, organizations, and individuals.

Organization Name	Acronym
Citizen Lake Monitoring Network	CLMN
Marathon County Conservation, Planning, and Zoning	CPZ
Wisconsin Dept. of Agriculture, Trade, and Consumer Protection	DATCP
United States Environmental Protection Agency	EPA
Lake Wausau Association	LWA
Lake Wausau Advisory Team	LWAT**
Metropolitan Planning Organization	MPO
North Central Conservancy Trust	NCCT
North Central Wisconsin Stormwater Coalition	NCWSC
Natural Resource Conservation Service	NRCS
Golden Sands Resource Conservation and Development, Inc.	RC&D
United States Army Corps of Engineers	USACE
University of Wisconsin-Extension	UWEX
Wisconsin Dept. of Natural Resources	WDNR
Wisconsin Waterfowl Assn. – Local Chapter	WWA

**Refer to Strategy 4.1 on page 22 pertaining to the development of the Lake Wausau Advisory Team, which currently does not exist.

GOAL 1: LAKE WAUSAU WILL SUPPORT A HEALTHY FISHERY AND WILDLIFE.

STRATEGY 1.1: The population goals for key fish species in Lake Wausau, which have been identified by Fishery Biologists with the WDNR, will be achieved and sustained. Depending on the species, this will be accomplished through the adjustment of regulations, preservation of existing habitat, and water quality and habitat improvements.

BLACK CRAPPIE

Fishery Goal BC: A crappie population of moderate density with a high proportion of quality size (8+ inch) and moderate proportion of preferred size (10+ inch) fish.

- **Objective (density**): A relative abundance of 10-15 crappie per net night from spring fyke netting surveys.
- **Objective (size structure):** Of all crappie 4.0 inches and longer captured by fyke net in spring, 40-60% should be 8.0 inches or longer and 10-20% should be 10.0 inches or longer.

Management Strategies:

- **Regulatory**: Continue with experimental reduced panfish bag limit and evaluate
- **Habitat:** Manage for natural aquatic plant communities; control EWM and CLP
- **Other:** maintain adequate predator densities.

BLUEGILL

Fishery Goal BG: A bluegill population of moderate density with a high proportion of preferred size (7+ inch) fish.

- **Objective (density):** A relative abundance of 7+ inch bluegill of 10-15 per mile from spring electrofishing surveys.
- **Objective (size structure):** Of all bluegill 3 inches and longer captured by electrofishing in late spring, 30-40% should be 7+ inches and 5-15% should be 8+ inches.

Management Strategies:

- **Regulatory:** Continue current special regulations.
- **Habitat**: Manage for natural aquatic plant communities; if EWM or CLP becomes overly abundant follow management steps in the aquatic plant management section.
- **Other:** Maintain adequate predator densities to control bluegill recruitment/density.

GOAL 1: LAKE WAUSAU WILL SUPPORT A HEALTHY FISHERY AND WILDLIFE.

MUSKELLUNGE

Fishery Goal M: A muskellunge population of low density with moderate proportions of preferred and memorable fish and potential for trophy size fish.

- **Objective (density):** 0.1 to 0.3 adult muskellunge per acre in spring population estimates
- **Objective (size structure):** Of all muskellunge 30 inches and longer captured by fyke netting in early spring, 30-50% should be 38 inches or longer and 10-20% should be 42 inches or longer.

Management Strategies:

- **Stocking:** stocking quota of 0.5 to 1.0 large fingerling per acre every 2 years
- **Assessment:** evaluate if natural reproduction is occurring and if so, to what extent
- **Regulatory:** Maintain current size limit regulation

NORTHERN PIKE

Fishery Goal NP: A northern pike population of moderate density with a moderate proportion of quality (21+ inch) and preferred size (26+ inch) fish.

- **Objective (density):** A relative abundance of 3-6 adult northern pike per net night in spring fyke net surveys.
- **Objective (size structure):** Of all northern pike 11 inches and longer captured by fyke net in spring, 30-50% should be 21 inches or longer and 10-15% should be 26 inches or longer.

Management Strategies:

- **Stocking:** Address as needed.
- **Regulatory:** None at this time.
- **Habitat**: Manage for natural aquatic plant communities; control EWM and CLP

WALLEYE

Fishery Goal W: A walleye population of moderate density with a moderate proportion of quality-size (15+) fish and preferred-size (20+) fish.

- **Objective (Density):** A population density of 3-6 adult walleye per acre in spring population estimates.
- **Objective (Size Structure):** Of all walleye 10+ inches, 40-50% should be 15+ inches and 10-15% should be 20+ inches.
- **Objective (Recruitment):** A relative abundance of 10-15 young of year per mile in fall electrofishing recruitment surveys.

Management Strategies:

- **Regulatory**: Maintain current regulation but continue evaluating efficacy.
- **Habitat**: Protect walleye spawning habitat. Protect and enhance coarse woody habitat.

GOAL 1: LAKE WAUSAU WILL SUPPORT A HEALTHY FISHERY AND WILDLIFE.

STRATEGY 1.2: Monitor the fish community to identify long-term trends and responses to changes in regulations. Share the results with LWA and local sportsperson clubs. Follow up with management strategies based on survey results which may include habitat restoration, stocking, or regulatory changes.

WHO: WDNR Fishery Biologists

WHEN: Every 7 years. Next fish community survey is scheduled for 2018 during different seasons using a variety of surveying gear.

MEASURE OF SUCCESS: The goals and objectives for each game species is achieved.

STRATEGY 1.3: Evaluate the response of the fishery to changes in the 10/25 panfish bag limit and walleye slot-limit regulations.

WHO: WDNR Fishery Biologists

WHEN: Walleye: Annually in fall using electrofishing. Bluegill: During 2019-2021 conduct electrofishing and angler surveys

MEASURE OF SUCCESS: A walleye population of moderate density with a moderate proportion of quality-size (15+) fish and preferred-size (20+) fish. A bluegill population of moderate density with a high proportion of preferred size (7+ inch) fish.

****STRATEGY 1.4: Continue to pursue the development of a project to improve fish spawning habitat downstream of the mouth of the Rib River.** Identify potential partners and work with USACE to develop a detailed feasibility analysis and cost estimates for scenarios identified in the hydrodynamic modeling exercise. Discussions about options should take place in transparent meetings which allow for questions and input from the public.

WHO: USACE, Advisory team, municipalities, LWA, Domtar and other businesses, WDNR Aquatic Plant and Fishery Biologists, fishing clubs

WHEN: As determined by the LWAT

MEASURE OF SUCCESS: An understanding about the scope of the fish habitat improvement project will be developed and the feasibility of pursuing next steps will be known.

STRATEGY 1.5: Ensure sufficient woody habitat remains in place to provide spawning habitat for musky, and perching areas for birds and turtles. See shoreland strategies for details. Review woody habitat survey to determine if there are areas lacking woody habitat. Contact property owners located in the specified areas.

WHO: Shoreland property owners and managers, fishing clubs, LWA

Assistance: WDNR Fishery Biologists, WDNR Grants

WHEN: Ongoing

MEASURE OF SUCCESS: Existing woody habitat is not “cleaned up”. When trees drop, they are left in place, and anchored woody habitat is added, where needed.

GOAL 1: LAKE WAUSAU WILL SUPPORT A HEALTHY FISHERY AND WILDLIFE.

STRATEGY 1.6: Determine the feasibility of establishing wild rice in other areas of Lake Wausau. Evaluation should address concerns about wild rice becoming overly dense in less-desirable areas and ability for control, should this occur.

WHO: WWA, LWA, WDNR Wildlife Biologist, WDNR Aquatic Plant Biologist

WHEN: To be determined.

MEASURE OF SUCCESS: Feasibility of additional wild rice establishments will be understood.

****STRATEGY 1.7: Monitor Lake Wausau and create a map showing the areas where CLP and EWM are present.** Retain copies of the map to identify changes over time. Inform a WDNR Aquatic Plant or Lake Biologist if populations appear to be expanding.

WHO: LWA

WHEN: Annually in early June for CLP and July or August for EWM

MEASURE OF SUCCESS: Changes in the CLP and EWM populations will be identified early on so control efforts can be taken while populations can be managed.

STRATEGY 1.8: Remove CLP biomass to reduce local blooms of filamentous and other algae. Follow harvesting guidance in the aquatic plant management plan. A permit from the WDNR is required. Take steps to reduce nutrients to Lake Wausau.

WHO: LWAT and LWA

WHEN: Annually in June or as needed.

MEASURE OF SUCCESS: Water quality problems resulting from CLP presence or die back will be minimized.

STRATEGY 1.9: Remove accumulated floating plant material if it is causing a recreational or aesthetic nuisance. Follow skimming guidance in the aquatic plant management plan. A permit from the WDNR is required.

WHO: LWAT

WHEN: Annually in June or as needed.

MEASURE OF SUCCESS: Recreational access to the lake from dense accumulation of floating plant material will be increased.

STRATEGY 1.10: If the management of aquatic plants is desired, keep the permit current and have an aquatic plant survey conducted the summer before the permit is requested from the WDNR. If possible, management strategies should avoid disturbance of high quality plant species.

WHO: LWAT, WDNR Aquatic Plant Biologist, WDNR lake grants

WHEN: Next aquatic plant survey should be conducted in 2021 if a permit update will be sought in 2022.

MEASURE OF SUCCESS: When, where, and how to manage aquatic plants will be agreed upon.

GOAL 1: LAKE WAUSAU WILL SUPPORT A HEALTHY FISHERY AND WILDLIFE.

****STRATEGY 1.11: Prevent new AIS from being introduced in Lake Wausau.** Provide information and reach out to the variety of lake users about steps to preventing the spread of AIS. Consider different messages and methods of communication to reach a wide array of user groups and generations.

Outreach Strategies:

- Newsletters, facebook, media outreach, presentations at annual meetings, signs at landings, special events (e.g. fishing tournaments, Wisconsin River Clean Up, kayak events, powerboat races), lake map, signs at local bait and sporting goods shops, restaurants, taverns.

Audiences:

- Waterfront property owners, sportsperson and conservation clubs, local residents, visitors

WHO: Local businesses, youth groups, WWA and other sportsperson and conservation clubs, LWA and other local lake groups, Wausau Kayak/Canoe Corporation, municipalities, Golden Sands RC&D

WHEN: Ongoing, year round.

MEASURE OF SUCCESS: New AIS will not be introduced nto Lake Wausau and the flowage will not be a source of AIS for other waterbodies.

STRATEGY 1.12: Prevent new AIS from becoming established in Lake Wausau. A group of lake users will attend a training to identify AIS. Trained volunteers will monitor for AIS, especially near boat launches and other points of access, and report any suspected AIS to biologists for confirmation and the steps needed to monitor and eradicate the new AIS. Contract for Citizen Lake Monitoring Network AIS training.

WHO: Local businesses, youth groups, WWA and other sportsperson and conservation clubs, LWA and other local lake groups, Wausau Kayak/Canoe Corporation, municipalities, Golden Sands RC&D

WHEN: Ongoing

MEASURE OF SUCCESS: No new AIS become established in Lake Wausau.

****STRATEGY 1.13: Develop and implement a strategy to inform lake users about new AIS infestations and the steps needed to prevent its spread within Lake Wausau and to other lakes.**

WHO: LWAT and other local lake groups

WHEN: Spring 2018

MEASURE OF SUCCESS: Lake users will be informed if new AIS is found in Lake Wausau.

STRATEGY 1.14: Encourage waterfront property owners to check their rafts and docks for AIS.

WHO: LWA

WHEN: Spring and fall

MEASURE OF SUCCESS: New AIS is identified while it is an early infestation.

GOAL 2: IMPROVE AND MAINTAIN WATER QUALITY IN LAKE WAUSAU.

STRATEGY 2.1: Reduce water quality problems by reducing aquatic plant biomass in targeted areas of Lake Wausau through the harvesting of aquatic plants. See Aquatic Plant Management Strategy Summary for Lake Wausau for options, locations, and details.

WHO: LWAT

****STRATEGY 2.2: Reduce the extent and frequency of cyanobacterial (blue-green algae) blooms in Lake Wausau near the confluence with the Eau Claire River.** Identify potential partners and work with USACE to develop a detailed feasibility analysis and cost estimates for scenarios identified in the hydrodynamic modeling exercise. Discussions about options should take place in transparent meetings which allow for questions and input from the public. Nutrient reductions to Lake Wausau will also help to alleviate the blooms.

WHO: USACE, LWAT, municipalities, LWA, WVIC, Domtar and other businesses, WDNR Water Quality Specialist

WHEN: As determined by LWAT

MEASURES OF SUCCESS:

Target concentrations of chlorophyll a, a measure of algae, is 20 ppb, to be exceeded no more than 30% of July 15 - Sept 15.

An understanding about the scope of the Eau Claire River water quality improvement project will be developed and the feasibility of pursuing next steps will be known.

****STRATEGY 2.3: Continue to explore the feasibility of improving the water quality upstream and downstream of the County Highway N Bridge with the installation of a culvert to re-establish water flow.** This project is tied to the fish habitat enhancement project downstream from the Rib River confluence. Identify potential partners and work with USACE to develop a detailed feasibility analysis and associated costs for scenarios identified in the hydrodynamic modeling exercise. Discussions about options should take place in open and transparent meetings which allow for questions and input from the public well before deadlines. Reducing nutrients to the lake will also benefit this problem.

WHO: USACE, LWAT, municipalities, LWA, WVIC, businesses, WDNR Water Quality Specialist

WHEN: As determined by LWAT and USACE

MEASURE OF SUCCESS: An understanding about the scope of the County Hwy N bridge water quality improvement project will be developed and the feasibility of pursuing next steps will be known.

STRATEGY 2.4: Explore strategies to improve water flow between the Rothschild Pavilion and islands to reduce sedimentation and growth of aquatic plants.

WHO: Village of Rothschild and LWAT RESOURCES: USACE, WDNR Aquatic Plant Biologist

WHEN: To be determined

MEASURE OF SUCCESS: This frequently visited location will be aesthetically pleasing.

GOAL 2: IMPROVE AND MAINTAIN WATER QUALITY IN LAKE WAUSAU.

STRATEGY 2.5: Reduce stormwater runoff to Lake Wausau.

Development on properties less than 1 acre: Willing property owners in the municipalities that discharge stormwater to Lake Wausau will employ techniques on the landscape that help to keep water quality in Lake Wausau healthy. Through the North Central Wisconsin Stormwater Coalition (NCWSC), the municipalities provide opportunities for residents to learn about their connection to the lake how they can reduce runoff from their property. This is accomplished through media campaigns, information in utility bills, and demonstration projects in the community. Funding is provided to assist with putting practices into place.

WHO: NCWSC and property owners.

WHEN: Ongoing

MEASURE OF SUCCESS: Stormwater flows and associated contaminants discharging to Lake Wausau will be reduced without investing in expensive infrastructure that would be needed to treat stormwater.

Development on properties greater than 1 acre: Follow the municipal stormwater management guidance.

WHO: Property owners, developers

WHEN: Ongoing

MEASURE OF SUCCESS: Stormwater flows and associated contaminants discharging to Lake Wausau will be reduced without investing in expensive infrastructure that would be needed to treat stormwater.

STRATEGY 2.6: Ensure impacts from mining activities in the Lake Wausau watershed have negligible impacts to the lake habitat and water quality. Support any future legislation that would protect or increase local control, oversight, and regulation of land use including mining.

WHO: Marathon County, WDNR, mine owners/operators, LWA

WHEN: Ongoing

MEASURE OF SUCCESS: Mines adhere to local and state standards related to mine operation and reclamation.

STRATEGY 2.7: Inform new shoreland property owners about how to contribute to healthy water quality in Lake Wausau.

WHO: To be determined by LWAT.

WHEN: When new property is purchased.

MEASURE OF SUCCESS: Localized negative impacts to water quality are minimal from adjacent land management practices.

GOAL 2: IMPROVE AND MAINTAIN WATER QUALITY IN LAKE WAUSAU.

STRATEGY 2.8: Establish a 35 foot shoreland buffer on a minimum of 25% (47,625 feet) of the total 190,500 feet (36 miles) of Lake Wausau's shoreland that did not meet the 35-foot goal in 2013.

WHO: Shoreland property owners (voluntary) RESOURCES: Marathon County, WDNR grants

WHEN: by 2028

MEASURE OF SUCCESS: A 35 foot shoreland buffer will be established on 47,625 feet of shoreline within 10 years.

STRATEGY 2.9: Pursue alternative options to stabilize the shoreland in areas with rock riprap. Options may include vegetated riprap and biological control methods. Educate shoreland property owners that have rock riprap about alternatives.

WHO: Shoreland property owners (voluntary) RESOURCES: Marathon County, WDNR grants

WHEN: Ongoing

MEASURE OF SUCCESS: Shoreland owners will have the information they need to make an informed decision about the best way to stabalize their shorelines.

STRATEGY 2.10: Remediate a minimum of 50% of eroded shoreline (1,586 feet) identified in the 2013 shoreland survey. Shoreline erosion can be remediated with a combination of biological and non-biological treatments.

WHO: Participating property owners RESOURCES: Marathon County, WDNR grants

WHEN: By 2028

MEASURE OF SUCCESS: Fifty percent of eroded shoreline will be remediated within 10 years.

STRATEGY 2.10a: Explore options to address any erosion occurring around the islands near Rothschild.

WHO: Village of Rothschild RESOURCES: Marathon County, WDNR grants

WHEN: To be determined.

MEASURE OF SUCCESS: The island shorelands will be stabilized while still providing habitat.

GOAL 2: IMPROVE AND MAINTAIN WATER QUALITY IN LAKE WAUSAU.

STRATEGY 2.11: Shoreland property owners will recognize the connections between their land management practices and water quality. Shoreland property is managed in a way that is beneficial to Lake Wausau and its inhabitants. Communication will include causes and effects of different shoreland management approaches, the types of healthy shoreland vegetation options, existing regulations, and cost-share incentives.

Communication strategies:

- Newsletters and mailings to all shoreland residents. Lead: LWA
- Informational newsletters and mailings to community.
  LEADS: Municipalities including Marathon County
- Develop a presentation that can be given at community events or to local organizations.
  LEADS: LWA, Golden Sands RC&D, Marathon County
- Create and establish demonstration sites.
  - Designate an area at local parks.
  - Designate display areas on public sites with identification. Lead: Municipalities
- Develop a planting workshop or clinic. Lead: LWA/UWEX Lakes/ Marathon County/Golden Sands RC&D
- Participation in boating and fishing trade shows. Lead: LWA Representatives

Resources for education and outreach programs:

- University public offering programs on water resource/shoreland through UW-Marathon County
- Media
- Social media – LinkedIn, LWA Website, Email, Facebook, Blogs
- Radio – WDEZ, WIFC, WHRM
- TV – Channel 9, Channel 7, Channel 12, Public TV
- Newspapers – Daily Herald, City Pages
- Public library
- Public meetings at varied times for greater attendance
- Golden Sands RC&D
- River Alliance of Wisconsin
- UWEX Lakes
- Signage/brochures at public demonstration sites

Incentives

- Funding through Marathon County, NCWSC, and WDNR grants
- Recognition, for those that wish, in newsletters, thank you letters to property owners, and other acknowledgments

WHEN: Ongoing

MEASURE OF SUCCESS: Localized negative impacts to water quality are minimal.

GOAL 2: IMPROVE AND MAINTAIN WATER QUALITY IN LAKE WAUSAU.

STRATEGY 2.12: Property owners in the Lake Wausau watershed have the support needed to manage their land in a way that does not negatively impact the lake.

WHO: Marathon County, NRCS, County Board of Supervisors and other elected officials, DATCP

WHEN: Ongoing

MEASURE OF SUCCESS: Minimal negative impacts on the lake's water quality will be a result of land uses management in the Lake Wausau watershed.

STRATEGY 2.13: Land that effects Lake Wausau's water quality or habitat will be protected property owners though conservation easements or purchase of land for protection or recreation.

WHO: Interested property owners, NCCT, Knowles-Nelson Stewardship Funds, WDNR Lake and River Protection Grants

WHEN: As needed

MEASURE OF SUCCESS: Water quality and habitat benefits occur due to protected land.

STRATEGY 2.14: Work together to solve problems by participating in community events to learn about water quality-related local farming practices.

WHO: LWA, WWA, LWAT

WHEN: As opportunities arise.

MEASURE OF SUCCESS: A healthy dialog related to water quality occurs within the Lake Wausau community.

STRATEGY 2.11: Work together to solve problems by participating in public meetings related to the Wisconsin River TMDL and 9-key Element Planning Processes for the Rib River and Eau Claire River.

WHO: LWAT, WWA, shoreland property owners, municipalities

WHEN: As opportunities arise.

MEASURE OF SUCCESS: Water quality plans that effect Lake Wausau are developed with a wide range of community input and perspectives.

GOAL 2: IMPROVE AND MAINTAIN WATER QUALITY IN LAKE WAUSAU.

STRATEGY 2.12: Understand the current water quality conditions and long-term trends in Lake Wausau. Follow the water quality monitoring strategies. Results are reviewed and shared routinely.

WHO: Volunteers, municipal or business staff

WHEN: Ongoing

MEASURE OF SUCCESS: A continuous record of water quality measurements exists for specific locations in Lake Wausau. Data can be used to evaluate the success of water quality improvement strategies and identify future problems.

WATER QUALITY MONITORING STRATEGY FOR LAKE WAUSAU

Water quality can vary seasonally and year-to-year. Long-term water quality monitoring can help to identify trends that are occurring over time. Monitoring will also help to determine the success of water quality improvement projects. For monitoring of water clarity, total phosphorus, and chlorophyll a, training is available from the local WDNR citizen lake monitoring network (CLMN) coordinator. If funding through the WDNR is not available for the total phosphorous and chlorophyll a analyses, samples can be submitted to a state-certified lab.

- Continue monitoring at the 3 primary sites in Lake Wausau, the East Basin, West Basin, and Asylum Pt. Coordinates for these locations can be found through the WDNR's Surface Water Data Viewer. Sample acquisition should follow the CLMN protocol for total phosphorus, chlorophyll a (algae), and water clarity.

- Monitoring the water quality at site of potential projects sites should be established, including Gulliver's Bay, the golf course bay, and downstream from the confluence with the Eau Claire River. Follow the CLMN protocol for total phosphorus, chlorophyll a, and water clarity.

- All data should be submitted to the WDNR Surface Water Inventory Management System (SWIMS) database for storage and use.

STRATEGY 2.13: Understand the current water quality conditions and long-term trends in the Rib River and Eau Claire Rivers. Work with WDNR to develop strategies that would benefit the TMDL efforts at locations with flow monitoring equipment.

WHO: Volunteers, municipal or business staff, schools

WHEN: Ongoing

MEASURE OF SUCCESS: A continuous record of water quality measurements exists for the Rib River and Eau Claire River. Data can be used to evaluate the success of water quality improvement strategies and identify future problems.

GOAL 3: SUPPORT RECREATIONAL OPPORTUNITIES ON LAKE WAUSAU.

STRATEGY 3.1: The public will have access to Lake Wausau at a variety of locations for a variety of recreational opportunities. Review existing and planned access and facilities on Lake Wausau.

WHO: Municipalities, LWAT

WHEN: 2018 and ongoing

MEASURE OF SUCCESS: Recreational access opportunities around Lake Wausau will be coordinated and any inadequacies will be identified.

STRATEGY 3.1A: Acquire a kayak launch structure to be placed on the shore of Pavilion Park.

This launch will be beneficial for connecting to other facilities on the lake, or the river itself, as a portage around the dam is located about 4,000 feet downstream to the lower Wisconsin River section below Rothschild Dam. Many kayakers presently launch from the boat landing area.

WHO: Village of Rothschild

WHEN: 2018

MEASURE OF SUCCESS: Kayakers will have easier access to Lake Wausau from Pavilion Park.

STRATEGY 3.2: Provide information about Lake Wausau at the points of access.

Information can include boating and fishing in Lake Wausau, good boating hygiene to limit the spread of aquatic invasive species (AIS) to and from the lake, and information about healthy lake demonstration sites.

WHO: Municipalities

WHEN: Ongoing

MEASURE OF SUCCESS: Lake users will have access to information related to recreation on Lake Wausau.

GOAL 4. WORK TOGETHER FOR A BETTER LAKE WAUSAU.

****STRATEGY 4.1: Develop a Lake Wausau Advisory Team to guide the implementation of strategies to protect and restore Lake Wausau, the Rib River, and the Eau Claire River.** With support from the LWA, Marathon County will assist with the initial facilitation of this group. The team should identify the desired level of commitment by partners, the meeting frequency, and lead responsibility for scheduling the meetings.

WHO: LWA, MPO Water Quality Technical Advisory Committee, cities of Schofield and Wausau, Village of Rothschild, town of Rib Mountain, Marathon County, WVIC, NCWSC, sports and conservation groups, WDNR, elected officials, farmers and farm groups

WHEN: 2018

MEASURE OF SUCCESS: A group of stakeholders will share responsibility for the management of Lake Wausau.

****STRATEGY 4.2: Maintain partnerships to assist with communication efforts related to Lake Wausau and use a variety of communication approaches to reach the spectrum of audiences.**

- University public offering programs on water resource/shoreland through UW-Marathon County
- Social media – LinkedIn, LWA Website, Email, Facebook, Blogs
- Radio – WDEZ, WIFC, WHRM
- TV – Channel 9, Channel 7, Channel 12, Public TV
- Newspapers – Daily Herald, City Pages
- Municipalities and Public library – websites, newsletters, meetings
- North Central Stormwater Coalition
- Public meetings at varied times for greater attendance
- Golden Sands RC&D
- River Alliance of Wisconsin
- UW-Extension Lakes/Lakes Partnership
- Realtors and other businesses
- Elected officials

WHO: LWA

WHEN: Ongoing, as needed

MEASURE OF SUCCESS: Those interested in Lake Wausau will have access to information.

GOAL 4. WORK TOGETHER FOR A BETTER LAKE WAUSAU.

STRATEGY 4.3: Lake Wausau will be recognized as beneficial to the regional quality of life and for its economic values.

WHO: Wausau/Central Wisconsin Convention & Visitors Bureau, municipalities, businesses, LWAT

WHEN: Ongoing

MEASURE OF SUCCESS: When municipalities and community groups recognize Lake Wausau as a benefit to their community in their plans and publications, increases in property values, increased use of boat landings and other recreational facilities, increase in recreational events sponsored on Lake Wausau (i.e. boat races, kayak events, fishing tournaments, water skiing competitions).

STRATEGY 4.4: Meet annually to discuss accomplishments and plan for the upcoming year. Formally update this plan every 5 years or as needed.

WHO: LWAT with public input

WHEN: Annual meeting. Next formal plan update: 2022 or sooner, if needed.

MEASURE OF SUCCESS: Implementation will be a coordinated effort. The plan will remain up to date.

STRATEGY 4.5: Keep informed about current topics associated with the Wisconsin River and coordinate with other stewardship groups by participating in the Wisconsin River partnership. The partnership includes river and reservoir stewardship groups in the upper and central Wisconsin River basin.

WHO: LWA LEAD: River Alliance of Wisconsin

WHEN: Annually

MEASURE OF SUCCESS: Lake Wausau will be represented in the Wisconsin River Partnership

STRATEGY 4.6: Pursue opportunities to develop LWA board member's knowledge of lake/river current issues by participating in statewide stewardship opportunities including the annual Wisconsin Lake Convention and Lake Leaders Institute. Inform LWA and LWAT members about these, and other relevant opportunities.

WHO: LWA

WHEN: As opportunities arise.

MEASURE OF SUCCESS: Lake Wausau leadership will be knowledgeable about current issues in lake/river management and membership will be informed.

GOAL 4. WORK TOGETHER FOR A BETTER LAKE WAUSAU.

STRATEGY 4.7: LWA membership will be aware of educational and informational opportunities such as LWA website and facebook page, local workshops, and no-cost subscription to Lake Tides.

WHO: LWA

WHEN: Ongoing

MEASURE OF SUCCESS: LWA members will have the information they need to make decisions that lead to a healthier lake.

STRATEGY 4.8: Keep the LWA vibrant and engaged by continuing efforts to enhance the membership.

WHO: LWA

WHEN: Ongoing

MEASURE OF SUCCESS: LWA will have a strong and informed membership.

STRATEGY 4.9: Explore the possibility of forming a Lake District.

WHO: LWA RESOURCES: UWEX Lakes, LWAT

WHEN: To be determined

MEASURE OF SUCCESS: A formal group would exist for Lake Wausau.

GOAL 1:

Lake Wausau will support a healthy fishery and wildlife.

Lake Wausau Habitat

Note: this section includes contributions from Crunkilton and Koeller, 2015.

Lake Wausau is enjoyed by local residents and visitors for wildlife observation, year-round fishing, and hunting. Good quality habitat is necessary to support all of these activities. Wetlands, woody tree trunks and limbs, aquatic plants, a variety of lakebed materials, and overhanging branches are all examples of habitat in Lake Wausau. However, habitat does not stop at the water's edge. Many species of animals use the near shore and the lake to survive and flourish. Lake Wausau hosts a wide range of habitat types; many areas within Lake Wausau have good quality habitat; however, some areas could be improved.

Habitat in and near Lake Wausau refers to areas where plants and animals reproduce and live. What comprises good habitat varies by species and their life stage yet there are certain habitat types that are desirable for many species.

For fish, the type of substrate in the lake, amount of structure (aquatic plants and woody structure), amount of water flow, and water quality all effect the suitability of Lake Wausau for specific species.

Turtles require logs for sunning to aid in the digestion of food.

Waterfowl and wading birds utilize wetlands for nesting and rearing their young. Some aspects of habitat are naturally occurring and where it is lacking, it can be enhanced.

Outstanding Habitat

Not all habitat is alike. Protection of critical habitat is important for the sustained health of aquatic fauna including fish, insects, birds, reptiles, and amphibians. Healthy lake habitat attracts a wide variety of waterfowl and shorebirds including ospreys, great blue herons, loons, and willets, to name a few. A well-established great blue heron rookery is present on islands east of Rookery View Park in the Town of Rib Mountain where more than 100 nests have been reported.

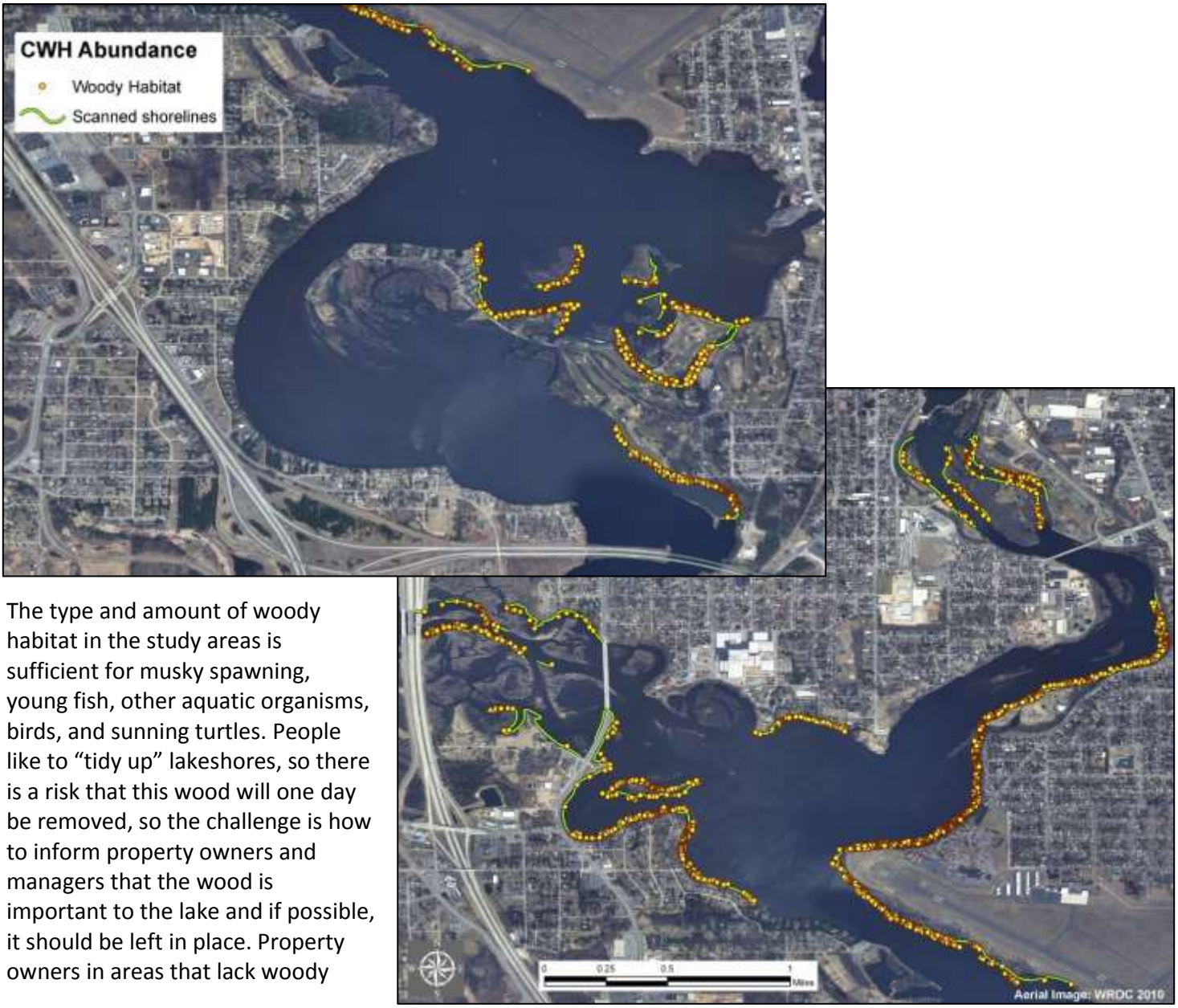
Lake sturgeon were re-introduced to the Wisconsin River near Merrill in Marathon County by WDNR fishery biologists to improve populations of this rare fish. Lake sturgeon were stocked from 2002 to 2006 and have access to Lake Wausau and beyond. Female lake sturgeon reach sexual maturity between 24 and 26 years of age and spawn every 4 to 6 years thereafter (Becker, 1983). Conditions for spawning include water temperatures of 53-59° F and shallow, fast-moving water over hard substrate such as cobble and boulder. This type of habitat can be found in Lake Wausau downstream of Whitewater Park.

Because of their slow sexual maturity, long spawning cycles, and specific habitat requirements, and the successful natural reproduction of sturgeon in Lake Wausau or elsewhere in the Wisconsin River has yet to be determined.

In-Lake Habitat

Woody Habitat

Coarse woody habitat (CWH) consists of downed trees and logs that extend partially into the water, which provides structure used by birds, turtles, young fish, and other aquatic organisms for foraging, spawning, and sun bathing. Woody habitat also reduces wave action, which reduces shoreline erosion. Results of the presence/absence data for the woody habitat from the shoreland survey were incorporated with a more detailed assessment of woody structure below the water. The detailed survey was conducted in limited areas of Lake Wausau, which were recommended by the WDNR Fishery Biologist to further evaluate fish habitat.



The type and amount of woody habitat in the study areas is sufficient for musky spawning, young fish, other aquatic organisms, birds, and sunning turtles. People like to "tidy up" lakeshores, so there is a risk that this wood will one day be removed, so the challenge is how to inform property owners and managers that the wood is important to the lake and if possible, it should be left in place. Property owners in areas that lack woody habitat should consider restoration in places that are not likely to create navigational hazard. The full habitat report can be found in Appendix B.

Lakebed Substrate

Understanding the distribution of substrate in Lake Wausau is key to understanding the ecological requirements for a sustainable fish community. Lake-bottom hardness is an important component for Lake Wausau's fishery. Different species prefer different substrate types for spawning and habitat (Table 1). Although gamefish are more desirable for angling, successful reproduction of non-game species is equally important in Lake Wausau. To anglers, non-game fish are an essential food source to large, desirable game fish. The continued successful reproduction of different game and non-game species of fish that are already present in the system is required to maintain fish diversity and ecosystem health.

Table 1. **Substrate types in Lake Wausau and fish preferences for spawning and habitat. (Crunkilton and Koeller, 2015)**

SOFT muck	HARDER sand, gravel, cobble some spawning in muck	HARD (only) sand and gravel
Bullhead	Tadpole Madtom	Bluntnose Minnow
Catfish	Golden Shiner	Central
Muskellunge	Spotfin Shiner	Mudminnow
Warmouth	Fathead Minnow	Darters
	Black Crappie	Rock Bass
	Bluegill	Smallmouth Bass
	Largemouth Bass	Mottled Sculpin
	Northern Pike	Yellow Perch
	Pumpkinseed	Lake Sturgeon
	Walleye	

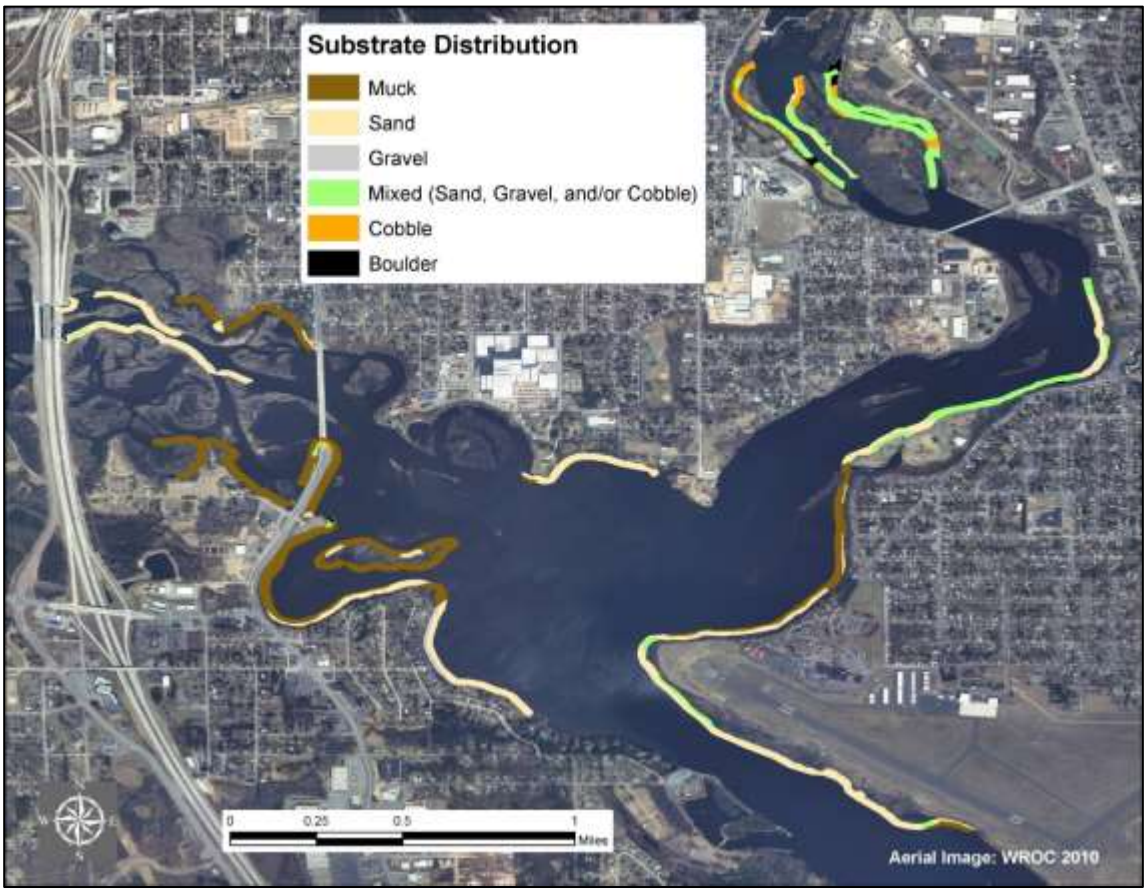
In select sections of Lake Wausau, the substrate-type was mapped using side-scan sonar. This survey was conducted during spring 2013. The fishery biologist with the WDNR felt these areas were most likely to have good substrate or had a good potential for improvements to provide good substrate for game fish. Results of the sediment surveys are displayed on the maps on the next page.

Fish Habitat Improvements near Rib River

As part of this planning effort, the USACE developed a 2-D hydrodynamic model of Lake Wausau to aid in decisions about in-lake management. The problems that had been identified included water quality issues associated with the Hwy N Bridge and those that occur near the golf course, the shallow water depths near the confluence with the Eau Claire River, and the degradation of fish spawning habitat near the confluence with the Rib River. More details about the model can be found in the water quality section and the Appendix.

The WDNR fishery biologist indicated that the area near the Rib River confluence once provide ideal spawning habitat for game fish. However, over the years, deposition of sediments from the Rib River has occurred, altering the morphology in this area. The sediment deposition filled channels that once provided essential habitat. It is believed that the rate of degradation has increased in recent years.

According to the USACE, the scenarios modeled for the Big Rib River area reflected increased flows and more defined channels in the backwaters. The primary means to achieve the habitat improvements included re-establishing a historic channel by the creation of a jetty and culvert near the I 39 Bridge and downstream dredging. The USACE ran a number of scenarios with different sized culverts. The supporting diagrams and results of the scenarios can be found in their report. Prior to implementing any of the scenarios, a sediment transport study should be conducted and the model should be refined. In addition, cost estimates should be obtained to help identify the most cost effective and longest-lasting options.


Substrate Distribution
Muck
Sand
Gravel
Mixed (Sand, Gravel, and/or Cobble)
Cobble
Boulder
0
0.25
0.5
1
Miles
Aerial Image: WROC 2010

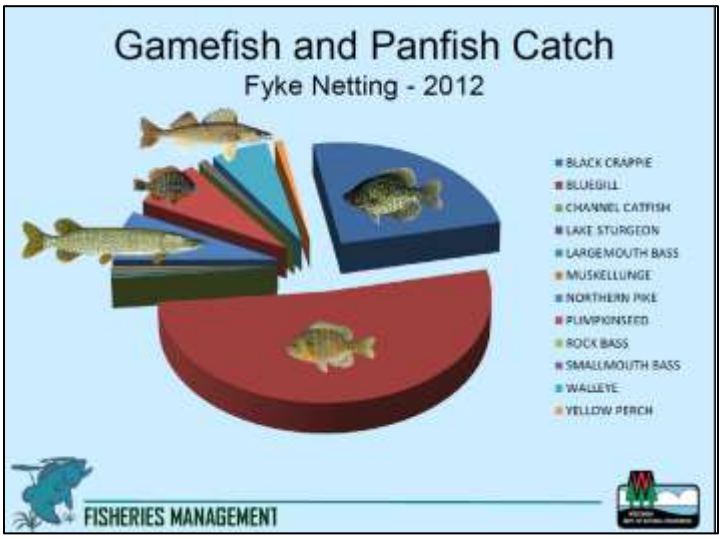

Substrate Distribution
Muck
Sand
Gravel
Mixed (Sand, Gravel, and/or Cobble)
Cobble
Boulder
0
0.25
0.5
1
Miles
Aerial Image: WROC 2010

The Fish Community

Overall, the fish community in Lake Wausau is healthy and thriving; however, there are some adjustments that can be made to achieve a better balance. Managing a lake for a balanced fishery can result in fewer expenses to lake stewards and the public. While some efforts may be needed to provide a more suitable environment to meet the needs of the fish, they usually do not have to be repeated on a frequently reoccurring basis. Protecting existing habitat such as emergent, aquatic, and shoreland vegetation, and allowing trees that naturally fall into the lake to remain in the lake are free of cost. Alternatively, restoring habitat in and around the lake can have an up-front cost, but the benefits will often continue for decades. Ideally, Lake Wausau will contain the habitat, water quality, and food necessary to support the fish communities and provide fishing opportunities for people without a lot of supplemental effort and associated expenses to maintain these conditions.

Fish Surveys and Results

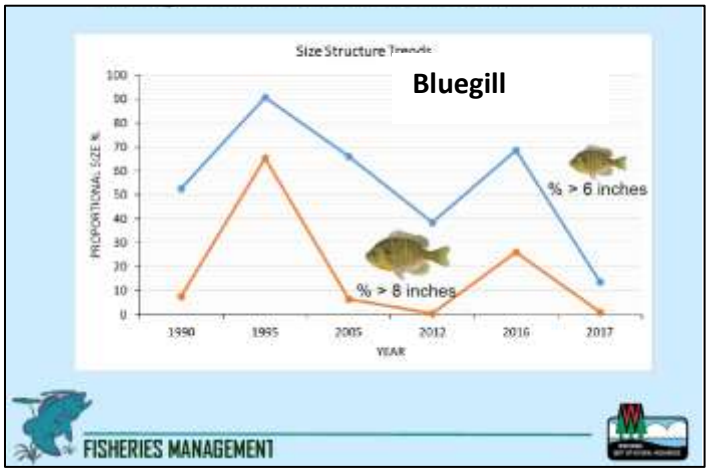
As a part of the development of this plan, Al Niebur, Fishery Biologist with the WDNR met with the group to interpret fish survey data collected from Lake Wausau and help the attendees with recommendations for some of the key gamefish species. His comments and recommendations were primarily based on four comprehensive surveys that were conducted in 1990, 1995, 2005, and 2012. Additional surveys have been conducted to evaluate specific species.



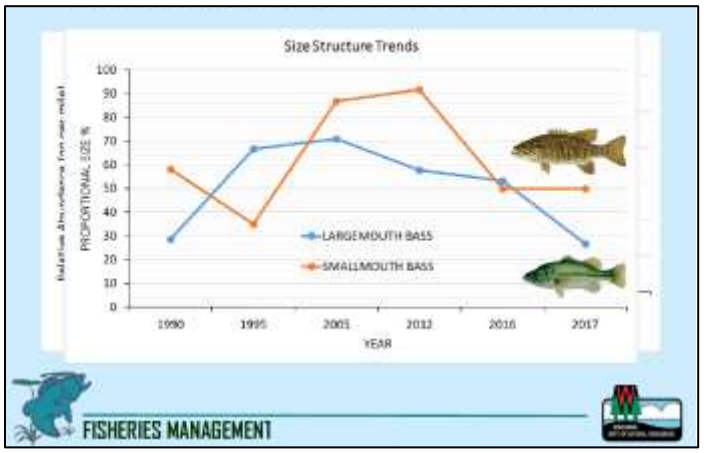
In addition to many non-game species of fish, in 2012, Lake Wausau was host to 12 species of gamefish and panfish. The most abundant species were bluegill and black crappie. Details about abundance and size structure can be found in Appendix C.

In 2012, black crappies were found in moderate abundance, size structure, and growth. Bluegill had moderate abundance and growth; however, their size structure was low, with only 14% of the population above 6 inches.

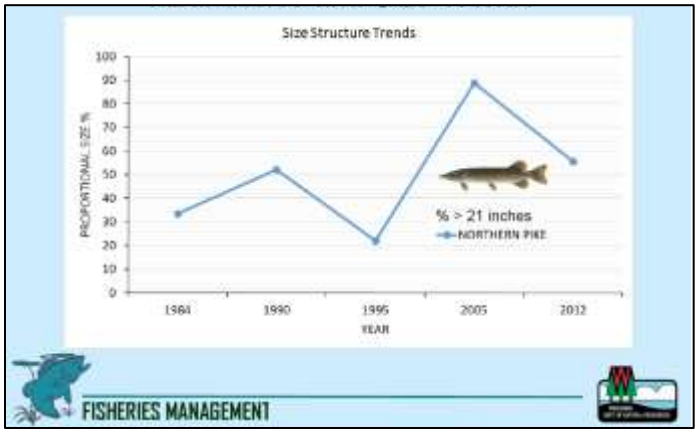
Niebur indicated that most of the fishery in Lake Wausau reproduces naturally, with some exceptions. Muskellunge are stocked. Lake sturgeon had been present in the Wisconsin River system but their movement and ability to spawn was limited due to the dams on the main river and its tributaries. They have been reintroduced into the stretch of river that includes Lake Wausau in an effort to restore their populations.



Black bass were moderate in abundance and growth. The size structure was high, with 89% of smallmouth greater than 14 inches and 57% of largemouth greater than 15 inches. Smallmouth comprised about two-thirds of the bass population in Lake Wausau.

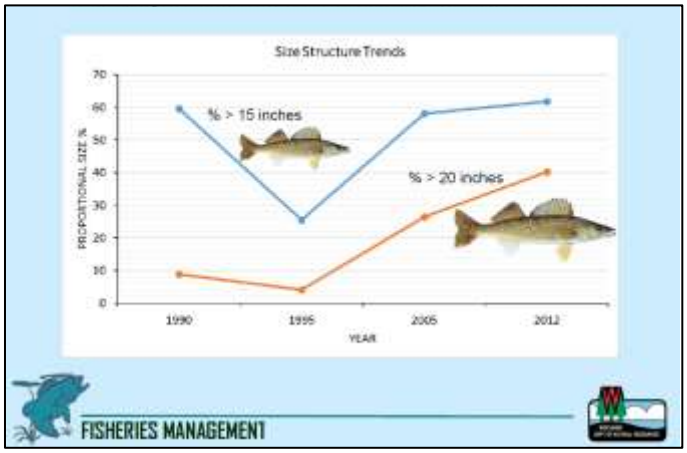


Northern pike were moderate in abundance with a fast growth rate. As a result, the size structure was considered high, with 78% of the population greater than 21 inches. The largest northern pike captured during the survey was 38.6 inches.



Muskellunge had moderate abundance and growth. Size structure was high, with 85% greater than 34 inches. The largest muskie captured was 48 inches.

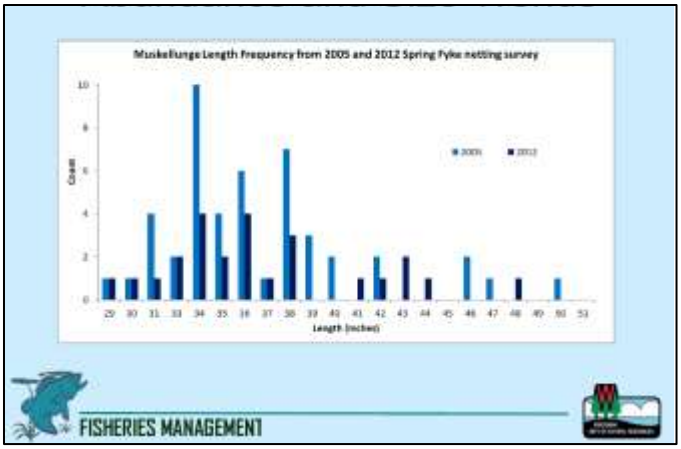
In 2012, walleye abundance and growth were moderate. The size structure was moderately-high, with 73% greater than 15 inches and 49% greater than 20 inches. Walleye fishing regulations were altered in an attempt to increase the percentage of larger fish. Of six flowages on the Wisconsin River, Lake Wausau has had the greatest response to this regulatory change.



When will we know more about the fish community?

The next comprehensive survey of the fishery is scheduled for 2018 to include spring fyke netting and electofishing, Annual fall electrofishing surveys will be conducted in Lake Wausau in upcoming years to track the response of walleye recruitment that is anticipated because of the newer slot-size limits.

To maintain sufficient numbers of larger panfish, regulations were implemented in 2016. A bag limit for panfish is 25 per day, with no more than 10 fish for each species.



HEALTHY FISHERY: What you can do?

- Follow fishing regulations.
- Add some woody habitat or if it exists, let it be.
- Go slow no-wake in the shallows and near shore, where young fish live.

Aquatic Plants

Lake Wausau hosts critical habitat in the form of aquatic plant beds that provide habitat below water, plants that extend above water, and wetlands. Aquatic plants provide valuable habitat and food. Leaves and stems provide structure and habitat for insects in their aquatic forms, such as dragonflies. These creatures consume algae and are food for fish, turtles, frogs, and birds.

Some species of aquatic plants provide valuable food sources for turtles, waterfowl, and fish. Wild celery (*Vallisnaria americana*) is such an important food source for the canvasback duck they share part of their scientific names. Wild rice provides food for migrating waterfowl. It is equally enjoyed by many people and is a critical and spiritual food for the Anishinabe, who named it Manoomin. Wild rice can be found in parts of Lake Wausau where water is slowly flowing and depths are less than 3 feet. Plants with large floating leaves, such as lily-pads provide cool respite in shallow water on a hot summer day and rafts for song birds and insects. The flowering parts of many aquatic plants reach above the water, awaiting visits by bees, butterflies, and other pollinators.

During photosynthesis, aquatic plants infuse oxygen into the water. Near shore, they act as baffles, reducing the energy of waves before they reach and erode shorelands.

Aquatic plants need sunlight to survive so they only grow in Lake Wausau as deep as the light can penetrate. Since Lake Wausau is stained brown from the adjacent wetlands, eight feet of water is the maximum depth that aquatic plants grow.

HABITAT: What You Can Do

- Minimize disturbance of aquatic plants.
- Add some woody habitat or if it exists, let it be.

Can there be too much plant growth?

While aquatic plants provide many benefits to Lake Wausau and its inhabitants, an excess of plant growth occurs in some regions of the lake, especially where flow is minimal, bottom substrate is mucky, and nutrients are abundant.

In some situations, aquatic plants can produce nuisance conditions for water quality, recreation or aesthetic issues. When this is the case, it is important to understand the aquatic plant community to determine the best ways to address problems without disturbing the balance of the aquatic ecosystem. These concepts were at the forefront during the development of an aquatic plant management plan (APM) for Lake Wausau.

Lake Wausau's Aquatic Plant Communities

Understanding the aquatic plant community and how it may be changing can help with the appreciation of the community and what it offers the aquatic ecosystem. This knowledge can also alert us to problems and how best to address them. The aquatic plant surveys conducted in 2012 and 2017 revealed that Lake Wausau

is home to many unique species of aquatic plants as well as some potentially problematic invasive species. Two surveys were conducted in each year; one focused on curly-leaf pondweed, CLP (*Potamogetan crispus*) early in the summer and the second characterized the full plant community. Different grid sizes were used to accommodate the variation in channel size within the flowage; a 45 m grid in the Rib River section and a 90 m grid in the Lake Wausau section. Details of these survey results can be found in Appendix D.

The presence of aquatic plants are not uniform across Lake Wausau. In many areas, especially where water depths are greater than 8 feet, few if any plants grow. The density of aquatic plant growth is also intermittent in the flowage. A map in Appendix E displays the rake fullness (plant density) for all of the vegetated sites in the 2017.

Aquatic plants exist in wet conditions, submergent types spend the majority or all of their growth below the water, floating types such as lily pads or duckweed have some or all of their growth on the water's surface, and emergent types are often rooted in water with much of their growth above the water. Examples of emergent species in Lake Wausau are cattails, bulrush, and wild rice.

Rib River Section Summary of Native Species

In total, 38 native species of aquatic plants have been identified in surveys of the Rib River section. The majority of species were submergent types. Nine floating-leaf types of plants were found and five emergent species which included, needle spikerush, sedge, water horsetail, wild calla, and wild rice.

This section had good aquatic plant diversity, with an average of nearly 5 species of plants/site. Two very high quality species were found, spiny hornwort (2012) and Vasey's pondweed (2017). Management options that create different conditions or include the use of chemicals should be avoided in the areas where sensitive species are found.

Lake Wausau Section Summary of Native Species

In total, 37 native species of plants were identified in the Lake Wausau study area. Most species were submergent. Nine floating-leaf types of plants were found including six tiny duckweed-like species two larger water lily-like plants and one floating liverwort. Two native emergent species were noted, pickerelweed and a bur-reed.

The Lake Wausau section hosted good plant diversity. Three high quality species were found, spiny hornwort (2012), Oaks' pondweed (2012), and creeping bladderwort (2012).

Aquatic Invasive Species (AIS) in Lake Wausau

Aquatic plants commonly found in Lake Wausau.

Aquatic invasive species frequently hail from other continents, often in bilge water in ships entering the Great Lakes. In some cases, they are desirable horticultural species that grow in abundance in their new homes. They are frequently spread to Wisconsin lakes by boats, trailers, and other equipment moved from one lake to another. Three species of AIS were identified in Lake Wausau during the aquatic plant surveys; Eurasian watermilfoil, EWM (*Myriophillum spicatum*), CLP, and purple loosestrife (*Lythrum salicaria*). All three species were scattered throughout the flowage.

The presence of these species suggests that increasing prevention efforts is warranted to prevent new AIS from becoming established in Lake Wausau. Many flowages in Wisconsin provide conditions for AIS to flourish, making it critical to reduce the potential for AIS to enter Lake Wausau. If it does enter, early detection and quick response to a newcomer is essential. In addition, it is important for boats, trailers, and equipment leaving Lake Wausau to be checked for aquatic plant material and sediment and any material be removed. To reduce duplicative efforts, Lake Wausau's strategies should be included in the countywide communication strategy about AIS prevention. This will help to control the spread to other water bodies.

Purple loosestrife

Purple loosestrife inhabits wet shorelands around Lake Wausau. This perennial plant was originally brought to Wisconsin for use in flower beds. Each plant produces thousands of seeds, having the ability to reproduce quickly and outcompete many native wetland species. Its purple steepled flowers resemble other native species so it is important to learn the difference before eliminating the plant.

Individual plants and their roots can be removed by hand. For larger populations, bio-control is frequently used in the management of purple loosestrife. Purple loosestrife beetles, *Galerucella*, can be collected from the wild or obtained through the WDNR. The starter populations of beetles are bred and released into the purple loosestrife population. Although the beetles do not kill the plants, they reduce flowering, seed production and overall height of the plants. The shorter plants allow native species to successfully compete for sunlight and nutrients. Domtar and other local efforts already conduct some purple loosestrife management on Lake Wausau but LWA could enhance these efforts. Training and assistance is available through the local AIS Coordinator or Golden Sands RC&D Council, Inc.

Eurasian watermilfoil (EWM)

EWM is likely the best known AIS in Wisconsin because it has become a nuisance in many lakes. EWM is a perennial aquatic plant that grows up to the water surface to flower, become pollinated, and produce seeds. When it grows in dense stands, the plant parts at the surface can make navigation difficult and feeding by predatory fish nearly impossible. New EWM plants can grow from seeds and fragments of the plant. Fragmentation can occur when plant parts are broken up by motor propellers, improper removal techniques, and by natural means in the fall.

Fortunately, the EWM in Lake Wausau has not been behaving aggressively and is quite sparse where it has been observed. EWM was noted at 15 sites in the Rib River section and 47 sites in the Lake Wausau section; the majority were visual observations.

It is important for lake users to learn to identify EWM so they can look for it in Lake Wausau and notify biologists if they suspect it is becoming more abundant. Other native, non-problematic species can be confused for EWM to those untrained. All users of Lake Wausau should check boats and other equipment and remove any fragments to reduce the chance of spread to other lakes and rivers.

Curly-leaf pondweed (CLP)

CLP is a non-native aquatic plant with a growth pattern that differs from native aquatic plants by growing below the ice during the winter, making it one of the first aquatic plants with full growth by June. In June, the plants senesce (dieback). For this reason, it does not typically impede recreation; however, it releases nutrients into the warmer water as the tissue dies. These nutrients often spur the growth of filamentous algae throughout the remainder of the summer. CLP propagates itself by two mechanisms. It produces buds called turions that can become situated in the lake sediment and develop into new plants. It also spreads by rhizomes (roots).

During the June 2017 survey, CLP was found at 120 sites in the Lake Wausau section and 20 sites in the Rib River section. While this may seem like a lot of sites, the average rake fullness was sparse and the majority of CLP plants or plant beds were sparse to moderate in density. Only five sites had dense growth. Any CLP harvesting activities should focus on the areas with the greatest density in areas that would result in water quality issues or nuisance to recreation. A map showing the density of CLP in 2017 is located in Appendix F.

Aquatic Plant Management Strategy Summary for Lake Wausau

Aquatic Invasive Species (AIS)

Prevention

Communication is essential to the prevention of AIS in Lake Wausau. Details about prevention options can be found in Turyk and Hamerla, 2017.

1. Ensure clear messaging exists at all points of access to Lake Wausau, Rib River, and Eau Claire River. Work with partners on the Wisconsin River upstream of Lake Wausau.
2. Coordinate efforts with partners and other lake/river groups in Marathon County to ensure community-wide messaging is being conducted efficiently.
3. Develop and carry out a Clean Boats/Clean Water program for Lake Wausau.
4. Communicate with LWA members about the importance of AIS prevention.
5. Involve youth in communication efforts. Schools and clubs can be helpful in crafting messages and spreading the word.

Monitoring

1. Provide annual opportunities to learn to identify AIS from native lookalikes. Involve people recreating in different areas of Lake Wausau and involve youth.
2. If new AIS is suspected, contact biologists for confirmation.
3. Work with biologists to develop a rapid response strategy to eradicate new AIS.
4. Inform lake users if new AIS is confirmed.

EWM

1. Learn to identify EWM and monitor its presence in Lake Wausau.
2. Contact biologists if EWM appears to be spreading.
3. Remove plants by hand. Learn proper hand removal techniques to avoid fragmentation of plants.

Purple Loosestrife

1. Continue monitoring for purple loosestrife and record locations on maps.
2. Coordinate with Domtar's monitoring and eradication efforts.
3. Inform property owners about how to properly identify purple loosestrife and techniques that can be used to eradicate individual plants or small beds.

Curly-leaf Pondweed (CLP) Management - Permit Required

The purpose for the management of CLP Lake Wausau is to improve localized water quality conditions that result in summer algae blooms and filamentous algal growth. Mechanical harvesting been determined to be the best option for Lake Wausau because the harvested plants remove the plant tissue and associated nutrients from the flowage which helps to achieve the management goal. In addition, the flow of water in the flowage does not provide sufficient contact time for chemical treatments to be effective. The use of chemicals would leave plant materials and associated nutrients in the flowage where they could enhance the growth of algae and aquatic plants, which does not result in achievement of the goal.

LWA has worked with staff from WDNR and UWSP to identify the locations where harvesting is most desirable. Because of the lifecycle of CLP, harvesting will achieve the greatest benefits if conducted when plants are at maximum growth, before senescence begins, which typically occurs in early June.

Harvesting has been permitted at specified locations in the flowage that have water depths that are sufficient to prevent the disturbance of sediment by the harvesting equipment. Maps of the permitted locations are displayed in Appendix E and can be found on the WDNR Surface Water Data Viewer. A skimmer can be used to remove floating plant fragments. The nutrient-rich cut plant material should be disposed of on land and away from shorelands and wetlands.

Wild Rice may not be mechanically harvested. The operator of the harvester should watch for wild rice since its location varies from year-to-year in Lake Wausau.

A permit approved by biologists with the WDNR is required for harvesting activities. New permits will need to be issued for harvesting to occur in 2018. The permit period can be up to 5 years. In 2023, a new permit will need to be sought and prior to that, a new aquatic plant survey should be conducted to evaluate the status of

the aquatic plant community and determine if any adjustments in strategies are warranted.

Discussions about EWM Management

Removal by hand is the strategy of choice for EWM control. Hand harvesting removes the plant materials and associated nutrients from the lake. However, fragmenting the plants can result in the generation of new plants, so proper removal techniques should be followed.

The use of chemicals to manage plants was also discussed. For several reasons, it was determined this option would not be appropriate for the conditions in Lake Wausau. When chemicals are used, the plant tissue remains in the waterbody where it accumulates on the lakebed and releases nutrients that would fuel algal blooms and enhance the growth of aquatic plants. In addition, many chemicals require a minimum time of contact with a plant to be effective. The rate of flow in Lake Wausau would dilute chemicals before they would be effective. Many of the areas with less flow, such as bays, already have problems with algae blooms.

Water level manipulation is used in some flowages that have dense beds of EWM. This is not the case in Lake Wausau. Should EWM populations explode, this option should be discussed.

Additional Aquatic Plant Management in Lake Wausau

Floating aquatic plants and plant fragments can build up on the surface of the water due to winds or currents. Some of the plants in Lake Wausau that float either routinely or seasonally that may create a nuisance includes filamentous algae, coontail, water celery, and duckweed. Even outside of the areas identified for harvesting, these floating plants can be removed by skimming the surface of the water.

Notable Habitat

Lake Wausau and its tributaries host special habitat for a number of species. The following maps and observations were made by Tom Meronek, WDNR fisheries biologist and Chris Hamerla, biologist with RC&D and longtime resident of the Wausau area. Many of these areas should be considered for critical habitat designation by the WDNR to ensure their value continues. NOTE: This was not a comprehensive assessment; there are other important areas in Lake Wausau that have not been included in this documentation.

Rib River Confluence Map

Abundant wildlife including muskrats, waterfowl, deer, various wading birds and song birds were commonly observed in this section of Lake Wausau.

The back sloughs of the Rib River had a high level of aquatic plant diversity (shaded green). Emergent and submersed species were abundant. The yellow star is the approximate location of Vasey's pondweed, an aquatic plant species of special concern.

Beds of dense wild rice observed in 2016 are shown on the map as orange hatched areas. These beds appeared to be less dense in 2017. Scattered small groups of wild rice were observed throughout the green shaded areas in this section.

Notable habitat map: Rib River Confluence.

Comments by Tom Meronek:
The upper confluence with the Rib River between the bridges is an important spawning area and nursery for bluegill and other sunfish, northern pike, and musky. Walleye, northern pike, and musky also stage in the green shaded area and transition to spawning in the Rib River.

Upper Lake Wausau Map

The green shaded areas displayed on this map had an abundance of waterfowl and muskrats. Aquatic plants were also abundant. Wild rice was scattered throughout area "A".

The red polygon marks the blue heron rookery. Waterfowl, muskrats, wading birds and song birds were commonly observed.

The pink oval shows the approximate shallow gravel/rock bar that supports an abundant mussel population. This observation was made during the 2016 drawdown of the lake.

Comments by Tom Meronek:
The back-bay "fingers" are important spawning area and nursery for bluegill and other sunfish, northern pike and musky.

Walleye, smallmouth bass, and northern pike use the south shoreline of area "A" for spring pre and post spawn staging.

Memorial Park did not have highly important use by fish except for transitioning to spawning areas near the dam.

The shores near the airport provide spawning area for musky, walleye, black crappie and in the bay yellow perch. The deep water rock is good for overwinter use by these species.

Notable habitat map: Upper Lake

Lower Lake Wausau Map

Waterfowl, muskrats, deer, wading birds and songbirds were commonly observed in the green shaded areas on this map. In 2016, abundant wild rice was found in the areas identified by orange hatch marks; however, in 2017 the populations were reduced. Wild rice was also scattered throughout the green shaded area.

Bluegills and black crappies were observed to be spawning in many of the shallow bays and sloughs surrounding the golf course and Pine Island. Bluegill and black crappie were observed to be spawning in the area identified by the pink horseshoe-shaped line.

Comments by Tom Meronek:
The back-bay "fingers" are important spawning area and nursery for bluegill and other sunfish as well as northern pike and musky.

Notable habitat map: Lower Lake Wausau.

GOAL 2:

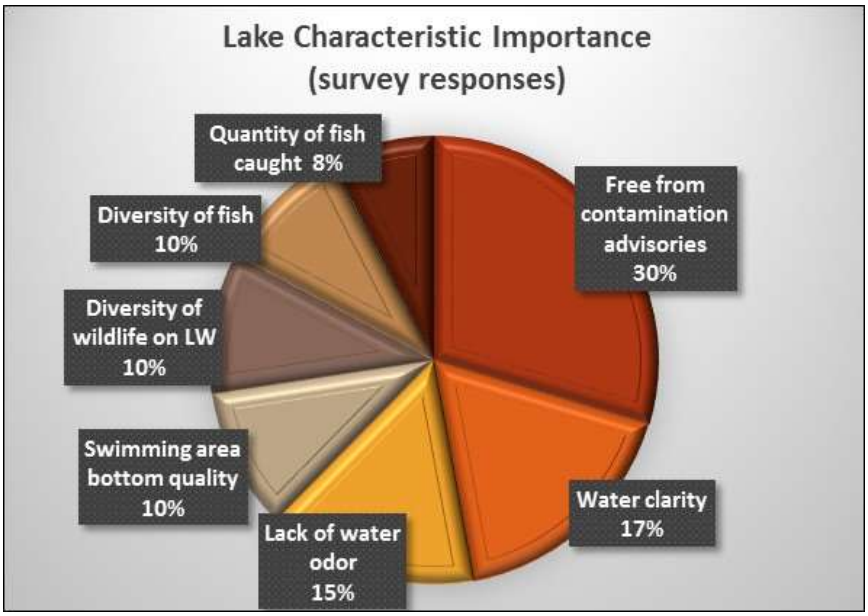
Improve and Maintain Water Quality in Lake Wausau.

Water Quality and Land Management

What did the people say about water quality?

(Survey results, Thompson et al 2014)

When asked to rank the importance of seven lake characteristics, being free from contamination advisories, good water clarity, and lack of water odors ranked the highest among those surveyed.



Perceptions about good or poor water quality varies with each person, typically due to their expectations, experiences, and understanding. The landowner survey included a series of questions to understand people's opinions and knowledge about water quality in Lake Wausau.

Some of the people who are concerned about the "weeds" and algae in Lake Wausau did not recognize the connection between the aquatic plant growth in Lake Wausau and the near-shore and watershed-wide land management practices. This may create an impediment to discussions about the need for changes in land management that would lead to reduced algal and aquatic plant growth. (Source: Floress, 2014 p 14).

The majority of survey respondents indicated that water quality in Lake Wausau had minimal negative effects on their recreational activities. However, approximately 20% of respondents indicated that poor water quality effects fishing and ice fishing "most of the time", (defined as greater than 76%). This difference in perception may be related to the location of where people are recreating in Lake Wausau and the time of year they are recreating. Nuisance-level water quality was identified by fewer than 25% of users of Lake Wausau, which included those that experience the lake from the land and the water.

Problems Related to Water Quality

Some areas of Lake Wausau experience nuisance algal blooms or extensive growth of aquatic plants. These issues are primarily located in bays or areas with minimal flow. Localized effects can also result from nearby sources of nutrients.

Nutrients, such as nitrogen and phosphorus, can facilitate the growth of algae and aquatic plants. It is the growth of these plants that are often perceived by the public as the problem; however, since many people may not attribute this growth to the quality of the water, addressing the source of the problem can be difficult. Helping landowners make this connection may provide people with the motivation needed to reevaluate and adjust the way they manage their land. A discussion about ways to lessen water quality impacts from land management can be found later in this section of the plan.

Water Quality in Lake Wausau

The quality of water in the flowage is effected by the surrounding geology, amount of wetlands, and the quality of water entering Lake Wausau from the Wisconsin, Rib, and Eau Claire Rivers, and local runoff.

Some water quality data have been collected in Lake Wausau, but has been sporadic over the years. It is difficult to make statements about long-term trends because of the inconsistent data; however, the existing data still provides some insights about the water quality conditions.

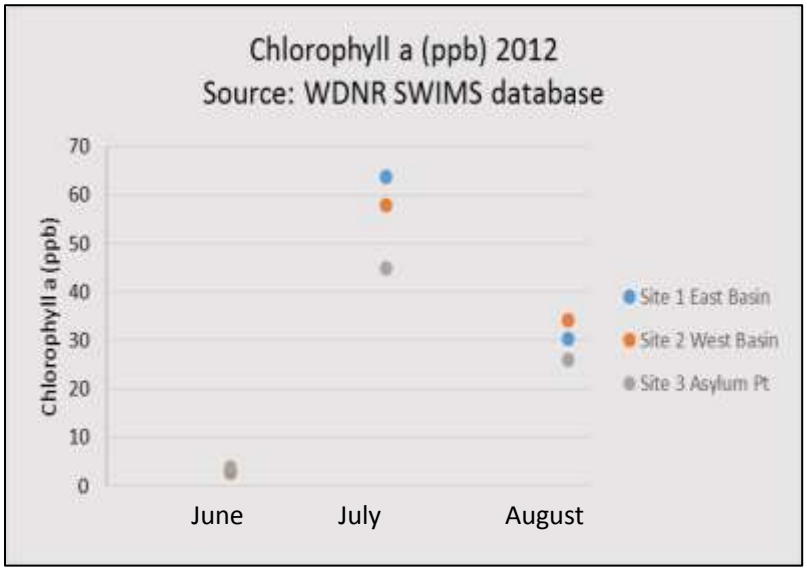
In summary, a review of the data indicated that oxygen concentrations were sufficient to support the species of fish in Lake Wausau. The water is moderately-hard, which provides sufficient calcium for the formation of bones, teeth, and shells of animals living in Lake Wausau.

Water Clarity and Algae

Water clarity is a measure of how deep light can penetrate into the water, which is affected by the brown staining of the water, suspended sediment, and the amount of algae.

In Lake Wausau, volunteer monitors measured water clarity in the East Basin, West Channel, and Asylum Point in the 1990s, 2011, and 2012. Water clarity ranged between 2 feet and 4.75 feet deep, with minimal differences between the basins. Lake Wausau has brown stained water, originating from wetlands. This is not harmful, but reduces the water clarity and the depths that aquatic plants can grow. Some of the variability occurred depending on the season. The best water clarity occurred in May, before the water warmed to temperatures preferred by algae. The poorest measurements occurred in July and August when the water is warmest. Unless the measurements were made following a storm, the poorer water clarity resulted from algal growth.

Chlorophyll *a* is used as a measure of algae. A pattern similar to water clarity existed with chlorophyll *a* in samples collected in 2012. In July the concentrations were high (44-63 ppb) and variability occurred between the three sampling sites in Lake Wausau. Ideally, concentrations should have a median of less than 20 ppb between July 15 and Sept 15. Routine sampling would indicate if algae Lake Wausau remains below this concentration.



What causes algae to bloom?

The nitrogen concentrations in Lake Wausau were relatively low, indicating that phosphorus is the primary nutrient responsible for algae and plant growth.

In 2012, a sufficient number of samples were collected from Lake Wausau to enable comparison to Wisconsin's phosphorus standard for large rivers, which is 100 ppb. Median summer phosphorus concentrations at the East Basin, West Channel, and Asylum Point sampling sites were 80, 71, and 63 ppb, respectively.

Additional water quality monitoring should be conducted in areas of Lake Wausau that experience problematic algal blooms to better understand the localized water quality conditions that may be responsible for the blooms. This will help to guide future actions and will allow for the assessment of any remediation actions put in place to reduce localized algal blooms. See the Water Quality Monitoring Strategy in Goal 2 for details.

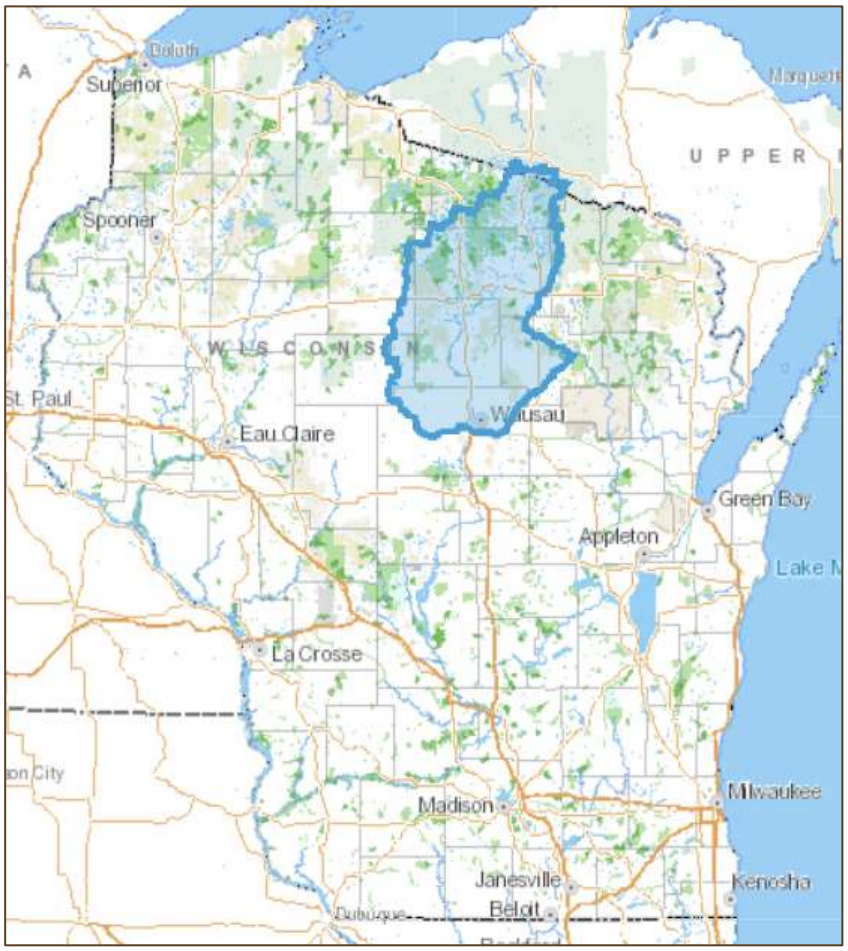
The Landscape and Water Quality

Where does the water come from?

To address the water quality problems in Lake Wausau, it is important to understand where the water originates. Most water enters Lake Wausau from the Wisconsin River. Water also comes from the Rib and Eau Claire Rivers and stormwater runoff from surrounding neighborhoods. In addition, stormwater is transported from parts of Wausau through storm sewers and discharges to Lake Wausau.

The Wisconsin River is a complex river system with its headwaters at Lac Vieux Desert in northeast Wisconsin. The area that drains to Lake Wausau includes the upper Wisconsin River watershed, which extends to the Wisconsin/Michigan border, shown in blue on the map.

Upper Wisconsin River Watershed



Land Management and Lake Wausau

The Wisconsin River watershed includes a tapestry of land uses and land management practices. While forests, grasslands, and wetlands allow precipitation to soak into the ground, resulting in more groundwater and improved water quality, other types of land uses may result in increased runoff and may have sources of pollutants that can influence portions of Lake Wausau, its inhabitants, and the growth of aquatic plants.

Frequently, it is the cumulative effect of many small impacts that create problems in lakes and streams. The way water moves across the landscape towards the waterbody and what it comes in contact with in route affects the water chemistry, amount of algal and aquatic plant growth, water temperature, and fish spawning habitat. These variables play a role in the health of the fishery and aquatic ecosystem as well as the aesthetic appeal of Lake Wausau.

Potential Problems from Landscape Activities and Alterations

- Increasing the amount of runoff to the rivers and Lake Wausau.
- Increased delivery of sediment, nutrients and other pollutants to the rivers and Lake Wausau.
- Local loss or alteration of wetlands and their services.
- Loss of important habitat.

Impervious (Hard Surfaces)

Importance: Development on the land may result in changes to natural drainage patterns, alterations to vegetation on the landscape, and may be a source of pollutants. Impervious surfaces such as pavement, rooftops, and compacted soil prevent rainfall from soaking into the ground, which can result in more runoff carrying sediment and pollutants to the lake, create a greater potential for erosion, and increase the temperature of the water. Storm water, wastewater, animal waste, and fertilizers used on lawns, gardens and crops can contribute nutrients that enhance the plants growth in Lake Wausau.

Solutions: Minimizing the amount of impervious surfaces in the design of subdivisions and other

developments can help to reduce water quality impacts and stormwater management costs. Examples include reducing driveway length/width or the amount of roadway in a development, and designing smaller building footprints.

Land management practices used to mimic natural processes and the reduction or elimination of nutrient additions to the land help prevent the nutrients from reaching the water. Ideally, runoff from impervious surfaces should be directed towards depressions on the landscape where particles can settle out and water can soak into the ground prior to reaching the lake or storm drain. The depressions may be naturally occurring or intentionally placed.

Depending on the amount and type of impervious surface, runoff management may include the use of raingardens, retention basins, or swales. Identifying storm drains with "drains directly to the river" signs may help to reduce the disposal of oil and other substances into the street drains and street cleaning can reduce the amount of solids and pollutants delivered to Lake Wausau.

Sediments and Pollutants

Reducing runoff can help reduce the amount of pollutants delivered to Lake Wausau, but reducing the amount of pollutants available to be carried by the runoff or groundwater is also beneficial. Intercepting runoff to allow particles and associated pollutants to remain on the landscape is desirable. This can be achieved using retention ponds and other depressions on the landscape and with unmowed vegetation, especially near the shorelands or on the top of a slope adjacent to Lake Wausau. Controlling erosion during construction, from farm fields, mining sites, or along the shorelands can also help to reduce the movement of soil and its nutrients to Lake Wausau and its tributaries.

Non-Metallic Mines and Water

Depending upon their location and management, non-metallic mines and their processing activities have the potential to be sources of a variety of materials in runoff. Sand and soil can be transported into wetlands and waterways. Once in a stream or river, this material may be deposited or conveyed downstream with the river flow. The deposited material can reduce water depths in the waterbody, alter bottom materials which may affect habitat, and carry nutrients or elements that could change or harm the aquatic ecosystem.

The non-metallic mines in the Lake Wausau watershed in Marathon County are primarily sand and gravel mines. State and local ordinances are designed to minimize the movement of materials from mine sites; however, depending on the jurisdiction, monitoring and enforcement of the ordinances may not be uniformly implemented.

Metallic Mines and Water

Like non-metallic mining, site disturbance from metallic mining can result in the movement of soil and other materials from the landscape into local wetlands and waterways. In addition, some metallic mines are associated with types of rock that become acidic from contact with oxygen. The resulting acidic water can mobilize metals, which can then leach to groundwater or flow into wetlands and waterways in runoff. Metals can have adverse effects on aquatic ecosystems.

In some cases, site designs and mining practices can be developed with the intent of reducing impacts to wetlands and waterways. Once mining has ceased, proper steps in closure can help to reduce long-term impacts of mining on the local population and the environment. Currently, Marathon County helps to assure that closure in conducted in a timely manner that is consistent with regulations.

Shorelands

Importance: The land nearest Lake Wausau may have the greatest localized impact on water quality and habitat. In addition to the health of Lake Wausau and its inhabitants, a healthy shoreland can provide privacy to people on land as well as those recreating on the lake.

Lake Wausau Assessment: Understanding the conditions of Lake Wausau's shoreland health provides guidance about where conditions might need to be protected or improved. In 2013, shoreland assessments were conducted. They focused on disturbance and on the status of shoreland vegetation. A brief summary of the results follow. Additional details about Lake Wausau's shorelands, including summary tables and maps, can be found in the Lake Wausau Shoreland Survey report.

Solutions: Incorporating key components of a healthy shoreland into land management strategies can lead to a healthy lake and enjoyment of the property. In an urban setting, some people prefer a managed look, which can be achieved while still providing components of a healthy shoreland. It is important to understand what you are trying to achieve and choose strategies that are attractive to you and fit your lifestyle and use of the shoreland.

Shoreland Vegetation

Importance: Shoreland vegetation is critical to a healthy lake. It helps to improve the quality of runoff flowing across the landscape towards Lake Wausau and also provides habitat for many animals including birds, butterflies, frogs, turtles, and a variety of small and large mammals. Shoreland vegetation that extends into the lake provides habitat for fish.

What is healthy shoreland vegetation?

Healthy shoreland vegetation includes a mixture of native grasses, flowers, trees, and shrubs that extends at least 35 feet inland from the water's edge. Greater depths of shoreland vegetation provides more habitat, protection from soil erosion, improved water quality, and reduced shoreland erosion. Shoreland vegetation stabilizes the shoreland by holding soil in place.

Trees and shrubs reduce the impact of rain on barren ground and provides habitat for song birds and other wildlife. Natural leaf litter or pine needles act as a sponge by retaining water, thus reducing runoff.

Wetlands occurring on shore provide critical services to Lake Wausau and its ecosystem. Wetlands host a dynamic environment, supporting a variety of aquatic and terrestrial animals and plants and provide important spawning and breeding areas. Many recreational opportunities are provided by wetlands

such as canoeing, hunting, and bird watching; and help to support foods like fish and wild rice.

Wetlands retain large amounts of water from runoff events and release it to Lake Wausau slowly over time. Wetlands also reduce wave energy that can erode shorelands.

Lake Wausau Assessment: Lake Wausau has some long stretches of healthy shoreland. The findings showed that short unmowed grasses and flowers, extending inland for 35 or more feet, occurred on approximately 24 linear miles of Lake Wausau's shorelands. Other stretches could be improved; approximately 190,500 feet of Lake Wausau's shoreland did not meet the 35-foot goal.

Trees and shrubs were present on approximately 86% of Lake Wausau's shoreland.

Solutions: Healthy shoreland vegetation can be restored in a variety of ways. Some people just stop mowing, while others prefer a more managed look. If possible, incorporate native grasses, flowers, shrubs, and trees into your design.

Shoreland Disturbances

Erosion and Barren Shorelands

Importance: Shoreland erosion is the loss of soil resulting from water movement across the landscape. Unmanaged runoff from impervious surfaces can lead to additional runoff near the shore, further facilitating erosion. Adjacent to the water, streambank erosion can occur from waves or flowing water.

Shoreland erosion adds sediment, nutrients, and other pollutants to the water and may result in a loss of land. In the lake, the eroded soil can make water cloudy and blanket fish spawning habitat. The loosely bound soil in the lake can prevent aquatic plants from taking root, leading to more frequent and intense algal blooms. In some areas of Lake Wausau, the additional buildup of sediment in the water reduces water depth, impeding access to recreational boaters.

Lake Wausau Assessment: Estimates of erosion on the shores of Lake Wausau totaled 3,172 linear feet. Shorelands with greater slopes along Lake Wausau were particularly vulnerable to erosion.

Barren shorelands were identified on 4,503 feet of Lake Wausau's shoreline.

Solutions: Water diversions, rain gardens, terraces, and planting or protecting deeply rooted native vegetation are some of the practices that can be employed to reduce runoff and erosion.

Meandering pathways and open-backed stairways can help to reduce erosion from access points to the lake. On the steep slopes around Lake Wausau, managing runoff at the top of the hill will help to reduce hillside erosion. In addition, it may be necessary to stabilize erosive sites on the hillside.

Marathon County staff and knowledgeable landscapers can assist interested landowners to ascertain the best approaches for a specific site.

Seawalls, Riprap, and Beaches

Importance: Loss of habitat can result from seawalls, riprap, and artificial beaches. Even boat landings and docks reduce the natural shoreland. Their cumulative effects can reduce the presence of quality habitat.

Lake Wausau Assessment: Riprap was identified at 186 sites with an estimated length of 38,750 feet. (Note: This is an underestimate since all sites identified in the survey as "greater than 100 feet in length" were calculated as 100 feet.)

Seawalls comprised an estimated 2,837 feet of Lake Wausau's shoreline.

During the 2013 survey 257 docks, 11 boat landings, and 3 dams existed on Lake Wausau.

***Solutions*:** Depending on the location within Lake Wausau, riprap or sea walls may not be needed to armor shorelands. In some cases, natural bio-logs may be used to replace the rock armament, providing shoreland stability and as well as habitat.

Culverts

Importance: Culverts transport debris that includes nutrients from fertilizer, soil, pet waste, and other organic material. Additional pollutants may include trash, chemicals from street maintenance, oil, grease, and metals from motorized vehicles.

Lake Wausau Assessment: Fifty culverts were inventoried around Lake Wausau, ranging from 0.5-3.5 feet in diameter. Most were storm water culverts, designed to discharge water from streets during snow melt or storm events. Storm water runoff can have localized impacts on water quality.

Solutions: Managing stormwater runoff on individual properties can reduce the amount of runoff and debris that is transported directly to Lake Wausau. Discouraging residents from using the storm drains as disposal sites for oil and other trash will

reduce the amount of pollutants that are discharged directly to Lake Wausau

Structures

Importance: Impervious rooftops generate additional runoff to the lake and streams. The added runoff can carry pollutants, leading to localized water quality problems.

Lake Wausau Assessment: One hundred fifty-six structures were observed within the 75 feet of Lake Wausau. Inventoried structures included principle buildings, detached decks, patios, gazebos, boathouses, and large storage containers.

Solutions: Managing runoff from hard surfaces can be accomplished by directing runoff from the landscape to depressions. Rain gardens are intentionally constructed to capture runoff and planted with attractive native plants. These practices are best if coupled with healthy shoreland vegetation which can help to manage nutrients and particles carried in runoff before they reach the lake.

Newly constructed raingarden.

Encouraging Change to Benefit Lake Wausau

Many people living around lakes are not aware of how the land management practices they choose may affect the lake they love. There are many strategies that can be selected to aid this understanding, which is needed before intentional changes are made. Starting the conversation and encouraging small steps can result in the greatest outcomes. Keep in mind that "beauty is in the eye of the beholder" holds true for a property owners' views of what they consider appealing on their landscape. Using visuals and examples can help people understand that the looks of healthy shorelands can vary need and still retain the desirable functions that improve water quality and provide habitat.

Information and Incentives

A variety of information about healthy shorelands exists. The selection of materials and strategies should be based on their appeal to a neighborhood or community.

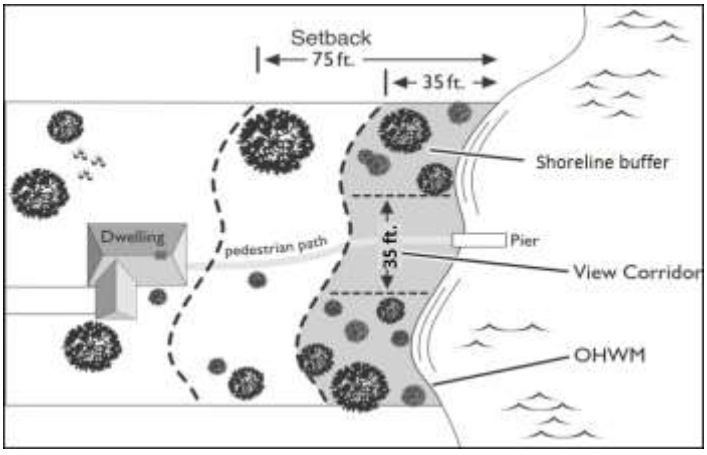
Demonstration sites on public land provide examples of good shoreland practices that can be viewed by anyone. Providing signs or brochures about the healthy shoreland management techniques used at these sites can enhance their value. The involvement of community or youth groups in the creation of demonstration sites along with media coverage is a way of getting the word out about the shoreland improvements.

A website has been created to aid shoreland property owners in identifying options for their land http://healthylakeswi.com. Since changes in shoreland health benefit the water held in trust for all of Wisconsin's citizens, grant funding has been made available through the WDNR to assist shoreland property owners with costs associated with improvements in shoreland and runoff management practices. In some cases, communities may also provide incentives through local cost-share programs, tax incentives, assistance by staff, and awards or other recognition.

Shorelands: Community Rules and Norms

In 1964, the state of Wisconsin adopted a shoreland zoning ordinance to protect public waters while allowing for shoreland development. These rules apply to unincorporated areas. In recent years, a better understanding about the relationships between lake water quality, habitat, and shoreland management led to some adjustments in the ordinance, following years of public input. Incorporated communities like the City of Wausau can adopt all or part of the state's shoreland zoning ordinance or create their own ordinance to protect their local lakes.

Pictorial depiction of Wisconsin's shoreland zoning ordinance.



OHWM = ordinary high water

Comprehensive land use plans for the towns, villages, cities, and the county also provide guidance that effects the health of Lake Wausau. In addition, the Marathon County Land and Water Resource Management Plan identifies steps to keep the county's lakes clean. A summary of local, state, and federal codes related to Lake Wausau can be found in Thompson et al. 2014.

Examples of books and brochures related to healthy lakes.

Addressing Water Quality Problems

Lake Wausau as a whole is not experiencing water quality problems; however, problems have been observed in limited regions of the lake. Ultimately, reducing algae blooms, dense aquatic plant growth, and sedimentation requires reductions in phosphorus and sediment inputs to Lake Wausau. These reductions can be attained through changes in land management practices throughout the watershed. Reducing phosphorus and sediment inputs from sources near the lake and its tributaries will result in reduced frequency and magnitude of algal blooms in the bays more quickly than changes made further out in the watershed.

If more immediate results are desired, communities around Lake Wausau may also choose to address areas with sediment and algal bloom problems by employing actions to redevelop channels and improve flow in targeted areas of Lake Wausau. Efforts may include strategic dredging and installing box culverts. These "fixes" will have a lifespan that can be increased if local and watershed-wide phosphorus and sediment reductions are also made.

To predict the response of possible solutions for some of the problem areas in Lake Wausau, the USACE developed a 2D hydrodynamic model of Lake Wausau to predict whether improvements could be made downstream of the I 39 Bridge over the Rib River, at the Hwy N Causeway, in the bay near the golf course, and near the mouth of the Eau Claire River. A description of the problem and potential solutions for each of the four sites follows.

After the model was developed, a variety of scenarios were tested for each location. Details about the model development and scenarios are described in the 2018 USACE report.

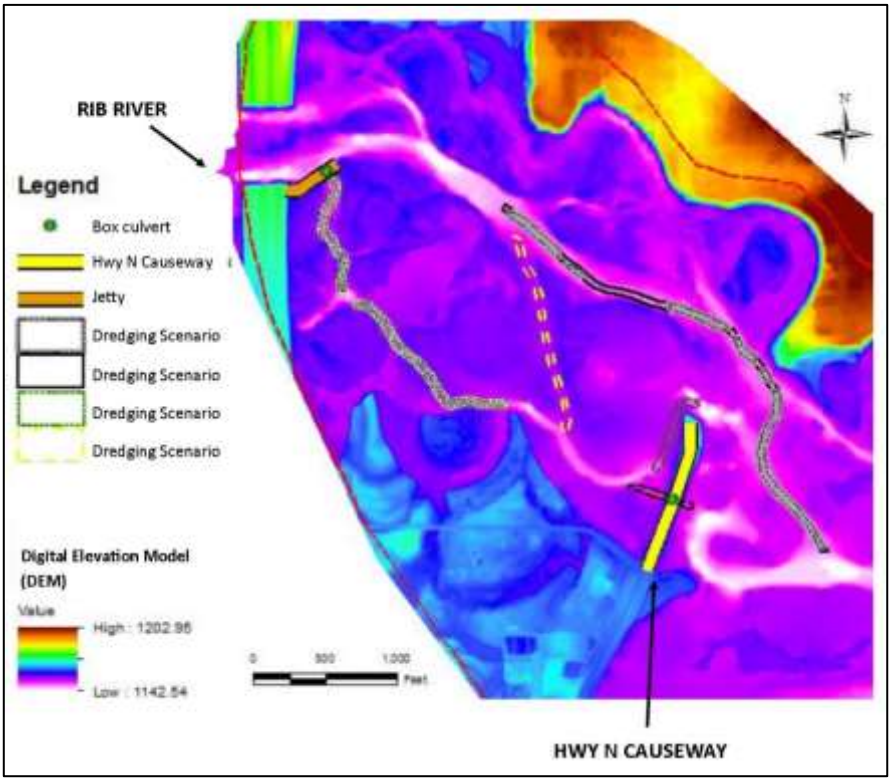
Rib River Problems: In the Rib River downstream of the I 39 Bridge, a wide shallow region exists due to sedimentation. This situation has replaced the more defined and deeper channel that once existed. This change has negative effects on game fish habitat and downstream water quality, especially near the Hwy N Causeway.

Rib River Potential Solutions: Re-establishing the historic Rib River channel could be accomplished through the creation of a jetty and installation of a box culvert to better direct the flow of the water near the I 39 Bridge. Dredging would also be required to redefine the channel further downstream (see schematic).

This effort would improve fish habitat and may increase the channel flow which is needed to improve the water quality problems that occur upstream and downstream of the Hwy N embankment.

Hwy N Causeway Problems: The south embankment that is a part of the 2004 Hwy N Causeway restricts the flow of the Rib River. As a result, semi-stagnant backwaters upstream and downstream of the embankment create ideal conditions for algal blooms during the summer.

Rib River between I 39 and Hwy N Causeway: USACE Model showing possible jetty, dredged channels, and box culverts.



Hwy N Causeway Potential Solutions: Increase flow in the upstream of the embankment by reestablishing the Rib River's historic channel and install a box culvert though the Hwy N embankment. If sufficient flow can be directed to the channel and through the culvert, algal blooms should reduce in magnitude and frequency. However, the model predicted low flows that may not be sufficient to maintain the channel.

Mouth of the Eau Claire River Problems: Sedimentation from the Eau Claire River has resulted in shallow water depths and a lack of channelize flow.

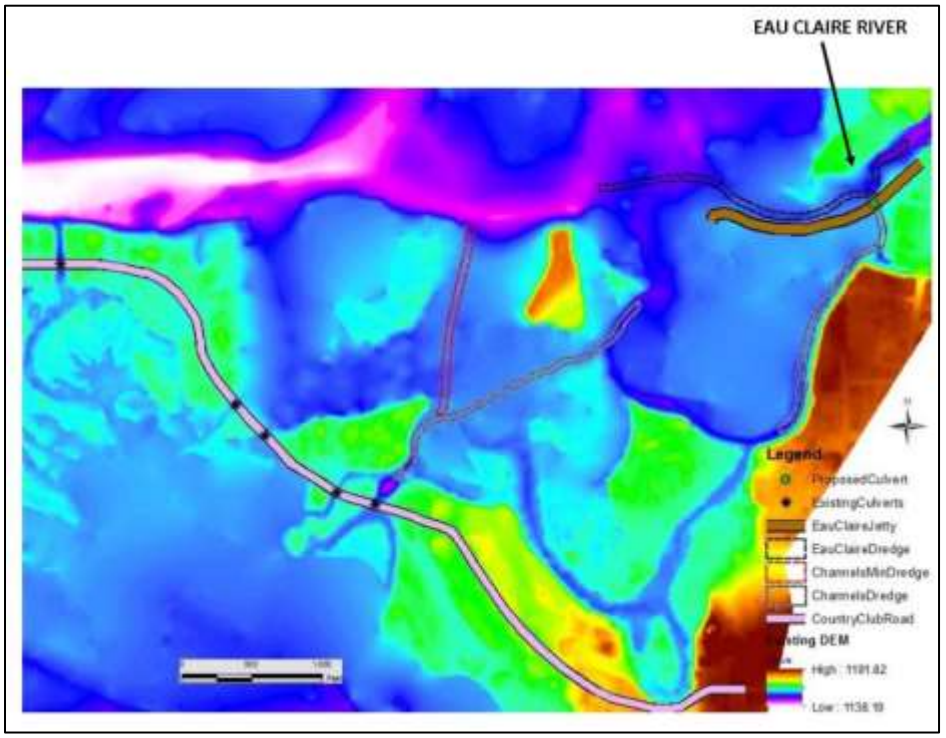
Mouth of the Eau Claire River Potential Solutions: Proposed alternatives included the construction of a 1,400 feet long jetty along the Eau Claire River channel following naturally high ground along the south bank as it makes its way towards the centerline of the Wisconsin River. Different culvert options and an open channel through the jetty were modeled to maintain flow in the backwater channel along the Lake Wausau shoreline between the Eau Claire River and the Country Club Road. Dredging options were also modeled for the Eau Claire River and specific backwater channels between the Eau Claire River and Country Club Rd.

Golf Course Problems: This bay experiences blue-green algal blooms and filamentous algae growth, creating aesthetic problems and reducing the potential for good aquatic habitat. The poor water quality conditions in the small channels near the golf course are due to high nutrient levels and stagnant flow.

Golf Course Potential Solutions: This part of Lake Wausau is very flat and the bay is a dead-end for water entering from both sides; therefore, the model did not predict any viable solutions from dredging or rerouting upstream water. Improved movement of water in this bay may be accomplished through mechanical means which would require additional assessment.

Reductions in phosphorus and sediment inputs from nearby land management practices would help to reduce algal growth in this area.

USACE model showing possible dredged channels, jetty, and box culvert, near the mouth of the Eau Claire River.



Prior to implementing any of the projects, the modeling scenarios and results should be studied by the advisory committee with assistance from the USACE modeling staff. Completion of a sedimentation study, updating the model with the results, and estimating costs of the projects are also recommended. A portion of the funding to conduct the studies, update the model, and accomplish these projects may be available through the USACE Continuing Authorities Program.

Following the development of the USACE model, the Village of Rothschild identified areas in Lake Wausau near the pavilion that they would like to improve. The Village is interested in participating with future modeling and improvement efforts.

Societal Rules Related to Water Quality

Numerous rules have been put into place to maintain the health of Lake Wausau and other Wisconsin waters. This section highlights some of the key legislation. Additional federal, state and local rules are in place to ensure that Wisconsin's waters remain fishable and swimmable. Many of these ordinances and regulations related to Lake Wausau have been summarized in a report by Thompson, et al., 2014.

Wisconsin's Public Trust Doctrine

As described on the WDNR's website, *Wisconsin lakes and rivers are public resources, owned in common by all Wisconsin citizens under the state's Public Trust Doctrine. Based on the state constitution, this doctrine has been further defined by case law and statute. It declares that all navigable waters are "common highways and forever free", and held in trust by the Department of Natural Resources.*

Wisconsin's Public Trust Doctrine requires the state to intervene to protect public rights in the commercial or recreational use of navigable waters. The DNR, as the state agent charged with this responsibility, can do so through permitting requirements for water projects, through court action to stop nuisances in navigable waters, and through statutes authorizing local zoning ordinances that limit development along navigable waterways.

The Clean Water Act (CWA)

The CWA is the primary Act guiding the health of the nation's waters. It was signed into law in 1972 by President Nixon. The United States Environmental Protection Agency (EPA) is the agency with the primary responsibility for the CWA. In Wisconsin, the state has accepted the responsibility for the enforcement of the CWA, with oversight by the EPA.

Wisconsin and the United States have developed guidance for the acceptable levels of some pollutants in groundwater, lakes, and streams. When a waterbody exceeds these thresholds, specific steps are required to address the problem. The authority for these guidance come from the Clean Water Act (CWA).

Some of the reservoirs in the Wisconsin River system do not meet the state and federal guidance for phosphorus and algal blooms. The CWA directs the state to identify how much phosphorus reduction is needed to meet the guidance. The process is called a TMDL, which stands for total maximum daily load.

The Wisconsin River and its TMDL

. Three reservoirs on the Wisconsin River experience significant blue-green algal blooms due to the excessive phosphorus levels in the water. In order to correct the problems in the reservoirs, a better understanding about the extent of the water quality impairments was needed. The first step was to monitor the water quality and quantity at many sites in the Wisconsin River and its tributaries.

Following three years of data collection, the monitoring data was used to develop phosphorus budgets for many reaches of the Wisconsin River and tributaries and identify the maximum daily amount of phosphorus that a stretch of the river can dilute without creating impairments to water quality and the aquatic ecosystem. This budget is the "TMDL". The land that drains to Lake Wausau is included in the TMDL budget and is discussed in the next section.

The Wisconsin River TMDL was prepared by staff from the WDNR working with experts from the U.S. Army Corps of Engineers, U.S. Geologic Survey, and UW-Stout. The phosphorus reductions that will have positive effects on the water quality in Lake Wausau will be based on the goals set for the Petenwell Flowage, since this downriver reservoir exceeds its phosphorus limit. Phosphorus reductions will need to take place in the watershed upstream of the Petenwell flowage which includes Lake Wausau's watershed.

Algae due to excessive phosphorus in the downstream Petenwell Flowage, Adams Co. WI

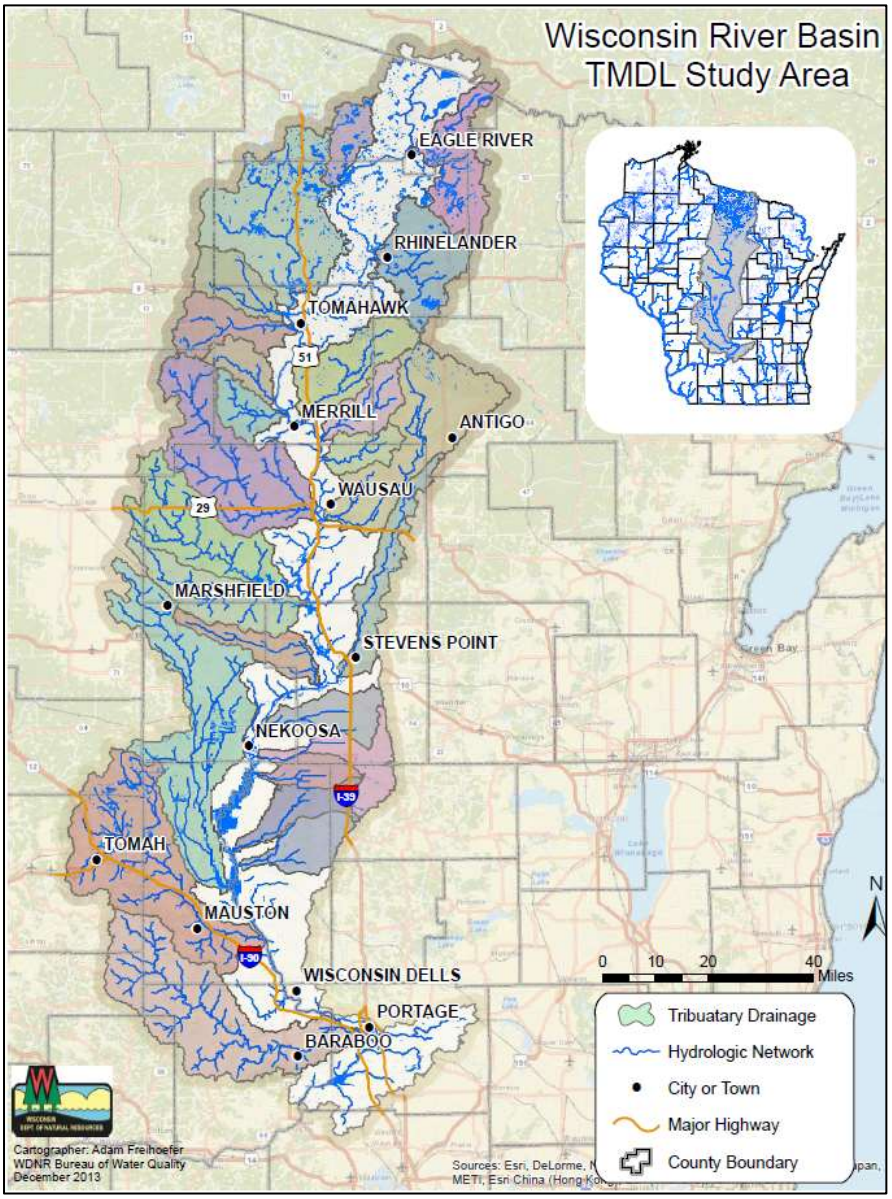
The next step will be to develop local plans that identify the steps, timeline and cost to achieve the reductions in the TMDL. Since the upstream reductions will benefit Lake Wausau, LWA and others are encouraged to participate in these planning processes.

According to the EPA's website, *A **TMDL** is a pollution budget and includes a calculation of the maximum amount of a pollutant that can occur in a waterbody and allocates the necessary reductions to one or more pollutant sources.*

A TMDL serves as a planning tool and potential starting point for restoration or protection activities with the ultimate goal of attaining or maintaining water quality standards.

Where does the phosphorus come from?

Many sources of phosphorus exist throughout the Wisconsin River watershed. Some areas within the watershed contribute more phosphorus than others. Some of the sources are naturally occurring. The "manageable" sources come from activities on the landscape.



Direct Sources

The Wisconsin River and some of its tributaries receive discharges from numerous permitted sources. These direct discharges, are called "point sources". They include municipal storm sewers, industrial and municipal wastewater treatment plants, and confined animal feeding operations (CAFOs). The terms of the discharge permits identify the amount of phosphorus allowed in the water discharged to the rivers.

Indirect Sources

"Non-point sources" also add phosphorus to the Wisconsin River and its tributaries. Non-point refers to the sources of nutrient pollutants coming off of the landscape within the watershed. Examples would be soil erosion, fertilizers, animal waste, and septic systems. The phosphorus from the landscape typically moves to the waterways in runoff.

TMDL outcomes related to Lake Wausau

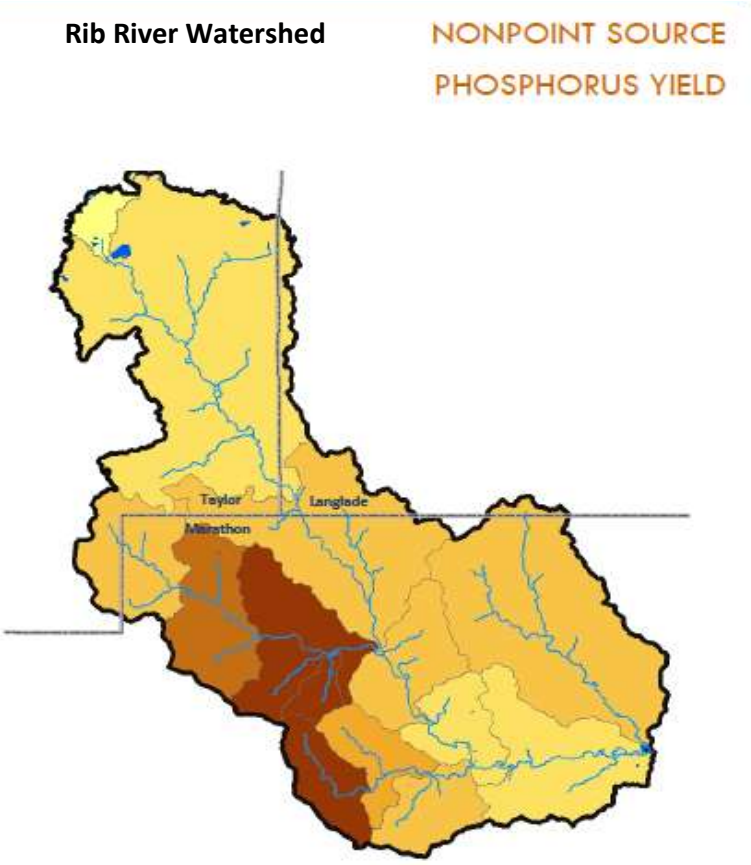
The next three sections identify point and non-point sources of phosphorus for the portions of the project area that effect Lake Wausau including the Rib River, Eau Claire River, and the Upper Wisconsin River.

Phosphorus in the Rib River Watershed

Within the Rib River watershed, two tributaries, Black Creek and Scotch Creek, are listed as impaired for exceeding Wisconsin's 75 ppb phosphorus limit for streams. Within the Rib River watershed, a combination of permitted "point" source discharges and runoff from non-urban areas of the watershed comprise the phosphorus sources to the Rib River and Lake Wausau. Permitted dischargers include four CAFOs, four municipal wastewater treatment facilities (WWTF), and stormwater runoff from the City of Wausau (MS4). Within the watershed, dairy comprises more than 75% of the phosphorus inputs. Natural inputs are the next most prevalent source.

Prioritizing inputs can help to achieve the greatest reductions, but it should be noted that the cumulative effects of all inputs result in the water quality impairments so reducing any of them contributes to the reduction of the overall load. The distribution of phosphorus sources within the Rib River watershed is not uniform; the darker the color on the map, the greater the phosphorus per acre of land. In general, lands closest to the water can have the greatest impact.

Rib River Watershed



Rib River Watershed

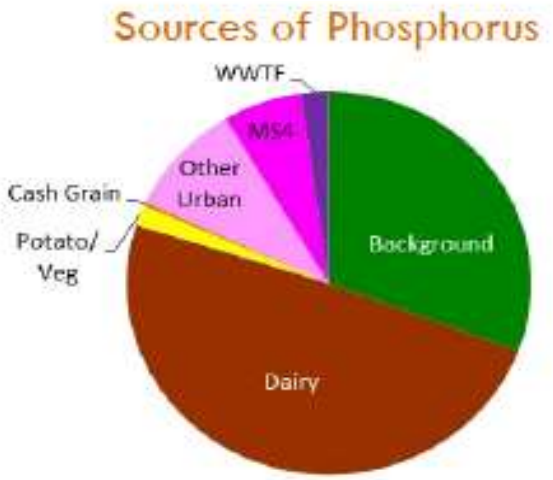
Phosphorus in the Eau Claire River Watershed

Two stream segments in the Eau Claire River system are listed as impaired, Spring Brook Creek and the West Branch of the Eau Claire River. Both exceed Wisconsin's phosphorus limit of 75 ppb for streams.

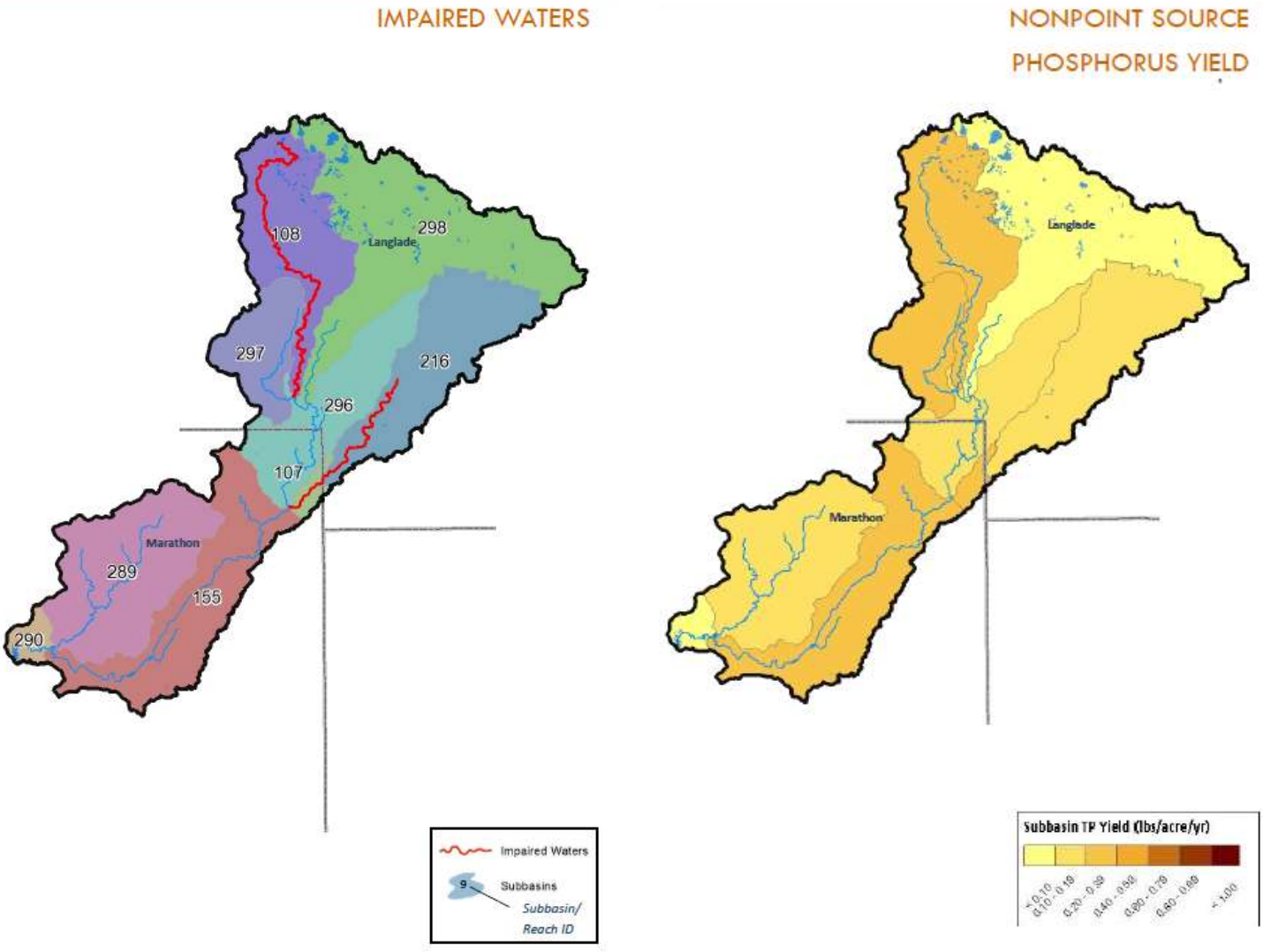
A combination of direct discharges and land use activities in the Eau Claire River watershed contribute phosphorus to its streams and rivers. Overall, the greatest contributions are associated with dairy, followed by naturally occurring phosphorus. The permitted discharges include stormwater runoff from the Cities of Schofield, Wausau, and Weston (MS4), municipal and industrial wastewater treatment facilities (WWTF), and two CAFOs.

Phosphorus sources in the watershed are not uniform. The map shows the estimated quantities of phosphorus coming off the landscape; this does not include an accounting of the permitted direct discharges, or "point" sources.

Eau Claire River Watershed



Eau Claire River Watershed

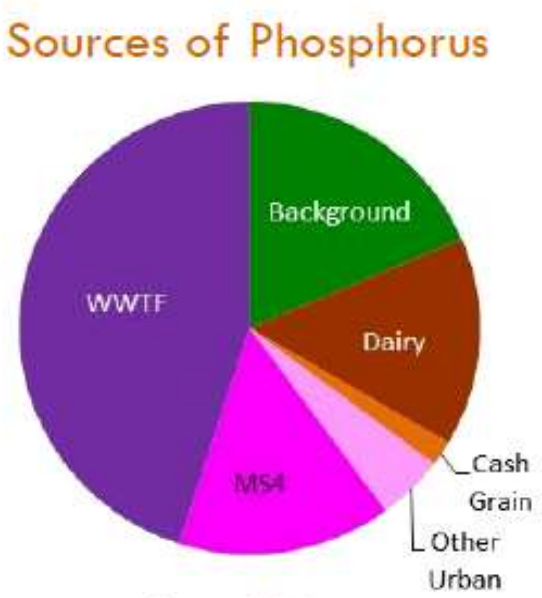


Phosphorus in the Upper Wisconsin River Corridor

Like the other watersheds, the Upper Wisconsin River Corridor has a combination of phosphorus sources that include runoff from the landscape and permitted direct discharges. Permitted discharges that occur above the Lake Wausau dam include four municipal and industrial WWTFs, runoff from the Cities of Merrill, Wausau and Schofield, Village of Rothschild, Marathon County, and the Town of Rib Mountain (MS4s).

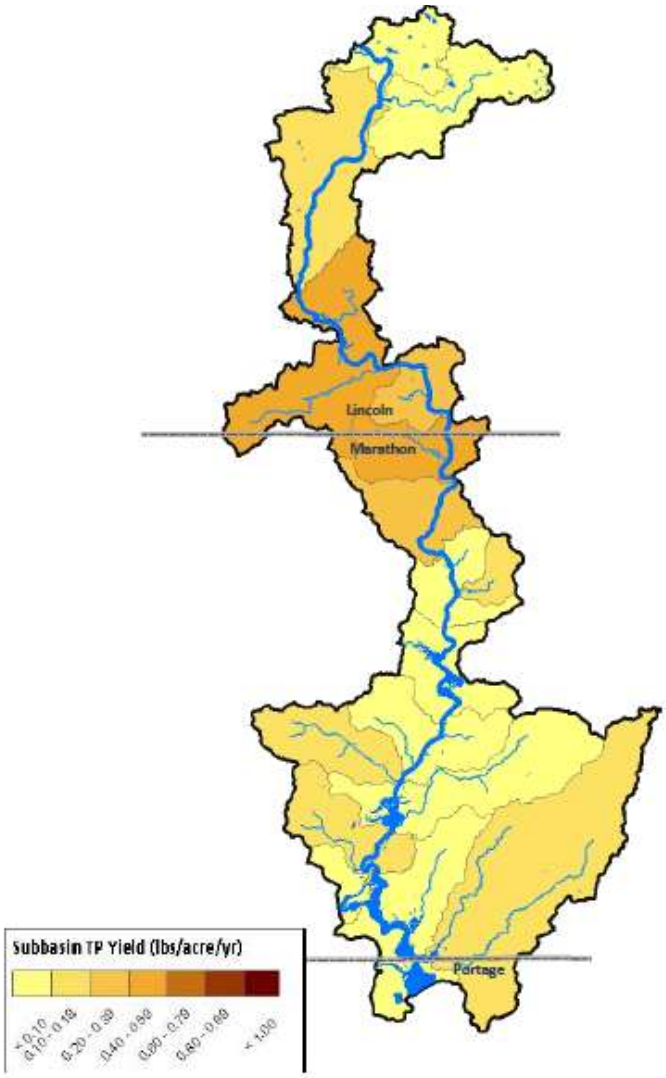
The model for the Upper Wisconsin River Corridor includes land in Lincoln and Marathon counties through Lake DuBay in Portage County. For this area, nearly half of the phosphorus inputs originate from WWTFs, followed by natural sources, MS4s, and dairy.

Upper Wisconsin River Corridor



Upper Wisconsin River Corridor

PHOSPHORUS NON-POINT SOURCES



How will the TMDL's phosphorus reductions be achieved?

Now that the phosphorus budget and allocations to reduce phosphorus are known, the next step will involve community members working together to develop specific strategies and timelines to the reduce phosphorus from the landscape in the Wisconsin River basin. Often, these strategies are documented in a *9 Key Element Plan*. To ensure these plans meet the community needs, citizens, municipalities, and those effected by these plan should all participate in discussions leading to their development.

Get Involved!

Wisconsin River TMDL

The Wisconsin River TMDL is available for review and public comment. Watch for announcements.

Learn more about the Wisconsin River TMDL and timelines for planning by visiting: http://dnr.wi.gov/topic/tmdls/wisconsinriver/

9 Key Element Plans

Following the completion of the Wisconsin River TMDL, development of the 9 Key Element Plans will be initiated, allowing the community to develop strategies to improve the water in the Rib River, Eau Claire River, Wisconsin River, and Lake Wausau.

Participate in the events and public input sessions for the development of the local plans!

Goal 3: Support Recreational Opportunities on Lake Wausau.

Recreation

Amenities and Activities

There are 25 points of public access to Lake Wausau that provide amenities such as boat launches, fishing access, hiking trails, picnic areas, shelters, playgrounds, and restrooms. These areas support a variety of activities that take place on and near Lake Wausau. The table below identifies some of the key facilities at these sites. A map showing water depths and the locations of these facilities was produced in 2012. It can be found on the Lake Wausau Association's website at http://lakewausau.org/.

Lake Wausau's setting provides ample opportunities for a variety choices on and off the beaten path and during different seasons of the year. The primary Wisconsin River channel remains deep enough for motorized boats and is popular for fishing and other water sports. This is the most frequented part of Lake Wausau. The braided channels downstream from the Rib River provide a quiet setting. The shallow water in this area is best suited for quiet sports such as non-motorized boating and wildlife viewing. This area provides an abundance of habitat for aquatic and non-aquatic animals and plants.

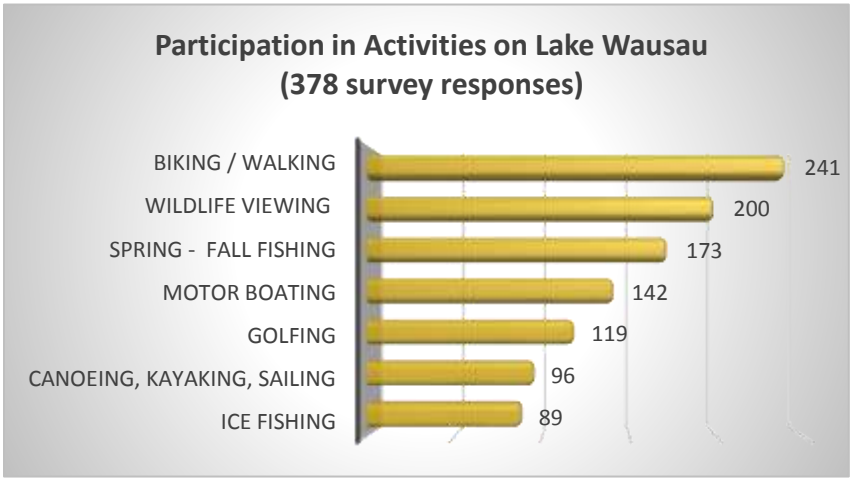
Gathering sites around Lake Wausau are good settings for the exchange of information related to recreation, fishing, and stewardship information. Kiosks and combined signs or brochures can help to disseminate information. Information can also be incorporated into fun activities, such as a water trail or on-water scavenger hunt.

	Bird Watching	Boat Launch	Canoe Portage	Fishing	Hiking	Picnic Area	Playground	Restroom (warm season)	Shelter	Swimming Pool
Bluegill Bay (North Area)	⊗	⊗		⊗	⊗	⊗		⊗	⊗	
Bluegill Bay (South Area)	⊗			⊗	⊗	⊗	⊗	⊗	⊗	
DC Everest County Park *	⊗	⊗		⊗	⊗	⊗		⊗		
Domtar Canoe Portage (removal)			⊗							
Domtar Canoe/Boat Launch		⊗	⊗	⊗	⊗					
Eau Claire Park		⊗	⊗	⊗	⊗	⊗				
Gulliver's Landing		⊗		⊗						
Independence Park	⊗	⊗		⊗	⊗	⊗	⊗			
Isle of Frents Park	⊗			⊗	⊗	⊗				
Kort Street Boat Launch	⊗	⊗		⊗		⊗		⊗		
Liberty Park					⊗	⊗			⊗	
McCleary Bridge Fishing Pier *	⊗			⊗						
Memorial Park	⊗	⊗		⊗	⊗	⊗	⊗	⊗	⊗	⊗
Oak Island Park	⊗	⊗		⊗	⊗	⊗	⊗		⊗	
Pavilion Park					⊗					
Radtke (Point) Park	⊗			⊗	⊗	⊗	⊗	⊗		
Rib River Park'	⊗									
Riverside Park	⊗			⊗	⊗	⊗	⊗		⊗	
Rookery View Park **				⊗						
Rothschild Park				⊗		⊗			⊗	⊗
Shelter Park	⊗					⊗	⊗		⊗	
Sparr's Landing		⊗	⊗	⊗				⊗	⊗	
Whitewater Park and Kayak Area			⊗	⊗	⊗					

* ADA Accessible Fishing Pier
**Landing spot for winter ice fishers

How is Lake Wausau Used?

Survey respondents were asked about the most common types of recreation that take place on and around Lake Wausau. Based on responses, the most popular activities do not require a boat. Walking and biking were selected by nearly 64% of respondents, followed by wildlife viewing. Open water fishing and motor boating were the next most popular activities.



What is Important?

Survey respondents were given a total of 100 points to assign to 7 lake characteristics. Of the options provided, good water quality ranked as the top three most important characteristics. This perspective was similar for those that lived nearer the lake but water clarity was less important to those living further from the lake.

Rank	Lake Characteristic	Mean	Standard Deviation
1	Free from contamination advisories	29.6	20.1
2	Water clarity	17.5	14.4
3	Lack of water odor	15.3	11.3
4	Swimming area bottom quality	10.2	11.3
5	Diversity of wildlife	10.2	11.4
6	Diversity of fish	9.6	10.8
7	Quantity of fish caught	7.6	10.2

Goal 4: Work Together for a Better Lake Wausau.

Working Together for a Better Lake Wausau

The Importance of Partnerships

Most people agree that working together is essential to maintaining Lake Wausau in a healthy condition. One LWA member stated, "You have a fragmented approach with different regulations in different municipalities and different thought processes relative to the value and the role of that governmental unit in protecting <water> quality. The hope of the lake association was there would be some opportunities to approach it holistically with all the governmental units." According to Floress (Thompson, et al, 2014), this comment speaks to the theme that ran through many of her interviews regarding the opportunity that additional cooperation among the various stakeholders of Lake Wausau could provide for improving it as a community resource, but that disconnection among stakeholders and governance hinders this opportunity.

"The hope of the lake association was there would be some opportunities to approach it <water protection> holistically with all the governmental units."

This plan and the process to develop it were designed to break through some of the barriers that created fragmented management.

Strategies for Implementation

Moving forward, the coordination of the strategies laid out in this plan should allow for all partners to contribute without any one being overburdened. An advisory team is a good way to prioritize need, coordinate leadership, and identify funding options. The team should include representation from key partners including the LWA, municipalities, local businesses, fishing and sportsperson groups, WVIC, and the WDNR. It will be beneficial to identify leadership and a means for commitment to the group which could be a memorandum of understanding, letter of commitment, or other more formalized agreement.

Once organized, the Lake Wausau Advisory Team should meet at least annually to discuss conditions in Lake Wausau, share accomplishments and impediments, and prioritize efforts for the upcoming year. If aquatic plant management is being conducted, this plan must be updated every five years. Otherwise, the plan should be updated as needed.

The LWA is committed to communicate as transparently, and timely as possible on any issues associated with the lake.

Meet the Partners

The following are summaries of the missions for many of the organizations identified in this plan. Additional letters of commitment are located in the appendix.

Golden Sands Resource Conservation and Development, Inc. (RC&D)

Golden Sands RC&D is a 501(c)3 nonprofit that started in 1972 with a mission to make Central Wisconsin a better place to live and work by bringing people together in projects grounded in science-based principles of conservation.

Lake Wausau Association (LWA)

The goal of LWA is to protect and maintain the lake for the entire community and to assure that this treasured resource remains healthy for current users and future generations. Formally initiated in 2011, LWA has approximately 200 members. All are welcome to join their efforts.

While the LWA represent leadership among community members, the implementation of this plan will need the support of the local community, the Wisconsin Dept. of Natural Resources, and many more partners.

Marathon County Conservation, Planning and Zoning

Mission: Protect our community's land and environment. Because we believe that the economic strength and vitality of our community is dependent on the quality of our resources. Through leadership, accountability, community engagement, and collaborative partnerships we promote thoughtful and deliberate use of resources and innovative solutions. So that Marathon County has healthy people, a healthy economy, and a healthy environment today and tomorrow.

Metropolitan Planning Organization (MPO)

The MPO performs transportation planning activities for the Wausau area in accordance with Federal regulations. The planning area includes the Cities of Mosinee, Schofield, and Wausau, the Villages of Kronenwetter, Rothschild, and Weston, and the Towns

of Bergen, Maine, Mosinee, Rib Mountain, Stettin, Texas, Wausau, and Weston.

North Central Wisconsin Stormwater Coalition (NCWSC)

Coordinates and collaborates on education and outreach activities, and recommends policy and operational changes for cooperating local governments to comply with regulations and reduce stormwater pollution in a cost effective manner so that residents of Central Wisconsin benefit from lakes and streams that remain swimmable and fishable.

Town of Rib Mountain (see Appendix for full Resolution)

Town of Rib Mountain recognizes the importance environmental resources have on the quality of life of our residents and is fortunate to have several environmental assets within the community, including Lake Wausau. Lake Wausau serves not only Town residents, but also the Wausau Metropolitan area as well as visitors and is a year-round recreational asset to our community.

The Town of Rib Mountain Board of Supervisors hereby formally recognizes the importance of Lake Wausau to the Rib Mountain community and will continue to support the Lake Wausau Association's efforts in protecting and enhancing our environmental asset.

River Alliance of Wisconsin

Mission: Empowering people to protect and restore water.

Village of Rothschild (see Appendix for full letter)

The Village of Rothschild has benefited from Lake Wausau since its creation over 100 years ago. The Village boasts about 4,500 feet of frontage - all in zoned parkland and open to the public (Pavilion Park). On this frontage is a wonderful view of Rib Mountain State Park, a double trailer boat launch, fishing piers, the Pavilion, and the island that host walkers, anglers, and picnickers. Other benefits of Lake Wausau as it relates to the Village are that there is an estimated 600 users/year utilizing the boat landing off Kort Street. This figure does not account for annual passes or kayaks.

Lastly, the Rothschild Pavilion, on the National Historic Building list, is a major draw to the public due to its location on the lake and its uniqueness. This facility is rented by the public and is booked nearly every weekend for up to 2 years in advance.

In closing, Lake Wausau is a significant asset to the Village but will be even more so upon completion of the Pavilion Park Master Plan along with TIO development.

City of Schofield (see the Appendix for the full statement)

Communities benefit from Lake Wausau in that its presence brings calming effects to the area such as the enjoyment of peaceful walks along the river, beautiful sunsets and organized activities such as festivals and fisheries. Studies show that the presence of lakes provide a healthier community.

Additionally, Lake Wausau provides access to our community for fishing, providing recreational qualities such as swimming, boating, transportation, kayaking, water skiing, hunting, snowmobiling and bird watching.

The City of Schofield benefits from blue space allowing the regeneration of real estate surrounding the Lake which provides growth and redevelopment opportunities.

City of Wausau

Message from Mayor Mielke: Lake Wausau is a tremendous asset to the City of Wausau. City residents and businesses enjoy its beauty through various means that include boating, fishing, swimming and spectacular views. The City is committed to the discharge of clean stormwater into Lake Wausau, the Rib River, Wisconsin and Eau Claire River through many devices and practices that include education and outreach, stormwater treatment measures, street sweeping, cleaning of catch basins, fall leaf pickup, and the routine inspection and maintenance of the City's storm sewer. The annual estimated operation and maintenance of the City's stormwater infrastructure is estimated at $1.5 million.

Wisconsin Dept. of Natural Resources (WDNR)

Mission: To protect and enhance our natural resources: our air, land and water; our wildlife, fish and forests and the ecosystems that sustain all life.
To provide a healthy, sustainable environment and a full range of outdoor opportunities.
To ensure the right of all people to use and enjoy these resources in their work and leisure.
To work with people to understand each other's views and to carry out the public will. And in this partnership consider the future and generations to follow.

United States Army Corps of Engineers (USACE)

USACE developed the hydrodynamic model for Lake Wausau and scenarios for flow and habitat improvement in parts of the reservoir. Their authority and programs can allow them to provide assistance with the implementation of these projects.

Wisconsin Waterfowl Association (WWA)

The purpose of WWA shall include: work to further restoration and conservation of Wisconsin's waterfowl and wetland resources, the implementation of education programs for Wisconsin youth that heighten awareness of our wetland resources, and promotion of legislation that protects Wisconsin's resources and the rights of citizens to hunt and fish.

References

Glossary

Algae: One-celled (phytoplankton) or multicellular plants either suspended in water (Plankton) or attached to rocks and other substrates (periphyton). Their abundance, as measured by the amount of chlorophyll a (green pigment) in an open water sample, is commonly used to classify the trophic status of a lake. Numerous species occur. Algae are an essential part of the lake ecosystem and provides the food base for most lake organisms, including fish. Phytoplankton populations vary widely from day to day, as life cycles are short.

Aquatic invasive species (AIS): Non-native species that can grow out of control in some Wisconsin lakes and rivers.

Blue-Green Algae: A form of algae that prefers nutrient-rich conditions. Many fish and other organisms prefer to consume other forms of algae so they may only control limited amounts of its growth. Some species of this type of algae can periodically be toxic to humans, pets, and wildlife during, causing skin rashes or even death. They often form floating scum as they die. Many can fix nitrogen (N_2) from the air to satisfy some of their nutrient needs.

Calcium: The most abundant cation found in Wisconsin lakes. Its abundance is related to the presence of calcium-bearing minerals in the lake watershed. Reported as milligrams per liter (mg/1) as calcium carbonate (CaCO3), or milligrams per liter as calcium ion (Ca++).

Chloride (Cl-): The chloride ion (Cl-) in lake water is commonly considered an indicator of human activity. Agricultural chemicals, human and animal wastes, and road salt are the major sources of chloride in lake water.

Chlorophyll a: Green pigment present in all plant life and necessary for photosynthesis. The amount present in lake water depends on the amount of algae and is therefore used as a common indicator of water quality.

Clarity: see "Secchi disc."

Concentration units express the amount of a chemical dissolved in water. The most common ways chemical data is expressed is in milligrams per liter (mg/l) and micrograms per liter (ug/l). One milligram per liter is equal to one part per million (ppm).

Eutrophication: The process by which lakes and streams are enriched by nutrients, and the resulting increase in plant and algae. The extent to which this process has occurred is reflected in a lake's trophic classification: oligotrophic (nutrient poor), mesotrophic (moderately productive), and eutrophic (very productive and fertile).

Filamentous Algae: Algae that forms filaments or mats attached to sediment, weeds, piers, etc.

Food Chain: The sequence of algae being eaten by small aquatic animals (zooplankton) which in turn are eaten by small fish which are then eaten by larger fish and eventually by people or predators. Certain chemicals, such as PCBS, mercury, and some pesticides, can be concentrated from very low levels in the water to toxic levels in animals through this process.

Hardness: The quantity of multivalent cations (cations with more than one +), primarily calcium (Ca++) and magnesium (Mg++) in the water expressed as milligrams per liter of CaCO3. Amount of hardness relates to the presence of soluble minerals, especially limestone, in the lake watershed.

Impoundment: Manmade lake or reservoir usually characterized by stream inflow and always by a stream outlet. Because of nutrient and soil loss from upstream land use practices, impoundments ordinarily have higher nutrient concentrations and faster sedimentation rates than natural lakes. Their retention times are relatively short.

Limiting factor: The nutrient or condition in shortest supply relative to plant growth requirements. Plants will grow until stopped by this limitation; for example, phosphorus in summer, temperature or light in fall or winter.

Mixing: see "Overturn."

Marl: White to gray accumulation on lake bottoms caused by precipitation of calcium carbonate (CaCO3) in hard water lakes. While it gradually fills in lakes, marl also precipitates phosphorus, resulting in low algae

populations and good water clarity. In the past, marl was recovered and used to lime agricultural fields.

Nitrate (NO3-): An inorganic form of nitrogen important for plant growth. Nitrogen is in this stable form when oxygen is present. A concentration of nitrate-nitrogen (NO3-N) plus ammonium-nitrogen (NH4-N) of 0.3 mg/l in spring will support summer algae blooms if enough phosphorus is present.

Overturn: Water temperature, chemistry, and density become uniform from the top to the bottom of the lake. Mixing allows bottom waters to contact the atmosphere, raising the water's oxygen content.

Phosphorus: Key nutrient influencing plant growth in most Wisconsin lakes. Soluble reactive phosphorus is the amount of phosphorus in solution that is available to plants. Total phosphorus includes the amount of phosphorus in solution and in particulate form.

Photosynthesis: the process by which green plants convert carbon dioxide (CO2) dissolved in water to sugar and oxygen using sunlight for energy. Photosynthesis is essential in producing a lake's food base, and is an important source of oxygen for many lakes.

Retention Time (turnover rate or flushing rate): The average length of time water resides in a lake, ranging from several days in small impoundments to many years in large seepage lakes. Retention time is important in determining the impact of nutrient inputs. Long retention times result in recycling and greater nutrient retention in most lakes. Retention time is calculated by dividing the volume of water passing through the lake per year by the lake volume.

Rooted Aquatic Plants (macrophytes): Refers to higher (multi-celled) plants growing in or near water. Macrophytes are beneficial to lakes because they produce oxygen and provide substrate for fish habitat and aquatic insects. Overabundance of such plants, especially problem species, is related to shallow water depth and high nutrient levels.

Secchi Disc (Secchi Disk): An 8-inch diameter plate with alternating quadrants painted black and white that is used to measure water clarity (light penetration). The disc is lowered into water until it disappears from view. It is then raised until just visible. An average of the two depths, taken from the shaded side of the boat, is recorded as the Secchi disc reading. For best results, the readings should be taken on sunny, calm days.

Sedimentation: Accumulated organic and inorganic matter on the lake bottom. Sediment includes decaying algae and weeds, marl, and soil and organic matter eroded from the lake's watershed.

TMDL: Total maximum daily load. This is a pollution budget that includes a calculation of the maximum amount of a pollutant that can occur in a waterbody and identifies how and where nutrients need to be reduced meet the goals.

Watershed: The total land area that drains toward the lake and its tributaries.

Literature Cited

Arik, M., S. Pero, C. Kasmerchek, N. Turyk. 2017. Lake Wausau Shoreland Survey, Marathon County, Wisconsin. University of Wisconsin-Stevens Point, Center for Watershed Science and Education. Report to Wisconsin Dept. Natural Resources.

Crunkilton, R. and C. Koeller. 2015. Lake Wausau Bathymetric Mapping. University of Wisconsin-Stevens Point. Report to Wisconsin Dept. Natural Resources.

Crunkilton, R. and C. Koeller. 2015. Lake Wausau In-lake Habitat. University of Wisconsin-Stevens Point. Report to Wisconsin Dept. Natural Resources.

Thompson, A., M. Vokoun, K. Floress. 2014. Lake Wausau Community Survey: Understanding the socio-economic conditions of surrounding management of Lake Wausau. University of Wisconsin-Stevens Point, UWEX Center for Land Use Education website: http:www.uwsp.edu/cnr/landcenter/

Turyk, N. and C. Hamerla. 2017. Aquatic Plant Survey Results and Management Strategies, and Aquatic Invasive Species Prevention Strategies for Lake Wausau, Marathon County, Wisconsin. Golden Sands RC&D, Inc. Report to Wisconsin Dept. Natural Resources.

Turyk, N. R. Jaworski. 2012. Aquatic Plant Survey of Lower Rib River and Lake Wausau, Marathon County, Wisconsin. University of Wisconsin-Stevens Point, Center for Watershed Science and Education. Report to Wisconsin Dept. Natural Resources.

US Army Corps of Engineers, St. Paul District. 2018. HEC-RAS Two-Dimensional Modeling: Lake Wausau, Wisconsin River and Tributaries Big Rib River and Eau Claire River City of Schofield, City of Wausau, Town of Rib Mountain, and Village of Rothschild, in Marathon County, Wisconsin

Appendices

Appendix A: Socio Economic Survey

Thompson, A., M. Vokoun, K. Floress. 2014.

(see electronic Appendix)

Appendix B: In-Lake Habitat Report

Crunkilton, R. and C. Koeller. 2015.

(see electronic Appendix)

Appendix C: USACE Hydrodynamic Modeling Results

US Army Corps of Engineers, St. Paul District. 2018

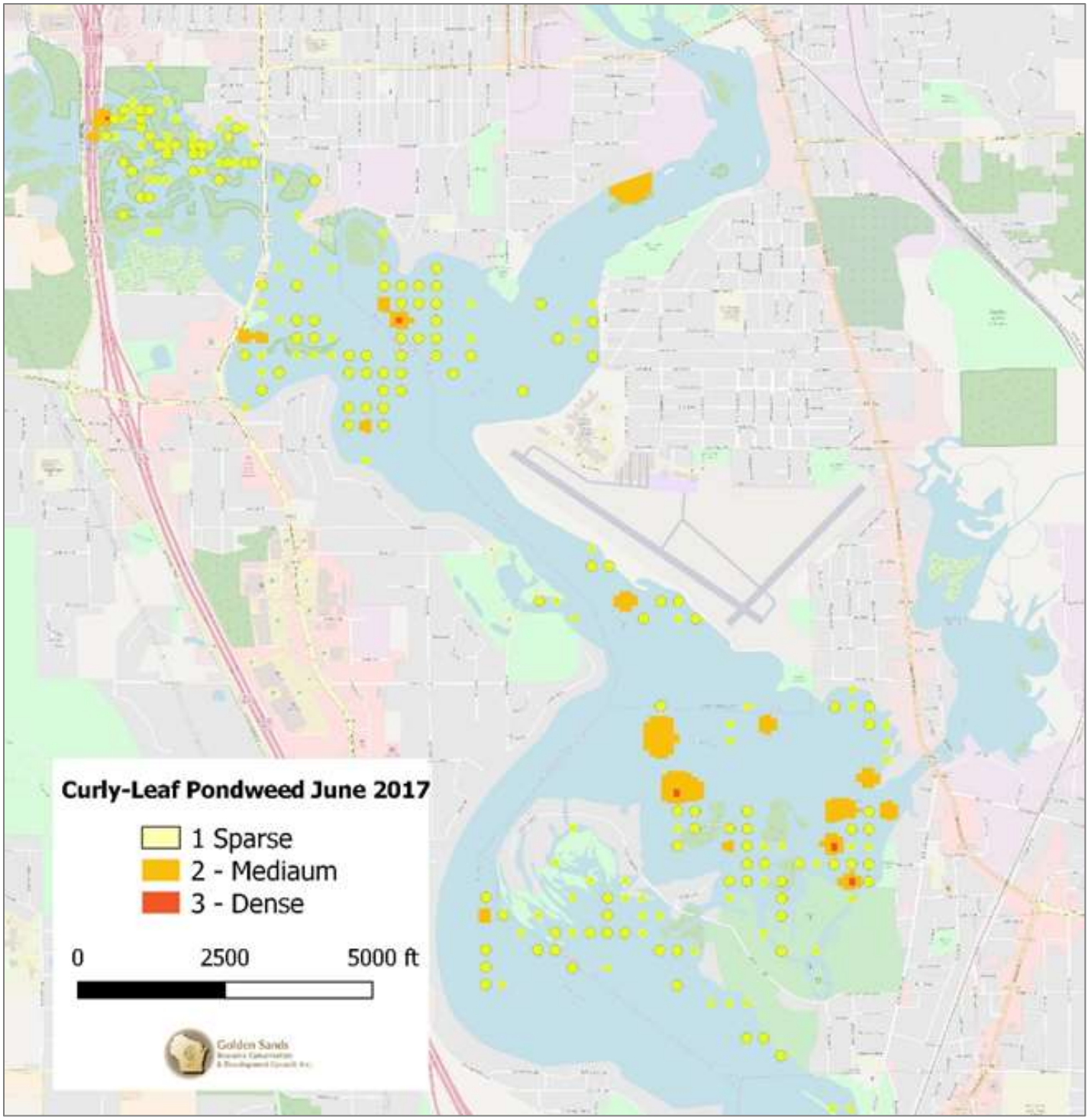
(see electronic Appendix)

Appendix D: Fish Survey Results

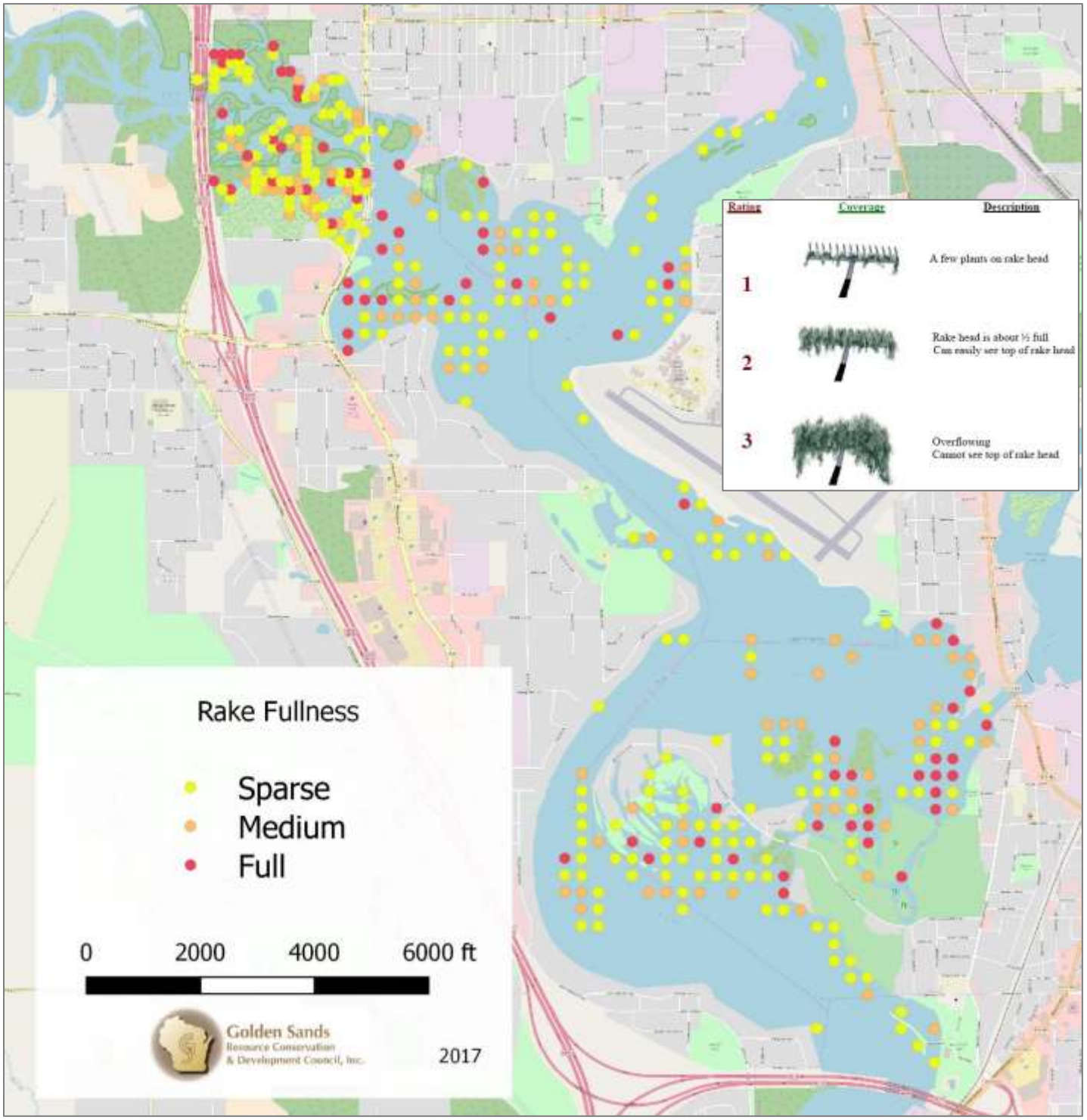
Niebur, A. Sept, 2017

(see electronic Appendix)

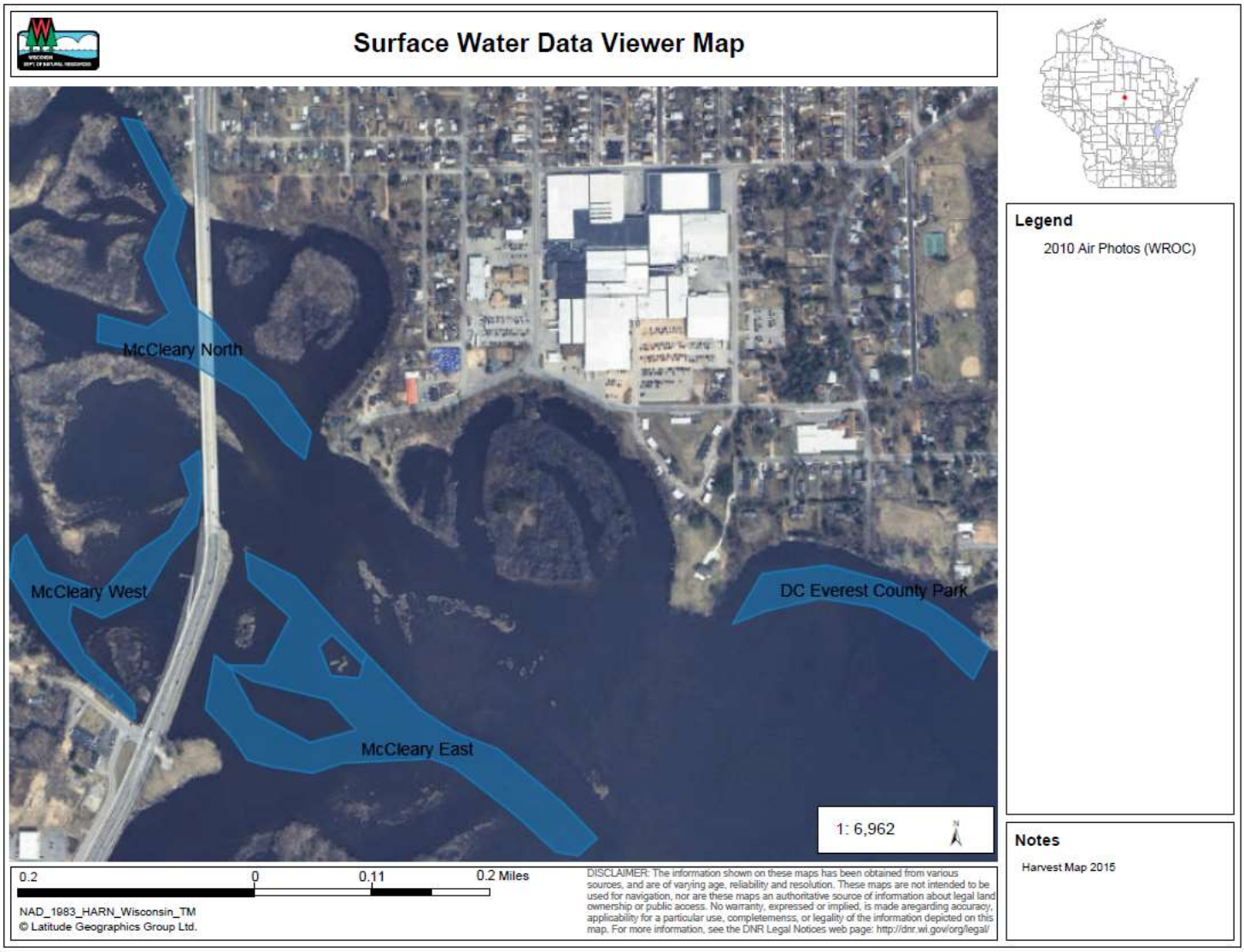
Appendix E: Location of CLP found during the June 2017 aquatic plant survey.



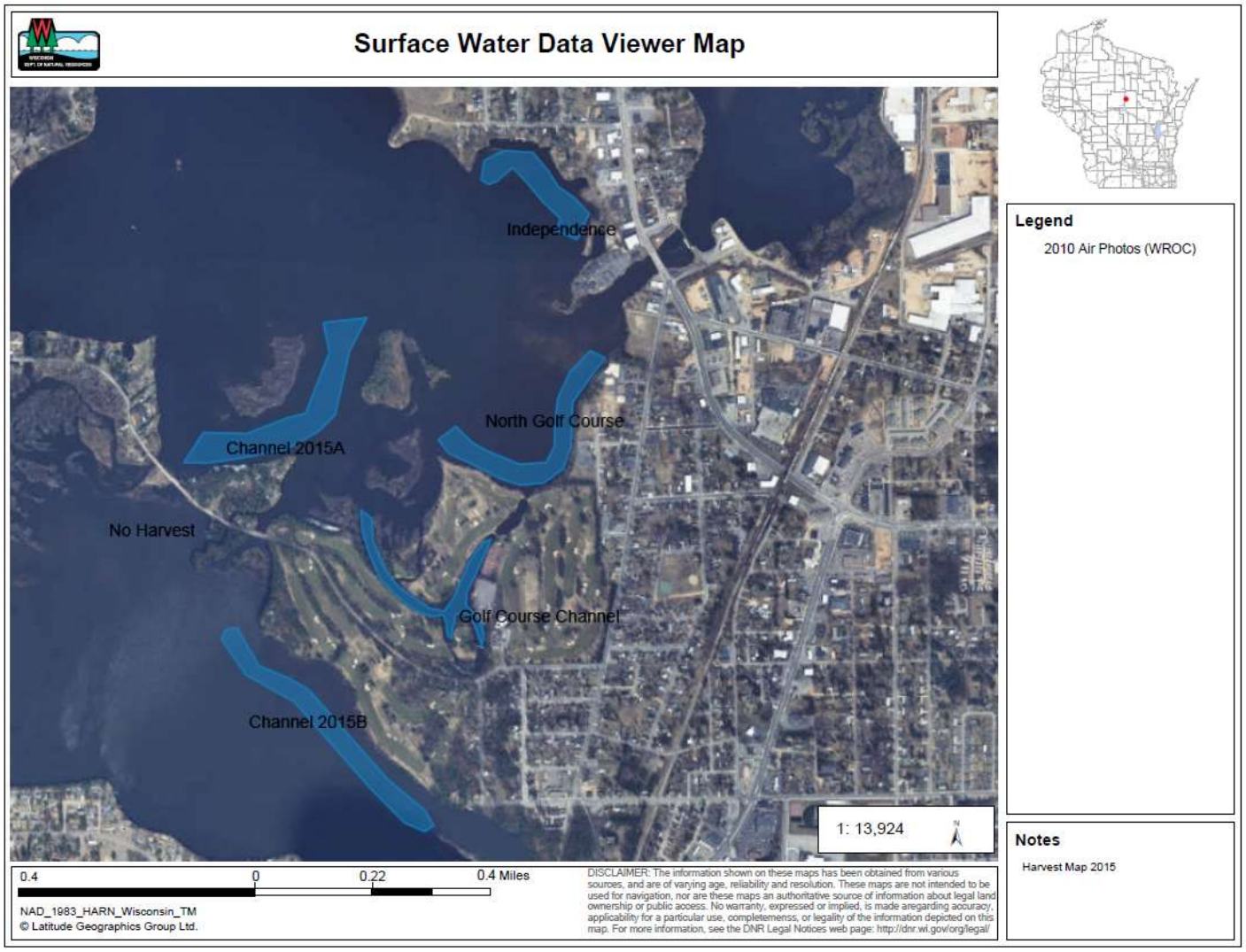
Appendix F: Aquatic Plant 2017 Survey – Rake Fullness



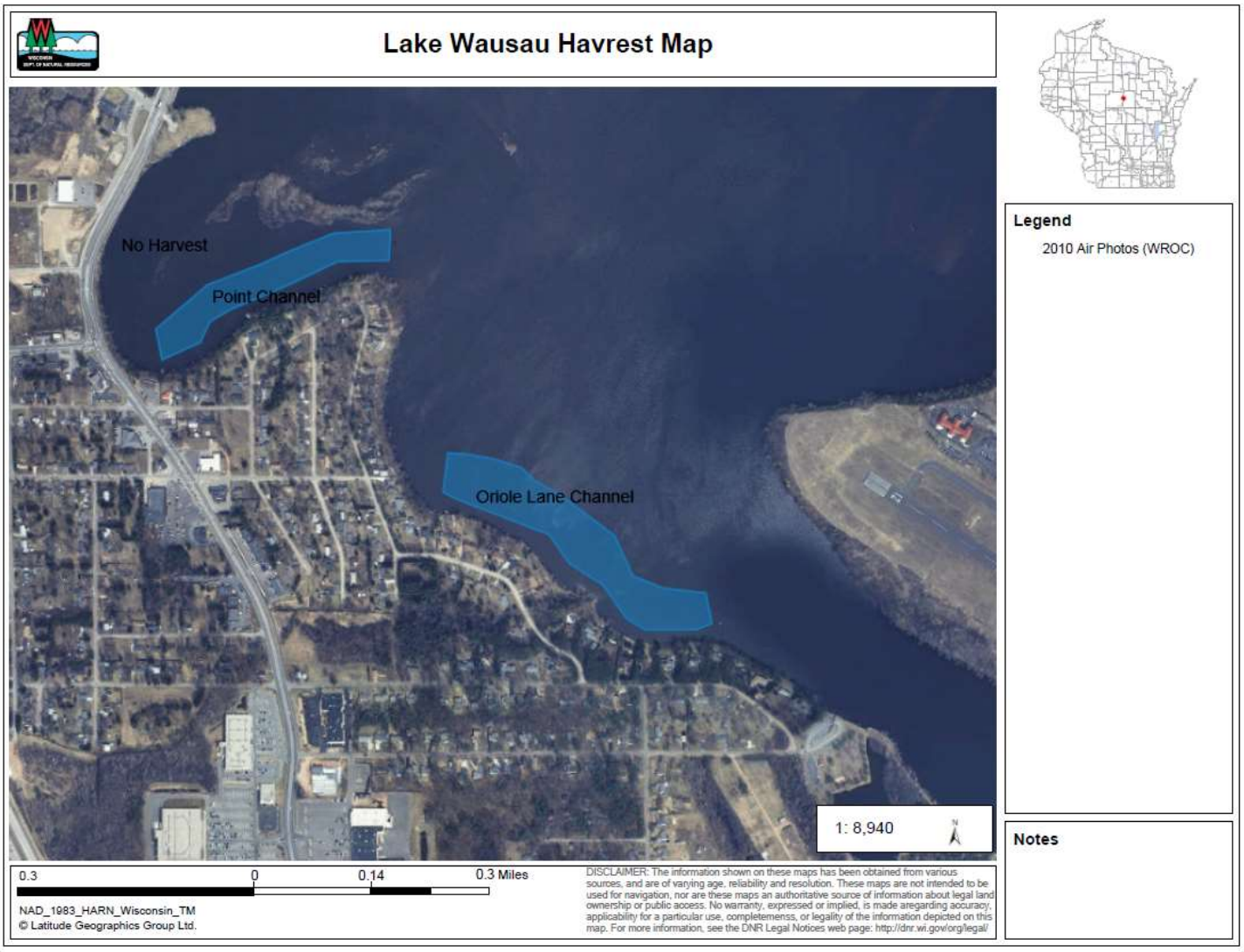
Appendix G: Aquatic Plant Harvesting Maps – Location 1



Appendix H: Aquatic Plant Harvesting Maps – Location 2



Appendix I: Aquatic Plant Harvesting Maps – Location 3

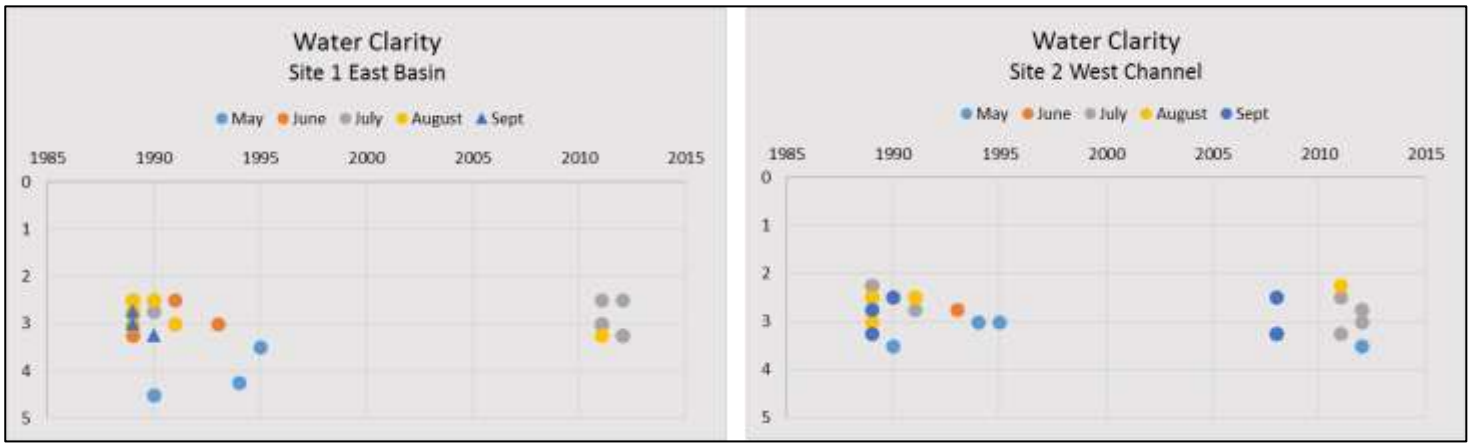


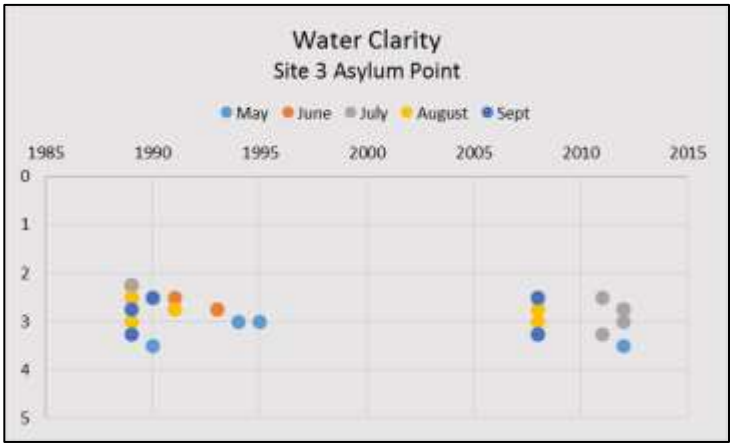
Appendix J: Aquatic Plant Management Plan

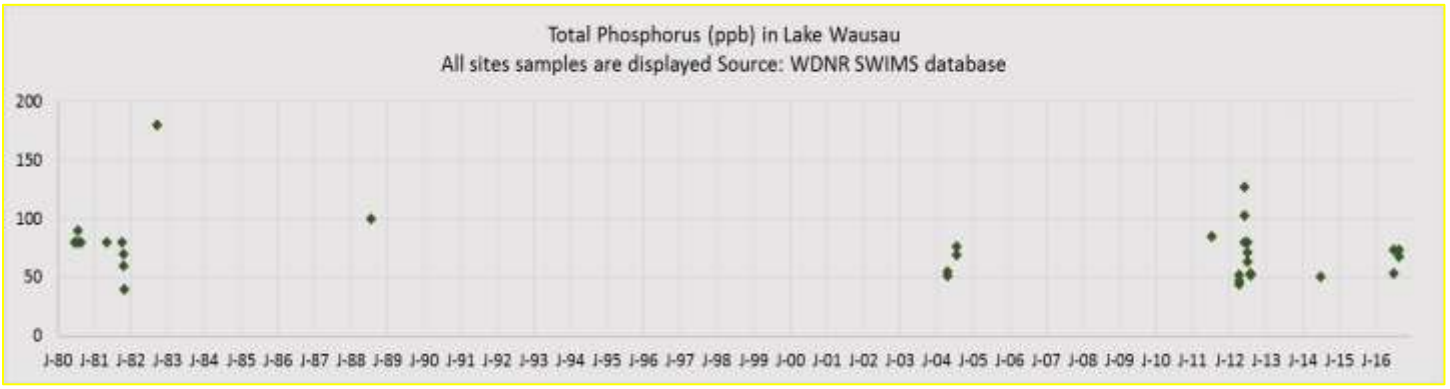
Golden Sands RC&D, Inc. 2018

(see electronic Appendix)

Appendix K: Water Quality in Lake Wausau

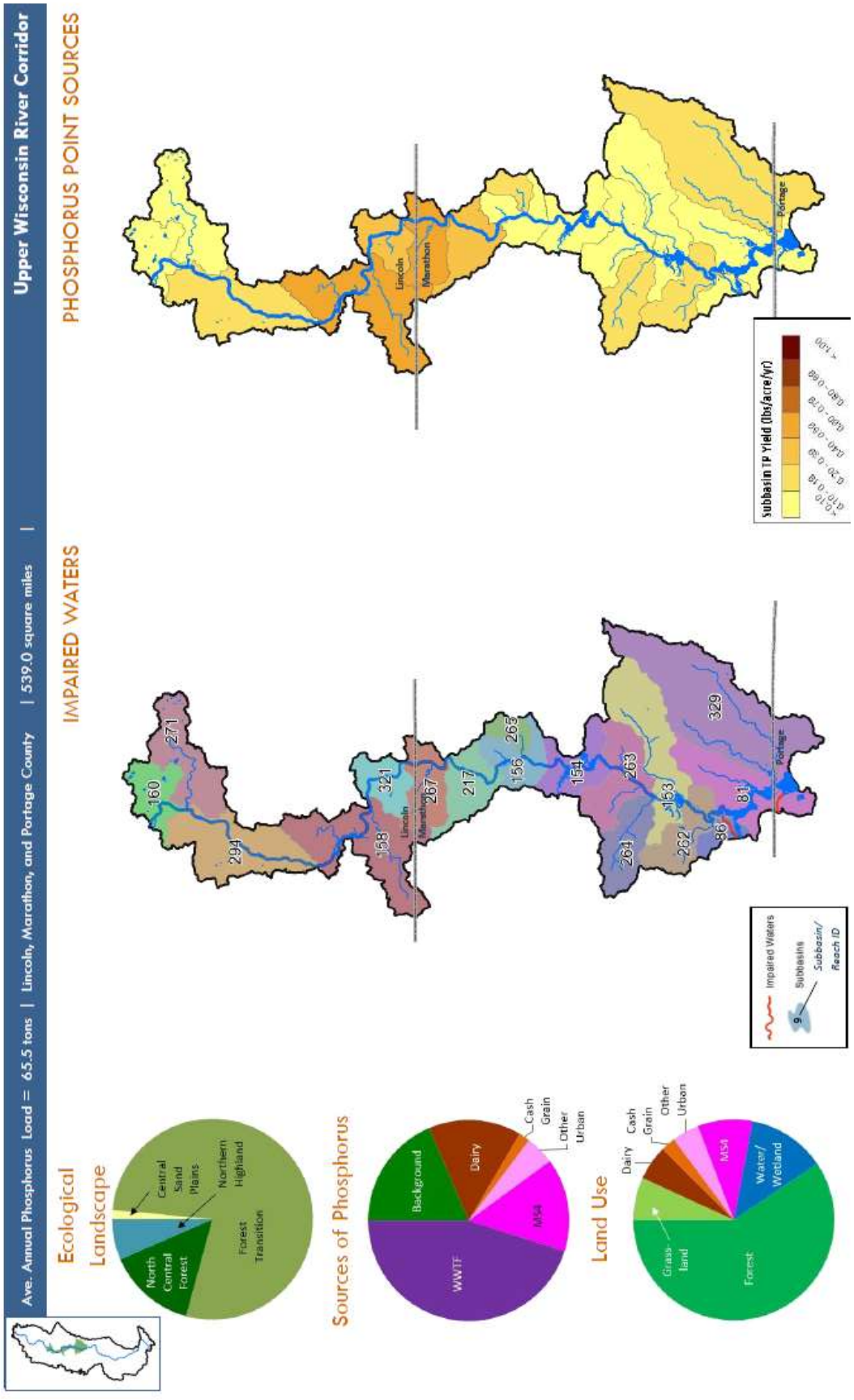






Appendix L: Phosphorus Loading Estimates by Sub-Basin

(Source: WDNR)



Appendix M: Town of Rib Mountain Resolution (passed by board 12/18/2017)

TOWN OF RIB MOUNTAIN
RESOLUTION NO. 17-08

RE: Recognition of Lake Wausau to the Rib Mountain Community

WHEREAS, the Town of Rib Mountain recognizes the importance environmental resources have on the quality of life of our residents; and

WHEREAS, the Town of Rib Mountain is fortunate to have several environmental assets within the community, including Lake Wausau; and

WHEREAS, Lake Wausau serves not only Town residents, but also the Wausau Metropolitan area as well as visitors; and

WHEREAS, Lake Wausau is a year-round recreational asset to our community; and

WHEREAS, the Town of Rib Mountain has been a steadfast supporter of the Lake Wausau Association's continuous efforts in protecting and improving Lake Wausau for all; and

WHEREAS, it is appropriate for the Town to formally recognize the importance of Lake Wausau to the Rib Mountain community and continue to support the Lake Wausau Association's protection, maintenance, and enhancement efforts.

NOW, THEREFORE, BE IT RESOLVED, by the Town of Rib Mountain Board of Supervisors hereby formally recognizes the importance of Lake Wausau to the Rib Mountain community and will continue to support the Lake Wausau Association's efforts in protecting and enhancing our environmental asset.

TOWN OF RIB MOUNTAIN BY:

Allen Opall, Town Chairman

ATTEST:

Michelle Peter, Clerk

Resolution 17-08

Appendix N: Village of Rothschild and Lake Wausau

George O. Peterson
President
gpeterson@rothschildwi.com

Gary D. Olson
Administrator
golson@rothschildwi.com

Timothy D. Vergara, P.E.
Administrator of Public Works
tvergara@rothschildwi.com

VILLAGE OF
Rothschild

Elizabeth Feilner
Clerk/Zoning Assistant
efeilner@rothschildwi.com

Sandra Balz
Treasurer/Utility Clerk
sbalz@rothschildwi.com

Toshia J. Ranallo
Administrative Assistant
tranallo@rothschildwi.com

December 22, 2017

RE: Lake Wausau and the Village of Rothschild

The Village of Rothschild has benefited from Lake Wausau since its creation over 100 years ago. In the past, paper mills and the logging industry used the river for power and transportation. The residents of the Village formed and incorporated as the Village of Rothschild in the early 1900's.

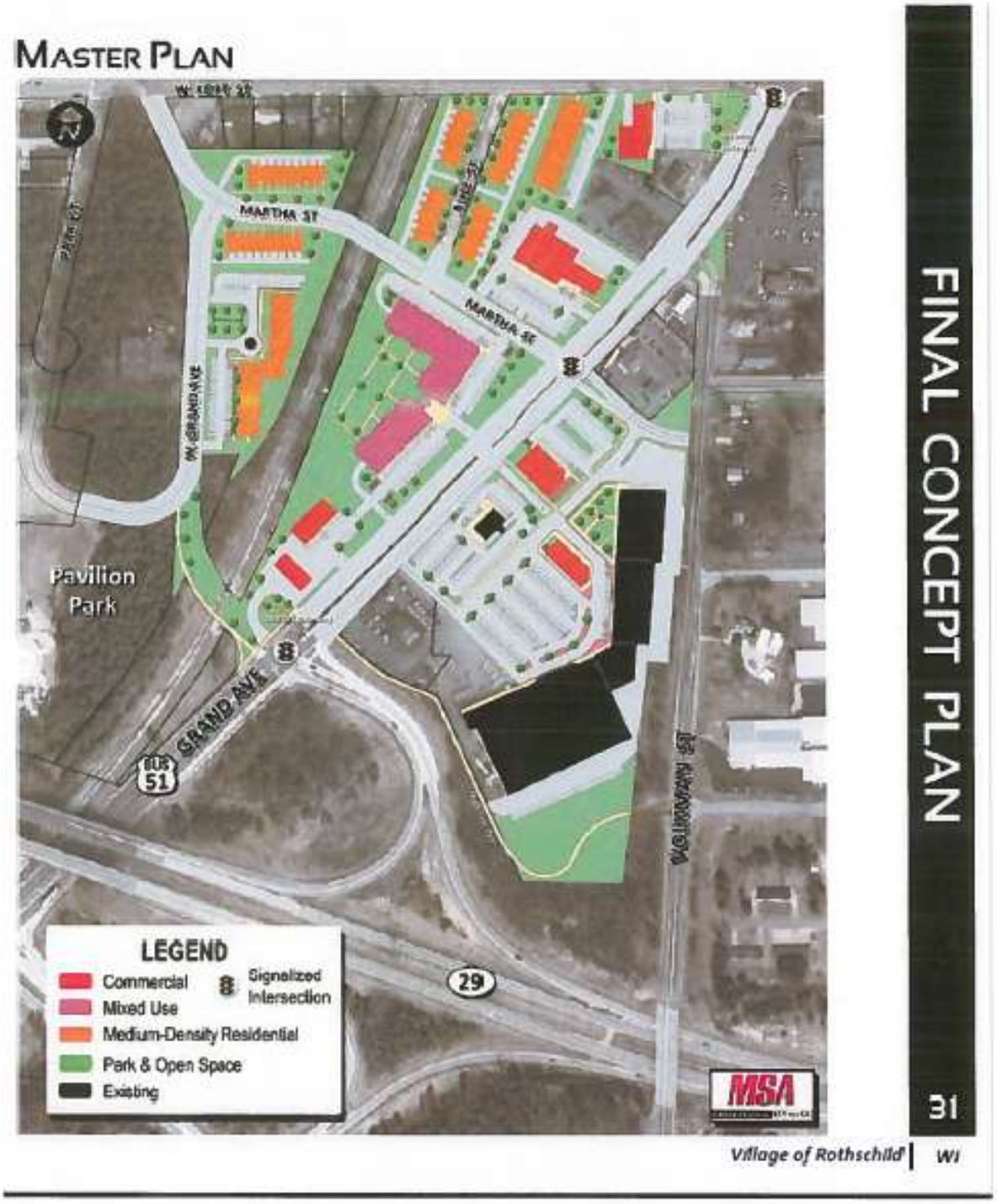
In this same era, the Village Pavilion, located on the shore of Lake Wausau, was a destination point for residents mainly due to the emerging greater Wausau's growth. A rail system was constructed from Wausau to Rothschild and street rail cars were used to bring people to this recreation area. This specific location was the home of a swimming area, docking and wharf area, the Whizzer (roller coaster), and a ski jump that used the frozen lake as part of the landing area.

Today, some of the original islands have eroded away. However, there lies about 10,000 feet of lake frontage owned by the Village itself, or the Domtar Paper Mill. The Village boasts about 4,500 feet of frontage – all in zoned parkland and open to the public (Pavilion Park). On this frontage is a wonderful view of Rib Mountain State Park, a double trailer boat launch, fishing piers, the Pavilion, and the island that host walkers, anglers, and picnickers.

211 Grand Avenue I Rothschild, WI 54474
Phone: 715-359-3660 I Fax: 715-359-7218 I www.rothschildwi.com

In 2012, the Village developed a Master Plan for Pavilion Park. The master plan has a considerable amount of development for the public and the proposed residential growth as part of its TID #2. Together, these plans received the 2012 Vernon Deines Memorial Award for Outstanding Small Town for Rural Plan, a national award from American Planners Association.

211 Grand Avenue I Rothschild, WI 54474
Phone: 715-359-3660 I Fax: 715-359-7218 I www.rothschildwi.com



211 Grand Avenue I Rothschild, WI 54474
Phone: 715-359-3660 I Fax: 715-359-7218 I www.rothschildwi.com

Other benefits of Lake Wausau as it relates to the Village are that there is an estimated 600 users/year utilizing the boat landing off Kort Street. This figure does not account for annual passes or kayaks.

The Village Board has approved a 2018 budget item for a kayak launch structure to be placed on the shore of Pavilion Park. This launch will be beneficial for connecting to other facilities on the lake, or the river itself, as a portage around the dam is located about 4,000 feet downstream to the lower Wisconsin River section below Rothschild Dam. Many kayakers presently launch from the boat landing area already.

Lastly, the Rothschild Pavilion, on the National Historic Building list, is a major draw to the public due to its location on the lake and its uniqueness. This facility is rented by the public and is booked nearly every weekend for up to 2 years in advance.

In closing, Lake Wausau is a significant asset to the Village but will be even more so upon completion of the Pavilion Park Master Plan along with TID development.

If you have any questions or concerns, please feel free to contact me at (715) 359-3660 or by e-mail at tvergara@rothschildwi.com.

Sincerely,

Timothy D. Vergara, PE
Administrator of Public Works

cc: Gary Olsen - Village Administrator
George Peterson – Village President

211 Grand Avenue I Rothschild, WI 54474
Phone: 715-359-3660 I Fax: 715-359-7218 I www.rothschildwi.com

Appendix O: City of Schofield

Communities benefit from Lake Wausau in that its presence brings calming effects to the area such as the enjoyment of peaceful walks along the river, beautiful sunsets and organized activities such as festivals and fisheries.

Additionally, Lake Wausau provides access to our community for fishing (Omega 3 fatty acids) as well as providing recreational qualities such as swimming, boating, transportation, kayaking, water skiing, hunting, snowmobiling and bird watching. Studies show that the presence of lakes provide a healthier community.

The City of Schofield benefits from blue space allowing the regeneration of real estate surrounding the Lake which provides growth and redevelopment opportunities.

Appendix P: City of Wausau

Office of the Mayor
Robert B. Mielke

WAUSAU
WISCONSIN

TEL: (715) 261-6800
FAX: (715) 261-6808

December 15, 2017

Mary Kate Riordan
975 South Park View Circle
Mosinee, WI 54455
Via email: marykater@mapleridge.com

Re: Quote from Mayor - Lake Management Plan

Dear Mary Kate,

Per Sean Gehin, below is a quote from the Mayor regarding the Lake Wausau Management Plan.

Lake Wausau is a tremendous asset to the City of Wausau. City residents and businesses enjoy its beauty through various means that include boating, fishing, swimming and spectacular views. The City is committed to the discharge of clean stormwater into Lake Wausau, the Rib River, Wisconsin and Eau Claire River through many devices and practices that include education and outreach, stormwater treatment measures, street sweeping, cleaning of catch basins, fall leaf pickup, and the routine inspection and maintenance of the City's storm sewer. The annual estimated operation and maintenance of the City's stormwater infrastructure is estimated at $1.5 million.

If you need anything else, feel free to let me know.

Kathi Groeschel
Executive Assistant, Mayor's Office
715-261-6800

407 Grant Street – Wausau, WI 54403

Appendix Q: US Army Corps of Engineers Continuing Authorities Programs Summary

Continuing Authorities Program

The term "Continuing Authorities Program" or "CAP" means a group of legislative authorities under which the Corps of Engineers is authorized to plan, design, and implement certain types of water resources projects without additional project specific congressional authorization. A requirement for application is sponsorship and cost sharing. The sponsoring agency may be a state, county, city, tribes or other group. Additional requirements for each of the small project authorities are detailed in this brochure.

Procedure for Getting a Project

1 2 3

Local Sponsor notifies Corps of problem → Corps conducts site investigation after receipt of letter from local sponsor → Corps requests study funds → Corps conducts project study → Local sponsor and Corps sign agreement to construct and maintain a project → Corps prepares plans and specs → Corps initiates construction

**Cost sharing for lands, easements, rights-of way, relocations and disposal areas as well as cost sharing for operations, maintenance, repair, replacement and rehabilitation varies by project authority.*

http://www.mvp.usace.army.mil

St. Paul District, U.S. Army Corps of Engineers
180 5th Street East, Suite 700
St. Paul, MN 55101-1678

US Army Corps of Engineers
St. Paul District

Nathan Campbell
651-290-5544
nathan.j.campbell@usace.army.mil

STREAMBANK AND SHORELINE PROTECTION

Section 14 of the Flood Control Act of 1946, as amended

PROJECT SCOPE ▶

Provide for protection of public facilities/services in imminent threat of damage by natural stream and shoreline erosion

STUDY COSTS ▶

Initial $100,000 = 100% Federal
Amount over $100,000 = 50% Federal and 50% non-Federal

PROJECT COSTS ▶

Non-Federal sponsor pays 35% of total project costs with a minimum of 5% in cash
Maximum Federal costs of $5,000,000

FLOOD CONTROL

Section 205 of the Flood Control Act of 1948, as amended

PROJECT SCOPE ▶

Provides for local protection from flooding by the construction or improvement of flood control works

STUDY COSTS ▶

Initial $100,000 = 100% Federal
Amount over $100,000 = 50% Federal and 50% non-Federal

PROJECT COSTS ▶

Non-Federal sponsor pays 35% of total project costs with a minimum of 5% in cash
Maximum Federal costs of $10,000,000

BENEFICIAL USE OF DREDGED MATERIAL

Section 204 of the Water Resources Development Act of 1992, as amended

PROJECT SCOPE ▶

Provides for protection, restoration, and creation of aquatic and/or wetland habitats associated with dredging for authorized navigation projects

STUDY COSTS ▶

100% Federal

PROJECT COSTS ▶

Non-Federal sponsor pays 35% of total project costs
Maximum Federal costs of $10,000,000

AQUATIC ECOSYSTEM RESTORATION

Section 206 of the Water Resources Development Act of 1996, as ammended

PROJECT SCOPE ▶

Provides restoration of degraded aquatic ecosystem structure, function and dynamic processes to a less degraded, more natural condition

STUDY COSTS ▶

Initial $100,000 = 100% Federal
Amount over $100,000 = 50% Federal and 50% non-Federal

PROJECT COSTS ▶

Non-federal sponsor pays 35% of total project costs
Maximum Federal costs of $10,000,000

PROJECT MODIFICATION FOR THE IMPROVEMENT OF THE ENVIRONMENT

Section 1135 of the Water Resources Development Act of 1986, as amended

PROJECT SCOPE ▶

Provides for improving environmental quality through modifications to Corps structures and operations of Corps structures or implementation of measures in affected areas

STUDY COSTS ▶

Initial $100,000 = 100% Federal
Amount over $100,000 = 50% Federal and 50% non-Federal

PROJECT COSTS ▶

Non-Federal sponsor pays 25% of total project costs
Maximum Federal costs of $10,000,000