# The Wilderness Waters Adaptive Management Plan (Presque Isle Township, Vilas County, Wisconsin)


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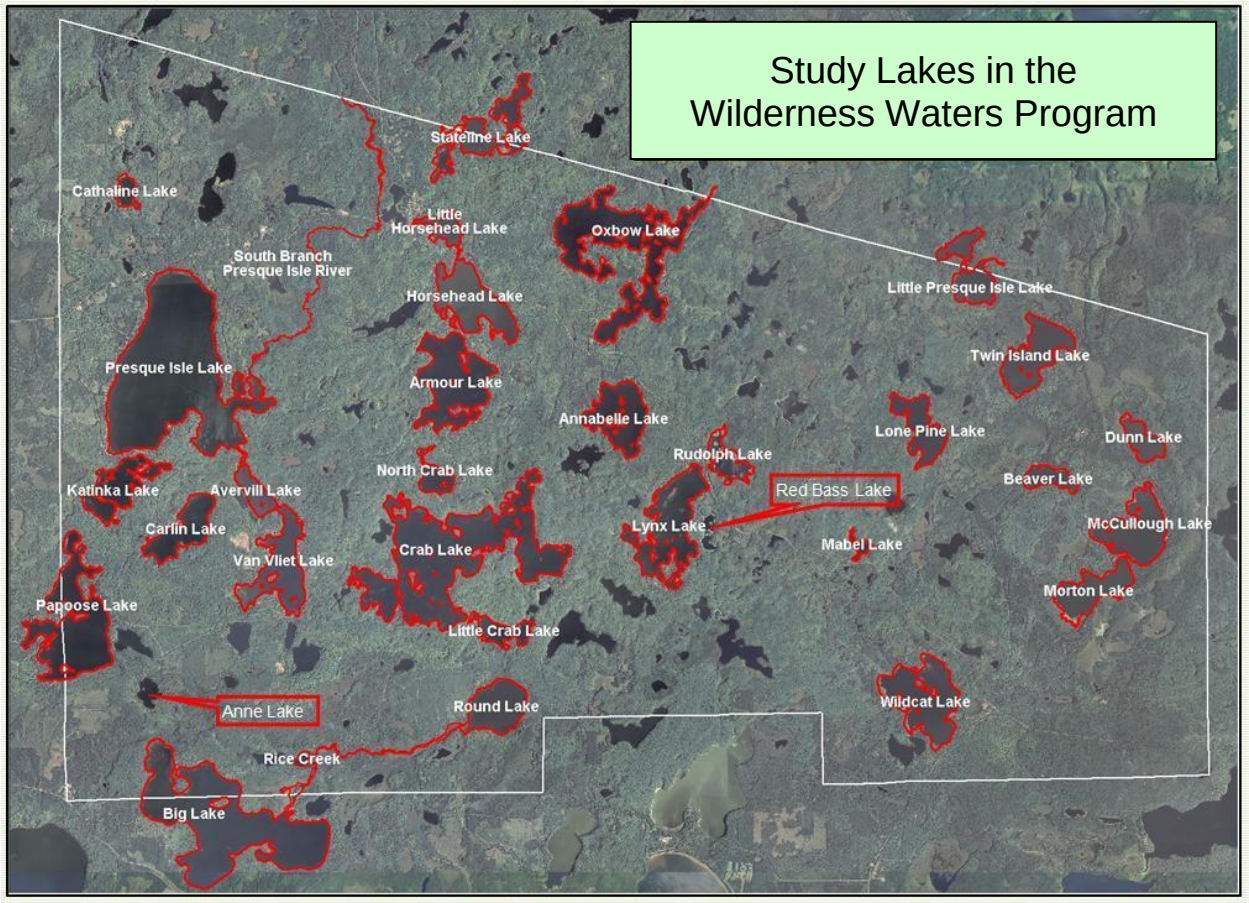


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This document is a product of four WDNR Lake Planning Grants:

Wilderness Waters: Armour, Big, and Horsehead Lakes
Wilderness Waters: Crab, Little Crab, and North Crab Lakes
Wilderness Waters: Annabelle, Anne, Red Bass, & VanVliet Lks
Wilderness Waters: Averill, Presque Isle, & Wildcat Lakes

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# CHAPTER 1

# What Is the Wilderness Waters Adaptive Management Plan?

This ***Wilderness Waters Adaptive Management Plan*** began with a large-scale project funded by a Wisconsin Department of Natural Resources (WDNR) Aquatic Invasive Species Control Grant that was awarded in 2010. The project was sponsored by the Presque Isle Town Lakes Committee (PITLC). White Water Associates, Inc., an independent ecological consulting firm, was a consultant to the PITLC. This plan was last updated in 2019. As the name implies, this plan is intended to be "adapted" as new information becomes available, new needs are identified, and some information becomes dated.

The ***Presque Isle Wilderness Waters Program*** was conceived and undertaken as a natural extension of the dedicated lake stewardship activities of the PITLC, individual lake associations, and lake volunteers. The Town of Presque Isle has demonstrated its awareness of the value of its water landscape by establishing and actively supporting the PITLC (in part, an outcome of the Vilas County AIS Planning Partnership's efforts). The PITLC has been active since 2005 and has received WDNR funding to conduct aquatic plant surveys on thirty-three water bodies in the area (with two additional lakes via lake association funding).

The PITLC views the region as an ecologically connected landscape. Individual lake studies are seen as part of a big picture. Important motivations for the Wilderness Waters Program are to understand the diversity of aquatic ecosystems in the township and systematically integrate lake monitoring and management efforts of the PITLC in a single program.

All of the water bodies in the region should be considered as an interacting suite of ecosystems. Each is ecologically unique. Certainly, each will have its own set of management goals and actions and each is subject to a lake-specific Aquatic Plant Management Plan (APMP). This Adaptive Management Plan brings all the lakes under a single program allowing greater opportunity and efficiency in water resource protection, management, and education.

Reasons for a single integrated program are practical as well as ecological. Since the PITLC is coordinating activities on a large number of lakes, the "life cycle management" of lake studies will be more effective and efficient under a single program. For example, lakes that have already received point-intercept plant surveys will be scheduled for follow up surveys in the next few years. Granting cycles and labor capacity of volunteers and others can be better managed and applied in a single integrated program. The ***Wilderness Waters Adaptive Management Plan*** is the mechanism by which this integrated understanding and management can occur.

In addition to establishing the Presque Isle Wilderness Waters Program, a major effort in this project was to conduct aquatic plant surveys and related activities on thirty-three water bodies (thirty-one lakes and two streams). Some water bodies have few or no public access sites, but all are used by members of the public and are therefore potentially exposed to aquatic invasive species (AIS) through human transport. The thirty-three water bodies that have been studied in the Wilderness Waters Program are listed in Exhibit 1 along with years when point-intercept aquatic plant surveys have been conducted. In this *Adaptive Management Plan*, these thirty one water bodies are referred to as the "Presque Isle study lakes." Aquatic Plant Management Plans (APMPs) have been prepared for each of these water bodies. These plans are associated with this adaptive management plan, but have been prepared as separate deliverables.

Project participants have embraced the concept of "adaptive management" in their approach to Presque Isle Township lakes stewardship. Simply stated, adaptive management uses findings from planned monitoring activities to inform future management actions and periodic refinement of the plan. An adaptive management plan accommodates new findings by integrating this information into successive iterations of the comprehensive plan. The plan will therefore be a dynamic entity, successively evolving and improving to fit the needs of Presque Isle Township lakes and the PITLC. A central premise of adaptive management is that scientific knowledge about natural ecosystems is uncertain and incomplete. It follows that a practical management plan allows for ongoing adjustments in management designed to "adapt" to changing conditions and new information or understanding. Monitoring the outcomes of plan implementation is essential to the process of adaptive management.

It is appropriate that the PITLC leads implementation of this plan. Success depends on a coalition of participants, each carrying out appropriate tasks and communicating needs and findings to other team members. Future projects and ongoing monitoring will inspire updates to the plan. Overall, the Presque Isle Wilderness Waters Program has a robust set of goals that seek to perpetuate an ecologically healthy waterscape. These goals address aquatic plant communities, shallow water aquatic habitat, riparian area condition, fish and wildlife communities, human recreational opportunities, and human capacities for long-term stewardship. The goals include:

1. Preserving native aquatic plants;
2. Identifying and protecting unusual and/or sensitive ecological areas;
3. Preventing introductions and/or spread of Aquatic Invasive Species;
4. Educating the public about healthy aquatic plant communities, AIS, shallow water and riparian habitat;
5. Managing healthy native aquatic plant communities with best available information and science (including minimizing nuisance plant and AIS problems);
6. Perpetuating high quality riparian areas, shallow water habitat, and fish and wildlife habitat through management, restoration, and protection;
7. Managing high quality, compatible, recreational opportunities in the Township; and
8. Planning for economic and human capacities necessary to achieve these goals over time.

**Exhibit 1. Wilderness Waters Water Bodies Subject to Point-Intercept Plant Surveys**

| *Lake Name* | *Years of Point-Intercept Aquatic Plant Surveys* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *2007* | *2008* | *2010* | *2011* | *2013* | *2014* | *2016* | *2017* | *2018* | *2019* | *2020* |
| *Annabelle Lake* | | ✓ | | | | ✓ | | | | ✓ | |
| *Anne Lake* | | | | | | | | | | ✓ | |
| *Armour Lake* | | ✓ | | | ✓ | | | | | | ✓ |
| *Averill Lake* | ✓ | | | | ✓ | | | | | ✓ | |
| *Big Lake* | ✓ | | | | ✓ | | | | | | ✓ |
| *Beaver Lake* | | | | ✓ | | | | | ✓ | | |
| *Carlin Lake* | | | ✓ | | | | | | | | |
| *Cathaline Lake* | | ✓ | | | | | | ✓ | | | |
| *Crab Lake* | ✓ | | | | | ✓ | | | | | ✓ |
| *Dunn Lake* | | | | ✓ | | | | | ✓ | | |
| *Horsehead Lake* | | ✓ | | | ✓ | | | | | | ✓ |
| *Katinka Lake* | | | ✓ | | | | | | | | |
| *Little Crab Lake* | ✓ | | | | | ✓ | | | | | ✓ |
| *Little Horsehead Lake* | ✓ | | | | | | ✓ | | | | |
| *Little Presque Isle Lake* | | | | ✓ | | | | | ✓ | | |
| *Lone Pine Lake* | | | | ✓ | | | | | | | |
| *Lynx Lake* | | ✓ | | | | | | ✓ | | | |
| *Mabel Lake* | | ✓ | | | | | | ✓ | | | |
| *McCullough Lake* | | | | ✓ | | | | | ✓ | | |
| *Morton Lake* | | | | ✓ | | | | | ✓ | | |
| *North Crab Lake* | ✓ | | | | | ✓ | | | | | ✓ |
| *Oxbow Lake* | ✓ | | | | | ✓ | | | ✓ | | |
| *Papoose Lake* | | ✓ | | | | | | ✓ | | | |
| *Presque Isle Lake* | ✓ | | | | ✓ | | | | | ✓ | |
| *Red Bass* | | | | | | | | | | ✓ | |
| *Rice Creek* | | | ✓ | | | | ✓ | | | | |
| *Round Lake* | | | ✓ | | | | ✓ | | | | |
| *Rudolph Lake* | | | ✓ | | | | | | | | |
| *S. Branch Pr. Isle River* | | | ✓ | | | | | ✓ | | | |
| *Stateline Lake* | | | ✓ | | | | | | ✓ | | |
| *Twin Island Lake* | | | | ✓ | | | | | ✓ | | |
| *Van Vliet Lake* | | ✓ | | | ✓ | | | | | ✓ | |
| *Wildcat Lake* | ✓ | | | | | ✓ | | | | ✓ | |

Besides this introductory chapter, the plan is organized in seven chapters. Chapter 2 describes the audience for the plan. Chapter 3 addresses why there should be a plan and discusses adaptive management and the underlying assumptions of the approach. Chapter 4 details how the plan was created, including the methodology used. Chapter 5 presents the findings from efforts to gather existing and new information about Presque Isle Township Lakes and its environs by providing summaries of information in eight subsections. Chapter 6 presents the desired future condition and goals established by the PITLC and the plan writers. Chapter 7 offers a menu of practical management actions ready to be adopted and adapted by those who want to take an active role in water resource stewardship. Three appendices complete this document. Appendix A contains *Literature Cited*. Appendix B presents the *Comparison of Presque Isle Lakes' Water Quality Parameters*. Appendix C consists of the *Review of Water Regulations and Planning Relevant to Presque Isle Lakes*.

# CHAPTER 2

# Who Is the Audience for the Adaptive Management Plan?

The title of Chapter 3 poses the question: "Why Have the *Wilderness Waters Adaptive Management Plan*?" The short answer is "Because we care!" We believe that people working together in the stewardship of this lake can make a difference. We can protect and restore a healthy ecosystem if we take a long-term, strategic approach. That approach is presented in this adaptive plan. It is an adaptive plan in the sense that it will grow and evolve. Implemented actions will be monitored. The plan will be evaluated. It will be reviewed and refined as years go by – as new generations take up their stewardship responsibility.

People who care about lakes and streams of Presque Isle Township are the most direct audience for this plan. They will be the implementers and evaluators of the plan. They will be the reviewers and future plan writers. Many of them live in or near the watershed. These are the "grassroots" – the constituency most connected to Presque Isle water bodies and the surrounding landscape. People who care are also those who live beyond the watershed boundaries. Some of these people visit Presque Isle Township for recreation and enjoyment. But the audience also includes foundations and other funding agencies, resource and regulatory agencies concerned with environmental quality, and other citizens that are working on their watersheds.

For those in the "grassroots" camp, this plan is intended to provide a practical approach to carrying out protection and restoration of Presque Isle Township water bodies. The plan does not have all the answers (it doesn't even have all the questions). It does not recommend every conceivable rehabilitation or protection action. But the plan does provide plenty with which to get started and leaves room for ideas and contributions from others. Our recipe mixes a pinch of the theoretical with a cupful of the practical. Those of you who are "hands-on" have plenty to do.

The mixed audience of this plan challenges the authors to present a plan that is scientifically grounded and technically oriented, but at the same time accessible and understandable by the public who will in large part be responsible for its implementation. Although scientists are the primary authors of the plan, the writing is aimed at non-scientists. We define terms where clarity is needed and cite other literature for those interested in the source of a statement, or in learning more about the topic. The PITLC and other township lake stewards have interacted with the plan writers throughout the process and reviewed plan drafts. The PITLC has encouraged our practical approach so that applications of the plan are conspicuous.

We will end this chapter with our strongest management recommendation:

***Approach lake and watershed management with humility.***

Lake and watershed ecosystems are enormously complex. Our understanding of how they work is not complete. In the case of an AIS establishment, complexity increases. Our ability to predict outcomes from specific actions is uncertain. New discoveries are made every day that have important implications for future watershed management. We may never know all we need, but that fact should not hinder good lake stewardship from taking place today in Presque Isle Township. The fact that ecosystems are inherently resilient is to our great advantage. They are able to rebound from disturbance and repair themselves from injury. In fact, some of today's best watershed managers state that "...successful restoration usually has less to do with skillful manipulation of ecosystems than it does with staying out of nature's way" (Williams et al., 1997). This plan is intended to complement nature's own processes.

# CHAPTER 3

# Why Have an Adaptive Management Plan?

Why have the *Wilderness Waters Adaptive Management Plan*? The gut-level answer ("because we care") was offered in Chapter 2, but the question deserves more thoughtful reflection – the focus of this chapter. This requires consideration of environment, economy, history, and culture. This chapter also defines some important terms and presents the process and underlying assumptions.

## Part 1 - Why Should We Care?

The health of a watershed and the health of local economies like those that exist in the Presque Isle Township are highly integrated. A sustainable economy depends on a healthy environment. In fact all social and economic benefits are based on the biological and physical properties of watersheds (Williams et al., 1997). In fact, our economy should be viewed as being nested inside our environment (Lanoo, 1996).

This link between a healthy environment and the economy is true at several scales. For example, someone who owns property on a lake in Presque Isle Township has invested in an ecosystem. A major reason that the property was purchased is typically linked to the quality of the environment. The economic value of the investment is linked to the health of lake and surroundings. If ecological health declines, so does the value of the property.

At a slightly larger scale, this same principal linking the environment and economy applies to municipalities. The Presque Isle Township community is caretaker of many ecosystems including the lakes and streams in the township. The long-term economic health of the municipality is tied to the health of the water resources. At even larger scales yet, this applies to Vilas County, to the State of Wisconsin, and so on.

The PITLC and this plan aspire to cultivate a deep connection between lake users and the water resources of the township. People will make the management plan work. Water resource stewardship must be a cultural imperative. In some ways, watershed restoration is about cultural restoration – rejuvenating citizens' civic responsibility to care for the environment in which they live. This is what Aldo Leopold referred to as "...the oldest task in human history: to live on a piece of land without spoiling it" (Leopold, 1948).

People need to feel vital by working to improve, beautify, or build. Sometimes that need is expressed by gardening, caring for a lawn, or volunteering on civic projects. The PITLC and this

plan endeavor to harness that energy and apply it to restoration and protection actions focused on Presque Isle lakes and their landscape. Education, rehabilitation, and protection become outlets for this creative energy.

Why should you care about creating and implementing a practical resource plan? Because we realize the economy and the economic options available to citizens in the watershed are tied to a healthy environment. Because we are all connected to the Presque Isle waterscape in some way. Because we feel a civic responsibility to care for the environment. Because we realize lakes in Presque Isle Township potentially affect other lakes. Because we can feel vital by doing meaningful work in the watershed. Because future generations depend on us to hand down a healthy Wilderness Waters environment for them to enjoy and use.

The adaptive management plan will be successful if it allows and organizes meaningful stewardship work for Presque Isle Township water resources. It needs to make provision for different kinds of approaches and different kinds of people who want to be part of the process. It has to be strategic and integrated so that various actions complement one another, and are consistent with the lakes' natural processes. The plan should help avoid management actions that work at cross-purposes or whose outcomes are undesirable.

## Part 2 - What Is an Adaptive Management Plan?

An adaptive management process (Walters, 1986) is an appropriate model to use in water resource management. In adaptive management, a plan is made and implemented based on the best available information and well-defined goals and objectives. Outcomes of management actions are monitored to determine whether they are effective in meeting stated objectives. Based on this evaluation the plan is adapted (modified) in a process of continuous learning and refining.

Adaptive management concedes and confronts a truth that resource managers are sometimes reluctant to acknowledge – uncertainty. Because natural systems are so diverse, so complex, and so variable, almost all management actions will have uncertain outcomes. An adaptive management approach essentially takes a position that says, "We will make our best attempt and get better as we go along. We'll listen to what the natural system tells us." In adaptive management, monitoring is crucial. Adaptive management uses information from monitoring to continually evaluate and refine management practices. Monitoring measures the success of restoration or management. Well-designed monitoring should indicate how effectively management measures are working and give us new insights into ecosystem structure and function. Monitoring should provide needed information to adapt management goals.

The *Adaptive Management Plan for Presque Isle Township Lakes* can be implemented through five kinds of management actions: protection, rehabilitation, enhancement, education,

and research. Research actions have a special subset called "monitoring actions" that serve all of the management actions. Each kind of action is summarized in the following bullets.

- Protection actions are used when high quality areas or ecosystem elements are identified and need to be safeguarded. Since aspects of the lakes and their surroundings are quite pristine, part of the adaptive management could fall under this kind of action. There are numerous forms that protection actions can take including protecting water quality, conservation easements, buffer zones to prevent runoff into the lake, boating restrictions and so on.
- Rehabilitation actions are those that manipulate site-specific elements of ecosystems in order to repair some past impact. Examples include planting lakeside natural vegetation in areas of erosion, placing fish structure where large woody material has been removed from the lake, or healing an area of active erosion. Individual rehabilitation actions contribute to overall lake and watershed restoration.
- Enhancement actions are intended to improve some function or value of the ecosystem. In some cases, these actions are meant to benefit human users of the lake (for example, enhancing recreation values by planting fish or creating new fish habitat).
- Education actions are those activities that serve to promote stewardship and inform people about natural ecosystems. This can include this management plan as an education piece. These actions also include installation of interpretive kiosks or incorporation of Presque Isle Township water resources information in science curricula of area schools. Every person that visits the lakes in Presque Isle Township represents an opportunity for education about healthy ecosystems and impacts to them.
- Research actions are employed to learn about the system being managed. Often we know very little about the plants, animals, habitats, ecosystems, and processes that our management actions are affecting. Research actions on water quality have been ongoing in Presque Isle lakes and streams by collecting basic water quality measures. More recently, surveys for aquatic plants have contributed to our understanding of the water resources in Presque Isle Township. Monitoring actions (a subset of research actions) are those that serve to evaluate the outcomes of protection, rehabilitation, enhancement, and education actions. Monitoring actions guide future management.

One word of caution is warranted. Our society typically thinks a long-term planning horizon is twelve months. Unfortunately, this is out of synchrony with the way an ecosystem functions. An ecological clock ticks off time in years, decades, centuries, and even millennia. Lake and watershed management and restoration must be viewed from this perspective. In fact,

the final outcomes of some of the good work put in place today might not be apparent until a new generation of lake stewards is on the scene.

### Part 3 - What Are the Plan's Underlying Assumptions?

As an adaptive plan, a basic assumption is that the management actions will change over time under the influence of stakeholders. Through iterative refinement, the plan will more closely reflect the needs of the water resources and the people who care about them. This plan has assumed a desired condition of sustainable health of the water resources. The plan attempts to reflect the collective vision of the people and organizations that are concerned with Presque Isle Township water resources. The PTLIC, Vilas County Land & Water Conservation Dept., the WDNR, the community of Presque Isle Township, and those who visit Presque Isle Township for recreation are among these stakeholders.

The Vilas County Land & Water Conservation Department provides a variety of land information and related services including: natural resource and water quality protection information, AIS information and assistance, geographic information, rural addressing, Public Land Survey System and surveying data, property ownership and tax assessment information and mapping products. This office can provide important assistance in Presque Isle Township water resources stewardship.

At a larger geographic scale, the WDNR published the *Headwaters Basin Integrated Management Plan* (WDNR et al., 2002) that provides a snapshot of current conditions of resources in the larger drainage basin that includes Presque Isle Township. The Plan outlines nineteen issues of concern to the basin, including control of exotic species (including AIS), shoreline development, resource inventory and monitoring, habitat loss, user conflicts, and protection of endangered, special concern, or unique species.

The integrating features of this adaptive management plan are the Presque Isle Township water resources and their surroundings. The plan assumes that proper planning in the beginning of the process will save time and money throughout the life of the program and that this can be accomplished by managing the causes rather than (or at least, in addition to) managing the symptoms of any impairments.

# CHAPTER 4

# How Was the Adaptive Management Plan Made?

There are five principal partners in the Wilderness Waters Program: (1) the PITLC, (2) volunteer lake stewards (some of whom are members of lake associations), (3) White Water Associates, and (4) the WDNR and (5) Vilas County. The specific actionable goals of the Wilderness Waters Program were to (1) establish an adaptive management plan that is sufficiently robust to encompass all water bodies in Presque Isle Township, (2) gather water quality information and establish aquatic plant studies on study lakes, and (3) deliver educational elements that serve to convey information about the Wilderness Waters Program and constituent water bodies. Thirteen objectives supported these goals:

***Objective 1.*** Develop a strategy that enables the Presque Isle Wilderness Waters Program to integrate and organize water resource stewardship for the Presque Isle area.

***Objective 2***. Gather, consolidate, assess, and manage information about aquatic plants and plant habitats of the study lakes.

***Objective 3.*** Gather, consolidate, assess, and manage information about water quality and potential risks to water quality of the study lakes.

***Objective 4.*** Conduct assessments of the shoreland and shallow water habitats of study lakes.

***Objective 5.*** Gather, consolidate, assess, & manage information about watersheds of study lakes.

***Objective 6.*** Conduct point-intercept aquatic plant surveys on the study lakes.

***Objective 7.*** Prepare and update APMPs for study lakes.[1]

***Objective 8.*** Create and update an adaptive management plan that integrates management for all lakes in Presque Isle Township and will serve as a foundation for future versions of the plan.

***Objective 9.*** Integrate recommendations from the GMU/basin plan and County Land & Water Resources Management Plan into the adaptive management plan.

***Objective 10.*** Conduct surveys of lake users for each of the study lakes focusing on the aquatic ecosystems, recreational uses, and aquatic plants.

***Objective 11.*** Continue and expand the AIS Prevention Program in the Town of Presque Isle.

***Objective 12.*** Deliver an educational program that serves to (1) train volunteers, and (2) increase support and capacity the PITLC and other stakeholders engaged in lake stewardship.

***Objective 13.*** Prepare a catalog of Presque Isle waterscape environmental, cultural, and aesthetic attributes with a qualitative evaluation of quality and associated potential threats.

[1] *Since 2010, APMPs for study lakes have been prepared by White Water Associates. All APMPs are available through PITLC.*

The effort included gathering, reviewing, and summarizing existing information pertaining to Presque Isle study lakes (for example, aquatic plants, water quality, and watershed information). Existing information is found in many repositories and forms: anecdotal accounts of residents, resource agency reports and memos, municipal planning and zoning documents, scientific reports, old and new photographs, best guesses of knowledgeable people, and government land office records. Not all of the existing information is of equivalent value in the planning process. Some is not verifiable or the methods by which it was collected are unknown.

***Water Quality*** - One of our objectives was to gather, consolidate, assess, and manage information about the Presque Isle study lakes' water quality and potential risks to water quality. Four tasks were applied to achieving this objective: (1) collect and review existing limnological information about Presque Isle lakes, (2) analyze and summarize existing Presque Isle lakes water quality data, (3) conduct water quality sampling on each of the water bodies and include findings in the water quality summary, and (4) assess the existing regimen of water quality sampling for Presque Isle lakes and determine appropriateness to lake conditions and revise (if needed).

***Watershed*** - Presque Isle lakes watershed analysis included delineating the Presque Isle lakes watershed area, mapping land cover/use and soils of the watershed; and digital elevation models. This information is discussed further in the several *Aquatic Plant Management Plans* created for individual water bodies in Presque Isle Township. We used existing layers of geographic information available from the WDNR and other sources and manipulated these data using geographical information system technology. We reviewed and summarized existing institutional programs that influence water quality (for example GMU basin plan, county land and water resources management plan, and township zoning ordinances).

***Shoreland & Shallow Water Habitat*** - One objective was to document shoreland conditions on the subject lakes for the purpose of establishing a baseline against which future changes can be measured. This new data will reflect the state of health of the shoreland and possible risks to the lake ecosystem. Achieving this goal will add important new information regarding ecosystem health to that which exists for the subject lakes. Starting in 2017, the Wilderness Waters Stewardship Program began incorporating shoreland and shallows habitat monitoring on subject lakes using a dedicated protocol developed by the WDNR (WDNR, 2016). There are three principal components of this monitoring:(1) obtain georeferenced photos of the entire lake shoreline area, (2) assess the riparian, bank, and littoral habitat by ownership parcel, and (3)

count and map all pieces of large woody material in water less than 2 feet deep. This monitoring is accomplished by two or three entire circumnavigations of the lake.

***Aquatic Plants*** - Formal aquatic plant surveys are conducted on Presque Isle lakes and two streams on an on-going basis using the WDNR point-intercept aquatic plant survey protocol. Repeat surveys are conducted on the lakes after five years have elapsed. The resulting data allow calculation of ecological metrics such as number of sites where a plant species is found, relative percent frequency of species occurrence, frequency of occurrence within vegetated areas, frequency of occurrence at all sites, and maximum depth at which plants are found. The data also allow calculation of metrics such as total number of points sampled, total number of sites with vegetation, total number of sites shallower than maximum depth of plants, frequency of occurrence at sites shallower than maximum depth of plants, Floristic Quality Index, maximum depth of plants (feet), average number of all species per site, average number of native species per site, species richness, and Simpson diversity index.. These data and subsequent analyses are used in the creation and periodic update of Aquatic Plant Management Plans prepared for Presque Isle Township water bodies. Repeat surveys provide insight into the dynamics of the plant communities in these water bodies.

***Aquatic Plant Management Plans*** - An important component of this project was our objective to prepare and periodically update Aquatic Plant Management Plans for Presque Isle water bodies. This involves interpreting and summarizing the aquatic plant information for each of the water bodies for inclusion in the plan. As time proceeds, some bodies of water have more than one point-intercept survey and these data allow insight into the dynamics of the plant communities. We created APMPs that included goals, objectives, monitoring, evaluation, plant community, nuisance species or AIS, management alternatives, and recommendations. Because of the large size of each of the APMP documents, they were prepared as stand-alone documents.

***Adaptive Management Plan*** – An important project objective called for the creation of this initial adaptive management plan for Presque Isle lakes that will help ensure integrated and high quality water resource management and will serve as a firm foundation for future iterations of the plan. The adaptive management plan integrates the *Aquatic Plant Management Plans* created as result of the 2007, 2008, 2010, 2011, 2013, 2014, 2016, 2017, 2018, 2019, and 2020 aquatic plant surveys. This objective was guided by two basic tasks. The first task was to develop management recommendations for Presque Isle lakes. These recommendations include topics such as water quality, fish habitat, special species habitat (rare plants and animals), sensitive

areas, non-native species, and ecological threats. The second task was to prepare a practical written plan, grounded in science that includes sections on implementation, monitoring, and adaptive management. The plan will lay the basis for its expansion in future phases. It will identify where more information is required.

***Other Related Plans*** - Because other organizations are involved with water resources planning and management in northern Wisconsin, an objective of the planning component of the project was to review recommendations from existing plans (for example, *Headwaters Basin Integrated Management Plan* and/or *Vilas County Land & Water Resources Management Plan*) and review these in the *Presque Isle Lakes Adaptive Management Plan* where appropriate. We also reviewed federal, state, and local regulations and ordinances that serve to protect water quality.

***Presque Isle Lakes Attributes and Risks*** – Another objective was to prepare a catalog of Presque Isle lakes' environmental, cultural, and aesthetic attributes with a qualitative evaluation of the quality and associated potential threats. This objective included three tasks: (1) through collaboration with Presque Isle lakes area stakeholders, list water-related environmental, cultural, and aesthetic attributes and describe each; (2) qualitatively evaluate each of the attributes; (3) identify and describe potential threats to the Presque Isle lakes.

***Lake User Surveys*** – The PITLC prepared, distributed, and analyzed responses for lake user surveys specific to each of the fourteen water bodies studied in 2010 and 2011. PITLC prepared a summary of the analysis. Since it has been more than ten years since this survey and other study lakes have been added to the program, it is advisable to update and expand the lake user survey in the next few years.

***Educational Efforts*** - Another objective was promote educational efforts intended to train volunteers in aquatic invasive species identification and aquatic ecology and to increase support, capacity, and involvement of various lake stakeholders (Town Lakes Committee, lake associations, and others). Toward this end, White Water staff was available for phone consultation with members of the PITLC and other stakeholders. We endeavored to increase support, capacity, and stakeholder involvement in long-term stewardship of Presque Isle lakes through communication of project progress and findings. Over the years of the Wilderness Water Program, White Water Associates scientists have presented at public meetings on the lake studies and planning process. In unique educational experiences that focus on Presque Isle Township study lakes, White Water Associates scientists present "floating workshops" for interested people

(lake residents, visitors, and lake stewards). Each field trip presents and discusses findings from current and past studies on the water body. In the typical setting, leader(s) and participants gather on pontoon boats and make several stops at points around a subject lake to discuss water quality, aquatic plants, fish habitat, riparian area health, aquatic invasive species, and more. In this informal setting, questions from participants are welcomed. Age of participants is skewed toward older adults, but frequently young people participate and add a fresh dimension. In some cases of inclement weather or other circumstances, these events have been presented as "virtual" floating workshops in an indoor setting.

# CHAPTER 5

# What is the State of Presque Isle Township Lakes?

An understanding of the features and conditions of the Presque Isle lakes and their landscape is the foundation for developing and implementing strategies that seek to protect and restore the biological health of the area. We have sought information useful to devising the adaptive management plan. This is just a good beginning. Future project phases will collect and incorporate additional information.

This chapter is intended to teach us about the Presque Isle study lakes. What are the lakes like? What is the surrounding landscape? What organisms live there? How healthy are the lakes? How have humans contributed (or detracted) from that health? Do threats to watershed health exist? This chapter identifies and organizes existing information and reports on new findings.

If you are new to the Presque Isle lakes and their surroundings, this chapter will make you familiar with features and conditions that exist here and provide some insight as to why things are the way they are. If you are a life-long resident of the Presque Isle lakes area, you may be familiar with parts of the discussion in this chapter. You may have things to contribute or correct. This would be a welcome response. Become engaged! Improve the understanding of the watersheds by adding your knowledge in future iterations of this plan.

We present Chapter 5 in nine Parts, each part reflecting the following topics: the lakes and their surroundings, fisheries, aquatic plants, aquatic invasive species, water quality, regional plans, special attributes, threats, and lake user surveys.

## Part 1 – Presque Isle Township Lakes and the Surrounding Area

Presque Isle Township is one of the northern-most townships in Vilas County, Wisconsin. The Township's northern border is shared with the State of Michigan. This interconnected water landscape is a target for migrating and breeding waterfowl and other birds. The Presque Isle lakes have value and function in this larger landscape as well as within their own watersheds. Exhibit 2 displays the Presque Isle study lakes. "Almost an island" is the literal translation of the French phrase "Presque Isle." French missionaries, perhaps disoriented by the preponderance of water in this area applied the name, "Presque Isle" to describe an area where the water seemed to dominate the land.

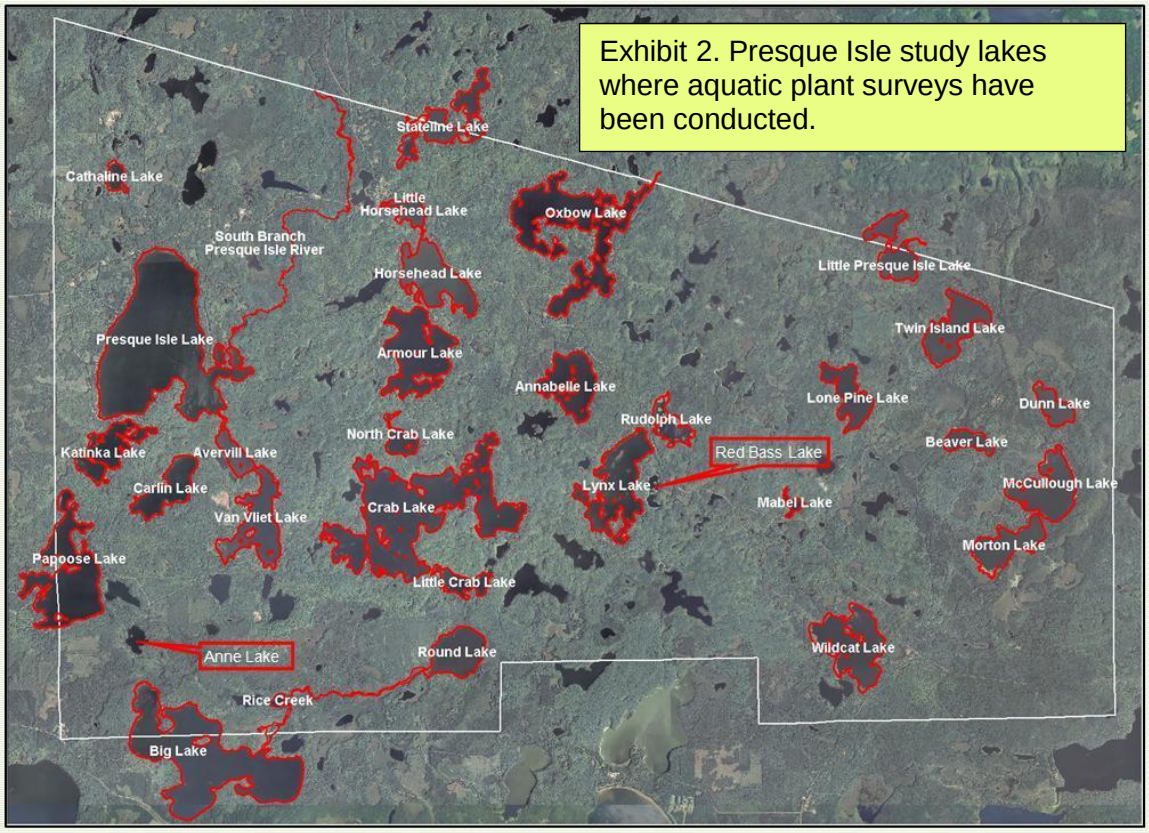



Exhibit 2. Presque Isle study lakes where aquatic plant surveys have been conducted.

Descriptive parameters for the Presque Isle Township water bodies that have undergone aquatic plant surveys are presented in Exhibit 3. Of the 31 lakes, 21 are drainage lakes, five are spring lakes, and five are seepage lakes. There is one river and one creek. Lake sizes from 18 acres (Mabel Lake) to 1,165 acres (Presque Isle Lake). Averill Lake is the shallowest lake with a maximum depth of 5 feet, and Presque Isle Lake is the deepest with a max depth of 103 feet.

The shoreline development index (SDI) is a quantitative expression derived from the shape of the lake. It is defined as the ratio of the shoreline length to the length of the circumference of a circle of the same area as the lake. A perfectly round lake would have an index of 1. Increasing irregularity of shoreline development in the form of bays and projections of the shore is shown by numbers greater than 1. For example, fjord lakes with extremely irregularly shaped shorelines sometimes have SDI's exceeding 5. A higher shoreline development index indicates that a lake has relatively more productive littoral zone habitat. The shoreline development index values for the Presque Isle study lakes can be observed in Exhibit 3. The minimum SDI value is 1.2 (Round Lake), the maximum is 4.2 (Oxbow Lake), and the average SDI value is 2.1.

The watershed (drainage basin) is all of the land and water areas that drain toward a particular river or lake. A water body is greatly influenced by its watershed. Water quality often decreases with an increasing ratio of watershed area to lake area. As the watershed to lake area increases there are more sources and amounts of runoff. In larger watersheds, runoff water can leach more minerals and nutrients and carry them to the lake. Exhibit 3 provides the watershed to lake ratios for the Wilderness Waters study lakes. The lakes with the smallest watershed:lake ratio were Carlin and Katinka Lakes (3:1), while Little Horsehead Lake had the highest (289:1).

The majority of the Presque Isle study lakes are considered designated waters. A designated water is a water body that has special designations that affect permit requirements (WI Admin. Code, 2014). They can be: Areas of Special Natural Resource Interest (ASNRI), Priority Navigable Waters (PNW), or Public Rights Features (PRF).

A water body designated as an Area of Special Natural Resource Interest can be any of the following: WDNR trout streams; Outstanding or Exceptional Resource Waters (ORW/ERW); waters or portions of waters inhabited by endangered, threatened, special concern species or unique ecological communities; wild rice waters; waters in ecologically significant coastal wetlands along Lake Michigan and Superior; or federal or state waters designated as wild or scenic rivers (WI Admin. Code, 2014).

Priority Navigable Waters meet any of these standards: navigable waterways, or portions thereof, that are considered OWR/EWR or trout streams; lakes less than 50 acres in size; tributaries and rivers connecting to inland lakes containing naturally-reproducing lake sturgeon populations; waters with self-sustaining walleye populations in ceded territories; waters with self-sustaining musky populations; or perennial tributaries to trout streams (WI Adm. Cd, 2014).

Lastly, Public Rights Features are those water bodies that meet any of the following criteria: any fish or wildlife habitat, determined by their primary associated physical features, including specific sites necessary for breeding, nesting, nursery and feeding; physical features of waterbodies that ensure protection of water quality; reaches of bank, shore or bed that are mostly natural in appearance or that screen man-made or artificial features; navigation thoroughfares or areas traditionally used for navigation during normal recreational activities such as boating, angling, hunting, or enjoyment or natural scenic beauty; or lake, river and stream sensitive areas (WI Admin. Code, 2014).

Starting in 2017, the Wilderness Waters Program began assessing shoreline and shallow water habitat conditions in lakes. This data will be used to document shoreland conditions and provide a baseline against which future changes can be measured. These data will reflect the state of health of the shoreland and possible risks to the lake ecosystem. The WDNR Shoreland Habitat Monitoring Field Protocol for evaluating shoreland habitat was used. All data collected is

organized and presented in the aquatic plant management plans along with appropriate recommended actions. Shoreline data collected will help develop a littoral zone and shoreland protection and restoration strategy that will be incorporated into each APMP.

## Exhibit 3. Water Body Parameters

| *Water Body* | *WBIC* | *Lake Type* | *Acreage* | *Max Depth (feet)* | *SDI* | *Watershed: Lake Ratio* | *Designated Water* |
|---|---|---|---|---|---|---|---|
| Annabelle Lake | 2953800 | Drainage | 194 | 30 | 2.2 | 16:1 | ASNRI |
| Anne Lake | 1832200 | Seepage | 34 | 77 | 1.3 | 4:1 | PNW |
| Armour Lake | 2953200 | Drainage | 328 | 56 | 2.3 | 44:1 | PNW |
| Averill Lake | 2956700 | Drainage | 68 | 5 | 1.5 | 38:1 | ASNRI |
| Beaver Lake | 2960600 | Drainage | 62 | 20 | 1.5 | 63:1 | None |
| Big Lake | 2334700 | Drainage | 827 | 61 | 2.4 | 20:1 | PNW |
| Carlin Lake | 2757900 | Seepage | 155 | 36 | 1.6 | 3:1 | None |
| Cathaline Lake | 2758200 | Seepage | 36 | 44 | 1.4 | 4:1 | PNW |
| Crab Lake | 2953500 | Drainage | 909 | 60 | 3.7 | 14.1 | ASNRI |
| Dunn Lake | 2960000 | Spring | 77 | 11 | 1.4 | 4:1 | ASNRI |
| Horsehead Lake | 2953100 | Drainage | 250 | 24 | 2.0 | 62:1 | PNW |
| Katinka Lake | 2957000 | Drainage | 170 | 60 | 2.9 | 3:1 | ASNRI |
| Little Crab Lake | 2955900 | Spring | 84 | 63 | 2.2 | 5:1 | ASNRI |
| Little Horsehead Lake | 2953000 | Drainage | 56 | 19 | 2.0 | 289:1 | PNW |
| Little Presque Isle Lake | 2959700 | Drainage | 144 | 18 | 2.1 | 6:1 | PNW |
| Lone Pine Lake | 2961600 | Drainage | 137 | 41 | 1.9 | 14:1 | PNW |
| Lynx Lake | 2954500 | Drainage | 307 | 48 | 2.8 | 4:1 | ASNRI |
| Mabel Lake | 2337600 | Seepage | 18 | 22 | 1.8 | 6:1 | PNW |
| McCullough Lake | 2960400 | Drainage | 221 | 27 | 1.8 | 21:1 | ASNRI |
| Morton Lake | 2960300 | Drainage | 165 | 29 | 2.0 | 41:1 | ASNRI |
| North Crab Lake | 2953400 | Drainage | 59 | 35 | 1.4 | 224:1 | ASNRI |
| Oxbow Lake | 2954800 | Drainage | 523 | 44 | 4.2 | 11:1 | PNW |
| Papoose Lake | 2328700 | Spring | 422 | 65 | 2.7 | 4:1 | PNW |
| Presque Isle Lake | 2956500 | Drainage | 1165 | 103 | 1.8 | 8:1 | PNW |
| Red Bass Lake | 2954700 | Seepage | 35 | 27 | 2.0 | 15:1 | PNW |
| Rice Creek | 2334500 | Creek | Unknown | Unknown | NA | NA | ASNRI |
| Round Lake | 2334900 | Drainage | 173 | 25 | 1.2 | 59:1 | ASNRI |
| Rudolph Lake | 2954300 | Drainage | 84 | 26 | 2.0 | 20:1 | PNW |
| S. Br. Presque Isle River | 2951600 | River | Unknown | Unknown | NA | NA | ASNRI |
| Stateline Lake | 2952100 | Spring | 205 | 67 | 3.2 | 7:1 | None |
| Twin Island Lake | 2959300 | Drainage | 203 | 15 | 1.7 | 12:1 | ASNRI |
| Van Vliet Lake | 2956800 | Spring | 230 | 20 | 2.5 | 6:1 | ASNRI |
| Wildcat Lake | 2336800 | Drainage | 293 | 38 | 2.1 | 6:1 | ASNRI |

The continental United States is divided into 18 watershed regions. Two watershed regions lie within Wisconsin: the Great Lakes and Upper Mississippi River, with Hydrologic Unit Codes: HUC#04 and HUC#07, respectively (Exhibit 4). The Presque Isle Township waterscape sits on this large-scale watershed divide.

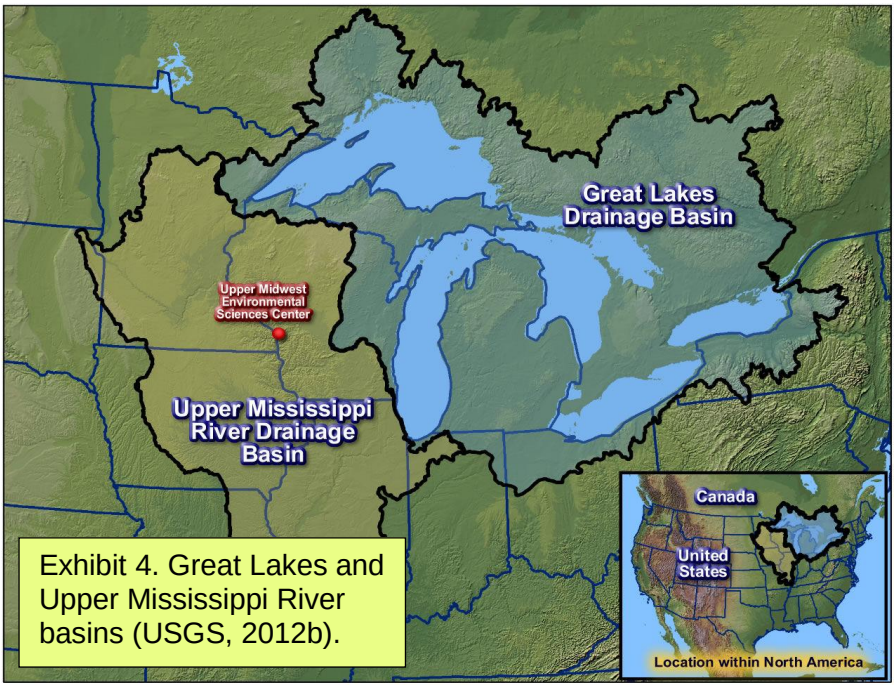
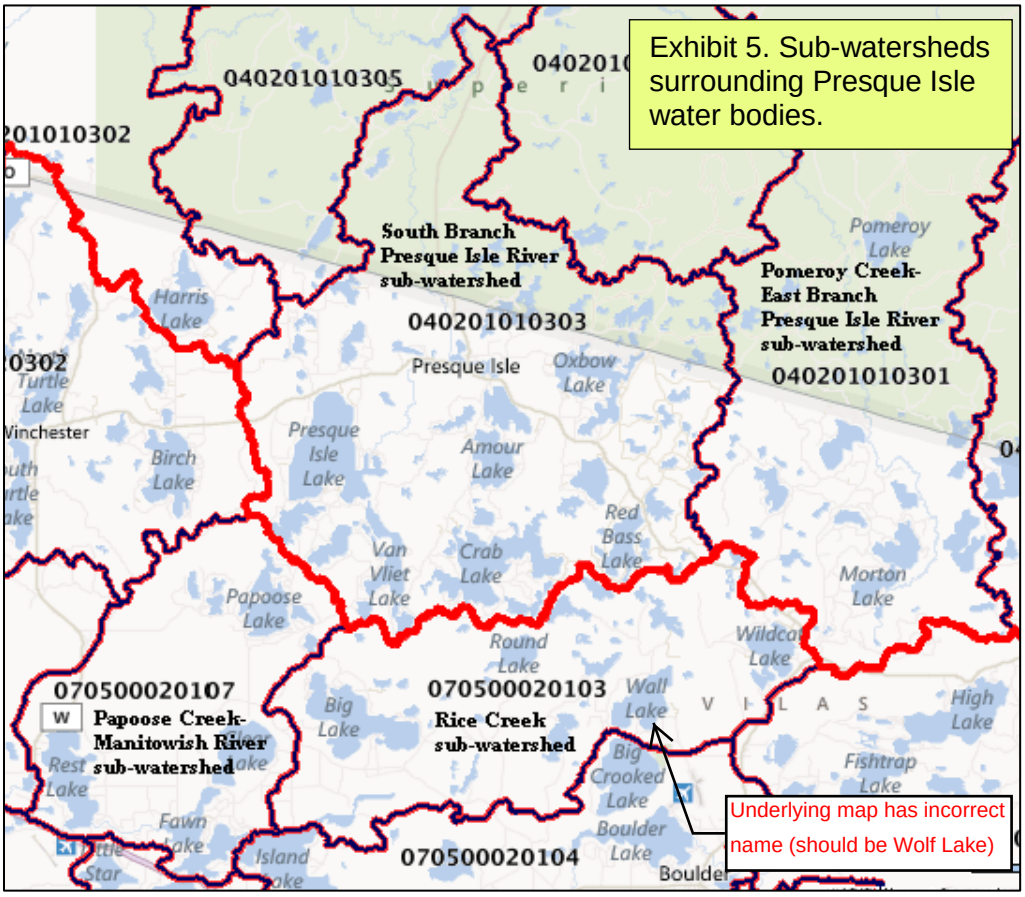



Exhibit 4. Great Lakes and Upper Mississippi River basins (USGS, 2012b).

Twenty five of the thirty one Presque Isle study lakes studied lie within the Great Lakes Region. The sub-region that contains these water bodies is named the South-central Lake Superior sub-region (HUC#040201). All of these water bodies are located in the Black-Presque Isle Rivers sub-basin (HUC#04020101). The Black-Presque Isle Rivers sub-basin is divided into even smaller watersheds and sub-watersheds, designated by 10 and 12 digit HUC codes. Again, all the water bodies fall into one watershed: the Presque Isle River watershed (HUC#0402010103). This watershed contains federal hydrologic sub-watersheds, two being: the Pomeroy Creek-East Branch Presque Isle River sub-watershed (HUC#040201010301) and the South Branch Presque Isle River sub-watershed (HUC#040201010303), as seen in Exhibit 5. There are seven study lakes located in the Pomeroy Creek-East Branch Presque Isle River sub-watershed: Beaver, Dunn, Little Presque Isle, Lone Pine, McCullough, Morton, and Twin Island Lakes. There are nineteen water bodies located in the South Branch Presque Isle River sub-watershed: South Branch Presque Isle River, Annabelle, Armour, Averill, Carlin, Cathaline, Crab, Horsehead, Katinka, Little Crab, Little Horsehead, Lynx (labeled as Red Bass in Exhibit 5), Presque Isle, North Crab, Oxbow, Presque Isle, Rudolph, Stateline, and Van Vliet Lakes.

The remaining six Presque Isle Township water bodies not located in the Great Lakes Region are located in the Upper Mississippi Region. These water bodies are located in the Chippewa River sub-region (HUC#070500). This sub-region is divided into sub-basins and watersheds, including: Flambeau River sub-basin (HUC#07050002) and the Manitowish watershed (HUC#0705000201). Finally, the Manitowish watershed is divided into federal hydrologic sub-watersheds, two being: the Rice Creek sub-watershed (HUC#070500020103) and the Papoose Creek-Manitowish River sub-watershed (HUC#070500020107), also seen in Exhibit 5. There are five waterbodies in the Rice Creek sub-watershed: Big Lake, Mabel Lake, Rice Creek, Round Lake, and Wildcat Lake. There is one lake in the Papoose Creek-Manitowish River sub-watershed: Papoose Lake.




Sub-watersheds are delineated by dark lines and 12 digit HUC codes. North of the red line is the Great Lakes Basin (HUC# beginning 04), and south of the red line is the Upper Mississippi Basin (HUC# beginning 07).

The elevation in Presque Isle Township ranges from 1,550 feet to 1,750 feet above sea level. Exhibit 6 shows the relative elevations for the area with orange areas of the landscape being the highest elevations and greens and blues being the lowest elevations.

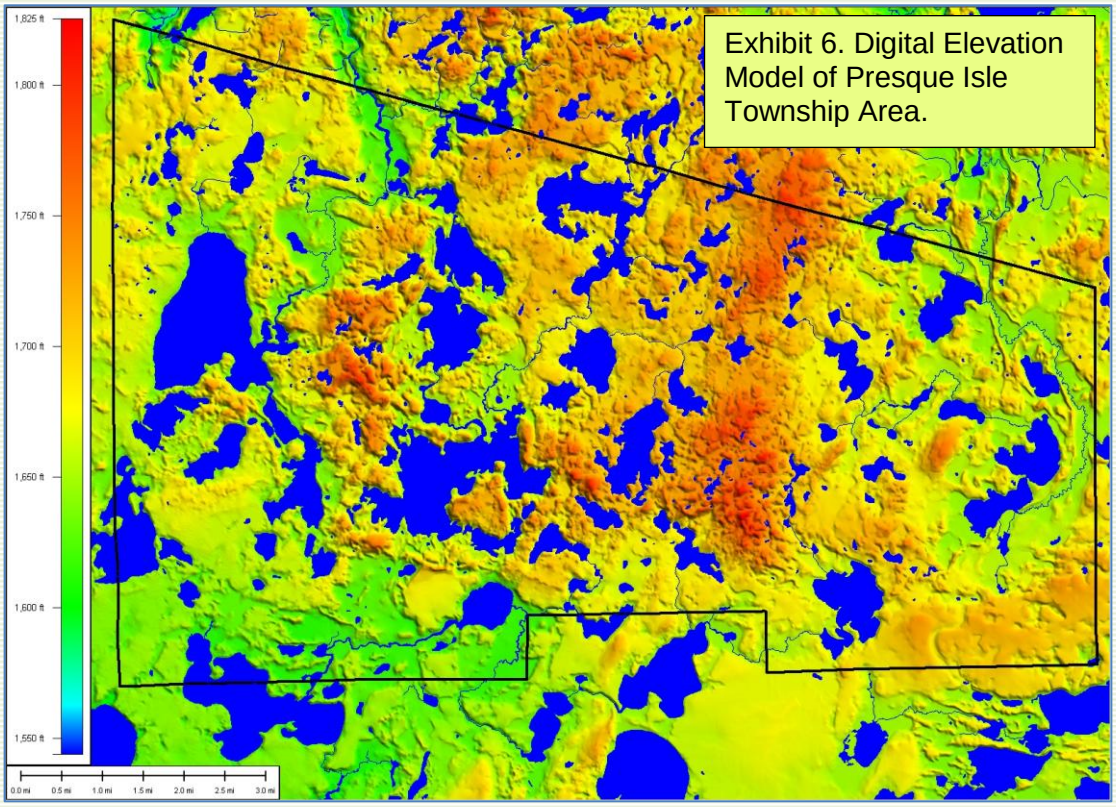



Exhibit 6. Digital Elevation Model of Presque Isle Township Area.

The Presque Isle watersheds are comprised of soils with good infiltration capacity. Soils are classified by the Natural Resource Conservation Service into four Hydrologic Soil Groups based on the soil's runoff potential (USDA, 1986). Runoff to a lake (such as after a rain storm or snow melt) differs greatly among land uses and cover types. Forest cover is the most protective, as it exports much less soil (through erosion) and nutrients (such as phosphorus and nitrogen) to the lake than agricultural or urban land use. Forested land is by far the dominant cover type in Presque Isle Township. The individual Aquatic Plant Management Plans for each of the Presque Isle study water bodies further discusses the soils and land cover for the specific watersheds.

## Part 2. Presque Isle Township Fisheries

It was beyond the scope of the current project to characterize the fish and fish habitats of the Presque Isle water bodies. It would be valuable to study and interpret these materials in future iterations of the Adaptive Management Plan. It would also be important to monitor for the presence of aquatic invasive fish species such as rainbow smelt and common carp. The WDNR has prepared fisheries reports for Wisconsin Ceded Territories. These can be viewed at http://dnr.wi.gov/topic/fishing/ceded/reports.html.

## Part 3. Aquatic Plants and Aquatic Plant Management Plans

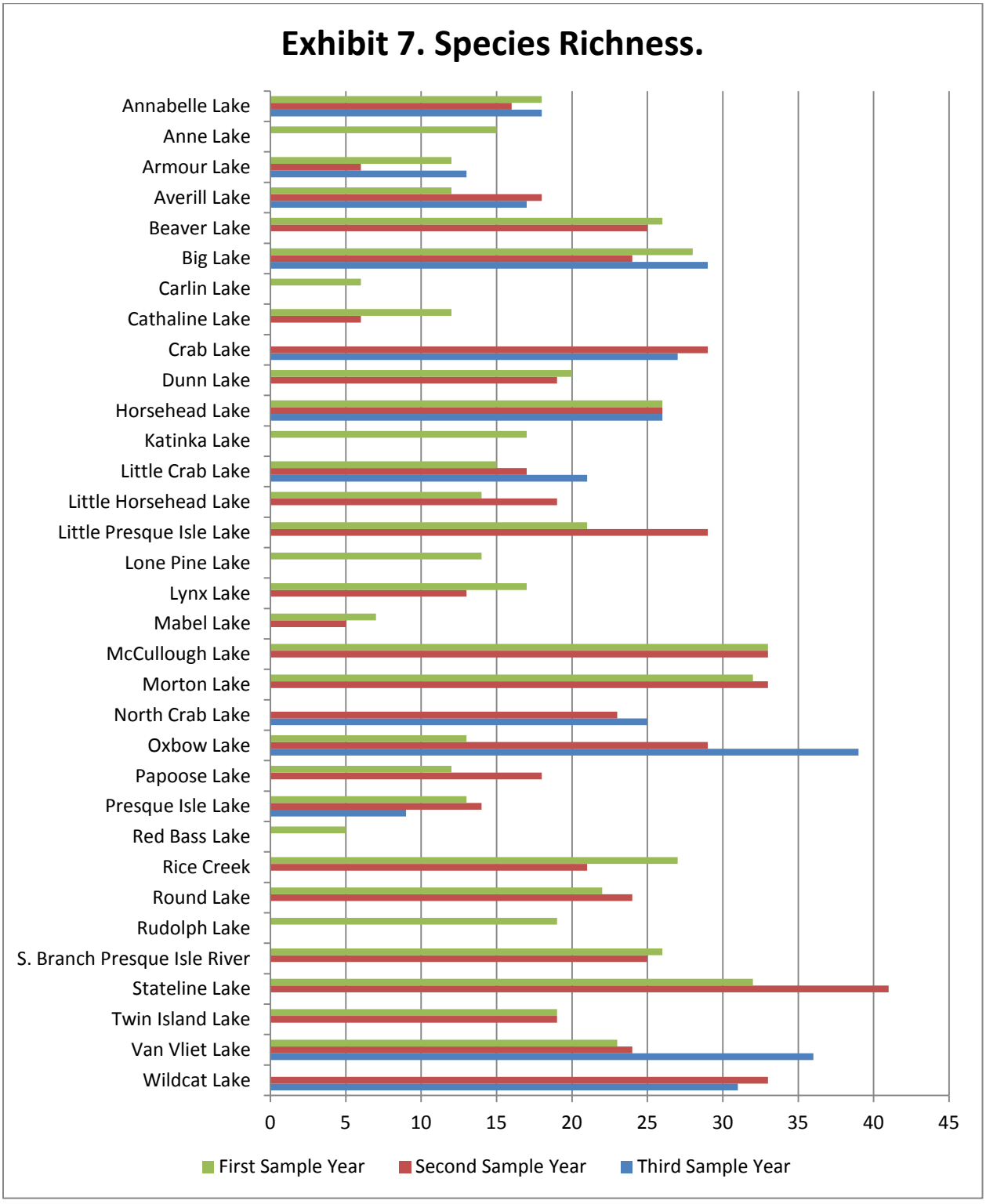
As far as we can determine, no systematic or large-scale plant management activity has taken place in any Presque Isle water bodies. In general, no nuisance aquatic plant issues have been documented. Over the years, there has been concern from some Van Vliet Lake residents regarding nuisance levels of native plants on that lake during low water periods. Although concern persists, periodic high water levels seem to diminish the perceived problem.

Part 3 overviews the aquatic plant communities found in the Presque Isle Township study lakes. The individual Aquatic Plant Management Plans present and interpret the plant data for each water body. The exhibits seen in this section compare statistics related to biodiversity and plant community health for all water bodies and aquatic plant surveys. Since the Wilderness Waters Program now spans fifteen years, we recommend that future versions of the Adaptive Management Plan examine change over time of not only aquatic plant community descriptors, but measures of water quality parameters as well.

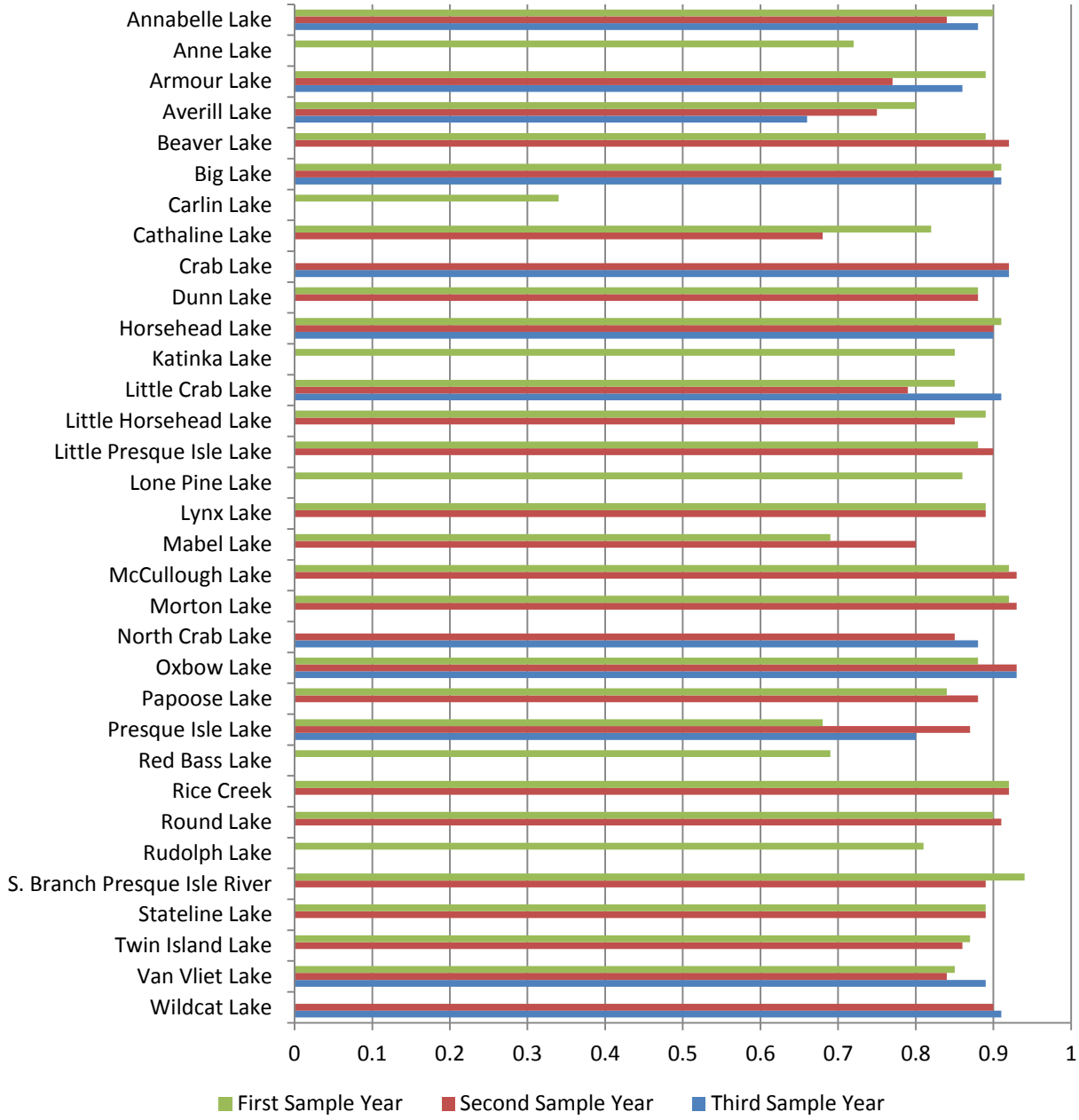
Species richness refers to the total number of species recorded in each lake. In this comparative analysis, we included species sampled by the rake as part of the species richness count—visual sightings were not included. Exhibit 7 displays species richness for all of the study lakes. In Presque Isle Township lakes, species richness ranged from 5 to 33.

Species richness is a measure of species diversity, but it doesn't tell the whole story. As an example, consider the plant communities of two hypothetical ponds each with 1,000 individual plants representing ten plant species (in other words, species richness is 10). In the first pond, each of the ten species populations is comprised of 100 individuals each. In the second pond, Species #1 has a population of 991 individuals and each of the other nine species is represented by one individual plant. Intuitively, we would say that first pond is more diverse because there is more "even" distribution of individual species. The "Simpson Diversity Index" (SDI) takes into account both richness and evenness in estimating diversity. The closer the Simpson Diversity Index is to 1, the more diverse the community is. Exhibit 8 displays the Simpson Diversity Index values for the studied lakes. Most of the lakes would be considered to have very diverse plant

communities. Carlin Lake is distinctive among the Presque Isle Township study lakes in that it has a very low Simpson Diversity Index. In general, the study lakes have remarkably high SDI values. Over the study years, SDI values for the Presque Isle lakes have remained quite stable.



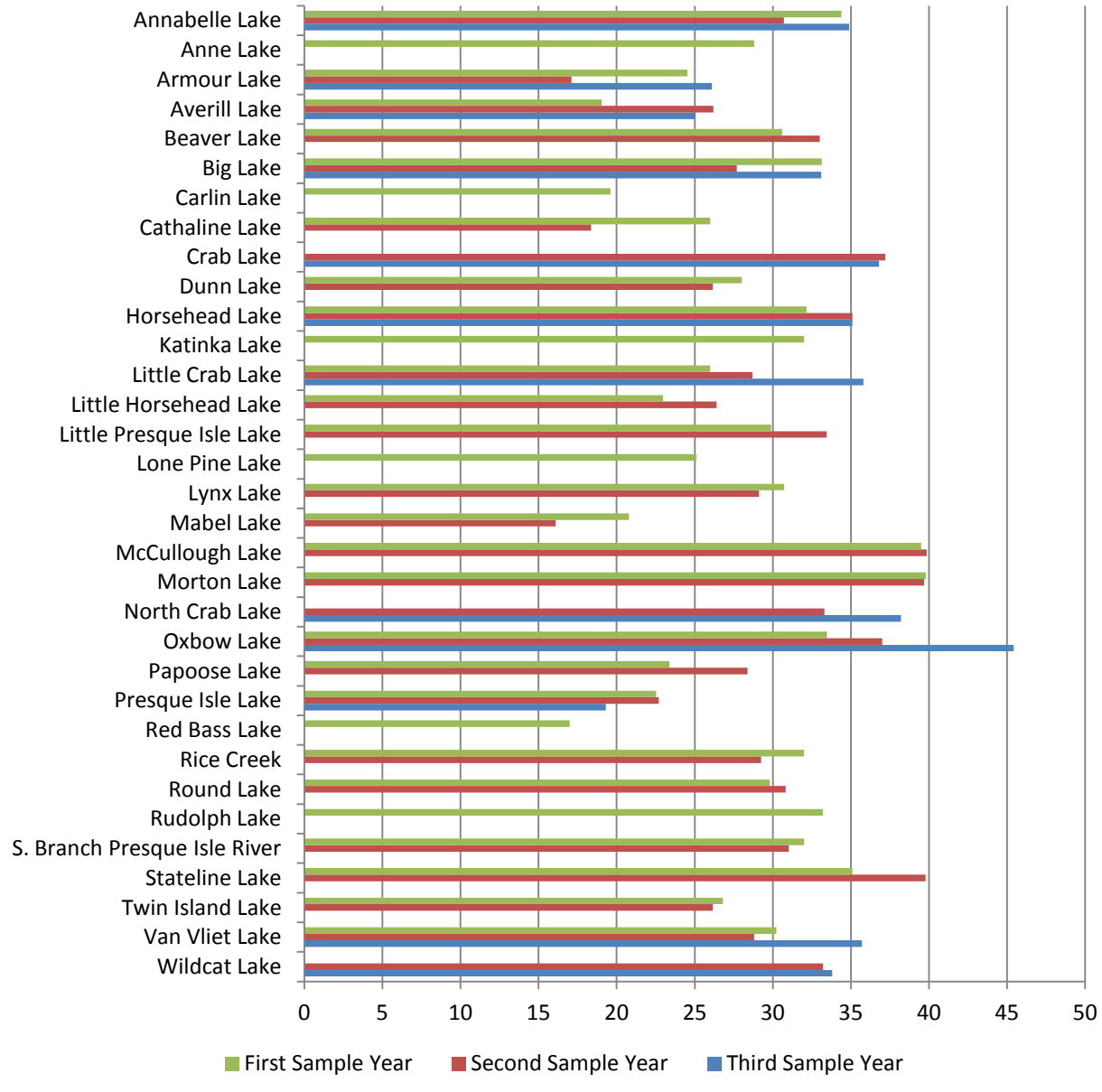
## Exhibit 8. Simpson Diversity Index (SDI).




Another measure of plant community diversity and quality is the *Floristic Quality Index* (FQI). Floristic quality is an assessment metric designed to evaluate the closeness that the flora of an area is to that of undisturbed conditions (Nichols, 1999). Among other applications, it forms a standardized metric that can be used to compare the quality of different lakes (or different locations within a single lake) and monitor long-term changes in a lake's plant community (an indicator of lake health). The FQI for a lake is determined by using the average

*coefficient of conservatism* times the square root of the number of native plant species present in the lake. Knowledgeable botanists have assigned to each native aquatic plant a *coefficient of conservatism* representing the probability that a plant is likely to occur in a pristine environment (relatively unaltered from presettlement conditions). The coefficients range from 0 to 10, with 10 assigned to those species most sensitive to disturbance. As more environmental disturbance occurs, the less conservative species become more prevalent. The FQIs for the Presque Isle Township lakes are given in Exhibit 9. Study lake FQI values range from 16 in Mabel Lake to 45 in Oxbow Lake. Over the study years, the FQI for individual lakes has remained relatively stable.

**Exhibit 9. Floristic Quality Index (FQI).**



Nichols (1999) analyzed aquatic plant community data from 554 Wisconsin Lakes to ascertain geographic (ecoregional) characteristics of the FQI metric. This is useful for considering how the Presque Isle lakes' FQIs (Exhibit 9) compare to other lakes and regions. The statewide medians for number of species richness and FQI are 13 and 22.2, respectively. Nichols (1999) determined that there are four ecoregional-lake types groups in Wisconsin: (1) Northern Lakes and Forests lakes, (2) Northern Lakes and Forests flowages, (3) North Central Hardwoods and Southeastern Till Plain lakes and flowages, and (4) Driftless Area and Mississippi River Backwater lakes. The Presque Isle lakes are located in the Northern Lakes and Forests lakes group. Nichols (1999) found species numbers for the Northern Lakes and Forests lakes had a median value of 13. On average, the number of species in the Presque Isle study lakes is higher than this average. The FQIs for most Presque Isle Township study lakes are higher than the median value for the Northern Lakes and Forests lakes group (24.3). These findings support the contention that Presque Isle Township study lakes are healthy and diverse.

Over the course of the survey years, six special concern species (relatively rare species) were found in survey lakes. Small purple bladderwort (*Utricularia resupinata*) was found in Annabelle Lake (2019), Katinka Lake (2010), North Crab Lake (2014 and 2020), Oxbow Lake (2018) and Rudolph Lake (2010). Vasey's pondweed (*Potamogeton vaseyi*) was found in Horsehead Lake (2012 and 2020), Morton Lake (2011), and Rudolph Lake (2010). Small yellow pond lily (*Nuphar microphylla*) was found in Rice Creek in 2010. American shoreweed (*Littorella uniflora*) was observed in Cathaline Lake in 2017. Water-thread pondweed (*Potamogeton diversifolius*) was observed in Stateline Lake in 2018. Northern naiad (*Najas gracillima*) was observed in Big Lake in 2020.

Over the course of the survey years, a few small populations of invasive plants were found. These invasive plant species are discussed in the next section (Part 4).

Wild rice was found during point intercept surveys of six study lakes: Armour Lake (2013), Averill Lake (2013), Big Lake (2013 and 2020), Rice Creek (2010 and 2016) Round Lake (2010 and 2016) and South Branch Presque Isle River (2010). More information about wild rice in these locations can be read in the respective Aquatic Plant Management Plans.

Wild rice is an important food source for many waterfowl and animals. It also has cultural significance to the Anishinaabe (Chippewa or Ojibwa), who call it *manoomin* (GLIFWC, *Wild Rice* brochure). Because of its ecological and cultural importance, the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) has systematically collected wild rice data, including: acreage, density, pounds collected by tribal and state peoples, and other useful data. GLIFWC also conducts aerial surveys of rice beds and maintains an aerial photography archive. According to the *Wisconsin Ceded Territory Manoomin Inventory*, a consistent bed of wild rice is found on

Round Lake at the Rice Creek inlet (David, 2010). The section of Rice Creek between Round Lake and Big Lake supports substantial rice beds (David, 2010). Also included in the *Manoomin Inventory* is a list of waters that are not currently listed as rice waters, but are being considered for the list. The *Inventory* states, "Presque Isle Lake has had anecdotal reports of wild rice being present.

## Part 4. Presque Isle Township Aquatic Invasive Species

Aquatic invasive species (plants and animals) have been documented in twenty-three of the thirty-three Wilderness Waters study lakes. This includes a total of nine invasive species. The aquatic invasive animal species (AIS) include: freshwater jellyfish (*Craspedacusta sowerbii*), rusty crayfish (*Orconectes rusticus*), Chinese mystery snail (*Cipangopaludina chinensis*) and banded mystery snail (*Viviparus georgianus*). Wetland/aquatic invasive species present in study lakes were: purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), narrow-leaved cattail (*Typha angustifolia*), yellow iris (*Iris pseudocorus*), and aquatic forget-me-not (*Myosotis scorpioides*). With the exception of freshwater jellyfish, all of these species are considered *Restricted* in Wisconsin. A *Restricted* species is one that is already established and causes, or has potential to cause, significant environmental or economic harm or harm to human health (WDNR, 2022). Exhibit 10 shows the invasive species present in Presque Isle Township study lakes.

## Exhibit 10. Invasive Species Present.

| *Water Body* | *Rusty Crayfish* | *Banded Mystery Snail* | *Chinese Mystery Snail* | *Freshwater Jellyfish* | *Purple Loosestrife* | *Reed canary grass* | *Narrow-leaved Cattail* | *Yellow Iris* | *Aquatic forget-me-not* |
|---|---|---|---|---|---|---|---|---|---|
| Annabelle Lake | | | | | X | X | | | X |
| Anne Lake | | | | | | | | | |
| Armour Lake | | | | | | | | X | X |
| Averill Lake | X | | | | | | | | X |
| Beaver Lake | | | | | | X | X | | |
| Big Lake | X | X | X | | X | | X | X | X |
| Carlin Lake | | | | | | | | | |
| Cathaline Lake | | | | | | | | | |
| Crab Lake | X | | | | X | X | | X | X |
| Dunn Lake | | | | | | X | | | X |
| Horsehead Lake | X | | | | | X | X | X | X |
| Katinka Lake | | | | | | | | | |
| Little Crab Lake | | | | | | X | | | |
| Little Horsehead Lake | | | | | | | | | |
| Little PI Lake | | | | | X | X | | | |
| Lone Pine Lake | | | | | | | | | |
| Lynx Lake | | | | | | X | X | | |
| Mabel Lake | | | | | | | | | |
| McCullough Lake | X | | | | | | | | |
| Morton Lake | | | X | | | X | | | |
| North Crab Lake | | | | | | | X | | |
| Oxbow Lake | | X | | X | | X | | | |
| Papoose Lake | X | | | | | X | | X | |
| Presque Isle Lake | X | | | | | X | X | | X |
| Red Bass Lake | | | | | | | | | |
| Rice Creek | X | X | | | X | | | X | |
| Round Lake | X | | X | | X | | | | |
| Rudolph Lake | | | | | | | | | |
| S. Branch PI River | | | | | | X | X | | |
| Stateline Lake | X | | | | | X | X | X | |
| Twin Island Lake | | | | | | X | | X | |
| Van Vliet Lake | X | | | | | X | | | X |
| Wildcat Lake | | X | X | X | | | | | X |

Freshwater jellyfish are native to the Yangtze River valley in China (McKercher et al., 2019). It is likely that they were introduced into northern waters by transportation of ornamental plants, by waterfowl, or fish stocking (McKercher et al., 2019). It is unclear what the jellyfishes' impact is on native plant and animal species, but it is possible that they prey on fish eggs and other zooplankton (McKercher et al., 2019). Freshwater jellyfish are not considered dangerous to humans. Freshwater jellyfish have been found in Oxbow Lake (1999) and Wildcat Lake (2008).

Rusty crayfish are native to parts of Ohio, Tennessee, Kentucky and Indiana, and were likely introduced to Wisconsin waters by fishermen using the crayfish as bait (Gunderson, 2014). Rusty crayfish negatively affect other native crayfish species, cause destruction to aquatic plant beds, reduce fish populations by eating eggs, and cause shoreland owners recreational problems (Gunderson, 2014). It is illegal to possess both live crayfish and angling equipment simultaneously on any inland Wisconsin water (except Mississippi River) (WDNR, 2018). It is also illegal to release crayfish into a water body without a permit (WDNR, 2018). Rusty crayfish have been found in Averill Lake (2003), Big Lake (1961), Crab Lake (2009), McCullough Lake (2003), Papoose Lake (2003), Presque Isle Lake (2003), Rice Creek, Round Lake (1998), Stateline Lake (2011) and Van Vliet Lake (2003).

Chinese mystery snails are from Southeast Asia and Eastern Russia and were likely released to the Great Lakes from an aquarium (Kipp et al., 2019a). The snail does not seem to have a significant impact on native species, but its ecological and anthropological threat comes from its potential to transmit parasites and diseases (Kipp et al., 2019a). It is illegal to introduce the Chinese mystery snail into Wisconsin waters. Chinese mystery snails have been discovered in Big Lake (2005), Morton Lake (2018-yet to be verified), Round Lake (2005), and Wildcat Lake (2005).

Banded mystery snails are native to northeastern United States down to Florida, the Gulf of Mexico, and some states along the Mississippi River. Records show that an amateur conchologist (scientist of sea shells and the animals that inhabit them) intentionally released banded mystery snails into the Hudson River, which led to its dispersal throughout the Great Lakes area (Kipp et al., 2019b). There is no known negative impact caused by the snails in the Great Lake region (Kipp et al., 2019b). Banded mystery snails have been found in Big Lake (2010), Rice Creek, Oxbow Lake (2005), and Wildcat Lake (2005).

Purple loosestrife is a perennial plant (2+ growing seasons) that prefers wetland areas (Czarapata, 2005). Purple loosestrife was introduced as an ornamental plant, and has since infested almost every county in Minnesota, Wisconsin and Michigan. It has opposite/whorled leaves with attractive purple flowers (Czarapata, 2005). It impacts native plants by competing for food sources and by replacing native plants. Its survival rate is excellent because it can

produce up to a million seeds in a growing season, which can lie dormant for years. It also can regenerate from plant fragments, which is why control methods need to be chosen carefully.

During a 2011 aquatic plant survey on Little Presque Isle Lake, a small population (about 15 plants) of purple loosestrife was found near the Frontier Lakes private boat landing at the southeast end of the lake. At the time of the survey, no purple loosestrife plants were removed. Another occurrence of purple loosestrife was seen in the 2010 aquatic plant survey on Rice Creek. A single purple loosestrife plant was found on a beaver dam. The plant was dug up, bagged and disposed of properly. More information about these findings can be found in the respective Aquatic Plant Management Plans of these water bodies. Other findings of purple loosestrife include Big Lake (2014), Crab Lake (2009 via WDNR survey), Little Presque Isle Lake (2011 and 2018), Rice Creek (2010 and 2016) and Round Lake (2016).

Reed canary grass (*Phalaris arundinacea*) has been found in nearly every county in Wisconsin. It is on the *Restricted* species list. It forms dense, monocultured stands in wetland and riparian areas (Czarapata, 2005). It reproduces by spreading rhizomes, and seeds (Czarapata, 2005). It is one of the first grasses to sprout in the spring, increasing its chances of out-competing other plants. Reed canary grass was discovered during the aquatic plant survey in Beaver Lake (2011 and 2018), Crab Lake (2020), Dunn Lake (2018), Little Presque Isle Lake (2018), Lynx Lake (2017), Morton Lake (2018), Oxbow Lake (2018), Papoose Lake (2017), South Branch Presque Isle River (2010 and 2017), Stateline Lake (2018), Twin Island Lake (2011) and Van Vliet Lake (2013). This large list of locations indicates the ease at which reed canary grass can spread and become established.

Narrow-leaved cattail (*Typha angustifolia*) is another perennial wetland plant that can grow very tall. It has a flowering spike of male flowers with another section of female flowers just below it (Czarapata, 2005). It grows along shorelines, roadsides, marshes, and wet meadows. Narrow-leaved cattails form monocultures that push out native plant species and can alter the hydrology and wildlife habitat (Czarapata, 2005). Narrow-leaved cattails were recorded at Beaver Lake (2018), Big Lake (2013), Crab Lake (2020), Lynx Lake (2017), South Branch Presque Isle River (2010) and Stateline Lake (2018).

Similar to other aquatic invasive plant species, yellow iris (*Iris pseudocorus*) can spread by seeds or vegetatively via rhizome fragments. Yellow iris forms dense clumps or mats that alter the hydrology of a lake and negatively impact native plant species (WDNR, 2017c). Yellow iris is a poisonous plant which also makes it harmful for wildlife species. It is a non-regulated invasive species and has been placed on the *Restricted* species list. The most common way to differentiate pale yellow iris from the native northern blue flag iris is by identifying flower color. Cross section of the seed head also reveals differences between the species (blue iris has six

seeds per cross section and yellow iris has three). Because it can take years for irises to flower, it is difficult to know how many invasive iris plants are in a certain area. Yellow iris has been observed at Crab Lake (2020), Horsehead Lake (2013), Papoose Lake (2015), Rice Creek (2016), Stateline Lake (2018) and Twin Island Lake (2018).

Curly-leaf pondweed (*Potamogeton crispus*) is an aquatic plant native to Eurasia. It is highly adaptable and can survive in fresh or brackish water, and can tolerate shallow, deep, still or flowing water (WDNR, 2017a). It can spread by fragmentation, but also by the production of turions (structures that detach from the plant to create a new plant). Turions lie dormant during the summer, and as the water cools in fall and winter, the turion germinates, producing winter curly-leaf pondweed growth (Mikulyuk and Nault, 2009). This allows the plant to establish early and either avoid competition or out-compete other plants (Mikulyuk and Nault, 2009). Curly-leaf pondweed is a *Restricted* species. It was reported in Big Lake (2010-WDNR search) but not confirmed as present.

Aquatic Forget-me-not (*Myosotis scorpioides*) grows in shallow water along the shoreline. It is an aggressively growing plant that can crowd out native plant species. It can form large monocultures, especially in situations where it is in or near a stream (WDNR, 2019). This plant is restricted in Wisconsin.

Other potentially harmful invasive species have been discovered in lakes within 50 miles of the Presque Isle Township Lakes. Such species include (but are not limited to): zebra mussels (*Dreissena polymorpha*), quagga mussels (*Dreissena bugensis)*, spiny water flea (*Bythotrephes longimanus*), and Eurasian water-milfoil (*Myriophyllum spicatum*). Future iterations of this Adaptive Plan may include information such as: geographical proximity to infested waters, water chemistry data, and predictions about each water body's susceptibility to these threatening invasive species. As an example, the remainder of this section offers this information about zebra mussels: an aggressive invasive species, currently not found in Presque Isle study lakes.

As of 2018, zebra mussels (*Dreissena polymorpha*) had not been recorded in any water body in Vilas County, Wisconsin (WDNR, 2017d). Similarly, neighboring Wisconsin counties Iron, Oneida, and Price, and Michigan's Gogebic County have reported no zebra mussel-infested waters. Lake Metonga, located in Forest County, Wisconsin (which borders Vilas County to the east) has a zebra mussel population. In addition, Michigan's Iron County, which borders Vilas County to the northeast, has zebra mussel-infested waters, including: Chicagon Lake, Hagerman Lake, Fortune Pond, and Lake Emily. It is also reported that Fortune Pond has a population of quagga mussels (*Dreissena bugensis*) (USGS, 2019). Since these zebra mussel-infested waters range from 45 to 60 miles from Presque Isle Township, it is unlikely that zebra mussels could be transferred via waterways, though transmission from boats or other equipment is possible.

Many water quality factors can augment or inhibit the growth and reproduction of zebra mussels. Calcium and conductivity levels are the most significant water quality constituents that help predict if zebra mussels can survive in a given lake.

Calcium is crucial to zebra mussel survival because it is used at every stage of the life cycle (ANS Task Force). This is why calcium is considered a limiting factor for establishment of zebra mussel populations in inland lakes. According to Claudi and Mackie (1994), lakes with calcium ranges from 5-6 mg/L allows no shell growth, 10-11 mg/L allows for poor growth, 25-26 mg/L allows for moderate growth, and greater than 35 mg/L allows for good growth. Important calcium thresholds for zebra mussels are as follows: survival (3 mg/L), shell growth (7 mg/L), reproduction (12 mg/L), and massive infestations (25 mg/L) (Claudi and Mackie, 1994).

Conductivity levels must also reach a certain level before it is suitable habitat for zebra mussels to live and survive. Conductivity values less than 22 µmhos/cm limit zebra mussel distribution, while values greater than 83 µmhos/cm will favor zebra mussel colonization (Cohen and Weinstein, 1998). In all study lakes, more recent water quality data should be collected.

The University of Wisconsin-Madison's AIS Smart Prevention website categorizes Wisconsin lakes' zebra mussel susceptibility based on their dissolved calcium concentrations and conductivity. Lakes are ranked: "Not Suitable," "Borderline Suitable" or "Suitable." Exhibit 11 displays the Presque Isle lakes' susceptibility based on the Smart Prevention website with additional water quality information for lakes with water quality information.

| Exhibit 11. Presque Isle Lakes' Susceptibility to Zebra Mussels (*Dreissena polymorpha*). | | | | |
|---|---|---|---|---|
| **Water body Name** | **Calcium (mg/L)** | **Conductivity (µmhos/cm)** | **Zebra Mussel Susceptibility (UW Smart Prevention)** | **Year data collected (most recent)** |
| *Annabelle Lake* | 3 | 28 | Not Suitable | 1985 |
| *Anne Lake* | 0.9 | 12.1 | Not Suitable | 2019 |
| *Armour Lake* | 11 | 84 | Not suitable | 1985 |
| *Averill Lake* | 17 | 120 | Suitable | 1985 |
| *Big Lake* | 17 | 121 | Borderline Suitable | 2003 |
| *Beaver Lake* | 9 | 102 | Borderline Suitable | 1979 |
| *Carlin Lake* | 1 | 19 | Not Suitable | 1960 |
| *Cathaline Lake* | No data | No data | Not Suitable | NA |
| *Crab Lake* | 8 | 90 | Not Suitable | 2012 |
| *Dunn Lake* | 14 | 134 | Borderline Suitable | 1979 |
| *Horsehead Lake* | 8 | 87 | Not Suitable | 1979 |
| *Katinka Lake* | 1 | 27 | Not Suitable | 1985 |
| *Little Crab Lake* | 2 | 28 | Not Suitable | 1985 |
| *Little Horsehead Lake* | 10 | 77 | Borderline Suitable | 1985 |
| *Little Presque Isle Lake* | 73* | 142 | Suitable | 2008 |
| *Lone Pine Lake* | 6 | 72 | Not Suitable | 1979 |
| *Lynx Lake* | 15.9 | 24 | Borderline Suitable | 2017 |
| *Mabel Lake* | 2 | 24 | Not Suitable | 1985 |
| *McCullough Lake* | 9 | 65 | Borderline Suitable | 1985 |
| *Morton Lake* | 13 | 88 | Borderline Suitable | 1985 |
| *North Crab Lake* | 9 | 73 | Not suitable | 1985 |
| *Oxbow Lake* | 4 | 35 | Not Suitable | 1985 |
| *Papoose Lake* | 17 | 122 | Borderline Suitable | 2012 |
| *Presque Isle Lake* | 16 | 131 | Borderline Suitable | 1979 |
| *Red Bass Lake* | 1.48 | 21.6 | Not Suitable | 2019 |
| *Rice Creek* | 19 | 118 | Not Available | 1963 |
| *Round Lake* | 19 | 117 | Borderline Suitable | 2003 |
| *Rudolph Lake* | 2 | No data | Not Suitable | NA |
| *S. Branch Pr. Isle River* | 12 | 91 | Not Available | 1989 |
| *Stateline Lake* | 16 | 63 | Borderline Suitable | 1960 |
| *Twin Island Lake* | 17 | 141 | Suitable | 2008 |
| *Van Vliet Lake* | 14 | 78 | Borderline Suitable | 1979 |
| *Wildcat Lake* | 23 | 160 | Suitable | 1985 |
| *Only total hardness data collected. | | | | |

## Part 5. Presque Isle Township Lakes Water Quality

Since 1979, water quality data has been collected in the Presque Isle lakes. A significant amount of Presque Isle Township lakes' water quality data can be obtained from the WDNR SWIMS database. More detailed water quality reports are included in the individual water body Aquatic Plant Management Plans. Appendix B contains a comparison of selected water quality parameters for Wilderness Waters lakes and streams.

Water clarity is one way to estimate the overall water quality in a lake. Water clarity is typically measured using a Secchi disk. Water clarity is influenced by material dissolved in the water (perceived as water color) and materials suspended in the water (algae and silt). The Water Clarity Index is used to describe a lake with respect to its average Secchi depth. Lakes can be classified as: very poor, poor, fair, good, very good or excellent based on their Secchi depth. Lakes studied within the Wilderness Waters Program ranged from poor to very good with respect to water clarity.

### Exhibit 12. Trophic Status

***Trophic state*** *of a lake is an indicator of water quality. Lakes are typically divided into three categories of trophic state: oligotrophic, eutrophic, and mesotrophic.*

***Oligotrophic*** *lakes are clear, deep, and free of weeds or large algal blooms. They are low in nutrients and do not support large fish populations, but they can develop a food web capable of sustaining a desirable fishery.*

***Mesotrophic*** *lakes are intermediate between the oligotrophic and eutrophic. The deepest levels become devoid of oxygen in late summer and limit coldwater fish. Anoxic conditions at the water-sediment interface causes phosphorus to be released from the sediments.*

***Eutrophic*** *lakes are high in nutrients and support large biomass (plants and animals). They are usually either weedy or subject to large algal blooms or both. Eutrophic lakes can support large fish populations, but are also susceptible to oxygen depletion. Small, shallow, eutrophic lakes are especially vulnerable to winterkill.*

*Over long periods of time, lakes go through natural aging from oligotrophic through mesotrophic to eutrophic. As part of this process, they begin to fill in. This aging process can be sped up by introductions of sediments and nutrients. (Shaw et al., 2004).*

Phosphorus is the key nutrient affecting the amount of algae and plant growth in a water body. If phosphorus levels are high, excessive aquatic plant growth can occur. Total phosphorus levels are the sum of soluble reactive phosphorus and phosphorus in plant and animal fragments (Shaw et al., 2004). A concentration of total phosphorus below 20 µg/L should be maintained to prevent nuisance algal blooms (Shaw et al., 2004). The individual aquatic plant management plans provide updated summaries of phosphorus levels in individual water bodies.

Chlorophyll *a* is the photosynthetic pigment that makes plants and algae green.

Chlorophyll *a* in lake water is an indicator of the amount of algae. Chlorophyll *a* concentrations greater than 10 µg/L are perceived as a mild algae bloom, but concentrations greater than 20 µg/L are perceived as a nuisance. Most Wilderness Waters study lakes fall below the nuisance chlorophyll *a* level. The APMPs summarize the histories of chlorophyll *a* concentration in individual water bodies.

As seen in Exhibit 12, trophic state is an indicator of water quality. The Trophic State Index takes into consideration the Secchi depth, phosphorus levels and chlorophyll levels. Lakes are typically divided into three categories of trophic state: oligotrophic, eutrophic, and mesotrophic. In cases where levels borderline two trophic states, they are described as "mild." The individual APMPs summarize trophic state for each of the water bodies studied.

Conductivity, hardness, alkalinity and pH data were collected for the Presque Isle study lakes. Conductivity is a measure of the ability of water to conduct an electric current. Conductivity is directly related to the total dissolved inorganic chemicals in the water. Usually, conductivity values are approximately two times the water hardness value, unless the water is receiving high concentrations of human-induced contaminants (Shaw et al., 2004). Hardness levels in a lake are affected by the soil minerals, bedrock type in the watershed, and frequency of contact between lake water and these materials (Shaw et al., 2004). One method of evaluating hardness is to test for calcium carbonate ($CaCO_3$).

Alkalinity is important in a lake to buffer the effects of acidification from the atmosphere. Acid rain has long been a problem with lakes that have low alkalinity levels and high potential sources of acid deposition (Shaw et al., 2004). A water body's sensitivity to acid rain depends on the alkalinity level it has. The APMPs summarize alkalinity values for study lakes.

The acidity level of a lake's water regulates the solubility of many minerals. A pH level of 7 is considered neutral. The pH level in Wisconsin lakes ranges from 4.5 in acid, bog lakes to 8.4 in hard water, marl lakes (Shaw et al., 2004). Natural rainfall in Wisconsin tends to be acidic. Some minerals become available under low pH (especially aluminum, zinc, mercury, iron and manganese) and can inhibit fish reproduction and/or survival. Mercury and aluminum are not only toxic to many kinds of wildlife, but also to humans (especially those that eat tainted fish). The pH levels of Presque Isle Township lakes are summarized in the individual APMPs.

## Part 6. Presque Isle Township Water Resources and Government Protection

Many organizations are involved with water resources regulations, planning, and management in northern Wisconsin including: (1) federal, state, county and local regulations and ordinances that influence water quality, (2) WDNR programs that strive to preserve and restore land and water resources (including Fisheries Management and Habitat Protection, Watershed,

Wastewater, Nonpoint Source Pollution Abatement, Drinking and Groundwater, Water Quality Monitoring, Wildlife, Endangered Resources, and Forestry (WDNR et al., 2002)), and (3) the *Vilas County Land & Water Resource Management Plan* (Vilas County Land & Water Conservation Department, 2009). Appendix C reviews some of these programs.

## Part 7. Presque Isle Township Special Attributes

The Presque Isle area could as easily be termed a "waterscape" as a "landscape" as the density of lakes is unique. As mentioned earlier, the Presque Isle waterscape sits on a watershed divide. Some of the water drains north through the Presque Isle River system and eventually into Lake Superior. Some eventually drains to the Mississippi River system.

The Presque Isle area also contains upland areas of great ecological significance. The Nature Conservancy's Catherine Wolter Wilderness Area is one example. The Northwoods Land Trust is a local land trust that owns outright several hundred acres of land and holds conservation easements on several thousand acres of additional lands. Immediately north of the Presque Isle Township area is the Ottawa National Forest, a large wild area of forest, streams, and lakes. The overall area is home to several terrestrial and aquatic species of concern.

Because of the numerous water bodies, the entire landscape could be referred to as a "riparian area" from an ecological perspective. These broad riparian areas offer an abundance of habitats for birds, mammals, amphibians, reptiles, and invertebrates that require this kind of habitat. Rarer microhabitats are also present and likely provide home to rare plants and animals. The interconnected water bodies form an enormous and diverse water resource for migrating and breeding waterfowl and other birds. As a migratory stopover for water-related birds and terrestrial birds, the Presque Isle area has global ecological importance. Numerous pairs of common loons nest on Presque Isle area lakes.

The lakes in the Presque Isle area are enormously popular as fisheries. Tourism is a principal economy in the region and the area is within a half-day's drive from large metropolitan areas. Resorts such as the Carlin Lake Lodge are destination vacations spots for many people from outside of the area. Many of the lakes have well-developed and heavily used boat access sites. There are twenty-three public piers across the Presque Isle area along with swimming beaches and many resorts.

Over the years, several organized fishing tournaments exist in the Presque Isle Township area. These include: (1) Chamber Walleye Tournament, (2) Lions Kid's Fishing Contest, (3) Bob Ellis Row Trolling Tournament, and (4) the Annual World Championship Musky Classic (the Musky Classic was discontinued in 2020). These are economically important gatherings of fishermen and boats, but they represent a concern from the standpoint of transporting AIS from

one lake to another in the waterscape. Tournament participants frequently move from lake to lake, sometimes hitting several in one day. This increases the opportunity for transporting AIS from one water body to another and makes the lakes vulnerable to AIS introduction.

Local organizations also recreate frequently on the waters of the Presque Isle area. The "Lady Yakkers" is a large group of kayakers that take frequent outings in groups of up to thirty. A local fishing club and fishing guides move from one lake to another as well.

Considerable study has been applied to a number of lakes in the Presque Isle Wilderness Waters Program. Presque Isle Township has eighty-four lakes. Thirty-three water bodies have been subject to formal study including point-intercept aquatic plant surveys and basic water chemistry and water quality monitoring. As discussed in a previous section, several of these lakes have above average Floristic Quality Indices (FQI) and aquatic plant diversity. Crab Lake is designated by the State of Wisconsin as an "outstanding resource water" (ORW) (WI Admin. Code, 2010).

The various attributes of the Presque Isle waterscape described above combine to make this area exceedingly unique. It is therefore a worthy goal to develop a management plan that serves to perpetuate this high quality aquatic system far into the future.

## Part 8. Presque Isle Area Township Environmental Threats

As outlined in the previous part, the Presque Isle lakes watershed ecosystem has numerous attributes of high ecological and aesthetic significance. These attributes are what makes Presque Isle Township a unique and special place. Nevertheless, these attributes are at risk of degradation from environmental threats. We outline some of these threats in this part of the adaptive management plan.

***Recreational pressure*** – Lakes in Presque Isle Township are well-known and much-used for fishing and other water-based recreation for people from near and far. These are popular recreation and vacation destinations and have received publicity outside of Wisconsin. An expanding base of admirers has resulted in increasing recreational pressures. The numerous access points to Presque Isle area lakes are convenient for the public, but increases fishing and other recreation pressure. These access sites are also points of littering and likely portals for introduction of aquatic invasive species. Motorboats can impact lake ecology in a variety of ways, including mechanical damage to aquatic vegetation, shoreline erosion and plant disturbance from wakes, and disturbance to sensitive wildlife.

***Development pressure*** – Presque Isle Township has some areas of fairly high residential development as well as development in the form of resorts, and road ways (impervious surfaces). In contrast, the area also has large areas with predominantly natural vegetation and broad and diverse riparian areas. In some areas, old-style lawns, cropped short and in close proximity to the shore indicate a need for some educational effort to inform residents about more ecologically friendly waterfront vegetation. Likewise, development of artificial beaches and removal of large woody material from the shallows diminishes the habitat quality for invertebrates and fish. The riparian wetlands and small ponds are also vulnerable to development and human "grooming" since their great ecological values are often overlooked.

***Water quality inputs*** – The water quality and aquatic ecosystem functioning of the Presque Isle study lakes is affected by all inputs of water (groundwater, precipitation, streams, and overland runoff). All of these sources have potential to carry pollutants of various kinds to individual lakes. Non-point source pollution (see next paragraph) remains an important threat to Presque Isle lakes water quality.

***Non-point source pollution*** – Surface runoff from the land, roadways, parking lots and other surfaces flows into Presque Isle study lakes and to area streams. This runoff carries with it sediment, nutrients (for example, from fertilizers) and contaminants (for example, herbicides) that can have detrimental effects on the Presque Isle study lakes' ecosystems. Known as non-point source pollution (because it does not emanate from a discrete point like an effluent pipe from a paper mill), this kind of runoff can come from lawns, golf courses, agricultural fields, clear-cuts, and impervious surfaces (for example, roads and paved parking lots). Sometimes the impact is physical, such as sediment covering gravel spawning areas. Sometimes it is chemical such as excess phosphorus from lawn fertilizers or faulty septic systems that might invoke an algal bloom. This type of pollution can be best controlled through education and protection of riparian buffers (natural vegetation near the waterways that absorb the pollutants before they reach the water).

***Commercial Groundwater Extraction*** – Drinking water has become an increasingly valuable commodity on a global scale. Commercial groundwater extraction to serve the bottled water industry has strained groundwater resources and human communities in many areas in the country. In Presque Isle Township surface waters and wetlands are in great abundance, but this makes them no less susceptible to the influences of human caused changes in the water table through extraction. Education on this topic is paramount to a vigilant public.

***Aquatic Invasive Species*** – Non-native plant and animal species have become a grave concern for aquatic, wetland, and terrestrial ecosystems. Presque Isle area study lakes have been relatively fortunate so far to avoid serious establishments of some of the more destructive organisms. Nevertheless, the threat remains an important concern especially given the numerous public access sites and the high volume of boat traffic (aquatic invasive species often hitchhike to new bodies of water via boats, trailers, and bait containers). Recreational linkages in the form of humans moving from one body of water to another with their watercraft, boat trailers, and fish bait containers are particularly significant in this landscape since this is a potential major vector for AIS. Transport of AIS can more readily occur on this landscape because short travel distances between water bodies means that desiccation and exposure to UV light has less time to kill AIS propagules. Even lakes with limited or no public access are susceptible since lake residents may travel to other nearby lakes for boating. Presque Isle Township lakes are vulnerable because of the proximity of AIS source populations. There are presently over twenty lakes in Vilas County with confirmed populations of Eurasian water-milfoil, an aggressive AIS. Zebra and quagga mussels, highly destructive AIS, have established populations in nearby counties. Spiny water fleas are present in Lake Gogebic, Gile Flowage, Stormy Lake, Trout Lake and Star Lake, all short drives from lakes in Presque Isle Township. The presence of these and other nearby sources of AIS provides a dangerously high opportunity for introduction into new lakes. This situation is the paramount concern of the Presque Isle Wilderness Waters Program. When it comes to non-native aquatic plant invaders, the best defense against establishment is a healthy community of native plants. The formal plant surveys conducted on the 33 water bodies so far indicate that healthy plant communities prevail on the lakes. Diverse native plant communities presently exist on most of the study lakes. Effective education and diligent monitoring are important factors in avoiding establishment of aquatic invasive species.

***Riparian ecosystem integrity*** – Healthy riparian areas (the naturally vegetated land near the water) provide numerous important functions and values to Presque Isle lakes. For example, they serve as habitat, filter out non-point source pollution, and protect against erosion. A lack of understanding and appreciation of these functions and values can result in degradation of the riparian area by landowners. Educating riparian owners around Presque Isle lakes as to the importance of riparian areas is important to the maintenance of these critical areas.

***Littoral zone ecosystem quality*** – An important area of productivity for a lake is the shallow water area known as the littoral zone. This is where plants grow, invertebrates live, fishes spawn, and aquatic birds and mammals spend much of their time. The presence of good aquatic

vegetation, diverse substrate, and dead woody material (logs and branches) is crucial to this littoral zone ecosystem. Sometimes the human temptation is to "clean up" these areas, but in fact this process diminishes the habitat quality greatly. Such poorly informed people represent a threat to the quality of the littoral zone. Presque Isle area study lakes are fortunate for the most part to have an abundance of good quality littoral zone habitat, but it can be degraded quickly. It is important to educate landowners and others about how to protect the littoral zone from degradation. Piers and swimming areas impact the littoral zone as well, but can coexist with a quality shallow water habitat if kept to a reasonable level.

***Habitat degradation of nearby aquatic and wetland habitats (ponds, streams)*** – The wetland habitats, streams, small lakes, and ponds in Presque Isle Township all contribute to the high quality of the study lakes. These smaller ecosystems can be overlooked in terms of their importance and therefore deserve special attention. One of the first protective measures to take is to identify where these features are and characterize their size and ecological composition. This informs future protection and restoration efforts.

## Part 9. Lake User Surveys

The Presque Isle Town Lakes Committee solicited input from all Presque Isle residents to better understand the needs, knowledge base, concerns and desires of the various water body users. PITLC specifically targeted the questions to learn more about the town's residents and visitors in a mailing of December 2011. It is recommended that the survey be updated in the near future.

# CHAPTER 6

# What Goals Guide the Adaptive Management Plan?

"Protect the Best and Restore the Rest" has become the credo of successful watershed managers across the country. This simple phrase acknowledges that watershed management is more than identifying the worst areas and trying to rehabilitate them. It recognizes that of equal or greater importance is identifying those areas that are of high or moderate quality in the watershed and establishing mechanisms to maintain that quality. "Protect the Best and Restore the Rest" also implies the importance of identifying imminent threats to watershed health and working to eliminate them. This simple principal is founded on the restoration ecology fact that the most certain way to successfully restore the structure and function of part of a broken watershed ecosystem is to rely on intact areas of the watershed to serve as the donors of healthy "parts" (such as aquatic insect species or good quality water). Acts of "Protecting the Best" allow us to "Restore the Rest" more effectively and economically. But, protecting the best is prerequisite.

The primary goal of the Wilderness Waters Program is to continue the quality of Presque Isle Township lakes, streams, and watersheds in perpetuity. Sometimes this will mean protecting what is good about a feature and its surroundings and sometimes it may mean restoring some component that has been degraded. Restoration is reestablishment of the structure and function of an ecosystem including its natural diversity (Cairns, 1988; National Research Council, 1992). It implies rehabilitating and protecting sufficient components of the ecosystem so that it functions in a more or less natural way, provides habitat for native plants and animals, and supports reasonable human uses.

This adaptive management plan offers several supporting goals. In an adaptive plan, new goals can be adopted as the plan evolves. We conclude this chapter by presenting these goals organized under topical headings.

***Restoration*** – Apply rehabilitation, protection, and education actions under the direction of specific objectives to identified specific areas in Presque Isle Township.

***Research*** – Gather information that is useful in planning and monitoring restoration actions and devising education programs.

***Monitoring*** – Establish a monitoring system that will provide data that reveal the quality of the surface water resources, detect changes in the ecosystems, and establish methods to evaluate the effectiveness of management efforts.

***Cultural Climate*** – Encourage a cultural and political atmosphere that allows and promotes good watershed stewardship including cooperation between citizens, businesses, public agencies, and municipalities.

***Sustainable Economy*** – Foster an environment that promotes a sustainable economy, provides a diversity of economic options for the residents of the watershed, and does not diminish opportunities for future generations of watershed residents.

***Recreation*** – Promote a sustainable recreation in Presque Isle Township where all citizens (now and in the future) can enjoy the opportunities of the natural and human-sustained environment while respecting the environment and the rights of fellow citizens.

***Program Maintenance*** – Foster a stewardship culture that engages people to donate time, talent, and money sufficient to support the implementation and periodic update of the Wilderness Waters Adaptive Management Plan.

***Protection*** – Identify and monitor threats to the ecological well-being of the Presque Isle Township landscape ecosystem (including the groundwater) in order to actively protect against degradation of environmental quality.

In the final chapter of this plan, we present possible objectives and actions that will serve to move toward these goals. This is not an exhaustive treatment, but a starting point, integrated with monitoring so that adaptive management can take place in subsequent years.

# CHAPTER 7

# What Objectives and Actions Move Us Toward Our Goals?

The Presque Isle Township water bodies that are subject to this adaptive management plan are healthy, diverse, and productive. These water bodies are crucial isolated reservoirs of healthy and diverse plant and animal communities and it is our challenge through this adaptive management plan to perpetuate that condition into the ecological future. The challenge will be met by a capable set of program partners that are prepared to devote themselves to stewardship of these "wilderness waters." These partners include the members of the Presque Isle Town Lakes Committee, individual lake associations, individual concerned citizens, the ecological scientists of White Water Associates, Inc., the WDNR and Vilas County.

Abraham Lincoln is attributed with the following wisdom: "If I had an hour to cut down a tree, I'd spend the first 45 minutes sharpening my axe." Planning and preparation are important for any task, but especially when working with a system as complex as a lake or watershed. The vision and goals described in the previous chapter provide the basis for developing objectives and actions to achieve the desired future for the water bodies in Presque Isle Township. In keeping with the spirit of an adaptive management plan, we present several actions and associated objectives that can be undertaken as human and financial resources allow in subsequent phases of the program. Desired outcomes of each action are also stated. The actions, objectives, and outcomes each need to be further developed so that appropriate methodology and accurate estimates of required effort can be described. The plan is flexible and allows the insertion of new actions at any point along the path of resource stewardship. As stated earlier in this document, each of the individual water bodies that are subject to this adaptive management plan have aquatic plant management plans that are published as separate documents and available through the PITLC. These aquatic plant management plans also have their own specific goals and actions, specific to each water body.

| Actions for the Presque Isle Township Lakes Adaptive Management Plan |
| --- |
| ***Action (Protection):*** Adopt and implement the *Aquatic Plant Management Plans* prepared for individual water bodies.<br><br>***Objective:*** To protect and maintain a high quality aquatic plant community in Presque Isle Township lakes and reduce opportunities for introduction of aquatic invasive plant species.<br><br>***Outcome:*** Healthy, diverse aquatic plant communities in Presque Isle Township lakes and a human community that is actively engaged in monitoring and protecting native aquatic plants.<br><br>***Status:*** Action included in Adaptive Management Plan. The *Aquatic Plant Management Plans* are complete and intended for adoption and implementation. |
| ***Action (Research):*** Conduct periodic assessments of Presque Isle lakes and streams for aquatic invasive plants and animals.<br><br>***Objective:*** To provide an early warning of introductions of aquatic invasive species to allow rehabilitation actions to occur when populations are still small.<br><br>***Outcome:*** Document the number and timing of surveys and maintain record of findings.<br><br>***Status:*** Action included in Adaptive Management Plan. This is an ongoing activity with more specific guidance provided in the *Aquatic Plant Management Plans*. |
| ***Action (Education):*** Continue to establish and maintain kiosks/educational structures at boat launches that provide information on the threats of aquatic invasive species introductions to Presque Isle Township lakes and outline how such introductions can be avoided.<br><br>***Objective:*** Prevent new introductions of aquatic invasive species.<br><br>***Outcome:*** Create more informed and responsible recreational users. PITLC should document that the kiosks are kept with educational material.<br><br>***Status:*** Action included in Adaptive Management Plan. This is an ongoing activity. |
| ***Action (Research):*** Continue to conduct point-intercept surveys for aquatic plants in Presque Isle Township lakes on an approximate five year cycle.<br><br>***Objective:*** To understand the diversity and abundance of native and non-native aquatic plants in Presque Isle lakes, establish a baseline against which plant community changes can be monitored, and investigate changes in aquatic plant communities.<br><br>***Outcome:*** Data archived by PITLC and submitted to the WDNR.<br><br>***Status:*** Action included in Adaptive Management Plan and is ongoing. |

| Actions for the Presque Isle Township Lakes Adaptive Management Plan |
|---|
| ***Action (Research):*** Identify, map, and characterize important wetlands (including ponds) within the Presque Isle Township watersheds. Assess quality and threats for these wetlands.<br><br>***Objective:*** Protect and monitor the health of important wetlands that influence the quality of Presque Isle Township surface waters.<br><br>***Outcome:*** Written report documents findings and recommends follow-up monitoring.<br><br>***Status:*** Action included in Adaptive Management Plan. Subject to future grant applications. |
| ***Action (Research):*** Conduct littoral zone and near shore riparian area assessments on selected lakes in Presque Isle Township.<br><br>***Objective:*** To document current conditions, identify potential restoration sites, and establish baseline against which future changes can be compared.<br><br>***Outcome:*** A written report should document findings.<br><br>***Status:*** Action included in Adaptive Management Plan and is ongoing. |
| ***Action (Research):*** In consultation with WDNR, prepare water sampling program (volunteer lake monitoring program including water transparency, nutrients, and chlorophyll *a*) for selected lakes in Presque Isle Township.<br><br>***Objective:*** To understand trophic status and fluxes in Presque Isle area lakes.<br><br>***Outcome:*** Samples and data delivered to Wisconsin State Lab of Hygiene and WDNR.<br><br>***Status:*** Action included in Adaptive Management Plan and is ongoing. |
| ***Action (Research):*** Using historical water quality data, examine lake trends.<br><br>***Objective:*** To understand changes in lake water quality over broad time periods.<br><br>***Outcome:*** A written analysis should be created and included in Adaptive Management Plan.<br><br>***Status:*** Action included in Adaptive Management Plan in the future. |
| ***Action (Education):*** Update the Lake User Survey by sending out surveys to landowners.<br><br>***Objective:*** To identify most up-to-date information regarding Presque Isle lakes user concerns and knowledge regarding health and the stewardship of the lakes.<br><br>***Outcome:*** A written analysis should be created and included in Adaptive Management Plan.<br><br>***Status:*** Action included in Adaptive Management Plan. |

| Actions for the Presque Isle Township Lakes Adaptive Management Plan |
|---|
| ***Action (Education):*** Establish an award or recognition of riparian owners that preserve or rehabilitate "natural shoreline" habitat on their property. This could be recognized local press along with an article about the ecological benefits of natural shorelines. Note the Vilas County Lakes and Rivers Association Blue Heron Shoreland Stewardship Award Program (https://vclra.org/blue-heron-shoreline-stewardship-award-program/) is a higher level program to which to emulate and aspire.<br><br>***Objective:*** To encourage good shoreline stewardship by riparian owners and improve the riparian area quality of Presque Isle Township lakes.<br><br>***Outcome:*** Monitor by general awareness of landowners and changes in shoreline maintenance behaviors.<br><br>***Status:*** Action included in Adaptive Management Plan. |
| ***Action (Education):*** Create periodic updates of the adaptive management plan when additional information is obtained (for example, when a new aquatic plant survey is conducted).<br><br>***Objective:*** To incorporate most up-to-date information regarding Presque Isle lakes and application of best stewardship practices.<br><br>***Outcome:*** Up-to-date management plan is available for ongoing implementation and stewardship of Presque Isle lakes.<br><br>***Status:*** Action included in Adaptive Management Plan and is ongoing. |

Future phases of the Wilderness Waters Program will build on the foundation established in this adaptive management plan. Additional aspects of the Presque Isle Township lakes will be explored. Future phases will include revisions to the adaptive management plan and aquatic plant management plans.

Lakes and streams in Presque Isle Township are unique and vulnerable features. In order for future generations to enjoy all that the area can provide, this adaptive plan should be embraced, developed, and implemented. It may seem slow at first, but considerable momentum already exists because of the hard work that has already occurred. The Wilderness Waters Program benefits from a well-prepared and duly concerned community of partners ready to take up stewardship responsibility.

# Appendix A
# Literature Cited

## Literature Cited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# Appendix B
# Comparison of Presque Isle Lakes Water Quality

# Comparison of Presque Isle Lakes' Water Quality Parameters

**Prepared by Angie Stine, B.S. and Dean Premo, Ph.D., White Water Associates, Inc.**

## Introduction

Since 1979, water quality data has been collected in the Presque Isle Lakes. A significant amount of Presque Isle water quality data has been obtained from the WDNR SWIMS database. In this appendix, comparisons of Secchi depth, phosphorus and chlorophyll *a* are made supported by exhibits at the end of the appendix. We also describe and compare other water quality parameters commonly sampled in the Presque Isle water bodies with additional exhibits. More information about all of these water bodies and their water quality can be found in the *Review of Water Quality* reports found in the Aquatic Plant Management Plans for each lake. In this appendix, we present the water quality data by tables (found within the narrative), figures (found within the narrative), and full page exhibits (found in the last section of the appendix). A literature cited section concludes this appendix.

## Secchi Depth, Phosphorus and Chlorophyll *a* data

As mentioned in the *Wilderness Waters Adaptive Management Plan*, water clarity gives an indication of the overall water quality in a lake and is typically measured using a Secchi disk. Every Presque Isle study water body has had Secchi depth data recorded except for South Branch Presque Isle River. In the SWIMS database, mean Secchi values have been established for each year sampled (based on only July and August mean depths). Exhibit 1 shows the mean Secchi depths for the Presque Isle Township study lakes.

The Water Clarity Index is used to describe a lake with respect to its mean Secchi depth. Lakes can be classified as: very poor, poor, fair, good, very good or excellent (Table 1).

**Table 1. Water clarity index (Shaw et al., 2004).**

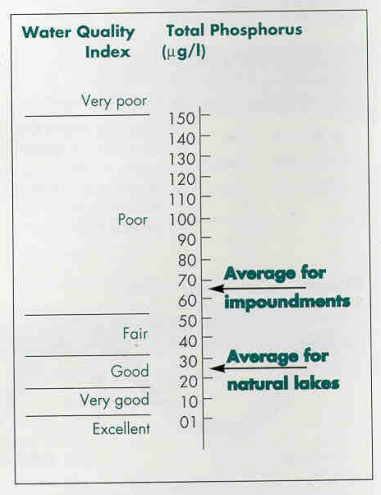
| Water clarity | Secchi depth (ft.) |
|---|---|
| Very poor | 3 |
| Poor | 5 |
| Fair | 7 |
| Good | 10 |
| Very good | 20 |
| Excellent | 32 |

Of the Presque Isle water bodies in this report, one was very poor, two were poor, twelve were fair, thirteen were good, four were very good, and none was excellent.

Phosphorus is another important parameter to consider when determining water quality. Exhibit 2 displays the mean total phosphorus levels of the Presque Isle Township lakes. A phosphorus level of 20 µg/L is considered the threshold for nuisance level algae blooms (indicated by thick black line in Exhibit 2). Thirteen lakes exceed the threshold for nuisance algae blooms. The average (17.41 µg/L) of all water bodies is below the nuisance threshold.

The Water Quality Index based on phosphorus can be seen in Figure 1. This classifies water bodies based on their total phosphorus concentrations. The higher the phosphorus level, the poorer the water quality. No lakes were considered very poor, poor, or fair, seventeen were good, sixteen were very good, and no water body was considered excellent with respect to phosphorus.

**Figure 1. Total phosphorus concentrations for Wisconsin's natural lakes and impoundments (Shaw et al., 2004).**




Chlorophyll *a* is another parameter that can determine water quality in a water body. Chlorophyll *a* is the photosynthetic pigment that makes plants and algae green, therefore making it an indicator of the amount of algae in lake water (Shaw et al., 2004). Exhibit 3 displays chlorophyll *a* data for Wilderness Waters Lakes. North Crab Lake, Rice Creek, and South Branch Presque Isle River did not have chlorophyll *a* data collected. All water bodies' mean chlorophyll *a* levels (except for Twin Island Lake) were well below the nuisance chlorophyll concentration. The average chlorophyll *a* level was 6.68, which is considered low.

The relationships between Secchi depth, phosphorus and chlorophyll *a* are very important with regard to water clarity. Because phosphorus is one of the main nutrients that affect the amount of algae and plant growth in a lake, and because chlorophyll *a* is the photosynthetic pigment that makes plants and algae green, they are good indicators of the amount of algae in lake water (Shaw et al., 2004). Low levels of

phosphorus are associated with low levels of chlorophyll *a*, which result in an increase in Secchi depth (greater water clarity). Similarly, high levels of phosphorus are associated with high levels of chlorophyll *a*, which result in a decrease in Secchi depth (lower water clarity).

## Comparison of Other Water Quality Parameters

Alkalinity in a lake is affected by the soil minerals, bedrock type in the watershed, and frequency of contact between lake water and these materials (Shaw et al., 2004). Alkalinity is important in a lake to buffer the effects of acidification from the atmosphere. Acid rain has long been a problem with lakes that have low alkalinity levels and high potential sources of acid deposition. Exhibit 4 illustrates the alkalinity levels of the Presque Isle study lakes. Some of the study lakes do not have alkalinity data available, so future monitoring of these lakes should include measurement of this parameter.

The pH level of a lake's water regulates the solubility of many minerals. A pH level of 7 is considered neutral. The pH level in Wisconsin lakes ranges from 4.5 in acid, bog lakes to 8.4 in hard water, marl lakes (Shaw et al., 2004). Natural rainfall in Wisconsin averages a pH of 5.6. Some minerals become available under low pH (especially aluminum, zinc, and mercury) and can inhibit fish reproduction and/or survival. A lake's pH level is important for the release of potentially harmful substances and affects plant growth, fish reproduction and survival. A lake with neutral or slightly alkaline pH is a good lake for fish and plant survival. Exhibit 5 displays the pH levels of the Presque Isle study lakes. Van Vliet Lake has the highest pH (8.9) and Mabel Lake has the lowest (6.2). The average pH of these lakes is 7.5.

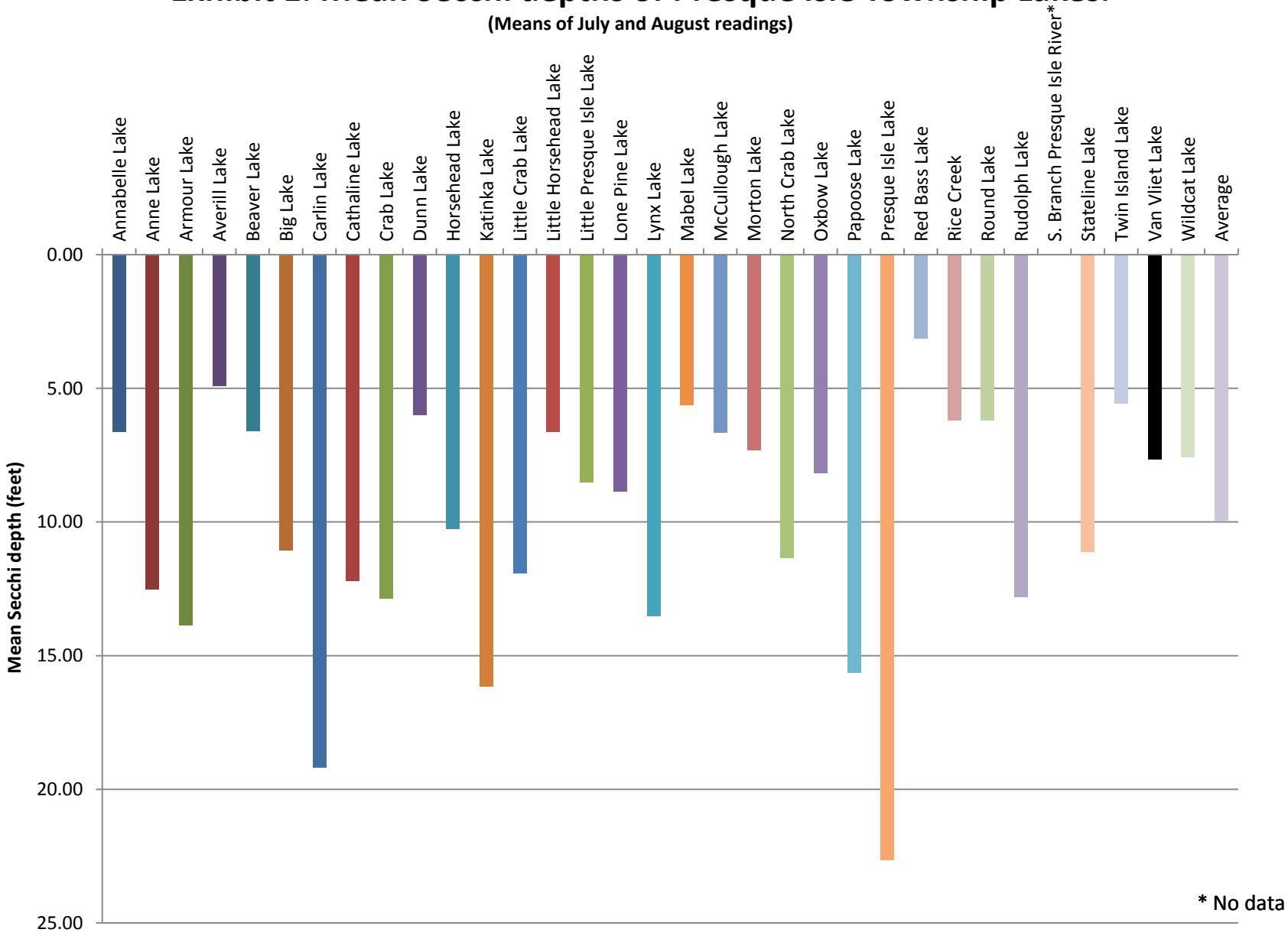
Conductivity is a measure of the ability of water to conduct an electric current. Conductivity is directly related to the total dissolved inorganic chemicals in the water. Usually, values are approximately two times the water hardness, unless the water is receiving high concentrations of human-induced contaminants (Shaw et al., 2004). Hardness levels in a lake are affected by the soil minerals, bedrock type in the watershed, and frequency of contact between lake water and these materials (Shaw et al., 2004). One method of evaluating hardness is to test for calcium carbonate ($CaCO_3$). Exhibit 6 displays the conductivity to hardness ratio for Wilderness Waters study lakes. The label above each lake describes the ratio of conductivity:hardness found in the lake. In cases where the ratio exceeds 2:1, these lakes may have other sources of contaminants. It appears that the majority of Presque Isle water bodies correspond with the conductivity/hardness ratio described above, and do not exceed the 2:1 ratio. From this measure, there appears to be minimal influence from human-induced contaminants on these lakes.

A water body can also be classified by the amount of calcium carbonate (hardness) in the water. Referring to the hardness levels in Exhibit 7, we see that Wildcat Lake, Little Presque Isle Lake, Twin Island Lake, and Lynx Lake (82.1, 73.0, 72.4, and 64 mg/L $CaCO_3$) have the highest hardness values. According to Table 2, these lakes have moderately hard water. The remaining water bodies have soft water.

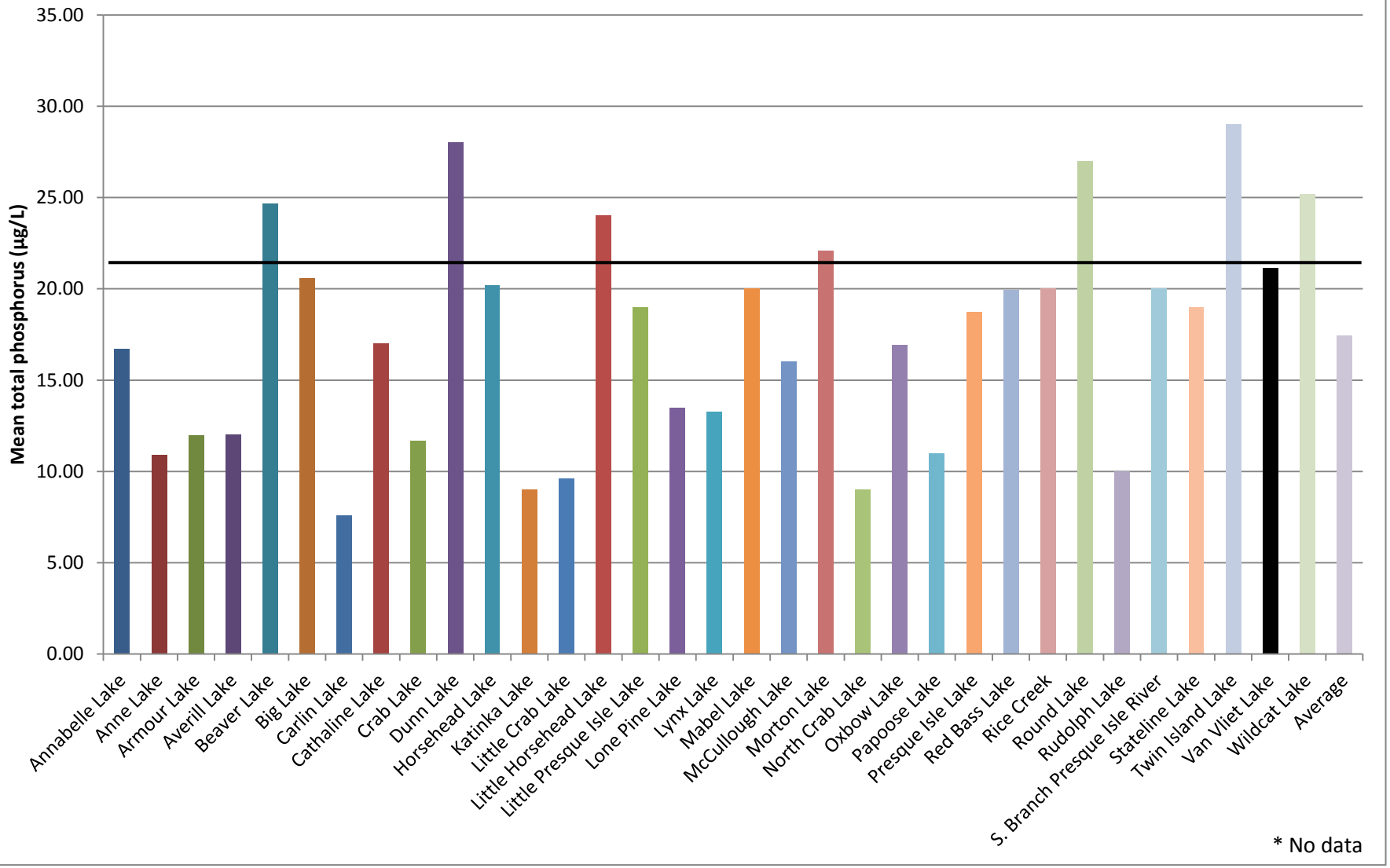
| Table 2. Categorization of hardness (mg/L of calcium carbonate ($CaCO_3$)) (Shaw et al., 2004). | |
|---|---|
| Soft water | 0-60 |
| Moderately hard water | 61-120 |
| Hard water | 121-180 |
| Very hard water | >180 |

# Exhibit 1. Mean Secchi depths of Presque Isle Township Lakes.

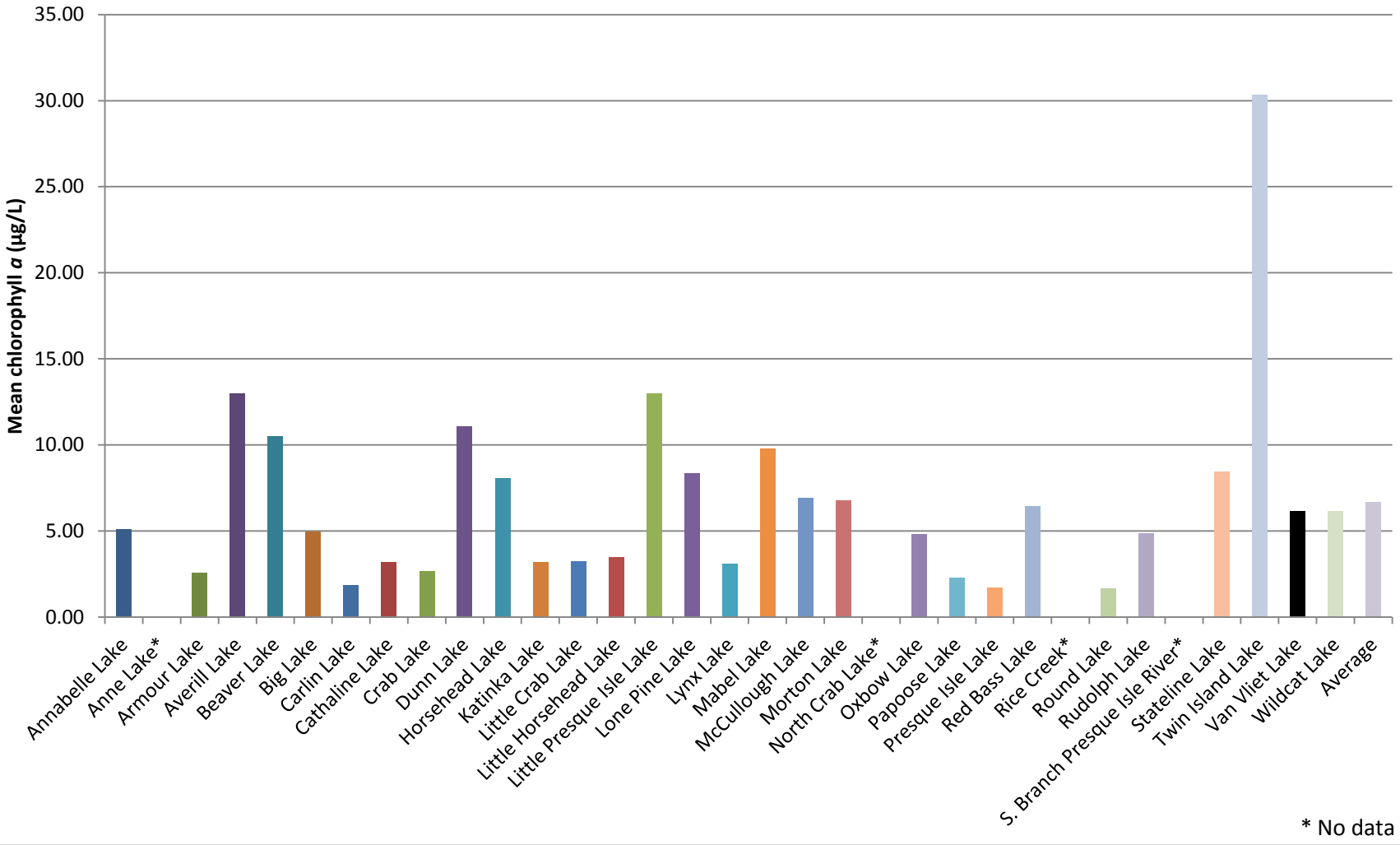
**(Means of July and August readings)**



## Exhibit 2. Mean total phosphorus in Presque Isle Township Lakes.



## Exhibit 3. Mean cholorphyll *a* levels for Presque Isle Township Lakes.



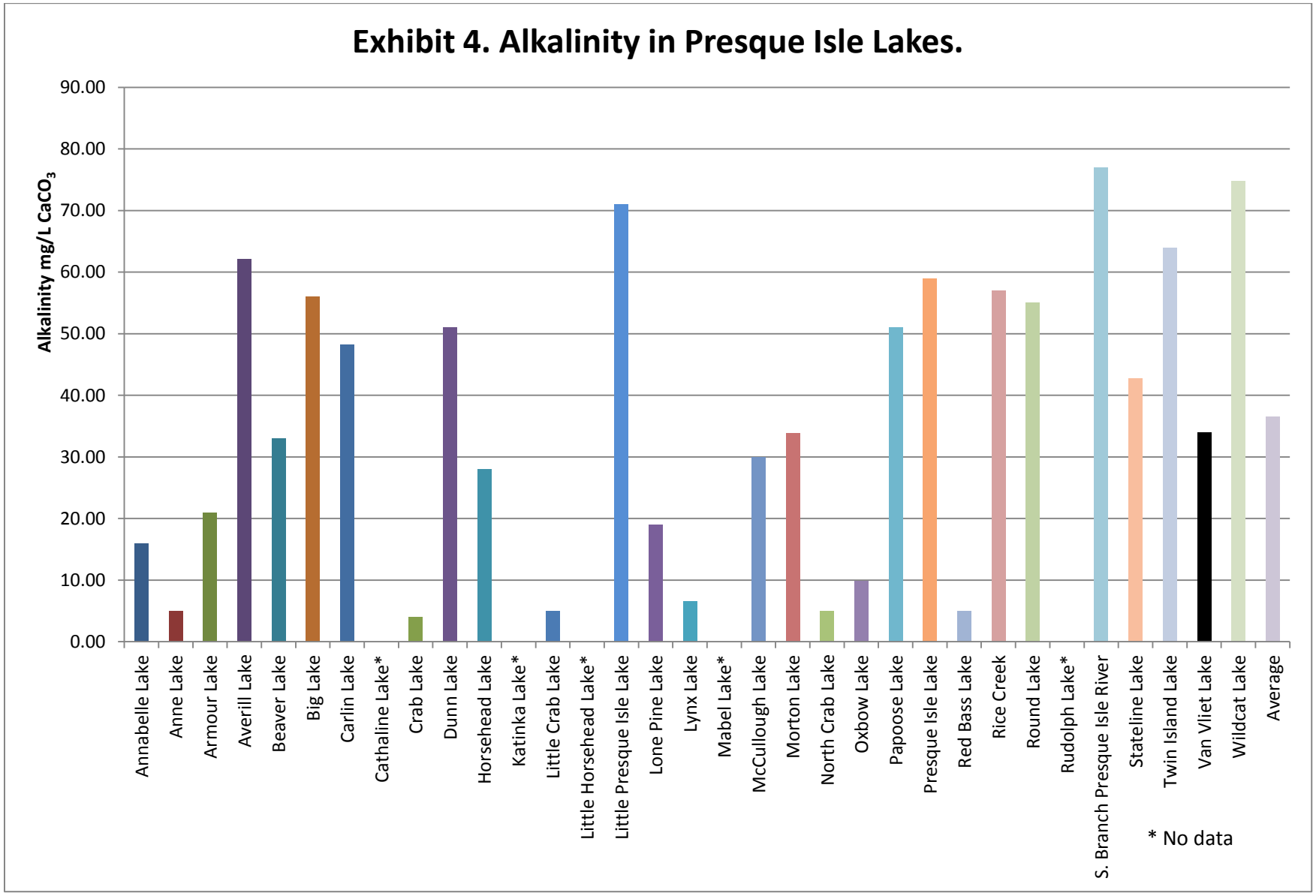


Exhibit 4. Alkalinity in Presque Isle Lakes.
Alkalinity mg/L $CaCO_3$
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Annabelle Lake
Anne Lake
Armour Lake
Averill Lake
Beaver Lake
Big Lake
Carlin Lake
Cathaline Lake*
Crab Lake
Dunn Lake
Horsehead Lake
Katinka Lake*
Little Crab Lake
Little Horsehead Lake*
Little Presque Isle Lake
Lone Pine Lake
Lynx Lake
Mabel Lake*
McCullough Lake
Morton Lake
North Crab Lake
Oxbow Lake
Papoose Lake
Presque Isle Lake
Red Bass Lake
Rice Creek
Round Lake
Rudolph Lake*
S. Branch Presque Isle River
Stateline Lake
Twin Island Lake
Van Vliet Lake
Wildcat Lake
Average
* No data

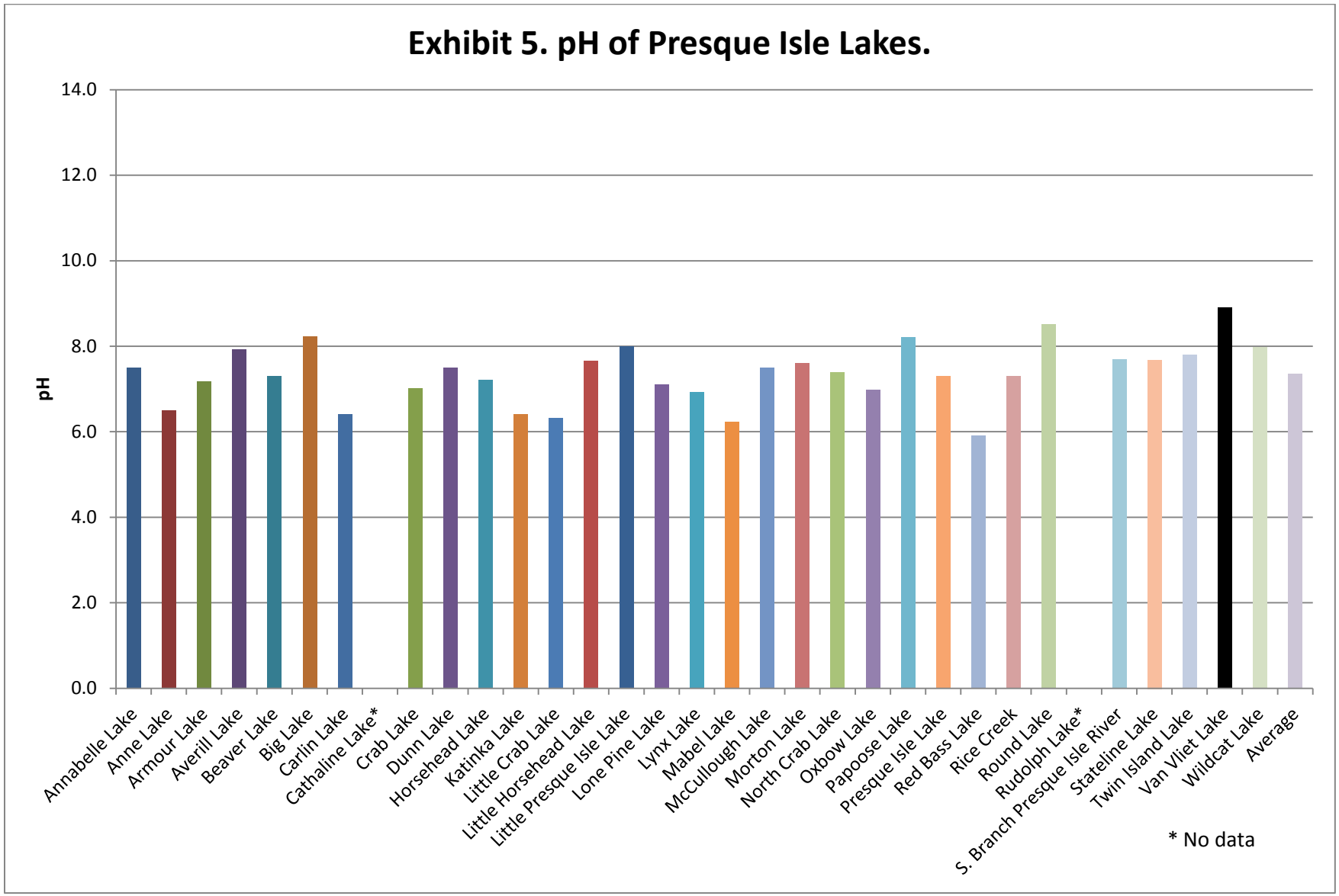
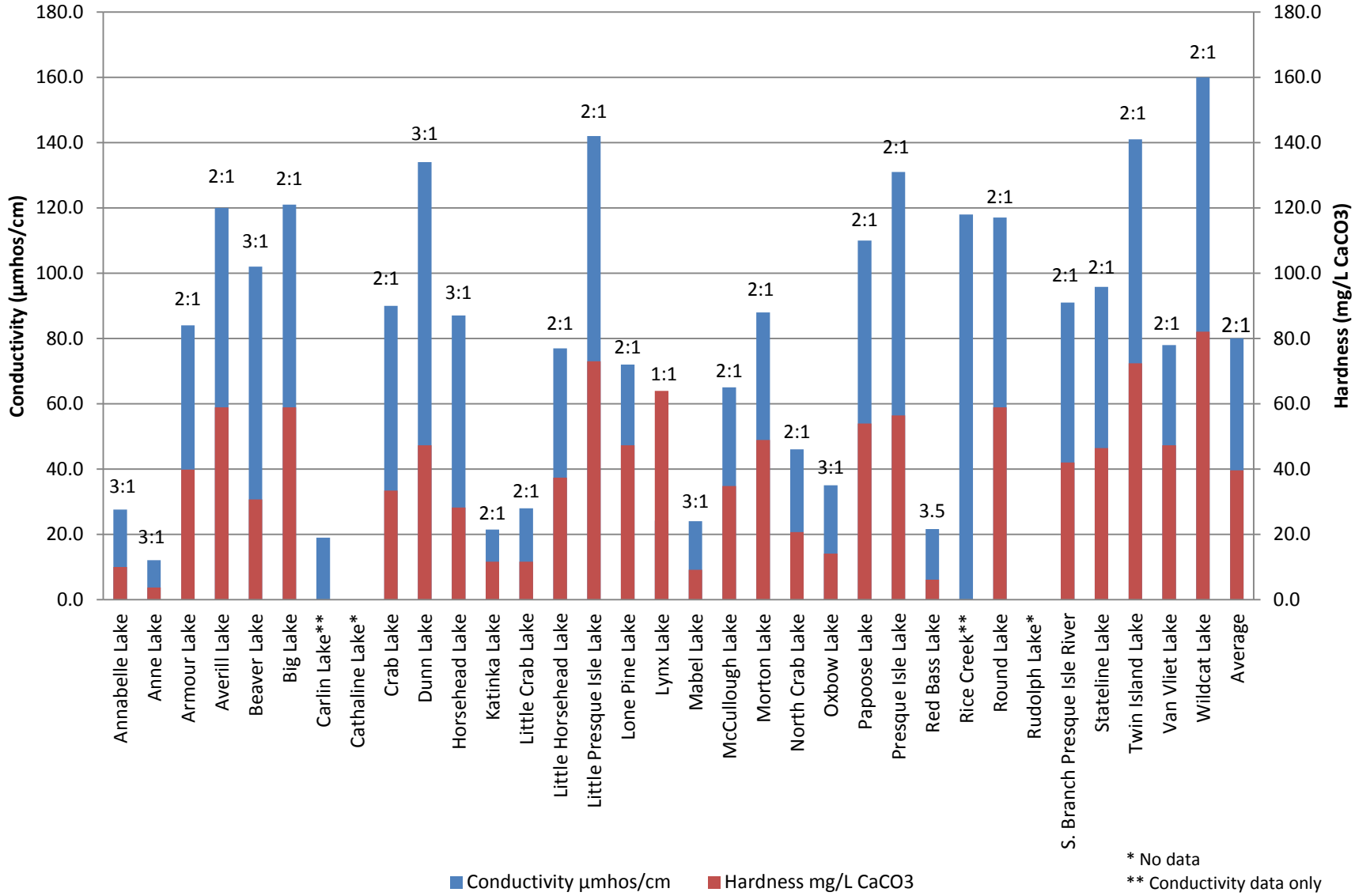
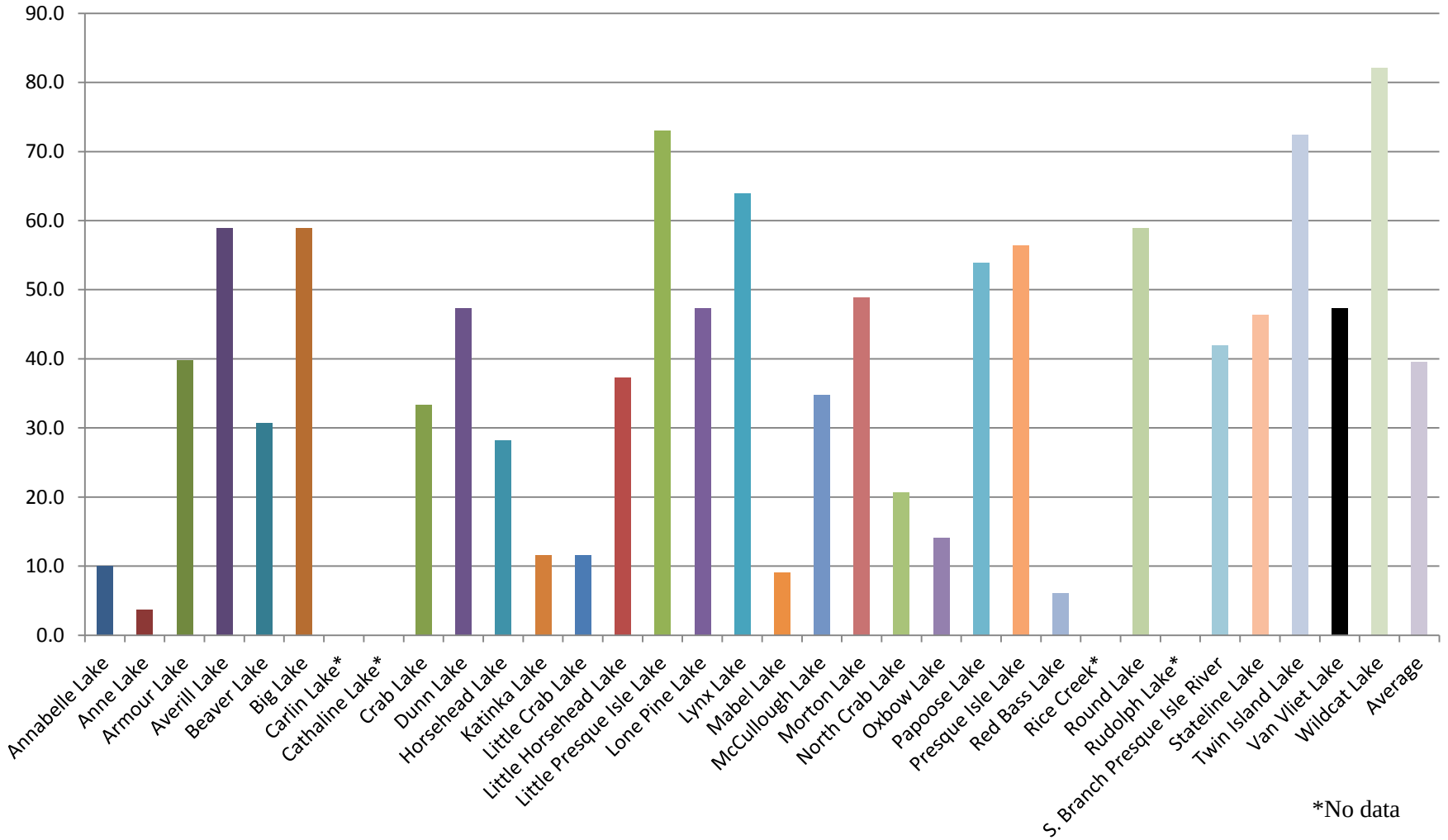


Exhibit 5. pH of Presque Isle Lakes.
pH
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Annabelle Lake
Anne Lake
Armour Lake
Averill Lake
Beaver Lake
Big Lake
Carlin Lake
Cathaline Lake*
Crab Lake
Dunn Lake
Horsehead Lake
Katinka Lake
Little Crab Lake
Little Horsehead Lake
Little Presque Isle Lake
Lone Pine Lake
Lynx Lake
Mabel Lake
McCullough Lake
Morton Lake
North Crab Lake
Oxbow Lake
Papoose Lake
Presque Isle Lake
Red Bass Lake
Rice Creek
Round Lake
Rudolph Lake*
S. Branch Presque Isle River
Stateline Lake
Twin Island Lake
Van Vliet Lake
Wildcat Lake
Average
* No data

## Exhibit 6. Conductivity:Hardness Ratio.



## Exhibit 7. Hardness mg/L CaCO3



**Literature Cited**

Shaw, B. Mechenich, C, and Klessig, L. 2004. *Understanding Lake Data (G3582).* Board of Regents of the University of Wisconsin System. Madison, WI.

Wisconsin Department of Natural Resources. 2018. *Surface Water Integrated Monitoring Systems (SWIMS) Database*. Retrieved 2019. <http://dnr.wi.gov/topic/surfacewater/swims/>

# Appendix C
# Review of Water Resource Regulations and Planning Relevant to Presque Isle Township Lakes

# Review of Water Resource Regulations and Planning Relevant to Presque Isle Township Lakes

In this appendix, we provide reviews of documents intended to preserve and protect Wisconsin waters, including those in Presque Isle Township. These reviews were developed from documents created by a variety of sources, including: the Environmental Protection Agency, the Wisconsin Administrative Code, the Wisconsin Department of Natural Resources, the Vilas County Lakes and Rivers Association, the Vilas County Land & Water Conservation Department, Vilas County Zoning and Planning Department, the Town of Presque Isle, and the Town of Winchester.

The first part of this appendix is a review of the federal, state and county regulations and ordinances that influence the water quality of the Presque Isle Township Lakes. Second is a review of the *Headwaters Basin Integrated Management Plan*. This plan describes issues of concern within the Headwaters Basin (where the Presque Isle Township Lakes are located), and provides examples of how the WDNR strives to preserve and restore the land and water resources.

# Regulations and Ordinances that Protect the Water Quality of the Presque Isle Township Lakes

Federal

The Army Corps of Engineers oversees projects that alter waterways-including discharges to wetlands, and the Environmental Protection Agency (EPA) regulates water quality pollution and drinking water standards. The EPA revised The Clean Water Act in 1972 in order to reduce pollutant discharges into waterways and mange polluted runoff. It has set waste water standards for industries, and for all contaminants in surface waters. The Clean Water Act deemed it unlawful to discharge any pollutant from a point source into navigable waters, unless a permit was obtained. You can view parts of the Clean Water Act at the EPA's website (http://www.epa.gov/npdes/pubs/cwatxt.txt).

State

For any given lake in Wisconsin, shoreland protection regulations can be set by the county, town or lake association; however, they must *at least* follow the regulations listed under the State of Wisconsin's Administrative Code, Chapter NR115: Wisconsin's Shoreland Protection Program. The purpose of this Program is to: "establish minimum shoreland zoning standards for ordinances…and to limit the direct and cumulative impacts of shoreland development on water quality; near—shore aquatic, wetland and upland wildlife habitat; and natural scenic beauty" (State of Wisconsin Legislature-a). This document states that a setback of 75 feet from the ordinary high-water mark (OHWM) of any navigable waters is required for all buildings and structures. It also states that the county will be in charge of establishing ordinances that consider the effect of vegetation removal on water quality, including soil erosion, and the flow of effluents, sediments and nutrients. Lastly, it says that a minimum of 35 feet vegetative buffer zone is required from the OHWM (State of Wisconsin Legislature-a).

Changes to the Wisconsin Administrative Code have limited the amount of phosphorus running off into waterbodies. Chapter 151 restricts the amount of phosphorus farmers can have come off their fields. Moreover, in 2009-2010, Wisconsin legislatures passed laws so that fertilizers with phosphorus would be banned from use on lawns or turfs, and that phosphorus levels in dishwater detergent were reduced considerably (State of Wisconsin Legislature-b).

In 2017, the Wisconsin Nutrient Reduction Strategy was developed, partly in response to the 2008 Gulf of Mexico Hypoxia Action Plan. This national plan set a national goal of 45% reduction in nitrogen and phosphorus loading to the Mississippi River to address the size of the hypoxic zone in the Gulf of Mexico. In Wisconsin, the main focus of nutrient reduction efforts is to address water quality problems caused by nutrients affecting state rivers, lakes and streams. Wisconsin's strategy follows the 2011 U.S. Environmental Protection Agency framework, which established elements for state nutrient reduction strategies: target watersheds with highest loading; address all sources; and track, measure and report progress. Implementation of the

Wisconsin Nutrient Reduction Strategy is occurring through existing state, federal and local programs (WDNR, 2017).

The Wisconsin Department of Natural Resources (WDNR) has developed the Wisconsin Pollutant Discharge Elimination System (WPDES) program. This program regulates the discharge of pollutants into waters. Types of permits issued are: individual, general (including ballast water discharge, pesticide pollutant discharge, etc.), storm water and agricultural (WDNR, 2012a).

The WDNR also requires permits for specific aquatic plant control techniques. Permits are required for aquatic plant control when: chemicals are used, biological controls are used, and physical techniques (such as barriers) are used; when wild rice is involved; when plants are mechanically removed, or when plants are removed manually from an area greater than 30 feet in width along a shoreline (WDNR, 2012b).

Wisconsin's Water Monitoring Strategy presents WDNR's vision to fulfill Wisconsin's Clean Water Act monitoring responsibilities and is integral to improving Wisconsin's monitoring, assessment, and reporting activities. This strategy supports the statewide commitment to achieving better water quality through monitoring (WDNR, 2015).

Personal Watercrafts (PWCs) are restricted to slow, to no-wake speed when within 200 feet of a shoreline, while boats must be at slow, to no-wake speed within 100 feet. These regulations can be more stringent under county or town ordinances (WDNR, 2011).

On July 12, 2015 Governor Walker signed 2015-17 biennial budget (Act 55) which modifies the shoreland zoning provisions. Act 55 changes the authority counties have in the development of a shoreland ordinance that is more restrictive than the shoreland zoning standards contained in NR 115 and changed other shoreland zoning standards. In fulfillment of its duty, under s. 281.31 Wis. Stats, the Wisconsin Department of Natural Resources developed a memorandum to provide general recommendations for counties and to answer questions regarding the interpretation and implementation of Act 55 as it relates to Wisconsin's shoreland protection program. Act 55 was enacted July 12, 2015, published July 13, 2015, and took effect July 14, 2015. The Wisconsin Department of Natural Resources memorandum can be viewed at: https://dnr.wi.gov/topic/ShorelandZoning/documents/Act55-2015-10-01.pdf

County

With the advent of Act 55, Vilas County shoreland and zoning ordinances are arguably weakened. Nevertheless, regulations and ordinances set by Vilas County can be found in the *Vilas County Shoreland and Zoning Ordinance* (2017). This document provides detailed information about zoning and planning near shoreland and wetland areas. The following is a brief summary of some of these regulations that inherently protect the water quality of these water bodies.

Article II discusses general shoreland protection provisions. According to the Ordinance, Shorelands are defined as lands within 1,000 feet from a lake, pond or flowage; and 300 feet from a river or stream (Vilas Co., 2017).

To prevent erosion, boathouses cannot be constructed if the slope of the land is greater than 20% (Vilas Co., 2017). Similarly, no land disturbances (filling, grading, excavating, creating of impervious areas, etc.) are allowed within 35 feet of the OHWM (Vilas Co., 2017). However, an erosion control plan is required (along with a Shoreland Alteration Permit) for conducting any alterations such as: land disturbance, construction of boat landing or roadway, and/or construction on slopes (Vilas Co., 2017).

Article VIII (Removal of Trees and Shore Cover) states, "Except as set forth in this section, natural shrubbery, trees, and undergrowth shall be preserved as far as practicable on all shoreland properties, and if removed, it shall be replaced with vegetation that is equally effective in meeting the objectives of this Ordinance." It is also prohibited to remove trees, shrubs or undergrowth within 75 feet of the lake. By keeping this vegetation, soils are less likely to erode and pollutants and contaminants are less likely to enter the water.

Local

The town of Presque Isle has a long history of shoreland zoning and protection. Sixty years ago (1959), the township established minimum lot sizes for township lakes (widths of 200 feet on all lakes, except for Crab Lake where a 400 foot minimum width obtains). A Shoreland chapter exists within the Town's Zoning Ordinance. Cutting vegetation is prohibited within 300 feet of the OHWM (Town of Presque Isle, 2001). A Shoreland Alteration Permit is required if filling, grading, lagooning, dredging, ditching or excavation is done within the shorelands (Town of Presque Isle, 2001).

Chapter 500 of the Zoning Ordinance has a few sub-chapters that can help protect the quality of water in the Presque Isle Lakes. Sub-chapter 501 states that no boat shall operate at speeds more than slow-no-wake within 200 feet of any lake's shoreline (Town of Presque Isle, 1999).

Section 501.03 (c) states that "motorboats shall be operated no faster than slow-no-wake on any lake less than 50 acres in size or any river within township boundaries" (Town of Presque Isle, 1999). This would include Cathaline Lake, Mabel Lake, and parts of Rice Creek and South Branch Presque Isle River. It also specifically states that "no person shall operate a motorboat that is propelled by an internal combustion engine on waters of Rice Creek."

Sub-chapter 502 discussed ordinances for all-terrain vehicles (ATVs). It states that "ATVs shall not be operated on wetlands, lakes, rivers…within the township…" (Town of Presque Isle, 2003).

Sub-chapter 503 is directed at personal watercraft ordinances. In section 503.5, personal watercraft must operate at speeds no more than slow-no-wake on lakes less than 50 acres in size,

and in stretches between 50 and 200 feet from shoreline on lakes greater than 50 acres (Town of Presque Isle, 1997).

Lastly, in sub-chapter 506, which is a joint ordinance for the towns of Presque Isle and Winchester, "no person shall operate a boat faster than slow-no-wake in an area beginning at the mouth of and including the entire northern-most bay, known locally as the "Inkpot", of Papoose Lake." In addition, "no person shall operate a boat faster than slow-no-wake in the bay adjacent to the public boat landing on Papoose Lake…" (Town of Presque Isle).

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## Review of *Headwaters Basin Integrated Management Plan* Relevant to Presque Isle Township Lakes

The *Headwaters Basin Integrated Management Plan* provides information about the conditions of the land and water resources found in the basin, and addresses the programs that strive to preserve and restore those resources. For the purpose of this Plan, we will discuss the programs that provide assistance and protection to the water quality of Wisconsin lakes, including the Presque Isle Township Lakes in the adaptive management plan.

Of the 15,057 lakes in Wisconsin, 34% are located within the Headwaters Basin. The Basin spans Forest, Florence, Lincoln, Langlade, Oneida and Vilas Counties. Crab Lake is the only lake considered an Outstanding Resource Water (ORW) (WDNR et al., 2002). Lakes on the Impaired Waters (303d) list include: Annabelle Lake, Lynx Lake, and Oxbow Lake (WDNR, 2018). Annabelle and Lynx lakes are listed as Impaired Waters due to mercury contamination in fish tissues, while Oxbow Lake is listed due to mercury contamination and total phosphorus sample data exceeding state thresholds for recreation and fish and aquatic life use (WDNR, 2018). Because all lakes in Presque Isle Township are close in proximity to each other, it is important to keep contamination from impaired waters out of healthy lakes. Because of the healthy and diverse aquatic communities found in the Presque Isle Lakes, it is important to preserve and protect these resources. The following bureaus strive to do this.

The Fisheries Management branch of the WDNR Water Division protects Wisconsin lakes by processing permits required for protecting shorelines, by helping interpret ordinances and regulations, and by providing biological and technical expertise to local units of government. They also help monitor lake levels, assist landowners in learning about lake ecology, process applications for lake management grants, and review licenses and inspections of dams (WDNR et al., 2002).

The Watershed Management branch of the WDNR Water Division, following the standards set by the Federal Clean Water Act, protects Wisconsin surface waters by writing plans for watersheds, such as: facilities plans, 305 (b) water quality reports to Congress, and aquatic nuisance and exotic species reports. They also create water quality modeling, such as: streams and lakes water quality modeling, contaminated sediment monitoring, and wasteload allocations. The Watershed Program also proposes water quality standards and policies, such as: surface water quality classification and standards, contaminated sediment investigation, total maximum daily loads, and designation of 303 (d) water bodies (WDNR et al., 2002).

The Wastewater branch of the WDNR Water Division, following the standards set by the Federal Clean Water Act, protects Wisconsin surface waters by issuing Wisconsin Pollutant Discharge Elimination System (WDPES) permits, by reviewing industrial and municipal baseline and

annual reports, and by providing information to communities about their program and its benefits (WDNR et al., 2002).

The Nonpoint Source Pollution Abatement Program, following the standards set by the Wisconsin Administrative Code, protects Wisconsin surface waters by encouraging landowners to minimize nonpoint pollution sources on their properties, by providing information about the best management practices for both rural and urban areas, and by assisting counties with implementing their land and water resource management plans (WDNR et al., 2002).

The Drinking Water and Groundwater branch of the WDNR Water Division, following the standards set by the federal Safe Drinking Water Act and the Wisconsin Administrative Code protects Wisconsin waters by enforcing standards for wells and pumps, by conducting surveys and inspections of water systems, and by reviewing water quality monitoring reports. They also provide assistance to well owners and the public (WDNR et al., 2002).

The Wildlife Management branch of the WDNR Land Division, following the standards set by the Wisconsin Administrative Code, protects Wisconsin waters by establishing State Wildlife and State Natural Areas, by conducting population and habitat surveys, developing wildlife management plans, monitoring threatened and endangered species, evaluating hunting and trapping regulations, and by educating and encouraging responsible management techniques (WDNR et al., 2002).

The Endangered Resources branch of the WDNR Land Division, following the standards set by the Wisconsin Administrative Code, protects Wisconsin waters by managing the Natural Heritage Inventory Program (NHI), which is used to determine the existence and location of native plant and animal communities, and of Endangered or Threatened Species of Special Concern, and by providing permits for incidental take of these species (WDNR et al., 2002).

The Wisconsin Bureau of Forestry, following the standards set by the Wisconsin Administrative Code, protects Wisconsin waters by providing technical assistance to county, state and private forest lands. The Bureau helps each county forest by developing a Ten Year Comprehensive Plan, and by assisting with timber sale, reforestation, development of wildlife habitat, and protection of endangered and threatened species. On the state level, the Bureau assists with establishing the best management practices of sustainable forestry, reforestation, and timber harvesting. With private landowners, they help with establishing best management practices of sustainable forestry, help protect endangered and threatened species, and provide assistance with forest disease and insect problems (WDNR et al., 2002).

These programs have been put in place the help preserve, protect and restore the water quality of all Headwater Basin water bodies, including those found in Presque Isle Township.

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