



Community Assistance Planning Report No. 338

A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR OZAUKEE COUNTY: 2021-2030



*To protect, preserve, and
enhance natural resources,
local ecology and the quality
of life in Ozaukee County*



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REPORT SUMMARY

MISSION STATEMENT

To protect, preserve, and enhance natural resources, local ecology and the quality of life in Ozaukee County.

INTRODUCTION

In 1997, Chapter 92 of the *Wisconsin Statutes* was amended to require, and give authority for, counties to develop their own land and water resource management plans (LWRMP). The LWRMP is a State-mandated long-range planning document intended to guide the activities of the Ozaukee County Land and Water Management Department in its efforts to protect and improve land and water resources.

The initial Ozaukee County LWRMP was adopted by the County Board in 1999, with several subsequent minor changes. The LWRMP was prepared and adopted following the requirements of Chapters ATCP 50 and NR 151 of the *Wisconsin Administrative Code*. The County submitted an interim plan to the Department of Agriculture, Trade and Consumer Protection (DATCP) in 2011 and DATCP extended State approval of the plan through .

This plan is, therefore, the second comprehensive revision of the initial plan, and is the first edition in which assistance was provided by SEWRPC. The development of this plan, as set forth herein SEWRPC Community Assistance Planning Report No. 338, *A Land and Water Resource Management Plan for Ozaukee County: 2021 – 2030*, is intended to serve as a multi-year workplan which will:

- Specifically address implementing State agricultural and nonagricultural nonpoint source water pollution performance standards developed by the Wisconsin Departments of Natural Resources (WDNR) and DATCP
- Identify local land and water resources concerns, issues, and priorities
- Establish goals and objectives in response to the identified concerns and issues
- Develop a comprehensive program integrating existing and proposed resource management programs, plans, and funding sources designed to achieve the established goals and objectives
- Establish partnerships between agencies, municipalities, and other organizations
- Incorporate an informational and educational strategy in response to the identified concerns and issues
- Identify a method to evaluate and monitor progress

The Ozaukee County Land and Water Resource Management Plan incorporates inventory findings, including land use, natural resource data, soil and bluff erosion levels, and water quality data. Additionally, the plan addresses principal land and water resource concerns and issues that were identified by the Ozaukee County Land and Water Resource Management Plan Advisory Committee. The principal issues and concerns that were identified by the Advisory Committee include the following:

- Education, including but not limited to public education about land and water issues, engaging homeowners on best management practices, and continuing education about invasive species
- Policy, including promoting sound agricultural practices and regulations, creating additional wetland areas utilizing tax incentives, and ensuring agricultural carrying capacity is sustainable
- Riparian Areas, including buffer establishment, restoring and maintaining riparian zones, and protecting and enhancing riparian lands and buffers

- Ecology, including but not limited to improving degraded forest areas, protecting and enhancing wetlands, and managing stormwater
- Water Quality, including but not limited to protecting surface and groundwater resources, reducing point and non-point pollution, and addressing legacy phosphorus through dredging
- Collaboration, including but not limited to supporting the agricultural community for future generations, securing money, sources of funding and commitments, and aligning projects with state/national funding priorities
- Flooding, including removal of privately-owned wastewater treatment systems from floodway areas and developing ways to slow flooding
- Soil Health, including protecting and improving soil health, infiltration, and stormwater management
- Minimizing impacts of urban and agricultural development
- Managing Coastal Properties, particularly through bluff stabilization

The Ozaukee County Land and Water Resource Management Plan update contains the following five chapters:

Chapter 1–Introduction and Plan Development Process

Chapter 2–Resource Assessment

Chapter 3–Related Plans, Regulations, and Programs

Chapter 4–Goals, Objectives, Implementation, and Estimated Costs

Chapter 5–Progress Monitoring and Evaluation

PUBLIC PARTICIPATION

The plan was developed under the guidance of an Advisory Committee that was comprised of individuals that have natural resource, nonpoint source, agricultural, or environmental backgrounds. The Committee

included agency personnel from the U.S. Fish & Wildlife Service, the Natural Resources Conservation Service (NRCS), the Farm Service Agency, WDNR, UW-Extension, and the Milwaukee Metropolitan Sewerage District (MMSD); County land and water management, planning and parks, and public health department staff; and representatives from the Milwaukee River Watershed Clean Farm Families, Ozaukee Washington Land Trust, Country Visions Cooperative, Milwaukee Riverkeeper, Wisconsin National Farmers Organization, and the Riveredge Nature Center.

Advisory Committee meetings were held on September 11, 2018 and September 10, 2020. The Committee reviewed the plan in draft form and provided comments and recommendations, which were then addressed in the final plan. On August 6, 2020, September 3, 2020, October 6, 2020, and November 5, 2020, the Ozaukee County Natural Resources Committee met to review the plan; these meetings were open to the public for citizen comment and input. Notice of these meetings was posted on the County's website the week prior to the meeting. This plan was recommended for approval by the Advisory Committee on September 10, 2020, and by the Ozaukee County Natural Resources Committee on November 5, 2020. It was approved by the Wisconsin Land and Water Conservation Board on [REDACTED]; and was adopted by the Ozaukee County Board of Supervisors on [REDACTED].

ASSESSMENT OF WATER QUALITY AND NONPOINT SOURCE POLLUTION ISSUES

The watershed areas and water resources of Ozaukee County are illustrated on Maps 2.12 and 2.13 respectively, in Chapter 2 of this report. As noted on Map 3.2 and discussed in Chapter 3 (Section 3.8), all of the rivers, streams, and lakes in Ozaukee County are currently designated for a warmwater fish and aquatic life objective. While it is not officially listed as a coldwater stream or trout water, the lower portions of Sauk Creek have populations of stocked rainbow and brown trout. In addition, recent studies by the WDNR have confirmed the presence of naturally reproducing rainbow trout in these reaches.

Currently (as shown on Map 3.3 and discussed in Chapter 3, Section 3.8), most of the water resources within the County are only partially meeting the established water use objectives. Section 303(d) of the Federal Clean Water Act requires that states periodically submit a list of impaired waters to the U.S. Environmental Protection Agency for approval. Impaired waters are those which are not meeting their established water use objectives. As noted in Table 3.3 of Chapter 3, the waterbodies in Ozaukee County that have been listed as Section 303(d) waters in 2018 (and that are under review as of 2020) are included for various reasons and include all or portions of the following: Cedar Creek; Cedarburg Pond 121; Cedarburg Creek; Cedarburg Stone Quarry; Fish Creek; Fredonia Creek; Kaul Creek; Lake Michigan; Little

Menomonee Creek; Little Menomonee River; Ludowissi Lake Branch to Sauk Creek; Milwaukee River, North Branch of the Milwaukee River; Nor-X-Way Channel; Sauk Creek; Sucker Creek; Trinity Creek; Ulao Creek; and the Unnamed Tributary to the Milwaukee River.

SUMMARY OF WORKPLAN

As set forth in Chapter 4, the land and water resource management plan identifies, prioritizes, and addresses land- and water-related resource conservation issues in Ozaukee County. It focuses on reducing nonpoint source pollution from rural and urban areas in the County to the levels needed to achieve the water use objectives. It also seeks measures to protect land and water resources, to promote soil health practices, to support existing projects and programs (particularly such programs as the Regional Conservation Partnership Program, the Targeted Runoff Management Grant Program, and the Harrington Beach Water Quality Initiative), and to support the County's Priority Farms strategy (as currently set forth in a Memorandum of Understanding with the WDNR). The workplan elements are designed to meet the State nonpoint source pollution abatement performance standards and prohibitions. The plan also has specific objectives for preserving and protecting land and water resources. The goals, objectives, and planned actions contained in this workplan were developed to focus on the priority issues and concerns identified by the LWRMP Advisory Committee. Six priority goals were established for the plan:

1. Provide natural resource, environmental, and State performance standards information and education
2. Implement the State performance standards to reduce agricultural non-point source water pollution
3. Implement the State performance standards to reduce non-agricultural non-point source water pollution
4. Invasive and exotic species management and control
5. Protect and preserve land and water resources
6. Increase cooperation with local, State and Federal partners

The recommended goals, workplan objectives, and planned actions for the years 2021-2030 are summarized below and are presented in Table 4.1 and in Chapter 4 of this report.

Educational Programming

Developing and implementing sound educational programming is an important component of the land and water resource management plan. The major focus of this goal is to foster a greater understanding of soil health, nutrient management, various best management practices, environmental stewardship, and the importance of pollinator and native plantings. The workplan objectives include:

- Enhance the general public's appreciation and involvement in protecting and restoring natural resources
- Promote sound agricultural practices, soil health, and foster knowledge of performance standards, regulations, sustainable agriculture, etc.
- Promote learning strategies for environmental education among youth
- Increase landowner and producer/operator awareness of conservation practices and programs
- Provide information to riparian property owners on the benefits of riparian buffers
- Provide information to county residents about how they can control nonnative and invasive species

Agricultural Performance Standards

The goal and objectives set forth in this plan focus on achieving the State minimum performance standards for rural nonpoint source pollution as well as the recommendations identified in the regional water quality and watershed management plans. The focus of this goal is to improve and protect surface and groundwater from agricultural runoff. The workplan objectives include:

- Implement the State agricultural performance standards
- Support the Farmland Preservation Program
- Reduce soil erosion to or below T

- Manage manure and livestock access to water resources in accordance with State performance standards
- Reduce soil delivery rate from riparian cropland
- Develop, implement, and monitor compliance of nutrient and pest management plans to protect water quality

Nonagricultural Performance Standards

Nonagricultural and urban land uses are a significant source of nonpoint pollution. The focus of this goal is to reduce the quantity and improve the quality of stormwater runoff from developed and developing areas. The workplan objectives include:

- Implement the State Nonagricultural Performance Standards
- Reduce construction site erosion
- Manage stormwater runoff more effectively
- Encourage urban-density land use to be confined to and within the identified urban service areas
- Comply with the Municipal Separate Storm Sewer System (MS4) permit requirements under Chapter NR 216 of the *Wisconsin Administrative Code*

Invasive and Nonnative Species Management and Control

Invasive and nonnative species can alter ecological relationships among native species and can affect ecosystem function, economic value of ecosystems, and human health. The focus of this goal is to promote and improve a healthy ecosystem. The workplan objective is to:

- Control the infestation of exotic and invasive plant and animal species.

Protect and Preserve Land and Water Resources

The focus of this goal is to implement planning strategies and programs (i.e. Milwaukee River TMDL's, Nine-key Element Plans, RCPP, FPP, Harrington Beach water quality initiatives, nonmetallic mining

reclamation, replace failing septic systems, and reduce the risk of contamination from hazardous waste), to preserve farmland and natural areas and protect surface and groundwater quality, wetlands, and floodplains. The workplan objectives include:

- Conserve Ozaukee County's unique natural resources in the face of increasing urbanization and resulting loss of farmland
- Prevent the degradation and disturbance of wetlands
- Create, restore and enhance wetland, riverine, and wildlife habitat throughout the County
- Prepare, update and implement comprehensive watershed management plans
- Promote riparian buffers along all water resources in the County, including their restoration, maintenance, protection, and enhancement
- Protect the quality and quantity of surface and groundwater resources
- Support efforts to protect and enhance forests, woodlots, and non-farmed areas
- Continue to implement and refine the County's shoreland/floodplain management program
- Adequately reclaim non-metallic mines (gravel pits and quarries)

Increase Cooperation with Local, State and Federal Partners

Coordination with Federal, State and local agencies is necessary to protect land and water resources in Ozaukee County. The focus of this goal is to strengthen existing partnerships and pursue opportunities for new partnerships. The workplan objectives include:

- Implement and periodically update the County comprehensive plan
- Look for new opportunities to coordinate and collaborate with local grass roots groups, the Milwaukee Metropolitan Sewerage District, conservation and wildlife clubs, and local, State and

Federal agencies to help implement the goals of this LWRMP, secure funding, and align projects with County/State/National priorities

IMPLEMENTATION STRATEGIES

The goals, workplan objectives and planned actions presented in the Ozaukee County LWRMP represent part of the framework for an annual workplan that will be developed and carried out by the Ozaukee County LWM Department over the next ten years. Proposed planned actions were purposely broadly defined in order to meet future changes in the environment, changes in programs and policies, changes in local priorities, and changes in available funding. As required by DATCP, a more detailed description of priority planned actions is set forth in Section 4.8 of Chapter 4, as a strategy to implement the nonpoint pollution performance standards and prohibitions under NR 151. Also, an estimate of the costs associated with plan implementation is provided in Table 4.2 of Chapter 4.

Estimated Costs

Since this plan does not have the authority to establish County budget items, the estimated costs provided in Table 4.2 are solely intended to satisfy state LWRM planning requirements and do not in any way represent anticipated Ozaukee County budgets. It is also assumed that no additional staff resources will be made available to implement this plan beyond what is currently allocated to land and water conservation programs in the County (approximately 6.8 full time equivalent employees). The cost estimates contained in Table 4.2 in Chapter 4 of this report are based on average annual costs to maintain existing program efforts and staffing levels.

It is reasonable to assume that existing staff will be able to provide a significant portion of the time required for implementing this plan. If additional manpower is needed, it will be obtained through cooperative ventures with local universities, colleges, and volunteer groups; consultants, and limited-term or seasonal staff increases.

PROGRESS MONITORING AND EVALUATION

Monitoring and evaluating program efforts is an important element that ensures the effectiveness of the planned actions described in Chapter 4 of this plan. The Ozaukee County Land and Water Management Department currently employs a variety of methods to monitor and evaluate the progress of program efforts. These methods include use of various databases, advisory committees, annual progress reports, and water quality monitoring. Monitoring program effectiveness will be carried out through analyses and

quantification of soil erosion and sediment delivery, priority farm compliance, tracking the level of protection of environmentally sensitive lands and analysis of water quality data. Chapter 5 of this report describes some of these efforts in more detail and how they will be used to monitor and evaluate the success in implementing planned activities.

Consistent and thorough evaluation and monitoring of conservation efforts is essential to ensure the effectiveness of the Milwaukee County Land and Water Resource Management Plan. An annual progress report will be the primary method used to evaluate progress of implementing the planned activities outlined in Chapter 4 of this report. The progress report will consist of a summary of the annual outcomes and accomplishments of planned activities outlined in the workplan. This summary may include, but is not limited to: completed information and education activities, landowners contacted, best management practices designed and installed, conservation and nutrient management plans written or revised, cost-share agreements developed, erosion control plans reviewed, compliance monitoring and status, and other planned program results. These annual progress reports will be compiled and forwarded to the DATCP and the WDNR. The results of the monitoring and evaluations conducted over the term of this plan (2021-2030), will be used to improve the next land and water resource management plan.

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A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR OZAUKEE COUNTY: 2021-2030

Chapter 1

INTRODUCTION AND PLAN DEVELOPMENT PROCESS

1.1 PLAN BACKGROUND AND PURPOSE

In 1997, the State Legislature, through Wisconsin Act 27, amended Chapter 92 of the *Wisconsin Statutes*, requiring that all counties develop a land and water resource management plan (LWRMP). The intent of this charge is to foster and support a locally led process that is intended to address each individual county's unique natural resources; identify particular problems associated with the resource base; and establish a plan to help protect and restore those resources. Additionally, the County plans are intended to focus on State minimum nonpoint source pollution performance standards related to agriculture and urban development. The plan development process is intended to encourage innovative programming and leadership and to build local support. The plan identifies the natural resources and the current condition of those resources, the limitations of those resources, and sets forth a strategy that addresses the natural resource issues and problems. This plan also provides a means to educate the public about these issues and problems and include them in the steps necessary to protect the natural resource base.

The initial Ozaukee County Land and Water Resource Management Plan was approved in 1999, with several subsequent minor changes. Chapter 92 of the *Statutes* requires that LWRM Plans must be updated every five years for counties to be able to receive conservation staff funding and cost-share grant monies. In 2018, Ozaukee County requested and received a two-year extension of its existing LWRMP from the Wisconsin Land and Water Conservation Board. This plan is the first full revision of the initial LWRM Plan. The revised multi-year land and water resource management plan must meet the requirements of *Wis. Stats.*, 92.06, and additional guidelines established by the Wisconsin Department of Agriculture, Trade and Consumer

Protection and the Wisconsin Land and Water Conservation Board. This plan will serve as a program guide for local conservation efforts in Ozaukee County.

1.2 OVERVIEW OF STUDY AREA

Ozaukee County is located in Southeastern Wisconsin, and is bordered on the east by Lake Michigan, on the north by Sheboygan County, on the west by Washington County, and on the south by Milwaukee County. The County covers about 235 square miles and contains three cities, all or parts of seven villages, and six towns. There are all or parts of six natural watersheds and a total of about 2,770 acres of inland surface waters within the County.

The majority of the population (and residential development) resides within the Cities of Cedarburg, Mequon, and Port Washington and the Village of Grafton. Significant amounts of residential development have also occurred in the Villages of Belgium, Fredonia, Thiensville, and Saukville (and to a lesser extent in the unincorporated communities of Waubeka and Lake Church), and scattered rural residential development has occurred in the Towns of Cedarburg and Grafton. However, much of the land in the County remains in agriculture, although the dairy industry has steadily declined. Today, the primary form of agriculture (acreage as reported by the United States Department of Agriculture's 2017 Census of Agriculture) involves forage (for hay, haylage, grass silage and greenchop), soybeans, and corn. The major industries within the County are generally located in business parks in outlying areas of the Cities of Cedarburg, Mequon, and Port Washington, and the Villages of Belgium, Fredonia, Grafton, and Saukville.

Steady urban development, particularly in the southern portion of Ozaukee County, is causing the County to face the challenge of balancing growth with protecting and maintaining its natural resources. The County has a rich and diversified natural resource base, including the Lake Michigan nearshore area, several inland lakes, as well as major river systems. Additionally, the County contains significant areas of quality wetlands, woodlands, and grasslands, the most important of which are incorporated into the areas designated as environmental corridors.

1.3 PLAN DEVELOPMENT AND PUBLIC PARTICIPATION

The revised/updated Ozaukee County Land and Water Resource Management Plan was developed through a collective effort of a number of agencies and organizations under the overall direction of the Ozaukee County Natural Resources Committee. Like the original plan, an important aspect of the development of

the revised plan relied on the participation from both citizens of the County, as well as representatives from various intergovernmental agencies. The agencies that were involved include the USDA Natural Resources Conservation Service, the Ozaukee County Land & Water Management Department, and the Southeastern Wisconsin Regional Planning Commission (SEWRPC). The plan was developed under the guidance of the Land & Water Resource Management Plan Advisory Committee. The members of the Advisory Committee and their affiliation are listed in Figure 1.1.

Valuable information was also obtained from SEWRPC Community Assistance Planning Report No. 87 (2nd Edition), *A Farmland Preservation Plan for Ozaukee County: 2035*, December 2013, as well as from SEWRPC Community Assistance Planning Report No. 133 (2nd Edition), *A Park and Open Space Plan for Ozaukee County*, June 2011, and from SEWRPC Community Assistance Planning Report No. 285, *A Multi-Jurisdictional Comprehensive Plan for Ozaukee County: 2035*, April 2008 and Amended May 2009.

The revision to the Ozaukee County Land and Water Resource Management Plan began on September 11, 2018, with a workshop by the Land & Water Resource Management Plan Advisory Committee to identify priority issues. By February of 2020, SEWRPC staff began work on the draft plan. Additionally, ____ meetings were held on _____. The Advisory Committee reviewed the plan in draft form and provided comments and recommendations, which were then addressed in the final plan. This plan was recommended for approval by the Advisory Committee on September 10, 2020. On October 6, 2020, the Ozaukee County Natural Resources Committee held a public hearing on the draft plan to obtain citizen comment and input. This meeting was announced on September 17, 2020 and September 24, 2020 as a Class II public notice (see Appendix A). The plan was recommended for approval by the Ozaukee County Natural Resources Committee on November 5, 2020. This plan was approved by the Wisconsin Land and Water Conservation Board on _____, and by the Ozaukee County Board of Supervisors on _____.

1.4 LAND AND WATER RESOURCE MANAGEMENT PLAN PRIORITY ISSUES

At the September 11, 2018, meeting of the Land & Water Resource Management Plan Advisory Committee, members identified the following priority issues with respect to how the Ozaukee County Land and Water Management Department could effectively and efficiently protect, preserve, and improve the County's natural resources:

- Education, including but not limited to public education about land and water issues, engaging homeowners on best management practices, and continuing education about invasive species

- Policy, including promoting sound agricultural practices and regulations, creating additional wetland areas utilizing tax incentives, and ensuring agricultural carrying capacity is sustainable
- Riparian Areas, including buffer establishment, restoring and maintaining riparian zones, and protecting and enhancing riparian lands and buffers
- Ecology, including but not limited to improving degraded forest areas, protecting and enhancing wetlands, and managing stormwater
- Water Quality, including but not limited to protecting surface and groundwater resources, reducing point and non-point pollution, and addressing legacy phosphorus through dredging
- Collaboration, including but not limited to supporting the agricultural community for future generations, securing money, sources of funding and commitments, and aligning projects with state/national funding priorities
- Flooding, including removal of privately-owned wastewater treatment systems from floodway areas and developing ways to slow flooding
- Soil Health, including protecting and improving soil health, infiltration, and stormwater management
- Minimizing impacts of urban and agricultural development
- Managing Coastal Properties, particularly through bluff stabilization

The goals, objectives, and recommended actions contained in this plan were developed to focus on those issues and concerns identified by the Land & Water Resource Management Plan Advisory Committee and by the Ozaukee County Land & Water Management Department, and to also address the minimum State performance standards and prohibitions.

SEWRPC Community Assistance Planning Report No. 338

A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR OZAUKEE COUNTY: 2021-2030

Chapter 1

INTRODUCTION AND PLAN DEVELOPMENT PROCESS

FIGURES

Figure 1.1
Land & Water Resource Management Plan 2021-2030 Advisory Committee

Jim Melichar, <i>Chairman</i>	Milwaukee River Watershed Clean Farm Families
Mike Paulus	Milwaukee River Watershed Clean Farm Families
Marc Sass	DNR Forester
Craig Helker.....	Water Resources Biologist - DNR East District
Tom Stolp	Executive Director, Ozaukee Washington Land Trust
Brian Vorpapel.....	Agronomist, Country Visions Cooperative
Bruce Luebke	US Fish & Wildlife Service, Leopold Wetland Management District
Stephanie Plaster.....	UWEX Agriculture Educator
Abigail Freeland.....	Washington Ozaukee Public Health Department
Michael Patin	District Conservationist, USDA NRCS
Andrew Struck.....	Director, Ozaukee County Planning and Parks Department
Marjie Tomter	President, Ozaukee Washington Land Trust Board of Directors
Cheryl Nenn	Milwaukee Riverkeeper
Karen Nenahlo	Senior Project Planner, Milwaukee Metropolitan Sewerage District
Don Hamm	President, WI National Farmers Organization and Local Farmer
Jesse Bennet.....	DNR Nonpoint Source Coordinator, SE Region
Matthew Peplinski.....	County Executive Director, Farm Service Agency
Bob Roden	Milwaukee River Watershed Clean Farm Families
Mandie Zopp	Director of Research and Conservation, Riveredge Nature Center
Geoff Schramm.....	Soil and Water Conservationist, Ozaukee County Land & Water Management Department
Jeffrey P. Bell.....	Soil and Water Coordinator, Ozaukee County Land & Water Management Department
Jacob Zimmerman	Water Resources Engineer, WDNR

Supporting Staff

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Andrew Struck.....	Director, Ozaukee County Planning and Parks Department
Jeffrey P. Bell.....	Soil and Water Coordinator, Ozaukee County Land & Water Management Department
Geoff Schramm	Soil and Water Conservationist, Ozaukee County Land & Water Management Department

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A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR OZAUKEE COUNTY: 2021-2030

Chapter 2

RESOURCE ASSESSMENT

2.1 INTRODUCTION

The conservation and wise use of agricultural and natural resources and the preservation of cultural resources are important factors influencing the growth and development potential of Ozaukee County. Aside from the County's physical location, the natural resource base is one of the assets that make the County a desirable community to reside and work. The natural resources of Ozaukee County not only provide recreational and aesthetic value, but also provide economic value as well. Protecting this resource base is also important to maintain biological diversity, which is vulnerable to the misuse that is associated with inappropriate development. Accordingly, future development should be guided to be consistent with the ability of the natural resource base to support various forms of urban and rural development without deterioration of the existing natural resources in the County.

The natural resources in Ozaukee County are susceptible to permanent damage resulting from inappropriate land use, transportation, and public facility development. Additionally, traditional occupations such as farming, silviculture, and horticulture also place significant burdens on the natural resource base. Sufficient understanding of the characteristics and elements of the natural resources must exist in order to prevent the environmental degradation and monetary costs associated with overuse and alteration of the existing natural resource base. A sound land and water resource planning program must recognize that natural resources in the County are limited. Ozaukee County and the local governments within the County must work together to develop a sound planning process that acknowledges the potential threats to the resource base; provides goals and objectives to preserve, protect and enhance that resource base; and educates the public on the value of natural resources and the benefits of good land stewardship.

This chapter provides inventory information on existing agricultural, natural, and cultural resources in Ozaukee County. The resource assessments that are discussed include soil types, existing farmland, farming operations, topography and geology, nonmetallic mining resources, water resources, woodland resources, natural areas and critical species habitats, environmental corridors, park and open space sites, cultural (historical and archeological) resources, and land use and demographics.

The base year for inventory data presented in this chapter ranges from 2010 to 2019. Much of the inventory data have been collected through regional land use and natural area planning activities conducted by SEWRPC. Additional inventory data have been collected from and by Ozaukee County, local units of government, and State and Federal agencies including the Wisconsin Department of Natural Resources (WDNR); Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP); State Historical Society of Wisconsin; and the U.S. Department of Agriculture (USDA).

2.2 SOILS AND AGRICULTURAL RESOURCES

Soil Survey

The USDA Natural Resources Conservation Service (NRCS) issued a soil survey for Ozaukee County in 2018. Soils were identified and mapped and organized by soil association, soil series, and soil type. The soil survey results, including the attributes of each soil type, are now available on the NRCS website as part of the Web Soil Survey (WSS) database. Unless otherwise noted, the soil information in this chapter was obtained from the WSS database.

Soil properties exert a strong influence on the manner in which the land is used, especially where land use is continually changing and evolving, as it is in Ozaukee County. Soils directly affect the types of land use that can take place, whether those uses are agricultural, recreational, commercial, or residential. Any comprehensive land and water resource management plan needs to evaluate how soils are currently being used, and also, how soils should best be used and managed over time. The soil survey can play an important role in land use decisions. The information contained in the soil survey can help identify which areas of the County are suitable for agricultural use and areas with limitations for development due to wet soils or bedrock near the surface.

Soil Associations

A soil association is a landscape that has a distinctive pattern of soils. There are five soil associations in Ozaukee County and Map 2.1 shows their spatial distribution across the County. Soils are typically grouped

into an association by drainage patterns, as well as surface horizon thickness. The general soil associations can be used for comparing suitability of relatively large areas for various land uses. However, for specific applications, the aforementioned detailed soil survey information should be relied upon, as well as onsite field data for confirmation purposes. Soils, as a whole, are very diverse and polymorphic, making it necessary to field verify what is actually on the landscape.

Saturated Soils

Soils that are saturated with water or that have a water table at or near the surface are known as hydric soils, and pose significant limitations for most types of development. High water tables often cause wet basements and poorly functioning absorption fields for private onsite waste treatment systems. The excess wetness may also restrict the growth of landscaping plants and trees. Wet soils also restrict or prevent the use of land for crops, unless the land is artificially drained. Map 2.2 depicts hydric soils in Ozaukee County, as identified by the NRCS. About 30 percent of the County, or about 44,698 acres, is covered by hydric soils not including surface water area. Although such areas are generally unsuitable for development, they may serve as important locations for restoration of wetlands and wildlife habitat, and for stormwater detention. There are additional non-hydric soils in the County, especially in the southern and eastern portions of the County, with hydric inclusions (the NRCS allows for up to 25 percent hydric inclusions in non-hydric soils).

Soil Suitability for Agricultural Production

The NRCS has classified the agricultural capability of soils based on their general suitability for most kinds of farming. These groupings are based on the limitations of the soils, the risk of damage when used, and the way in which the soils respond to treatment. Generally, lands with Class I and II soils are considered "National Prime Farmlands." About 65 percent of Ozaukee County is covered by prime farmland soils. Lands with Class III soils are considered "Farmlands of Statewide Significance," which cover about 22 percent of the County. Class I soils have few limitations, the widest range of use, and the least risk of damage when used. The soils in the other classes have progressively greater natural limitations. Class II soils have some limitations that reduce the choice of plants that can be grown, or require moderate conservation practices to reduce the risk of damage when used. Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both, and Class IV soils have very severe limitations. Class V, VI, and VII soils are considered suitable for pasture, but not for crops, and Class VIII soils are so rough, shallow, or otherwise limited that they do not produce economically worthwhile yields of crops, forage, or wood products.

The location and amount of Class I, II, and III soils, as set forth in Map 2.3 and Table 2.1, were an important consideration when farmland preservation areas were identified in the County farmland preservation plan¹ and existing town comprehensive plans. SEWRPC Community Assistance Planning Report No. 87 (2nd Edition), used the following criteria to designate Prime Farmlands: farms with at least 50 percent of soils classified as Class I, II, or III, located within a farming block of at least 100 acres, and having a minimum farm size of 35 acres.

Following preparation of the original Ozaukee County farmland preservation plan in 1983, the NRCS developed an alternative method for identifying areas to be preserved as farmland. This method is known as the Land Evaluation and Site Assessment (LESA) system. LESA is a numeric system for rating potential farmland preservation areas by evaluating soil quality (LE or land evaluation) and geographic variables (SA or site assessment). An analysis using the LESA system for rating potential farmland preservation areas in Ozaukee County was conducted in 2007 as part of the County multi-jurisdictional comprehensive planning process.² Map 2.4 depicts the land evaluation ratings for agricultural soils in the County, grouped by various ranges. Additional information about the LESA system and the analysis undertaken in 2007 can be found in Chapter II of the farmland preservation plan.

Soil Erosion Potential for Agricultural Lands

The erosion potential from wind and water for agricultural soils in Ozaukee County is summarized on Map 10 and Table 28 in Chapter III of SEWRPC Community Assistance Planning Report No. 285, A Multi-Jurisdictional Comprehensive Plan for Ozaukee County: 2035, Amended May 2009. The categories of erosion potential shown on that map are based on the amount of topsoil that has been lost, based on NRCS estimates. About 8 percent of the County, or 11,318 acres, has been identified as having highly erodible soils, and about 26 percent, or 38,497 acres, has been identified as having potentially highly erodible soils.

Farm Drainage Districts

Farm drainage district are special-purpose units of government authorized under Chapter 88 of the *Wisconsin Statutes*. Farm drainage districts are formed to plan and carry out area-wide drainage improvements to correct problems of high water tables and poor drainage that interfere with agricultural

¹ Documented in SEWRPC Community Assistance Planning Report No. 87 (2nd Edition), A Farmland Preservation Plan for Ozaukee County: 2035, Ozaukee County, Wisconsin, December 2013

² Documented in SEWRPC Community Assistance Planning Report No. 285, A Multi-Jurisdictional Comprehensive Plan for Ozaukee County: 2035, April 2008, Amended May 2009

uses and practices. A drainage district may lie in more than one local government and may also cross county lines. Drainage districts are governed by a three member board appointed by the County Circuit Court. The board has the authority to purchase land for the construction and maintenance of drainage systems, which may include ditches, canals, levees, reservoirs, silt basins, and pumps. The cost of improvements are assessed against the lands that are specifically benefited.

There are two active drainage districts in Ozaukee County, both located in the Town and Village of Belgium. The districts include the Belgium-Holland Drainage District No. 1 and Belgium-Holland Drainage District No. 2. The districts also include lands in the Town of Holland in Sheboygan County. The two districts encompassed an area of about 4,078 acres in Ozaukee County in 2006. Both districts are governed by the Ozaukee County Farm Drainage Board. Additional information about drainage districts can be found in Chapter II of the County farmland preservation plan, and a map of the two drainage districts can be found in Chapter II of the County comprehensive plan.

Existing Farmland

Agricultural lands in 2015 were identified by SEWRPC as part of the regional land use inventory conducted as part of the regional planning program. The land use inventory identified croplands, pasture lands, orchards, nurseries, specialized farming, and nonresidential farm buildings. Farm residences, together with a 20,000-squarefoot dwelling site, are classified as single-family residential land uses. Based on the land use inventory, about 65,086 acres, or about 101.7 square miles, representing about 43 percent of the County, were in agricultural use in 2015. It should be noted that this includes lands actually used for agriculture—primarily cultivated lands and lands used for pasture—and excludes the wetland and woodland portions of farm fields. Table 2.2 sets forth the number of acres occupied by farmland in each community and the County in 2015, and Map 2.5 shows the area devoted to farmland use in 2015, categorized as follows:

- Cultivated Lands, which includes lands used for the cultivating crops including row crops, grain crops, vegetable crops, and hay.
- Pasture Land and Unused Agricultural Lands, which includes lands used as pasture, or lands that were formerly cultivated or used for pasture that have not yet succeeded to a wetland or woodland plant community.

- Orchards and Nurseries, which includes lands used for orchards, nurseries, and sod farms. This category does not include greenhouses, which are shown as commercial on the existing land use map in the County comprehensive plan.
- Farm Buildings, which includes barns, silos, and other buildings used to store farm equipment or supplies or house farm animals.

Cultivated lands were the predominant type of agricultural use in Ozaukee County. Cultivated lands accounted for about 57,300 acres, or about 88 percent of all agricultural land in 2015. This is a decrease of 8,103 acres of cultivated lands, or about 12 percent, from the year 2000 inventory set forth in the County farmland preservation plan. In total, agricultural lands decreased by about 12,515 acres, or about 16 percent, between 2000 and 2015.

Farm Production and Revenue

In addition to inventory information regarding the suitability of lands and soils in the County for agricultural uses, it is also important to collect farm production and revenue inventory data.^{3,4} Farm production and revenue data are useful in determining the economic impact of agricultural operations in Ozaukee County and identifying the major types of agricultural products and operations. Additional information about both of these topics can be found in Chapter II of the County farmland preservation plan.

Agricultural sectors (or commodity groups) in the County and State in 2017, and the amount and percentage of revenue associated with each commodity group, are set forth in Table 2.3. Milk from cows (dairy farms) were the predominant source of agricultural revenue in the County in 2017, accounting for almost half (or about 46 percent) of agricultural revenue. Similarly, about 45 percent of agricultural revenue Statewide was based on dairy farms. Of the 316 farms in the County in 2017, 40, or about 13 percent, were dairy farms. Comparison of the 2002 Census of Agriculture to the 2017 Census of Agriculture indicates that the number of dairy farms had decreased by about 59 percent, while the agricultural revenue of dairy farms had increased by about 80 percent.

³ Data included in this section are 2017 data for Ozaukee County from the USDA National Agricultural Statistics Service. Data are reported at the County level, and are not available for local governments.

⁴ The USDA defines a farm as any place from which \$1,000 or more of agricultural products (crops and livestock) were sold or normally would have been sold during the year under consideration.

Cattle and calves (beef cattle farms) were the second-largest source of agricultural revenue in Ozaukee County in 2017, accounting for about 27 percent of sales. Statewide, beef cattle farms accounted for just 13 percent of revenues. The relative importance of beef cattle farms in the County compared to the State is likely due to the proximity of Ozaukee County's agricultural lands to the Milwaukee metropolitan market area. Comparison of the 2002 Census of Agriculture to the 2017 Census of Agriculture indicates that the number of beef cattle farms had decreased by about 38 percent, while the agricultural revenue of beef cattle farms had increased by about 442 percent.

Grain crops were the third-largest source of agricultural revenue in Ozaukee County in 2017, accounting for about 14 percent of the total. The percentage of agricultural revenue from grain crops Statewide was higher, accounting for about 24 percent of the total revenue.

Table 2.4 sets forth total value of sales⁵ in 2017 for farms in Ozaukee County. There were 92 farms, or about 29 percent of all farms in Ozaukee County, that had total value in sales of less than \$2,500. A similar percentage, about 32 percent, of farms Statewide had a total value in sales less than \$2,500. There were 99 farms, or about 31 percent of all farms in the County, with total value in sales of \$100,000 or more, compared to about 25 percent of farms Statewide with total value in sales of \$100,000 or more. The 2002 Census of Agriculture had indicated that 42 percent of all farms in the County (as compared to 29 percent in 2017) had a total value in sales of less than \$2,500, while 21 percent of all farms in the County (as compared to 31 percent in 2017), had a total value in sales of more than \$100,000. The State also experienced a similar, but somewhat smaller, change in total value of sales between 2002 and 2017.

Average net income from farm operations in the County in 2017 was \$59,981, which was significantly higher than the State average of \$36,842. In comparison, the average net income from farm operations in the County as reported by the 2002 Census of Agriculture was \$20,616 (an increase of about 191 percent between 2002 and 2017), while for the State it was \$17,946 (an increase of about 105 percent between 2002 and 2017).

Farming was the primary occupation of about 50 percent of the farm producers within the County in 2017, while Statewide, farming was the primary occupation of about 46 percent of the farm producers.

⁵ *The total value of sales is equal to the gross market value before taxes and production expenses for all agricultural products sold.*

Number and Size of Farms

Table 2.5 sets forth the number of farms by size category⁶ in Ozaukee County and Wisconsin. As noted earlier, there were 316 farms in the County in 2017 (as compared to 533 farms in 2002). The average farm size was 188 acres. This compares to 221 acres for farms in the State. The largest percentages of farms in the County, about 30 percent, were between 10 and 49 acres, and an additional 22 percent of farms were between 50 and 179 acres. Only about 12 percent of farms were more than 500 acres in size. Review of similar information contained in the County Farmland Preservation Plan indicates that the number of farms had increased between 1997 and 2002, but have steadily decreased since 2002 (from 427 farms in 1997 to 316 farms in 2017). However, the average farm size had decreased between 1997 and 2007, but had increased between 2007 to 2017 (from 164 acres in 1997 to 188 acres in 2017).

Farmland Preservation

There are a number of Federal and State conservation programs that have been created to help protect farmland and related rural land. These programs include the Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), Wetland Reserve Program (WRP), and Wisconsin Farmland Preservation Program (FPP). One of the key programs for farmland preservation in Ozaukee County is the Wisconsin Farmland Preservation Program, which allows farmers who agree to maintain farmland in agricultural use to receive annual State income tax credits. Additional information about farmland preservation in Ozaukee County can be found in Chapter II of the County Farmland Preservation Plan and in Chapter II of the County Comprehensive Plan. As shown on Map 2.6, only the Town of Belgium participates in the Farmland Preservation Program and has adopted a Farmland Preservation Plan.

2.3 NATURAL RESOURCES

Topography and Geology

The landforms and physical features of Ozaukee County, such as geology, topography and drainage patterns, are an important determinant of growth and development. The physiography (physical geography) of the area not only must be considered in sound land use, transportation, utility, and community facility planning and development, but it also contributes directly to the natural beauty and overall quality of life in the County.

⁶ Data included in this section includes lands owned by the farmer, not lands the farmer may rent.

Glaciation has largely determined the physiography and topography, as well as the soils, within the County. Generalized landforms and topographic characteristics in 100-foot interval contours are shown on Map 2.7. Land surface elevations range from about 580 feet above sea level at the Lake Michigan shoreline to approximately 990 feet in the southwestern portion of the Town of Cedarburg. In general, the topography of the County is relatively level to gently rolling in some areas, with low lying areas associated with streams and wetlands. The nature of the Lake Michigan shoreline in the County is generally characterized by areas of steep slopes, including bluffs and several ravines.

There is evidence of four major stages of glaciation in the Southeastern Wisconsin Region. The last, and most influential in terms of present physiography and topography in Ozaukee County, was the Wisconsin stage, which is believed to have ended in the State about 11,000 years ago. Except for a few isolated spots where dolomite bedrock is exposed at the surface, the entire County is covered with glacial deposits ranging from large boulders to fine grain clays such as silty clay loam till, loam to clay loam, and organic mucky peat. Glacial deposits may be economically significant because some are prime sources of aggregate limestone, which has historically been quarried in the County.

Knowledge of bedrock and the surface deposits overlaying the bedrock is important to land use, transportation, and other utility and community facility planning. Bedrock conditions and the overlaying surface deposits directly affect the construction costs of urban development such as streets, highways, and utilities, particularly those that involve extensive trenching or tunneling, and also affect the location of onsite waste treatment systems. The bedrock formations underlying the planning area consist of the Milwaukee Formation and Niagara Dolomite. The Milwaukee Formation includes shale and shale limestone and dolomite in the bottom third. It is approximately 130 feet thick and is found in a 23,276 acre area, or about 36 square miles, in the eastern portion of the County along Lake Michigan. Niagara Dolomite is approximately 100 feet thick and is found in a 135,520-acre area, or almost 212 square miles in the central and western portions of the County. Map 2.8 depicts the depth to bedrock found in the planning area.

Lake Michigan Bluff and Ravine Areas

Shoreline erosion and bluff stability conditions are important considerations in planning for the protection and sound development and redevelopment of lands located along Lake Michigan. These conditions can change over time because they are related to changes in climate, water level, the geometry of the near shore areas, the extent and condition of shore protection measures, the type and extent of vegetation, and the type of land uses in shoreland areas. In 1997, SEWRPC completed a study of shoreline erosion and bluff stability conditions along Lake Michigan for its entire length in the Southeastern Wisconsin Region. The

findings for Ozaukee County are summarized in Table 2.6 and depicted on Map 2.9. The findings shown in Table 2.6 are from multiple research points along several shoreline “reaches” that begin in Milwaukee County and progress northward along the shoreline to the Ozaukee – Sheboygan County border. The linear expanse of each reach was determined by the presence of similar shoreline characteristics.

Information summarized in Table 2.6 includes bluff height, bluff stability, shoreline recession data, and beach width. The same information is documented in greater detail in the 1995 SEWRPC Lake Michigan shoreline recession and bluff stability report. Bluff stability field research was conducted at 192 sites, including 62 sites in Ozaukee County. A safety factor score was calculated for potential failure surfaces within the bluffs using shear strengths and stresses. The score is defined as the ratio of the forces resisting shear, such as soil cohesion and friction, to the forces promoting shear, such as soil mass, along a failure surface. A score of less than 1.0 is considered unstable, a score of 1.0 to 1.1 is considered marginally stable, and a score of greater than 1.1 is considered stable.

There are approximately 25 linear miles of Lake Michigan shoreline in Ozaukee County. The shoreline contains areas of substantial bluffs with heights of up to 140 feet, ravines, areas of gently rolling beaches with widths of up to 150 feet, and areas of low sand dune ridges and swales. Bluff stability safety factors ranged greatly in the planning area from 0.59 to 1.88. Shoreline recession rates also ranged greatly from an average of 0 feet per year to 4.1 feet per year between 1963 and 1995. Estimated beach width ranged between 0 feet and 150 feet at selected sites along the shoreline.

Ozaukee County’s Coastal Resilience Self-Assessment indicates a high probability of several coastal hazard issues including shoreline recession and bluff failure. Lake Michigan bluff erosion and stability is a complex process resultant of numerous factors including: the dynamics of Lake Michigan (e.g. wave attack, lake levels, and beach width), soil type (e.g. type, composition, stratification, and moisture), land use, land cover, bluff angle, long shore current and sediment budget and surface and subsurface drainage (e.g. groundwater). Lake Michigan bluff erosion and stability is a concern to many landowners, public land managers and elected officials due to land values, property assets, land uses, economics, Lake Michigan access, ecological value and public health and safety. Current collaboration the University of Wisconsin Madison’s Department of Geoscience and the Wisconsin Geologic and Natural History Survey through the project titled “Local Factors Influencing Bluff Failure in Ozaukee County Parks” involves both data collection and analyzation to better understand, and in turn, predict bluff erosion/slumping behavior at County Parks along the Lake Michigan shoreline (e.g. Virmond Park, Lion’s Den Gorge Nature Preserve). Additional work to ensure coastal resiliency along the Lake Michigan shoreline is needed.

Nonmetallic Mineral Resources⁷

Nonmetallic minerals include, but are not limited to, crushed stone (gravel), dimension stone, peat, and clay. Nonmetallic mines (quarries and pits) in Southeastern Wisconsin provide sand, gravel, and crushed limestone or dolomite for structural concrete and road building; peat for gardening and horticulture; and dimension stone for use in buildings, landscaping, and monuments. Nonmetallic mineral resources are important economic resources that should be taken into careful consideration whenever land is being considered for development. Mineral resources, like other natural resources, occur where nature put them, which is not always convenient or desirable. Wise management of nonmetallic mineral resources is important to ensure an adequate supply of aggregate at a reasonable cost for new construction and for maintenance of existing infrastructure in the future.

Potential Sources of Sand, Gravel, Clay and Peat

Map 2.10 shows the location of areas that have the potential for commercially workable sources of sand, gravel, clay, and peat. The information was developed by the Wisconsin Geological and Natural History Survey (WGNHS) in 2006 using a variety of sources, including geologic studies,⁸ data from Road Material Survey records collected by WGNHS for the Wisconsin Department of Transportation, information on existing quarries, and information on closed quarries that were recently active. The sand and gravel potential is shown as high, medium, or low based on the glacial geology (Mickelson and Syverson, 1997). Table 2.7 sets forth the amount of area identified as having the highest potential for significant deposits of gravel and coarse to moderate sand ("outwash deposits" on Map 2.10).

Although Map 2.10 shows potential areas of commercially viable clay and peat deposits, many of the areas so depicted are wetlands or environmentally sensitive areas (such as the Cedarburg Bog) that are unlikely to be disturbed for material extraction.

Potential Sources of Crushed and Building Stone

Map 2.11 shows the location of potential commercially workable sources of stone suitable for crushed or building stone. The information was developed by the WGNHS based on areas underlain by Silurian dolomite within 50 feet of the land surface. Areas in Ozaukee County with bedrock near enough to the surface to economically quarry stone are limited to only about 17,863 acres, or about 11 percent of the

⁷ There are no marketable metallic mining resources in Ozaukee County.

⁸ Bedrock geology from Preliminary Bedrock Maps of Ozaukee County (WOFR 2004-16) by T. Evans, K. Massie-Ferch, and R. Peters, WGNHS.

County. Areas with bedrock near the surface are a northeasterly extension of the ridge of shallow bedrock that is an important stone-producing area around Sussex and Lannon in Waukesha County.

Existing Nonmetallic Mining Sites and Registered Sites

There were three active and one inactive nonmetallic mining operations regulated by Ozaukee County in 2020. In addition, the Town of Saukville regulates a number of nonmetallic mining operations within the Town as well. Each mining operation may include a combination of active mining sites, future mining sites, proposed mining sites, reclaimed mining sites, and unreclaimed mining sites. Section 295.16 (4) of the *Wisconsin Statutes* establishes which activities are exempt from nonmetallic mining reclamation requirements. Additional information about this topic is included in Chapter III of the Ozaukee County Comprehensive Plan.

Surface Water Resources

Surface water resources, consisting of lakes and streams and their associated wetlands, floodplains, and shorelands, constitute an extremely important part of the natural resource base of the County. Surface water resources provide recreational opportunities, influence the physical development of the County, provide for wildlife habitat, and enhance its aesthetic quality. The number of acres of surface waters, wetlands, and floodplains in the County are listed in Table 2.8.

Both surface water and groundwater are interrelated components of a single hydrologic system. The groundwater resources are hydraulically connected to the surface water resources in as much as the former provide the base flow of streams and contribute to inland lake levels. The surface water (Lake Michigan) and ground water resources constitute the major source of supply for domestic, municipal, and industrial water users in Ozaukee County.

Watersheds

Watersheds within the County are shown on Map 2.12. All of the major watersheds, and an area that drains directly into Lake Michigan, are part of the Great Lakes-St. Lawrence River drainage system. The County includes portions of four major watersheds: the Menomonee River; the Milwaukee River; Sauk Creek; and the Sheboygan River. The Lake Michigan direct drainage area (including the Sucker Creek watershed), can be considered a fifth watershed. All of the major watersheds are further subdivided into drainage basins as identified by the Wisconsin Department of Natural Resources. The drainage basins are also shown on Map 2.12.

Lakes and Streams

Lakes and streams are readily susceptible to degradation through improper land use development and management. Water quality can be degraded by excessive pollutant loads, including nutrient loads, which enter from malfunctioning and improperly located onsite waste treatment systems, from sanitary sewer overflows, from construction and other urban runoff, and from improper urban and agricultural practices. The water quality of lakes and streams may also be adversely affected by the excessive development of riparian areas and by the filling of peripheral wetlands, which remove valuable nutrient and sediment traps while adding nutrient and sediment sources. It is important that existing and future development in riparian areas be managed carefully to avoid further water quality degradation and to enhance the recreational and aesthetic values of surface water resources.

Rivers and streams are classified as either perennial or intermittent. Perennial rivers and streams are defined as those that maintain, at a minimum, a small continuous flow throughout the year except under unusual drought conditions. Intermittent streams are defined as watercourses that do not maintain a continuous flow throughout the year. There are approximately 94 miles of both types of rivers and streams in Ozaukee County, as reported by the WDNR in their 1964 surface water inventory for the County.⁹ Major streams in the Menomonee River watershed, which generally includes the area in the southwestern corner of the County, include the Little Menomonee Creek and the Little Menomonee River. Major streams in the Milwaukee River watershed, which generally includes the area in the western half of the County, include the Milwaukee River and Cedar Creek. Sauk Creek is the major stream in the Sauk Creek watershed, which generally includes the area in the north central portion of the County. The major stream in the Ozaukee County portion of the Sheboygan River watershed is Belgium Creek, which is a tributary to the Onion River in Sheboygan County. Belgium Creek is identified as an intermittent stream. The major stream in the Lake Michigan direct drainage area, which includes the area in the eastern portion of the County, is Sucker Creek.

Lakes have been classified by the Regional Planning Commission as being either major or minor. Major lakes have 50 acres or more of surface water area, and minor lakes have less than 50 acres of surface water area. There are two major lakes located entirely within Ozaukee County, Lac du Cours (57 acres) and Mud Lake (148 acres). Both are located in the Milwaukee River watershed. One other major lake, in the Milwaukee River watershed, is Spring Lake (65 acres). This lake is located partially within Ozaukee County and partially

⁹ *Wisconsin Department of Natural Resources (Wisconsin Conservation Department), Surface Water Resources of Ozaukee County, 1964.*

within Sheboygan County. In addition to the major lakes, there are 546 minor lakes and ponds distributed throughout Ozaukee County. The total surface area of all major and minor lakes in the County is 986 acres.

The WDNR has also developed extensive information about the watersheds within the State, including Ozaukee County, which can be found on their website at www.dnr.wi.gov/topic/Watersheds/basins. This website provides more information about the surface water resources and watersheds in Ozaukee County. Information about hydrologic monitoring stations, dams, designated waters, and public access to the rivers, streams, and lakes within Ozaukee County can also be found in Chapter III of the County Comprehensive Plan. Beginning in 2006, the Ozaukee County Planning and Parks Department was awarded Federal, State, local and private funds to develop, refine, and implement the Ozaukee County Fish Passage Program. To date, this program has completed successful projects for stream channel maintenance, restoration, and education. Some achievements of the program include reconstructing over 30 major road and stream crossings, removal of over 138 small stream impediments, reconnecting over 75 stream miles for fish and aquatic life passage, implementing a comprehensive environmental monitoring program (including fisheries, water quality, and sediment contamination surveys), and providing educational and outreach opportunities to many local residents and volunteers. Additional information about stream passage impediments can be found in Chapter III.

Wetlands

Wetlands are generally defined as areas that have a predominance of hydric soils and that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of hydrophytic (water loving) vegetation.¹⁰ Wetlands generally occur in depressions and near the bottom of slopes, particularly along lakeshores and stream banks, and on large land areas that are poorly drained. Wetlands may, however, under certain conditions, occur on slopes and even on hilltops.

¹⁰ The definition of "wetlands" used by SEWRPC is the same as that of the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency (USEPA). Under this definition, wetlands are areas that are inundated or saturated by surface water or groundwater at a frequency, and with a duration sufficient to support, and that under normal circumstance do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. This definition differs somewhat from the definition used by the WDNR. Under the WDNR definition, wetlands are areas where water is at, near, or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which has soils indicative of wet conditions. As a practical matter, application of either the WDNR definition or the USEPA-Army Corps of Engineers-SEWRPC definition has been found to produce relatively consistent wetland identification and delineations in the majority of the situations in Southeastern Wisconsin.

Wetlands are important resources for the ecological health and diversity of the County. They provide essential breeding, nesting, resting, and feeding grounds and provide escape cover for many forms of fish and wildlife. Wetlands also contribute to flood control, because such areas naturally serve to store excess runoff temporarily, thereby tending to reduce peak flows. Wetlands may also serve as groundwater recharge and discharge areas. In addition, wetlands help to protect downstream water resources from siltation and pollution by trapping sediments, nutrients, and other water pollutants. In consideration of the important natural functions of wetland areas and their recreational value for hunting, fishing, and wildlife viewing, continued efforts should be made to protect these areas by discouraging wetland draining, filling, and urbanization, which can be costly in both monetary and environmental terms.

The location and extent of wetlands in the County in 2015, as delineated by the Regional Planning Commission under contract with the WDNR as part of an update of the Wisconsin Wetlands Inventory, are shown on Map 2.13. These wetlands encompassed about 31.3 square miles, or about 13 percent of the County. Also shown on Map 2.13 are “farmed wetlands”, areas that meet the definition of a wetland but were being actively farmed. In 2015, farmed wetlands encompassed about 398 acres in Ozaukee County.

Shorelands and Floodplains

Shorelands are defined by the *Wisconsin Statutes* as lands within the following distances from the ordinary high water mark of navigable waters: 1,000 feet from a lake, pond, or flowage; 300 feet from a river or stream; or to the landward side of the floodplain, whichever distance is greater. In accordance with the requirements set forth in Chapters NR 115 (shoreland regulations) and NR 116 (floodplain regulations) of the *Wisconsin Administrative Code*, the Ozaukee County shoreland and floodplain zoning ordinance restricts uses in wetlands located in the shorelands, and limits the uses allowed in the 100-year recurrence interval floodplain to prevent damage to structures and property and to protect floodwater conveyance areas and the storage capacity of floodplains. The ordinance also limits the removal of vegetation and other activities in shoreland areas and requires most structures to be set back a minimum of 75 feet from navigable waters. State law requires that counties administer shoreland and floodplain regulations in unincorporated areas.

Floodplains are the wide, gently sloping areas contiguous to, and usually lying on both sides of, a stream channel. For planning and regulatory purposes, floodplains are normally defined as the areas, excluding the stream channel, subject to inundation during a 1-percent-annual-probability (100-year recurrence interval) flood event. This is the flood event that may be expected to be reached or exceeded in severity once in every 100-years – or stated another way, there is a 1 percent chance of this event being reached or exceeded in severity in any given year. Floodplain areas are generally not well suited to urban development, not only

because of the flood hazard, but also because of the presence of high water tables and, generally, of soils poorly suited to urban uses such as hydric soils. Floodplain areas often contain important natural resources, such as high-value woodlands, wetlands, and wildlife habitat and, therefore, constitute prime locations for parks and open space areas. Every effort should be made to discourage incompatible urban development on floodplains, while encouraging compatible park and open space uses.

Floodplain mapping for Ozaukee County was updated as part of Wisconsin Department of Natural Resources (WDNR) "Map Modernization Program" initiated in 2004. The updated maps were approved by the WDNR and the Federal Emergency Management Agency (FEMA) in 2014. Floodplains, as identified in the new FEMA mapping, are shown on Map 2.13. Approximately 30 square miles, or about 13 percent of the total area of the County, were located within the 1-percent -annual-probability (100-year recurrence interval) flood hazard area.

Groundwater Resources

Groundwater resources constitute another key element of the natural resource base of the County. Groundwater not only sustains lake levels and wetlands and provides the base flow of streams, but also serves as the water supply for domestic, municipal, and industrial water users in Ozaukee County, with the exception of the City of Port Washington and portions of the City of Mequon and the Village of Thiensville, which obtain their water from Lake Michigan. Map 2.14 depicts the depth to the water table, or groundwater, in Ozaukee County.

Ozaukee County has generally seen an increase in overall water consumption, both surface and groundwater, over the past few decades. Detailed information on water consumption can be found online in the USGS National Water Information System database at waterdata.usgs.gov/wi/nwis/wu.

Like surface water, groundwater is susceptible to depletion in quantity and to deterioration in quality as a result of contamination and over-usage. The vulnerability of groundwater to contamination is a combination of several factors, including soil type, subsurface material characteristics, and depth to groundwater levels. Thus, land use planning must appropriately consider the potential impacts of urban and rural development on this important resource.

The subsurface units within Ozaukee County that supply useable amounts of groundwater to wells are known as aquifers, and they differ widely in their ability to store and transport water. There are three major aquifers within Ozaukee County. From the ground surface downward, they include: 1) the sand and gravel

aquifer, 2) the Niagara dolomite aquifer, and 3) the sandstone aquifer. The first two aquifers are commonly referred to as the “shallow” aquifer, because of their proximity to the land surface and their intimate hydraulic interconnection. The latter, accordingly, is commonly known as the “deep” aquifer. Additional information about these aquifers can be found in Chapter III of the County Comprehensive Plan.

Recharge of the aquifers under Ozaukee County is derived largely by precipitation. Areas of groundwater recharge are shown on Map 2.15. Areas were placed into the following classifications: very high (more than six inches of recharge per year), high (four to six inches of recharge per year), moderate (three to four inches of recharge per year), and low (less than three inches of recharge per year). Protecting recharge areas classified as having a high or very high recharge potential is particularly important for the long-term protection and preservation of groundwater resources in Ozaukee County. Protecting these areas would be largely achieved through implementing the 2035 Multi-jurisdictional Comprehensive Plan for Ozaukee County, as that plan recommends preserving environmental corridors, isolated natural resource areas, significant natural areas, prime agricultural lands, and other agricultural and open areas of the County. In addition, the use of low impact development designs, cluster developments, and other sustainable development designs have the potential to effectively maintain infiltration capabilities in urban areas.

As shown on Map 2.15, about 5 percent of the County is rated “very high” for recharge potential, and about 19 percent is rated “high” for recharge potential. Most of the high and very high recharge potential areas are located along rivers and streams, the Lake Michigan shoreline, and around the Cedarburg Bog. About one-half of the County (about 57 percent) is classified as having “moderate” recharge potential, and about 6 percent is classified as having a “low” potential.

Primary environmental corridors were overlaid on Map 2.15 to indicate the correlation between such areas and groundwater recharge potential. About 19 percent of the areas classified as having very high water recharge potential are located in primary environmental corridors, and about 16 percent of areas classified as having high recharge potential are located in primary environmental corridors.

More detailed information on groundwater conditions in the Southeastern Wisconsin Region, including Ozaukee County, is set forth in SEWRPC Technical Report No. 37, *Groundwater Resources of Southeastern Wisconsin*, June 2002, SEWRPC Technical Report No. 41, *A Regional Aquifer Simulation Model for Southeastern Wisconsin*, June 2005, and SEWRPC Planning Report No. 52 (Volumes 1 and 2), *A Regional Water Supply Plan for Southeastern Wisconsin*, December 2010.

Forest Resources

Woodlands

With sound management, woodlands can serve a variety of beneficial functions. In addition to contributing to clean air and water and regulating surface water runoff, woodlands help maintain a diversity of plant and animal life. Destroying woodlands, particularly on hillsides, can contribute to excessive stormwater runoff, siltation of lakes and streams, and loss of wildlife habitat. Woodlands identified in the SEWRPC 2015 land use inventory are indicated on Table 2.18 and shown on Map 2.24. Woodlands are defined as upland areas of one acre or more in area, having 17 or more trees per acre (each deciduous tree measuring at least four inches in diameter 4.5 feet above the ground), and having canopy coverage of 50 percent or greater. Coniferous tree plantations and reforestation projects are also classified as woodlands. Table 2.11 lists the number of acres of woodlands in the County and each civil division. In 2015, woodlands encompassed about 12.7 square miles, or about 5 percent of the County.¹¹ Review of the Ozaukee County Comprehensive Plan indicates that there were about 11.2 square miles of woodlands in 2000. Therefore, woodlands increased about 1.5 square miles, or about 13 percent, between 2000 and 2015.

Natural Areas and Critical Species Habitat Sites

A comprehensive update to the inventory of natural and geological resources in the County was conducted by the Regional Planning Commission in 2009 as part of an amendment to the regional natural areas and critical species habitat protection and management plan.¹² This update systematically evaluated physical changes to high-quality natural areas, critical species habitat, and sites having geological significance within the Region, including Ozaukee County, and reflects new findings since the preparation of the original natural areas plan.

In addition, information about critical aquatic habitat sites, Wisconsin's Wildlife Action Plan, important bird areas, pre-settlement vegetation, reestablishment of forest interior (also see Map 46 and Table 44 of the Amendment to the Natural Areas and Critical Species Habitat plan), and invasive plant species, can be found in Chapter III of the County Comprehensive Plan.

¹¹ *This data includes upland woods only, not lowland woods classified as wetlands, such as tamarack swamps.*

¹² *SEWRPC Planning Report No. 42, A Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin, September 1997, as amended in 2010.*

Natural Areas

Natural areas are tracts of land or water so little modified by human activity, or sufficiently recovered from the effects of such activity, that they contain intact native plant and animal communities believed to be representative of the landscape before European settlement. Natural areas sites are classified into one of three categories: natural areas of statewide or greater significance (NA-1), natural areas of countywide or regional significance (NA-2), and natural areas of local significance (NA-3). Classification of an area into one of these three categories is based on consideration of the diversity of plant and animal species and community type present; the structure and integrity of the native plant or animal community; the extent of disturbance from human activity, such as logging, agricultural use, and pollution; the commonness of the plant and animal community; unique natural features; the size of the site; and the educational value.

A total of 50 natural areas, encompassing about 7,657 acres, or about 5 percent of the County, were identified in Ozaukee County in 2009. Of the 50 identified sites, six are classified as NA-1 sites and encompass about 2,783 acres, 12 are classified as NA-2 sites and encompass about 1,718 acres, and 32 are classified as NA-3 sites and encompass about 3,156 acres. Map 2.16 depicts the locations of the natural areas identified in 2009. Table 2.9 sets forth a description of each natural area.

Critical Species Habitat

Critical species habitat sites are those areas, outside of natural areas, where the chief value lies in their ability to support rare, threatened, or endangered species. Such areas constitute “critical” habitat that is important to ensure survival of a particular species or group of species of special concern.

A total of 17 sites supporting threatened or rare plant or bird species have been identified in Ozaukee County. These sites, which together encompass an area of about 729 acres, are shown on Map 2.16 and described in Table 2.9.

Since 2009, an additional five critical species habitat sites have been identified in the County, including Baehr Road Wetlands and Meadows, Mequon Beach Habitat Area, and Mequon Wetland Habitat Area, all located in the City of Mequon; Cedarburg Wetlands and Meadows Habitat Area, located in the Towns of Cedarburg and Saukville; and Decker Corner Habitat Area, located in the Town of Cedarburg. The five sites together encompass about 620 acres.

Geological Sites

A total of 16 sites of geological importance, including one glacial feature and 15 bedrock geology sites, were identified in the County in 2009. The geological sites included in the inventory were selected on the basis of scientific importance, significance in industrial history, natural aesthetics, ecological qualities, educational value, and public access potential. The 16 sites selected in Ozaukee County include five sites of statewide significance (GA-1), six sites of countywide or regional significance (GA-2), and five sites of local significance (GA-3). Together, these sites encompass about 274 acres in Ozaukee County. Map 2.17 depicts the locations of the sites of geological importance. Table 2.10 sets forth a description of each site.

Environmental Corridors and Isolated Natural Resource Areas

One of the most important tasks completed under the regional planning program for Southeastern Wisconsin has been the identification and delineation of those areas in the Region containing concentrations of the best remaining elements of the natural resource base. Preserving such areas in essentially natural, open uses is vital to maintaining a high level of environmental quality in the Region, protecting its natural heritage and beauty, and providing recreational opportunities in scenic outdoor settings.

Identification of these areas is based upon the presence of one or more of the following important elements of the natural resource base: 1) rivers, streams, and lakes and associated riparian buffers and floodplains; 2) wetlands; 3) woodlands; 4) prairies; 5) wildlife habitat areas; 6) wet (hydric), poorly drained, and organic soils; and 7) rugged terrain and high relief topography. The presence of elements that are closely related to the natural resource base, including park and open space sites, natural areas, historic sites, and scenic views, are also considered in the delineation of these areas. Many of the natural resource elements that form the basis for delineation have been described in the preceding sections of this chapter.

The delineation on a map of the natural resource and resource-related elements specified above results in an essentially linear pattern of relatively narrow, elongated areas that have been termed "environmental corridors" by the Regional Planning Commission.¹³ Primary environmental corridors are a minimum of 400 acres in size, two miles in length, and 200 feet in width. Secondary environmental corridors connect with the primary environmental corridors and are at least 100 acres in size and one mile in length. Areas at least five acres in size that contain important natural resource base elements, but are separated physically from

¹³ A detailed description of the process of refining the delineation of environmental corridors in Southeastern Wisconsin is presented in SEWRPC Technical Record, Vol. 4, No. 2 (March 1981), pp 1-21.

primary and secondary environmental corridors by intensive urban or agricultural land uses have also been identified and have been termed “isolated natural resource areas”. Environmental corridors and isolated natural resource areas within Ozaukee County in 2015 are shown on Map 2.18. At that time, such areas encompassed about 49.2 square miles, or about 21 percent of the County.

In any consideration of environmental corridors and isolated natural resource areas, it is important to note that preserving such resources serves many beneficial purposes, in addition to protecting the important natural resources that make up the corridors. Corridor lands provide areas for the storage of flood waters away from homes and other developed areas; help to protect water quality by filtering sediment and fertilizer from runoff before it enters surface waters; provide wildlife habitat and corridors for the movement of animals; and contribute to the scenic beauty of the County and the Region. Excluding urban development from environmental corridors helps to prevent problems such as water pollution, wet and flooded basements, and building and pavement failures.

In addition, because of the many interacting relationships between living organisms and their environment, the destruction and deterioration of any one element of the natural resource base may lead to a chain reaction of deterioration and destruction. The draining and filling of wetlands, for example, may destroy fish spawning grounds, wildlife habitat, groundwater recharge or discharge areas, and the natural filtration action and floodwater storage functions that contribute to maintaining high levels of water quality and stable streamflows and lake stages in a watershed. The resulting deterioration of surface water quality, may in turn lead to the deterioration of the quality of the groundwater that serves as a source of domestic, municipal, and industrial water supply and on which low flows in rivers and streams may depend. Similarly, the destruction of woodland cover may result in soil erosion and stream siltation, more rapid stormwater runoff and resultant increased flood flows and stages, as well as destruction of wildlife habitat. Although the effects of any one of these environmental changes may not in and of itself be overwhelming, the combined effects will eventually create serious environmental and developmental problems. The need to maintain the integrity of the remaining environmental corridors and isolated natural resource areas thus becomes apparent.

Primary Environmental Corridors

As shown on Map 2.18, the primary environmental corridors in Ozaukee County are located along the major rivers and their tributaries, along Lake Michigan, around the major lakes in the County, and in large wetland areas. In 2015, about 34.0 square miles, comprising about 14 percent of the total area of the County, were encompassed within the primary environmental corridors.

The primary environmental corridors contain almost all of the best remaining woodlands, wetlands, and wildlife habitat areas in the County and are, in effect, a composite of the best remaining elements of the natural resource base. Such areas have immeasurable environmental and recreational value. Protecting the primary environmental corridors from additional intrusion by incompatible land uses, and thereby from degradation and destruction, is one of the principal objectives of this plan.

Secondary Environmental Corridors and Isolated Natural Resource Areas

As shown on Map 2.18, secondary environmental corridors in Ozaukee County are located chiefly along the small perennial and intermittent streams within the County. About 8.5 square miles, comprising about 4 percent of the County, were encompassed within secondary environmental corridors in 2015. Secondary environmental corridors contain a variety of resource elements and are often remnant resources from primary environmental corridors that have been developed with intensive agricultural or urban uses. Secondary environmental corridors facilitate surface water drainage and provide corridors for the movement of wildlife and for the dispersal of seeds for a variety of plant species. Such corridors should be considered for preservation in natural, open use or incorporated as drainage ways, stormwater detention or retention areas, or as local parks or recreation trails, in developing areas.

As also shown on Map 2.18, isolated natural resource areas within Ozaukee County include a geographically well-distributed variety of isolated wetlands, woodlands, and wildlife habitat; in 2015, these areas encompassed about 6.7 square miles, or about 3 percent of the County. Isolated natural resource areas may provide the only available wildlife habitat in an area, provide good locations for local parks and nature areas, and lend aesthetic character and natural diversity to an area. Such areas should be preserved in natural open uses insofar as practicable, being incorporated for use as parks and open space reservations or stormwater detention or retention areas where appropriate.

Park and Open Space Sites

A comprehensive areawide inventory of park and open space sites was conducted in 1973 under the initial regional park and open space planning program.¹⁴ The inventory is updated periodically, including again in 2018 for use in preparing the 4th edition of the County park and open space plan, which is currently under preparation.

¹⁴The regional park and open space plan is documented in SEWRPC Planning Report No. 27, A Regional Park and Open Space Plan for Southeastern Wisconsin: 2000, November 1977.

The 2018 inventory identified all park and open space sites owned by a public agency, including Federal, State, County, or local units of government and school districts. Also identified in the inventory were lands held in conservation easements by organizations such as the Wisconsin Department of Natural Resources (WDNR) and the Ozaukee Washington Land Trust (OWLT). The inventory also included privately owned resource-oriented outdoor recreation sites such as golf courses, campgrounds, ski hills, boating access sites, swimming beaches, hunting clubs, and group camps such as Scout or YMCA camps, and special use outdoor recreation sites. Sites owned by nonprofit conservation organizations, such as OWLT, were also identified. The inventory of private outdoor recreation sites focused on resource-oriented sites because the County park and open space plan is most directly concerned with providing sites and facilities for resource-oriented activities such as golf courses, picnic areas, swimming beaches, trails, and boat launches. The inventory also identified other recreation resources such as existing trails and bicycle ways and historic sites listed on the National Register of Historic Places.

As of 2018, there were 13,082 acres of park and open space land in fee simple ownership in Ozaukee County. An additional 2,319 acres were under conservation or other easements intended to protect the natural resources of a site.

Information about lake and river access sites, and trails and bicycle ways can be found in Chapter III of the County park and open space plan.

Park and Open Space Sites Owned by Ozaukee County

Park and open space sites owned by Ozaukee County in 2018 are shown on Map 2.19 and listed in Table 2.11. In 2018, Ozaukee County owned 10 such sites encompassing 873 acres, or less than 1 percent of the total area of the County. The largest parks include the 293-acre Hawthorne Hills County Park, the 243-acre Mee-Kwon County Park, and the 125-acre Tendick Nature Park.

In addition to the County park system, Ozaukee County also owns five other park and outdoor recreation sites encompassing 405 acres. These sites include: the Ozaukee County Fairgrounds in the City of Cedarburg, the Guenther Farmstead Property in the Town of Saukville, the Ozaukee County Trail Property in the Town of Port Washington, the Bee Keeper Bog Property in the Town of Fredonia, and the Shady Lane Property in the Town of Fredonia.

Park and Open Space Sites Owned by the State of Wisconsin

As indicated in Table 2.12 and shown on Map 2.19, in 2018 there were nine State-owned park and open space sites in Ozaukee County, encompassing 3,285 acres, or about 2 percent of the total area of the County. Of the nine sites, eight sites encompassing 2,985 acres were owned by the WDNR; and one site, encompassing 300 acres, was owned by the University of Wisconsin-Milwaukee (UWM).

Wisconsin Department of Natural Resources

The WDNR has acquired large areas of park and open space lands in Ozaukee County for a variety of resource protection and recreational purposes. Sites acquired for natural resource preservation and limited recreational purposes include the Cedarburg Habitat Preservation, Cedarburg Bog State Natural Area, and a number of scattered sites, including four sites within the North Branch Milwaukee River Wildlife and Farming Heritage Project Area.

One Department-owned site, Harrington Beach State Park, is associated with more intensive recreational activities. The site provides camping, swimming, picnicking, trail facilities (hiking, biking, horseback riding, and cross-country skiing), and a wildlife refuge.

Map 2.19 also reflects project boundaries approved by the Wisconsin Natural Resources Board for State forests, parks, and wildlife areas within the County. Lands within the approved project boundaries have been identified by the Board as appropriate additions to adjacent parks, forests, natural areas, or wildlife areas and are intended to be acquired by the Department of Natural Resources, on a "willing seller-willing buyer" basis, for recreational or open space purposes as funding permits.

University of Wisconsin

In 2018, there was one open space site affiliated with UWM. The UWM Cedarburg Bog Field Station encompasses about 300 acres and is located in the Town of Saukville.

Federally-Owned Park and Open Space Sites

Map 2.19 and Table 2.12 also identify six open space sites in Ozaukee County owned by the U.S. Fish and Wildlife Service, encompassing 715 acres, or less than 1 percent of the total area of the County. Five of the open space sites were purchased for the primary purpose of preserving and improving breeding habitat for waterfowl in Wisconsin.

Park and Open Space Sites Owned by Local Governments, School Districts, or Other Public Districts

In addition to the County-, State-, and Federally-owned park and open space sites in Ozaukee County, in 2018 there was a total of 180 sites owned by local units of government, school districts, or other public districts. Those sites, listed on Table 2.13 and shown on Map 2.20, encompass 3,117 acres, or about 2 percent of the total area of the County. Local governments own 140 park and open space sites, public school districts own 22 sites, and other public districts own 18 sites. The acreage attributed to school district sites includes only those portions of the site used for recreational or open space purposes.

The 18 sites included on Table 2.13 and shown on Map 2.20 as owned by other public districts are sites owned by the Milwaukee Metropolitan Sewerage District (MMSD). These sites were purchased by the MMSD under its "Greenseams" program. The program is intended to permanently protect key lands within the MMSD planning area for long term benefits for floodplain management. Where applicable, the properties can be used for hiking, bird watching, and other passive recreation, but would remain largely undeveloped and be restored to natural conditions. In 2018, the 18 sites owned by the MMSD in Ozaukee County encompassed 611 acres.

Private and Public-Interest Resource Oriented Park and Open Space Sites

Private Outdoor Recreation and Open Space Sites

The 2018 inventory of park and open space sites also identified a total of 81 privately owned resource-oriented recreation sites as listed on Table 2.14 and shown on Map 2.21. Together they encompassed 3,469 acres, or about 2 percent of the total area of the County.

Examples of privately-owned recreation sites include hunting clubs, stables, golf courses, boat access sites, campgrounds, an ice-skating facility, swimming beaches, subdivision parks, a game farm, and recreation areas associated with private schools.

Private Resource Protection Sites

In addition, the 2018 inventory of park and open space sites identified a total of 21 sites owned by private organizations for natural resource protection purposes. Those sites are listed on Table 2.15 and shown on Map 2.22. The 21 open space area sites owned for resource preservation purposes encompass 1,218 acres, or about 1 percent of the total area of the County. Those sites include 18 Ozaukee Washington Land Trust sites, two sites owned by the Nature Conservancy, and one site owned by the Riveredge Nature Center.

Conservation Easements

Many privately-owned open space and environmentally sensitive sites in Ozaukee County are protected under conservation easements. These easements are typically voluntary contracts between a private landowner and a land trust or government body that limit, or in some cases prohibit, future development of the parcel. The property owner sells or donates a conservation easement for the property to a land trust or government agency, but retains ownership. The owner is not prohibited from selling the property, but future owners must abide by the terms of the conservation easement. Conservation easements typically do not include any provision for public access. Those easements, listed on Table 2.16 and shown on Map 2.23, encompassed 2,319 acres in Ozaukee County in 2018. All of the conservation easements identified on the table and map provide for the permanent protection of resources on private land.

2.4 CULTURAL RESOURCES

Cultural resources are evidence of past human activities and they are unique and nonrenewable. Cultural resources encompass historic buildings, structures and sites; and archeological sites. Cultural resources in Ozaukee County have important recreational and educational value. Cultural resources help to provide the County and each of its distinct communities with a sense of heritage, identity, and civic pride. Resources such as historical and archeological sites and historic districts can also provide economic opportunities through tourism.

The NRCS is specifically required by the National Historical Preservation Act, the National Environmental Policy Act, and various other State and Federal laws to consider the impacts its conservation programs may have on cultural resources. To insure protection, the NRCS may require a cultural resource inventory as part of the conservation planning process. A qualified professional cultural resource consultant will prepare an inventory and report, which is submitted to the Wisconsin State Historic Preservation Office (SHPO). The SHPO determines the eligibility of historical or archaeological site(s). The U.S. Army Corps of Engineers is also required by Federal law to protect cultural resources and cannot permit a wetland disturbance without a cultural resource assessment. New development, therefore, requires a detailed description of all structures or areas of archeological or historic interest on the proposed site, and a detailed explanation of how the development will affect such structures or areas. To protect and preserve cultural resources, recommendations are made during the preliminary planning process to move roads, redesign structures, or change practices to avoid adverse effects to cultural resources.

Historical Resources

In 2020, there were 36 historic sites and six historic districts in the County listed on the National Register of Historic Places. Sites and districts listed on the National Register of Historic Places have an increased measure of protection against degradation and destruction. Listing on the National or State Register requires government agencies to consider the impact of their activities, such as the construction or reconstruction of a highway, or a permit which they issue, on the designated property. If the property would be adversely affected, the agency must work with the State Historic Preservation Officer to attempt to avoid or reduce adverse effects.

The 42 historic sites and districts listed on the National Registers of Historic Places are only a small fraction of the buildings, structures, and districts listed in the Wisconsin Architecture and History Inventory. The Wisconsin Architecture and History Inventory is a database administered by the State Historical Society of Wisconsin that contains historical and architectural information on approximately 150,000 properties statewide. The listed sites have architectural or historical characteristics that may make them eligible for listing on the National and State registers of historic places. In 2020 there were more than 2,000 properties in Ozaukee County included in the Wisconsin Architecture and History Inventory. The inventory can be accessed through the State of Wisconsin Historical Society website at www.wisconsinhistory.org/ahi.

Additional information about historical resources, including information about local landmarks, certified local governments, State historical markers, etc., can be found in Chapter III of the Ozaukee County comprehensive plan. A map and table listing the historic sites and districts as of 2018 can be found in the 4th edition of the Ozaukee County park and open space plan which is currently under preparation.

Archaeological Resources

Preserving archaeological resources is also important to preserving the cultural heritage of Ozaukee County. Like historical sites and districts, significant prehistoric and historic archaeological sites provide the County and each of its communities with a sense of heritage and identity, which can provide for economic opportunities through tourism if properly identified and preserved. Archaeological sites found in Ozaukee County fall under two categories: prehistoric sites and historic sites. Prehistoric sites are defined as those sites that date from before written history. Historic sites are sites established after history began to be recorded in written form (the State Historical Society of Wisconsin defines this date as A.D. 1650).

As of 2005, there were 393 known prehistoric and historic archaeological sites in Ozaukee County listed in the State Historical Society's Archaeological Sites Inventory, including prehistoric and historic camp sites,

villages, and farmsteads; marked and unmarked burial sites; and Native American mounds. No archaeological sites in the County are listed on the National or State Registers of Historic Places. Additional information about burial sites and Native American sites and trails can be found in Chapter III of the Ozaukee County Comprehensive Plan.

2.5 DEMOGRAPHICS AND LAND USE

Demographics

Population growth in Ozaukee County from 1860 to 2010 is indicated in Table 2.17 and Figure 2.1. The County population was relatively stable until 1940, when the resident population stood at 19,000 people. Since then, the County population has grown steadily—averaging an increase of 9,600 people every decade for the past seven decades. The Wisconsin Department of Administration estimated population of the County stood at 89,905 in 2019.

As indicated in Table 2.17, in percentage terms, the population of Ozaukee County has increased more rapidly than the Southeastern Wisconsin Region and the State in each decade going back to the 1930s. Between 1970 and 2010, the population of Ozaukee County increased by 59 percent, compared to increases of 15 percent and 29 percent for the Region and State, respectively. The City of Mequon is the most populous community in the County, with 23,132 residents, or about 27 percent of the County's population, in 2010. The next most populous communities are the Village of Grafton (11,459 persons), the City of Cedarburg (11,412 persons), and the City of Port Washington (11,250 persons), each accounting for about 13 percent of the County's population.

A summary of significant demographic information in Ozaukee County is presented below.

- In 2010, about 24 percent of the County population was under the age of 18; about 61 percent was between the ages of 20 and 64; and about 15 percent was age 65 and over. This age distribution is similar to that of the Region as a whole.
- In 2010, there were 34,228 households in Ozaukee County with an average household size of 2.47 persons per household. As with population, in percentage terms, the number of households in Ozaukee County has increased more rapidly than that within the Southeastern Wisconsin Region. The number of households, or occupied housing units, is important to land use and public facility

planning. Households directly influence the demand for urban land as well as the demand for transportation and other public facilities and services, such as public sewer, water, and parks.

- The 2010 median family income was \$89,200 for Ozaukee County. Median family income has a significant effect on the type, size, and location of housing.
- In 2018, about 15.6 percent of all County residents 16 years of age and older were employed. The majority of County workers were employed in management or professional occupations (about 20.7 percent), sales and office occupations (about 19.3 percent), and production, transportation, and material moving occupations (about 12.2 percent).
- In 2018, just over 77 percent of County residents 25 years of age and older had attended some college or attained an associates, bachelor, or graduate degree.
- Over 50 percent of employed Ozaukee County residents worked in Ozaukee County in 2018. About 6,000 more people commuted out of the County for work than commuted into the County. Of County residents who commuted out of the County for work, the largest percentage went to work in Milwaukee County.

Land Use

Soil erosion problems, water pollution problems, land use conflicts, including recreational use and the risk of damage to the environment, as well as the ultimate means for abatement of these problems, are primarily a function of human activities within the County, and of the ability of the underlying natural resource base to sustain those activities. This becomes especially significant in areas that are in close proximity to lakes, wetlands, and rivers and streams. Accordingly, the land uses and attendant population levels in the County are important considerations in the development of Ozaukee County's land and water resource management plan. The land use information presented here is derived from inventories developed by SEWRPC; the most recent inventory was completed in 2015.

Urban Land Uses

Urban land uses consist of residential; commercial; industrial; governmental and institutional; recreational; and transportation, communication, and utility uses. As indicated in Table 2.18 and on Map 2.24, urban land uses encompassed about 58.6 square miles, or about 25 percent of the County, in 2015. Single-family residential land comprised the largest urban land use category in the County, encompassing 30.4 square

miles, or about 52 percent of all urban land and about 13 percent of the County. Commercial land encompassed about 2.0 square miles or about 3 percent of all urban land and about one percent of the County. Industrial and government and institutional both encompassed similar amounts of land as commercial uses. Intensively used recreational land encompassed about 4.2 square miles, or about seven percent of all urban land and about two percent of the County. Land used for transportation, utilities, and communications facilities encompassed about 15.9 square miles, or about 27 percent of all urban land and about seven percent of the County.

Nonurban Land Uses

Nonurban (or rural) land uses consist of agricultural lands; surface waters; wetlands; woodlands; landfills and other extractive type uses; and other open lands. As indicated in Table 2.18 and on Map 2.24, nonurban land uses encompassed about 176.8 square miles, or about 75 percent of the County in 2015. Agricultural land was the predominant land use in the County in 2015. It encompassed 101.7 square miles, or about 58 percent of nonurban land uses and 43 percent of the County. Much of the existing agricultural land is located outside the urban service areas, and is primarily located in the Towns of Belgium, Fredonia, Port Washington, and Saukville. Agricultural lands include all croplands, pasture lands, orchards, nurseries, and nonresidential farm buildings.

Natural resource areas, consisting of surface water, wetlands, and woodlands, combined to encompass 47.5 square miles, or about 27 percent of nonurban land uses and about 20 percent of the County in 2015. Natural resource areas are located throughout the County, in both rural areas and within established urban service areas. Landfill and extractive lands encompassed about 1.0 square mile, or less than one percent of nonurban land uses and less than one percent of the County in 2015.

Other open lands encompassed about 26.6 square miles, or about 15 percent of nonurban land uses and about 11 percent of the County, in 2015. Open lands include lands in rural areas that are not being farmed, and other lands that have not been developed. Examples of lands in the latter category include undeveloped portions of park sites, excess transportation rights-of-way, lots that have been platted but not yet developed, subdivision outlots, and undeveloped portions of commercial and industrial lots.

SEWRPC Community Assistance Planning Report No. 338

A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR OZAUKEE COUNTY: 2021-2030

Chapter 2

RESOURCE ASSESSMENT

TABLES

Table 2.1
Agricultural Soil Capability in Ozaukee County Communities

Local Government	Class I Soils (acres)	Class II Soils (acres)	Class III Soils (acres)	Class IV, V, VI, VII, and VIII Soils and Unclassified Areas^a (acres)	Total (acres)^b
City of Mequon	58	23,538	4,004	2,435	30,035
Town of Belgium	--	17,264	3,348	2,148	22,760
Town of Cedarburg	482	10,205	3,656	1,599	15,942
Town of Fredonia	389	12,078	6,416	3,148	22,031
Town of Grafton	11	7,023	2,832	1,571	11,437
Town of Port Washington	2	8,463	1,505	1,485	11,455
Town of Saukville	174	8,936	8,050	3,885	21,045
Other Cities and Villages	102	9,082	3,385	3,320	15,889
Ozaukee County	1,218	96,589	33,196	19,591	150,594
Percent of County Total	0.8	64.1	22.1	13.0	100.0

^a Unclassified areas also include surface water areas.

^b Total acreage by community is based on 2010 civil division boundaries.

Source: USDA-Natural Resources Conservation Service and SEWRPC

Table 2.2
Existing Agricultural Lands in Ozaukee County: 2015

Local Government	Cultivated Lands (acres)	Pasture Land and Unused Agricultural Land (acres)	Orchards and Nurseries (acres)	Farm Buildings (acres)	Total (acres)
City of Mequon	5,836	1,009	801	208	7,854
Town of Belgium	15,188	873	134	307	16,502
Town of Cedarburg	54,358	490	255	205	5,308
Town of Fredonia	11,887	948	39	291	13,165
Town of Grafton	2,509	440	40	127	3,116
Town of Port Washington	7,397	179	88	165	7,829
Town of Saukville	7,741	697	117	275	8,830
Other Cities and Villages	2,384	74	0	24	2,482
Ozaukee County	57,300	4,710	1,474	1,602	65,086
Percent of County Total	88.0	7.2	2.3	2.5	100.0

Source: SEWRPC

Table 2.3
Agricultural Sectors in Ozaukee County and Wisconsin: 2017

Sector	Ozaukee County		Wisconsin	
	2017 Sales (in thousands)	Percent of Total Agricultural Revenues	2017 Sales (in thousands)	Percent of Total Agricultural Revenues
Milk from Cows (dairy)	34,540	45.9	5,150,658	45.1
Cattle and Calves (beef cattle)	20,546	27.3	1,496,148	13.1
Grains				
Corn	4,741	6.3	1,757,433	15.4
Wheat	568	0.8	51,257	0.4
Soybeans	4,887	6.5	938,273	8.2
Barley	-- ^a	-- ^a	2,830	-- ^a
Other Grains ^b	76	0.1	22,971	0.2
Subtotal	10,272	13.7	2,772,764	24.2
Vegetables ^c	1,116	1.5	542,954	4.8
Horticulture ^d	3,562	4.7	264,098	2.3
Other ^e	5,219	6.9	1,200,801	10.5
Total	75,225	100.0	11,427,423	100.0

^a Less than \$1,000 and/or 0.05 percent.

^b Includes sorghum, rice, other grains, oil seeds, dry beans, and dry peas.

^c Includes melons, potatoes, and sweet potatoes.

^d Includes nurseries, greenhouses, floricultures, and sod.

^e Includes tobacco, cotton and cottonseed, fruits, other crops, poultry, eggs, pigs, sheep, goats, horses, aquaculture, and other animals.

Source: USDA National Agriculture Statistics Service, 2017 Census of Agriculture

Table 2.4
Farms in Ozaukee County and Wisconsin by Value of Sales: 2017

Value of Sales	Ozaukee County		Wisconsin	
	Number of Farms	Percent	Number of Farms	Percent
Less than \$2,500	92	29.1	20,714	32.0
\$2,500 to \$4,999	20	6.3	4,837	7.5
\$5,000 to \$9,999	18	5.7	5,653	8.7
\$10,000 to \$24,999	39	12.4	7,186	11.1
\$25,000 to \$49,999	22	7.0	4,951	7.6
\$50,000 to \$99,999	26	8.2	5,572	8.6
\$100,000 or more	99	31.3	15,880	24.5
Total	316	100.0	64,793	100.0

Source: USDA National Agriculture Statistics Service, 2017 Census of Agriculture

Table 2.5
Farm Size in Ozaukee County and Wisconsin: 2017

Size	Ozaukee County		Wisconsin	
	Number of Farms	Percent	Number of Farms	Percent
Fewer than 10 acres	51	16.1	5,923	9.1
10 to 49 acres	95	30.1	16,919	26.1
50 to 179 acres	69	21.8	21,254	32.8
180 to 499 acres	63	19.9	14,177	21.9
500 to 999 acres	29	9.2	4,180	6.5
1,000 acres or more	9	2.9	2,340	3.6
Total	316	100.0	64,793	100.0
Average Size	188	--	221	--

Source: USDA National Agriculture Statistics Service, 2017 Census of Agriculture

Table 2.6
Bluff Stability and Shoreline Recession Along Lake Michigan Shoreline of Ozaukee County: 1995

Shoreline Analysis Reach (see Map 2.9)	Bluff Heights (feet)	Deterministic Bluff Stability Safety Factor		Shoreline Recession Data 1963 – 1995		Estimated Beach Width (feet)	
		1995 Conditions	1977 Conditions	Total (feet)	Annual Average (feet per year)	1995 Conditions	1977 Conditions
Reach 11 ^a	80 - 140	0.69 – 1.12	0.69 – 1.13	20 - 100	0.3 – 2.5	0 - 100	10 – 25
Reach 12	80 - 140	0.57 – 1.88	0.66 – 1.05	0 - 70	0.0 – 2.2	0 - 100	0 – 25
Reach 13	100 – 130	0.59 – 1.81	0.49 – 0.82	0 - 60	0.0 – 1.9	0 - 50	10 – 30
Reach 14	No significant bluff	N/A	N/A	50	1.6	No significant beach	No significant beach
Reach 15	85 – 100	0.72 – 1.47	0.61 – 1.21	0 - 50	0 - 1.6	10 – 100	5 – 70
Reach 16	No significant bluff	N/A	N/A	0 - 80	0.0 – 2.5	0 - 150	5 – 20
Reach 17	No significant bluff	N/A	N/A	0 - 130	0.0 – 4.1	30 - 100	Less than 20

^a Includes a portion of Milwaukee County.

Source: SEWRPC

Table 2.7
Areas with the Highest Potential for Significant
Deposits of Sand and Gravel (Outwash Deposits)

Local Government	Acres	Percent^a
City of Mequon	7,825	26.0
City of Port Washington	403	10.8
Village of Belgium	-	0.0
Village of Fredonia	421	31.5
Village of Grafton	544	16.7
Village of Newburg	34	64.5
Village of Saukville	578	25.3
Village of Thiensville	196	28.3
Town of Belgium	-	0.0
Town of Cedarburg	2,767	17.4
Town of Fredonia	5,399	24.5
Town of Grafton	1,900	16.6
Town of Port Washington	326	2.9
Town of Saukville	5,440	25.8
Total ^b	25,833	17.1

^a Percent of the land area of each local government.

^b Includes data for the City of Cedarburg.

Source: Wisconsin Geologic and Natural History Survey and SEWRPC

Table 2.8
Surface Waters, Floodplains, and Wetlands in Ozaukee County: 2015

Local Government^a	Surface Water^b (acres)	Floodplains (acres)	Nonfarmed Wetlands (acres)	Farmed Wetlands (acres)
City of Mequon	767	3,894	2,900	37
Town of Belgium	102	2,559	1,969	64
Town of Cedarburg	273	2,194	2,673	35
Town of Fredonia	308	2,413	3,513	128
Town of Grafton	294	1,727	1,615	5
Town of Port Washington	32	935	857	43
Town of Saukville	567	4,052	5,154	53
Other Cities and Villages	284	1,433	974	33
Ozaukee County	2,627	19,207	19,655	398

^a Acres by community are based on 2015 civil division boundaries.

^b One-Percent Annual Probability (100-Year Recurrence Interval) Floodplains pursuant to the FEMA FIS, December 2007.

Source: Federal Emergency Management Agency, Wisconsin Department of Natural Resources, and SEWRPC

Table 2.9
Natural Areas and Critical Species Habitat Sites in Ozaukee County

Number on Map 2.16	Site Identification		Ownership	Size (Acres)
	Name	Civil Division(s)		
Site Classification ^a : NA-1				
1	Fairy Chasm State Natural Area ^b	City of Mequon	Ozaukee Washington Land Trust and other private	47 ^c
2	Kurtz Woods State Natural Area ^b	Village of Bayside	Ozaukee Washington Land Trust and other private	70
3	Riveredge Creek and Ephemeral Pond State Natural Area ^b	Town of Grafton	Ozaukee Washington Land Trust and other private; protected with conservation easement	100
4	Riveredge Nature Center and other private; protected with conservation easement	Town of Saukville	Riveredge Nature Center and other private; protected with conservation easement	100
5	Cedarburg Bog State Natural Area ^b	Town of Saukville	Department of Natural Resources, University of Wisconsin-Milwaukee, and private	2,063
6	Sapa Spruce Bog State Natural Area and Black Spruce Bog ^b	Town of Saukville	University of Wisconsin and private; protected with conservation easement	63
6	Huiras Lake Woods and Bog	Town of Fredonia	Department of Natural Resources, Milwaukee Jewish Welfare Fund, and other private; protected with conservation easement by Ozaukee Washington Land Trust	440
Subtotal – 6 Sites				2,783
Site Classification ^a : NA-2				
7	Pigeon Creek Low and Mesic Woods	City of Mequon	Private	82
8	Donges Bay Gorge	City of Mequon	Ozaukee Washington Land Trust	22
9	Abbott Woods and Ravine	Town of Grafton	Private; protected with conservation easement	31
10	Milwaukee River Mesic Woods	Town of Saukville	Ozaukee County and private	382
11	Ducks Limited Bog	Town of Fredonia	Ozaukee County and private	382
12	Riveredge Mesic Woods	Town of Saukville	Ducks Limited and other private	21
13	Riveredge Nature Center and other private; protected with conservation easement	Town of Saukville	Riveredge Nature Center and other private; protected with conservation easement	212
14	Kinnamon Conifer Swamp	Town of Saukville	Private	391
14	Max's Bog	Town of Saukville	Private and State of Wisconsin Public Trust Lands	30
15	South Conifer Swamp	Town of Saukville	Private and State of Wisconsin Public Trust Lands	53
16	Cedarburg Beech Woods State Natural Area ^b	Town of Saukville	University of Wisconsin-Milwaukee and private	134
17	Janik's Woods	Town of Saukville	University of Wisconsin-Milwaukee and private	134
17	Harrington Beach Lacustrine Forest	Town of Fredonia	Private	163
18		Town of Belgium	Department of Natural Resources	197
Subtotal – 12 Sites				1,718
Site Classification ^a : NA-3				
19	Highland Road Woods	City of Mequon	Private	53
20	Pigeon Creek; Maple Woods	City of Mequon	Private	13
21	Solar Heights; Low Woods	City of Mequon	City of Mequon and private	116
22	Triple Woods	City of Mequon	City of Mequon and private	53
23	Ville du Parc; Riverine Forest	City of Mequon	City of Mequon and private	111
24	Mequon Wetland	City of Mequon	City of Mequon and private	111
25	Mole Creek Swamp/ Pleasant Valley Park Woods	City of Mequon	Private	76
		Town of Cedarburg	Town and City of Cedarburg; WE Energies; and private	150

Table continued on next page.

Table 2.9 (Continued)

Number on Map 2.16	Site Identification		Ownership	Size (Acres)
	Name	Civil Division(s)		
Site Classification ^a : NA-3 (continued)				
26	Cedar-Sauk Low Woods	Town of Cedarburg Town of Saukville Town of Trenton (Washington County)	Department of Natural Resources and private	210 ^d
27	Grafton Woods; (Bratt Woods)	Town of Grafton	Ozaukee Washington Land Trust; protected with conservation easement	18
28	Sherman Road Woods	Town of Cedarburg	Private	71
29	Five Corners Swamp	Town of Cedarburg	Department of Natural Resources and private	175
30	Cedar Creek Forest	Town of Cedarburg	Private	23
31	Cedar Heights Gorge	Town of Grafton	Private	9
32	Ulao Lowland Forest	Town of Grafton	Private	342
33	U.S. Fish and Wildlife Service Area	Town of Grafton	U.S. Fish and Wildlife Service	67
34	Lion's Den Gorge	Town of Grafton	Ozaukee County, Ozaukee Washington Land Trust, and private; includes conservation easement	21
35	Hansen's Lake Wetland	Town of Saukville	Ozaukee Washington Land Trust	16
36	Knollwood Road Bog	Town of Saukville	Private and State of Wisconsin Public Trust Lands; protected with conservation easement	9
37	Hawthorne Drive Forest	Town of Port Washington	Private	55
38	Spring Lake; Beech Forest	Town of Fredonia	Private	62
39	Spring Lake Marsh	Town of Fredonia	Private and State of Wisconsin Public Trust Lands	21
40	County Line Low Woods	Town of Fredonia Town of Sherman (Sheboygan County)	Private; protected with conservation easement	225 ^e
41	Beekeeper Bog	Town of Fredonia	Ozaukee County and private; protected with conservation easement	21
42	Department of Natural Resources Lowlands	Town of Fredonia	Department of Natural Resources and private	187
43	Pioneer Road Lowlands	Town of Fredonia	Private; protected with conservation easement	93
44	Cedar Valley Swamp	Town of Fredonia	Private	140
45	Evergreen Road Bog	Town of Fredonia	Private and State of Wisconsin Public Trust Lands	44
46	Kohler Road Woods	Town of Fredonia	Private	128
47	Waubeka Low Woods	Town of Fredonia	Ozaukee County and private; protected with conservation easement	162
48	Cedar Grove Swamp	Town of Belgium	Private and U.S. Fish and Wildlife Service	185
49	Belgium Swamp – North	Town of Belgium	Private	152
50	Belgium Swamp – South	Town of Belgium	Private	148
Subtotal – 32 Sites				3,156
Total for 50 Natural Area Sites				7,657
Site Classification ^a : CSH				
51	Mee-kwon Park Woods	City of Mequon	Ozaukee County and private	40
52	Highland Woods	City of Mequon	City of Mequon; conservation easement with Ozaukee Washington Land Trust	48
53	Garvey Woods	City of Mequon	Private	10
54	Gengler's Woods	City of Mequon	Ozaukee Washington Land Trust	4
55	Stauss Woods	City of Mequon	Ozaukee Washington Land Trust	8

Table continued on next page.

Table 2.9 (Continued)

Number on Map 2.16	Site Identification		Ownership	Size (Acres)
	Name	Civil Division(s)		
Site Classification ^a : CSH (continued)				
56	Union Pacific Right-of Way	City of Mequon	Private	1
57	Eastbrook Road Woods	City of Mequon	Private	9
58	Pecard Sedge Meadow	City of Mequon	Private	16
59	Bike Path Island	Town of Grafton	Bureau of Land Management	1
60	Woodland Meadows Woods	Town of Cedarburg	Private	40
61	Cedarburg Woods – West	Town of Cedarburg	Private	4
62	Port Washington Clay Banks	Town of Grafton	Private	35
63	Cedar-Sauk Upland Woods	Town of Saukville	Private	44
64	Port Washington Beach and Dunes	Town of Port Washington	Private	29
65	Sauk Creek Nature Preserve	Town of Port Washington	Ozaukee Washington Land Trust	13
66	Heinen Woods	Town of Fredonia	Private	32
67	Harrington Beach Old Fields	Town of Belgium	Department of Natural Resources	395
			Critical Species Habitat Sites Total – 17	729

^a NA-1 identifies Natural Area sites of statewide or greater significance; NA-2 identifies Natural Area sites of countywide or regional significance; NA-3 identifies Natural Area sites of local significance; and CSH identifies critical species habitats.

^b SNA, or State Natural Area, identifies those sites officially designated as State Natural Areas by the State of Wisconsin Natural Areas Preservation Council.

^c Plus 33 in Milwaukee County.

^d Plus 14 acres in Washington County.

^e Plus 71 acres in Sheboygan County.

Source: SEWRPC

Table 2.10
Significant Geological Sites in Ozaukee County

Number on Map 2.17	Site Name	Ownership	Location	Size (Acres)	Description
Site Classification ^a : GA-1					
1	Thiensville Roadcut and Quarry	Ozaukee County and private	City of Mequon	9	Road cut and small old quarry provide only sizable exposure of the Devonian Thiensville Formation anywhere.
2	Ozaukee Buried Forest	Private	City of Mequon	32	Old water-filled sand quarry contains remnants of ancient forest.
3	Milwaukee River-Grafton Outcrops and Lime Kiln Park	Ozaukee County and private	Village of Grafton	57	Undisturbed, 40-foot-high rock outcrops along the Milwaukee River, containing the best and most extensive exposures of Silurian Racine Dolomite in the Region. Historically used for scientific research.
4	Cedar Creek-Anschuetz Quarries	Private	Town of Cedarburg	5	Outcrops and abandoned quarries along Cedar Creek that were main supply of stone for area buildings.
5	Phyllocarid Quarry	Private	Town of Fredonia	4	Small, partially water-filled quarry in Upper Silurian Waubakee Dolomite. Only site in Wisconsin where Silurian phyllocarid fossils have been found.
Site Classification ^a : GA-2					
6	Virmond Park Clay Banks	Ozaukee County	City of Mequon	10	Clay banks along Lake Michigan shoreline.
7	Groth Quarry	City of Cedarburg	City of Cedarburg	7	One of the more important geological sites in the area because of its prominence in the fossil reef studies of eminent geologists. Contains unique reef fossil biota.
8	Druecker's Lime Kiln	Private	Town of Port Washington	1	Nineteenth-century patented lime kiln, possibly only remaining example.
9	Sauk Creek Outcrop	Private	Town of Port Washington	3	Unquarried riverbank and low falls exhibiting natural outcrops of Silurian Racine Dolomite.
10	Harrington Beach State Park Quarry	WDNR	Town of Belgium	25	Large, water-filled quarry and restored pot kiln, and extensive exposures of Devonian rock containing abundant, highly diverse marine fossils.
11	Little Menomonee River Reef District	Private	City of Mequon	1	Silurian Racine Dolomite reef rock exposures. Has considerable importance in scientific research. Contains a wide variety of reef features.
Site Classification ^a : GA-3					
12	Riveredge Bluff	Riveredge Nature Center	Town of Saukville	1	Rock bluff of massive Racine Dolomite on south bank of Milwaukee River.
13	Saukville Reef	Private	Town of Saukville	3	Small quarries exposing Racine Dolomite reef.
14	Waubeka Quarry	Private	Town of Fredonia	2	Small, abandoned quarry exhibiting an uncommonly exposed type section.
15	Fredonia Quarries	Private	Town of Fredonia	6	Two small, undisturbed mid-19th-century quarries and several outcrops of Racine Dolomite.
16	Belgium Abandoned Shoreline	Private	Town of Belgium	108	Gravel and sand beaches and wind-cut cliffs and terraces indicating higher ancient lake levels.
Total – 16 Geological Sites				274	--

^a GA-1 identified Geological Area sites of statewide or greater significance; GA-2 identifies Geological Area sites of countywide or regional significance; and GA-3 identifies Geological Area sites of local significance.

Source: Wisconsin Department of Natural Resources, Wisconsin Geological and Natural History Survey, and SEWRPC

Table 2.11
Park and Open Space Sites Owned by Ozaukee County: 2018

Number on Map 2.19	Site Name	Location^a	Size (Acres)
Ozaukee County Park System			
1	Mee-Kwon County Park	T9N, R21E, Sections 10, 11	243
2	Virmond County Park	T9N, R22E, Section 28	63
3	Covered Bridge County Park	T10N, R21E, Section 10	17
4	Lion's Den Gorge Nature Preserve	T10N, R22E, Section 10	74
5	Hawthorne Hills County Park ^b	T11N, R21E, Sections 3, 4	293
6	Tendick Nature Park	T11N, R21E, Section 14	125
7	Ehlers County Park	T11N, R21E, Sections 13, 14, 23, 24	10
8	Harborview County Park	T11N, R22E, Section 28	1
9	Waubedonia County Park	T12N, R21E, Sections 27, 34	45
10	River Oaks County Park	T10N, R22E, Section 7	2
Total – 10 Sites			873
Not included in the County Park System			
11	Ozaukee County Fairgrounds	T10N, R21E, Sections 22, 27	18
12	Guenther Farmstead Property	T11N, R21E, Section 17	249
13	Ozaukee County Trail Property	T11N, R22E, Section 4	36
14	Bee Keeper Bog Property	T12N, R21E, Section 5	41
15	Shady Lane Property	T12N, R21E, Section 34	61
Total – 5 Sites			405

^a Indicates location given in U.S. Public Land Survey Township, Range, and Section.

^b Includes Hawthorne Hills Golf Course, Pioneer Village, and H.H. Peters Youth Camp.

Source: Ozaukee County and SEWRPC

Table 2.12
State of Wisconsin and Federal Park and Open Space Sites in Ozaukee County: 2018

Number on Map 2.19	Site Name	Location^a	Size (Acres)
Department of Natural Resource Sites (WDNR)			
16	Cedarburg Bog State Natural Area	T11N, R21E, Section 32	1,634
17	Cedarburg Habitat Preservation	T10N, R21E, Section 20	19
18	WDNR Site – North Branch Milwaukee River Project	T12N, R21E, Section 5	316
19	WDNR Site (Two Properties)	T12N, R21E, Section 9	93
20	WDNR Site	T11N, R21E, Section 31	80
21	WDNR Site	T10N, R22E, Section 8	33
22	WDNR Site – Scattered Wetland	T12N, R21E, Section 7	81
23	Harrington Beach State Park	T12N, R22E, Section 24	729
Subtotal – 8 Sites			2,985
University of Wisconsin Site			
24	UWM Cedarburg Bog Field Station	T11N, R21E, Section 30	300
Subtotal – 1 Site			300
U.S. Fish and Wildlife Service Sites (USFWS)			
25	USFWS Land	T11N, R21E, Section 13	41
26	USFWS – Belgium Waterfowl Protection Area	T12N, R22E, Section 10	158
27	USFWS – Blue Wing Waterfowl Production Area	T10N, R22E, Section 16	55
28	USFWS – Cedar Grove Waterfowl Production Area	T12N, R22E, Section 2	115
29	USFWS – Armin O. Schwengel Waterfowl Production Area	T12N, R22E, Section 8	302
30	USFWS – Ulao Waterfowl Production Area	T10N, R22E, Section 9	44
Subtotal – 6 Sites			715
Total – 15 Sites			4,000

^a Indicates location given in U.S. Public Land Survey Township, Range, and Section.

Source: Wisconsin Department of Natural Resources, Ozaukee County, and SEWRPC

Table 2.13
Park and Open Space Sites Owned by Cities, Villages, Towns,
School Districts, or Other Public Districts in Ozaukee County: 2018

Number on Map 2.20	Site Name	Location ^a	Size (Acres)
Owned by the City			
1	Pioneer Park	T9N, R21E, Section 3	2
2	Pukaite Woods	T9N, R21E, Section 12	18
3	Mequon Rotary Park	T9N, R21E, Section 12	76
4	Scout Park	T9N, R21E, Section 13	7
5	Prinz Site	T9N, R21E, Section 14	11
6	Highland Woods	T9N, R21E, Section 15	85
7	Little Menomonee Nature Preserve	T9N, R21E, Section 21	20
8	Mequon Community Park	T9N, R21E, Section 22	13
9	Settlers Park	T9N, R21E, Section 23	1
10	Riverview Park	T9N, R21E, Section 24	11
11	Villa Grove Park	T9N, R21E, Section 24	5
12	Burcyk Property	T9N, R21E, Section 32	62
13	Lemke Park	T9N, R21E, Section 32	42
14	Swan Road Prairie	T9N, R21E, Section 32	20
15	Mequon Nature Preserve	T9N, R21E, Section 33	550
16	Lily Lane Nature Preserve	T9N, R21E, Section 34	13
17	Trinity Creek Wildlife Area	T9N, R21E, Section 35	40
18	River Barn Park	T9N, R21E, Section 35	43
19	Garrison's Glen	T9N, R22E, Section 6	21
20	Moonlight Landing	T9N, R22E, Section 18	1
21	Shoreland Nature Preserve	T9N, R22E, Section 18	19
22	Willow Bay Nature Preserve	T9N, R22E, Section 18	23
23	River Forest Nature Preserve	T9N, R22E, Section 18	53
24	Grasslyn Nature Preserve	T9N, R22E, Section 31	15
25	K. Kearney Carpenter Park	T9N, R22E, Section 32	35
26	Harrison Park	T10N, R21E, Section 22	2
27	Willowbrooke Park	T10N, R21E, Section 22	7
28	Cedar Hedge Park	T10N, R21E, Section 23	14
29	Georgetown Park	T10N, R21E, Section 26	2
30	Georgetown Walking Paths Park	T10N, R21E, Section 26	3
31	Woodland Park	T10N, R21E, Section 26	5
32	Adlai Horn Park	T10N, R21E, Section 26	8
33	Beckmann Park	T10N, R21E, Section 26	1
34	Cedar Creek Park Complex	T10N, R21E, Section 26	12
35	Highland Bridge Park	T10N, R21E, Section 26	1
36	Boy Scout Park	T10N, R21E, Section 27	1
37	Mayor E. Stephan Fischer Park	T10N, R21E, Section 27	2
38	Centennial Park	T10N, R21E, Section 27	24
39	Maple Manor Park	T10N, R21E, Section 27	2
40	Cedar Creek Walkway	T10N, R21E, Section 27	1
41	City Hall	T10N, R21E, Section 27	1
42	Doctor's Park	T10N, R21E, Section 27	1
43	Founders Cemetery Park	T10N, R21E, Section 27	2
44	Rappold Park	T10N, R21E, Section 27	1
45	Top View Trails Park	T10N, R21E, Section 28	1
46	Prairie View Park	T10N, R21E, Section 33	5

Table continued on next page.

Table 2.13 (Continued)

Number on Map 2.20	Site Name	Location^a	Size (Acres)
Owned by the City (continued)			
47	Hillcrest Park	T10N, R21E, Section 34	1
48	Westlawn Lot No. 1	T10N, R21E, Section 34	1
49	Westlawn Woods Park	T10N, R21E, Section 34	10
50	Wurthmann Park	T10N, R21E, Section 34	1
51	Cedar Pointe Park	T10N, R21E, Section 34	5
52	Cedar Pointe Conservancy	T10N, R21E, Section 34	13
53	City Entrance	T10N, R21E, Section 34	1
54	Cedars Park	T10N, R21E, Section 35	6
55	Herman A. Zuenert Park	T10N, R21E, Section 35	20
56	Skating Facility	T10N, R21E, Section 35	2
57	Beechwood Park	T10N, R21E, Section 35	4
58	Misty Ridge Park	T10N, R22E, Section 5	2
59	Undeveloped Park	T11N, R22E, Section 20	18
60	Birchwood Hills Nature Area	T11N, R22E, Section 21	19
61	Norport Park/Antoine Park	T11N, R22E, Section 21	8
62	Lions Park	T11N, R22E, Section 21	1
63	Kolbach Park	T11N, R22E, Section 21	3
64	Municipal Softball Field	T11N, R22E, Section 21	7
65	Hales Trail & Kaiser Dr.	T11N, R22E, Section 21	3
66	Whitefish Park	T11N, R22E, Section 21	10
67	Upper Lake Park	T11N, R22E, Section 28	79
68	Veteran's Memorial Park	T11N, R22E, Section 28	5
69	Columbia Park	T11N, R22E, Section 28	1
70	City Athletic Field and Community Waterpark	T11N, R22E, Section 28	26
71	Stacker Park	T11N, R22E, Section 28	1
72	Coal Dock Park	T11N, R22E, Section 28	21
73	Fisherman's Park/Rotary Park	T11N, R22E, Section 28	2
74	Gilson Park	T11N, R22E, Section 28	1
75	Lion's Comfort Station	T11N, R22E, Section 28	1
76	Port Washington Marina	T11N, R22E, Section 28	23
77	Horseshoe Courts	T11N, R22E, Section 29	1
78	White Pines Park	T11N, R22E, Section 29	2
79	Boerner Park	T11N, R22E, Section 29	2
80	Schanen Acres Park	T11N, R22E, Section 29	1
81	Gatzke Nature Preserve	T11N, R22E, Section 29	2
82	Hill School Park	T11N, R22E, Section 29	1
83	West Side Park	T11N, R22E, Section 29	1
84	Bley Estates Park	T11N, R22E, Section 30	2
85	Hidden Hills Park	T11N, R22E, Section 30	1
86	Westport Meadows Park	T11N, R22E, Section 32	6
87	Oakland Ave. Greens	T11N, R22E, Section 33	1
Owned by the City Subtotal – 87 Sites			1,597
Owned by the Village			
88	Donald A. Molyneux Park	T9N, R21E, Section 22	1
89	Village Park	T9N, R21E, Section 23	18
90	Shady Hollow Park	T10N, R21E, Section 12	4
91	Heritage Settlement Park	T10N, R21E, Section 12	16
92	Meadowbrook Park-Family Aquatic Center	T10N, R21E, Section 13	7
93	Mole Creek Park	T10N, R21E, Section 13	1
94	River Island Park	T10N, R21E, Section 13	6
95	Wildwood Park	T10N, R21E, Section 23	4

Table continued on next page.

Table 2.13 (Continued)

Number on Map 2.20	Site Name	Location^a	Size (Acres)
Owned by the Village (continued)			
96	Grafton Lions Park	T10N, R21E, Section 23	13
97	Cedar Highlands Open Space	T10N, R21E, Section 23	2
98	Canary Lane Park	T10N, R21E, Section 23	1
99	Paramount Plaza	T10N, R21E, Section 24	1
100	Riverfront Park	T10N, R21E, Section 24	1
101	Veteran's Memorial Park	T10N, R21E, Section 24	3
102	Third Avenue Park	T10N, R21E, Section 24	6
103	Grafton Multi-Purpose Senior Center	T10N, R21E, Section 24	4
104	Chair Factory Historical Marker	T10N, R21E, Section 24	1
105	Dellwood Park	T10N, R21E, Section 24	1
106	Pine Street Park	T10N, R21E, Section 24	1
107	Lime Kiln Park	T10N, R21E, Section 25	28
108	Acorn Park	T10N, R21E, Section 26	1
109	Centennial Park	T10N, R22E, Section 19	26
110	Cheyenne Park	T10N, R22E, Section 19	2
111	South Side Park	T10N, R22E, Section 30	11
112	Blackhawk Valley Park	T10N, R22E, Section 30	8
113	Friendship Park	T11N, R21E, Section 25	2
114	Schowalter Park	T11N, R21E, Section 25	40
115	Grady Park	T11N, R21E, Section 26	11
116	West Riverside Park	T11N, R21E, Section 35	4
117	Quade Park	T11N, R21E, Section 35	10
118	East Riverside Park	T11N, R21E, Section 35	29
119	Peninsula Park	T11N, R21E, Section 36	12
120	Veteran's Park	T11N, R21E, Section 36	1
121	Stony Creek Park	T12N, R21E, Section 26	4
122	Veteran's Park	T12N, R21E, Section 26	1
123	Partridge Lane Site	T12N, R21E, Section 27	4
124	Marie Kraus Park	T12N, R21E, Section 34	27
125	Children's Park	T12N, R21E, Section 35	1
126	Fireman's Park	T12N, R21E, Section 35	4
127	Pepi's Playground	T12N, R22E, Section 15	3
128	Village Hall	T12N, R22E, Section 15	1
129	Community Park	T12N, R22E, Section 15	8
130	Bares Memorial Park	T12N, R22E, Section 22	1
131	Heritage Park	T12N, R22E, Section 22	19
132	Lake Hills Park	T12N, R22E, Section 23	2
Owned by the Village Subtotal – 45 Sites			351
Owned by the Town			
133	Pleasant Valley Nature Park	T10N, R21E, Section 2	88
134	Creekside Park	T10N, R21E, Section 8	1
135	Krohn Park Public Canoe Launch	T10N, R21E, Section 10	12
136	Cedar Creek Farms Canoe Launch	T10N, R21E, Section 14	1
137	Orthopaedic Hospital of Wisconsin Fields	T10N, R21E, Section 21	5
138	Town-Owned Land (MLG Park)	T10N, R21E, Section 32	20
139	Hamilton Park	T10N, R21E, Section 35	1
140	North Canoe Launch	T10N, R22E, Section 06	1
Owned by the Town Subtotal – 8 Sites			129
Owned by the School District			
141	Homestead High School	T9N, R21E, Section 23	44
142	H.C. Steffen and Wilson Avenue School	T9N, R21E, Section 27	14

Table continued on next page.

Table 2.13 (Continued)

Number on Map 2.20	Site Name	Location^a	Size (Acres)
Owned by the School District (continued)			
143	School District Site	T9N, R21E, Section 28	110
144	Oriole Lane School	T9N, R22E, Section 7	15
145	Lakeshore Middle School and Range Line Schools	T9N, R22E, Section 30	14
146	Donges Bay School	T9N, R22E, Section 31	7
147	ABC Kids Care, Inc.	T10N, R21E, Section 10	7
148	Woodview Elementary and John Long Middle School	T10N, R21E, Section 13	18
149	Thorson School	T10N, R21E, Section 23	12
150	Kennedy School	T10N, R21E, Section 24	4
151	Parkview School	T10N, R21E, Section 27	7
152	Cedarburg Junior and Senior High School	T10N, R21E, Section 27	38
153	School District Site	T10N, R21E, Section 30	20
154	Westlawn School	T10N, R21E, Section 34	3
155	Grafton Elementary and High School	T10N, R22E, Section 19	28
156	Zaun Soccer Park	T10N, R22E, Section 30	36
157	Saukville Elementary School	T11N, R21E, Section 25	6
158	Lincoln Elementary School	T11N, R22E, Section 21	6
159	Thomas Jefferson Middle School	T11N, R22E, Section 21	6
160	Port Washington High School	T11N, R22E, Section 28	2
161	Dunwiddie School	T11N, R22E, Section 29	5
162	Ozaukee Middle and High Schools	T12N, R21E, Section 26	27
Owned by the School District Subtotal – 22 Sites			429
Owned by Other Public Districts			
163	MMSD Conservation Plan	T9N, R21E, Section 8	55
164	MMSD Conservation Plan	T9N, R21E, Section 16	20
165	MMSD Conservation Plan	T9N, R21E, Section 20	56
166	MMSD Conservation Plan	T9N, R21E, Section 21	8
167	MMSD Conservation Plan	T9N, R21E, Section 24	7
168	MMSD Conservation Plan	T9N, R21E, Section 29	73
169	MMSD Conservation Plan	T9N, R21E, Section 29	30
170	MMSD Conservation Plan	T9N, R21E, Section 30	32
171	MMSD Conservation Plan	T9N, R21E, Section 30	10
172	MMSD Conservation Plan	T9N, R21E, Section 32	18
173	MMSD Conservation Plan	T9N, R21E, Section 32	2
174	MMSD Conservation Plan	T9N, R21E, Section 34	40
175	MMSD Conservation Plan	T9N, R21E, Section 34	26
176	MMSD Conservation Plan	T9N, R22E, Section 20	85
177	MMSD Conservation Plan	T10N, R21E, Section 5	74
178	MMSD Conservation Plan	T12N, R21E, Section 7	40
179	MMSD Conservation Plan	T12N, R21E, Section 9	15
180	MMSD Conservation Plan (Huiras)	T12N, R21E, Section 9	20
Owned by the Other Public Districts Subtotal – 18 Sites			611
Sites Owned by Cities, Villages, Towns, School Districts, or Other Public Districts Total – 180 Sites			3,117

^a Indicates location given in U.S. Public Land Survey Township, Range, and Section.

Source: SEWRPC

Table 2.14
Private Outdoor Recreation and Open Space Sites in Ozaukee County: 2018

Number on Map 2.21	Site Name	Location ^a	Size (Acres)
Owned by an Organization			
1	Carlson Park/Ozaukee Ice Center	T9N, R21E, Section 2	7
2	St. Mary's Health Center	T9N, R21E, Section 3	14
3	Trinity School	T9N, R21E, Section 19	14
4	Wisconsin Lutheran Seminary	T9N, R21E, Section 22	35
5	Calvary Lutheran Church and School	T9N, R21E, Section 22	1
6	Lumen Christi Catholic School	T9N, R21E, Section 24	6
7	Concordia University	T9N, R22E, Section 8	30
8	Villa Du Park Country Club	T9N, R22E, Section 18	107
9	St. John's Lutheran	T9N, R22E, Section 19	4
10	St. Francis Borgia School	T10N, R21E, Section 16	30
11	Buckskin Bowmen Club	T10N, R21E, Section 21	11
12	Fireman's Park	T10N, R21E, Section 27	20
13	First Immanuel Lutheran School	T10N, R21E, Section 27	3
14	Our Savior Lutheran School	T10N, R22E, Section 18	4
15	Ducks Limited	T11N, R21E, Section 5	40
16	Saukville Rifle and Pistol Club	T11N, R21E, Section 8	59
17	Blue Heron Wildlife Sanctuary	T11N, R21E, Section 14	92
18	YMCA Saukville	T11N, R21E, Section 25	21
19	Tamarack Retreat, Inc.	T11N, R21E, Section 31	112
20	Portview Christian Center	T11N, R22E, Section 20	9
21	St. John XXIII Catholic Middle School	T11N, R22E, Section 21	8
22	St. John XXIII Catholic Elementary School	T11N, R22E, Section 21	1
23	Random Lake Rod and Gun Club	T12N, R21E, Section 11	54
24	JCC Rainbow Day Camp	T12N, R21E, Section 16	100
25	Stony Hill School Site	T12N, R21E, Section 28	1
26	Americanism Center	T12N, R21E, Section 28	13
27	VFW Park	T12N, R21E, Section 28	1
28	Ozaukee County Fish and Game Recreation Preserve	T12N, R21E, Section 32	60
29	Divine Savior Catholic School	T12N, R21E, Section 32	1
30	Oak Park	T12N, R21E, Section 32	11
31	St. Mary's School	T12N, R22E, Section 24	6
Owned by an Organization Subtotal – 31 Sites			875
Commercial Owned			
32	Fox Hill Stables	T9N, R21E, Section 3	28
33	Pigeon Creek Farm	T9N, R21E, Section 4	42
34	Willow Run	T9N, R21E, Section 9	12
35	Apple Ridge	T9N, R21E, Section 10	30
36	Kartar Singh Dhaliwal Soccer Park	T9N, R21E, Section 28	25
37	Split Rail Stables	T9N, R22E, Section 5	46
38	Missing Links Golf	T9N, R22E, Section 8	38
39	Baehmann's Golf Center	T10N, R21E, Section 22	56
40	Grafton Dells	T10N, R21E, Section 25	17
41	River Park Leased Land	T10N, R21E, Section 25	13
42	Legion Park	T10N, R21E, Section 35	1
43	Flying S Ranch	T10N, R22E, Section 4	37
44	Fire Ridge Golf Club	T10N, R22E, Section 6	222
45	Grafton Equestrian Center	T10N, R22E, Section 20	15

Table continued on next page.

Table 2.14 (Continued)

Number on Map 2.21	Site Name	Location^a	Size (Acres)
46	Ulao Meadows	T10N, R22E, Section 20	4
47	Northshore Equestrian	T10N, R22E, Section 29	26
48	Lakefield Farm, LLC	T10N, R22E, Section 30	22
49	McFadden Farm	T10N, R22E, Section 32	36
50	Winterhaven Farm	T10N, R22E, Section 32	57
51	Appy Orse Acres	T11N, R21E, Section 12	99
52	Raymond's Driving Range	T11N, R22E, Section 31	18
53	Freedom Ridge/Dream Colour Stables	T12N, R21E, Section 1	41
Commercial Owned Subtotal – 22 Sites			885
Owned by Other Private Entities			
54	Mequon Country Club	T9N, R21E, Section 13	270
55	Milwaukee Area Technical College	T9N, R21E, Section 14	172
56	St. Cecilia School	T9N, R21E, Section 22	1
57	North Shore Country Club	T9N, R21E, Section 25	212
58	Ozaukee Country Club	T9N, R21E, Section 26	152
59	Subdivision Park 1	T9N, R21E, Section 36	19
60	Lac Du Cours Homes – Outlot/Open Space	T9N, R21E, Section 36	12
61	Range Line Valley	T9N, R21E, Section 36	27
62	Mequon Colony Estates	T9N, R22E, Section 7	1
63	River Oaks Park	T9N, R22E, Section 18	1
64	Riverdale Park	T9N, R22E, Section 18	1
65	Whitman Place Subdivision Park No. 2	T9N, R22E, Section 31	3
66	Moldenhauer Lake Access	T10N, R21E, Section 11	2
67	Edgewater Golf Course	T10N, R21E, Section 12	72
68	Airport Soccer Fields	T10N, R21E, Section 15	39
69	Cedar Creek Equestrian Center	T10N, R21E, Section 17	16
70	St. Joseph School	T10N, R21E, Section 24	5
71	St. Paul School	T10N, R21E, Section 24	5
72	Oxford Manor Subdivision Park	T10N, R21E, Section 25	1
73	Muttland Meadows	T10N, R21E, Section 25	10
74	Tennis Courts	T10N, R21E, Section 35	1
75	Home-Owners Association Park	T10N, R22E, Section 7	8
76	Deerfield Subdivision Dedication	T11N, R21E, Section 15	9
77	The Bog Golf Course	T11N, R21E, Section 21	233
78	Badger Camp Site	T12N, R21E, Section 1	47
79	Rheingans Boat Access	T12N, R21E, Section 3	13
80	Pfeiffers Paradise	T12N, R21E, Section 28	1
81	Wisconsin Licensed Game Farm	T12N, R22E, Section 12	376
Other Private Entities Owned Subtotal – 28			1,709
Private Sites Total – 81			3,469

^a The location numbers represent the U.S. Public Land Survey Township, Range, and Section in which the site is located.

Source: SEWRPC

Table 2.15
Privately Owned Resource Protection Sites in Ozaukee County: 2018

Number on Map 2.22	Site Name	Owner	Location^a	Size (Acres)
1	Riveredge Nature Center	Riveredge Nature Center	T11N, R21E, Section 7	373
2	The Nature Conservancy Site	The Nature Conservancy	T11N, R21E, Section 30	24
3	The Nature Conservancy Site	The Nature Conservancy	T11N, R21E, Section 30	18
4	Beimborn	The Ozaukee Washington Land Trust	T11N, R21E, Section 18	60
5	Bratt Woods	The Ozaukee Washington Land Trust	T10N, R21E, Section 13	18
6	Cedarburg Environmental Study Area	The Ozaukee Washington Land Trust	T10N, R21E, Section 30	40
7	Donges Bay Gorge	The Ozaukee Washington Land Trust	T9N, R22E, Section 33	24
8	Fairy Chasm	The Ozaukee Washington Land Trust	T9N, R22E, Section 33	20
9	Forest Beach Migratory Preserve	The Ozaukee Washington Land Trust	T12N, R22E, Section 36	118
10	Hames	The Ozaukee Washington Land Trust	T12N, R21E, Section 28	7
11	Heimerl	The Ozaukee Washington Land Trust	T12N, R21E, Section 9	10
12	Huiras Lake	The Ozaukee Washington Land Trust	T12N, R21E, Section 9	108
13	Kinnamon	The Ozaukee Washington Land Trust	T11N, R21E, Section 19	102
14	Kurtz Woods	The Ozaukee Washington Land Trust	T10N, R21E, Section 1	31
15	Kurtz Woods Outlot	The Ozaukee Washington Land Trust	T10N, R21E, Section 1	15
16	MacLaurin Woods	The Ozaukee Washington Land Trust	T12N, R21E, Section 31	5
17	Maier Cottage	The Ozaukee Washington Land Trust	T10N, R21E, Section 10	1
18	Sauk Creek Nature Preserve	The Ozaukee Washington Land Trust	T11N, R22E, Section 29	31
19	Shannon	The Ozaukee Washington Land Trust	T11N, R21E, Section 20	37
20	Spirit Lake Preserve	The Ozaukee Washington Land Trust	T9N, R21E, Section 11	156
21	Ville Du Park	The Ozaukee Washington Land Trust	T9N, R21E, Section 13	20
Total – 21 Sites				1,218

^a Indicates location given in U.S. Public Land Survey Township, Range, and Section.

Source: SEWRPC

Table 2.16
Lands Under Conservation Easements in Ozaukee County: 2018

Number on Map 2.23	Holder of Easement	Location^a	Size (Acres)
1	WDNR	T11N, R21E, Section 30	21
2	WDNR	T12N, R21E, Section 28	11
3	WDNR	T11N, R21E, Section 22	10
4	WDNR	T11N, R21E, Section 34	8
5	WDNR	T11N, R21E, Section 14	7
6	WDNR	T12N, R21E, Section 27	6
7	WDNR	T10N, R21E, Section 8	3
8	WDNR	T12N, R21E, Section 29	2
9	WDNR	T11N, R21E, Section 7	1
10	WDNR	T11N, R21E, Section 33	1
11	WDNR	T12N, R21E, Section 30	1
12	WDNR (Granbinger)	T12N, R21E, Section 6	76
13	WDNR (Huiras)	T12N, R21E, Section 5	261
14	WDNR (Lake Hills West)	T11N, R21E, Section 25	26
15	WDNR (Luedtke)	T12N, R21E, Section 4	120
16	WDNR (Mueller)	T12N, R21E, Section 4	214
17	WDNR (North Branch Milwaukee River-Stemper)	T12N, R21E, Section 17	201
18	WDNR (Winter)	T12N, R21E, Section 5	23
19	WDNR	T11N, R21E, Section 27	19
20	WDNR	T11N, R21E, Section 7	5
21	WDNR (Cole)	T11N, R21E, Section 27	5
22	WDNR (Aloha Auto)	T11N, R22E, Section 32	1
23	WDNR (Bell)	T11N, R21E, Section 27	6
24	WDNR (Bell)	T11N, R21E, Section 27	2
25	WDNR (Dickman)	T11N, R21E, Section 34	7
26	MMSD	T9N, R21E, Section 4	4
27	MMSD (Huntington Park Subdivision)	T9N, R21E, Section 32	98
28	MMSD (Kohl)	T9N, R21E, Section 33	6
29	MMSD (Mayer)	T9N, R21E, Section 12	43
30	The Ozaukee Washington Land Trust (Abbott)	T10N, R22E, Section 28	26
31	The Ozaukee Washington Land Trust (Brickman)	T9N, R21E, Section 1	15
32	The Ozaukee Washington Land Trust (Cudahy)	T10N, R21E, Section 36	43
33	The Ozaukee Washington Land Trust (Dieringer)	T12N, R22E, Section 19	240
34	The Ozaukee Washington Land Trust (Fairchild)	T11N, R21E, Section 36	12
35	The Ozaukee Washington Land Trust (Foth)	T12N, R22E, Section 26	7
36	The Ozaukee Washington Land Trust (Kaul)	T10N, R22E, Section 8	56
37	The Ozaukee Washington Land Trust (Kursel)	T9N, R21E, Section 9	40
38	The Ozaukee Washington Land Trust (Lord)	T12N, R21E, Section 19	24
39	The Ozaukee Washington Land Trust (Lynn)	T11N, R21E, Section 20	36
40	The Ozaukee Washington Land Trust (Meissner)	T10N, R22E, Section 28	16
41	The Ozaukee Washington Land Trust (Parsons)	T10N, R21E, Section 31	153
42	The Ozaukee Washington Land Trust (Pierson)	T11N, R21E, Section 3	14
43	The Ozaukee Washington Land Trust (Pigeon Creek)	T9N, R21E, Section 9	3
44	The Ozaukee Washington Land Trust (Pigeon Creek)	T9N, R21E, Section 9	1
45	The Ozaukee Washington Land Trust (Sandhill)	T11N, R21E, Section 4	121
46	The Ozaukee Washington Land Trust (Sieckman)	T11N, R21E, Section 18	111
47	The Ozaukee Washington Land Trust (Uihlein)	T10N, R21E, Section 25	9
48	The Ozaukee Washington Land Trust (Watts/Cudahy)	T10N, R21E, Section 25	175
49	The Ozaukee Washington Land Trust (Windy Hill)	T10N, R21E, Section 31	29
Total – 49 Sites			2,319

Table continued on next page.

Table 2.16 (Continued)

Note: All of the conservation easements listed above provide for the permanent protection of resources on private land.

^a Indicates location given in U.S. Public Land Survey Township, Range, and Section.

Source: Ozaukee Washington Land Trust, Wisconsin Department of Natural Resources, Milwaukee Metropolitan Sewerage District, and SEWRPC

Table 2.17
Historic Resident Population Levels in Ozaukee County, the Region, and the State: 1850-2010

Year	Ozaukee County			Region			Wisconsin		
	Population	Change from Preceding Census		Population	Change from Preceding Census		Population	Change from Preceding Census	
		Absolute	Percent		Absolute	Percent		Absolute	Percent
1850	-- ^a	--	--	113,389	--	--	305,391	--	--
1860	15,682	--	--	190,409	77,020	67.9	775,881	470,490	154.1
1870	15,564	-118	-0.8	223,546	33,137	17.4	1,054,670	278,789	35.9
1880	15,461	-103	-0.7	277,119	53,573	24.0	1,315,497	260,827	24.7
1890	14,943	-518	-3.4	386,774	109,655	39.6	1,693,330	377,833	28.7
1900	16,363	1,420	9.5	501,808	115,034	29.7	2,069,042	375,712	22.2
1910	17,123	760	4.6	631,161	129,353	25.8	2,333,860	264,818	12.8
1920	16,355	-768	-4.6	783,681	152,520	24.2	2,632,067	298,207	12.8
1930	17,394	1,039	6.5	1,006,118	222,437	28.4	2,939,006	306,939	11.7
1940	18,985	1,591	9.1	1,067,699	61,581	6.1	3,137,587	198,581	6.8
1950	23,361	4,376	23.0	1,240,618	172,919	16.2	3,434,575	296,988	9.5
1960	38,441	15,080	64.6	1,573,614	332,996	26.8	3,951,777	517,202	15.1
1970	54,461	16,020	41.7	1,756,083	182,469	11.6	4,417,821	466,044	11.8
1980	66,981	12,520	23.0	1,764,796	8,713	0.5	4,705,642	287,821	6.5
1990	72,831	5,850	8.7	1,810,364	45,568	2.6	4,891,769	186,127	4.0
2000	82,317	9,486	13.0	1,931,165	120,801	6.7	5,363,675	471,906	9.6
2010	86,395	4,078	5.0	2,019,970	88,805	4.6	5,686,986	323,271	6.0

^a In 1853, seven Towns (Belgium, Cedarburg, Fredonia, Grafton, Mequon, Port Washington, and Saukville) and the Village of Port Washington, then in Washington County, and which contained a resident population of 8,281 in 1850, were detached from the remainder of Washington County to form Ozaukee County.

Source: U.S. Bureau of the Census and SEWRPC

Table 2.18
Land Uses in Ozaukee County: 2015

Land Use Category	Square Miles	Percent of Subtotal	Percent of County
Urban ^a			
Single-Family Residential	30.4	52.0	13.0
Multifamily Residential ^b	1.9	3.2	0.8
Commercial	2.0	3.4	0.8
Industrial	2.0	3.4	0.8
Government and Institutional	2.2	3.7	0.9
Recreational	4.2	7.2	1.8
Transportation, Communications, and Utilities	15.9	27.1	6.8
Urban Subtotal	58.6	100.0	24.9
Rural			
Agricultural	101.7	57.5	43.2
Woodlands	12.7	7.2	5.4
Wetlands	30.7	17.4	13.0
Water	4.1	2.3	1.8
Landfill and Extractive	1.0	0.6	0.4
Other Open Lands	26.6	15.0	11.3
Rural Subtotal	176.8	100.0	75.1
Total	235.4	--	100.0

^a Parking lots are included with the associated use.

^b Includes two-family residential.

Source: SEWRPC

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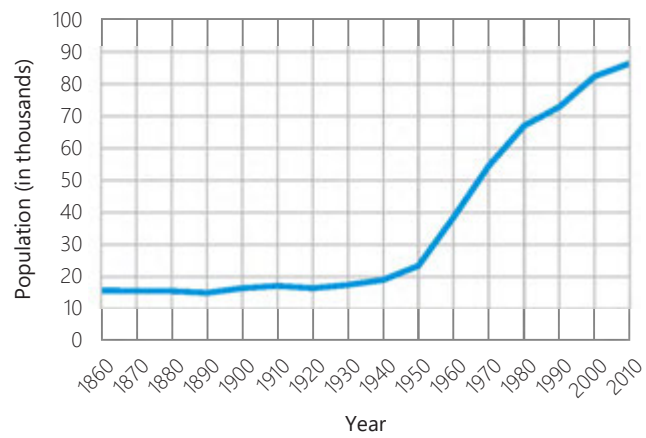
A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR OZAUKEE COUNTY: 2021-2030

Chapter 2

RESOURCE ASSESSMENT

FIGURES

Figure 2.1
Historic Population Levels in
Ozaukee County 1860-2010



Source: SEWRPC

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A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR OZAUKEE COUNTY: 2021-2030

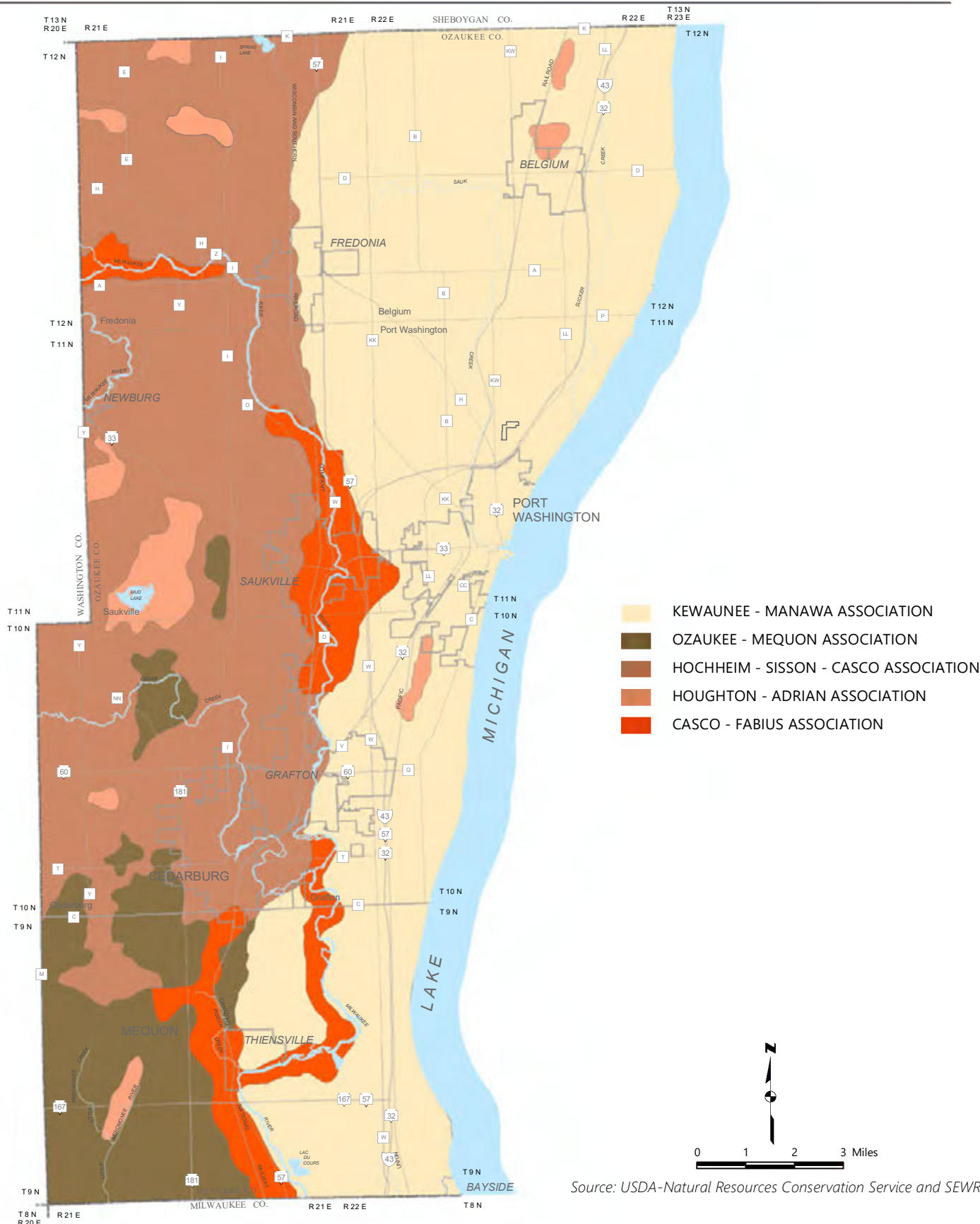
Chapter 2

RESOURCE ASSESSMENT

MAPS

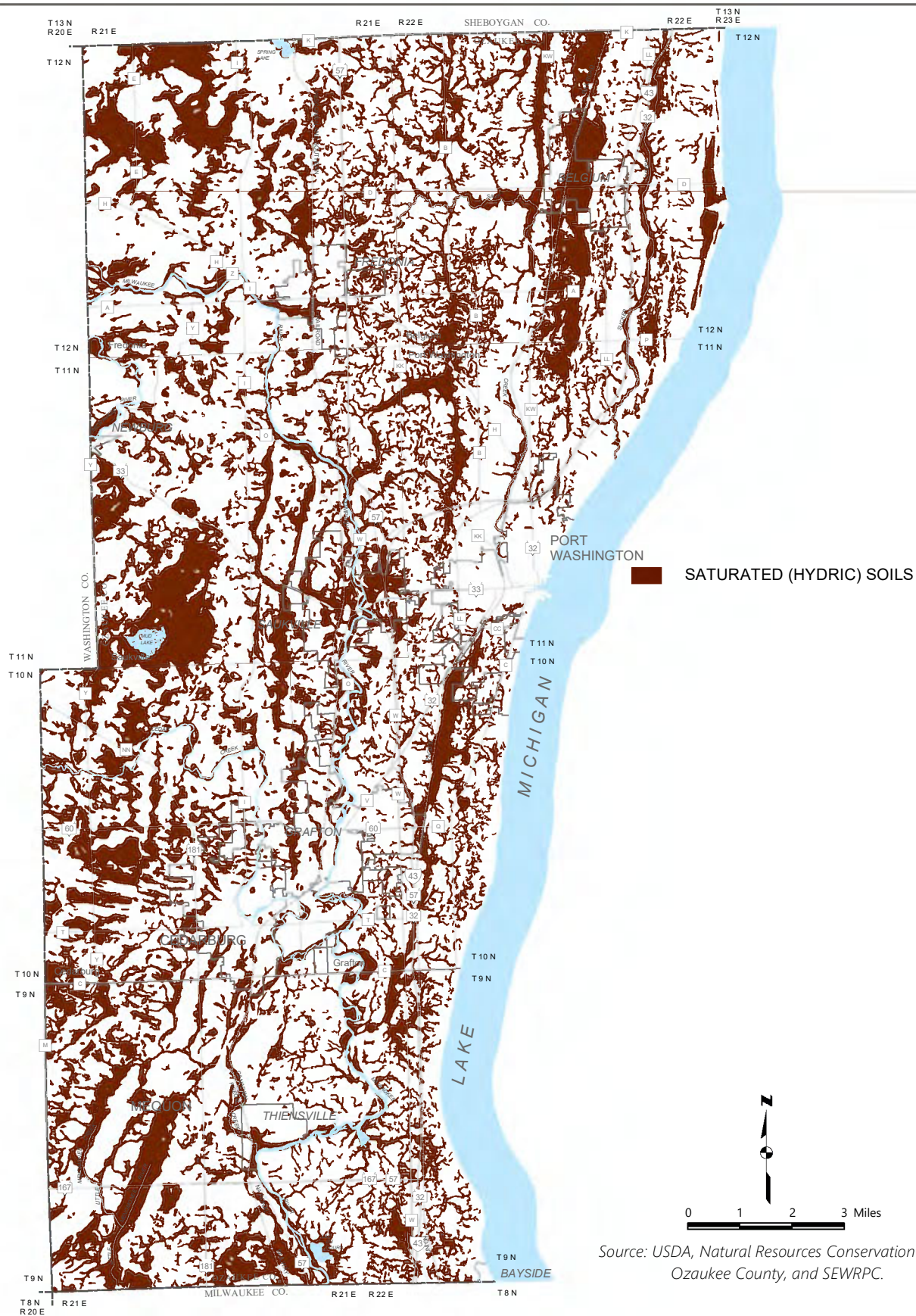
Map 2.1

General Soil Associations in Ozaukee County



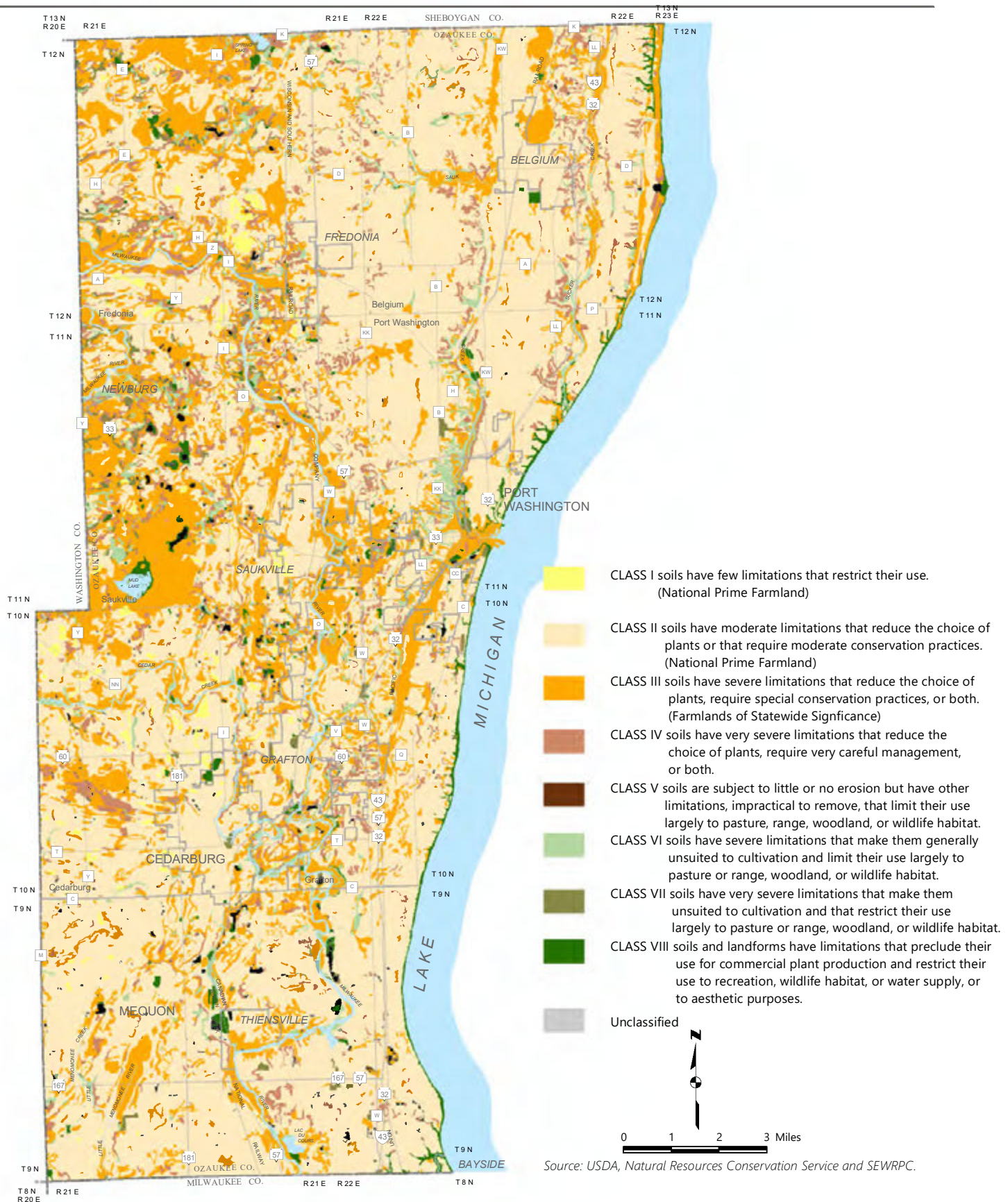
Source: USDA-Natural Resources Conservation Service and SEWRPC.

Map 2.2 Saturated Soils in Ozaukee County

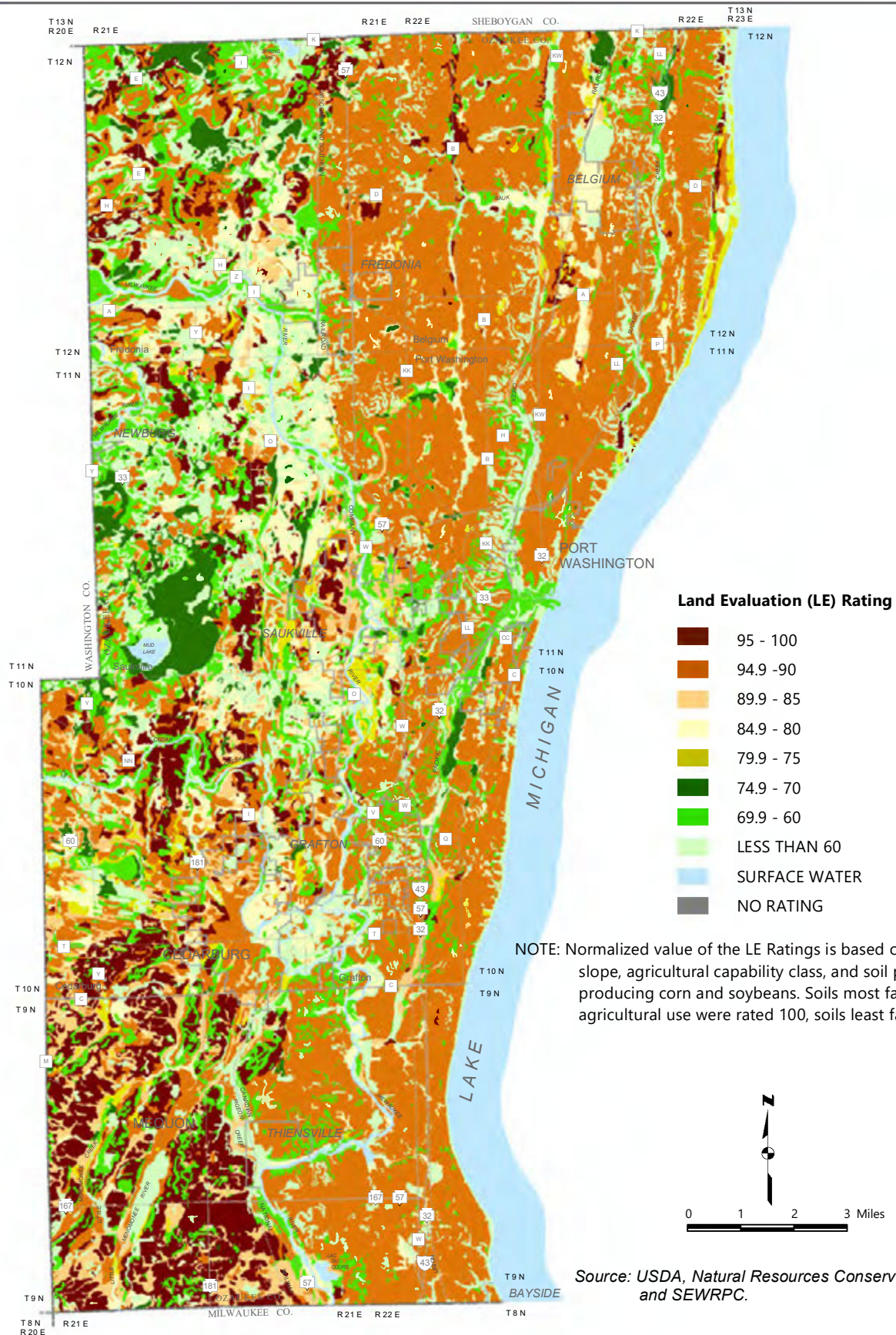


Source: USDA, Natural Resources Conservation Service, Ozaukee County, and SEWRPC.

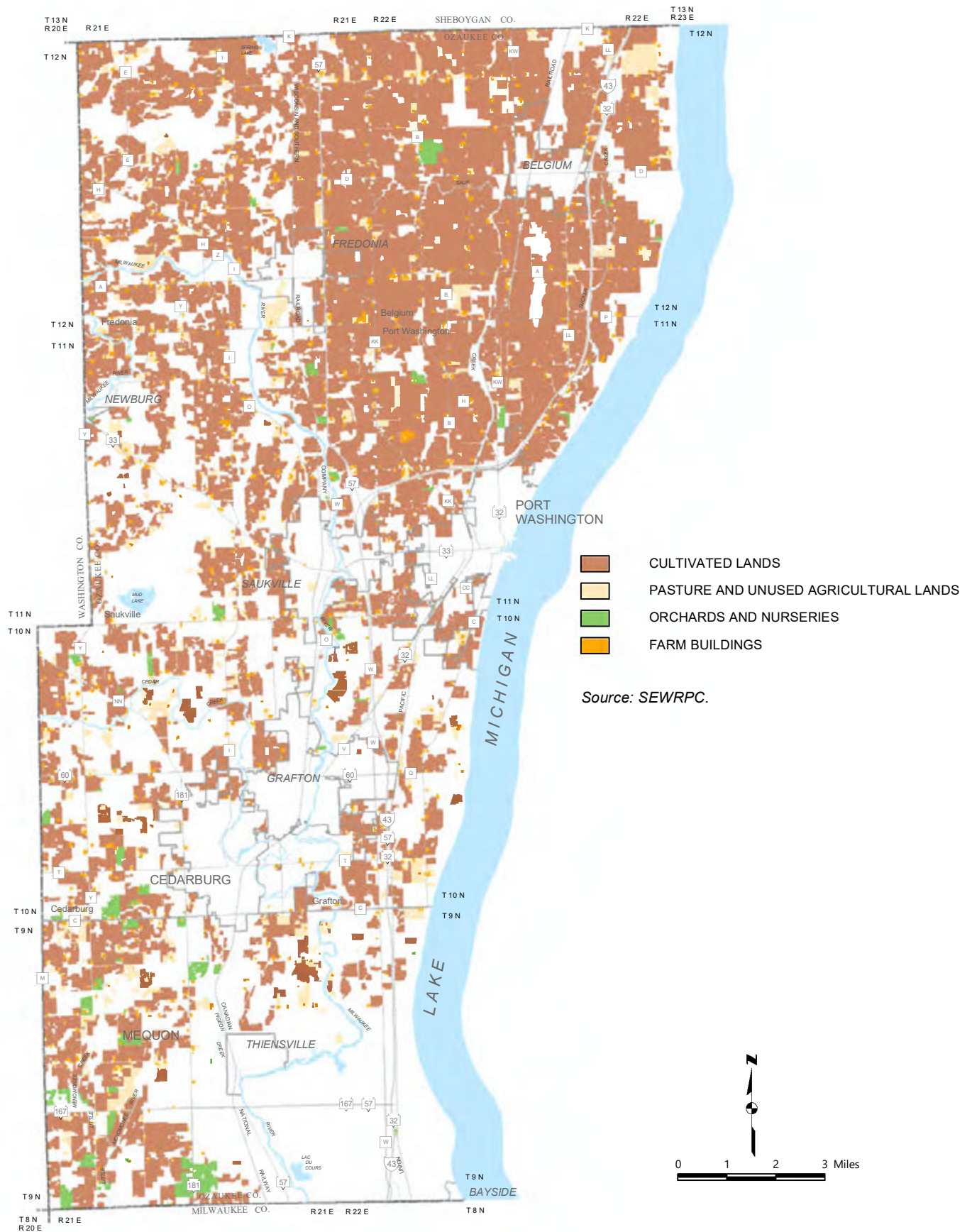
Map 2.3
Agricultural Soil Capability in Ozaukee County



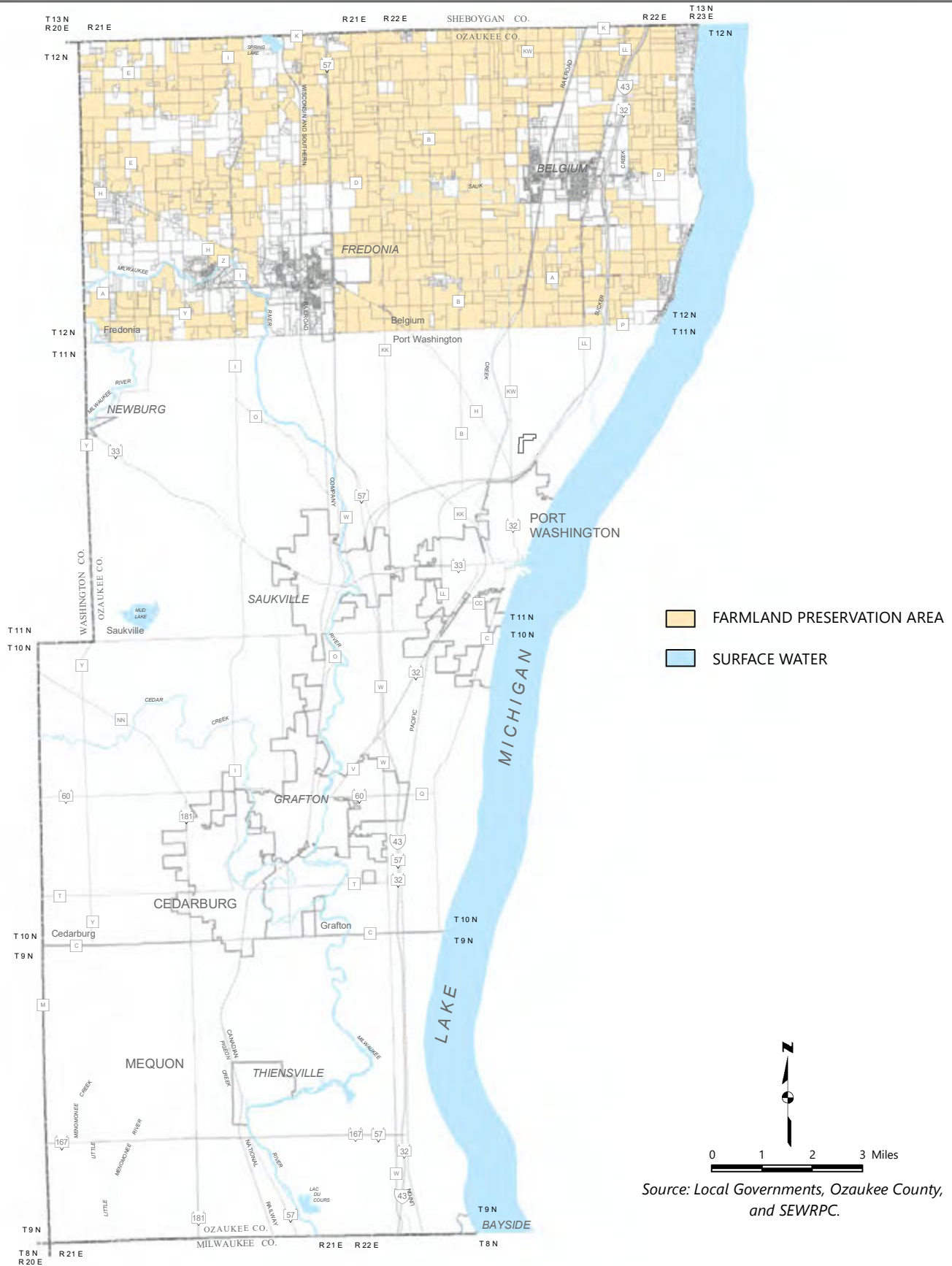
Map 2.4 Land Evaluation Ratings for Soils in Ozaukee County



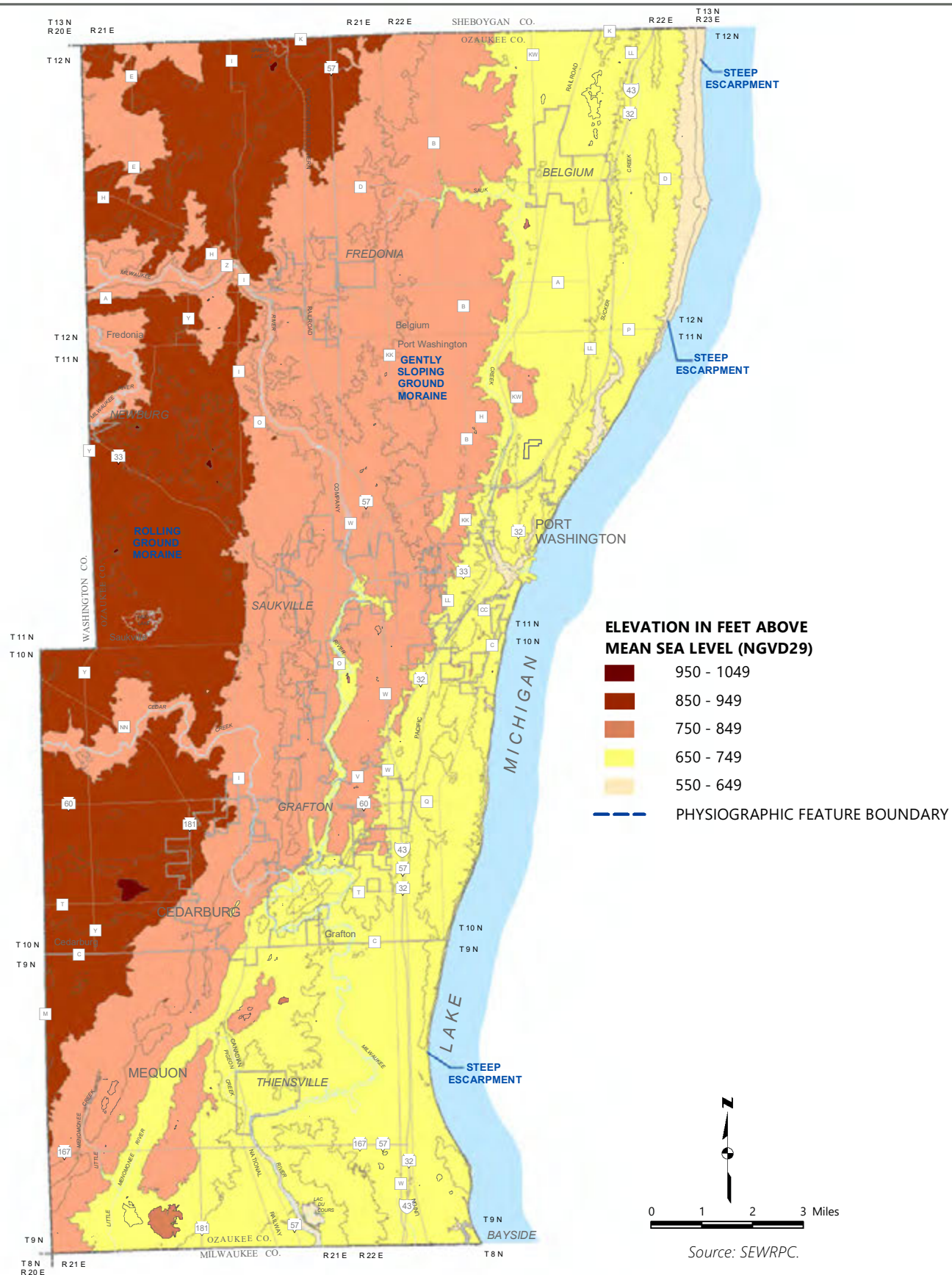
Map 2.5 Generalized Existing Agricultural Lands in Ozaukee County: 2015



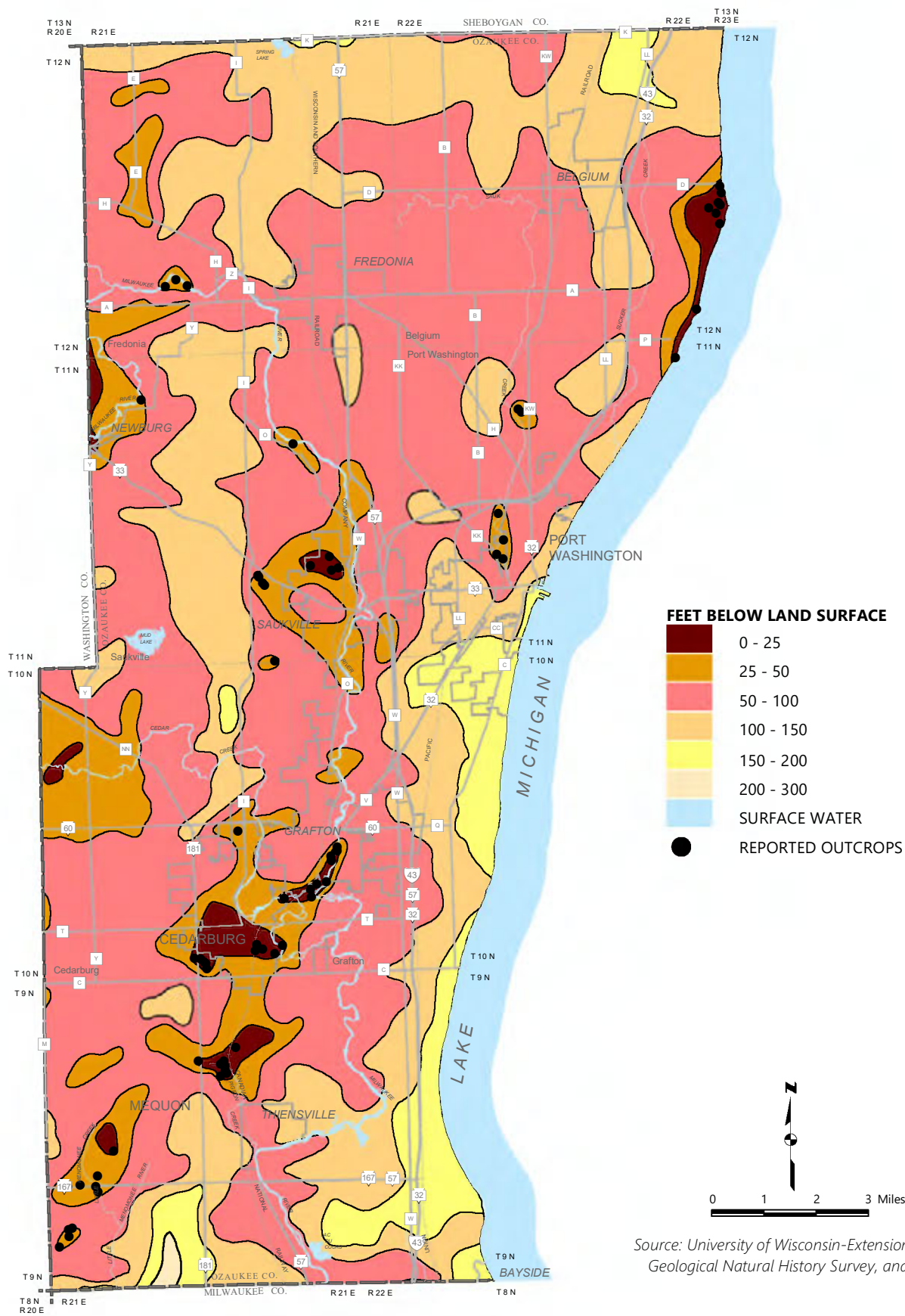
Map 2.6 Farmland Preservation Areas in Ozaukee County: 2035



Map 2.7 Physiographic Features and Generalized Topographic Characteristics in Ozaukee County

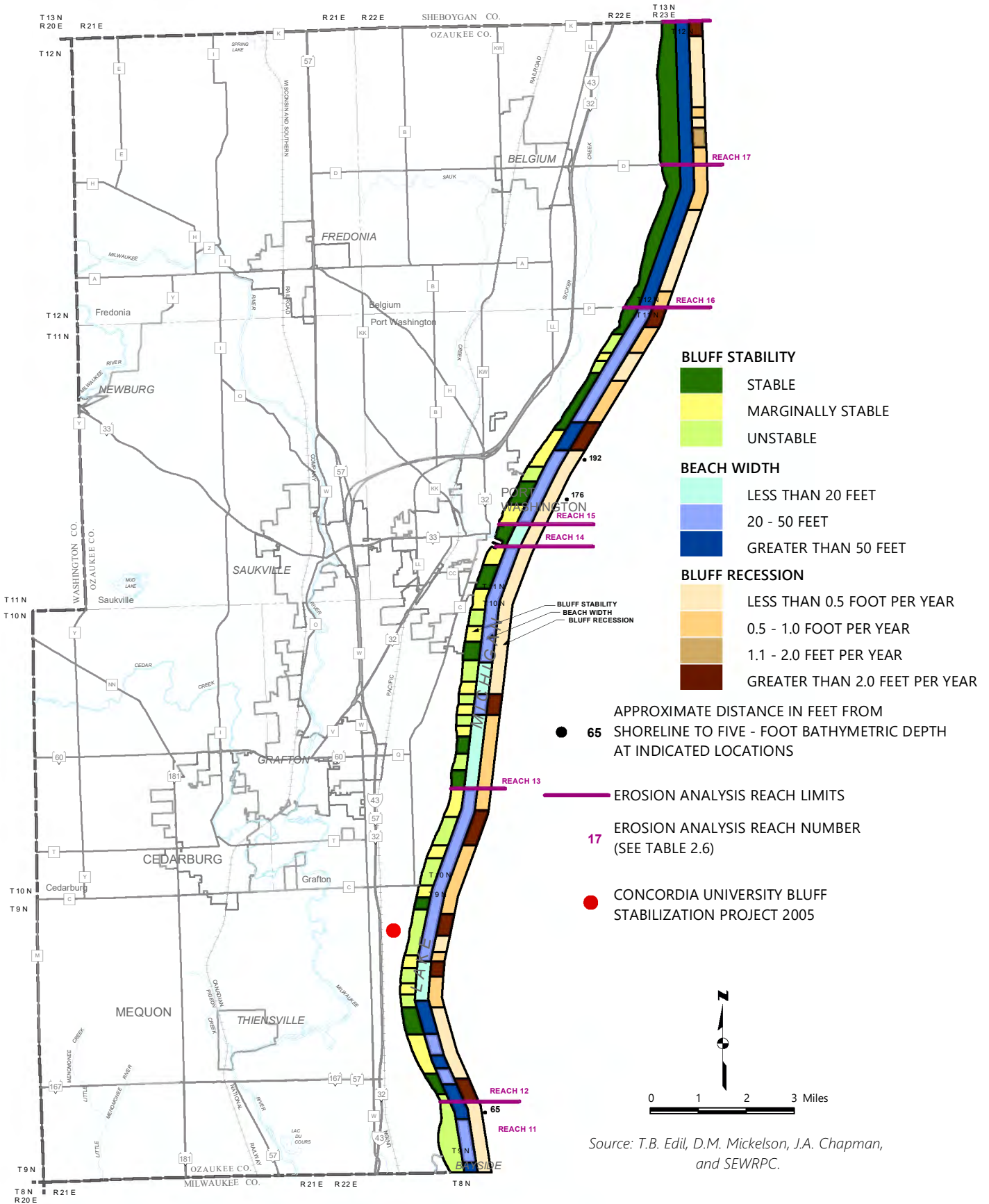


Map 2.8 Generalized Depth to Bedrock in Ozaukee County

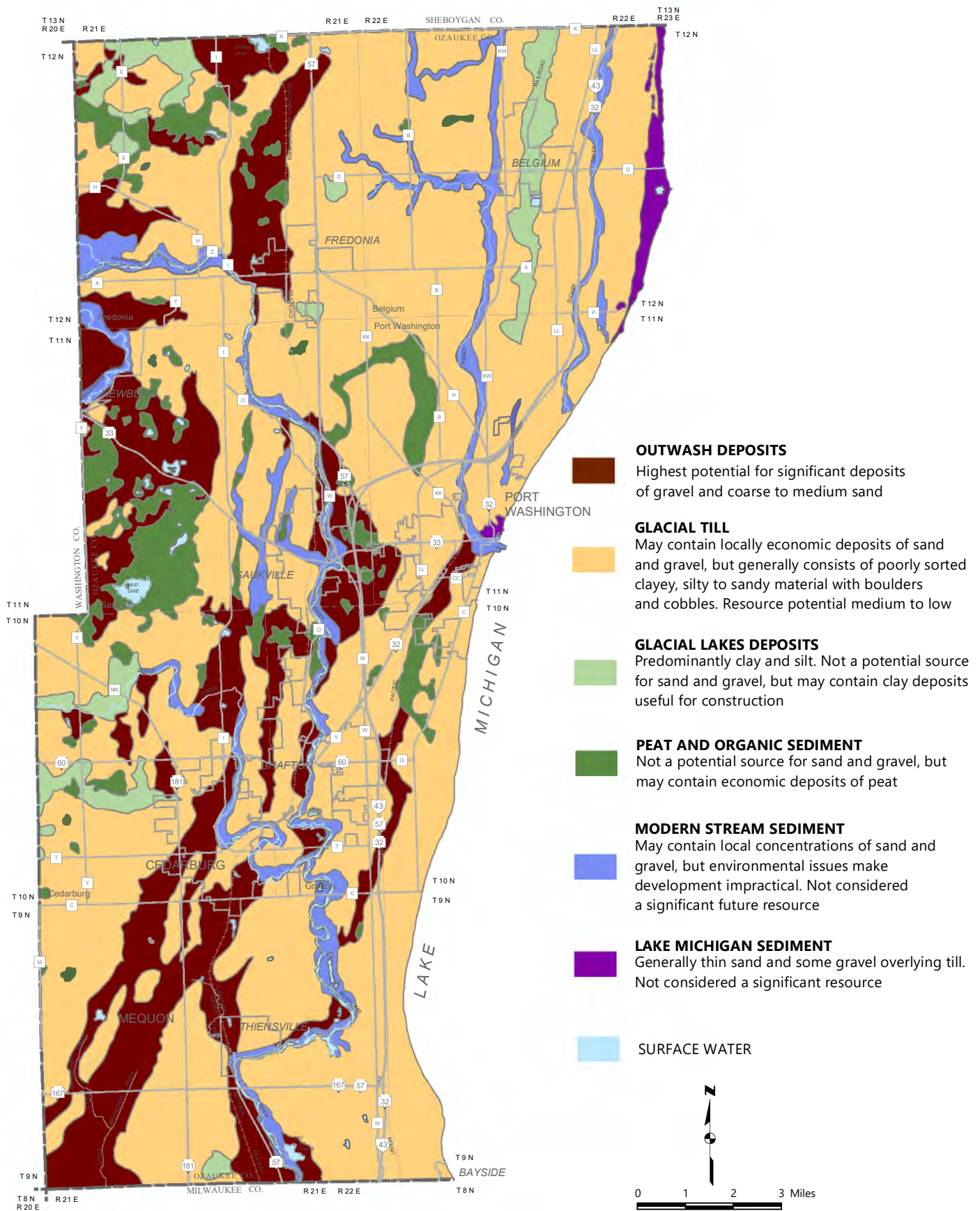


Source: University of Wisconsin-Extension, Wisconsin Geological Natural History Survey, and SEWRPC.

Map 2.9 Summary of Lake Michigan Shoreline Erosion and Bluff Stability Analysis in Ozaukee County



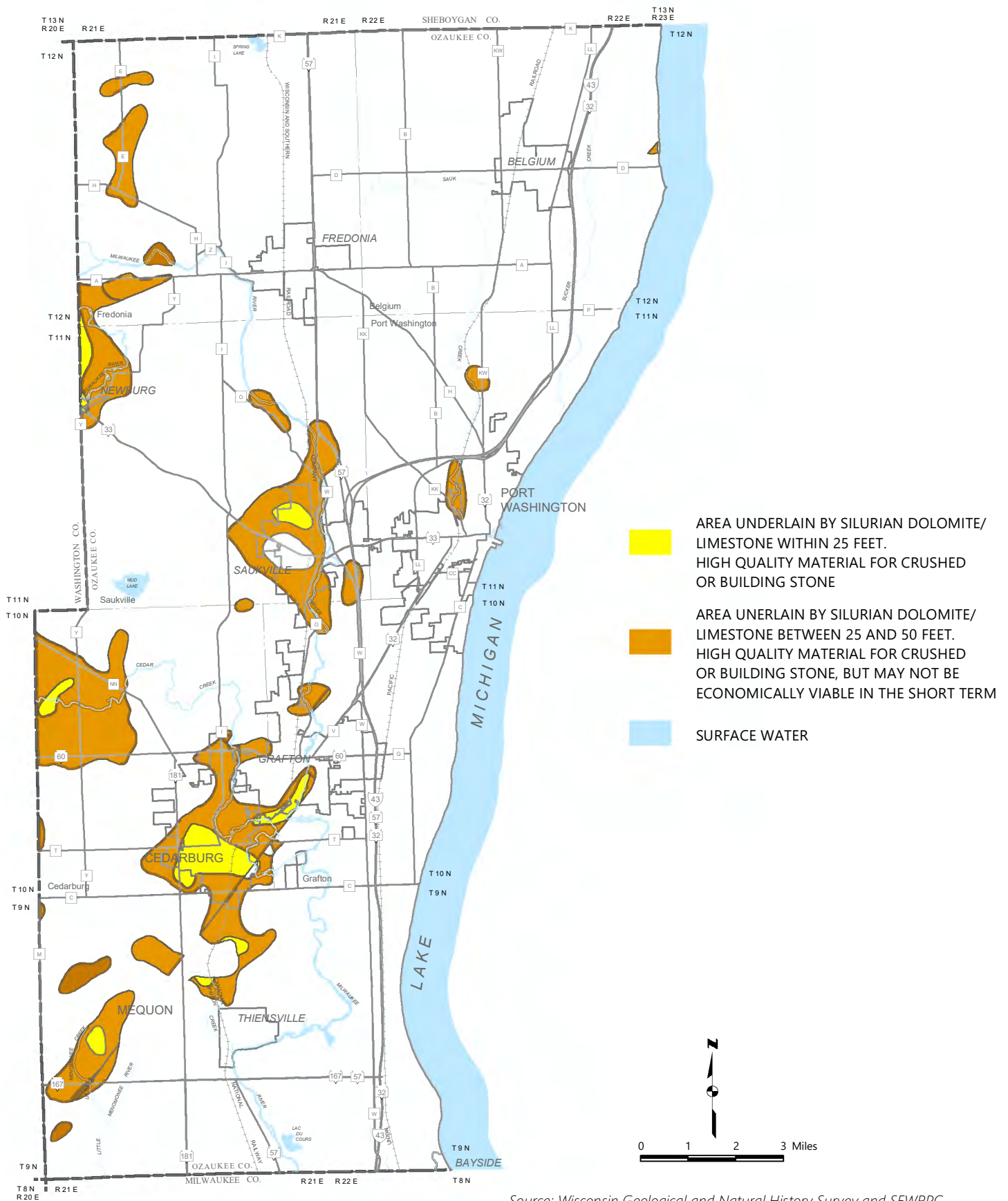
Map 2.10
Potential Sources of Sand, Gravel, Clay, and Peat in Ozaukee County



Source: Wisconsin Geological and Natural History Survey and SEWRPC.

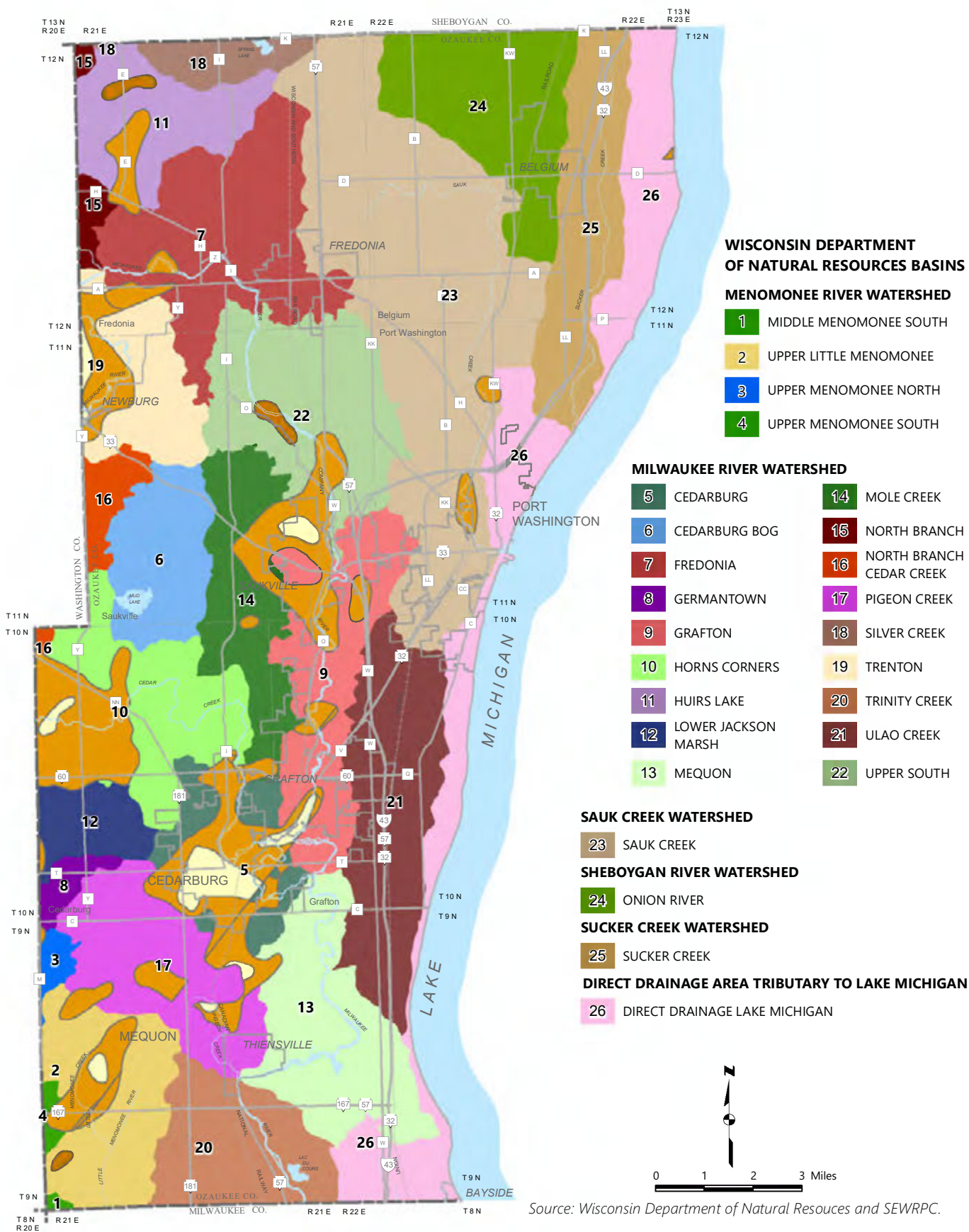
Interpretation by Bruce A. Brown, P.G. Data compilation by Michael L. Czechanski, 2006.
PRELIMINARY DRAFT

Map 2.11 Areas with Potential as Sources of Crushed or Building Stone in Ozaukee County



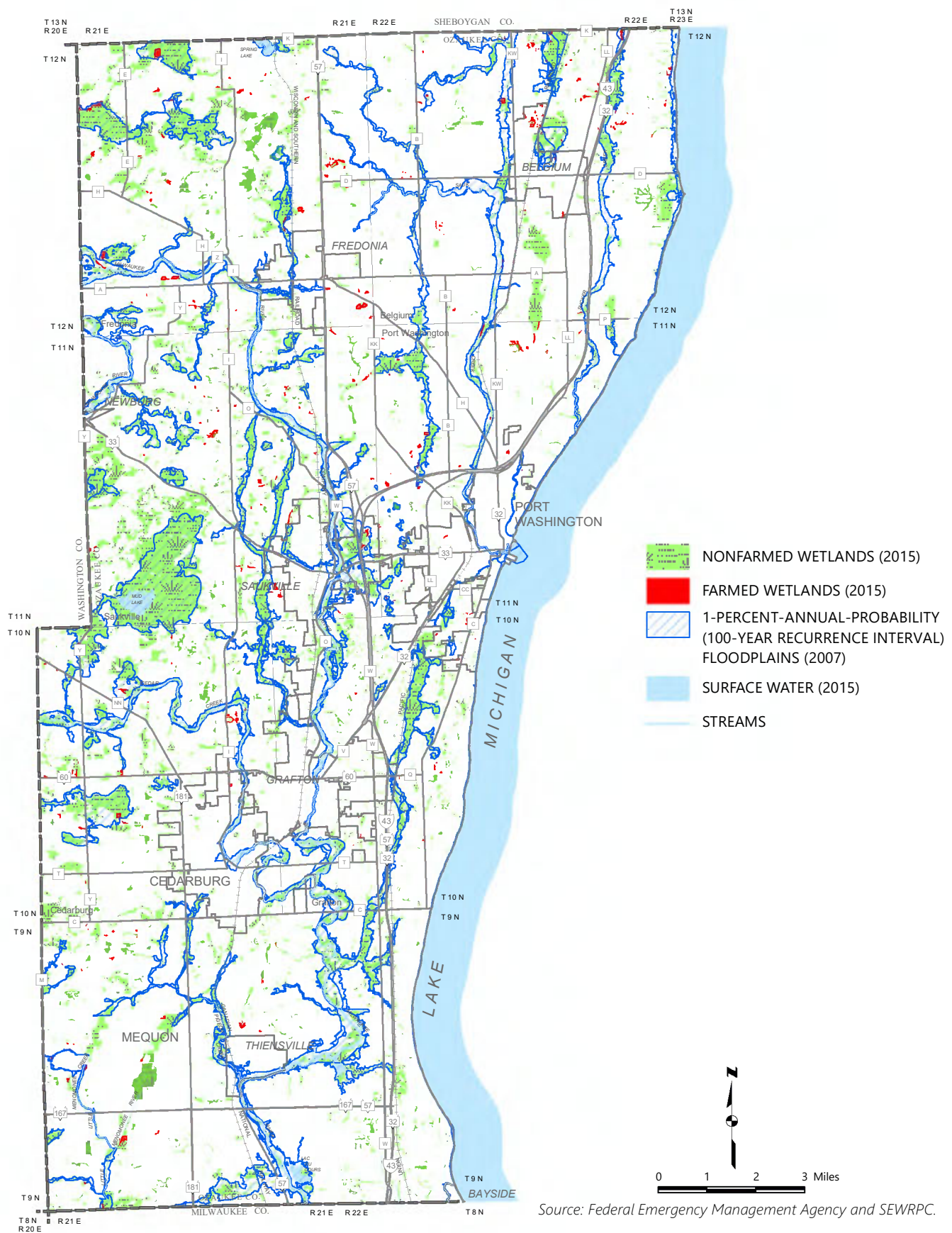
Source: Wisconsin Geological and Natural History Survey and SEWRPC.
Interpretation by Bruce A. Brown, P.G. Data compilation by Michael L. Czechanski, 2006.

Map 2.12
Watershed Features in Ozaukee County

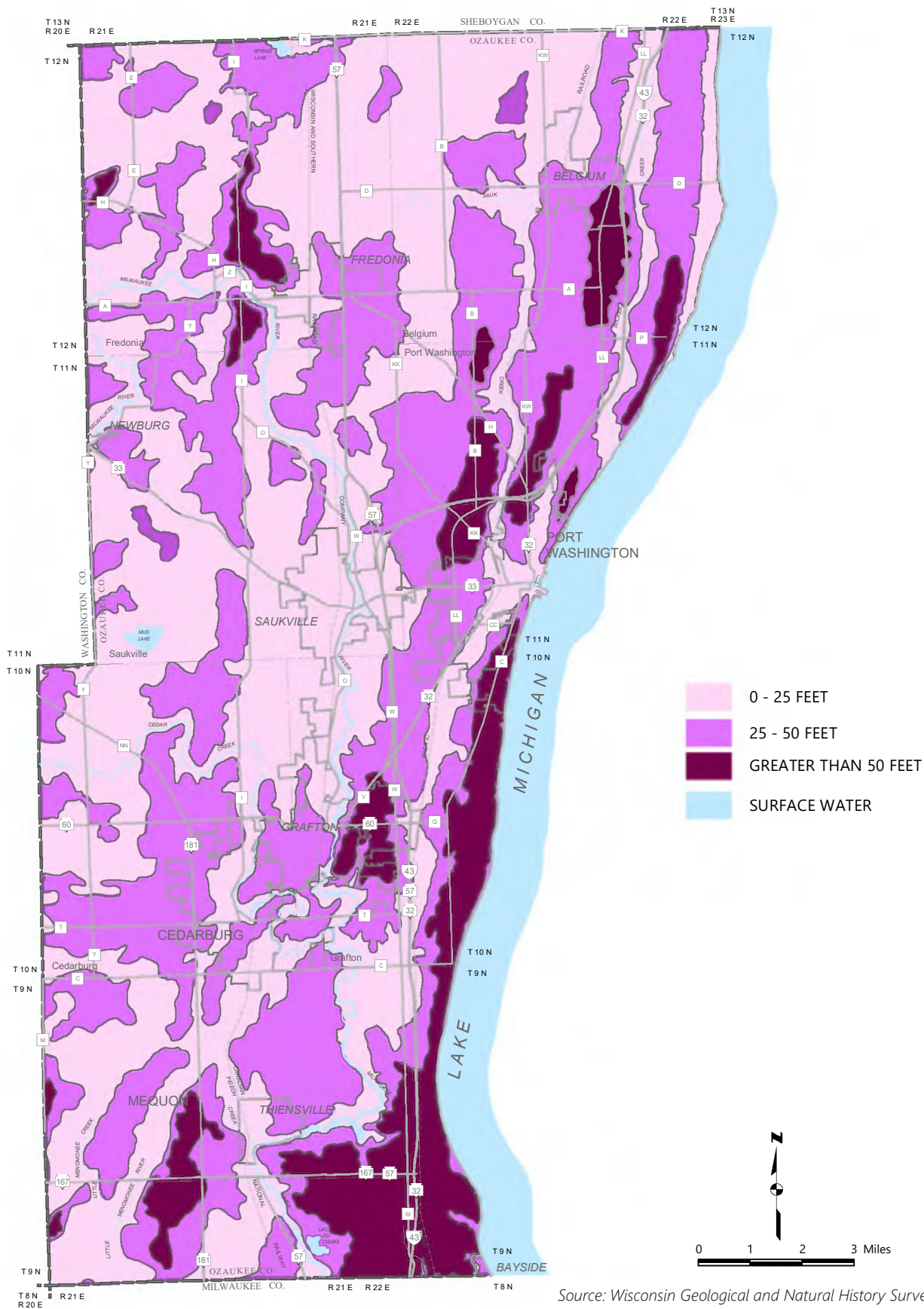


Source: Wisconsin Department of Natural Resources and SEWRPC.

Map 2.13
Surface Waters, Wetlands, and Floodplains in Ozaukee County



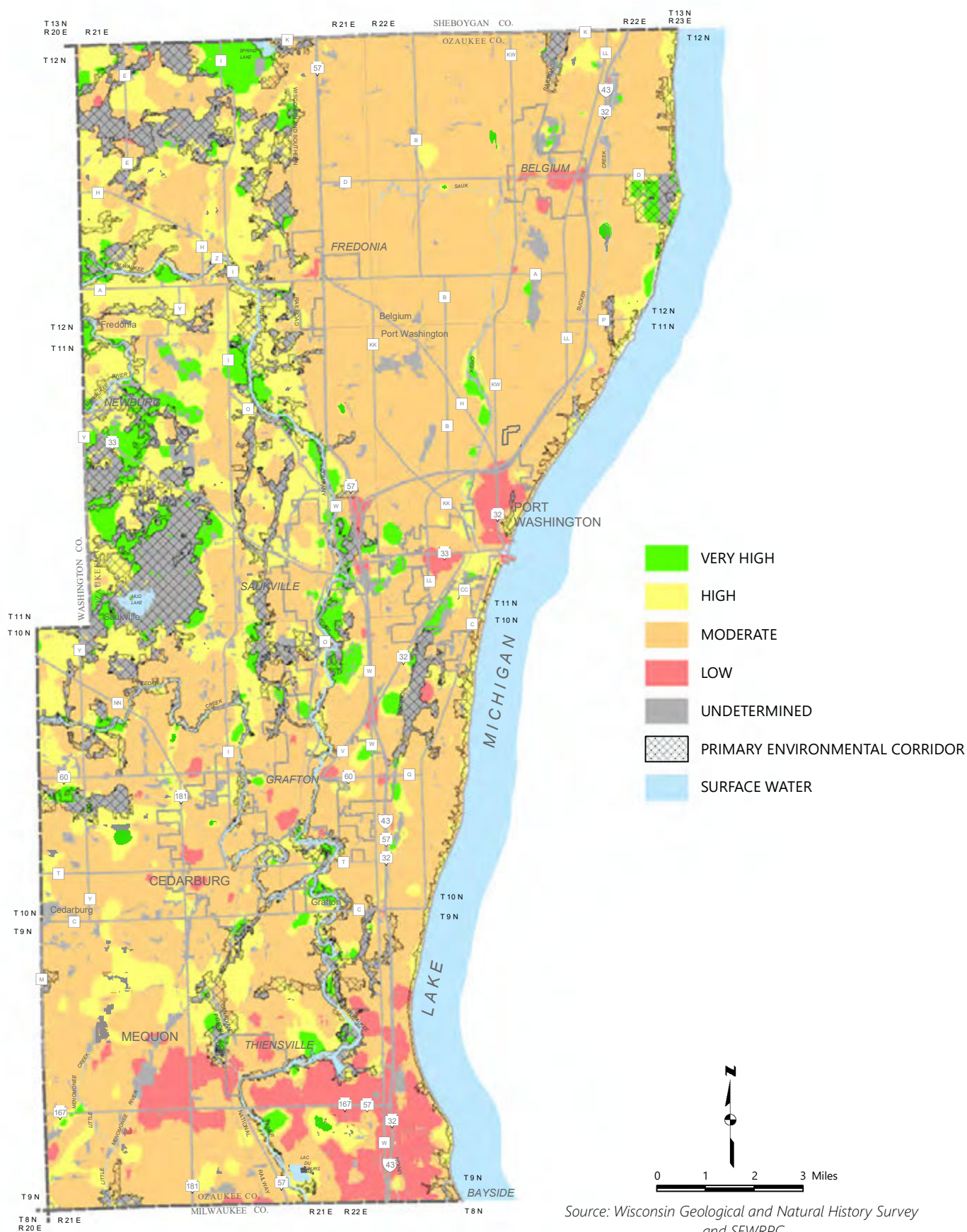
Map 2.14 Depth to Shallow Water Table in Ozaukee County



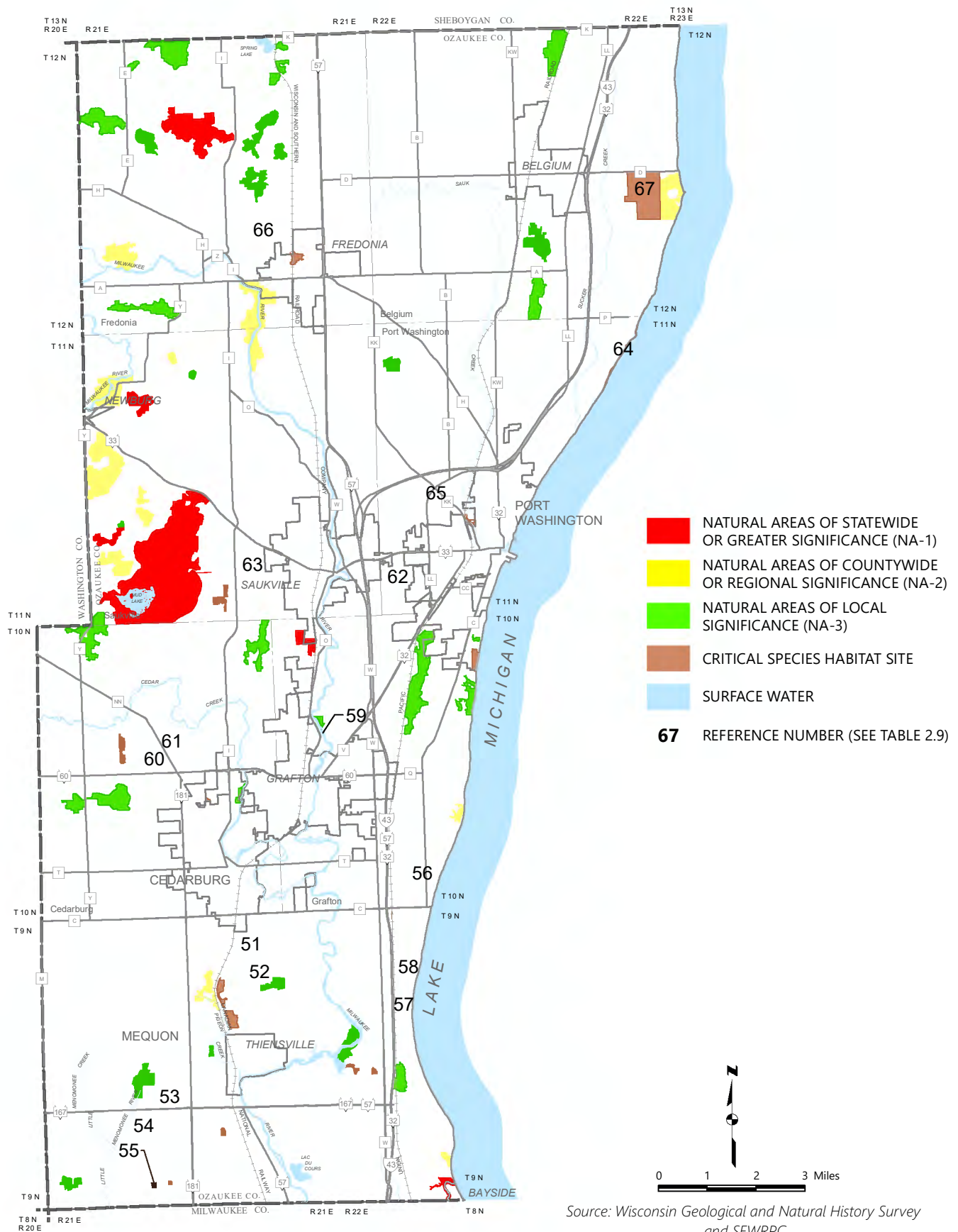
Source: Wisconsin Geological and Natural History Survey and SEWRPC.

Map 2.15

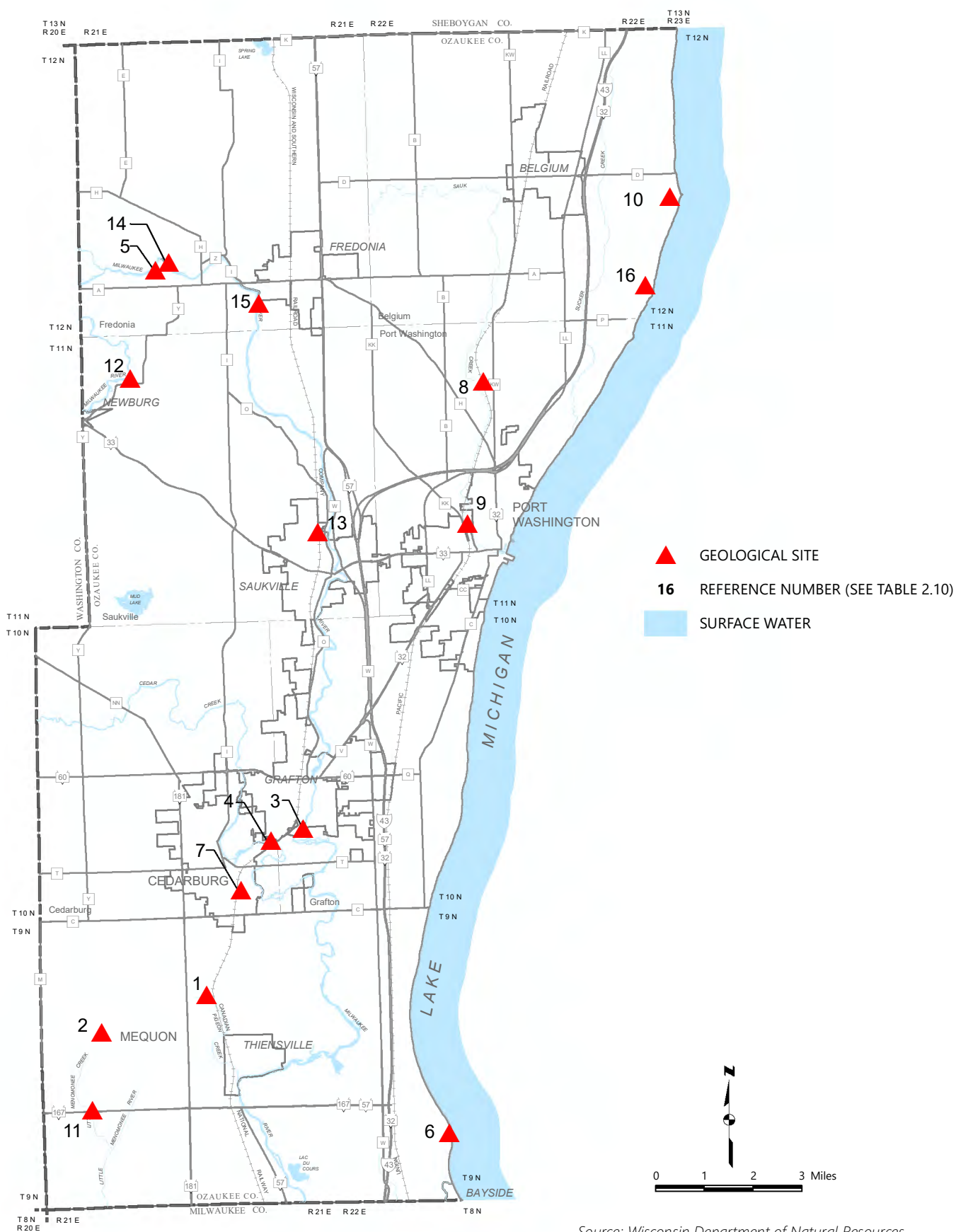
Groundwater Recharge Potential in Ozaukee County



Map 2.16
Natural Areas and Critical Species Habitat Sites in Ozaukee County

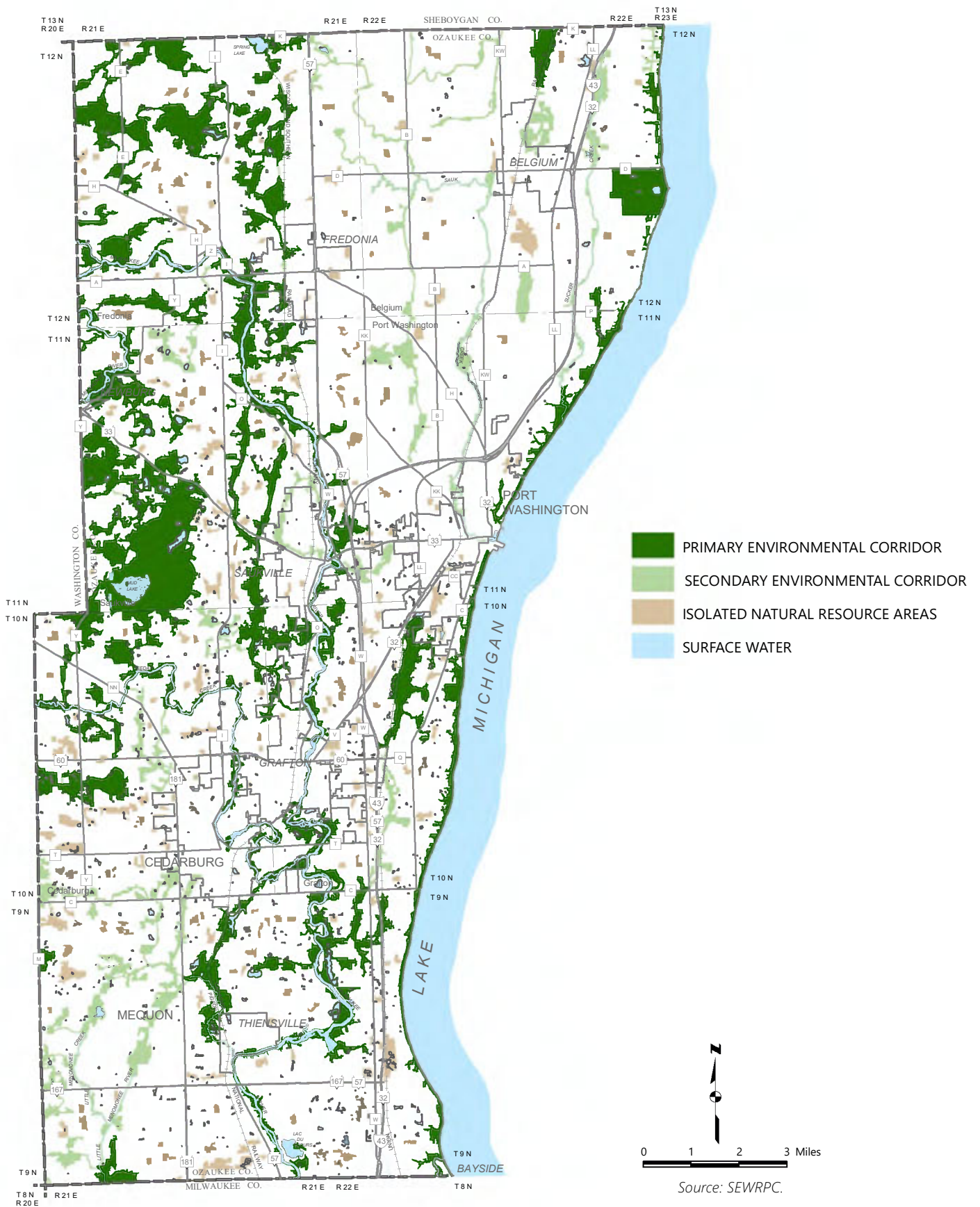


Map 2.17
Significant Geological Sites in Ozaukee County: 2009

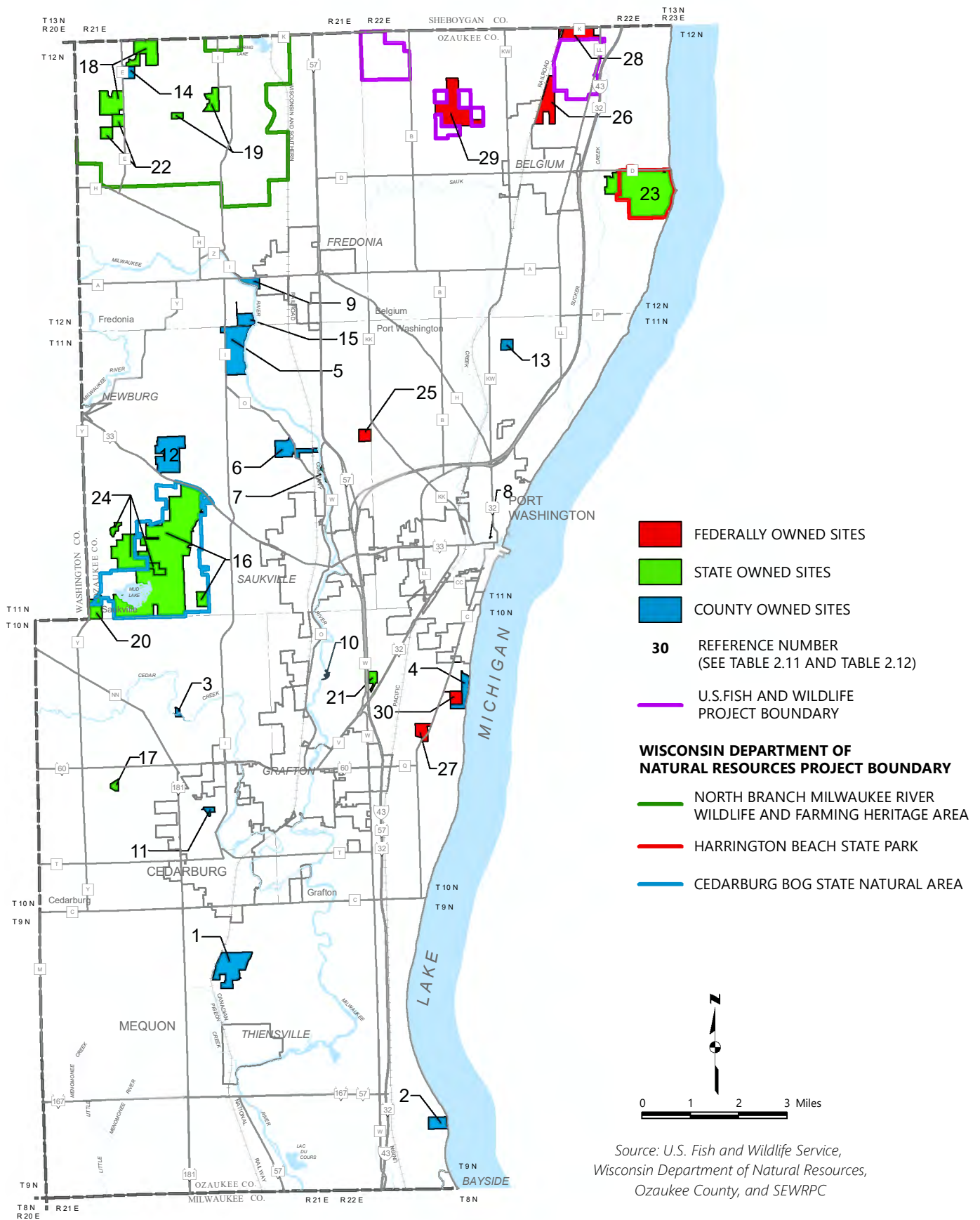


Source: Wisconsin Department of Natural Resources,
 Wisconsin Geological and Natural History Survey, and SEWRPC.

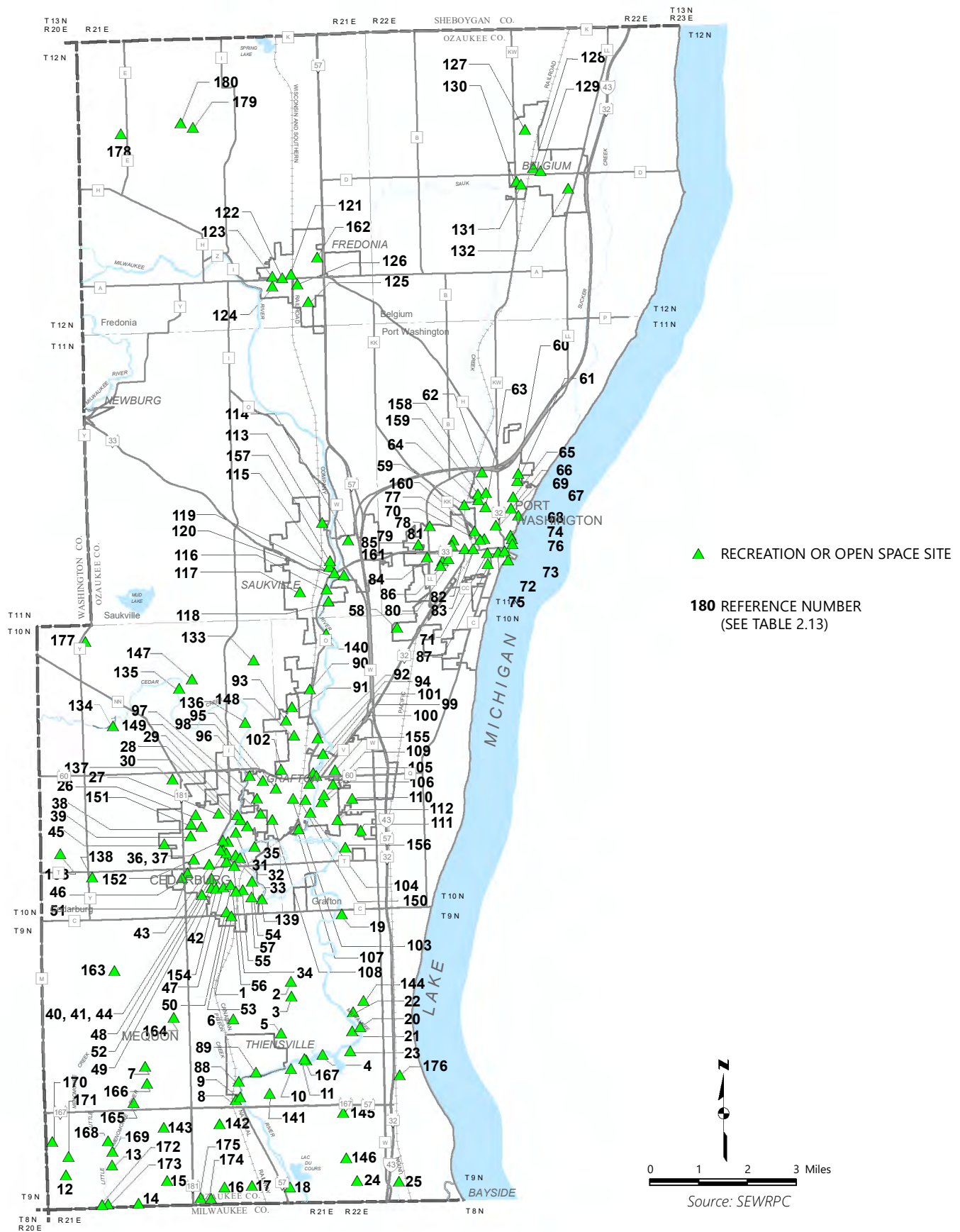
Map 2.18
Environmental Corridors and Isolated Natural Resource Areas in Ozaukee County: 2015



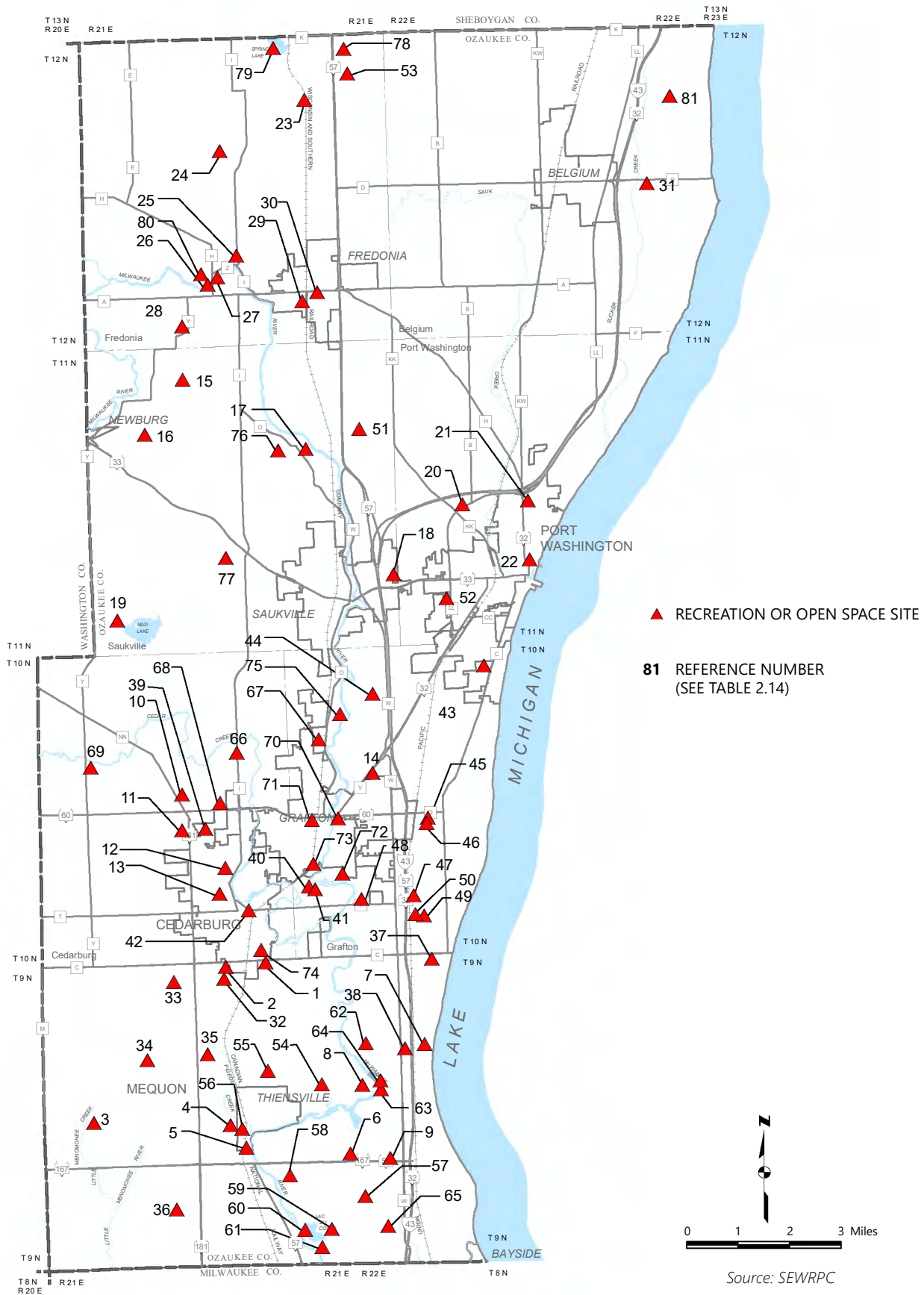
Map 2.19
Ozaukee County, State of Wisconsin, and Federal Park and Open Space Sites: 2018



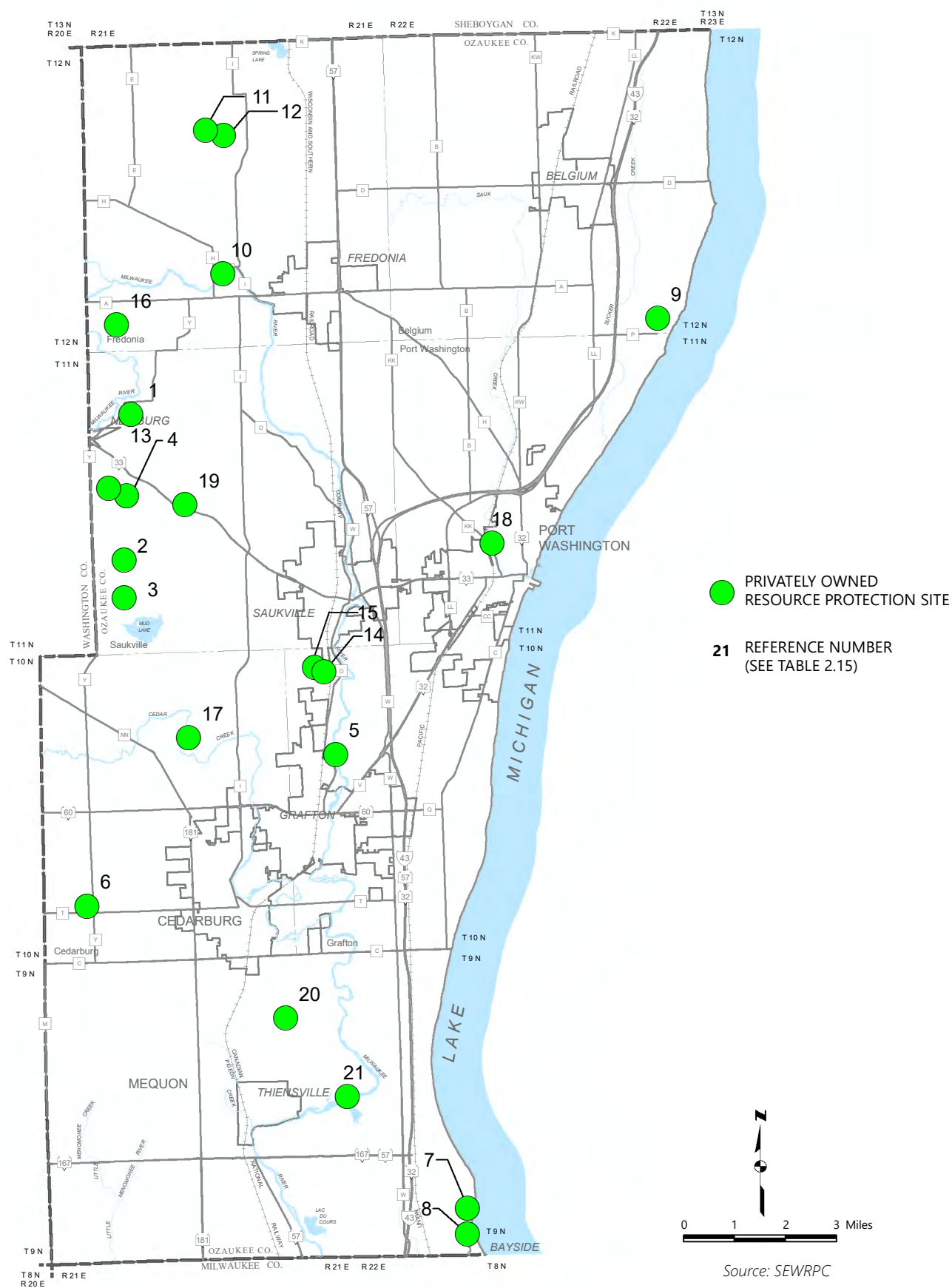
Map 2.20
Park and Open Space Sites Owned by Cities, Villages, Towns,
School Districts, or Other Public Districts in Ozaukee County: 2018



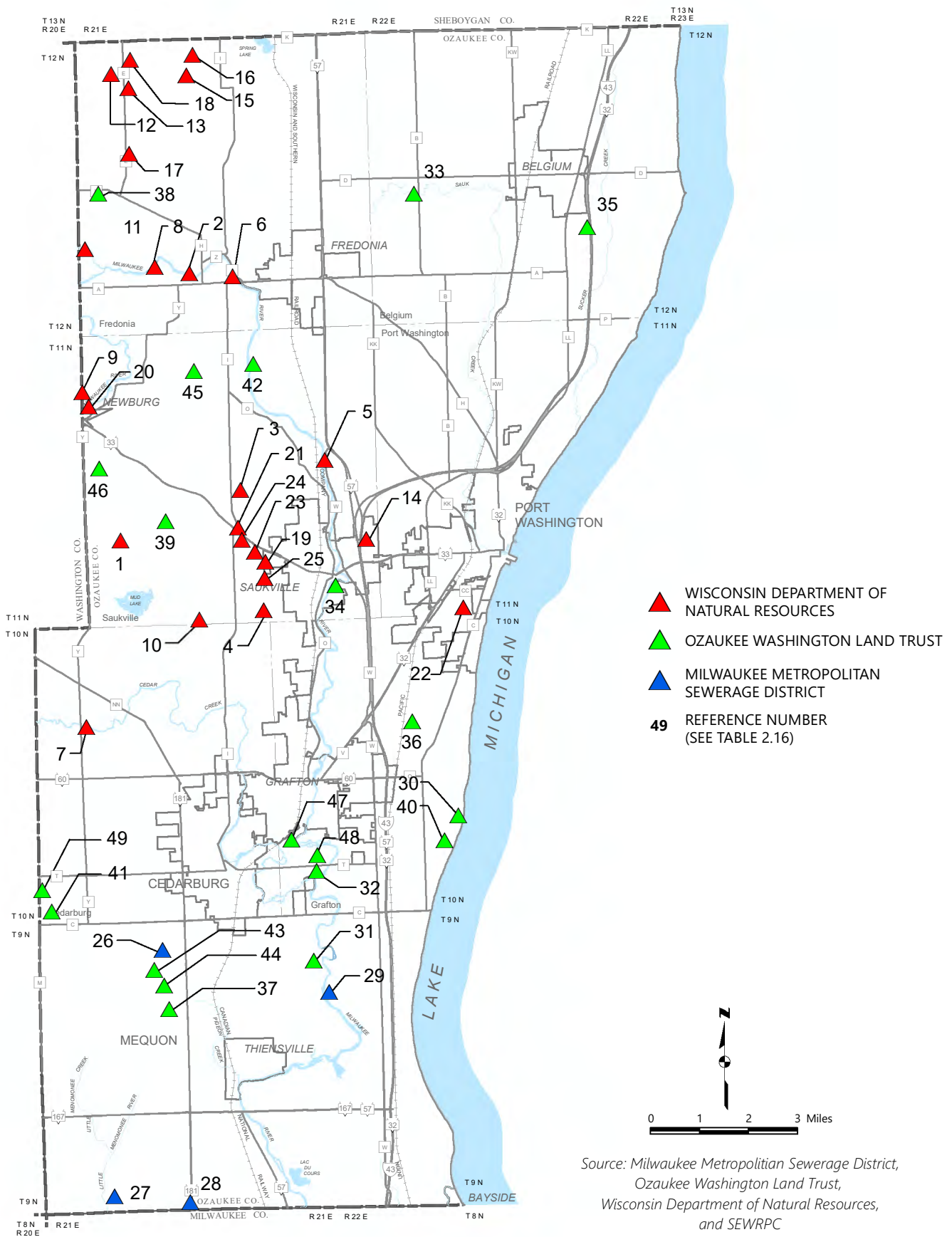
Map 2.21
Private Outdoor Recreation and Open Space Sites in Ozaukee County: 2018



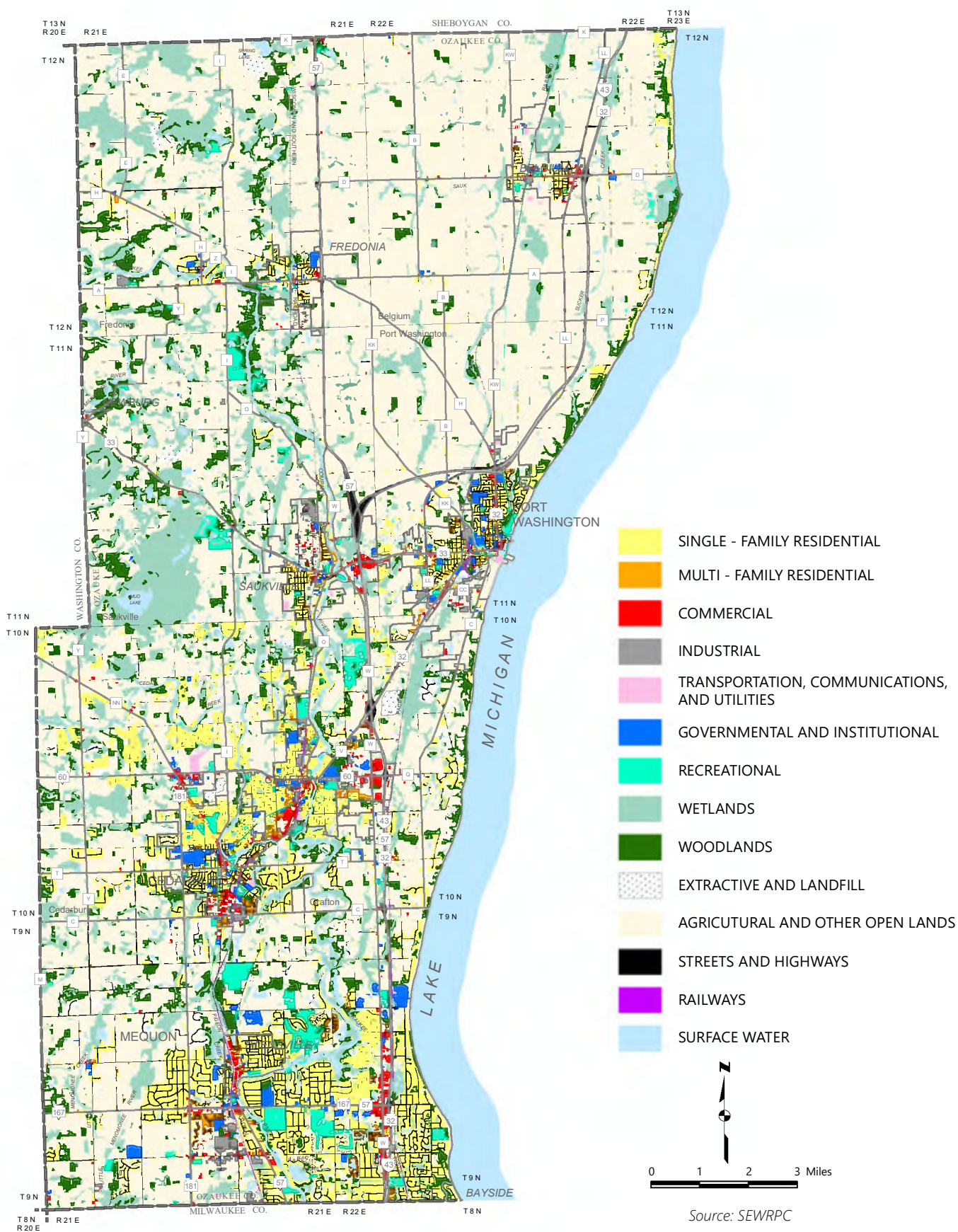
Map 2.22
Privately Owned Resource Protection Sites in Ozaukee County: 2018



Map 2.23
Lands Under Conservation Easements in Ozaukee County: 2018



Map 2.24
Generalized Land Use in Ozaukee County: 2015



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Chapter 3

RELATED PLANS, REGULATIONS, AND PROGRAMS

3.1 INTRODUCTION

This updated Ozaukee County land and water resource management plan builds upon the initial plan and complements other planning and resource management efforts and programs linking local level planning with regional and watershed level plans. The plan, therefore, provides an integrated framework within which Ozaukee County will conduct activities to protect and rehabilitate the land and water resource base of the County and contribute to the environmentally sound management of these valuable resources in a coordinated and compatible manner with watershed-wide needs and resource management programs. One of the first steps in the land and water resource management planning program is the inventory, collation, and review of the recommendations of relevant previously prepared reports and plans.

There are a number of existing plans that focus on the natural resources of Ozaukee County. These plans include programs that address the interconnection of the natural resources of Ozaukee County with those of the related watersheds and Southeastern Wisconsin, as well as the importance of natural resources at the County and community level. The plans collated and reviewed for input into this plan were generally those most relevant to actions the County has or may undertake. In addition, the land and water resource management plan also considers selected plans prepared at the local level, including local comprehensive plans, park and open space plans, lake and water quality management plans, and sewer service area plans prepared for individual communities or for special purpose units of government. All of these documents provide the basis for developing an integrated scheme for the sustainable management of the natural resources of Ozaukee County through the coordinated efforts of Federal, State, County, and local

governments, special-purpose units of government, and community groups. The land and water resource management plan provides an opportunity to promote detailed action at the local level while achieving strategic objectives within the boundaries of Ozaukee County, its watersheds, and the Region. This plan considers planning objectives identified by local officials and also those reflected in locally adopted comprehensive plans and ordinances. Accordingly, an important step in the planning process was a review of the existing framework of areawide and local plans and related land use regulations. This chapter presents a summary of that review.

3.2 REGIONAL PLANS

Regional Land Use and Transportation Plan (VISION 2050)

The regional land use and transportation plan, referred to as VISION 2050, recommends a long-range vision for land use and transportation in the seven-county Region. It makes recommendations to local and State government to shape and guide land use development and transportation improvement, including public transit, arterial streets and highways, freight, and bicycle and pedestrian facilities to the year 2050. Map 3.1 shows the recommended regional land uses¹ in Ozaukee County. The key recommendations of the plan as they pertain to land and water resource management include:

- ***Environmental Corridors***

VISION 2050 recommends limiting development within primary environmental corridors to essential transportation and utility facilities and compatible outdoor recreation facilities. Rural Estate residential development in upland environmental corridors, using cluster subdivision design at a maximum density of one dwelling unit per five acres, could also occur. The plan further recommends that local governments consider preserving secondary environmental corridors and isolated natural resource areas in natural open space uses. Map 2.18 in Chapter 2 of this report shows the primary environmental corridors within Ozaukee County.

- ***Urban Development***

VISION 2050 recommends focusing urban development within urban service areas that typically include public sanitary sewer and water supply, parks, schools, and shopping areas. New residential development would occur largely as infill, redevelopment, and new development under the Small Lot Traditional Neighborhood, Mixed-Use Traditional Neighborhood, and Mixed-Use City Center land

¹ Documented in SEWRPC Planning Report No. 55, VISION 2050: A Regional Land Use and Transportation Plan, July 2017.

use categories. This would encourage a compact development pattern that would minimize the cost of extending and maintaining urban services. It would also allow single-family homes on smaller lots (one-quarter acre or less) and multifamily housing, which tends to be more affordable to a wider range of households than single-family homes on larger lots. In addition, it would encourage walkable neighborhoods with housing in proximity to a mix of uses, such as parks, schools, and businesses. Figure 3.1 presents illustrations of the various VISION 2050 land use categories.

- ***Productive Agricultural Land***

The compact development pattern recommended under VISION 2050 would minimize the impacts of new development on productive agricultural land, including highly productive Class I and II soils (prime agricultural land), as classified by the U.S. Natural Resources Conservation Service. Some Class I and II farmland located in the vicinity of existing urban service areas may be converted to urban use as a result of planned expansion of those urban service areas to accommodate efficient regional growth. VISION 2050 defers to county plans to identify productive agricultural land. The Ozaukee County farmland preservation plan,² which was adopted in 2013, identifies prime agricultural lands. Further details about the County farmland preservation plan are provided in Section 3.3 of this report.

- ***Residential Development Outside Urban Service Areas***

VISION 2050 recommends accommodating the demand for homes in an open space setting on a limited basis through Rural Estate development where there would be no more than one home per five acres. Residential development at this density can accommodate future demand for living in an open space setting while minimizing impacts on the natural resource and agricultural base, maintaining rural character, and avoiding excessive demands on rural public facility and service systems, especially when cluster subdivision design is used. Cluster subdivision design should accommodate homes on no more than one acre of residential land (home and yard area) while maintaining the overall density of one home per five acres

Every four years, the Commission conducts an interim review and update of the regional land use and transportation plan, in part to address Federal requirements. The 2020 Review and Update assessed implementation to date of VISION 2050, reviewed the year 2050 forecasts underlying the plan, and monitored current transportation system performance. The 2020 Review and Update

² Documented in SEWRPC Community Assistance Planning Report No. 87 (2nd Edition), A Farmland Preservation Plan for Ozaukee County, Wisconsin, December 2013.

examined whether it remains reasonable for the recommendations in VISION 2050 to be accomplished over the next 30 years, given the implementation of the plan to date and available and anticipated funding for the transportation component. Based on the implementation evaluation and public input, no changes were made to the land use component of the plan. VISION 2050 will continue to recommend: focusing new urban development in urban centers; a compact development pattern with a mix of housing types and uses; and preserving primary environmental corridors and agricultural land.

Regional Natural Areas Plan

Map 2.16 in Chapter 2 of this report presents the regional natural areas plan as it pertains to Ozaukee County. The natural areas plan³ identifies the most significant remaining natural areas, critical species habitats, geological sites, and archaeological sites in the Region, and recommends means for their protection and management. The plan identifies potential sites for public or private protective ownership, and protection of other sites, insofar as it is possible, through zoning or other regulatory means without protective ownership. It also recommends preparing and implementing a detailed management plan for each site placed under protective ownership. Table 2.9 in Chapter 2 includes an inventory of natural areas, critical species habitat sites, and geological areas in the County.

Regional Park and Open Space Plan

The regional park and open space plan consists of two basic elements: an open space preservation element and an outdoor recreation element.⁴ The open space preservation element consists of recommendations for preserving primary environmental corridors within the Region. The outdoor recreation element consists of a resource-oriented outdoor recreation element that provides recommendations for the number and location of large parks, recreation corridors, and water-access facilities, and an urban outdoor recreation element that provides recommendations for the number and distribution of local parks and outdoor

³ SEWRPC Planning Report No. 42, A Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin, September 1997, documents the 1994 inventory. SEWRPC Amendment to Planning Report No. 42, Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin, December 2010 documents the plan update.

⁴ SEWRPC Planning Report No. 27, A Regional Park and Open Space Plan for Southeastern Wisconsin: 2000, November 1977.

recreational facilities required in urban areas of the Region. The Ozaukee County park and open space plan⁵ refines, details, and extends this regional plan.

Regional Water Quality Management Plan

In 1979, SEWRPC completed and adopted a regionwide water quality management plan for Southeastern Wisconsin as a guide to achieving clean and healthy surface waters within the seven-county Region. The design of the plan is, in part, to meet the Congressional mandate that the waters of the United States be “fishable and swimmable” to the extent practical. It is set forth in SEWRPC Planning Report No. 30, *A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000*, Volume One, *Inventory Findings*, September 1978; Volume Two, *Alternative Plans*, February 1979; and Volume Three, *Recommended Plan*, June 1979. Subsequently, SEWRPC completed a report documenting the updated content and implementation status of the regional water quality management plan: SEWRPC Memorandum Report No. 93, *A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report*, March 1995. This status report also documents the extent of progress made toward meeting the water use objectives and supporting water quality standards set forth in the regional plan.

The 2007 regional water quality management plan update for the greater Milwaukee watersheds^{6,7} addressed three major elements of the original regional water quality management plan: the land use element; the point source pollution abatement element; and the nonpoint source pollution abatement element, and it also included consideration of instream and riparian habitat considerations. Conduct of the regional water quality management plan update planning effort was in conjunction with development of the MMSD 2020 facilities plan. The 2013 amendment revisions were based on changes to the watershed water quality models necessitated by findings during additional modeling efforts conducted after the plan report was issued. Conduct of those modeling efforts was under a separate study directed toward evaluating the possible effects of climate change on water quality in the streams in the study area.

⁵ SEWRPC *Community Assistance Planning Report No. 133 (3rd Edition)*, A Park and Open Space Plan for Ozaukee County, June 2011.

⁶ SEWRPC *Planning Report No. 50*, A Regional Water Quality Management Plan Update for the Greater Milwaukee Watersheds, December 2007, amended May 2013.

⁷ The greater Milwaukee watersheds are the Kinnickinnic, Menomonee, Milwaukee, and Root River watersheds, the Oak Creek watershed, and the Lake Michigan direct drainage area, of which portions of the Menomonee and Milwaukee River watersheds, and the Lake Michigan direct drainage area, are located in Ozaukee County.

The original regional water quality management plan and its subsequent updates and status reports include specific recommendations for reducing nonpoint source pollutant levels. Evaluation of the degree to which the adopted water use objectives for rivers and streams could meet recommended plan conditions within the greater Milwaukee watersheds were based on detailed water quality modeling.

Regional Water Supply Plan

The Commission has conducted a regional water supply study and planning program for the Southeastern Wisconsin Region.⁸ The regional water supply plan together with past SEWRPC groundwater inventories and development of a ground water simulation model^{9,10} form the basis of the SEWRPC regional water supply management program. These three elements were prepared in collaboration with the U.S. Geological Survey (USGS), the Wisconsin Geological and Natural History Survey, the University of Wisconsin-Milwaukee, the Wisconsin Department of Natural Resources (WDNR), and many of the area's water supply utilities.

The regional water supply plan includes the following major components:

- Identification of public utility water supply service areas.
- Recommendations for source of water supply for identified service areas.
- A recommendation for implementing comprehensive water conservation programs, including both supply side efficiency measures and demand side conservation measures with the scope and content of these programs to be determined on a utility-specific basis reflecting the type and sustainability of the source of supply and probable future water supply infrastructure requirements.
- Identification of important groundwater recharge areas and recommendations for protecting and preserving recharge areas that have a high or very high recharge potential.

⁸ SEWRPC Planning Report No. 52, A Regional Water Supply Plan for Southeastern Wisconsin, December 2010.

⁹ SEWRPC Technical Report No. 37, Groundwater Resources of Southeastern Wisconsin, June 2002.

¹⁰ SEWRPC Technical Report No. 41, A Regional Aquifer Simulation Model for Southeastern Wisconsin, June 2005.

- Recommendations for implementing state-of-the-art stormwater management practices which, to the extent practicable, will maintain the natural recharge of areas committed to urban land use development.
- Recommendations related to siting new high-capacity wells.
- Recommendations for installing enhanced rainfall infiltration systems in areas where evaluations conducted in conjunction with the siting of high-capacity wells in the shallow aquifer indicate probable reductions in baseflow on nearby streams or water levels in nearby lakes and wetlands due to the installation and operation of these wells.

The recommendations and guidance given in the plan should be considered by municipalities in Ozaukee County when evaluating the sustainability of proposed developments and in conducting local land use planning.

3.3 COUNTY AND MULTI-JURISDICTIONAL PLANS

Ozaukee County Multi-Jurisdictional Comprehensive Plan

The Ozaukee County multi-jurisdictional comprehensive plan¹¹ was adopted in 2008, and an amendment to incorporate local plans was approved by the Ozaukee County Board in 2009. With the exception of the City of Cedarburg, all cities, towns, and villages in the County, including the Village of Newburg which straddles the Ozaukee-Washington County line, participated in the multi-jurisdictional planning program to develop the comprehensive plan for the county and each of the participating local governments. As part of the planning process, the County and local governments identified existing and future land uses and important natural resources that should be preserved to maintain the high quality of life in Ozaukee County. Map 3.1 reflects the desired land use pattern as adopted by the Ozaukee County Board of Supervisors in

¹¹ Documented in SEWRPC Community Assistance Planning Report No. 285, A Multi-Jurisdictional Comprehensive Plan for Ozaukee County: 2035, April 2008, amended May 2009.

May 2009. Maps 111 through 124¹² in Chapter XIII of the County comprehensive plan show the land use plan maps adopted by local communities.

The County and local comprehensive plans were prepared to comply with the requirements of Wisconsin's comprehensive planning law, which took effect in 1999. The law, set forth in Section 66.1001 of the *Wisconsin Statutes*, requires County and local governments that enforce zoning, subdivision, or official mapping ordinances to have an adopted comprehensive plan by January 1, 2010. The law requires comprehensive plans to include nine elements: issues and opportunities; agricultural, natural, and cultural resources; land use; housing; transportation; utilities and community facilities; economic development; intergovernmental cooperation; and implementation. The land use element includes the land use plan map for Ozaukee County for the design year 2035, as shown on Map 96 of the County comprehensive plan. The land use plan map serves as a visual representation of the plan and supports the plan's goals, objectives, policies, and programs. In addition, the law requires that the planning process identify and map natural limitations to building site development and environmentally sensitive lands (see Maps 92 and 94, respectively, of the County comprehensive plan). The law further requires that the plan identify and map productive agricultural soils. A land evaluation and site assessment (LESA) analysis by the County meets this requirement and was used to develop goals and objectives for farmland preservation in Chapter VII of the County comprehensive plan. Map 84 of the County comprehensive plan shows the results of the LESA analysis.

Essentially, Ozaukee County and participating local communities envision most urban development will continue to occur within planned urban (sanitary) service areas. The County and local communities also desire the preservation of agricultural resources, environmentally sensitive areas, and rural and small town (community) character. Many of the agricultural, natural, and cultural resource goals and objectives identified in Chapter VII, *Agricultural, Natural, and Cultural Resources Element*, of the County comprehensive plan address these desires.

¹² There have been amendments of the County land use plan map and several local government land use plan maps since their initial adoption. Contact the Ozaukee County Planning and Parks Department for amendments to the County comprehensive plan, and the city, town, or village clerk to determine if a particular community has adopted any amendments to its local comprehensive plan.

Ozaukee County Park and Open Space Plan

The current Ozaukee County park and open space plan¹³ was adopted by the County Board of Supervisors in June 2011. With a planning horizon of 2035, the plan allows the County to maintain its eligibility to apply for and receive Federal and State aids to support acquiring and developing park and open space sites and facilities. The plan consists of both an open space preservation element and an areawide outdoor recreation element, intended to, respectively, protect areas containing important natural resources and to provide major parks, areawide trails, and resource-oriented recreational facilities. Major parks are publicly owned parks at least 100 acres in size that provide opportunities for such resource-oriented activities as camping, golfing, picnicking, and swimming. The plan assigns responsibility for providing community parks, neighborhood parks, and local trails to cities, villages, and towns.

The adopted park and open space plan recommends protecting about 33,262 acres of open space lands, or about 22 percent of the County, through a combination of public or nonprofit conservation organization ownership, conservation easements, or protective zoning. These 33,262 acres include planned primary and secondary environmental corridors, planned isolated natural resource areas, and areas outside corridors but within U.S. Fish and Wildlife Service, the WDNR, and Ozaukee County project boundaries. This plan also recommends that the State, Ozaukee County, and local units of government preserve to the extent practicable prime agricultural lands in Ozaukee County. In regard to key actions related to natural resources, it is recommended that: the WDNR continue to acquire lands at Harrington Beach State Park; six new parks (five of which were already owned by the County) be added to the County park system; and the County consider developing a water trail system.

Specifically, the County park and open space plan recommends acquiring about 7,489 acres of land for park and open space preservation purposes, for which the County would be responsible for acquiring about 2,526 acres of that total. The plan recommends that the County develop additional facilities at Hawthorne Hills County Park, Mee-Kwon County Park, Tendick Nature Park, and six other parks owned by Ozaukee County; develop six new parks to be added to the County park system; develop trails within the Milwaukee River and Little Menomonee River Corridors; and continue to maintain existing County parks and the Ozaukee Interurban Trail.

¹³ Documented in SEWRPC Community Assistance Planning Report No. 133, (3rd Edition), A Park and Open Space Plan for Ozaukee County, June 2011.

Ozaukee County Farmland Preservation Plan

The current Ozaukee County farmland preservation plan¹⁴ was adopted by the County Board of Supervisors in July 2013. With a planning horizon of 2035, the plan intends to address the requirements of the Wisconsin Farmland Preservation Program (as set forth in Chapter 91 of the *Wisconsin Statutes*) and related tax credits under subchapter IX of Chapter 71 of the *Statutes*, which requires counties to update their farmland preservation plans. The County plan was prepared in cooperation with UW-Extension and 10 participating local governments. Map 31 in Chapter V of the County farmland preservation plan shows the Farmland Preservation Plan for Ozaukee County.

Agriculture is an important part of the County's economy and, due to changes in agricultural practices as well as the demand for new agricultural products and technologies, there is potential growth for agricultural industries and supporting businesses. In addition to its impact on the economy, the plan considers farmland preservation important to providing scenic beauty, preserving natural ecological systems, producing fresh locally grown produce, and preserving the rural character and lifestyle in much of the County. The agriculture industry continues to be a vital element of Ozaukee County's economic, cultural, and ecological landscape. To retain these attributes, implementing a farmland preservation plan is essential, and provides a foundation and guide for many preservation methods and tools that County and local governments and nonprofit conservation organizations can use to protect farmlands.

In accordance with Section 91.10(1)(d) of the *Wisconsin Statutes*, a county farmland preservation plan must clearly identify areas that the county plans to preserve for agricultural and agricultural-related uses. Developing criteria for identifying farmland preservation areas (FPAs) was part of the planning process. In accordance with the Statutes, FPAs include undeveloped natural resource and open space lands, but do not include areas planned for nonagricultural development. Map 28 in Chapter V of the County farmland preservation plan shows the FPAs.

Comprehensive Watershed and Basin Plans

The Regional Planning Commission has developed a comprehensive plan for the Milwaukee River watershed.¹⁵ The Milwaukee River Watershed encompasses about 151 square miles, or about 64 percent of the total land area of Ozaukee County. The remaining 36 percent of Ozaukee County includes: the

¹⁴ Documented in SEWRPC Community Assistance Planning Report No. 87 (2nd Edition), A Farmland Preservation Plan for Ozaukee County: 2035, *Ozaukee County, Wisconsin*, December 2013.

¹⁵ SEWRPC Planning Report No. 13, A Comprehensive Plan for the Milwaukee River Watershed, October 1971.

Sheboygan River, Sauk Creek, and Sucker Creek watersheds which are all direct tributaries to Lake Michigan; certain lands located immediately adjacent and which drain directly to Lake Michigan; and the Menomonee River Watershed. The Sheboygan River Watershed encompasses about 11 square miles, or about five percent of the total land area of Ozaukee County. The Sauk Creek Watershed encompasses about 34 square miles, or about 15 percent of the total land area of Ozaukee County. The Sucker Creek Watershed encompasses about 10 square miles, or about four percent of the total land area of Ozaukee County. Comprehensive plans have not been developed for the Sauk Creek, Sucker Creek, or Sheboygan River watersheds. The Milwaukee River plan includes delineations of new floodplain boundaries and updates to existing boundaries along many streams in each sub-watershed. While dated, a number of recommendations flowing from the Plan remain highly relevant today. The Plan includes recommendations for future land use, park and open space needs, stormwater and floodland management, water quality management, and fisheries management. The watershed plan also recommends continuing to maintain and preserve primary and secondary environmental corridors and isolated natural resource areas in open space uses, and preserving and restoring potential wetland and prairie areas.

The WDNR also prepares State of the Basin Reports for each major basin in the State to provide an overview of land and water resource quality, identify challenges facing these resources, and outline future actions for the WDNR. The State of the Basin reports for Ozaukee County include the Milwaukee River basin.¹⁶ This report has identified the high priority issues and actions that will need to be monitored and managed to restore and protect the basin's resources for the present and future.

Flood Mitigation

At the time of preparation of this land and water resource management plan, the Regional Planning Commission and the Ozaukee County Division of Emergency Management were cooperatively preparing a Hazards Mitigation Plan Update for Ozaukee County. The plan includes flood mitigation recommendations to minimize flood damages in the County. The study area for the plan includes the entire County.

The primary objective of the flood mitigation portion of the hazard mitigation plan is to mitigate damages to buildings located adjacent to the streams and lakes of the County. Consistent with regional, State, and Federal flood mitigation standards, the plan addresses floods with recurrence intervals up to, and including, 100-years. Because of the somewhat scattered nature of flooded structures in the County, the plan assigns a high priority to voluntary acquisition and demolition or voluntary floodproofing of flooded structures in

¹⁶ Wisconsin Department of Natural Resources, *The State of the Milwaukee River Basin, August 2001, PUBL WT-704-2001*.

the County. Future mitigation investigations for areas with a large number of flooded structures could include structural projects such as levees or storage facilities.

Watershed Restoration Plans

Menomonee River Watershed Restoration Plan

The Milwaukee Metropolitan Sewerage District (MMSD), in collaboration with the Southeastern Wisconsin Watersheds Trust, Inc. (SWWT), has developed a watershed restoration plan for the Menomonee River watershed.¹⁷ This plan was developed within the overall framework provided by the SEWRPC regional water quality management plan update for the greater Milwaukee watersheds, and the primary purpose was to identify specific actions to improve water quality that could have been implemented between 2010 and 2015, and to present general recommendations for activity beyond 2015. The plan identifies recommended actions based upon consideration of many factors, including overall effectiveness, scientific underpinning, regulatory considerations, and stakeholder goals.

Through the stakeholder input of the SWWT, three major focus areas emerged for the watershed restoration plan: bacteria/public health; habitat; and nutrients/phosphorous. These focus areas reflect the linkage between water quality parameters and water use in the Menomonee River watershed. Relative to these focus areas, the plan identifies a set of targets to achieve over the plan period.

The plan seeks to identify and develop management strategies that could meet the targets in a cost-effective manner. The approach the plan uses assumes implementing the existing regulations for point and nonpoint sources of pollution. The analysis used in developing the plan assumes the management strategies recommended to meet these regulations are in place and can serve as the foundation upon which new management strategies can be added to achieve the desired goals. The watershed restoration plan categorizes these management strategies, comprised of facilities, policies, operational improvements, and programs into three categories: existing regulatory management strategies; other management strategies in various states of implementation; and management strategies recommended for implementation under the regional water quality management plan update for the greater Milwaukee watershed, but which have not yet been implemented.

¹⁷ *Milwaukee Metropolitan Sewerage District, Menomonee River Watershed Restoration Plan, April 2010.*

The plan also prioritizes the identified management strategies. As part of this prioritization, the plan identifies as foundational actions those management strategies whose implementation is necessary for achieving the full benefit of other strategies.

Additional, more detailed water quality related information can be found in Section 3.8 of Chapter 3 of the LWRMP.

Fredonia-Newburg Area Watershed-Based Plan

MMSD, in collaboration with the WDNR, hired Applied Ecological Services, Inc. (AES) and AquaVitae (AV) to conduct a watershed planning effort and produce a comprehensive watershed-based plan for the Fredonia-Newburg Area watersheds.¹⁸ This plan meets the requirements of the United States Environmental Protection Agency (USEPA) to develop and implement a watershed-based plan designed to enable waterbodies within the watershed to achieve water quality standards/criteria (i.e. nine key element watershed plan).

The watershed planning process is a collaborative effort involving voluntary stakeholders whose primary intent is to restore impaired waters and protect unimpaired waters by developing an ecologically based management plan. The Fredonia-Newburg Area watershed-based plan focuses on improving water quality by prioritizing cost effective projects in areas where progress in improving water quality is possible. Water quality improvement projects include protecting green infrastructure, creating protection policies, implementing ecological restoration, and educating the public.

Having a watershed-based plan will allow Fredonia-Newburg Area watershed stakeholders to access 319 Grant funding and other funding for watershed improvement projects recommended in the plan.

Additional, more detailed water quality related information can be found in Section 3.8 of Chapter 3 of the LWRMP.

¹⁸ Documented in Milwaukee Metropolitan Sewerage District, Fredonia-Newburg Area Watershed-Based Plan, Ozaukee, Sheboygan and Washington Counties, Wisconsin, A Strategy for Protecting and Restoring Watershed Health, Final Report, October 2019, prepared by Applied Ecological Services, Inc. and AquaVitae.

Cedar, Pigeon, Ulao, and Mole Creeks Watershed Restoration Plan

SWWT, in collaboration with the MMSD, the WDNR, the Washington County Land and Water Conservation Division, the Ozaukee County Land and Water Management Division, and the Milwaukee RiverKeeper, has developed a watershed restoration plan for the Cedar, Pigeon, Ulao, and Mole Creeks sub-watersheds.¹⁹ This plan was developed within the overall framework provided by the SEWRPC regional water quality management plan update for the greater Milwaukee watersheds, and the primary purpose is to provide guidance in project planning, prioritizing, and identifying investment opportunities among diverse watershed stakeholders working toward achieving improved water quality. The plan will serve as a non-point source implementation plan for the specified sub-watersheds, to make progress in meeting the allocations in the Total Maximum Daily Loads (TMDL)²⁰, to address other pollutants found in the waters such as chlorides, and to ultimately delist the impaired waters from the 303(d) list. The plan intends to provide guidance on watershed restoration during the period of 2020 through 2030.

The plan builds upon prior watershed planning for the planning area by, among other things, ensuring that the plan satisfies the nine key elements recommended by the United States Environmental Protection Agency (USEPA) and provides reasonable assurance that the recommended management measures will help to achieve plan goals toward improved water quality and impaired stream delisting.

Additional, more detailed water quality related information can be found in Section 3.8 of Chapter 3 of the LWRMP.

TMDL Study for the Milwaukee River Basin

In 2018, CDM Smith, on behalf of the MMSD and the WDNR, completed a TMDL study²¹, for the U.S. Environmental Protection Agency, Region 5. U.S. Environmental Protection Agency regulations and the Clean Water Act require states to identify waterbodies that do not meet established water quality standards and to develop TMDLs for those impaired waterways. Elevated phosphorus, sediment, and bacteria levels in the Milwaukee River Basin have led to low dissolved oxygen concentrations, degraded habitat, excessive algal growth, turbidity, and recreational impairments. As a result, impairments to beneficial uses within the

¹⁹ *Southeastern Wisconsin Watersheds Trust, Inc., Cedar, Pigeon, Ulao, and Mole Creeks Watershed Restoration Plan, June 2020.*

²⁰ *A TMDL is the amount of a pollutant a waterbody can receive and still meet water quality standards.*

²¹ *Documented in Total Maximum Daily Loads for Total Phosphorus, Total Suspended Solids, and Fecal Coliform, Milwaukee River Basin, March 19, 2018, prepared by CDM Smith.*

Basin, such as preserving and enhancing fish and other aquatic life and recreational use, have occurred. The purpose of this study is to describe the overall TMDL development process, the water quality impairments within the Basin, the technical approach and assumptions used to develop TMDLs for each impaired waterbody, the load and wasteload allocations by source that must be met to achieve water quality standards and targets, and the management practices that can be considered for TMDL implementation. This study also developed an implementation plan for the TMDLs, consisting of those programs and management measures needed to provide reasonable assurance toward achieving the load allocations developed for this TMDL study. The actual allowable load of pollutants for each TMDL reach is set forth in Appendix A of the study.

Additional, more detailed water quality related information can be found in Section 3.8 of Chapter 3 of the LWRMP.

Key Item: TMDL plans and TMDL-related programs and projects, particularly those located within the Milwaukee River Basin and the Cedar Creek and Milwaukee River (Thiensville Section), are priority issues for Ozaukee County.

Comprehensive Conservation Plan for the Leopold Wetland Management District

In 2008, the Leopold Wetland Management District (WMD), administered by the U.S. Fish and Wildlife Service, prepared a Comprehensive Conservation Plan²² for managing habitat, wildlife, and public use in the District. Established in 1993, the Leopold WMD manages almost 13,500 acres (an increase of about 1,500 acres since 2013) of Waterfowl Production Areas in 17 counties in the southeastern portion of Wisconsin including Ozaukee County, covering some of the most important waterfowl areas of the State. The plan outlines how the District will fulfill its legal purpose and contribute to the National Wildlife Refuge System's wildlife, habitat, and public use goals, objectives, and strategies for the next 15 years. The plan is a guide for strategic planning and prioritizing programs. Affected communities were involved in the planning process.

²² U.S. Fish and Wildlife Service - Leopold Wetland Management District, Comprehensive Conservation Plan, 2008.

Conservation and Greenway Connection Plans

The MMSD, with the assistance of SEWRPC, prepared a “greenway connection plan”²³ as a companion to a “Conservation Plan”²⁴ prepared by the Conservation Fund staff, a National nonprofit conservation organization. The Conservation Plan identifies land parcels to protect for multiple purposes including flood reduction, stormwater management, wildlife habitat, water quality, and recreational benefits. The Conservation Plan identified 165 sites for protection through public acquisition or conservation easements throughout the Menomonee River, Root River, and Oak Creek watersheds within the District’s planning area. The planning area within Ozaukee County includes the City of Mequon and the Village of Thiensville. The greenway connection plan identifies potential greenway corridors connecting, and typically downstream of, the isolated parcels identified in the Conservation Plan. In addition, it envisions that the planning process would synthesize the results of the other related open space planning efforts undertaken in the MMSD area, resulting in a comprehensive District-wide greenway connection plan having flood mitigation benefits as well as a wide range of other environmental benefits. In 2018, MMSD owned 18 sites in Ozaukee County (an increase of nine sites since 2010), under its “Greenseams” program with assistance from the Conservation Fund.

North Branch Milwaukee River Wildlife and Farming Heritage Area Plan

The WDNR established the North Branch Milwaukee River Wildlife and Farming Heritage Area in 2002. A feasibility study for the North Branch Area sets forth goals for creating grasslands and restoring wetlands, while maintaining the viability of farming in the area. The study identifies all townships in the North Branch study area as critical habitat within the Southeast Focus Area of the Upper Mississippi River and Great Lakes Region Joint Venture of the North American Waterfowl Management Plan (1992). As such, the area is eligible to receive grants through the North American Wetland Conservation Act because of the potential for, and value to wildlife of, restoring grasslands and wetlands and because some of the highest waterfowl breeding densities come from this area of the State. The project site consists of about 19,487 acres that lie within the Milwaukee River Basin and includes portions of northwestern Ozaukee County, northeastern Washington County, and southwestern Sheboygan County. The project site encompasses river and stream corridors, large wetland complexes, agricultural lands, and three minor lakes. Map 2-19 in Chapter 2 of this report shows the portion of the project site within Ozaukee County.

²³ Documented in SEWRPC Memorandum Report No. 152, A Greenway Connection Plan for the Milwaukee Metropolitan Sewerage District, December 2002.

²⁴ The Conservation Fund; Applied Ecological Service, Inc.; Heart Lake Conservation Associates; Velasco & Associates; and K. Singh & Associates, Conservation Plan, technical report submitted to MMSD, October 31, 2001.

3.4 CITY, VILLAGE, AND TOWN PLANS

City, Village, and Town Park and Open Space Plans

Park and open space plans prepared by local units of government are set forth in Table 88 in Chapter V of the County comprehensive plan. The plans identify needed recreational facilities and delineate natural areas and other open spaces to preserve within their respective community. Each plan intends to further establish or maintain eligibility for Federal Land and Water Conservation Fund and Wisconsin Stewardship Fund grant programs administered by the WDNR. The Ozaukee County comprehensive plan and comprehensive plans for participating local governments incorporate the recommendations from the existing city, village, and town park and open space plans.

3.5 COUNTY AND LOCAL ORDINANCES

Good community development depends not only on quality planning at all levels of government, but on practical implementation measures as well. Land use and development regulations affect the type of uses allowed on a parcel, as well as the detailed design and site layout of proposed developments. The following presents a summary of land use regulations adopted by Ozaukee County²⁵ and zoning, subdivision, and official mapping regulations adopted by participating local governments.

Zoning

A zoning ordinance is a public law that regulates and restricts the use of property in the public interest. The primary function of zoning should be to implement an adopted master or comprehensive plan and plan elements or components thereof, including land use and farmland preservation plans. A zoning ordinance divides a community into districts for the purpose of regulating the use of land and structures (including areas to preserve); the height, size, shape, and placement of structures; and the density of housing. A zoning ordinance typically consists of two parts: a text setting forth regulations that apply to each of the various zoning districts, together with related procedural and administrative requirements; and a map delineating the boundaries of zoning districts.

²⁵ Ozaukee County also exercises zoning authority over County-owned lands in unincorporated areas, in accordance with an ordinance adopted by the County Board on May 1, 2013.

County Shoreland and Floodplain Zoning Ordinances

Under Section 59.692 of the *Wisconsin Statutes*, counties are responsible for zoning shoreland areas within unincorporated areas. The *Statutes* define shoreland areas as lands within the following distance from the ordinary high-water mark of navigable waters: 1,000 feet from a lake, pond, or flowage; and 300 feet from a river or stream or to the landward side of the floodplain, whichever distance is greater.

The Ozaukee County Shoreland and Floodplain Zoning Ordinance includes restrictions on uses in wetlands located in the shorelands, and limits the types of uses that can occur in the 100-year recurrence interval flood hazard area to prevent damage to structures and property and to protect the floodwater conveyance and storage capacity of floodplains. The ordinance also includes restrictions on the removal of vegetation and other activities in the shoreland area, and requires that most structures be set back a minimum of 75 feet from navigable waters. Minimum requirements for uses in unincorporated shoreland areas are set forth in Chapter NR 115 of the *Wisconsin Administrative Code*. Minimum floodplain requirements are set forth in Chapter NR 116. Map 2-13 in Chapter 2 depicts the floodplains located within the County. Map 25 in Chapter II of the County farmland preservation plan depicts the shorelands and shoreland wetlands within the County.

County regulations continue to apply in shoreland areas annexed by cities and villages after May 7, 1982, unless the city or village adopts shoreland regulations that are at least as restrictive as those included in the County ordinance. Where County regulations continue in effect, the city or village is responsible for enforcing the regulations. Cities and villages are also required to regulate wetlands of five acres or larger within shoreland areas, including those that were in the city or village prior to 1982, under Chapter NR 117 of the *Wisconsin Administrative Code*; and to enforce the minimum floodplain standards set forth in Chapter NR 116 within all floodplain areas of the city or village.

County Animal Waste Storage Ordinance

Chapter 12 of the Ozaukee County Code of Ordinance sets forth the County's Animal Waste Storage regulations. The purpose of the ordinance is to regulate the design, siting, construction, installation, alteration, closure, and use of animal waste storage facilities, and the application of wastes from these facilities in order to prevent water pollution, and thereby protect the health and safety of residents and transients, prevent the spread of disease, and promote the prosperity and general welfare of the citizens of Ozaukee County.

Local Zoning Ordinances

Each city, town, and village in Ozaukee County has adopted a zoning ordinance. Appendix D in the County farmland preservation plan presents zoning district maps and regulations for each participating local government. Map 26 in the County farmland preservation plan also depicts generalized basic zoning in Ozaukee County for participating local governments based on zoning in effect in 2010.

Land Division Regulations

A land division ordinance is a public law that regulates the division of land into smaller parcels. Land division ordinances provide for appropriate public oversight of the creation of new parcels and help ensure that new development is appropriately located; lot size minimums specified in zoning ordinances are observed; arterial street rights-of-way are appropriately dedicated or reserved; access to arterial streets and highways is limited in order to preserve the traffic-carrying capacity and safety of such facilities; adequate land for parks, drainageways, and other open spaces is appropriately located and preserved; street, block, and lot layouts are appropriate; and adequate public improvements are provided. Cities, villages, towns, and counties can enact land division ordinances, with the latter's approval authority applying only to unincorporated (town) areas and limited objecting authority applying within cities and villages. Thus, within towns, it is possible for both counties and towns to have concurrent jurisdiction over land divisions. Cities and villages also have "extraterritorial" plat approval jurisdiction over subdivisions proposed in town areas near their corporate boundaries.

Chapter 236 of the *Wisconsin Statutes* sets forth general requirements governing the subdivision of land, including, among others, surveying and monumenting requirements, necessary approvals, recording procedures, and requirements for amending or changing subdivision maps. The *Statutes* also grant authority to county and local governments to review subdivision maps, commonly referred to as plats, with respect to local plans and ordinances. Section 236.45 authorizes county and local governments to adopt their own land division ordinances, which may be more restrictive than State requirements.

The Ozaukee County shoreland and floodplain zoning ordinance includes land division regulations for areas located in the shoreland. Ozaukee County also has authority under Section 236.10 of the *Statutes* to review and approve all subdivisions located in unincorporated portions of the County. All cities, towns, and villages in the County have adopted a land division ordinance. Chapter 236 requires local governments to review and act on plats for subdivisions. Subdivisions are defined in the *Statutes* as "a division of a lot, parcel, or tract of land by the owner thereof or the owner's agent for purpose of sale or of building development, where the act of division creates five or more parcels or building sites of 1.5 acres each or less in area; or

five or more parcels or building sites of 1.5 acres each or less in area are created by successive divisions within a period of five years.” Local subdivision ordinances may be broader in scope and require review and approval of land divisions in addition to those meeting the statutory definition of a “subdivision,” including review of land divisions creating condominiums or fewer than five lots. Table 36 of the County farmland preservation plan provides a summary of the scope of land division ordinances adopted by local governments in Ozaukee County.

Nonmetallic Mining Reclamation Ordinance

The Ozaukee County nonmetallic mining reclamation ordinance ensures the effective reclamation of nonmetallic mining sites in the County. The ordinance adopts the uniform Statewide standards for nonmetallic mining required by Section 295.12(1)(a) of the *Statutes* and Chapter NR 135 of the *Wisconsin Administrative Code*. The requirements of the ordinance apply to all operators of nonmetallic mining sites within Ozaukee County operating or commencing operation after August 1, 2001, except for nonmetallic mining sites located in a city, village, or town that has adopted a local mining reclamation ordinance pursuant to Section 295.14 of the *Statutes* and Section NR 135.32(2) of the *Administrative Code*. All reclamation plans must meet the standards set forth by the Ozaukee County nonmetallic mining reclamation ordinance including those addressing surface water and wetland protection, groundwater protection, topsoil management, final grading and slopes, topsoil redistribution for reclamation, and revegetation and site stabilization, and also set forth criteria for assessing completion of successful site reclamation, intermittent mining, and maintenance. As of 2020, the County oversees four nonmetallic mining reclamation plans (Hetzel Pit/Bee Keeper Bog, Home Pit, Spring Lake Pit, and Grabinger Pit).

A number of communities require nonmetallic mining restoration plans for nonmetallic mining sites through local zoning ordinances. Communities with zoning ordinances that require restoration plans include: the Town of Cedarburg, Town of Fredonia, Village of Fredonia, Town of Grafton, City of Port Washington, Town of Port Washington, and Town of Saukville. Local zoning requirements are in addition to State nonmetallic mining site reclamation requirements. All nonmetallic mining operations must comply with Chapter NR 135 of the *Wisconsin Administrative Code* as enforced by Ozaukee County unless the municipality has adopted a nonmetallic mining reclamation ordinance that complies with Chapter NR 135. The Town of Saukville adopted a nonmetallic mining reclamation ordinance in 2010 that meets the State requirements.

3.6 STATE NONPOINT SOURCE POLLUTION CONTROL STANDARDS AND PROHIBITIONS

Construction Site Erosion Control and Stormwater Management

Stormwater management and construction site erosion control ordinances act to protect water quality and protect and promote health, safety, and general welfare by minimizing the amount of sediment and other pollutants carried to lakes, streams, and wetlands by stormwater and runoff discharged from construction sites or land disturbing activities. Table 90 in Chapter V of the County comprehensive plan sets forth local governments in Ozaukee County that have adopted a construction site erosion control ordinance and a stormwater management ordinance or plan. In many cases, the local construction site erosion control ordinance includes stormwater management regulations.

Sections 62.234 and 61.354 of the *Statutes* grant authority to cities and villages, respectively, to adopt ordinances for preventing erosion from construction sites and the management of stormwater runoff from lands within their jurisdiction. Under Section 60.627 of the *Statutes*, towns may adopt village powers and subsequently utilize the authority conferred on villages to adopt their own erosion control and stormwater management ordinances.

Chapter NR 216 of the *Wisconsin Administrative Code*, which intends to reduce the discharge of pollutants carried by stormwater, requires county and local governments in urbanized areas, which are based on population and density, to obtain a Wisconsin Pollutant Discharge Elimination System (WPDES) Stormwater Discharge Permit. The code requires that the designated county or local government meet State standards to control pollution that enters a municipal storm sewer system and develop a storm sewer system map, a public information and education program, a stormwater and erosion control ordinance, an illicit discharge detection program, and a plan to reduce suspended solids. The designated county or local government must then submit an annual report on progress in meeting the requirements to the WDNR.

Chapter NR 151 of the *Wisconsin Administrative Code* required that municipalities with a WPDES permit reduce the amount of total suspended solids in stormwater runoff by 20 percent by 2008 and by 40 percent by 2013, with respect to stormwater runoff from areas of existing development with no controls as of October 2004. The following communities have received a WPDES Stormwater Discharge Permit under Phase I stormwater regulations: the Village and Town of Grafton (joint application); the City of Mequon and Village of Thiensville (joint application); the Village of Bayside (joint application with other Milwaukee County communities); the Village of Saukville, the Town of Cedarburg, and the City of Cedarburg. The Town

of Saukville does not require a Phase I WPDES permit. Ozaukee County has obtained a permit for County facilities located in any area where a local government required a permit.

Phase II of NR 216 requires municipalities outside urbanized areas with a population greater than 10,000 and a density over 1,000 persons per square mile to obtain a WPDES Stormwater Discharge Permit. As a result of Phase II requirements, Ozaukee County, the Cities of Cedarburg, Mequon and Port Washington, the Villages of Grafton, Saukville and Thiensville, and the Towns of Cedarburg and Grafton have also obtained a permit. The Ozaukee County Board of Supervisors adopted a Construction Site Erosion Control and Post-Construction Storm Water Management Ordinance in 2009.

In addition, regardless of whether a municipality is required to have a stormwater discharge permit under Chapter NR 216, Chapter NR 151 requires that all construction sites that have one acre or more of land disturbance must achieve an 80 percent reduction in the amount of sediment that runs off the site. With certain limited exceptions, those sites required to have construction erosion control permits must also have post-development stormwater management practices to reduce the total suspended solids (sediment) that would otherwise run off the site by 80 percent for new development, 40 percent for redevelopment, and 80 percent for infill development. If it can be demonstrated that the solids reduction standard cannot be met for a specific site, total suspended solids must be controlled to the maximum extent practicable.

Under the requirements of Chapter NR 151, beginning March 10, 2008, incorporated municipalities with average population densities of 1,000 people or more per square mile that are not required to obtain municipal stormwater discharge permits must implement public information and education programs relative to specific aspects of nonpoint source pollution control; municipal programs for management of leaf and grass clippings; and site specific programs for application of lawn and garden fertilizers on municipally-owned properties with over five acres of pervious surface. This requirement applies to virtually all cities and villages.

The MMSD also promulgates stormwater management regulations as set forth in MMSD Rules Chapter 13, Surface Water and Stormwater. The purpose of Chapter 13, which applies to all users of the sewerage system and all governmental units in the sewer service area, is to:

- Reduce the unsafe conditions, property damage, economic losses, and adverse health effects caused by flooding

- Maximize the effectiveness of flood abatement facilities and watercourse improvements
- Reduce the number and magnitude of releases of sewage to the environment from sanitary and combined sewers and to protect sewage collection and treatment facilities from high flows
- Promote comprehensive watershed planning and intergovernmental cooperation
- Restore and enhance opportunities to use and enjoy watercourses

Runoff management is required for any development or redevelopment that meets all of the criteria set forth in Subchapter III – Stormwater Runoff Management Requirements, and applies to all cities, villages, and other governmental units (including counties, special districts, and state agencies if the other governmental unit asserts exemption from local land development requirements and receives sewer service from the District).

State Standards and Regulations for Control of Nonpoint Source Pollution

Through 1997 Wisconsin Act 27, the State Legislature required the WDNR and DATCP to develop performance standards for controlling nonpoint source pollution from agricultural and nonagricultural land and from transportation facilities.²⁶ The performance standards are set forth in Chapter NR 151, "Runoff Management," of the *Wisconsin Administrative Code*, which became effective on October 1, 2002, and was revised in 2004, 2010, and 2018. Below is a summary of the standards and prohibitions that apply to the Ozaukee County Land and Water Resource Management plan:

²⁶ *The State performance standards are set forth in the Chapter NR 151, "Runoff Management," of the Wisconsin Administrative Code. Additional code chapters that are related to the State nonpoint source pollution control program include: Chapter NR 152, "Model Ordinances for Construction Site Erosion Control and Storm Water Management;" Chapter NR 153, "Targeted Runoff Management and Notice of Discharge Grant Programs;" Chapter NR 154, "Best Management Practices, Technical Standards and Cost-Share Conditions;" Chapter NR 155, "Urban Nonpoint Source Water Pollution Abatement and Storm Water Management Grant Program;" and Chapter ATCP 50, "Soil and Water Resource Management." Those chapters of the Wisconsin Administrative Code became effective in October 2002. Chapter NR 120, "Priority Watershed and Priority Lake Program;" and Chapter NR 243, "Animal Feeding Operations" were repealed and recreated in October 2002.*

Agricultural Regulations, Performance Standards, and Prohibitions

Performance standards relate to four areas of agriculture: cropland soil erosion control, soil loss from riparian lands, manure management, and nutrient management.

The agricultural performance standards are:

- Sheet, rill and wind erosion: Maintain soil erosion rates on all cropland at or below “T” (Tolerable Soil Loss).
- Tillage setback: Allow no tillage within a five- to 20-foot setback from the top of a surface water channel in agricultural fields for the purpose of maintaining streambank integrity and avoiding soil deposits into State waters.
- Phosphorus index: A limit on the amount of phosphorus (an average phosphorus index of 6 or less over the accounting period and which may not exceed a phosphorus index of 12 in any individual year) that may run off croplands as measured by the Wisconsin Phosphorus Index.
- Manure storage facilities: All new or substantially altered manure storage facilities must meet current engineering design standards to prevent surface or groundwater pollution.
- Process wastewater handling: A prohibition against significant discharge of process water from milk houses, feedlots, and other similar sources.
- Clean water diversion: Divert clean water runoff away from contacting feedlots, manure storage facilities, and barnyards in water quality management areas (areas within 300 feet of a stream, 1,000 feet from a lake, or areas susceptible to groundwater contamination).
- Nutrient management: Application of manure or other nutrients to croplands must be done in accordance with a nutrient management plan, designed to meet State standards for limiting the entry of nutrients into groundwater or surface water resources. This standard does not apply to applications of industrial waste, municipal sludge, or septage regulated under other WDNR programs, provided that the material is not comingled with manure prior to application.

- Silurian bedrock (this performance standard was added to NR 151 in 2018): To address land spreading of manure on soils in sensitive areas of the State – i.e. where depth to bedrock is shallow and the bedrock is fractured (also described as karst topography), mechanical manure application may not cause fecal contamination of water in a well, or be applied on areas of cropland or pastures that have 24 inches or less of separation between the ground surface and apparent water table, and must be applied in conformance with a nutrient management plan that is consistent with all applicable standards.
- Manure management: Prohibitions include no direct runoff from animal feedlots to “waters of the state”, no overflow of manure storage facilities, no unconfined manure piles in shoreland areas (areas within 300 of a stream, 1,000 feet from lakes), and no unlimited livestock access to “waters of the state” where the livestock prevent sustaining an adequate vegetative cover.
- TMDL: A crop or livestock producer shall reduce discharges of pollutants from a livestock facility or cropland to surface waters if necessary, to meet a load allocation in a US EPA and state approved TMDL.

In general, only if cost share funds are available do those lands that do not meet the NR 151 standards (and were cropped or enrolled in the U.S. Department of Agriculture Conservation Reserve or Conservation Reserve Enhancement Programs as of October 1, 2002), need to meet these agricultural performance standards. Existing cropland that met the standards as of October 1, 2002, must continue to meet the standards. New cropland must meet the standards, regardless of whether cost share funds are available.

Chapter NR 243, “Animal Feeding Operations,” of the *Wisconsin Administrative Code* sets forth rules for concentrated animal feeding operations and other animal feeding operations for the purpose of controlling the discharge of pollutants to waters of the State. The definition of concentrated animal feeding operations is any livestock and poultry operations with more than 1,000 animal units. Calculation of animal units depends upon each different type and size class of livestock and poultry. For example, facilities with 1,000 beef cattle, 700 milking cows, or 200,000 chickens each would be the equivalent of 1,000 animal units. All concentrated animal feeding operations and certain types of other animal feeding operations must obtain WPDES permits. In general, the definition of animal feeding operations is any feedlot or facility, other than pasture, where feeding of animals for a total of 45 days in any 12-month period occurs.

Under Chapter NR 216, "Stormwater Discharge Permits" of the *Wisconsin Administrative Code*, agriculture is not exempt from the requirement to submit a notice of intent (NOI) for one or more acres of land disturbance for the construction of structures such as barns, manure storage facilities or barnyard runoff control systems. Construction of an agricultural building or facility must follow an erosion and sediment control plan consistent with Section NR 216.46, *Wisconsin Administrative Code*, including meeting the performance standards of Section NR 151.11, *Wisconsin Administrative Code*. Agriculture is exempt from this requirement for activities such as planting, growing, cultivating and harvesting crops for human or livestock consumption and pasturing of livestock as well as for sod farms and tree nurseries. NR 216 establishes the criteria and procedure for issuance of stormwater discharge permits to limit the discharge of pollutants carried by stormwater runoff into waters of the State.

Nonagricultural (Urban) Performance Standards and Stormwater Discharge Permits

The nonagricultural performance standards set forth in Chapter NR 151 encompass two major types of land management. The first includes standards for areas of new development and redevelopment and the second includes standards for developed urban areas. The performance standards address the following areas:

- Construction sites for new development and redevelopment
- Post construction stormwater runoff for new development and redevelopment
- Developed urban areas
- Nonmunicipal property fertilizing.

Chapter NR 151 requires counties and local units of government in urbanized areas to obtain a WPDES stormwater discharge permit as required under Chapter NR 216.²⁷ Ozaukee County, the Cities of Cedarburg, Mequon and Port Washington, the Villages of Grafton, Saukville, and Thiensville, and the Towns of Cedarburg and Grafton, have applied for and been issued these permits.

²⁷ Chapter NR 216 of the Wisconsin Administrative Code, "Storm Water Discharge Permits," sets forth requirements for construction site erosion control and for industrial, municipal, and transportation-related stormwater discharge permits.

Chapter NR 151 requires permit holders to reduce the amount of total suspended solids in stormwater runoff from areas of existing development that is in place as of October 2004 to the maximum extent practicable, according to the following standards:

- By March 10, 2008, the NR 151 standards call for a 20 percent reduction
- By October 1, 2013, the standards call for a 40 percent reduction

Permitted municipalities are required to implement the following 1) public information and education programs relative to specific aspects of nonpoint source pollution control; 2) municipal programs for collection and management of leaf and grass clippings; and 3) site-specific programs for application of lawn and garden fertilizers on municipally controlled properties with over five acres of pervious surface. The requirements of Chapter NR 151 (as of March 10, 2008) do not require incorporated municipalities with average population densities of 1,000 people or more per square mile to obtain municipal stormwater discharge permits, however, they must still implement the three programs noted above.

In addition, regardless of whether a municipality is required to have a stormwater discharge permit under Chapter NR 216, Chapter NR 151 requires that all construction sites that have one acre or more of land disturbance must achieve an 80 percent reduction in the amount of sediment that runs off the site. With certain limited exceptions, those sites required to have construction erosion control permits must also have post-development stormwater management practices to reduce the total suspended solids (sediment) that would otherwise run off the site by 80 percent for new development, 40 percent for redevelopment, and 80 percent for infill development. If a specific site can demonstrate that it cannot meet the solids reduction standard, it must then control total suspended solids to the maximum extent practicable.

Section NR 151.12 of the *Wisconsin Administrative Code* requires infiltration of post-development runoff from areas developed on or after October 1, 2004, subject to specific exclusions and exemptions as set forth in Sections 151.12(5)(c)5 and 151.12(5)(c)6, respectively. In residential areas, Section NR 151.12 requires infiltration of either 90 percent of the annual predevelopment infiltration volume or 25 percent of the post-development runoff volume from a two-year recurrence interval, 24-hour storm. However, Section NR 151.12 requires use of no more than 1 percent of the area of the project site as an effective infiltration area. In commercial, industrial and institutional areas, NR 151.12 requires infiltration of 60 percent of the annual predevelopment infiltration volume or 10 percent of the post-development runoff volume from a two-year

recurrence interval, 24-hour storm. In this case, NR 151.12 requires use of no more than 2 percent of the project site as an effective infiltration area.

3.7 CONSERVATION PROGRAMS

Coordination with Federal, State, regional, and local agencies is paramount to protecting the land and water resources of Ozaukee County. The conservation programs mentioned below are vital to successfully implementing this plan. The positive integration of programs and funding sources administered by the County and its cooperating agencies do the most toward accomplishing the workplan objectives set forth in Chapter IV.

Federal Programs

The USDA Farm Service Agency (FSA) and NRCS have several programs directed at agricultural producers to alleviate cropland erosion, and to protect natural resources, as well as provide a financial incentive. There are four programs that help to reduce erosion, protect wildlife habitat, restore wetlands, and improve water quality. All programs involve cost-share assistance from the Federal government, provided the landowner follows the prescribed practices of each program.

Conservation Reserve Program

The Conservation Reserve Program (CRP) is a voluntary program for agricultural landowners that provides annual rental payments and cost-share assistance to establish long-term, resource-conserving covers on eligible farmland. The program was originally authorized by the Food Security Act of 1985 and was reauthorized by the 2018 Farm Bill. The CRP goal is to reduce soil erosion, protect the nation's ability to produce food and fiber, reduce sedimentation in streams and lakes, improve water quality, establish wildlife habitat, and enhance forest and wetland resources. It encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as a prairie-compatible, noninvasive forage mix; wildlife plantings; trees; filter strips; or riparian buffers. Farmers receive an annual rental payment for the term of the 10- to 15- year contract based on the agriculture rental value of the land, and up to 50 percent Federal cost sharing to establish vegetative cover. The FSA, an agency of the USDA, administers the program with the NRCS providing technical assistance. NRCS works with landowners to develop their application, and to plan, design, and install the conservation practices on the land.

The Conservation Reserve Enhancement Program (CREP) is a part of the CRP. The CREP targets specific state or nationally significant conservation concerns. In exchange for removing environmentally sensitive land

from production and establishing permanent resource conserving plant species, each CREP agreement pays farmers and ranchers an annual rental rate along with other federal and non-federal incentives as applicable. Participation is voluntary, and the contract period is typically 10-15 years. While both the CREP and the CRP focus on environmentally sensitive lands, CREP is a partnership between state governments and the Federal government. This partnership is in place to address high priority conservation concerns, and CREP cannot enroll land in the program if the state does not have a CREP agreement²⁸.

Other programs that are also part of the CRP, or which the Farm Service Agency administers, include among others: the CRP Grasslands; the Emergency Conservation Program; and the Emergency Forest Restoration Program. Further information about these programs can be obtained from the Farm Service Agency website at www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index

Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP) is a voluntary conservation program that supports agriculture and environmental quality as compatible goals. Through EQIP, farmers may receive financial and technical help with structural and management conservation practices on agricultural land. EQIP offers contracts through the NRCS for conservation practice implementation for periods ranging from one to 10 years, and it pays up to 75 percent of the costs of eligible conservation practices. The program may also make incentive payments and cost share payments to encourage a farmer to adopt land management practices such as nutrient management, manure management, integrated pest management, or wildlife habitat management.

Conservation Stewardship Program

The Conservation Stewardship Program (CSP) helps agricultural producers maintain and improve their existing conservation systems and adopt additional conservation activities to address priority resource concerns. CSP contracts are for five years, but successfully fulfilling the initial contract (and agreeing to additional conservation objectives) allows the opportunity to compete for an additional 5-year term. To meet the renewal stewardship threshold, the participant must agree to meet or exceed two additional priority resource concerns or agree to adopt or improve conservation activities to achieve higher levels of conservation on two existing priority resource concerns. Contract payments are based upon the existing level of conservation on the land uses included in the contract, an NRCS assessment of the existing

²⁸ *Wisconsin's CREP agreement, in place since 2001, focuses on environmentally sensitive land next to rivers and streams and two designated geographic areas for wildlife habitat.*

stewardship at the time of enrollment and implementing additional conservation activities. The program design is for working lands and is the largest conservation program in the United States with 70 million acres of productive agricultural and forest land enrolled.

Healthy Forests Reserve Program

The Healthy Forests Reserve Program (HFRP) helps landowners restore, enhance, and protect forestland resources on private lands through easements and financial assistance. Through the program, landowners promote the recovery of endangered and threatened species under the Endangered Species Act, improve plant and animal diversity, and enhance carbon sequestration. The program provides landowners with 10-year restoration agreements and 30-year or permanent easements for specific conservation actions. Some landowners may avoid regulatory restrictions under the Endangered Species Act by restoring or improving habitat on their land for a specified period of time. Lands enrolled in the HFRP easements must be privately owned, and restore, enhance, or measurably increase the recovery of threatened or endangered species, improve biological diversity, or increase carbon storage.

Agricultural Conservation Easement Program

The Agricultural Conservation Easement Program (ACEP) helps landowners, land trusts, and other entities protect, restore, and enhance wetlands, grasslands, and working farms and ranches through conservation easements.

Under the Agricultural Land Easements component, the ACEP helps state and local governments, American Indian tribes, and non-governmental organizations protect working agricultural lands and limit non-agricultural uses of the land. The NRCS provides financial assistance to eligible partners for purchasing Agricultural Land Easements that protect the agricultural use and conservation values of eligible land. In the case of working farms, the program helps farmers and ranchers keep their land in agriculture. The NRCS may contribute up to 50 percent of the fair market value of the agricultural land easement. When protecting grasslands of special environmental significance, the NRCS may contribute up to 75 percent of the fair market value of the agricultural land easement.

Under the Wetlands Reserve Easements component, the ACEP helps to restore, protect, and enhance enrolled wetlands. The NRCS provides technical and financial assistance directly to private landowners and Indian tribes to restore, protect, and enhance wetlands through the purchase of a wetland reserve easement. This program offers landowners three options; permanent easements, 30-year easements, and term easements.

Regional Conservation Partnership Program

The Regional Conservation Partnership Program (RCPP) promotes coordination between NRCS and its partners to deliver conservation assistance to producers and landowners. NRCS helps producers through partnership agreements and RCPP conservation program contracts. The program encourages partners to join in efforts with producers to increase the restoration and sustainable use of soil, water, wildlife, and related natural resources on regional or watershed scales. Eligible partners include agricultural or silvicultural producer associations, farmer cooperatives or other groups of producers, state or local governments, American Indian tribes, municipal water treatment entities, water and irrigation districts, conservation-driven non-governmental organizations, and institutions of higher education. Eligible participants may enter into conservation program contracts or easement agreements under the framework of a partnership agreement. Current RCPP projects in southeastern Wisconsin in 2020 included the Oconomowoc River and the Milwaukee River Watershed Conservation Partnership.

Key Item: The Milwaukee River Watershed Conservation Partnership, and in particular, the portion of the Milwaukee River Watershed covered by the Fredonia-Newburg Area Nine Key Element Plan (see Map 3.5), is a priority area for Ozaukee County.

Emergency Watershed Protection Program

The Emergency Watershed Protection Program (EWP) was established by Congress to respond to emergencies created by natural disasters and to take emergency measures to safeguard lives and property after a natural occurrence has caused a sudden impairment of a watershed. Hazards include floods and the products of erosion created by floods, fire, windstorms, or other natural disasters. Local sponsors such as city, county, state, and tribal governments sponsor Emergency Watershed Protection projects. Sponsors are responsible for 25 percent of the construction costs, which can be direct cash expenditures or in-kind materials or services. The NRCS works with the sponsors to identify watershed impairments that threaten life and/or property (and defines property as significant infrastructure such as dwellings, office buildings, utilities, bridges and roads, but not land). The program cannot utilize funds to solve problems or remedy conditions that existed before the disaster or event. Through the Floodplain Easement portion of the program, the NRCS may purchase easements on any floodplain lands that have a history of repeated flooding.

Watershed Protection and Flood Prevention Program

The purpose of the Watershed Protection and Flood Prevention Program (including River Basin operations) is to assist Federal, State, local agencies, local governments, tribal governments, and program participants to protect and restore watersheds from damage caused by erosion, floodwater, and sediment, to conserve and develop water and land resources, and solve natural resource and related economic problems on a watershed basis. The program provides technical and financial assistance to local landowners or project sponsors, builds partnerships, and requires local and state funding contributions. Project sponsors can propose land treatment solutions or structural solutions. An approved watershed plan must be in place prior to initiation of any corrective land treatment or structural solution. Under this program, Ozaukee County has worked closely with the Wisconsin Division of Emergency Management to secure FEMA Hazard Mitigation Grant Program funds to purchase properties in the Milwaukee River floodplain.

Great Lakes Restoration Initiative

The Great Lakes Restoration Initiative (GLRI) is a multiagency Federal effort that targets the most significant environmental problems affecting the Great Lakes. Federal agencies do the work of the GLRI guided by five-year Action Plans. Action Plan III includes input from states, tribes, local governments, universities, business, and others. It outlines priorities and goals for the GLRI for fiscal years 2020 – 2024, working to accelerate environmental progress in five focus areas: toxic substances and Areas of Concern; invasive species; nonpoint source pollution impacts on nearshore health; habitats and species; and foundations for future restoration areas. Grant opportunities for restoration projects are available, primarily through the Environmental Protection Agency (EPA). Specifically, the EPA and its partner agencies agree on program and project priorities to implement the GLRI Action Plan. The EPA then appropriates money, which in turn provides funding to other federal government agencies. Those agencies, and the EPA, use that money to fund restoration projects, which the federal agencies themselves, or other entities such as states, tribes, local governments, universities, or nongovernmental organizations then undertake.

Demonstration Farm Network

The U.S. Department of Agriculture, the Natural Resources Conservation Service (NRCS), and the Ozaukee County Land & Water Management Department have entered into an agreement to launch a new demonstration farm network in Ozaukee County. This is the third demonstration farm network in Wisconsin in which the NRCS has collaborated with conservation partners in order to help establish the network. The partnership will support a network of farms that will demonstrate the best conservation practices to reduce phosphorus entering Lake Michigan. The partnership will also address the effectiveness of current conservation systems used to reduce nonpoint source pollution, as well as demonstrate to farmers and the

general public that the right combination of traditional conservation practices and other new innovative technologies functioning on the landscape can produce viable and sustainable economic and environmental benefits.

State and Local Programs

In addition to the following conservation related programs, Ozaukee County is also host to a number of conservation related partnerships, including but not limited to the Ulao Creek Partnership, the Southeastern Wisconsin Invasive Species Consortium Inc., the Friends of the Cedarburg Bog, the Milwaukee River Watershed Clean Farm Families, and the Ozaukee County Demonstration Farm Network. Further information about these partnerships can be found online at the Ozaukee County Land & Water Management Department's website at www.co.ozaukee.wi.us/295/Land-Water-Management.

Wisconsin Farmland Preservation Program

The initial Wisconsin Farmland Preservation Program was enacted in 1977 to provide income tax credits to eligible farmland owners. The County and local governments administer the program, but the Wisconsin Land and Water Conservation Board (LWCB) had to first certify that the county farmland preservation plan met the standards specified in Chapter 91 of the *Wisconsin Statutes*. Of the 72 counties in Wisconsin, 70 had certified farmland preservation plans. Ozaukee County's farmland preservation plan was first certified in 1983.

In 2009, the Wisconsin Legislature enacted Wisconsin Act 28, which repealed and recreated the Wisconsin Farmland Preservation Program set forth in Chapter 91 of the *Wisconsin Statutes*, and related tax credits under subchapter IX of Chapter 71 of the *Statutes*. The "Working Lands Initiation" refers to the new program, which creates new tools to help identify and preserve farmland. The law also requires counties to update their farmland preservation plans. The Farmland Preservation Plan for Ozaukee County adopted in 1983 was required to be updated and recertified by the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) by the end of 2013, under an extension approved by DATCP, to enable the County and local governments within the County to continue participating in the State farmland preservation program. With assistance from SEWRPC, Ozaukee County in cooperation with UW-Extension and ten cooperating local governments prepared an updated farmland preservation plan to meet the requirements set forth in Chapter 91 of the *Statutes*.

The intent of the original farmland preservation program was to encourage farmland preservation by providing tax credits to eligible farmland owners who voluntarily chose to enter into an agreement with the

State through farmland preservation agreements, or through the enactment of exclusive agricultural zoning by the local government in which the land is located. The new Wisconsin Farmland Preservation Program provides landowners the opportunity to continue to claim farmland preservation tax credits through zoning or through agreements with DATCP for areas within Agricultural Enterprise Areas (AEAs). It can be noted that only the Town of Belgium has implemented a farmland preservation zoning district consistent with this program. The new State program also includes a process for establishing AEAs and created a Purchase of Agricultural Conservation Easements (PACE) Program.

In exchange for farming their land and meeting certain conservation standards, landowners can receive an annual income tax credit. The amount of the tax credit depends on whether the land is located in a farmland preservation zoning district, whether a farmland preservation agreement covers the land, or both. In addition to having an agreement within one of the state's Agricultural Enterprise Areas (AEAs) or being in a farmland preservation zoning district, the individual claiming a tax credit must be: the landowner; a Wisconsin resident; have produced \$6,000 in gross farm revenue in the past year, or \$18,000 in the past three years; and must meet certain state soil and water conservation standards.

Soil and Water Resource Management Program

DATCP administers Wisconsin's soil and water resource management program (SWRM) under the provisions of Chapter 92 of the *Wisconsin Statutes* and Chapter ATP 50 of the *Wisconsin Administrative Code*. The SWRM grant program supports locally led conservation efforts. Awarding of grant funds to counties pays for conservation staff and provide landowner cost-sharing to implement their LWRMP. The current version of Chapter ATP 50, revised in February 2018, relates specifically to agricultural programs and it establishes requirements and/or standards for:

- Soil and water conservation on farms
- County soil and water programs, including land and water resource management plans
- Grants to counties to support county conservation staff
- Cost-share grants to landowners for implementing conservation practices
- Design certifications by soil and water professionals

- Local regulations and ordinances
- Cost-share practice eligibility and design, construction, and maintenance

Targeted Runoff Management Grant Program

The Targeted Runoff Management (TRM) Grant Program, in operation since 1999, was significantly revised effective January 1, 2011. Administering Targeted Runoff Management Grants is through Chapter NR 153 and NR 154 of the *Wisconsin Administrative Code*. These grants provide technical and financial assistance to local governments for managing nonpoint source pollution. Most grants address agricultural problems. The agricultural project grants address many types of water resources, including impaired waters in areas with Total Maximum Daily Load (TMDL), impaired waters outside TMDL areas, high-quality surface waters threatened by degradation, and ground water protection and improvement. Agricultural projects can vary in scale, from small-scale projects addressing a single farm to larger-scale projects that address agricultural sources on a watershed basis. The program requires that projects outside a TMDL area must implement the State's agricultural nonpoint source performance standards and prohibitions set forth in Chapter NR 151. Projects designed to implement TMDLs may also implement practices that indirectly achieve State standards and prohibitions as long as the management practices require achievement of the goals of the TMDL. Targeted Runoff Management (TRM) Grants also provide funding for a limited number of urban storm water construction projects but restrict the urban TRM projects to TMDL areas.²⁹ Only small-scale projects are available in urban areas.

All TRM grants provide 70 percent cost sharing for construction of management practices, with up to 90 percent cost sharing available for agricultural projects where the farmer qualifies for economic hardship. Large scale TRM projects may also provide limited funding for staff support. Each year, the WDNR establishes caps on grant amounts consistent with available funding.

Chapter NR 153 also administers the Notice of Discharge Grants. Notices of Discharge are issued by the WDNR under Chapter NR 243, "Animal Feeding Operations." WDNR issues Notices of Discharge to small

²⁹ *Chapters NR 154 and NR 155, which administer a companion grant program, the Urban Nonpoint Source Storm Water Management Grant Program, complements the TRM Program by making grants for urban areas available Statewide for a variety of planning and construction activities. These urban grants are available to address a wide range of water resources including impaired waters in TMDL areas, impaired waters outside TMDL areas, high quality waters that are threatened by stormwater runoff, and groundwater that is threatened or degraded by stormwater runoff.*

and medium livestock operations that fail to meet Federal point source discharge requirements or that are causing fecal contamination of a drinking water well. In many of these cases, this requires the farmer to fix the site regardless of cost sharing. However, the WDNR may decide to offer a grant to help facilitate site clean-up. Not cleaning up problem sites results in issuance of WPDES permits or referral to the Wisconsin Department of Justice for prosecution. The WDNR and DATCP work jointly to address these sites.

Urban Nonpoint Source and Storm Water Management Grant Program

The Urban Nonpoint Source and Storm Water Management Grant Program provides cost-share funds for planning or construction activities for controlling nonpoint source pollution from urban areas. Projects funded by this program are site-specific, serve areas smaller in size than a sub-watershed, and target high-priority problems. Eligible applicants include cities, villages, towns, counties, regional planning commissions, and special purpose districts such as lake districts, sewerage districts, and sanitary districts. In addition, an "urban project area" must meet at least one of the following criteria:

- The area has a residential population density of at least 1,000 people per square mile
- The area has a commercial land use
- The area is a portion of a privately-owned industrial site not covered by a WPDES permit issued under Chapter NR 216 of the *Wisconsin Administrative Code*
- The area is a municipally owned industrial site

The maximum cost-share rate available for planning grants is 70 percent of eligible costs. The cap on the total State share for planning projects is \$85,000. The maximum cost-share rate available for construction grants is 50 percent of eligible costs, with a total State share for a construction project of \$150,000 and a potential grant of an additional \$50,000 for land acquisition, where needed. Planning grants can pay for a variety of eligible activities, including stormwater management planning for existing and new development, related information and education activities, ordinance and utility district development, and enforcement. Construction grants can pay for construction of best management practices to control stormwater pollution from existing urban areas. Projects may be eligible for funding whether or not they are designed to meet the performance standards identified in Section NR 151.13 of the *Wisconsin Administrative Code*, but the highest priority in selecting projects under this program is given to projects that implement performance

standards and prohibitions contained in Chapter NR 151 or that address waterbodies listed on the Federal Section 303(d) list of impaired waters.

Knowles-Nelson Stewardship Program

The Knowles-Nelson Stewardship Program preserves the State's most significant land and water resources for future generations and provides the land base and recreational facilities needed for quality outdoor experiences. The program achieves these goals by funding the acquisition of land and easements for conservation and recreation purposes, developing and improving recreational facilities, and restoring wildlife habitat. The administrative rules for the program are set forth in Chapter NR 50 and NR 51 of the *Wisconsin Administrative Code*. The program provides 50 percent matching grants to local units of government and qualified nonprofit conservation organizations for the acquisition of land and easements. To maintain eligibility to apply for and receive such funding, local units of government must prepare and periodically update a park and open space plan.

Lake Protection Grant and River Protection Grant Programs

The Lake Protection Grant program as set forth in Chapter NR 191 of the *Wisconsin Administrative Code* assists local governments, lake districts and associations, and other nonprofit organizations in improving and protecting water quality in lakes. A 75 percent State cost-share is available, with a 25 percent local match. Projects that are eligible for cost-share assistance include land acquisition for easement establishment, wetland restoration, and various lake improvement projects such as those involving pollution prevention and control, diagnostic feasibility studies, and lake restoration.

The River Protection Grant program as set forth in Chapter NR 195 of the *Wisconsin Administrative Code* assists local governments, lake districts and associations, and other nonprofit organizations in improving and protecting water quality in rivers. A 75 percent State cost-share is available, with a 25 percent local match. Cost-share funding cannot exceed \$50,000 for a management project. The types of projects that are eligible for cost-share assistance include management activities such as land acquisition, easement establishment, ordinance development, installation of nonpoint source pollution abatement projects, river restoration projects, and river plan implementation projects.

Municipal Flood Control Grant Program

Under Chapter NR 199, "Municipal Flood Control Grants," of the *Wisconsin Administrative Code* municipalities, including cities, villages, and towns, as well as metropolitan sewerage districts are eligible for cost-sharing grants from the State for projects to minimize flooding and flood-related damages. Projects

may include acquisition and removal of structures; floodproofing of structures; riparian restoration projects, including removal of dams and other artificial obstructions, restoration of fish and native plant habitat, erosion control, and streambank restoration projects; acquiring vacant land to create open-space flood storage areas; constructing structures for collecting, retaining, storing, and transmitting stormwater and groundwater for flood control; and preparing flood insurance studies and other flood mapping projects. Municipalities and metropolitan sewerage districts are eligible for up to 70 percent State cost-share funding for eligible projects and have to provide at least a 30 percent local match.

Clean Water Fund Program

The State Clean Water Fund Program (CWFP) provides financial assistance to municipalities for the planning, design, and construction of projects to control and treat urban stormwater runoff. Eligible applicants include counties, cities, villages, towns, town sanitary districts, public inland lake protection and rehabilitation districts, and metropolitan sewerage districts. Eligible projects must relate to either a WPDES permit, a performance standard, or a plan approved by the WDNR. The primary purpose of an eligible urban runoff project must be to improve water quality. The program provides loans at an interest rate of 65 percent of the current CWFP market rate.

The CWFP also has a Small Loan Program that provides interest rate subsidies to municipalities that have a loan from the State Trust Fund Loan Program for the planning, design, and construction of urban runoff projects with total estimated costs of \$1 million or less.

Wisconsin Coastal Management Program

The Department of Administration, Bureau of Intergovernmental Relations administers the Wisconsin Coastal Management Program (WCMP). The WCMP is a voluntary State-Federal partnership that works through a council appointed by the Governor to provide policy coordination among State agencies and to award Federal funds to local governments and other entities for implementing initiatives related to managing coastal zones in the State. The program has identified wetlands protection, habitat restoration, public access, land acquisition, nonpoint source pollution control, land use and community planning, natural hazards, and Great Lakes education projects as current priorities. The program also aids local governments in managing and protecting shorelands, wetlands, and floodplains through zoning and permitting.

Wisconsin Surface Water Grant Program

The WDNR is proposing to consolidate five related administrative code chapters governing three cost-sharing grant programs into one new administrative code chapter. This would create a comprehensive

surface water grant program that provides financial assistance to nonprofit organizations and governmental units to protect and restore surface water and aquatic ecosystems and control aquatic invasive species. The Program's two primary activities include: planning projects to help communities understand the condition of aquatic ecosystems and watersheds, collect data, conduct studies, and develop management plans; and management projects to protect and improve water quality and aquatic habitat and prevent and control aquatic invasive species.

Harrington Beach Water Quality Improvement Initiative

Since 2004, annual water quality monitoring conducted at Harrington Beach sites has resulted in a documented high occurrence of beach closures and advisories due to elevated E. coli levels. Approximately 125,000 people used Harrington Beach in 2012 per the WDNR. A preliminary assessment of the drainage ditches that border the park to the north and south (see Appendix B__) indicate the presence of both human and ruminant (includes bovine) sources of E. coli. The concern over the degraded water quality at Harrington Beach is of local and state concern. Degraded surface water presents a public health risk and a potential negative pressure to real estate values.

Through a grant from the Fund for Lake Michigan, the Ozaukee County Land and Water Management Department in 2015 tested 34 outfalls such as ditch outlets, tile outlets, etc., to identify possible sources of the pollution. DNA testing by the UW-Milwaukee School of Freshwater Science identified both bovine and human sources of E. coli in many of the water samples. To address the bovine sources, Ozaukee County is working with area farmers to implement more effective management strategies to reduce agricultural runoff. To address human sources of E. coli, the Land and Water Management Department is requesting assistance of homeowners to replace potentially failing septic systems. One-third of the twenty-nine potentially failing septic systems have been replaced in the last 5 years. To reduce agricultural runoff, manure storage, buffers, and soil health practices are being applied.

Producer-Led Watershed Protection Program

The Producer-Led Watershed Protection Program focuses on ways to increase farm participation in voluntary efforts by fostering locally led decision making by producers. Ozaukee County's currently active Producer-Led Group is the Milwaukee River Watershed Clean Farm Families. This group is focused on promoting soil health principles as well as providing funding to area farmers in the project area within the Milwaukee River watershed for implementing practices such as No-Till and cover crops. Grant funding available through DATCP along with matching dollars from organizations such as the Fund for Lake

Michigan help farmers address soil and water quality challenges of their local landscapes with innovative and collaborative approaches.

Fish Passage Program

Ozaukee County's Fish Passage Program is a nationally recognized (National Association of Counties Award 2011) program. Approximately \$17.5 million of federal, state, local, and non-profit organization funding has been awarded to develop, refine, and implement an "Ozaukee Fish Passage Program" (Program) within the Ozaukee County Planning and Parks Department. The Program reconnects, restores, and enhances existing, high quality habitat in the Milwaukee River and direct tributaries to Lake Michigan, the Milwaukee Estuary, and the mainstem of the Milwaukee River. The Program also addresses human activities that can directly or indirectly create impediments that fragment aquatic connectivity and inhibit access to these high-quality habitats as well as impair water quality. Additional information on this program related to Fish Migration and Habitat Connectivity, Fish Passage Impediment Classification and Prioritization, Large-Scale Impediment/road Stream Crossing Design, Dam Removals, Fishway Construction, and Linear Connectivity Outcomes, is provided in Appendix C.

Lateral Connectivity and Habitat Restoration

Land use changes in the Milwaukee River basin have greatly diminished the ecological health of rivers and riparian corridors. Stream, wetland, and upland natural habitats are fragmented and degraded, local flooding is exacerbated to the detriment of farmland, homes, and infrastructure, and water quality is diminished, both in the Milwaukee River and also downstream along the Lake Michigan coastline. Many rivers and streams were historically dredged and straightened, and wetlands destroyed and drained to increase available land and increase agricultural production. Often, the soils excavated in digging the ditch were cast to the sides of the channel, creating levees on both sides that isolate the channel from the floodplain. The lack of recurring overbank flows prohibit floodplain building and the former wetland corridors lack suitable overbank flood flows to sustain a diverse wetland plant and wildlife community. In addition, stream channels are left over-widened with unconsolidated substrate and very poor habitat conditions for fish and wildlife.

The Ecological Prioritization GIS Tool is used to develop integrated prioritization maps for restoration and preservation to improve the ecological, water quality and hydrologic conditions within streams and riparian corridors, particularly for native fish and wildlife. Tool outputs have identified multiple high-priority projects for maximum ecological benefit in Ozaukee County. Specifically, the Ozaukee County Planning and Parks Department is completing large scale, comprehensive, holistic habitat restoration projects on Ulao Creek

(approximately 2.5 miles), Mole Creek (approximately 1.5 miles), and the Little Menomonee River (approximately 0.25 miles). Construction, restoration, and environmental monitoring activities at all locations are ongoing.

General project goals include: (1) improve geomorphic function of the project reach(s) by creating a channel that is appropriately sized for its watershed, is connected to a regularly inundated floodplain, and has a self-sustaining, natural meander geometry, (2) provide high quality, diverse in-stream and wetland habitat for fish, birds, reptiles, amphibians, and mammals, specifically those that have been identified as species of local conservation interest (SLCIs), (3) demonstrate successful use of County-developed GIS Tools (Ecological Prioritization and Fish and Wildlife Habitat) to prioritize and cost-effectively improve the ecological function of a riparian corridor and adjacent lands for fish and wildlife habitat, (4) improve water quality in the project areas and in downstream waters by removing pollutants and decreasing erosion risk through stormwater management, (5) document impacts on water quality through water quality monitoring (continuous and discrete sampling) on the site and within the watershed, and (6) document improvements to the fish and wildlife communities. Project activities and outcomes typically include excavating a stable meandering stream plan form (typical meander length of 7-10 times mean stream width), increase stream length and sinuosity, decrease mean stream width, and increase effective water depths and stream velocities, increase in-stream and bank habitat cover for fish and wildlife, reconnect riparian wetlands, restore and enhance former and existing wetlands in areas of hydric soils, increase canopy shade by planting a diverse selection of native deciduous trees to replace tree canopy, assist with bank stabilization, provide cooling effects for the stream, and combat the spread of invasive vegetation (e.g., reed canary grass), and increase coarse substrate riffles for lithophilic spawning fish and macroinvertebrates.

Lateral Connectivity and Habitat Restoration Design: Empirical relationships are typically developed to estimate appropriate channel geometry based on analog streams within the region. Streams with relatively flat slopes, similar watershed areas, and a well-developed meander pattern that do not appear to have been intentionally manipulated are analyzed with respect to stream form, including sinuosity, meander wavelength, radius of curvature, and bankfull width to generate hydraulic geometry relationships. Engineering and design also include analyzing hydraulic conditions for a variety of flows, including estimation of peak flow rates, to assure the project will function as desired at all flows. In addition, potential impact to the upstream floodplain as a result of project improvements is considered. To the extent practical, woody debris is incorporated into the design to provide for bank stability, in-stream diversity, and fish and wildlife habitat.

The Ozaukee County Planning and Parks Department is completing large scale, comprehensive, holistic habitat restoration projects on Ulao Creek (approximately 2.5 miles), Mole Creek (approximately 1.5 miles), and the Little Menomonee River (approximately 0.25 miles). Construction, restoration, and environmental monitoring activities at all locations are ongoing.

Larval Trapping

Larval trapping is conducted in the spring and is used to detect the presence or absence of egressing larval northern pike and/or other species originating in tributaries. As funding allows, larval trapping occurs in streams prior to and after fish passage impediment removal or remediation projects and/or habitat restoration projects led by the Planning and Parks Department.

Two types of traps are used in larval surveys, box traps and quatrefoils. Box traps consist of a wooden frame and metal wire mesh with a single 7mm slot oriented upstream to capture larval or young-of-year (YOY) fish drifting downstream. Each trap is staked in place and weighted by cinder blocks or rocks. Box traps rely on the flow of the stream to transport larval fish into the trap. Quatrefoil traps are constructed from clear acrylic sheets with four 5mm slots, creating an entrance to an inner chamber. Quatrefoil traps require a glow stick and are utilized in areas that have little to no stream flow. The glow stick entices larval fish (photoreactive) to swim into the trap in the absence of stream flow.

Larval monitoring is used because other, more traditional fish monitoring methods such as electrofishing are impractical during the northern pike spawning season (i.e., early spring) due to fast water flow velocities, high turbidity, elevated water conductivity and very small fish, which are not susceptible to electrofishing gear. It is safer to conduct larval trapping during spring when stream conditions can be difficult and, at times, dangerous to work in. Box traps and quatrefoil light traps are relatively inexpensive and require little time and few resources to deploy and maintain. Traps can be deployed over extended periods of time to increase the chance of pike detection. Traps also reduce the chances of injuring and/or killing sampled fish. Larval trap netting fills a critical gap ecological monitoring and provided a reliable, consistent method for detecting Northern Pike spawning in various tributaries. Monitoring via larval traps also allows the Department to identify other fish species in project streams and characterize the fisheries community within each stream.

The Program has captured dozens of other fish species, including four least darters captured in Mee-Kwon Creek in 2013. The least darter is a species of special concern in Wisconsin and only has been captured in Ozaukee County on one other occasion since 1924. The Planning and Parks Department has a fisheries

database containing years of larval trapping data from over 18 tributary streams. This data is sent to the WDNR for inclusion in the statewide Surface Water Integrated Monitoring System (SWIMS) database.

Electrofishing

Ozaukee County Planning and Parks Department staff, with the help of volunteers, conducts electrofishing fisheries monitoring on an annual basis throughout the Milwaukee River Watershed, as site conditions and grant funding allow. These surveys typically occur in the late spring and summer and consist of electrofishing by boat mounted, backpack or tow-behind barge units. Tow-behind barges and boat mounted electrofishing units are used to conduct fish surveys on the Milwaukee River, while backpack electrofishing is used to conduct fish surveys on the smaller tributaries.

Electrofishing surveys collect information about existing fish communities and potential native indicator fish species. Ozaukee County staff also performs mark-recapture electrofishing surveys at all large-scale fish passage impediment removal or remediation projects, which is used to demonstrate fish passage following construction and restoration activities. Sampling sites include 100-meter long reaches up and downstream of each impediment (project reach). Block nets are installed and maintained at the upstream and downstream end of each site prior to construction activities to remove fish from the project reach during construction, and to complete pre-construction sampling and marking. Prior to construction activities, fish are captured upstream and downstream of the impediment and clipped on the upper or lower caudal fin, respectively. All fish are then released downstream of the downstream block net. Removal of fish from the immediate construction area decreases fish mortality and prevents fish from becoming trapped in the dewatered construction area. Following construction activities, the downstream block net is removed and after a period of 24 hours, each project reach is re-sampled to determine if marked fish have moved upstream of the former impediment to demonstrate successful fish passage.

Data from all electrofishing surveys is maintained by the Ozaukee County Planning and Parks Department and routinely provided to the Wisconsin Department of Natural Resources for inclusion in the Surface Water Integrated Monitoring System (SWIMS) database.

Qualitative Fish Habitat Rating Assessments

The WDNR has developed a draft predictive fisheries model for main rivers and streams in Wisconsin, covering approximately 79 fish species. This theoretical model uses several variables including temperature, hydrologic models, land-use associations, and archived species occurrence data to predict both species

occurrence and abundance. However, this is a coarse, state-wide model focused on larger rivers and streams and does not include any localized in-stream habitat characteristics.

In response, qualitative fish habitat rating assessments have been completed on 27 tributary streams within the Milwaukee Estuary AOC and Lake Michigan Basin, using a protocol developed by Department staff based on the WDNR's "Guidelines for Qualitative Physical Habitat Evaluation of Wadable Streams" protocols for streams < 10 m wide. This protocol has been refined to include habitat measurements that are compatible with the USGS Habitat Suitability Index (HSI). The habitat assessment measurements were used in a model based on the USGS HSI to create scores for individual fish species in each habitat assessment station. These habitat assessments are used in conjunction with a fisheries data layer for estimating the overall habitat quality of the various stream reaches and potential for various target species occurrence. Stream measurements fall under two broad categories: physical characteristics and water quality. From the 15 primary field measurements, each target species' specific habitat requirements are derived and scored according to USGS HSI models.

Model outputs provide both an indication of the overall stream quality and of habitat conditions for the targeted species. These outputs have been extrapolated to their corresponding representative stream reaches, helping assess the main project river or stream and its potential to support the occurrence or reproduction of focal/Species of Local Conservation Interest (SLCIs fish species). The model outputs are used by the Ozaukee County Planning and Parks Department and other local partners to inform decisions involving priorities for potential habitat restoration and protection projects.

Lake Sturgeon Habitat Assessment

The Ozaukee County Planning and Parks Department is currently implementing the use of side-scan sonar and field assessments to classify habitat and substrate for use in a comprehensive habitat suitability model for Lake Sturgeon in the Milwaukee River in Milwaukee County and Ozaukee County. Lake Sturgeon (*Acipenser fulvescens*) is one of the Great Lakes basin's oldest and largest indigenous species. Historically, this species had populations that numbered in the millions basin-wide, but were reduced to remnant populations by 1920 from overharvest, habitat loss and degradation, and water quality impairments. Furthermore, the construction of dams and other flood control measures along the Milwaukee River in the 1900s prevented natural sturgeon regeneration. Lake Sturgeon are potamodromous, periodic spawners, migrating from lake feeding grounds upriver to spawn in the spring. Slow growth, late sexual maturation, and natal spawning requirements complicate rehabilitation efforts.

Since 2006, Riveredge Nature Center (RNC), in partnership with the Wisconsin Department of Natural Resources (WDNR), has implemented the "Return the Sturgeon" reintroduction project in alignment with Wisconsin's statewide Lake Sturgeon Management Plan. This project includes the annual rearing and release of thousands of fingerling Lake Sturgeon into the Milwaukee River and Lake Michigan Basin. As of 2020, WDNR and RNC have released approximately 17,686 juvenile sturgeon, and adult Lake Sturgeon are beginning to return to the Milwaukee River to naturally spawn as they reach sexual maturity. In conjunction with these efforts, the Ozaukee County Planning and Parks Department and its partners have removed or remediated several fish passage impediments in the Milwaukee River Watershed, reconnecting 31 river miles between the Milwaukee River's mouth at Lake Michigan to the Bridge Street Dam in the Village of Grafton. However, it is unknown if remnant, accessible habitat will support a naturally reproducing population, as no comprehensive Lake Sturgeon instream habitat suitability information exists for the Milwaukee River.

Successful, proactive sturgeon management requires knowledge of existing (or lack of) high quality spawning and nursery habitat. Traditional, comprehensive instream habitat surveys of large areas can be time intensive and costly as well as employing discrete sampling techniques which requires data extrapolation. Alternatively, side-scan sonar is an innovative, low cost, effective method to identify substrate and capture continuous habitat data, particularly for species highly dependent on substrate requirements such as Lake Sturgeon. Side-scan sonar can capture substrate information over large areas where traditional, comprehensive habitat survey methods are not feasible due to time, financial, or other constraints. The Ozaukee County Planning and Parks Department is collecting sonar images from Milwaukee River confluence with the Milwaukee Harbor to the Bridge Street Dam in the Village of Grafton, and from Cedar Creek confluence with the Milwaukee River to the Nail Factory dam.

The final report generated by analysis of the sonar images will be sent to all partners to help inform decisions involving the Milwaukee River Lake Sturgeon reintroduction project, identify potential habitat restoration projects and to determine priorities for future protection and restoration projects. The resultant substrate and bathymetric mapping of the Milwaukee River and Cedar Creek will have multiple, long term applicability to other studies and uses (e.g. aquatic habitat, sediment evaluation, etc.) across the Great Lakes natural resources community.

Invasive Species Inventories

The Ozaukee County Planning and Parks Department conducts invasive vegetation species inventories within Ozaukee County-owned properties, habitat restoration project areas, and within rights-of-way of

state, county and federal roads to obtain information on invasive species presence and population. The inventories combine systematic field and GPS data acquisition methods to better understand and enhance the Ozaukee County Planning and Parks Department's knowledge of invasive plant locations, population levels, treatment methods and success. The inventory's objective is to accurately locate invasive species populations within natural areas, determine population levels (e.g. density and coverage), prescribe recommended control/treatment, and reassess population locations and infestation levels after several years of on-the-ground control and management. During invasive vegetation species inventories,

Planning and Parks staff also inventory ash tree populations as part of invasive emerald ash borer detection and management. Between 2016 – 2019, Ozaukee County Planning and Parks Department staff formally inventoried 252 acres of County Park land and detected 29 invasive vegetation species including: amur maple, autumn olive, black locust, bull thistle, Canada thistle, common buckthorn, common burdock, common comfrey, common tansy, common teasel, cut-leaved teasel, Dame's rocket, emerald ash borer, garlic mustard, glossy buckthorn, honeysuckle (*Lonicera* spp.), Japanese barberry, Japanese knotweed, lily of the valley, multiflora rose, narrow-leaved cattail, phragmites, purple crown vetch, purple loosestrife, reed canary grass, snowdrop, white sweet clover, wild parsnip and yellow sweet clover. Inventories are ongoing in conjunction with ongoing management activities.

In 2019, Ozaukee County Planning and Parks Department staff also conducted surveys along the rights-of-way of all private, local, state, county and federal roads within Ozaukee County for invasive teasel, Japanese knotweed, phragmites and wild parsnip to add to and update an existing database managed by the Southeastern Wisconsin Invasive Species Consortium, Inc (SEWISC). Examples of two invasive species inventories are provided in Appendix C.

Emerald Ash Borer/Tree Planting Efforts

Historically, ash tree species made up a significant proportion of the tree canopy in Ozaukee County. Since the arrival of emerald ash borer (EAB) in 2008, the majority of ash trees in Ozaukee County have died. It is estimated that 20% of the total tree canopy in Wisconsin is ash (WDNR), but inventories and field observations have found some woodlands in Ozaukee County to be comprised of 80-90% ash with a 99% mortality rate due to EAB.

The Ozaukee County Planning and Parks Department has removed over 2,500 EAB-infected ash trees in the Ozaukee County Park System alone and has implemented extensive native tree planting efforts within Ozaukee County Parks and properties, habitat restoration project areas, and private lands beyond normal

operations to mitigate the loss of the ash tree canopy. EAB management plans also exist for several County Parks.

Since 2014, the Ozaukee County Planning and Parks Department has planted nearly 37,000 trees prioritizing locally native species throughout Ozaukee County, the majority within the Ozaukee County Park System. This information is stored in a GIS database managed by the Department. The Ozaukee County Planning and Parks Department will continue to prioritize the removal of hazardous EAB-infected ash trees and native tree plantings to mitigate the loss of ash due to EAB.

Wildlife Monitoring

The Ozaukee County Planning and Parks Department often conducts wildlife monitoring activities in association with habitat restoration or enhancement projects conducted within the Ozaukee County Park System, and in habitat restoration project areas, as an important component to project planning and evaluating management decisions and effects. Wildlife monitoring has largely focused on avian, herptile, and mammal species. Monitoring activities conducted include breeding bird point-count surveys, audio/visual surveys, acoustic recording surveys, trail camera surveys, nest-box surveys, and trapping surveys (e.g. aquatic funnel trapping, and passive cover-object trapping).

Other Restoration Efforts

Prairie Restoration: Habitat loss is ever-increasing due to development, fragmentation, invasive species, poor water quality, and climate change. Native prairie/grassland are one of the most threatened natural communities and proactive measures are necessary to preserve and restore existing natural areas. The addition of native prairie/grassland species will improve native plant diversity, provide critical habitat for declining species of birds and pollinator species, improve soil, filter stormwater and improve water quality. The Ozaukee County Planning and Parks Department has been implementing native prairie restoration projects within several Ozaukee County Parks to create continuous and high-quality habitat to mitigate historical losses. Since 2011, the Department has seeded diverse native prairie on 41 acres at Tendick Nature County Park, eight acres at Virmond County Park, one acre at Ehlers County Park, and 0.5 acres at Harborview County Park. The Ozaukee Planning Parks Department will continue expanding these efforts as opportunities arise with planned expansions at Tendick Nature County Park, Virmond County Park, and the Little Menomonee River Fish and Wildlife Area County Park.

Wetland Restoration: Wetlands within the landscape provide a variety of important ecosystem services such as slowing and filtering water to improve water quality, recharging groundwater, and providing

habitat for a diversity of plants and animals. Wisconsin has lost nearly half of its original 10 million wetland acres and efforts should be made to protect and restore what remains. The Ozaukee County Planning and Parks Department has implemented several wetland restoration projects within the Ozaukee County Park System and habitat restoration project areas on private land. Since 2017, the Ozaukee County Planning and Parks Department has restored a 0.5-acre wetland at Tendick County Nature Park, is creating and restoring 6.5 acres of wetlands at the Little Menomonee River Fish and Wildlife County Park, and constructed a 0.30-acre wetland at Virmond County Park. The Ozaukee Planning Parks Department will continue expanding these efforts as opportunities arise with plans for future projects at Tendick Nature County Park and the Little Menomonee River Fish and Wildlife Area County Park.

Bird City Program

The mission of the Bird City Wisconsin program is: *To encourage all communities in Wisconsin to implement sound bird-conservation practices by offering public recognition to those that succeed in (a)enhancing the environment for birds and (b) educating the public about the interactions between birds and people and about the contributions birds make to a healthy community.* Specific categories to determine bird city community status includes: habitat creation, protection and monitoring; community forest management; limiting or removing threats to birds; public education; energy and sustainability; and world migratory bird day.

Ozaukee County has maintained High-Flyer status, meaning the county meets a minimum of six Bird City criteria within the major categories, through the Bird City Wisconsin Program, since its inception in 2010. In order to maintain Bird City status, Ozaukee County is required to implement actions throughout the County to improve and expand habitat and conditions for birds while incorporating education and outreach to expand the reach and efforts of Bird City communities.

The Ozaukee County Planning and Parks Department maintains High-Flyer status through habitat creation, protection and monitoring through prairie and reforestation projects, land acquisition and monitoring of bird nest boxes installed in the Ozaukee County Park System. In addition, the Department conducts education and outreach to the public through informational workshops, volunteer work-days, and training to numerous conservation corps teams that work with the Ozaukee County Park System on ecologically focused projects. The Ozaukee County Planning and Parks Department plans to continue efforts that will benefit birds, education the public and to maintain the High-Flyer Bird City status

3.8 WATER QUALITY STANDARDS AND WATER QUALITY CONDITIONS

Water quality standards are the basis for protecting and regulating the quality of surface waters. The standards implement portions of the Federal Clean Water Act (CWA) by specifying the designated uses of waterbodies and setting water quality criteria to protect those uses. The standards also include policies to protect high-quality waters and to prevent waters from being further degraded. Water quality standards are established to sustain public health and welfare, enjoyment of waters, and for the protection and propagation of fish, aquatic organisms, and other wildlife.

Water quality standards consist of three elements: designated uses, water quality criteria, and anti-degradation policy. These are set forth in Chapters NR 102, "Water Quality Standards for Wisconsin Surface Waters," NR 103, "Water Quality Standards for Wetlands," NR 104 "Uses and Designated Standards," NR 105, "Surface Water Quality Criteria and Secondary Values for Toxic Substances," and NR 207 "Water Quality Antidegradation and Antibacksliding," of the *Wisconsin Administrative Code*.

It is important to note that the water quality data referenced in this section of the Ozaukee County Land and Water Resource Management Plan would not be possible without the water quality monitoring, funding assistance, and volunteer work of numerous agencies and organizations over many years. Many of these organizations are noted in this section and include but are not limited to: US EPA; USGS; WDNR; Ozaukee County Planning and Parks Department; MMSD; Milwaukee Riverkeeper; and SEWRPC.

Designated Uses

The designated uses of a waterbody are a statement of the types of activities the waterbody should support, regardless of whether they are currently being attained. These uses establish water use objectives and water quality goals for the waterbody and determine the water quality criteria needed to protect those uses and achieve those goals. In Wisconsin, waterbodies are assigned four uses: recreation, fish and aquatic life, public health and welfare, and wildlife.

The fish and aquatic life use is divided into several categories:

- Coldwater community
- Warmwater sportfish community

- Warmwater forage fish community
- Limited forage fish community
- Limited aquatic life community

Coldwater communities include surface waters capable of supporting a community of coldwater fish and other aquatic organisms or serving as a spawning area for coldwater fish species. Warmwater sportfish communities include surface waters capable of supporting a community of warmwater sport fish or serving as a spawning area for warmwater sport fish. Warmwater forage fish communities include those waters capable of supporting an abundant diverse community of forage fish and other aquatic organisms. Because identical water quality criteria apply to them, the warmwater sportfish and warmwater forage fish categories are sometimes referred to a “warmwater fish and aquatic life (FAL).” Limited forage fish communities include surface waters of limited capacity and naturally poor water quality or habitat. These waters are capable of supporting only a limited community of forage fish and other aquatic organisms. Limited aquatic life communities include waters of severely limited capacity and naturally poor water quality or habitat. These waters are capable of supporting only a limited community of aquatic organisms. It is important to recognize that establishing a designated use other than coldwater or warmwater fish and aquatic life is not necessarily an indication of reduced water quality since such streams may be limited by flow or size but may still be performing well relative to other functions.

For the purpose of the anti-degradation policy to prevent the lowering of existing water quality, Wisconsin has classified some waters of the State as outstanding or exceptional resource waters. These waters, listed in Sections NR 102.10 and NR 102.11 of the *Wisconsin Administrative Code*, are deemed to have significant value due to the presence of valuable fisheries, hydrologically or geographically unique features, outstanding recreational opportunities, or other unique environmental features or settings.

The water use objectives for fish and aquatic life for waterbodies in Ozaukee County are shown on Map 3.2. All of the stream reaches and lakes within the County are classified as warmwater fish and aquatic life communities and full recreational use. There are no designated coldwater communities, limited forage fish

communities, limited aquatic life communities, outstanding resource waters, or exceptional resource waters within the County.³⁰

The designated uses shown on Map 3.2 are regulatory designations. They serve to define the water quality criteria that apply to these waters and as the basis for determining whether water quality conditions in them meets the requirements set forth under the CWA and Wisconsin law. For management purposes, agencies such as the WDNR may also use other classification systems. These systems may be based on factors such as water temperature, stream discharge, stream depth, or stream width. These systems may provide useful information about water quality and biological conditions within waterbodies. While they may serve as a basis for evaluating such conditions for management purposes, until they are reflected in the water quality standards promulgated by the State, they lack the regulatory significance of the designated uses shown on Map 3.2.

Surface Water Quality Criteria

Water quality standards also specify criteria that must be met to ensure that the designated uses of waterbodies are supported. These water quality criteria are statements of the physical, chemical, and biological characteristics of the water that must be maintained if the water is to be suitable for the designated use. Some criteria consist of limits or ranges of concentrations that are not to be exceeded. Others are narrative descriptions of conditions that apply to all waters.

The applicable water quality criteria for water uses designated in Southeastern Wisconsin are shown in Tables 3.1 and 3.2. Table 3.1 shows the applicable water quality criteria for all designated uses for five water quality parameters: dissolved oxygen concentration, pH, *Escherichia coli* bacteria (*E. coli*) concentration,³¹ total phosphorus concentration, and chloride concentration. It also shows the criterion for water temperature for limited aquatic life waters. Table 3.2 shows the water quality criteria for temperature for each of the fish and aquatic life categories. As part of the temperature criteria, the warmwater communities are further categorized based on their seven-day, 10-percent probability low flow (7Q10).³² The 7Q10s of

³⁰ While it is not officially listed as a coldwater stream or trout water, the lower portions of Sauk Creek have populations of stocked rainbow and brown trout. In addition, recent studies by the WDNR have confirmed the presence of naturally reproducing rainbow trout in these reaches.

³¹ Prior to June 1, 2020, Wisconsin's water quality criteria for recreational use were based upon concentrations of fecal coliform bacteria. It should be noted that *E. coli* is one species within the fecal coliform bacteria group.

³² This is the seven consecutive day low flow that has an annual probability of occurrence of 10 percent.

all the streams in Ozaukee County are less than 200 cubic feet per second (cfs), thus they are designated as small warmwater communities.

In addition to the numerical criteria presented in the tables, there are narrative standards that apply to all waters. All surface waters must meet these conditions at all times and under all flow conditions. Section NR 102.04(1) of the *Wisconsin Administrative Code* states that: "Practices attributable to municipal, commercial, domestic, agricultural, land development or other activities shall be controlled so that all waters including the mixing zone meet the following conditions at all times and under all flow conditions:

"(a) "Substances that will cause objectionable deposits on the shore or in the bed of a body of water shall not be present in such amounts as to interfere with public rights in the waters of the State.

"(b) "Floating or submerged debris, oil, scum or other material shall not be present in such amounts as to interfere with public rights in the waters of the State.

"(c) "Materials producing color, odor, taste, or unsightliness shall not be present in such amounts as to interfere with public rights in the waters of the State.

"(d) "Substances in concentrations or combinations which are toxic or harmful to humans shall not be present in amounts found to be of public health significance, nor shall such substances be present in amounts which are acutely harmful to animal, plant, or aquatic life."

For streams within the Milwaukee River watershed, including those in Ozaukee County, the Milwaukee River Basin Total Maximum Daily Load (TMDL) study sets a goal for total suspended solids (TSS) in which the concentration of TSS is not to exceed 12 milligrams per liter (mg/l).³³ While this goal is not a regulatory water quality criterion, the WDNR is using it as a basis for developing effluent limitations for discharge permits issued under the Wisconsin Pollutant Discharge Elimination System and for evaluating water quality conditions within streams in the Menomonee and Milwaukee River watersheds in Ozaukee County.

³³ *Milwaukee Metropolitan Sewerage District, Total Maximum Daily Loads for Total Phosphorus, Total Suspended Solids, and Fecal Coliform: Milwaukee River Basin, Wisconsin, Report, March 19, 2018.*

Water Quality Conditions

Since 2000, several studies have examined water quality conditions in waterbodies located in Ozaukee County. The findings of these studies are summarized by watershed and stream in the subsections that follow.

Fish Creek

The MMSD conducted water quality sampling in Fish Creek during the period 2002 through 2005.³⁴ Dissolved oxygen concentrations ranged between 4.0 mg/l and 12.4 mg/l, with a mean concentration of 8.2 mg/l. While dissolved oxygen concentrations at each site occasionally dipped below 5.0 mg/l, concentrations in about 93 percent of the samples complied with the State's water quality criterion of 5.0 mg/l. Slightly better compliance was observed at the downstream sampling station. Total phosphorus concentrations in Fish Creek ranged between 0.018 mg/l and 0.710 mg/l, with a mean concentration of 0.120 mg/l. Concentrations at both stations often exceeded the planning standard used to evaluate conditions, with concentrations in 56 percent of the samples being higher than 0.10 mg/l.³⁵ Higher concentrations were observed at the downstream sampling station. Concentrations of fecal coliform bacteria in Fish Creek ranged between 16 cells per 100 milliliters (cells per 100 ml) and 93,000 cells per 100 ml, with a median value of 435 cells per 100 ml. Concentrations usually exceeded the water quality criteria in effect at the time, with concentrations in less than 31 percent of the samples being lower than the geometric mean standard of 200 cells per 100 ml. Limited sampling showed that concentrations of *E. coli* were often high, ranging between 15 cells per 100 ml and 19,000 cells per 100 ml.

Milwaukee River Basin

Menomonee River Watershed

Staff from the Regional Planning Commission compiled and analyzed available water quality data collected by the WDNR, MMSD, Milwaukee Riverkeeper, and U.S. Geological Survey for the Menomonee River watershed from the period 1998 through 2011.³⁶ These analyses included data from the Little Menomonee River, which has headwaters located in Ozaukee County and Little Menomonee Creek, which is located

³⁴SEWRPC *Technical Report No. 39, Water Quality Conditions and Sources of Pollution in the Greater Milwaukee Watersheds, November 2007.*

³⁵ *Wisconsin's water quality criterion for phosphorus went into effect in 2010, after the publication of the cited report.*

³⁶ SEWRPC *Memorandum Report No. 204, Development of a Framework for a Watershed-Based Municipal Stormwater Permit for the Menomonee River Watershed, January 2013.*

entirely in Ozaukee County. For tributaries such as the Little Menomonee River and Little Menomonee Creek, this study examined water quality on a whole-stream basis.

During the period assessed, several water quality parameters in the Little Menomonee River complied with the State's water quality criteria. Dissolved oxygen concentrations in over 87 percent of the samples were higher than the State criterion of 5.0 mg/l. Chloride concentration in over 99 percent of the samples were less than both the State's acute toxicity water quality criterion of 757 mg/l and chronic toxicity criterion of 395 mg/l. Water temperatures in the stream were less than the applicable acute temperature criterion on almost 99 percent of the days assessed and the sublethal temperature criterion during almost 94 percent of the weeks assessed.

Concentrations of other water quality parameters indicated the presence of water quality problems in the Little Menomonee River. Concentrations of total phosphorus in only 14 percent of the samples collected were less than the State's water quality criterion of 0.075 mg/l. Similarly, concentrations of fecal coliform bacteria in less than 17 percent of the samples were lower than the geometric mean criterion of 200 cells per 100 ml which was in effect at the time the analyses were conducted. High concentrations of total suspended solids were detected in the River, ranging from 0 mg/l to 1,100 mg/l with a mean value of 132 mg/l. Concentrations of total suspended solids in most samples were higher than the 12 mg/l target set in the Milwaukee River Basin TMDL.

As part of this study, Commission staff also examined water quality conditions related to two water quality parameters in Little Menomonee Creek. During a limited period of continuous monitoring, water temperatures in the Creek complied with both the acute and sublethal temperature criteria. Concentrations of total phosphorus in less than 18 percent of the samples were less than the State's water quality criterion of 0.075 mg/l.

Milwaukee River Watershed

During 2012 through 2013, the Ozaukee County Planning and Parks Department collected and analyzed water samples at 30 water quality sampling sites on streams in the portion of the Milwaukee River watershed located in Ozaukee County.³⁷ Streams that were sampled included the Milwaukee River, the North Branch of the Milwaukee River, Cedar Creek, Fredonia Creek, Hawthorne Drive Creek, Mole Creek, Pigeon Creek,

³⁷ A.T. Struck, M. Aho, R. McCone, B. Stuhr, K. Kroening, and T. Dueppen, *Monitoring to Address 7 of 11 BUIs—Milwaukee River Estuary AOC Task 2: Water Quality Report, Ozaukee County Planning and Land Use Department, March 31, 2015.*

Riverside Drive Creek, Trinity Creek, and Ulao Creek. At each sampling station, five samples were collected. The report presented results as percentages of the samples collected from the study area and noted sites where concentrations of water quality parameters exceeded certain thresholds related to water quality criteria or other thresholds thought to indicate poor water quality. While the report did not list all sites where exceedances occurred, in some instances it noted sites that had exceedances in more than one sample or where high concentrations were present. The results give an indication of overall water quality conditions in the portion of the Milwaukee River watershed that is located in Ozaukee County.

Concentrations of fecal coliform bacteria were higher than the State's former geometric mean criterion of 200 cells per 100 ml in 25 out of 150 samples. In addition, concentrations in at least one sample were higher than 200 cells per 100 ml at 14 sites and higher than the State's former single sample criterion of 400 cells per 100 ml at 10 sites. Streams in which more than one sample had concentrations that exceeded 200 cells per 100 ml included the Milwaukee River at two sites, Fredonia Creek, Hawthorne Drive Creek, Mole Creek, the North Branch of the Milwaukee River, Pigeon Creek, Trinity Creek, and Ulao Creek.

Concentrations of total phosphorus were higher than the applicable State water quality criterion in 89 out of 150 samples³⁸. High concentrations of orthophosphate, a dissolved form of phosphorus which is readily available to plants and algae, were reported in several streams, including two upstream sites in the mainstem of the Milwaukee River, Hawthorne Drive Creek, the North Branch of the Milwaukee River, Riverside Drive Creek, and Ulao Creek.

Concentrations of total suspended solids in 42 out of 150 samples were higher than the 12 mg/l target set in the Milwaukee River Basin TMDL.

The study also examined several chemical forms of nitrogen that can serve as plant nutrients. Total nitrogen includes all forms of nitrogen that are available to plants and algae. It consists of ammonia, total Kjeldahl nitrogen, which is a combination of ammonia and organic forms of nitrogen, and inorganic nitrogen consisting of the combined total of nitrate and nitrite. Wisconsin has promulgated water quality criteria for

³⁸ According to the State's water quality standards, concentrations of total phosphorus in the Milwaukee River downstream from the confluence with Cedar Creek are not to exceed 0.100 mg/l and concentrations in upstream portions of the Milwaukee River and all other streams of the Milwaukee River watershed in Ozaukee County are not to exceed 0.075 mg/l.

ammonia, but not for the other forms of nitrogen. For some forms, the study compared concentrations to water quality criteria recommended by the U.S. Environmental Protection Agency (USEPA).³⁹

While the study did not compare concentrations of ammonia to the State's water quality criteria for ammonia, it noted that elevated concentrations were detected in samples from four sites in the Milwaukee River and in samples from Cedar Creek, Hawthorne Drive Creek, the North Branch of the Milwaukee River, Riverside Drive Creek, Trinity Creek, and Ulao Creek. Concentrations of Kjeldahl nitrogen were higher than the USEPA's recommended reference concentration of 0.65 mg/l in 126 out of 150 samples. Concentrations of nitrate plus nitrite were higher than the USEPA's recommended reference concentration of 0.94 mg/l in 129 out of 150 samples. Concentrations of total nitrogen were higher than the USEPA's recommended reference concentration of 1.59 mg/l in 129 out of 150 samples. These results suggest that concentrations of nitrogen compounds in the Milwaukee River watershed may be high enough to cause or contribute to water quality problems.

The Ozaukee County Planning and Land Use Department is currently conducting water quality monitoring in the Little Menomonee River and Creek, Kaul Creek, Mole Creek, and Ulao Creek. This monitoring includes the use of continuous monitoring equipment and collection of water samples for chemical analysis. Through grant funding beginning in 2016, a series of discrete water quality sampling events and continuous water quality monitoring using stationed units is providing data necessary to establish a baseline and provides insight into water quality trends associated with stream and habitat restoration pre- and post-construction, potentially validating the numerous benefits of the Department's restoration projects. Discrete water quality samples are collected and analyzed for chloride, E. coli, orthophosphate (dissolved reactive phosphorus), total phosphorus chloride, and total suspended solids (TSS) by the Wisconsin SLOH approximately every 30 days from May – October. Additional quantitative abiotic parameters are measured at time of water sampling using a handheld instrument, including: water temperature; pH; conductivity; total dissolved solids (TDS); dissolved oxygen concentration and percent saturation; turbidity; salinity; atmospheric pressure; air temperature; wet and bankfull width of the stream; and water depth and velocity (at one foot increments across the stream). Visual observations regarding water clarity, condition of riparian habitat, and presence of animal species are also noted. Deployable continuous water quality monitoring units are deployed seasonally (May – October) and are designed to measure water temperature, water depth, dissolved oxygen concentration, pH, and conductivity, and are programmed to record readings every 30 minutes.

³⁹ U.S. Environmental Protection Agency, *Ambient Water Quality Criteria Recommendations—Information Supporting Development of State and Tribal Nutrient Criteria—Rivers and Streams in Nutrient Ecoregion VII, EPA 822-B-00-018, 2000.*

Milwaukee River

Four recent reports summarize water quality data from the Milwaukee River in Ozaukee County.

As part of developing a watershed restoration plan for a portion of the Milwaukee River watershed near the Villages of Fredonia and Newburg, Applied Ecological Services reviewed and summarized available data from two sampling sites along the Milwaukee River that had been collected by the WDNR and Milwaukee Riverkeeper over the period 2008 through 2018.⁴⁰ The upstream site is located at the streamside rearing facility near the west entrance to Riveredge Nature Center and the downstream site is located at Hawthorne Road near the main entrance to Riveredge Nature Center. Mean dissolved oxygen concentrations at the upstream and downstream sites were 9.4 mg/l and 7.6 mg/l, respectively. Mean total phosphorus concentrations at the upstream and downstream sites were 0.117 mg/l and 0.155 mg/l, respectively. These mean values are higher than the State's water quality criterion of 0.075 mg/l.

As part of a project for the MMSD, the Great Lakes Environmental Center conducted monthly water quality sampling during spring, summer, and fall at four sites in the Milwaukee River between September 2017 and November 2019.⁴¹ From upstream to downstream, these sites were located:

- Downstream from Riverside Drive near Evergreen Lane north of the Village of Saukville
- Downstream from the Village of Saukville wastewater treatment plant
- At CTH T
- At STH 167

Dissolved oxygen concentrations in the River ranged between 3.2 mg/l and 19.7 mg/l with median values from upstream to downstream of 8.7 mg/l, 8.6 mg/l, 13.4 mg/l, and 9.0 mg/l. At all of the sites except CTH T, concentrations of dissolved oxygen in over 10 percent of the samples were less than the State's water quality criterion of 5.0 mg/l. Values of specific conductance ranged between 340 microSiemens per centimeter

⁴⁰ *Applied Ecological Services, Fredonia-Newburg Area Watershed-Based Plan, Ozaukee, Sheboygan, and Washington Counties, Wisconsin: A Strategy for Protecting and Restoring Watershed Health, October 2019.*

⁴¹ *Great Lakes Environmental Center, Baseline Water Quality Monitoring, Milwaukee River Watershed, Phase One, Report to the Milwaukee Metropolitan Sewerage District, March 31, 2020.*

($\mu\text{S}/\text{cm}$) and 1,395 $\mu\text{S}/\text{cm}$ with median values at the sites from upstream to downstream of 738 $\mu\text{S}/\text{cm}$, 738 $\mu\text{S}/\text{cm}$, 751 $\mu\text{S}/\text{cm}$ and 741 $\mu\text{S}/\text{cm}$. These values are high and may indicate that high concentrations of chloride are present in the River. Concentrations of total suspended solids ranged between 1.7 mg/l and 260 mg/l with median values at the sites from upstream to downstream of 7.5 mg/l, 10.0 mg/l, 6.8 mg/l, and 12.0 mg/l. Concentrations in over 10 percent of the samples from the upstream three sites and in half the samples from the downstream site were higher than the 12 mg/l target set in the Milwaukee River Basin TMDL. Concentrations of total phosphorus ranged between 0.022 mg/l and 0.610 mg/l with median values at sites from upstream to downstream of 0.089 mg/l, 0.084 mg/l, 0.088 mg/l, and 0.093 mg/l. Concentrations in over half the samples collected at each of the four sites were higher than the State's water quality criterion of 0.075 mg/l. Concentrations of fecal coliform bacteria ranged from 14 cells per 100 ml to 73,000 cells per 100 ml with median values at the sites from upstream to downstream of 160 cells per 100 ml, 150 cells per 100 ml, 180 cells per 100 ml, and 190 cells per 100 ml. Concentrations in over 10 percent of the samples collected at each site were higher than the State's former geometric mean water quality criterion of 200 cells per 100 ml. Concentrations of *E. coli* ranged from 12 cells per 100 ml to 13,000 cells per 100 ml with median values at sites from upstream to downstream of 170 cells per 100 ml, 160 cells per 100 ml, 135 cells per 100 ml, and 210 cells per 100 ml. Concentrations in over half of the samples collected at each site were higher than the State's geometric mean water quality criterion of 126 cells per 100 ml. The large percentage of samples that had high concentrations of fecal coliform bacteria and *E. coli* indicate that fecal wastes from humans or animals may be entering the Milwaukee River.

During 2012 and 2013, monthly water quality samples were collected and analyzed from three sites located in the Milwaukee River upstream of, at, and downstream from the outfall into the River from the Village of Grafton's wastewater treatment plant.⁴² At each site, samples were collected near both the east bank and the west bank of the River. Dissolved oxygen concentrations at these sites ranged from 7.6 mg/l to 19.3 mg/l, with a mean value of 13.08 mg/l. Values of specific conductance ranged from 491 $\mu\text{S}/\text{cm}$ to 1,102 $\mu\text{S}/\text{cm}$ with a mean value of 658 $\mu\text{S}/\text{cm}$. These values are high and may indicate that high concentrations of chloride are present in the River. Concentrations of total suspended solids ranged between 1.7 mg/l and 155 mg/l, with a mean value of 16.9. Concentrations in over one-fourth of the samples were greater than the target level of 12.0 mg/l set by the Milwaukee River Basin TMDL. Concentrations of total phosphorus ranged from below the limit of detection to 0.798 mg/l with a mean value of 0.103 mg/l. Concentrations in about 39 percent of the samples exceeded the State's water quality criterion of 0.075 mg/l. While more

⁴² *Symbiont*, Milwaukee River Monitoring Report, Report to the Village of Grafton, November 12, 2013.

exceedances of this criterion occurred at the site upstream of the WWTP outfall than at the sites at or downstream of the outfall, statistical testing did not detect any differences in water quality among the sites.

Ozaukee County conducted continuous monitoring of water temperature, dissolved oxygen, pH, and specific conductance at three locations in the Milwaukee River during 2011 through 2013.⁴³ The upstream site was located upstream of the confluence with Riverside Drive Creek. The middle site was located downstream from the Bridge Street dam in Grafton, and the downstream site was located downstream from the confluence with Trinity Creek. While concentrations of dissolved oxygen did not drop below the State's water quality criterion of 5.0 mg/l during 2011, daily minimum concentrations below 60 percent saturation⁴⁴ were detected at both the upstream and downstream sites during summer months. Daily average concentrations for dissolved oxygen at the upstream site were also below 60 percent saturation during the month of July. During July and portions of June and August 2012, the majority of daily minimum and daily average concentrations at the upstream site were below 60 percent saturation. Considerable fluctuations were observed in dissolved oxygen concentrations at the other two sites. The results from 2012 are likely related to the low flows and high water temperatures associated with the 2012 drought. During 2013, daily minimum dissolved oxygen concentrations at the upstream site were commonly below 60 percent saturation from late July through mid-September.

During 2011 and 2012, pH readings at all three continuous monitoring sites were generally within the 6.0 standard units (stu) to 9.0 stu range specified in Wisconsin's water quality criteria for pH, with occasional readings exceeding 9.0 stu. In 2013, all pH readings at all three sites were within the 6.0 stu to 9.0 stu range.

During all three years, daily minimum, average and maximum specific conductance at all three sites on the Milwaukee River were generally above 500 $\mu\text{S}/\text{cm}$.

Cedar Creek Subwatershed

As part of a project for the MMSD, the Great Lakes Environmental Center conducted monthly water quality sampling during spring, summer, and fall at two sites in Cedar Creek located in Ozaukee County between September 2017 and November 2019.⁴⁵ The upstream site was at STH 60 and the downstream site was at

⁴³ *Struck and others 2015, op. cit.*

⁴⁴ *Saturation concentration is the concentration of dissolved oxygen that water can hold under ambient conditions of temperature and pressure. As water temperature increases, the saturation concentration decreases.*

⁴⁵ *Great Lakes Environmental Center, op. cit.*

Green Bay Road. Dissolved oxygen concentrations in the Creek ranged between 4.0 mg/l and 17.5 mg/l with median values of 8.7 mg/l at the upstream site and 11.0 mg/l at the downstream site. At the upstream site, concentrations of dissolved oxygen in fewer than 10 percent of the samples were less than the State's water quality criterion of 5.0 mg/l. Dissolved oxygen concentrations in all of the samples collected at the downstream site were higher than 5.0 mg/l. Values of specific conductance ranged between 514 μ S/cm and 958 μ S/cm with median values of 745 μ S/cm at both sites. Concentrations of total suspended solids ranged between 0.5 mg/l and 30 mg/l with median values of 4.0 mg/l at the upstream site and 3.9 mg/l at the downstream site. Concentrations in several samples from the upstream site and in some samples from the downstream site were higher than the 12 mg/l target set in the Milwaukee River Basin TMDL. Concentrations of total phosphorus ranged between 0.022 mg/l and 0.160 mg/l with median values of 0.098 mg/l at the upstream site and 0.093 mg/l at the downstream site. Concentrations in the majority of the samples collected in both of these studies were higher than the State's water quality criterion of 0.075 mg/l. Concentrations of fecal coliform bacteria in the Ozaukee County section of Cedar Creek ranged from 7 cells per 100 ml to 4,600 cells per 100 ml with median values of 180 cells per 100 ml at the upstream site and 160 cells per 100 ml at the downstream site. Concentrations in several samples from both sites were higher than the State's former geometric mean water quality criterion of 200 cells per 100 ml. Concentrations of *E. coli* ranged from 8 cells per 100 ml to 4,600 cells per 100 ml with median values of 145 cells per 100 ml at the upstream site and 122 cells per 100 ml at the downstream site. Concentrations in over half of the samples from the upstream site and almost half of the samples from the downstream site were higher than the State's geometric mean water quality criterion of 126 cells per 100 ml. The large percentage of samples that had high concentrations of fecal coliform bacteria and *E. coli* indicate that fecal wastes from humans or animals may be entering this stream.

As part of the same project the Great Lakes Environmental Center also conducted monthly water quality sampling over the same period during spring, summer, and fall at one site in Mud Creek, a tributary stream to Cedar Creek.⁴⁶ Dissolved oxygen concentrations in the Creek ranged between 1.9 mg/l and 10.4 mg/l with a median value of 7.1 mg/l. Concentrations in about 10 percent of the samples were lower than the State's water quality criterion of 5.0 mg/l. Values of specific conductance ranged between 259 μ S/cm and 776 μ S/cm with a median value of 317 μ S/cm. Concentrations of total suspended solids ranged between 0.05 mg/l and 14 mg/l with a median value of 1.5 mg/l. About 90 percent of concentrations in Mud Creek were less than 5.6 mg/l, indicating that concentrations in almost all of the samples were less than the 12 mg/l target set in the Milwaukee River Basin TMDL. Concentrations of total phosphorus ranged between

⁴⁶ *Ibid.*

0.002 mg/l and 0.059 mg/l with a median value of 0.016 mg/l. Concentrations in all of the samples were less than 0.075 mg/l, indicating that they complied with the State's water quality criterion. Concentrations of fecal coliform bacteria ranged from 2 cells per 100 ml to 2,100 cells per 100 ml with a median value of 87 cells per 100 ml. Concentrations in slightly more than 10 percent of the samples were higher than the State's former geometric mean water quality criterion of 200 cells per 100 ml. Concentrations of *E. coli* ranged from 8 cells per 100 ml to 930 cells per 100 ml with a median value of 101 cells per 100 ml. Concentrations in less than half of the samples were higher than the State's geometric mean water quality criterion of 126 cells per 100 ml. The large percentage of samples that had high concentrations of fecal coliform bacteria and *E. coli* indicate that fecal wastes from humans or animals may be entering this stream.

Mole Creek

As part of a project for the MMSD, the Great Lakes Environmental Center conducted monthly water quality sampling during spring, summer, and fall at one site in Mole Creek between September 2017 and November 2019.⁴⁷ Dissolved oxygen concentrations in the Creek ranged between 4.5 mg/l and 18.5 mg/l with a median value of 9.0 mg/l. Dissolved oxygen concentrations in less than 10 percent of the samples were below the State's water quality criterion of 5.0 mg/l. Values of specific conductance ranged between 314 μ S/cm and 851 μ S/cm with a median value of 739 μ S/cm. Concentrations of total suspended solids in Mole Creek ranged between 1.5 mg/l and 18 mg/l with a median value of 3.5 mg/l. About 90 percent of concentrations were less than 7.4 mg/l, indicating that concentrations in almost all of the samples were less than the 12 mg/l target set in the Milwaukee River Basin TMDL. Concentrations of total phosphorus ranged between 0.022 mg/l and 0.100 mg/l with a median value of 0.056 mg/l. Concentrations in 90 percent of the samples were less than 0.092 mg/l, indicating that concentrations in many samples were greater than the State's water quality criterion of 0.075 mg/l. Concentrations of fecal coliform bacteria ranged from 5 cells per 100 ml to 2,200 cells per 100 ml with a median value of 350 cells per 100 ml. Concentrations in over half of the samples were higher than the State's former geometric mean water quality criterion of 200 cells per 100 ml. Concentrations of *E. coli* ranged from 10 cells per 100 ml to 3,300 cells per 100 ml with a median value of 140 cells per 100 ml. Concentrations in over half of the samples were higher than the State's geometric mean water quality criterion of 126 cells per 100 ml. The large percentage of samples that had high concentrations of fecal coliform bacteria and *E. coli* indicate that fecal wastes from humans or animals may be entering this stream.

⁴⁷ Great Lakes Environmental Center, *op. cit.*

North Branch of the Milwaukee River

As part of developing a watershed restoration plan for a portion of the Milwaukee River watershed near the Villages of Fredonia and Newburg, Applied Ecological Services reviewed and summarized available data from two sampling sites along the North Branch of the Milwaukee River that had been collected by the WDNR and the Milwaukee Riverkeeper over the period of 2008 through 2018.⁴⁸ The upstream site is located at CTH M in Washington County and the downstream site is located at the Ozaukee-Washington County line. Mean dissolved oxygen concentrations at the upstream and downstream sites were 9.2 mg/l and 7.1 mg/l, respectively. Mean total phosphorus concentrations at the upstream and downstream sites of the North Branch of the Milwaukee River were 0.084 mg/l and 0.132 mg/l, respectively. These mean values are higher than the State's water quality criterion of 0.075 mg/l. Mean total suspended solids concentration at the upstream site was 13 mg/l, suggesting that concentrations in some samples were higher than the 12.0 mg/l target set in the Milwaukee River Basin TMDL.

Pigeon Creek

As part of a project for the MMSD, the Great Lakes Environmental Center conducted monthly water quality sampling during spring, summer, and fall at one site in Pigeon Creek between September 2017 and November 2019.⁴⁹ Dissolved oxygen concentrations in the Creek ranged between 7.2 mg/l and 17.0 mg/l with a median value of 9.8 mg/l. Values of specific conductance ranged between 745 μ S/cm and 1,037 μ S/cm with a median value of 823 μ S/cm. These values are high and may indicate that high concentrations of chloride are present in the stream. Concentrations of total suspended solids in Pigeon Creek ranged between 1.2 mg/l and 23 mg/l with a median value of 3.8 mg/l. About 90 percent of concentrations were less than 9.3 mg/l, indicating that concentrations in almost all of the samples were less than the 12 mg/l target set in the Milwaukee River Basin TMDL. Concentrations of total phosphorus ranged between 0.011 mg/l and 0.083 mg/l with a median value of 0.041 mg/l. Concentrations in 90 percent of the samples were less than 0.073 mg/l, indicating that concentrations in almost all of the samples were less than the State's water quality criterion of 0.075 mg/l. Concentrations of fecal coliform bacteria ranged from 7 cells per 100 ml to 4,200 cells per 100 ml with a median value of 175 cells per 100 ml. Concentrations in slightly under half of the samples were higher than the State's former geometric mean water quality criterion of 200 cells per 100 ml. Concentrations of *E. coli* ranged from 7 cells per 100 ml to 3,100 cells per 100 ml with a median value of 140 cells per 100 ml. Concentrations in over half of the samples were higher than the State's geometric mean water quality criterion of 126 cells per 100 ml. The large percentage of samples that had

⁴⁸ *Applied Ecological Services 2019, op. cit.*

⁴⁹ *Great Lakes Environmental Center, op. cit.*

high concentrations of fecal coliform bacteria and *E. coli* indicate that fecal wastes from humans or animals may be entering this stream.

Riverside Drive Creek

As part of a project for the MMSD, the Great Lakes Environmental Center conducted monthly water quality sampling during spring, summer, and fall at one site in Riverside Drive Creek between September 2017 and November 2019.⁵⁰ Dissolved oxygen concentrations in the Creek ranged between 3.8 mg/l and 25.6 mg/l with a median value of 7.3 mg/l. Dissolved oxygen concentrations in over 10 percent of the samples were below the State's water quality criterion of 5.0 mg/l. In addition, the high maximum concentrations suggest that supersaturation of dissolved oxygen may be occurring in this stream and that the stream may be experiencing large fluctuations in dissolved oxygen concentrations over the course of the day. Such conditions can be harmful to fish and other aquatic organisms. Values of specific conductance ranged between 540 μ S/cm and 1,066 μ S/cm with a median value of 801 μ S/cm. These values are high and may indicate that high concentrations of chloride are present in the stream. Concentrations of total suspended solids in Riverside Drive Creek ranged between 0.5 mg/l and 30 mg/l with a median value of 6.3 mg/l. About 90 percent of concentrations were less than 16 mg/l, indicating that concentrations in more than 10 percent of the samples were greater than the 12 mg/l target set in the Milwaukee River Basin TMDL. Concentrations of total phosphorus ranged between 0.064 mg/l and 0.900 mg/l with a median value of 0.175 mg/l. Concentrations in 10 percent of the samples were less than 0.098 mg/l, indicating that concentrations in the vast majority of samples were greater than the State's water quality criterion of 0.075 mg/l. Concentrations of fecal coliform bacteria ranged from 2 cells per 100 ml to 4,400 cells per 100 ml with a median value of 220 cells per 100 ml. Concentrations in over half of the samples were higher than the State's former geometric mean water quality criterion of 200 cells per 100 ml. Concentrations of *E. coli* ranged from 4 cells per 100 ml to 1,400 cells per 100 ml with a median value of 260 cells per 100 ml. Concentrations in over half of the samples were higher than the State's geometric mean water quality criterion of 126 cells per 100 ml. The large percentage of samples that had high concentrations of fecal coliform bacteria and *E. coli* indicate that fecal wastes from humans or animals may be entering this stream.

Ulao Creek

As part of a project for the MMSD, the Great Lakes Environmental Center conducted monthly water quality sampling during spring, summer, and fall at two sites in Ulao Creek between September 2017 and

⁵⁰ *Ibid.*

November 2019.⁵¹ The upstream site was at STH 60 and the downstream site was at Bonniwell Road. Dissolved oxygen concentrations in the Creek ranged between 1.7 mg/l and 14.5 mg/l with median values of 7.0 mg/l at the upstream site and 8.8 mg/l at the downstream site. At both sites, concentrations of dissolved oxygen in over 10 percent of the samples were less than the State's water quality criterion of 5.0 mg/l. Values of specific conductance ranged between 488 μ S/cm and 1,395 μ S/cm with median values of 893 μ S/cm at the upstream site and 1,004 μ S/cm at the downstream site. These values are high and may indicate that high concentrations of chloride are present in the stream. Concentrations of total suspended solids ranged between 2.2 mg/l and 250 mg/l with median values of 7.5 mg/l at the upstream site and 12.0 mg/l at the downstream site. Concentrations in half of the samples from the downstream site and in a substantial number of samples from the upstream site were higher than the 12 mg/l target set in the Milwaukee River Basin TMDL. Concentrations of total phosphorus ranged between 0.030 mg/l and 0.640 mg/l with median values of 0.094 mg/l at the upstream site and 0.120 mg/l at the downstream site. These results confirm previous findings of high total phosphorus concentrations in Ulao Creek.⁵² Concentrations of total phosphorus in the Creek in 2013 ranged between 0.0651 mg/l and 0.315 mg/l with a mean value of 0.175mg/l. Concentrations in 2014 ranged between 0.125 mg/l and 0.821 mg/l with a mean value of 0.529 mg/l. Total phosphorus concentrations in a large percentage of samples collected in Ulao Creek in both of these studies were higher than the State's water quality criterion of 0.075 mg/l. Concentrations of fecal coliform bacteria in the Creek ranged from 2 cells per 100 ml to 12,500 cells per 100 ml with median values of 260 cells per 100 ml at the upstream site and 480 cells per 100 ml at the downstream site. Concentrations in over half of the samples from both sites were higher than the State's former geometric mean water quality criterion of 200 cells per 100 ml. Concentrations of *E. coli* ranged from 9 cells per 100 ml to 12,500 cells per 100 ml with median values of 320 cells per 100 ml at the upstream site and 452 cells per 100 ml at the downstream site. Concentrations in over half of the samples from both sites were higher than the State's geometric mean water quality criterion of 126 cells per 100 ml. The large percentage of samples that had high concentrations of fecal coliform bacteria and *E. coli* indicate that fecal wastes from humans or animals may be entering this stream.

⁵¹ *Ibid.*

⁵² A.T. Struck, M. Aho, L. Roffler, R. McCone, B. Stuhr, K. Kroening, and T. Dueppen, 2015, *op. cit.*

Sheboygan River Watershed

In 1994, the WDNR conducted fish and macroinvertebrate surveys in the East and West Branches of Belgium Creek.⁵³ These surveys indicated that a fair quality fish community and poor quality macroinvertebrate community were present in the East Branch at Jay Road and a poor-to-fair quality fish community and a fairly poor quality macroinvertebrate community were present in the Village Branch of the West Branch of Belgium Creek. Based on sampling conducted in 1995, the WDNR concluded that the West Branch of Belgium Creek was a source of bacteria to the Onion River.⁵⁴ These results suggest that water quality conditions in these streams may be poor.

Sauk and Sucker Creek Watershed

The WDNR updated its water quality management plan for Sauk and Sucker Creeks in 2011.⁵⁵ This report indicated that water chemistry, fish, and macroinvertebrate sampling conducted in 2010 and 2011 showed that water quality in Sauk and Sucker Creeks ranged from poor to good. The presence of higher quality fish and macroinvertebrate communities in lower reaches of the two Creeks suggested that conditions were better in downstream areas. In 2009 and 2010, phosphorus concentrations in both Creeks exceeded the State's water quality criterion of 0.075 mg/l. The report also noted that large sediment plumes were frequently observed entering Lake Michigan from both Sauk and Sucker Creeks during spring snow melt and heavy rains. The report described nonpoint source pollution originating from erosion at construction sites and runoff from impervious surfaces, agricultural fields, and barnyards as the primary causes of degraded water and habitat quality in these streams.

The WDNR conducted a targeted watershed assessment of Sauk Creek in 2014.⁵⁶ As part of this study, aquatic community surveys and sampling for total phosphorus were conducted at the same sites that were monitored in 2010. Sampling for total phosphorus found that concentrations in all of the samples collected from the mainstem of Sauk Creek exceeded the State's water quality criterion with concentrations ranging between 0.083 mg/l and 0.432 mg/l. Based on limited sampling this study found that concentrations of total

⁵³ *Wisconsin Department of Natural Resources, Water Resources of the Sheboygan River Basin, PUBL WR-669-01, May 2001.*

⁵⁴ *T. Aartila and S. Galaneau, "Stream Reclassification Survey for Belgium Creek and its Branches: The East Branch and the West Branch," Wisconsin Department of Natural Resources, Southeastern Region, 1998.*

⁵⁵ *Wisconsin Department of Natural Resources, Sauk and Sucker Creek 2011 Water Quality Management Plan Update, December 5, 2011.*

⁵⁶ *Wisconsin Department of Natural Resources, Sauk Creek Targetted (sic) Watershed Assessment Plan 2017, EGAD No. 3200-2017-07, October 2017.*

phosphorus in upstream tributaries to Sauk Creek were also high, with concentrations in samples from Ludowissi Lake Branch ranging between 0.214 mg/l and 0.262 mg/l and the concentration in a single sample from Holy Cross Branch of 0.610 mg/l. The results of aquatic community surveys also supported a conclusion that these tributaries are likely impaired due to high concentrations of total phosphorus. The report also noted the presence of heavy growth of filamentous algae at all sites monitored in the watershed, which is consistent with high phosphorus concentrations.

The 2017 WDNR report also compared the condition of aquatic communities in Sauk Creek in 2014 to those found in 2010. It reported that some improvements had occurred in the macroinvertebrate communities in the headwaters and near the mouth of Sauk Creek since 2010. It also found that there had been some declines in macroinvertebrate community quality in the middle section of the Creek. Improvements in the quality of the fish community in the headwaters of the Creek were noted; however, the quality of this community had declined since 2010 immediately downstream from the headwaters and in the Holy Cross Branch of Sauk Creek.

In 2011, Cedarburg Science submitted the results of sampling conducted at three sites along Sucker Creek during the summer and fall of 2010 to the WDNR for consideration in the development of Wisconsin's 2012 impaired waters list. Concentrations of dissolved oxygen at sampling sites at Pebble Beach Road and CTH D were below the State's water quality criterion of 5.0 mg/l in all of the samples, with mean concentrations of 0.40 mg/l and 0.82 mg/l, respectively, at these two sites. Dissolved oxygen conditions were better downstream, with concentrations ranging between 6.49 mg/l and 8.55 mg/l at High Point Beach Road. Total phosphorus concentrations were high at all three Sucker Creek sampling stations, with mean concentrations of 2.34 mg/l, 1.46 mg/l, and 0.559 mg/l being reported at Pebble Beach Road, CTH D, and High Point Beach Road, respectively. While concentrations of *E. coli* in samples ranged from 60 colony forming units per 100 milliliters (cfu per 100 ml) to 2,419 cfu per 100 ml, mean concentrations at all three sites exceeded 1,580 cfu per 100 ml.

Summary of Water Quality Conditions in Ozaukee County

The available summaries of water quality conditions for surface waters in Ozaukee County indicate the presence of several water quality problems. Low concentrations of dissolved oxygen are occasionally present at many locations in the County. It is likely that this results from nutrient enrichment of these waters. This is indicated by the fact that concentrations of total phosphorus in many waterbodies in the County are often high. Concentrations of total suspended solids often exceed the target level set in the Milwaukee River Basin TMDL, contributing to both nutrient enrichment and habitat degradation. In addition, limited

sampling indicates that concentrations of nitrogen compounds are also high in many waterbodies. The high values of specific conductance detected in several waterbodies in the County suggest that high concentrations of chloride are present.

Impaired Waters

Under the Clean Water Act (CWA), waterbodies that are not achieving their designated uses are considered impaired waters. Section 303(d) of the CWA requires that states periodically submit a list of impaired waters to USEPA for approval. The most recently approved list for Wisconsin was submitted in 2018. The State of Wisconsin submitted a proposed list in April 2020. As of August 2020, this proposed list was under review by USEPA. Table 3.3 and Map 3.3 indicate the waterbodies in Ozaukee County that were listed as impaired as of 2018 and that are proposed to be listed as of 2020.

Several streams in Ozaukee County are included on the impaired waters list due to the presence of impairments related to high instream concentrations of total phosphorus. Fish Creek, the Little Menomonee River, the North Branch of the Milwaukee River, Sucker Creek, and Ulao Creek are listed as impaired due to the presence of degraded biological communities resulting from high total phosphorus concentrations. Fredonia Creek, the Nor-X-Way Channel, and Sauk Creek are also listed as impaired due to high concentrations of total phosphorus. Cedar Creek upstream from Ruck Dam, the Milwaukee River, and Trinity Creek are listed as impaired due to the high total phosphorus concentrations; however, the WDNR has noted that they were unable to document the presence of a biological impairment in these streams. The WDNR has also proposed adding Cedarburg Creek, Kaul Creek, and an unnamed tributary to the Milwaukee River located near the Ozaukee-Milwaukee County line to the impaired waters list for high concentrations of total phosphorus, although they have been unable to document the presence of a biological impairment in these streams. Depending on the stream, these high concentrations are attributed to either nonpoint source pollution or a combination of nonpoint source and point source pollution.

Several waterbodies in the County are included on the impaired waters list due to the presence of contaminated fish tissue. Cedar Creek upstream from Ruck Dam, the Milwaukee River downstream from the site of the former Lime Kiln Dam, Cedarburg Pond 121, Cedarburg Stone Quarry, and Lake Michigan are listed as impaired due to the presence of fish contaminated with polychlorinated biphenyls (PCBs). In addition, Cedarburg Stone Quarry and Lake Michigan are listed as impaired due to the presence of fish tissue contaminated with mercury. At most sites, the PCB contamination is attributed to the presence of contaminated sediment and the mercury contamination is attributed to deposition from the atmosphere.

Four streams in Ozaukee County are included on the impaired waters list due to restrictions on recreational use of the water resulting from the presence of high concentrations of bacteria used to indicate contamination with fecal material. Little Menomonee Creek, the Little Menomonee River, and the Nor-X-Way Channel are listed as impaired due to the presence of high concentrations of fecal coliform bacteria. The Milwaukee River is listed as impaired due to the presence of high concentrations of *E. coli*. The source of the fecal contamination is attributed to a combination of nonpoint source and point source pollution and other causes.

Several streams in Ozaukee County are included on the impaired waters list due to the presence of toxic substances at concentrations high enough to produce toxicity effects in aquatic organisms. The Little Menomonee River is listed as impaired due to the presence of creosote at concentrations high enough to cause chronic toxicity effects. This is attributed to the presence of contaminated sediment. Fish Creek is listed as impaired due to the presence of concentrations of chloride that are high enough to cause chronic toxicity effects. The Little Menomonee River and Ulao Creek are listed as impaired due to the presence of concentrations of chloride that are high enough to cause both chronic and acute toxicity effects. The WDNR has also proposed adding the Nor-X-Way Channel to the impaired waters list due to the presence of concentrations of chloride that are high enough to cause chronic toxicity effects. Depending on the stream, these high concentrations are attributed to either nonpoint source pollution or a combination of nonpoint source and point source pollution.

Three streams in Ozaukee County are currently included on the impaired waters list due to the presence of elevated water temperatures resulting from the presence of an unknown pollutant. The Little Menomonee River, the Milwaukee River, and Trinity Creek are listed as impaired due to elevated water temperatures. In addition, the WDNR has proposed adding the Nor-X-Way Channel to the impaired waters list due to the presence of elevated water temperatures. The unknown pollutant or pollutants causing these impairments are attributed to a combination of nonpoint source and point source pollution.

Ludowissi Lake Branch to Sauk Creek is included on the impaired waters list due to the presence of a degraded biological community resulting from the presence of an unknown pollutant. The unknown pollutant or pollutants causing this impairment are attributed to a combination of nonpoint source and point source pollution.

Impaired waterbodies located in the Milwaukee River watershed with impairments related to total phosphorus, fecal coliform bacteria, and *E. coli* are addressed by the Milwaukee River Basin TMDL.⁵⁷ Impairments related to PCBs in Cedar Creek and the Milwaukee River between the site of the former Lime Kiln Dam in Grafton downstream to Thiensville Dam are addressed by the Cedar Creek and Milwaukee River PCB TMDL.⁵⁸

TMDLs for Waterbodies in Ozaukee County

Milwaukee River Basin TMDL

Under the Clean Water Act, states are required to develop Total Maximum Daily Loads (TMDLs) to address impaired waterbodies that are not meeting water quality standards and not achieving their designated uses. A TMDL includes both a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards and an allocation of that load among the various sources of that pollutant. The TMDL must also account for seasonal variations in water quality and include a margin of safety to account for uncertainty in predicting how well pollutant reductions will result in meeting water quality standards.

A TMDL allocates the allowable load between a wasteload allocation for point sources such as municipal wastewater treatment plants, industrial dischargers, concentrated animal feeding operations, and municipal separate storm sewer systems (MS4s); a load allocation for nonpoint sources such as agricultural sources, urban sources not covered under a discharge permit, and natural background loads; and a margin of safety. Wasteload allocations are implemented through limits established in discharge permits under the Wisconsin Pollutant Discharge Elimination System (WPDES). Load allocations are implemented through a wide variety of Federal, State, and local programs as well as voluntary action by citizens. These programs may include regulatory, non-regulatory, or incentive-based elements, depending on the program. Implementation of load allocations is typically an adaptive process, requiring the collaboration of diverse stakeholders and the prioritization and targeting of available programmatic, regulatory, financial, and technical resources.

The Milwaukee River Basin, including the portions of the Menomonee River and Milwaukee River watersheds that are located in Ozaukee County, is addressed in the Milwaukee River Basin TMDL that was approved in

⁵⁷ *Milwaukee Metropolitan Sewerage District 2018, op. cit.*

⁵⁸ *Wisconsin Department of Natural Resources, Polychlorinated Biphenyls (PCBs) Total Maximum Daily Load for Cedar Creek and Milwaukee River (Thiensville Segment) Ozaukee County, WI, August 29, 2008.*

2018.⁵⁹ This TMDL addresses impairments such as recreation restrictions, oxygen depletion, degraded biological communities, elevated water temperatures, high phosphorus, and degraded habitat resulting from high concentrations of fecal coliform bacteria, total phosphorus, and total suspended solids. It establishes wasteload allocations and load allocations for fecal coliform bacteria, total phosphorus, and total suspended solids in 55 TMDL basins of the Kinnickinnic River, Menomonee River, and Milwaukee River watersheds, including four TMDL basins of the Menomonee River watershed and 12 TMDL basins of the Milwaukee River watershed that are wholly or partially located within Ozaukee County (see Map 3.4).

The developers of the Milwaukee River Basin TMDL used two models to simulate flow and calculate loads of fecal coliform bacteria, total phosphorus, and total suspended solids and predict associated water quality conditions under existing and anticipated future conditions for all the TMDL basins in the Milwaukee River Basin. The Hydrological Simulation Program-Fortran (HSPF) was used to model the TMDL basins within the Kinnickinnic and Menomonee River watersheds. The Loading Simulation Program in C++ (LSPC) was used to model the TMDL basins in the Milwaukee River watershed. LSPC includes HSPF algorithms but uses a different database structure.

For total phosphorus and total suspended solids, the Milwaukee River Basin TMDL expresses the load allocations for agricultural and non-permitted urban areas and the wasteload allocations for municipal separate storm sewer systems as an average monthly percent reduction from the TMDL baseline loads. Table 3.4 shows the average monthly percent reductions of total phosphorus loads for agriculture, urban areas that are not required to be covered under a WPDES permit for the discharge of stormwater, and MS4 systems for TMDL basins located wholly or partially within Ozaukee County. Depending on the TMDL basin, these reductions range between 23 percent and 65 percent for agriculture, 38 percent and 82 percent for non-permitted urban areas, and 36 percent and 87 percent for MS4 systems.

Table 3.5 shows the average monthly percent reductions of total suspended solids loads for agriculture, urban areas that are not required to be covered under a WPDES permit for the discharge of stormwater, and MS4 systems for TMDL basins located wholly or partially within Ozaukee County. Depending on the TMDL basin, these reductions range between 45 percent and 75 percent for agriculture, 59 percent and 76 percent for non-permitted urban areas, and 58 percent and 88 percent for MS4 systems.

⁵⁹ *Milwaukee Metropolitan Sewerage District 2018, op. cit.*

It should be noted that the pollutant load reductions given in Tables 3.4 and 3.5 are average monthly reductions. The Milwaukee River Basin TMDL also gives daily loading capacities and allocations that vary by month of the year. This reflects the fact that average total phosphorus and total suspended solids loading varies substantially by month. This variation is primarily driven by seasonal patterns in precipitation and vegetative cover that influence runoff and erosion rates. These same seasonal patterns also affect stream flow, which is the basis for pollutant assimilative capacity.

The Milwaukee River Basin TMDL used a load duration curve approach to develop allowable bacteria loads for each TMDL basin. This methodology considers how streamflow conditions relate to pollutant sources and makes rough determinations of what flow conditions result in exceedances of water quality standards. The TMDL is presented as a set of fecal coliform bacteria load duration curves that are given in Appendix D of the Milwaukee River Basin TMDL. Depending on the TMDL basin, the TMDL calls for reducing loads of fecal coliform bacteria by approximately one to three orders of magnitude under low flow and dry conditions, one to two orders of magnitude under mid-range flow and moist conditions, and one order of magnitude under high flow conditions.

Meeting the water quality targets set in the Milwaukee River TMDL will require substantial reductions in nonpoint source loading. The percent reductions goals from the TMDL (Tables 3.4 and 3.5) could be used to help prioritize work in the Milwaukee River basins located in Ozaukee County. For example, for TMDL basins located predominantly in the County, the highest agricultural TSS reduction goals and phosphorus reduction goals are assigned to basins MI-26 (Pigeon Creek), and MI-17 and MI-16 (Milwaukee River).

Cedar Creek and Milwaukee River (Thiensville Section) PCB TMDL

In 2008, the WDNR developed a TMDL to address PCBs in downstream reaches of Cedar Creek and in the Milwaukee River between the site of the former Lime Kiln Dam in Grafton and the Thiensville Dam.⁶⁰ This study identified the appropriate load of PCBs from Cedar Creek that will result in reducing the concentrations of PCBs in the tissue of fish in Cedar Creek and the Milwaukee River. It established a fish tissue concentration target of 0.21 milligrams per kilogram for fish in these waters. This tissue concentration is associated with the PCB threshold for “one meal per month” consumption level used by the State of Wisconsin when issuing specific fish consumption advisories. It also established PCB wasteload allocations of 0 grams per day for point sources, load allocations of 0 grams per day for external nonpoint sources such

⁶⁰ Wisconsin Department of Natural Resources 2008, *op. cit.*

as runoff and atmospheric deposition, and a load allocation of 0.17 grams per day for internal loads such as scour and resuspension of contaminated sediment in Cedar Creek and the Milwaukee River.

Nine-Key Element Watershed Plans

In 1987, Congress enacted Section 319 of the Clean Water Act (CWA), which established a national program to control nonpoint sources of water pollution. Section 319 grant funding is available to states, tribes, and territories for the restoration of impaired waters and to protect unimpaired and high quality waters. Watershed plans funded by CWA Section 319 funds must address nine key elements that the USEPA has identified as critical for achieving improvements in water quality.⁶¹ In addition, projects implemented using Federal funds provided under Section 319 must directly implement a watershed-based plan that USEPA has determined to be consistent with the nine elements. Thus, a finding of consistency with the nine elements is a significant benefit to implementing the plan because it makes projects recommended under the plan eligible for Federal funding. The nine elements from the USEPA Nonpoint Source Program and Grants Guidelines for States and Territories are as follows:

1. Identification of causes of impairment and pollutant sources or groups of similar sources that need to be controlled to achieve needed load reductions, and any other goals identified in the watershed plan. Sources that need to be controlled should be identified at the significant subcategory level along with estimates of the extent to which they are present in the watershed.
2. Estimates of the load reductions expected from management measures.
3. Descriptions of the nonpoint source management measures that will need to be implemented to achieve load reductions in element 2, and a description of the critical areas in which those measures will be needed to implement this plan.
4. Estimates of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan.

⁶¹ U.S. Environmental Protection Agency, Handbook for Developing Watershed Plans to Restore and Protect Our Waters, EPA 841-B-08-002, March 2008.

5. An information and education component used to enhance public understanding of the plan and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented.
6. A reasonably expeditious schedule for implementing the nonpoint source management measures identified in this plan.
7. A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented.
8. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards.
9. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under element eight.

Two nine-key element plans cover portions of the Milwaukee River watershed in Ozaukee County: the Cedar, Pigeon, Ulao, and Mole Creeks Watershed Restoration Plan⁶² and the Fredonia-Newburg Area Watershed-Based Plan.⁶³ The watershed areas covered by these plans are shown on Map 3.5. The Cedar, Pigeon, Ulao, and Mole Creeks plan was reviewed by the WDNR and USEPA and found to be consistent with the nine key elements in June 2020. As of August 2020, the Fredonia-Newburg area plan was being reviewed by the WDNR and USEPA. A finding that the plan is consistent with the nine key elements provides eligibility for nonpoint source pollution funding through Section 319 of the Federal Clean Water Act for implementing projects in the plan's study area for a period of ten years.

Both plans conducted modeling studies using the WDNR's Erosion Vulnerability Assessment for Agricultural Lands (EVAAL) package to identify agricultural parcels vulnerable to sheet, rill, and gully erosion. Both plans also used the USEPA's Spreadsheet Tool for Estimating Pollutant Loads (STEPL) to estimate pollutant loads before and after the installation of proposed management practices. The plans used the results from these modeling studies to identify priority areas for implementing best management practices. This identification

⁶² *Southeastern Wisconsin Watershed Trust, Inc., Cedar, Pigeon, Ulao, and Mole Creeks Watershed Restoration Plan, June 29, 2020.*

⁶³ *Applied Ecological Services 2019, op. cit.*

will be very useful for targeting placement of practices under this land and water resource management plan.

Both plans also include detailed information and education elements. The target audiences of the recommended activities include decision makers, county and municipal staff, landowners, agricultural producers, and the general public. It should be noted that some of the recommended activities in this element are ongoing efforts that Ozaukee County has been participating in.

Both plans recommend implementing many specific projects; however, these recommendations are presented differently in the two plans.

The Cedar, Pigeon, Ulao, and Mole Creeks plan recommends types and numbers of projects to be implemented but does not identify specific sites for implementation. Examples of the types of projects recommended in this plan include developing and implementing nutrient management plans for farms not currently covered by such plans, adopting reduced tillage methods, planting cover crops, installation and diversions to grassed waterways, installing riparian grass filter strips, installing runoff management systems in barnyards and feedlots, and streambank stabilization.

The Fredonia-Newburg area plan also recommended implementing specific projects and identified potential sites for project implementation. Examples of specific projects recommended in this plan include implementing agricultural conservation practices such as no till or reduced tillage, conservation cropping, vegetated filter strips, and manure injections; retrofitting stormwater basins; installing green infrastructure practices such as rain gardens, bioswales, and permeable pavement; wetland restorations; converting roadside grass-lined swales to bioretention facilities; and installing and expanding riparian buffers. The plan also made more general policy recommendations on several topics, including protecting sensitive lands and groundwater recharge areas, reducing applications of road salt, septic system maintenance, stormwater management, natural areas restoration, and stream and riparian area maintenance and restoration.

With the voluntary participation of the landowners involved, many of the projects recommended by these two plans would be suitable for development and implementation under this land and water resource management plan.

Water Quality Monitoring

The Ozaukee County Planning and Parks Department has established a robust water quality sampling and monitoring program on the Little Menomonee River and Creek, Mole Creek, and Ulao/Kaul Creek through grant funding beginning in 2016. A series of discrete water quality sampling events and continuous water quality monitoring using stationed units is providing data necessary to establish a baseline and provides insight into water quality trends associated with stream and habitat restoration pre- and post-construction, potentially validating the numerous benefits of the Department's restoration projects. Discrete water quality samples are collected and analyzed for chloride, E. coli, orthophosphate (dissolved reactive phosphorus), total phosphorus chloride and total suspended solids (TSS) by the Wisconsin State Laboratory of Hygiene approximately every 30 days from May – October. Additional quantitative abiotic parameters are measured at time of water sampling using a handheld instrument, including: water temperature, pH, conductivity, total dissolved solids (TDS), dissolved oxygen concentration and percent saturation, turbidity, salinity, atmospheric pressure, air temperature, wet and bankfull width of the stream, and water depth and velocity (at one foot increments across the stream). Visual observations regarding water clarity, condition of riparian habitat, and presence of animal species are also noted. Deployable continuous water quality monitoring units are deployed seasonally (May – October) and are designed to measure water temperature, water depth, dissolved oxygen concentration, pH, and conductivity and are programmed to record readings every 30 minutes. Further details of recent monitoring efforts during 2016 through 2019 are provided in Appendix E.

Chapter 3

RELATED PLANS, REGULATIONS, AND PROGRAMS

TABLES

Table 3.1
Applicable Water Quality Criteria for Streams and Lakes in Southeastern Wisconsin

Water Quality Parameter	Designated Use Category ^a				Source
	Coldwater Community	Warmwater Fish and Aquatic Life	Limited Forage Fish Community (Variance Category)	Limited Aquatic Life Community (Variance Category)	
Temperature (°F)	See Table 3.2				NR 102 Subchapter II
Dissolved Oxygen (mg/l)	6.0 minimum 7.0 minimum during spawning	5.0 minimum	3.0 minimum	1.0 minimum	NR 102.04(4) NR 102.04(3)
pH Range (Standard Units)	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0	NR 102.04(4) ^c
<i>Escherichia coli</i> Bacteria (Colony forming units per 100 ml) ^d					NR 102.04(6) NR 104.06(2)
Geometric Mean	126	126	126	126	
Single Sample Maximum	410	410	410	410	
Total Phosphorus (mg/l)					NR 102.06(3)
Designated Streams ^e	0.100	0.100	0.100	0.100	NR 102.06(4)
Other Streams	0.075	0.075	0.075	--	NR 102.06(5)
Stratified Reservoirs	0.030	0.030	0.030	--	NR 102.06(6)
Unstratified Reservoirs	0.040	0.040	0.040	--	
Stratified Two-story Fishery Lakes	0.015	0.015	0.015	--	
Stratified Drainage Lakes	0.030	0.030	0.030	--	
Unstratified Drainage Lakes	0.040	0.040	0.040	--	
Stratified Seepage Lakes	0.020	0.020	0.020	--	
Unstratified Seepage Lakes	0.040	0.040	0.040	--	
Chloride (mg/l)					NR 105.05(2)
Acute Toxicity ^f	757	757	757	757	NR 105.06(5)
Chronic Toxicity ^g	395	395	395	395	

^a NR 102.04(1) All surface waters shall meet the following conditions at all times and under all flow conditions: (a) Substances that will cause objectionable deposits on the shore or in the bed of a body of water, shall not be present in such amounts as to interfere with public rights in waters of the state. (b) Floating or submerged debris, oil, scum, or other material, shall not be present in amounts as to interfere with public rights in waters of the state. (c) Materials producing color, odor, taste, or unsightliness shall not be present in such amounts as to interfere with public rights in waters of the state. (d) Substances in concentrations which are toxic or harmful to humans shall not be present in amounts found to be of public health significance, nor shall substances be present in amounts which are acutely harmful to animal, plant, or aquatic life.

^b Temperatures at any point may not exceed 86°F. Temperatures at any point in waters classified as wastewater effluent channels may not exceed 120°F.

^c The pH shall be within the stated range with no change greater than 0.5 unit outside the natural seasonal maximum and minimum.

^d The geometric mean of *E. coli* in samples collected over any 90-day period between May 1 and September 30 shall not exceed 126 colony forming units (cfu) per 100 ml. In addition, the concentrations of *E. coli* shall not exceed 410 cfu per 100 ml in more than 10 percent of the samples collected over any 90-day period between May 1 and September 30. These criteria took effect in May 2020. This replaced a criterion based on the concentration of fecal coliform bacteria under which the geometric mean concentrations was not to exceed 200 cells per 100 ml and the concentrations in single samples were not to exceed 400 cells per 100 ml in more than 10 percent of samples collected in a month.

^e Designated in Chapter NR 102.06(3)(a) of the Wisconsin Administrative Code. In Ozaukee County, the Milwaukee River downstream from the confluence with Cedar Creek is a designated stream.

^f The acute toxicity criterion is the maximum daily concentration of a substance which ensures adequate protection of sensitive species of aquatic life from the acute toxicity of that substance and will adequately protect the designated fish and aquatic life use of the surface water if not exceeded more than once every three years.

^g The chronic toxicity criterion is the maximum four-day concentration of a substance which ensures adequate protection of sensitive species of aquatic life from the chronic toxicity of that substance and will adequately protect the designated fish and aquatic life use of the surface water if not exceeded more than once every three years.

Source: Wisconsin Department of Natural Resources and SEWRPC

Table 3.2
Ambient Temperatures and Water Quality Criteria for Temperature for Nonspecific Streams and Lakes in Southern Wisconsin^a

Month	Cold Water Communities (°F)			Large Warmwater Communities ^b (°F)			Small Warmwater Communities ^c (°F)			Limited Forage Fish Communities ^d (°F)			Inland Lakes and Impoundments ^e (°F)		
	Ta	SL	A	Ta	SL	A	Ta	SL	A	Ta	SL	A	Ta	SL	A
January	35	47	68	33	49	76	33	49	76	37	54	78	35	49	77
February	36	47	68	33	50	76	34	50	76	39	54	79	39	52	78
March	39	51	69	36	52	76	38	52	77	43	57	80	41	55	78
April	47	57	70	46	55	79	48	55	79	50	63	81	49	60	80
May	56	63	72	60	65	82	58	65	82	59	70	84	58	68	82
June	62	67	72	71	75	85	66	76	84	64	77	85	70	75	86
July	64	67	73	75	80	86	69	81	85	69	81	86	77	80	87
August	63	65	73	74	79	86	67	81	84	68	79	86	76	80	87
September	57	60	72	65	72	84	60	73	82	63	73	85	67	73	85
October	49	53	70	52	61	80	50	61	80	55	63	83	54	61	81
November	41	48	69	39	50	77	40	49	77	46	54	80	42	50	78
December	37	47	69	33	49	76	35	49	76	40	54	79	35	49	77

Note: Acronyms for temperature criteria categories include: **Ta**-ambient temperature, **SL**-sublethal temperature, and **A**-acute temperature. The ambient temperature, sublethal temperature water quality criterion, and acute temperature water quality criterion specified for any calendar month shall be applied simultaneously to establish the protection needed for each identified fish and other aquatic life use. The sublethal criteria are to be applied as the mean of the daily maximum water temperatures over a calendar week. The acute criteria are to be applied as the daily maximum temperature. The ambient temperature is used to calculate the corresponding acute and sublethal criteria and for determining effluent limitations in discharge permits under the Wisconsin Pollutant Discharge Elimination System.

^a As set forth in Section NR 102.25 of the Wisconsin Administrative Code.

^b Waters with a fish and aquatic life use designation of "warmwater sportfish community" or "warmwater forage fish community" and unidirectional 7Q10 flows greater than or equal to 200 cubic feet per second. The 7Q10 flow is the seven-day consecutive low flow with a 10 percent annual probability of occurrence (10-year recurrence interval).

^c Waters with a fish and aquatic life use designation of "warmwater sportfish community" or "warmwater forage fish community" and unidirectional 7Q10 flows less than 200 cubic feet per second. The 7Q10 flow is the seven-day consecutive low flow with a 10 percent annual probability of occurrence (10-year recurrence interval).

^d Waters with a fish and aquatic life use designation of "limited forage fish community."

^e Values are applicable for those lakes and impoundments south of STH 10.

Source: Wisconsin Department of Natural Resources

Table 3.3
Impaired Waters Within Ozaukee County: 2020^a

Waterbody^b	Extent/Area^c	Impairment	Pollutant	Source^d	Listing Date^e
Cedar Creek (WBIC 21300)	RM 5.01-32.71 RM 0.0-5.0	Impairment Unknown Contaminated Fish Tissue	Total Phosphorus PCBs	PS/NPS Contaminated Sediment	2014-TMDL 1998-TMDL
Cedarburg Pond 121 (WBIC 21700)	15-acre pond	Contaminated Fish Tissue	PCBs	Contaminated Sediment	2012-TMDL
Cedarburg Creek (WBIC 22900)	RM 0.0-4.5	Impairment Unknown	Total Phosphorus	NPS	Proposed 2020-TMDL
Cedarburg Stone Quarry (WBIC 8500)	5.43-acre pond	Contaminated Fish Tissue Contaminated Fish Tissue	Mercury PCBs	Contaminated Sediment PS	1998 2012
Fish Creek (WBIC 44700)	RM 0.00-3.38	Degraded Biological Community Chronic Aquatic Toxicity	Total Phosphorus Chloride	NPS NPS	2014 2018
Fredonia Creek (WBIC 26600)	RM 0.0-4.11	High Phosphorus Levels	Total Phosphorus	PS/NPS	2014-TMDL
Kaul Creek (WBIC 5032520)	RM 0.00-0.99	Impairment Unknown	Total Phosphorus	NPS	Proposed 2020-TMDL
Lake Michigan (WBIC 20)	103.28 miles of shoreline	Contaminated Fish Tissue Contaminated Fish Tissue	PCBs Mercury	Contaminated Sediment Atmospheric Deposition	1998 1998
Little Menomonee Creek (WBIC 17900)	RM 0.0-3.9	Recreational Restrictions-Pathogens	Fecal Coliform Bacteria	Other	2010-TMDL
Little Menomonee River (WBIC 17600)	RM 0.0-9.0	Chronic Aquatic Toxicity Recreational Restrictions-Pathogens Degraded Biological Community Chronic Aquatic Toxicity/Acute Aquatic Toxicity Elevated Water Temperature	Creosote Fecal Coliform Bacteria Total Phosphorus Chloride Unknown Pollutant Unknown Pollutant	Contaminated Sediment Other PS/NPS NPS PS/NPS PS/NPS	1998 2010-TMDL 2012-TMDL 2016 2016
Ludowissi Lake Branch to Sauk Creek (WBIC 49700)	RM 0.00-4.81	Degraded Biological Community	Unknown Pollutant	PS/NPS	2018
Milwaukee River (WBIC 15000)	RM 29.33-68.50 RM 19.35-29.33 RM 2.9-19.35	Impairment Unknown Elevated Water Temperature Recreational Restrictions-Pathogens Contaminated Fish Tissue Contaminated Fish Tissue Recreational Restrictions-Pathogens Impairment Unknown Elevated Water Temperature	Total Phosphorus Unknown Pollutant <i>E. coli</i> PCBs PCBs <i>E. coli</i> Total Phosphorus Unknown Pollutant	PS/NPS PS/NPS PS/NPS Contaminated Sediment Contaminated Sediment PS/NPS NPS PS/NPS	2014-TMDL 2016 1998-TMDL 1998-TMDL 1998 1998-TMDL 2014-TMDL 2016
North Branch of the Milwaukee River (WBIC 27100)	RM 0.0-23.5	Degraded Biological Community	Total Phosphorus	PS/NPS	2012-TMDL

Table continued on next page.

Table 3.3 (Continued)

Waterbody^b	Extent/Area^c	Impairment	Pollutant	Source^d	Listing Date^e
Nor-X-Way Channel (WBIC 18450)	RM 0.0-4.9	Recreational Restrictions-Pathogens High Phosphorus Levels Chronic Aquatic Toxicity Elevated Water Temperature	Fecal Coliform Bacteria Total Phosphorus Chloride Unknown Pollutant	Other NPS PS/NPS PS/NPS	2010-TMDL 2014-TMDL Proposed 2020 Proposed 2020
Sauk Creek (WBIC 49500)	RM 0.0-15.9	High Phosphorus Levels	Total Phosphorus	NPS	2012
Sucker Creek (WBIC 50100)	RM 0.0-10.19	Degraded Biological Community	Total Phosphorus	Unknown	2012
Trinity Creek (WBIC 20400)	RM 0.0-3.1	Impairment Unknown Elevated Water Temperature	Total Phosphorus Unknown Pollutant	NPS PS/NPS	2014-TMDL 2016
Ulaa Creek (WBIC 21200)	RM 0.0-8.6	Degraded Biological Community Chronic Aquatic Toxicity/Acute Aquatic Toxicity	Total Phosphorus Chloride	NPS	2014-TMDL 2016
Unnamed Tributary to the Milwaukee River (WBIC 20200)	RM 0.00-1.36	Impairment Unknown	Total Phosphorus	PS/NPS	Proposed 2020-TMDL

^a As listed on the State of Wisconsin's impaired waters list pursuant to Section 303(d) of the Federal Clean Water Act.

^b WBIC indicates the Wisconsin Department of Natural Resources' waterbody identification code.

^c RM indicates river mile. This is measured upstream from the confluence with the waterbody that the waterbody listed drains into.

^d NPS indicates that the source is nonpoint source pollution. PS indicates that the source is point source pollution.

^e TMDL after the listing date indicates that a TMDL for the indicated impairment has been approved for this waterbody.

Source: Wisconsin Department of Natural Resources and SEWRPC

Table 3.4
Total Phosphorus Load Reduction Goals for Reaches in
Ozaukee County from the Milwaukee River Basin TMDL^a

TMDL Basin^b	Percent Reduction from Agriculture	Percent Reduction from Non-Permitted Urban Areas	Percent Reduction from MS4 Systems
Menomonee River Watershed			
MN-01	46	60	59
MN-05	58	--	69
MN-06	45	--	65
MN-09	49	--	60
Milwaukee River Watershed			
MI-07	45	64	63
MI-13	33	42	40
MI-14	62	78	--
MI-15	51	70	--
MI-16	53	76	75
MI-17	57	82	81
MI-21	51	76	75
MI-22	37	76	49
MI-24	52	78	77
MI-25	23	38	36
MI-26	65	--	87
MI-27	27	--	48

^a Percent reduction is calculated as the average of the monthly percent load reduction from baseline. Baselines are given in Tables A.1 (MN) and A.1 (MI) of the Milwaukee River Basin TMDL.

^b TMDL basins in Ozaukee County are shown on Map 3.4 TMDL Basins.

Source: CDM Smith

Table 3.5
Total Suspended Solids Load Reduction Goals for Reaches in
Ozaukee County from the Milwaukee River Basin TMDL^a

TMDL Basin^b	Percent Reduction from Agriculture	Percent Reduction from Non-Permitted Urban Areas	Percent Reduction from MS4 Systems
Menomonee River Watershed			
MN-01	46	59	58
MN-05	51	--	63
MN-06	42	--	67
MN-09	51	--	63
Milwaukee River Watershed			
MI-07	68	75	74
MI-13	66	69	68
MI-14	70	74	--
MI-15	57	62	--
MI-16	65	70	69
MI-17	65	70	70
MI-21	70	76	76
MI-22	70	76	71
MI-24	60	68	67
MI-25	60	68	77
MI-26	75	--	88
MI-27	45	--	66

^a Percent reduction is calculated as the average of the monthly percent load reduction from baseline. Baselines are given in Tables A.2 (MN) and A.2 (MI) of the Milwaukee River Basin TMDL.

^b TMDL basins in Ozaukee County are shown on Map 3.4 TMDL Basins.

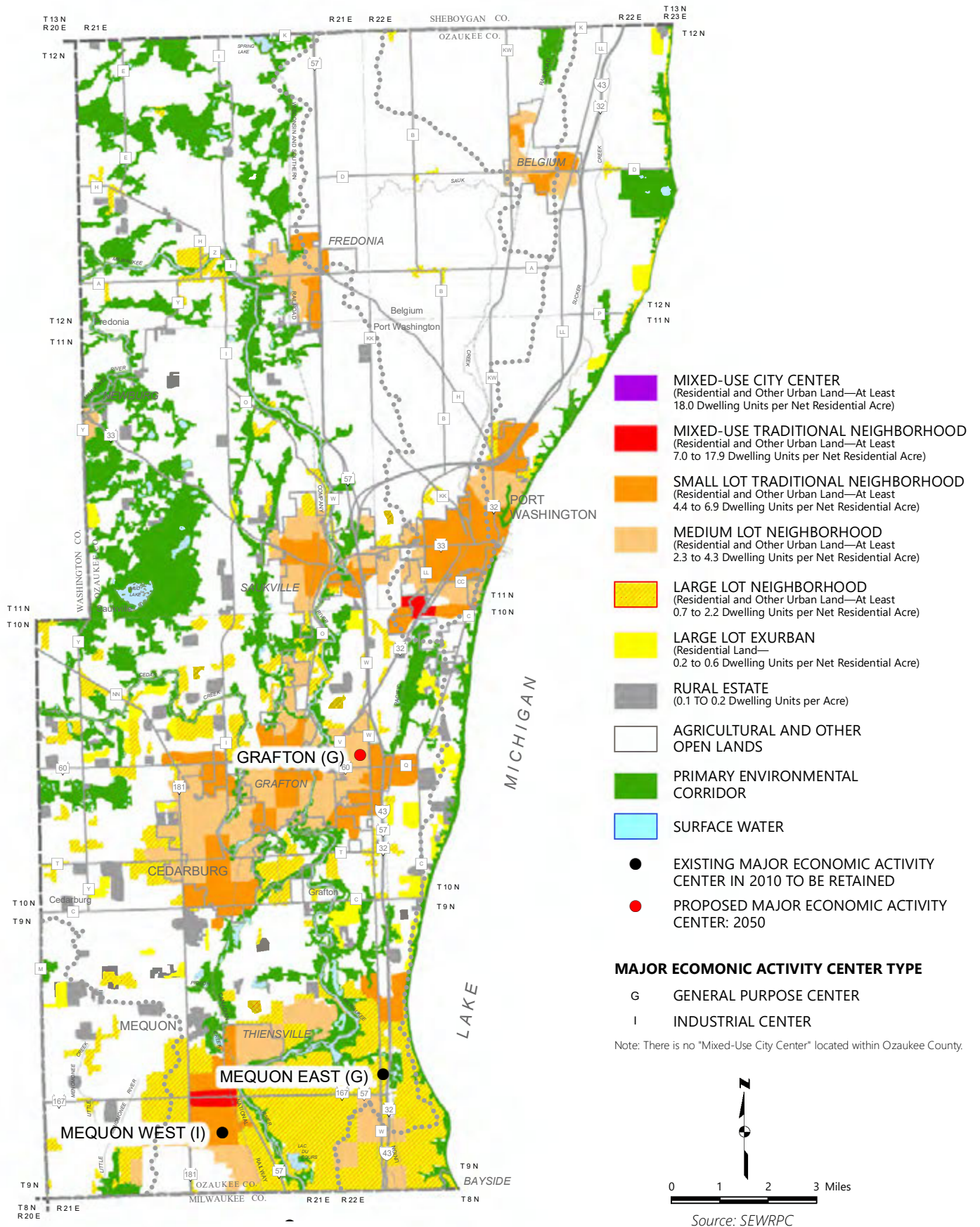
Source: CDM Smith

Chapter 3

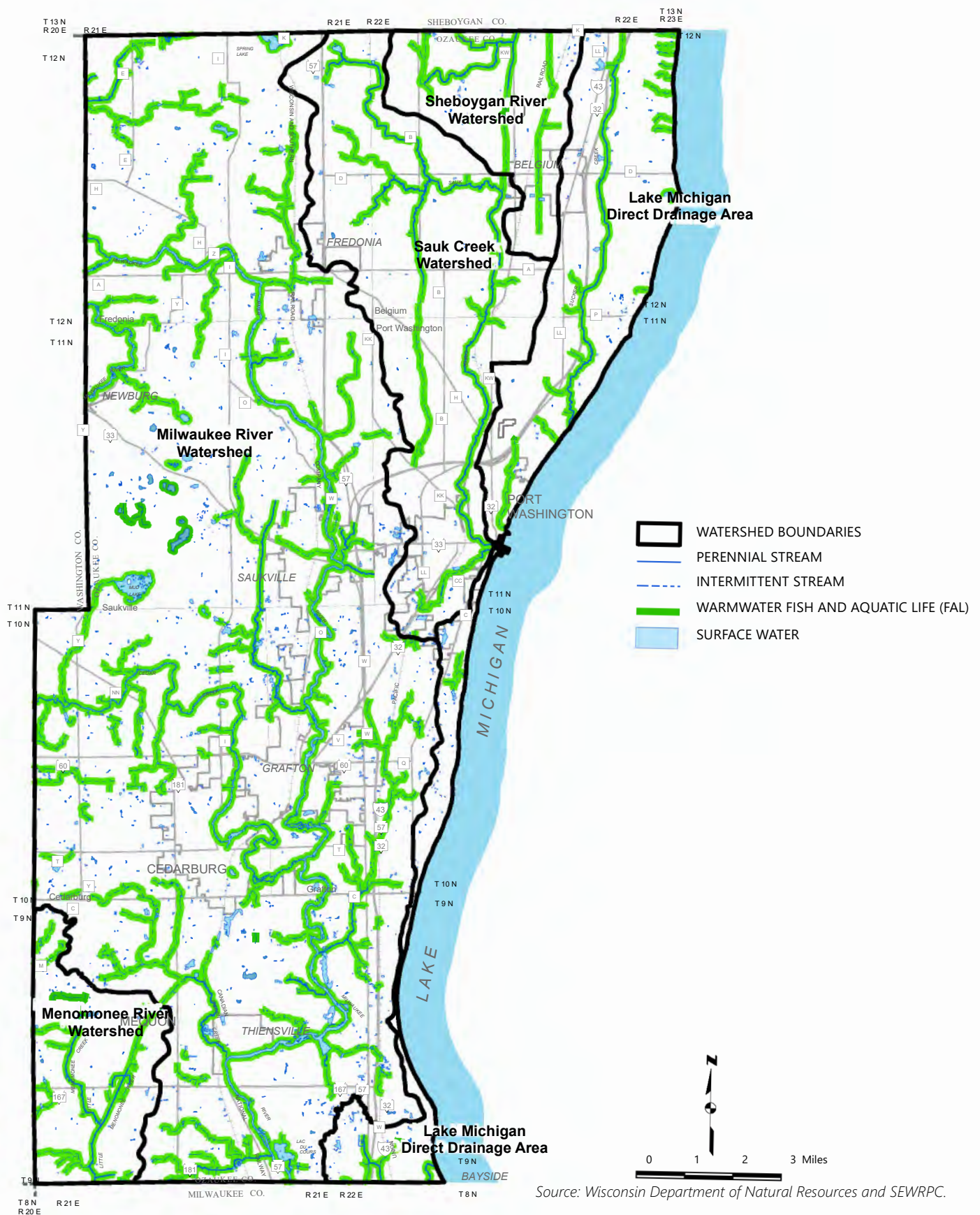
RELATED PLANS, REGULATIONS, AND PROGRAMS

MAPS

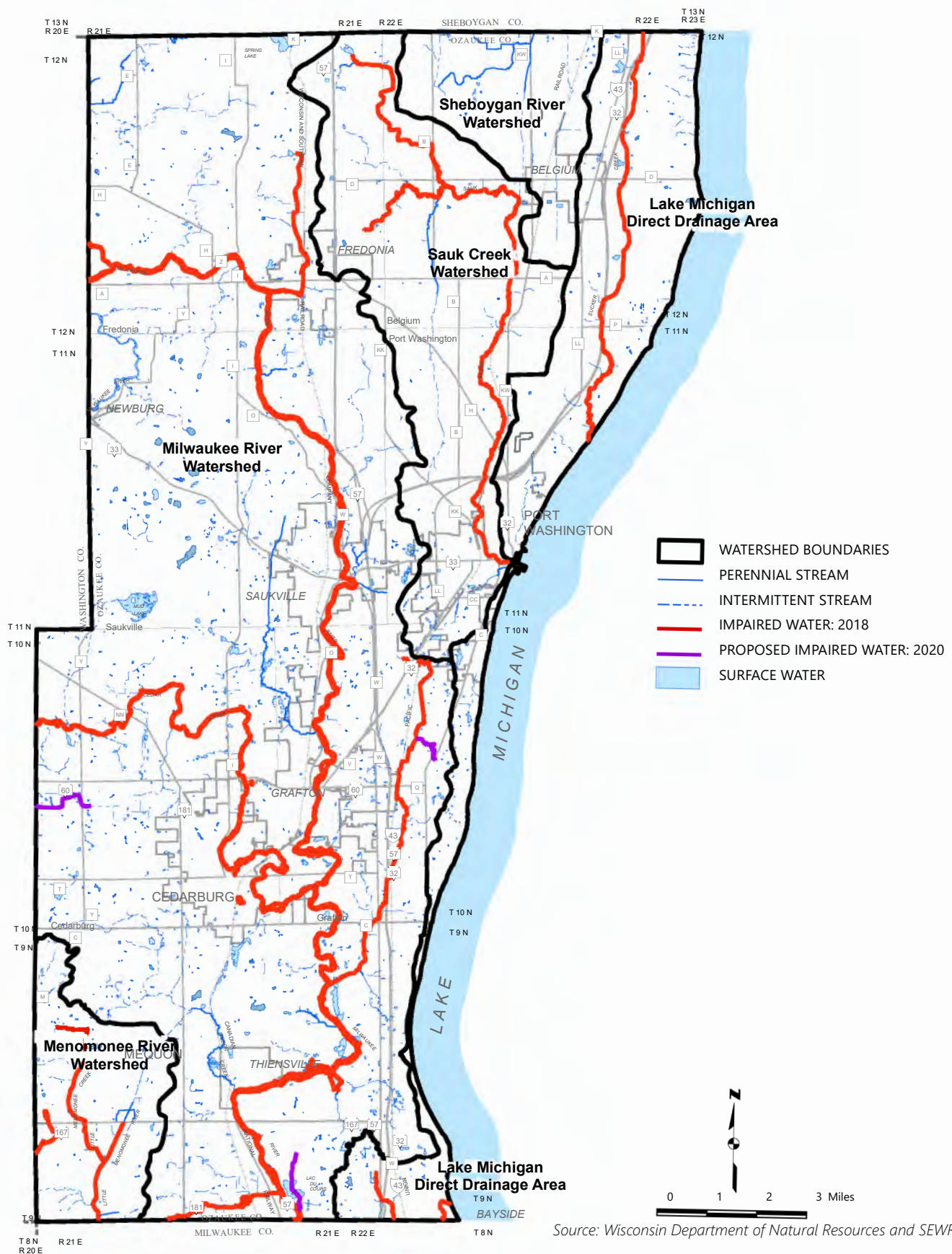
Map 3.1
2050 Regional Land Use Plan as it Pertains to Ozaukee County



Map 3.2 Water Use Objectives for Streams Within Ozaukee County: 2020

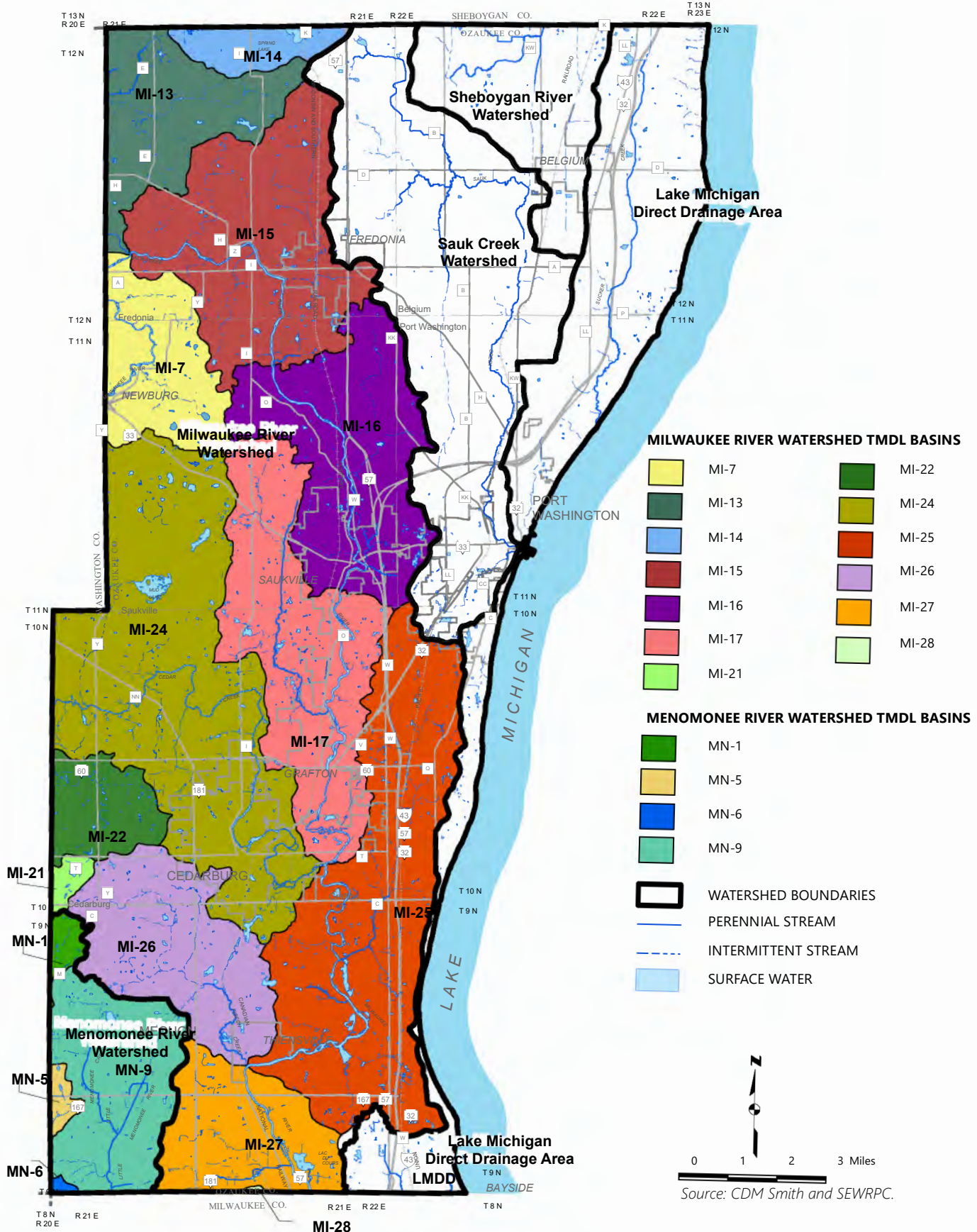


Map 3.3 Impaired Waters Within Ozaukee County: 2020



Map 3.4

TMDL Basins from the Milwaukee and Menomonee River Watersheds TMDL Within Ozaukee County: 2020



SEWRPC Community Assistance Planning Report No. 338

A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR OZAUKEE COUNTY: 2021 - 2030

Chapter 4

GOALS, OBJECTIVES, AND ESTIMATED COSTS

4.1 INTRODUCTION

The Ozaukee County Land and Water Resource Management Plan incorporates a comprehensive set of goals, workplan objectives, and planned actions that were developed based on the inventory findings set forth in chapter 2; the principal issues and concerns that were identified by the Advisory Committee; and the input received from the Ozaukee County Natural Resources Committee and the Ozaukee County Land & Water Management (LWM) Department. These goals, workplan objectives, and planned actions will guide the implementation of this plan over the next ten years. The Advisory Committee's principal issues and concerns, which form the basis of this plan's goals, objectives, and actions, are set forth below.

- Education, including but not limited to public education about land and water issues, engaging homeowners on best management practices, and continuing education about invasive species
- Policy, including promoting sound agricultural practices and regulations, creating additional wetland and wildlife areas
- Soil health, including protecting and improving soil health, infiltration, and stormwater management
- Riparian Areas, including establishing buffers, restoring and maintaining riparian zones, and protecting and enhancing riparian lands and buffers

- Ecology, including but not limited to improving degraded forest areas, protecting and enhancing wetlands, and managing stormwater
- Water Quality, including but not limited to protecting surface and groundwater resources, reducing point and non-point pollution, and addressing legacy phosphorus through dredging
- Collaboration, including but not limited to supporting the agricultural community for future generations, securing money, sources of funding and commitments, and aligning projects with state/national funding priorities
- Flooding, including removal of privately-owned wastewater treatment systems from floodway areas and developing ways to lessen flooding
- Minimizing impacts of urban and agricultural development
- Managing Coastal Properties, particularly through bluff stabilization

To achieve the goals, the Ozaukee County Land & Water Management Department plans to partner with State and Federal agencies and other environmental organizations on a variety of projects and programs. The objectives of the plan were divided into categories pertaining to the following goals:

- Educational programming
- Agricultural performance standards
- Nonagricultural performance standards
- Invasive and nonnative species management and control
- Protect and preserve land and water resources
- Increase cooperation with local, state and federal partners

The recommended goals, workplan objectives, and planned actions for the years 2021-2030 are summarized in this chapter and are presented in more detail in Table 4.1. Ozaukee County's Land and Water Resource Management Plan is a long-range, living instrument to plan conservation efforts over a 10-year period, therefore, the workplan objectives and planned actions may require amendment due to varying environmental conditions, local priorities and commitments, changing programs and policies, and funding considerations. The general goals of this plan, developed as part of a public participation process and approved by the LWM Department, will not change and any necessary amendments to workplan activities would only be accomplished with proper approvals from the Ozaukee County Natural Resources Committee and the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP). It is further understood that after its initial approval by DATCP, the Land and Water Resource Management Plan must be subject to a five-year review by DATCP.

4.2 EDUCATIONAL PROGRAMMING

Goal and Workplan Objectives

Developing and implementing sound educational programming is an important component of the land and water resource management plan. The major focus of this goal is to foster a greater understanding of soil health, nutrient management, various best management practices, environmental stewardship, and the importance of pollinator and native plantings. As shown in Table 4.1, the workplan objectives related to educational programming consist of the following:

- Enhance the general public's appreciation and involvement in protecting and restoring natural resources
- Promote sound agricultural practices, soil health, and foster knowledge of performance standards, regulations, sustainable agriculture, etc.
- Promote learning strategies for environmental education among youth
- Increase landowner and producer/operator awareness of conservation practices and programs
- Provide information to riparian property owners on the benefits of riparian buffers
- Provide information to county residents about how they can control nonnative and invasive species

Planned Actions

The planned actions to meet the educational goal and workplan objectives generally consist of the Ozaukee County Land & Water Management (LWM) Department providing informational and educational materials, conducting workshops/presentations/seminars, and/or hosting meetings with individuals, organizations, or agencies about the natural resource, conservation, and environmental performance standards and best management practices of most interest to the targeted audience. Further details of these planned actions, organized by workplan objective, is provided in Table 4.1. This table also indicates when these actions are envisioned to occur, and which agencies would be involved.

In addition, much of the County's public educational programming is conducted in collaboration or cooperation with the County's partners in managing land and water resources. These partners include the local governments within the County; State agencies such as DATCP, WDNR, and the University of Wisconsin-Extension; and private organizations such as the Riveredge Nature Center, the Mequon Nature Preserve, the Ozaukee Washington Land Trust, the Milwaukee Metropolitan Sewerage District (MMSD), and The Conservation Fund. In addition, the LWM Department will continue to participate in the SE Wisconsin Watersheds Trust "Respect Our Waters Program" which provides information and education to the public on ways to promote clean water.

Furthermore, Ozaukee County intends to implement a Soil Health Initiative to promote soil health practices through such means as:

- Continued assistance to, and support of, the Ozaukee County Demonstration Farm Network and the Milwaukee River Watershed Clean Farm Families. The Farm Network (currently with four demonstration farms), was created through a cooperative effort with the NRCS which also includes a soil health initiative.

Key Item: The Clean Farm Families is a producer led group which was formed in 2016 to promote soil health. In partnership with the Clean Farm Families, a 35-acre Soil Health Demonstration Site was established along STH 57 to compare conventional farmed plots to plots using cover crops and no-till. The Clean Farm Families is a priority program for Ozaukee County and the Soil Health Demonstration Site is a priority project for Ozaukee County.

The County will monitor changes in soil health conditions, crop yield, profitability, etc. at this site. The LWM Department will continue to work closely with the Farm Network and the Clean Farm Families to conduct soil health field days, soil health workshops featuring national presenters, etc.

- The LWM Department has purchased an Interseeder Planter to establish cover crops in early growing corn. The interseeder converts to a no-till drill and is used to plant cover crops in the fall. The LWM Department also purchased a roller-crimper. Such equipment is made available to farmers on a rental basis. A grant was received from the Fund for Lake Michigan along with limited county funds to purchase the equipment. The County leases a tractor and hires a driver to get the cover crops established, and the farmer provides the fuel. In 2020 the farmers paid \$14/acre for this service. In addition, the County was awarded a soil health initiative grant in 2019 and 2020 from the Fund for Lake Michigan to help cover part of the farmers cost for cover crop seed.
- The *No-till Farmer* magazine is being provided to farmers at no cost to provide educational material to promote no-till and cover crops to improve soil health. The County is using funds from the DATCP Nutrient Management Farmer Education Grant to cover the magazine subscription cost. The magazine is provided to about 60 select farmers.
- The LWM Department is also working with researchers who have received a USDA Conservation Innovation Grant (CEG) to evaluate runoff from fields using cover crops and no-till. The researchers will also evaluate the change in soil health over a 5-year period.

4.3 AGRICULTURAL PERFORMANCE STANDARDS

Goal and Workplan Objectives

The goal and objectives set forth in this plan focus on achieving the State minimum performance standards for rural nonpoint source pollution as well as the recommendations identified in the regional water quality and watershed management plans. The focus of this goal is to improve and protect surface and groundwater from agricultural runoff. Specifically, the workplan objectives that were identified include the following:

- Implement the State agricultural performance standards
- Support the Farmland Preservation Program

- Reduce soil erosion to or below T
- Manage manure and livestock access to water resources in accordance with State performance standards
- Reduce soil delivery rate from riparian cropland
- Develop, implement, and monitor compliance of nutrient and pest management plans to protect water quality

Planned Actions

The planned actions that are to be used in combination to achieve the aforementioned goal and workplan objectives include, among others as noted below, Ozaukee County Land & Water Management (LWM) Department plans to utilize a detailed database/tracking system to identify and assist in managing farms prioritized for compliance with State performance standards, to track sediment, nutrient and phosphorus savings, etc. The LWM Department will also offer technical assistance to landowners and producers to help improve feedlot maintenance, improve manure handling and storage, establish riparian buffers, protect and improve soil health, expand nutrient management plan acreage, and pursue cost sharing opportunities. In addition, The LWM Department will notify landowners and producers of compliance status and key issues associated with needed best management practices.

In regard to soil erosion, the LWM Department and the NRCS will continue to develop farm conservation plans for agricultural producers and to encourage landowners and farmers to utilize a wide variety of best management practices designed to target soil erosion. The County will continue to conduct an erosion/transect survey annually to monitor the use of conservation practices and their effectiveness in reducing agricultural erosion. In regard to manure management, the LWM Department will monitor manure management practices and nutrient management plans in the County to ensure that practices comply with Federal and State performance standards.

The County will promote the establishment of appropriate riparian buffers designed according to NRCS standards to reduce sediment delivery to water resources. Planned actions associated with improving stream sedimentation and agricultural drainage include individual agricultural producers implementing best management practices to reduce soil erosion and sediment delivery as identified in farmland management plans to be prepared by the LWM Department staff. In addition, it is also recommended that farmers and

rural landowners periodically clean out accumulated sediment from drainage channels following the proper permitting procedures.

The LWM Department will continue to work with farmers to develop nutrient management plans that consider a variety of best management practices, review farm plans, and review manure storage and livestock facility siting plans.

In addition, the LWM Department will continue to collaborate and leverage funding to accomplish these goals through the Milwaukee River Watershed Conservation Partnership and the MMSD's USDA-funded Regional Conservation Partnership Project. In this regard, the USDA NRCS through the Regional Conservation Partnership Program has awarded \$7.5 million to the Milwaukee River Watershed Conservation Partnership with the MMSD being the lead agency. Improved drinking water protection and reduced flooding are among the list of positive impacts that will result from this collaborative effort with federal, state, and local partners to carry out land and water conservation work in the Milwaukee River Watershed for five years starting in 2021. Ozaukee County is one of 12 partners associated with the MOU and success of this Regional Conservation Partnership Program.

4.4 NONAGRICULTURAL PERFORMANCE STANDARDS

Goal and Workplan Objectives

Nonagricultural and urban land uses are a significant source of nonpoint pollution. The focus of this goal is to reduce the quantity and improve the quality of stormwater runoff from developed and developing areas. Workplan objectives include the following:

- Implement the State Nonagricultural Performance Standards
- Reduce construction site erosion
- Manage stormwater runoff more effectively
- Encourage urban-density land use to be confined to and within the identified urban service areas
- Comply with the Municipal Separate Storm Sewer System (MS4) permit requirements under Chapter NR 216 of the *Wisconsin Administrative Code*

Planned Actions

In order to accomplish the identified nonagricultural nonpoint pollution goal and workplan objectives, a number of management practices need to be implemented. Construction sites are one of the most significant contributors of sediment to waterbodies when best management practices are not properly installed and maintained. In regard to construction site erosion, local governments shall continue to administer construction erosion control as required per the Wisconsin Dwelling Code. The LWM Department will continue to review erosion control plans and respond to erosion problems and complaints, inspect compliance of approved erosion control plans, recommend WDNR conservation practice standards, and continue to administer the County's Construction Site Erosion Control and Post Construction Stormwater Management Ordinance.

Not only does stormwater transport sediment and contaminants, but it also contributes to erosion of streambanks and temperature fluctuations of water resources. A coordinated program should be developed to prepare and implement detailed comprehensive stormwater management plans for logical subwatershed and groundwater protection areas. This program should address new development, redevelopment of existing urban areas, and existing urban areas.

The Planning and Parks Department would also encourage limiting agricultural rezonings to those lands located within planned urban service areas, and that the county and local communities should adhere to adopted comprehensive plan recommendations regarding the location of urban-density development.

4.5 INVASIVE AND NONNATIVE SPECIES MANAGEMENT AND CONTROL

Goal and Workplan Objectives

Invasive and nonnative species can alter ecological relationships among native species and can affect ecosystem function, economic value of ecosystems, and human health. The focus of this goal is to promote and improve a healthy ecosystem. To address the goal pertaining to this subject, the following workplan objective has been identified:

- Control the infestation of nonnative and invasive plant and animal species.

Planned Actions

Nonnative and invasive species control strategies rely heavily on information, education, and communication. Therefore, this plan includes a range of activities to implement an effective identification,

prevention, and eradication program. The LWM Department will continue to work closely with the Southeastern Wisconsin Invasive Species Consortium.

The emerald ash borer is a nonnative insect, native to Asia, which currently threatens ash trees in the Great Lakes region. Infestations are widespread throughout Southeastern Wisconsin, including Ozaukee County. As such, the entire State is under quarantine in order to regulate the movement of firewood and other materials such as timber between counties. The LWM Department will continue to conduct periodic workshops and presentations about nonnative and invasive species identification and control.

The LWM Department will encourage the County and municipal departments to identify, control, and manage invasive species in parks and along public roadways.

4.6 PROTECT AND PRESERVE LAND AND WATER RESOURCES

Goal and Workplan Objectives

The focus of this goal is to implement planning strategies and programs (i.e. Milwaukee River TMDL's, Nine-key Element Plans, RCPP, FPP, Harrington Beach water quality initiatives, nonmetallic mining reclamation, replace failing septic systems, and reduce the risk of contamination from hazardous waste), to preserve farmland and natural areas and protect surface and groundwater quality, wetlands, and floodplains. In order to more effectively protect and preserve land and water resources, workplan objectives have been identified as follows:

- Conserve Ozaukee County's unique natural resources in the face of increasing urbanization and resulting loss of farmland
- Prevent the degradation and disturbance of wetlands
- Create, restore and enhance wetland, riverine, and wildlife habitat throughout the County
- Prepare, update and implement comprehensive watershed management plans
- Promote riparian buffers along all water resources in the County, including their restoration, maintenance, protection, and enhancement

- Protect the quality and quantity of surface and groundwater resources
- Support efforts to protect and enhance forests, woodlots, and non-farmed areas
- Continue to implement and refine the County's shoreland/floodplain management program
- Adequately reclaim non-metallic mines (gravel pits and quarries)

Planned Actions

Protecting and preserving land and water resources is of particular importance to Ozaukee County, which can be demonstrated by the number and breadth of workplan objectives and planned actions associated with this goal. The loss of farmland and rural character is an important concern in Ozaukee County. The County, Towns, Cities, and Villages should follow adopted comprehensive plans when considering proposals for new development and redevelopment. Ongoing and future development should be held to high environmental standards by implementing comprehensive plans and using local ordinances and policies to protect open and green space and environmental corridors. In addition, the Ozaukee County LWM Department will encourage farmers to continue farming through sustainable and alternative agricultural practices.

The regional water quality management plan update¹ provides specific recommendations on land use, point source pollution abatement, and nonpoint source pollution abatement on urbanizing watercourses. These recommendations were determined by detailed modeling needed to achieve the adopted water use objectives for the Region. The recommendations will provide an invaluable resource tool for Ozaukee County and its Towns, Cities, and Villages in land and water management planning.

In order to meet the identified goal and workplan objectives related to protecting and preserving Ozaukee County's land and water resources, the County will continue to use land use planning and regulatory tools to preserve productive farmland and agricultural businesses including but not limited to preserving open space, encouraging use of Exclusive Agricultural Zoning, encouraging use of Farmland Enterprise Zones, and encouraging agri-business as an element of Ozaukee County's economic development plan.

¹ *SEWRPC Planning Report No. 50, A Regional Water Quality Management Plan Update for the Greater Milwaukee Watersheds, December 2007, amended May 2013.*

Achieving health soils along with riparian buffers are one of the most effective means of protecting water quality through reducing sediment and nutrient delivery to waterbodies. Accordingly, the LWM Department will continue to work with and form more resource partnerships to educate about the value and benefit of achieving soil health. Ozaukee County will offer Soil and Water Resource Management Program (SWRM) cost-share funds, as available, to install cover crops, no-till, and bioengineered systems with vegetated buffers.

The Planning and Parks Department will also continue to implement its comprehensive Fish Passage Program, which attempts to restore natural stream functions and to reconnect and enhance high quality habitat for native species through a combination of fish passage impediment removals and stream and habitat restoration activities. This Program seeks to re-establish migratory fish passage between 11,149 wetland acres and 215 stream miles of the Milwaukee River Watershed, the Milwaukee Estuary, direct tributaries to Lake Michigan, and Lake Michigan. To date, the Program and its partners have removed or remediated over 300 impediments to fish and aquatic life passage, restoring access to over 150 miles of in-stream habitat and thousands of acres of wetland habitat.

The LWM Department will continue to work to achieve the pollutant reduction goals set forth in both regional water quality and watershed management plans. The LWM Department will also continue to encourage development of watershed management plans incorporating the Environmental Protection Agency's nine key elements. Such plans provide a framework for improving water quality in a holistic manner within a geographic watershed. The nine elements help assess the contributing causes and sources of nonpoint source pollution, involve key stakeholders, and prioritize restoration and protections strategies to address water quality problems. The LWM Department will also continue its efforts to protect surface and groundwater through its Private Onsite Wastewater Treatment System maintenance program and its Manure Storage Ordinance, through its efforts to identify and correct failing septic systems and help prepare and implement nutrient management plans in coordination with soil health principles, and work with livestock operations located within areas with of Silurian bedrock to reduce impacts to groundwater.

Additionally, the LWM Department will protect shoreline and water resources from continued degradation by continuing to administer its shoreland ordinance, which limits the extent of activities such as filling, tree cutting, and grading that occur within the shoreland zone. Ozaukee County will continue to update existing floodplain maps and encourage the mapping of un-modeled areas.

The LWM Department will continue to monitor the Lake Michigan shoreline, especially in those reaches with relatively high unprotected bluffs and where shoreline protection structures are in need of maintenance, are failing or have failed, and where shoreline protection structures have been placed in isolated situations and are likely to cause differential erosion processes acting on unprotected portions of the shoreline in the vicinity of those structures. The LWM Department will also continue to support voluntary private land conservation to preserve productive farming, wetlands, and riparian buffers through such programs as MMSD's Working Soils and OWLT's land protection work.

4.7 INCREASE COOPERATION WITH LOCAL, STATE AND FEDERAL PARTNERS

Goal and Workplan Objectives

Coordination with Federal, State and local agencies is necessary to protect land and water resources in Ozaukee County. The focus of this goal is to strengthen existing partnerships and pursue opportunities for new partnerships. In order to increase cooperation with those partners, workplan objectives have been identified as follows:

- Implement and periodically update the County comprehensive plan
- Look for new opportunities to coordinate and collaborate with local grass roots groups, the Milwaukee Metropolitan Sewerage District, conservation and wildlife clubs, and local, State and Federal agencies to help implement the goals of this LWRMP, secure funding, and align projects with County/State/National priorities

Planned Actions

The LWM Department will work with the multi-jurisdictional advisory committee, citizens, and other County departments to periodically update the countywide comprehensive plan based on Wisconsin's comprehensive planning law. The currently adopted plan essentially recommends that most urban development will continue to occur within planned urban service areas, and that the agricultural resources, environmentally sensitive areas, and rural and small-town character of the County will be preserved wherever possible.

In order to improve the consistency and effectiveness of ordinance administration, the County may enter into working agreements with other agencies to coordinate and streamline the environmental permit process.

Ozaukee County and the LWM Department will continue active membership in and/or collaboration with the USDA, NRCS, WDNR, DATCP, MMSD, Fund for Lake Michigan, Ulao Creek Partnership, Southeastern Wisconsin Invasive Species Consortium Inc., the Friends of Cedarburg Bog, the Milwaukee River Watershed Clean Farm Families, the Ozaukee County Demonstration Farm Network, and the Milwaukee River Regional Conservation Partnership, among others. Partnerships are essential to conservation efforts throughout the country. They enhance communication techniques, improve outreach, and are a funding source and/or a funding requisite that can make more grant programs accessible. Such partnerships can also enhance other related efforts, such as the efforts of the Greenseams Program, which is an innovative MMSD flood management program that permanently protects key lands containing water-absorbing soils. The program makes voluntary purchases of undeveloped, privately owned properties in areas expected to have major growth in the next 20 years, and provides open space along streams, shorelines and wetlands.

An example of an existing partnership is the Milwaukee River Watershed Clean Farm Families, which, working as part of the Milwaukee River Watershed Conservation Partnership, provides a platform for producers and landowners to share ideas, concerns, priorities, and lessons learned about agricultural conservation efforts within the Milwaukee River Watershed. The Clean Farm Families promotes best soil and water conservation practices by working directly with area producers, the Natural Resources Conservation Service's Environmental Quality Incentive Program, and the Ozaukee County Land and Water Management Department. The Clean Farm Families educates landowners and producers about cover crops, conservation tillage, low-disturbance manure injection, and other conservation practices that allow for a better understanding of soil and water quality benefits in ways that may improve a farmer's bottom-line.

Another example is the Ozaukee County Demonstration Farm Network, which is a Great Lakes Restoration Initiative project designed to showcase and demonstrate leading-edge conservation practices that improve Great Lakes water quality by reducing phosphorus from entering Lake Michigan through Sauk Creek, Sucker Creek, and the Milwaukee River. In cooperation with the Ozaukee County Land and Water Management Department, the USDA – Natural Resources Conservation Service, and the Clean Farm Families, the Demonstration Farm Network focuses on improving soil health and condition, encouraging innovative land management that reduces costs and increases profits, and improving the conservation systems used to reduce non-point source pollution.

The Milwaukee River Watershed Conservation Partnership intends to implement cost-effective conservation solutions that will improve water quality and soil quality along the impaired Milwaukee River corridor. Project objectives include: recruit landowner participation in land management activities through

conservation practices through demonstration workshops, agriculture innovation field days and incentives; permanent land protection through agricultural conservation easements; and coordinate and facilitate diverse groups to educate and promote conservation.

An example of a new potential new partnership is the effort to form a “Friends of Sucker Brook Watershed” group. In association with other partnerships, the group’s intent would be to help restore Sucker Brook.

4.8 IMPLEMENTATION STRATEGIES

The goals, workplan objectives and planned activities presented in this chapter represent part of the framework for an annual workplan that will be developed and carried out by the Ozaukee County LWM Department over the next ten years. Proposed planned activities were purposely broadly defined in order to meet future changes in the environment, changes in programs and policies, changes in local priorities, and changes in available funding. As required by DATCP, a more detailed list of planned activities is set forth below, as a strategy to implement the nonpoint pollution performance standards and prohibitions under NR 151. Also, an estimate of the costs associated with plan implementation is provided.

Priority Farm Strategy (Implementation of Agricultural Performance Standards)

Farms, like all major industries, must meet environmental standards to control runoff from cropland, pastures and livestock facilities to protect water quality. However, rapidly enforced performance standards could pose undue economic hardship on family farms. Ozaukee County recognizes that the line between resource protection and a healthy farm community must be carefully drawn and will follow prudent policies and procedures outlined in ATCP 50 to guide the process. The County’s preference is that agricultural landowners and operators comply with the state and local performance standards and prohibitions voluntarily. The main tools of choice to accomplish voluntary compliance include education, conservation practice incentives, targeting of resources, participation in appropriate programs, and fostering partnerships.

Key Item: Priority Farm related efforts as discussed in this chapter are of particular importance to Ozaukee County.

Ozaukee County has a Memorandum of Understanding (MOU) with the WDNR and the LWM Department outlining roles and responsibilities for implementing the State’s Agriculture Performance Standards.

Following is a summary of the current process. Updating the MOU with DNR will be a priority in 2021 to align the goals and objectives of this plan.

To equitably implement the previously noted standards and prohibitions in agricultural areas, a systematic and comprehensive approach will be required. The strategy for implementation detailed below is a likely process for implementation, with room for flexibility as program experience develops and fiscal conditions dictate. In the following sections, the term “landowner” is used generically to describe the person responsible for compliance with the above noted standards.

1. Conduct information and education activities.

The Ozaukee County LWM Department will distribute information and educational material prepared by the WDNR and DATCP to appropriate landowners. The information will also be distributed via the County *Ozaukee Dirt* newsletter, County website, public informational meetings, and individual contacts with landowners.

The educational materials will be designed to achieve the following objectives:

- Educate landowners about Wisconsin’s agricultural performance standards and prohibitions, County ordinances, applicable conservation practices, and cost-share grant opportunities
- Promote voluntary implementation of conservation practices necessary to meet the performance standards and prohibitions
- Inform landowners of compliance procedures and agency roles to be used statewide and locally
- Make landowners aware of expectations for compliance and consequences for noncompliance.

2. Priority Farm Strategy – Identify and evaluate farms for compliance with standards and prohibitions.

The Ozaukee County Priority Farm Strategy is to target implementation of the performance standards and provide cost-sharing and technical assistance in areas of greatest environmental need or threat to public health. Priority Farms will be identified using the following criteria:

- Reports of environmental incidents, including well contamination, fish kills, manure spills or manure storage overflow events

- Public complaints
- Volunteer landowners that identify soil and water conservation issues on their farms and request LWM assistance
- Watersheds with impaired waters, approved TMDLs, nine key element watershed-based plans or areas in shoreland zone or with high susceptibility to groundwater contamination

LWM staff will use the above criteria to prioritize farms for assistance and limited cost-sharing. In the event the number of priority farms exceeds the assistance available, the highest priority farms will be those that have caused documented environmental incidents or are in sensitive environmental areas. See Appendix F for a list of the priority ranking factors and such information is located within this plan.

3. *Document and report compliance status.*

Following completion of records review and onsite evaluations, an NR 151 Status Report will be prepared and issued to owners of the parcel evaluated. This report will be consistent with NR 151.090 and 151.095 requirements, and include at a minimum:

- Compliance status of individual parcels with each of the performance standards and prohibitions;
- Corrective measure options and an approximate cost estimate to comply with each of the performance standards and prohibitions for which a parcel is not in compliance;
- Status of eligibility for available cost-share funding;
- Grant funding and technical assistance available from Federal, State, and local government sources and third-party service providers;
- An explanation of conditions that apply if public cost share funds are used (see Appendix G for a listing of cost-share funds utilized in 2010 – 2019);
- A timeline for completing corrective measures, if necessary;

- Signature lines indicating landowner agreement or disagreement with report findings;
- Process and procedures for contesting evaluation results to the County; and
- A copy of performance standards, prohibitions, and technical design standards.

All evaluations and compliance status reports will be kept as public records in the office of the Ozaukee County LWM Department, and once developed, will be part of a County GIS based tracking system. If a landowner agrees with the initial compliance determination and no corrective actions are required, a Letter of NR 151 Compliance would be issued (see Item 5 below) and the site updated in the County tracking system/spreadsheet. If a landowner disagrees with the initial compliance determination, the landowner may meet and discuss concerns with the LWM Department regarding the compliance determination process and results. If, after discussing the NR 151 Status Report with the LWM Department, the landowner still disagrees with conclusions, the landowner may choose to follow the appeals process with the WDNR. WDNR staff, on a case-by-case basis, may also be involved with County generated NR 151 compliance evaluations, determinations, and/or corrective actions.

4. *Offer technical assistance and available cost-share funding to implement appropriate best management practices.*

If a site is determined to be out of compliance with the State standards, technical assistance and any available cost-sharing will be offered to the landowner to bring them into compliance. A list of conservation practices likely to be utilized to meet state performance standards and potential sources of cost-share funding is found in Appendix H. If no cost-share funding was available, a landowner would not be required to comply until such time that cost-sharing becomes available. However, if cost-share funding is offered, and a landowner refuses to make the corrective actions needed to bring the site into compliance, future cost-sharing is not required and the landowner will be required to implement the practices needed to bring the site into compliance.

5. *Administer funding and technical assistance.*

Once a landowner agrees to implement the corrective actions to bring the site into compliance with the State standards, and if cost-sharing is involved, the cost-share agreement and schedule for implementation will be executed. If technical assistance is required, it will be arranged through

appropriate agencies/staff with the proper engineering job approval or conservation planning certifications.

After the corrective measures are applied, the site will be re-evaluated to determine if the parcel has been brought into compliance with the relevant performance standards or prohibitions. If the site is in compliance, the NR 151 Status Report would be updated to include a Letter of NR 151 Compliance. This would serve as official notification that the site has been determined to be in compliance with applicable performance standards and prohibitions. Under NR 151, once a site is determined to be in compliance, it is required that the site remain in compliance with the NR 151 standards and prohibitions for perpetuity without additional cost sharing being required.

6. Issue required notices and enforcement activities.

Following compliance status notification, if appropriate action is not taken by the landowner/operator in a reasonable amount of time as detailed in the NR 151 Status Report, enforcement action may commence.

Generally, a NR 151 Violation Letter would be sent via certified mail to notify the landowner of the violation and explain possible enforcement action that may follow. It is anticipated that the LWM Department would consult with WDNR staff prior to issuing the NR 151 violation letter and after referring the case for further enforcement.

7. Compliance monitoring and annual reporting.

The LWM Department will use a spreadsheet database to record progress on implementing performance standards and meet reporting requirements. Once developed, the spreadsheet data is expected to be incorporated into a GIS spatial tracking system. Compliance monitoring may be done as random spot checks or through scheduled inspections of sites previously cost-shared. Annual reports will be compiled to evaluate the progress of administering performance standards and prohibitions and submitted to the WDNR and DATCP.

Nonagricultural Implementation Strategy

To implement the above-noted standards and prohibitions fairly in the nonagricultural areas, a systematic and comprehensive approach will be required. Runoff pollution from urban lands can be the leading cause of water quality problems in some areas. As in rural areas, the State standards are focused on achieving reductions in sediment loads delivered to streams and lakes. Attached to the soil particles are nutrients such

as phosphorus that fuels the growth of algae and weeds in bodies of water. Other pollutants from urban areas include flakes of metal from vehicles, particles from vehicle exhaust, bits of tire and brake linings, soot from smokestacks, lead, zinc, pet waste, leaves, grass clippings, and a variety of chemical compounds.

To minimize water pollution, flooding, and other negative impacts of urbanization on downstream water resources (lakes, streams, wetlands and groundwater) and property owners, controls on soil erosion and sedimentation during construction and management of stormwater after development will be enforced through applicable local governmental regulations. The review of construction site erosion control and post-construction stormwater management facilities is required in MS-4 areas under Chapter XIV of the Ozaukee County Code of Ordinances.

Table 90 in Chapter V of the County comprehensive plan identifies the local governments in Ozaukee county that have adopted construction site erosion control ordinances and a stormwater management ordinance or plan. These ordinances require erosion control practices for land disturbing activities, as set forth in the Wisconsin Storm Water Management and Post-Construction Technical Standards, a set of documents that specify the minimum requirements needed to plan, design, install, and maintain a wide array of conservation practices aimed at preserving the land and water resources of Wisconsin. The WDNR construction site erosion and sediment control standards can be downloaded at:

http://dnr.wisconsin.gov/topic/Stormwater/standards/const_standards.html.

It should be noted that local erosion control ordinances do not apply to single-family home construction, which is regulated under Chapter Comm 21 of the *Wisconsin Administrative Code*. By State statute, Comm 21 supersedes all local ordinances. In Ozaukee County, the Towns administer the regulations for erosion control for single-family home construction.

Municipal Storm Water Discharge Permits

Chapter NR 216, "Storm Water Discharge Permits," of the *Wisconsin Administrative Code* also contains stormwater permitting requirements for regulating discharges from municipal separate storm sewer systems. Phase II of NR 216 requires municipalities outside urbanized areas with a population greater than 10,000 and a density over 1,000 persons per square mile to obtain a Wisconsin Pollutant Discharge Elimination System stormwater discharge permit. As a result of Phase II requirements, Ozaukee County, the Cities of Cedarburg, Mequon, and Port Washington, the Villages of Grafton, Saukville, and Thiensville, and the Towns of Cedarburg and Grafton have applied for and been issued these permits. Requirements for permitted municipalities are set forth in Chapter 3 of this report.

4.9 ESTIMATED COSTS OF PLAN IMPLEMENTATION

Since this plan does not have the authority to establish county budget items, the estimated costs provided below are solely intended to satisfy State LWRM planning requirements and do not in any way represent anticipated Ozaukee County LWM Department budgets. It is also assumed that no additional staff resources will be made available to implement this plan beyond what is currently allocated to land and water conservation programs in the County (approximately 6.8 full time equivalent employees). The cost estimates contained in Table 4.2 are based on average annual costs to maintain existing program efforts and staffing levels.

The cost-sharing estimates in Table 4.2 are based on a statutory requirement of 70 percent cost-sharing and are dependent on the need for landowners to comply with the state performance standards described earlier in this chapter. Crop erosion control has greatly improved in Ozaukee County owing to the widespread practice of conservation tillage and sowing of herbicide resistant field crops. Therefore, compared to other Wisconsin counties, the costs to meet these requirements should be nominal. Much of Ozaukee County has, however, been under intensive agriculture use for over a hundred years and many of its streams have accumulated sediment throughout that period. If nutrient management and other cropland or performance standards are enforced on a majority of cropland acres, these costs could be greater. Average salary increases and inflationary costs are included in the increases shown each year. Currently, all cost-share funding is acquired from Federal and State sources, the Ozaukee County LWM Department will continue to apply for grants to supplement those funds. The table assumes that Ozaukee County's current budgeted staffing level of 6.8 full time employees is maintained, and it assumes stable segregated and bonding cost-share funds by the State. Conservation practices, such as diversions, riparian buffers, filter strips and building projects such as manure storage facilities, concrete barnyards and roofed feedlots are considered "hard practices." Cropping practices, such as nutrient management and conservation tillage, are known as "soft practices." The projected cost-share needs for installing hard and soft best management practices over the next ten years is only an approximate estimate due to uncertain funding levels, changing land use and farm economy, and increasing practice installation costs.

The procedures and cost estimates outlined in this chapter represent the best estimates of the LWM Department at the time of plan preparation and are all subject to change. No attempt is made to identify the source of funding beyond the assumptions noted above. All of the estimated costs are subject to the annual budget processes at the county, state and Federal levels. The LWM Department will make every

attempt to take advantage of the wide array of grants and partnerships that may be available through public or private sources to implement this plan.

Chapter 4

GOALS, OBJECTIVES, AND ESTIMATED COSTS

TABLES

Table 4.1
Ozaukee County Workplan (2021-2030)

Workplan Objectives	Planned Actions	Years	Agencies
<p>GOAL #1 Provide Natural Resource, Environmental, and State Performance Standards Information and education (1.7 FTE and 20 percent of Budget/year)</p> <p>Enhance the general public's appreciation and involvement in protecting and restoring natural resources.</p>	<ol style="list-style-type: none"> 1. Make available informational brochures and fact sheets about such topics as performance standards, best management practices, protecting natural resources, wildlife management, various pollution concerns, etc. 2. Provide and keep up-to-date information, including education and outreach materials, on the county web site and in social media posts. 3. Conduct periodic workshops or presentations on important conservation issues. 4. Use newspaper, radio and TV news stories/press releases to deliver environmental programming. 5. Work with the Riveredge Nature Center, Mequon Nature Preserve, Ozaukee Washington Land Trust, MMSD, The Conservation Fund, Milwaukee Riverkeeper, and other organizations to promote natural resource appreciation. 6. Continue to participate in the SE Wisconsin Watersheds Trust "Respect Our Waters Program". 7. Provide fish passage information to residents and local and regional natural resources managers (e.g. culvert replacement, AOP criteria, etc.). 8. Support volunteer work days (invasive management, tree planting, etc.) in county parks and natural areas. 	<p>2021-2030</p>	<p>LWM Department; UW-Extension; MMSD; Riveredge Nature Center; Mequon Nature Preserve; Ozaukee Washington Land Trust; MMSD; The Conservation Fund; Milwaukee Riverkeeper; Wisconsin Wetlands Association</p>
<p>Promote sound agricultural practices, soil health, and foster knowledge of performance standards, regulations, sustainable agriculture, etc.</p>	<ol style="list-style-type: none"> 1. Inform new landowners and agricultural producers about best management practices and their obligation to maintain compliance with performance standards through personal contact, direct mail notifications, newsletters, fact sheets, web pages, workshops etc. 2. Support efforts to ensure that agricultural carrying capacity is sustainable. 3. Promote soil health practices. 4. Conduct workshops and field days in partnership with the Milwaukee River Watershed Clean Farm Families, Cedar Creek Farmers, and Ozaukee County Demonstration Farm Network focused on improving soil health. 5. Support demonstration sites and research plots, and assist researchers and farmers with implementation of the USDA Conservation Innovation Grant Project. 6. Implement the Ozaukee County Cover Crop/Soil Health Program – make available to farmers the County's interseeded planter, no-till drill, and roller crimper. 7. Continue to work with the Clean Farm Families on the 35-acre cover crop/soil health demonstration site on State Hwy 57. 8. Provide a minimum of two soil health scholarships to farmers to attend the Annual National No-tillage Conference. 9. Implement an Ozaukee County Soil Health Initiative, to promote soil health practices and increase the use of cover crops by a potential target of about five percent annually. 10. Use the above Planned Actions to help with implementation of TMDL and 9-key element watershed-based plans and other water quality improvement efforts to address water quality impairments. 11. Implement the Milwaukee River Watershed Conservation Partnership's new USDA Regional Conservation Partnership Project in collaboration with lead partner MMSD. 	<p>2021-2030</p>	<p>LWM Department; UW-Extension; DATCP; WDNR</p>

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Table 4.1 (Continued)

Workplan Objectives	Planned Actions GOAL #1 (continued)	Years	Agencies
Promote learning strategies for environmental education among our youth.	<ol style="list-style-type: none"> 1. Utilize new and existing programs to help implement a curriculum to inform students about natural resource issues, their function and role in the environment, and ways they can manage and restore those resources. 2. Assist area youth groups in the development of outdoor classroom activities to promote land and water conservation. 3. Support an annual poster contest. 4. Participate in the Community Rivers Program. 	2021-2030	LWM Department; UW-Extension; Riveredge Nature Center; Schools; Youth Groups
Increase landowner and producer/operator awareness of conservation practices and programs.	<ol style="list-style-type: none"> 1. Continue to provide an annual newsletter <i>Ozaukee Dirt</i>. 2. Provide I&E at display booths for various events such as Treasures of Oz, City of Mequon Arbor Day, etc. 3. Maintain web page on conservation programs, technical services, and cost-shared practices. 4. Offer annual workshops on soil health, nutrient management planning, and/or soil preservation techniques. 5. Distribute information material during office and site visits. 6. Host a field day primarily directed towards the agricultural community on different topics relating to agricultural best management practices and soil health. 7. Utilize social media. 	2021-2030	LWM Department; UW-Extension; NRCS; FSA
Provide information to riparian property owners on the benefits of riparian buffers.	<ol style="list-style-type: none"> 1. Assist in developing demonstration sites to illustrate sound riparian land management and buffer establishment. 2. Provide informational and educational programming targeted towards Lake Michigan and river riparian property owners. 	2021-2030	LWM Department; Planning & Parks Department; UW-Extension; WDNR
Provide information to county residents about how they can control exotic and invasive species.	<ol style="list-style-type: none"> 1. Assist with the efforts of the Southeastern Wisconsin Invasive Species Consortium. 2. Distribute information to the public related to invasive species identification, control, and management. 3. Promote native species plantings by offering native trees, shrubs, prairie seed, and plants through the annual County Tree, Shrub, Prairie Seed, and Bluebird House Sale program. 4. Work with and encourage County and municipal departments to identify, control, and manage invasive species in public parks and roadways. 	2021-2030	LWM Department; UW-Extension; WDNR; Southeastern Wisconsin Invasive Species Consortium; Schools; Youth Groups; Work Groups
GOAL #2 Implement the State Performance Standards to Reduce Agricultural Non-Point Source Water Pollution (1.7 FTE and 20 percent of Budget/year)			
Implement the State Agricultural Performance Standards.	<ol style="list-style-type: none"> 1. Utilize an inventory tracking system for landowner's compliance status to State performance standards. 2. Notify landowners of compliance status and identify key problems and needed BMPs when necessary. 3. Offer technical assistance cost sharing if available. 4. Inspect landowners' efforts to maintain and/or implement compliant practice(s). 5. Notify landowner of compliance status. Refer non-compliance to the DNR if necessary for enforcement. 6. Participate in the implementation of TMDL watershed-based plans designed to address water quality impairments. 7. Participate in the implementation of 9-key element plans and other water quality improvement efforts. 8. Collaborate with partner organizations (MMSD, Milwaukee Riverkeeper, USGS, etc.) to share data. 	2021-2030	LWM Department; DATCP; NRCS; WDNR

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Table 4.1 (Continued)

Workplan Objectives	Planned Actions GOAL #2 (continued)	Years	Agencies
Support the Farmland Preservation Program.	<ol style="list-style-type: none"> 1. Continue to assess and evaluate farm practices and parcel management. 2. Review farm plans, ensure conservation compliance, and update farmland-zoning certificates. 3. Notify DATCP of status changes. 4. Partner with MMSD's Working Soils program to permanently protect farmland. 	2021-2030	LWM Department; DATCP; NRCS
Reduce soil erosion to or below T as required by State and County performance standards.	<ol style="list-style-type: none"> 1. Conduct annual cropland erosion/transect survey to monitor erosion levels. 2. Encourage landowners to develop farm conservation plans on critical agricultural fields and develop practices as needed. <ol style="list-style-type: none"> a. Practice conservation tillage to leave 30 percent or more residue. b. Use no-till practices for fields in WQMA if practical. c. Use cover crops. d. Practice crop rotations to minimize soil loss. e. Contour farm if practical. f. Establish permanent vegetation in concentrated flow channels. g. Rotationally graze horses and cattle where practical. 3. Utilize SWRM cost-share funds, other Federal, State, Multi-Discharger Variance (MDV), Adaptive Management, and other organization funds to implement approved conservation practices. 4. Use the above Planned Actions to help implement the Milwaukee River TMDL, 9-key element watershed-based plans, and other water quality improvement efforts designed to address water quality impairments. 	2021-2030	LWM Department; DATCP; NRCS; FSA; WDNR
Manage manure and livestock access to water resources in accordance with State performance standards.	<ol style="list-style-type: none"> 1. Make producers aware of local, state and federal guidelines and performance standards. 2. Continue to work with producers to improve feedlot maintenance, manure handling, and storage. 3. Continue to work with dairy farmers to contain or control the discharge of milkhouse waste. 4. Locate manure stack areas outside of WQMA. 5. Install fencing to properly manage livestock and horses in areas with water resources. 6. Limit manure applications on highly erodible lands and lands with permeable soils, karst topography, or high bedrock. 7. Limit manure applications on highly erodible lands and lands with permeable soils, karst topography, or share programs. 8. Continue to reduce contaminated barnyard runoff through education and available state and federal cost-share programs. 9. Address legacy phosphorus accumulation through dredging and other methods. 10. Continue to review manure storage and nutrient management plans and issue permits. 11. Continue to conduct livestock facility and animal waste ordinance related inspections. 	2021-2030	LWM Department; DATCP; NRCS; WDNR

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Table 4.1 (Continued)

Workplan Objectives	Planned Actions GOAL #2 (continued)	Years	Agencies
Reduce soil delivery rate from riparian cropland.	<ol style="list-style-type: none"> 1. Work with landowners, FSA and NRCS to utilize CRP/CREP to establish buffers in the riparian corridor. 2. Reduce sediment delivery from fields by promoting best management practices to reduce soil erosion and preparing farmland management plans. 3. Clean out accumulated sediment from agricultural drainageways as needed and where applicable, incorporating the proper permitting process and associated sediment removal actions. 4. Assist the Drainage District Boards. 5. Utilize SWRM cost-share funds, Regional Conservation Partnership Program (RCPP), and other Federal and State funds to create effective grassed waterway systems. 6. Promote protection and improvement of soil health through implementation of practices such as no-till, cover cropping, diverse rotations, etc. 7. Utilize Federal, State, MDV, Adaptive Management, and non-profit organization funds to cost-share conservation practices. 8. Use the above Planned Actions to help implement the Milwaukee River TMDL, 9-key element watershed-based plans, and other water quality improvement efforts designed to address water quality impairments. 	2021-2030	LWM Department; DATCP; NRCS; FSA
Develop, implement, and monitor compliance of nutrient management plans to protect water quality.	<ol style="list-style-type: none"> 1. Work with producers, DATCP, NRCS and technical service providers to expand nutrient management planned acreage. 2. Assist NRCS and TSPs with compliance inspections and updates of expired NMPs and PMPs. 3. Develop a database to track sediment, nutrient, and phosphorus savings. 4. Continue to support water quality testing and monitoring efforts, and contribute data to Milwaukee Riverkeeper's Milwaukee River Report Card. 5. Use the above Planned Actions to help implement the Milwaukee River TMDL, 9-key element watershed-based plans, and other water quality improvement efforts designed to address water quality impairments. 	2021-2030	LWM Department; DATCP; NRCS; TSP; Milwaukee Riverkeeper
GOAL #3 Implement the State Performance Standards to Reduce Non-Agricultural Non-point Source Water Pollution (.4 FTE and 5 percent of Budget/year)			
Implement the State Non-Agricultural Performance Standards.	<ol style="list-style-type: none"> 1. Continue to encourage the adoption of storm water management and construction site erosion control standards and guidelines for urban, urbanizing, and redeveloping areas as set forth in Chapter NR 151 of the Wisconsin Administrative Code designed to achieve the pollutant reduction goals set forth in the regional water quality and watershed management plans. 2. Inspect compliance of approved plan requirements during construction. 3. Encourage municipalities and towns to take responsibility for maintenance of major storm water management systems. 4. Continue to support ongoing water quality monitoring activities. 5. Collaborate with partner organizations (MMSD, Milwaukee Riverkeeper, USGS, etc.) to share data. 6. Continue to analyze water quality data associated with habitat restoration projects and associated BMP's for water quality improvements and fish, avian, and herptile response (i.e. monitoring fish and wildlife to obtain a biological monitoring analog to water quality chemical and physical parameters). 	2021-2030	LWM Department; WDNR; Towns; Local Government

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Table 4.1 (Continued)

Workplan Objectives	Planned Actions GOAL #3 (continued)	Years	Agencies
Reduce construction site erosion.	<ol style="list-style-type: none"> 1. Continue to review erosion control plans for new and re-development sites. 2. Recommend WI DNR Conservation Practice Standards. 3. Continue to respond to complaints of erosion problems and notify local building inspectors of uninstalled or unmaintained erosion control measures. 4. Administer the County Construction Site Erosion Control and Post Construction Stormwater Management Ordinance. 	2021-2030	LWM Department; WDNR; Towns; Local Government
Manage storm water runoff more effectively.	<ol style="list-style-type: none"> 1. Work with the Towns and Local Governments to encourage consistent requirements and standards for storm water management and regulation. 2. Develop a coordinated permitting process between the Wisconsin Department of Natural Resources and local levels of government in the county for storm water management projects. 3. Recommend special protection to outstanding and exceptional water resources and environmentally sensitive areas. 4. Encourage the WDNR and other appropriate agencies to further assist efforts to clean out accumulated sediment from catch basins, drainageways and streams. 	2021-2030	LWM Department; WDNR; City of Mequon; Towns; Local Government
Encourage urban-density land use to be confined to and within the identified urban service areas.	<ol style="list-style-type: none"> 1. Limit agricultural rezoning to planned urban service areas. 2. Adhere to town adopted land use plans. 3. Incorporate the County-wide comprehensive planning goals and objectives into land use planning programs. 	2021-2030	LWM Department; Planning and Parks Department; Towns; Local Government
Comply with the Municipal Separate Storm Sewer System (MS4) permit requirements under NR216 of the Wisconsin Administrative Code.	<ol style="list-style-type: none"> 1. Assist in the implementation of permit requirements that will include: public outreach and education; illicit discharge detection and elimination; and construction site pollution control and prevention. 2. Assist in implementation of the Respect Our Waters program and other stormwater education programs. 	2021-2030	LWM Department; Towns; Local Government
GOAL #4 Invasive and Exotic Species Management and Control (.2 FTE and 2 percent of Budget/year)			
Control the infestation of exotic and invasive plant and animal species.	<ol style="list-style-type: none"> 1. Distributed informational material, answer phone and direct inquiries. 2. Organize and educate local work and youth groups to identify and eliminate exotic and invasive species. 3. Continue to conduct periodic workshops and presentations on exotic and invasive plant and animal species control such as the Emerald Ash Borer. 4. Work closely with the Southeastern Wisconsin Invasive Species Consortium. 5. Encourage County and municipal departments to identify, control, and manage invasive species in public parks, roadways, and natural areas. 6. Support County and partner organization's invasive species inventories. 	2021-2030	LWM Department; UW- Extension; Southeastern Wisconsin Invasive Species Consortium; Local Government

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Table 4.1 (Continued)

Workplan Objectives	Planned Actions	Years	Agencies
Conserve Ozaukee County's unique natural resources in the face of increasing urbanization and resulting loss of farmland.	<p>GOAL #5 Protect and Preserve Land and Water Resources (3.7 FTE and 45 percent of Budget/year)</p> <ol style="list-style-type: none"> Continue use of land use planning and regulatory tools to preserve productive farmland and agricultural businesses: <ol style="list-style-type: none"> Recommend preserving open/green space to builders and developers. Promote conservation subdivisions and rural cluster development. Continue to encourage Exclusive Agricultural Zoning. Protect farmland through Land Division Ordinances. Support the Purchase of Development Rights and the Transfer of Development Rights to conserve farmland. Encourage the formation of Farmland Enterprise Zones. Encourage agri-business as an element of Ozaukee County's economic development plan. Promote farmland preservation opportunities available through the Regional Conservation Partnership Program and Ozaukee Washington Land Trust. Promote Sustainable and Alternative Farm Practices. Advise subdivision associations and landowners on how to manage their wetlands, woodlots and detention ponds. Continue to support farm to table initiatives, helping connect local farmers with local buyers. Help distribute an annual <i>Farm Fresh Atlas</i> to advertise farmer's markets. Continue to support acquiring and preserving environmental corridors and important identified natural areas and critical species habitat areas, including such recommendations as set forth in the County Park and Open Space Plan. Continue to analyze water quality data associated with habitat restoration projects and associated BMP's for water quality improvements and fish, avian, and herptile response (i.e. monitoring fish and wildlife to obtain a biological monitoring analog to water quality chemical and physical parameters). 	2021-2030	LWM Department; Planning and Parks Department; UW- Extension; Towns; Local Government
Prevent the degradation and disturbance of wetlands.	<ol style="list-style-type: none"> Administer the County's shoreland/floodplain zoning ordinance. Continue to notify the appropriate government agencies of wetland disturbance or destruction. Work together with the DNR, USACE and SEWRPC to resolve wetland related issues. Continue to assist landowners with required shoreland – wetland permits. 	2021-2030	LWM Department; WDNR; USACE; Wisconsin Wetlands Association; SEWRPC

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Table 4.1 (Continued)

Workplan Objectives	Planned Actions GOAL #5 (continued)	Years	Agencies
Create, restore, and enhance wetland, riverine, and wildlife habitat throughout the county.	<ol style="list-style-type: none"> 1. Work with landowners, DNR, FSA, USF&W, NRCS, and non-profit conservancy organizations to utilize local, state and federal program funds for wetland and riverine improvements. 2. Continue to assist planning commission staff, contractors and WDNR with stream restoration and wetland mitigation, crossing, and relocation projects. 3. Continue to assist with fish passage, stream restoration, stream re-meandering, lateral reconnections (stream connections to adjacent wetlands and floodplains, and stream bank stabilization projects, including projects identified in nine key element plans. 4. Seek funding sources for lake and river water quality protection. 5. Support the Riveredge Nature Center's conservation initiatives such as its Lake Sturgeon reintroduction and Swamp Metalmark butterfly projects. 6. Support use of the Ecological Prioritization GIS tool to help prioritize restoration and preservation of Ozaukee County land and water resources and to help improve ecological connectivity across watersheds. 7. Promote water quality monitoring on Ozaukee County streams to provide information on the water quality benefits of stream and wetland restoration projects that can be used to help guide future restoration projects. 	2021-2030	LWM Department; UW-Extension; NRCS; WDNR; FSA; USF&W; Work Groups; Non-governmental organizations (NGO's)
Prepare, update, and implement watershed management plans.	<ol style="list-style-type: none"> 1. Continue to encourage and implement watershed plans consistent with the EPA's nine key elements. 2. Continue to coordinate implementation of phosphorus and sediment limits, TMDL's, and other similar performance standards. 3. Continue to support the producer led Clean Farm Families, Cedar Creek Farmers, and Ozaukee County Demonstration Farm Network programs. 4. Continue water quality monitoring on Ozaukee County streams to inform the development and implementation of watershed management plans. 	2021-2030	LWM Department; Planning and Parks Department; UW-Extension; NRCS; WDNR; FSA; USF&W; Work Groups
Promote riparian buffers along all water resources in the County, including their restoration, maintenance, protection and enhancement.	<ol style="list-style-type: none"> 1. Continue to work with and form more resource partnerships to educate riparian landowners of the water quality benefits of buffers and soil health. 2. Use GIS and field inspections to characterize the existing riparian buffer widths along county streams. 3. Implement an Ozaukee County Buffer Initiative to identify buffer needs in the Sauk and Sucker Creek watersheds to focus efforts and funds in an attempt to install buffers on a potential target of 80 percent of the streams and tributaries in the watersheds by 2025. 4. Implement riparian and stream restoration projects identified in nine key element plans. 5. Offer SWRM cost-share funds to install bio-engineered systems with vegetated buffers. 6. Continue to implement CRP/CREP to protect water quality. 7. Recommend alternative methods available to protect shorelines subject to low erosion intensity. 8. Implement new agricultural buffer standards as set forth in Chapter NR 151 of the Wisconsin Administrative Code designed to achieve the pollutant reduction goals set forth in the regional water quality and watershed management plans. 	2021-2030	LWM Department; Planning and Parks Department; DATCP; WDNR; NRCS; FSA

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Table 4.1 (Continued)

Workplan Objectives	Planned Actions GOAL #5 (continued)	Years	Agencies
Protect the quality and quantity of surface and groundwater resources.	<ol style="list-style-type: none"> 1. Utilize SWRM and EQIP cost-share funds to permanently abandon unused wells. 2. Continue to identify and help correct failing septic systems. 3. Develop a policy or program to hasten the replacement of older, potentially failing septic systems. 4. Continue administering the Private Onsite Wastewater Treatment System (POWTS) maintenance program. 5. Promote water conservation through I&E to local residents at all levels. 6. Encourage the infiltration of storm water as set forth in Chapter NR 151 of the Wisconsin Administrative Code. 7. Continue to assist the efforts of the Harrington Beach Water Quality Improvement Initiative. 8. Help developers identify potential storm water infiltration areas using field data, web-based GIS mapping, and soil surveys. 9. Incorporate SEWRPC Regional Water Supply Plan recommendation into storm water standards. 10. Conduct hazardous waste clean-up days (Clean Sweep). 11. Work with agricultural producers to soil test farm fields and provide assistance to producers to develop nutrient management plans for farm fields. 12. Work with agricultural producers on nutrient management plans in sync with soil health principles. 13. Work with livestock operations within the Silurian bedrock performance standard area to reduce impacts to groundwater. 14. Continue to administer the County's Manure Storage Ordinance. 15. Participate in the implementation of TMDL watershed plans designed to address water quality impairments. 16. Participate in the development and implementation of 9-key element plans and other water quality improvement efforts. 17. Support water quality monitoring and education efforts on behalf of the County, Milwaukee Riverkeeper, MMSD, SEWRPC, and others. 18. Support implementation of WDNR Area of Concern plan recommendations. 	2021-2030	LWM Department; DATCP; WDNR; NRCS; SEWRPC; Non-governmental organizations (NGO's)
Support efforts to protect and enhance forests, woodlots, and non-farmed areas.	<ol style="list-style-type: none"> 1. Administer the Ozaukee County annual tree and shrub program and Pollinator Plant Sale. 2. Work with area foresters to provide forestry assistance to landowners and promote tree diversity. 3. Support efforts and programs to improve degraded forest areas such as the CRP, the Healthy Forests Reserve Program, MMSD's Greenseams Program, etc. 	2021-2030	LWM Department; WDNR
Continue to implement the County's shoreland/floodplain management program.	<ol style="list-style-type: none"> 1. Update existing floodplain maps and encourage the mapping of un-modeled areas. 2. Recommend adoption of floodland zoning regulations and participation in the Nation Flood Insurance Program to effected municipal units of government. 3. Continue participation in the FEMA National Flood Insurance Community Rating System Program. 4. Preserve and protect streams and watercourses impacted by new construction and redevelopment. 5. Continue to enforce the County Shoreland regulations. 6. Continue to monitor and protect the Lake Michigan shoreline, especially in those reaches with relatively high unprotected bluffs, and promote bluff stabilization. 7. Support removal of privately owned septic systems from floodway areas. 8. Continue to support efforts to reduce flooding including participation in the Flood Hazard Mitigation Program and the state Municipal Flood Control Program. 9. Reduce impervious surfaces and encourage stormwater management BMP's on County-owned lands. 	2021-2030	LWM Department; Planning and Parks Department; WDNR; Towns; Local Government

Table continued on next page.

Table 4.1 (Continued)

Workplan Objectives	Planned Actions GOAL #5 (continued)	Years	Agencies
Adequately reclaim non-metallic mines (gravel pits and quarries).	1. Administer NR 135 Non-Metallic Mining Reclamation pursuant to the County's Ordinance.	2021-2030	LWM Department; Town of Saukville
Implement and periodically update the County comprehensive plan.	GOAL #6 Increase cooperation with Local, State and Federal Partners (.5 FTE and 8 percent of Budget/year) 1. Work with the multi-jurisdictional advisory committee and citizens to periodically update the County comprehensive plan based on Wisconsin's comprehensive planning law.	2021-2030	LWM Department; Planning and Parks Department; DATCP; NRCS; FSA; WDNR; UW-Extension; USF&W; SEWRPC
Look for opportunities to coordinate and collaborate with local grass roots groups, MMSD, conservation and wildlife clubs, local, state and federal agencies to help implement the goals this LWRMP, secure funding, and align projects with County/State/National priorities.	1. Enter into working agreements with other agencies to coordinate ordinance administration. 2. Work with landowners and non-profit conservancy organizations to promote innovations in shoreline protection and restoration through demonstration sites of new products and techniques and cost-share incentives. 3. Work with researchers implementing the USDA Conservation Innovation Grant. 4. Continue to rely on NRCS and DATCP for engineering and technical assistance, and grant funding. 5. Look for opportunities to coordinate efforts with local grass roots groups, conservation and wildlife clubs, local, state and federal agencies. 6. Continue to support such organizations as the Ulao Creek Partnership, Milwaukee Riverkeeper, the Southeastern Wisconsin Invasive Species Consortium Inc., Treasures of Oz, the Ozaukee Washington Land Trust, and the Friends of the Cedarburg Bog. 7. Continue to support such partnerships as the Milwaukee River Watershed Clean Farm Families, the Ozaukee County Demonstration Farm Network, the Southeastern Wisconsin Watersheds Trust, and the Milwaukee River Watershed Conservation Partnership. 8. Support efforts to establish a Friends of Sucker Brook Watershed, and with other partners, seek to restore the Sucker Brook Watershed. 9. Continue to pursue those funding opportunities such as 319 Grant funds, CFRP, EQIP, CSP, ACEP, etc. that are consistent with County priorities. 10. Prioritize such land and water resource management related efforts that are consistent with recommendations in adopted plans such as the Ozaukee County Multi-Jurisdictional Comprehensive Plan, the Ozaukee County Park and Open Space Plan, the Ozaukee County Strategic Plan, nine key element plans, etc. 11. Work with Ozaukee County municipalities, adjacent counties, and other partners including The Nature Conservancy and snowmobile clubs to implement fish passage impediment inventories and impediment removal or remediation projects.	2021-2030	LWM Department; Planning and Parks Department; DATCP; NRCS; FSA; WDNR; MMSD; Milwaukee Riverkeeper; UW-Extension; USFS USCOE USF&W SEWRPC; Work Groups; Schools; Youth Groups; Ozaukee Washington Land Trust; River Groups; Non-governmental organizations (NGO's)

Source: Ozaukee County Land and Water Management Department; and SEWRPC

Table 4.2
Estimated Total Costs for Plan Implementation: 2021-2025

Cost Category	2021 (\$)	2022 (\$)	2023 (\$)	2024 (\$)	2025 (\$)	Five-Year Total Costs (\$)
Salary and Benefits	761,292	775,800	790,620	805,752	821,196	3,954,660
Operating Expenses	81,726	83,360	85,027	86,727	88,461	425,301
Landowner Cost-Share Hard Practices	172,500	172,500	172,500	110,000	110,000	737,500
Landowner Cost-Share Soft Practices	77,400	77,400	77,400	67,400	67,400	367,000
Total Annual Costs	1,092,918	1,109,060	1,125,547	1,069,879	1,087,057	5,484,461

Note: Anticipate 2 percent annual increases for salaries, benefits, and operating expenses.

Does not include funding from the RCPP program.

Includes cost-share funding from the Producer-Led Watershed Protection Grant and the Conservation Innovation Grant.

Source: Ozaukee County Land and Water Management Department and SEWRPC

SEWRPC Community Assistance Planning Report No. 338

A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR OZAUKEE COUNTY: 2021 - 2030

Chapter 5

PROGRESS MONITORING AND EVALUATION

5.1 INTRODUCTION

The monitoring and evaluation of program efforts are important to ensure the effectiveness of the planned activities detailed in Chapter 4 of this plan. The Ozaukee County LWM Department currently employs, and plans to maintain, a variety of methods to monitor and evaluate the progress of program efforts, which include databases, advisory committees, annual progress reports, and water quality monitoring. Monitoring program effectiveness will be carried out through analyses and quantification of soil erosion and sediment delivery, priority farm compliance, tracking the level of protection of environmentally sensitive lands, and analysis of water quality data. This chapter describes some of these efforts in more detail and indicates how they will be used to monitor and evaluate the success in implementing planned activities.

5.2 MONITORING AND EVALUATION

Performance Tracking Systems

Ozaukee County's priority farms strategy will involve identifying and evaluating farmland for compliance with performance standards and prohibitions. Ozaukee County will identify priority farms for compliance determinations, track progress on implementing performance standards, and meet reporting requirements. This database can inventory parcel ownership, track notices sent to landowners, and record conservation measures installed and cost-share funds awarded. In addition, the LWM Department will track progress and compliance of riparian buffer and other best management practices through the Conservation Reserve, Soil and Water Resource Management, or other programs.

Ozaukee County currently tracks manure storage facilities, shoreland zoning permits, and wetland/Chapter 30 permits using a spreadsheet database. The database is used to monitor compliance with rural and urban nonpoint source pollution performance standards and to generate annual reports of activities such as plan reviews, permits issued, inspections conducted, and enforcement action taken.

The County also tracks its efforts administering the Private Onsite Wastewater Treatment System maintenance program, the Manure Storage Ordinance, the Construction Site Erosion Control and Post Construction Stormwater Management Ordinance. The County is also interested in developing a tracking program to monitor acres of cover crops planted annually.

GIS technology will be further developed and used as a primary tool to track installation of best management practices and monitor landowner compliance with the performance standards and prohibitions. The County presently utilizes GIS to track nutrient management planning and has a parcel-based land management software package application available, called "NR151 Web Tracking." In addition, all data regarding landowner compliance with the performance standards and prohibitions is presently in a hard copy format in the landowner file. The county is working with the Land Information Office to develop a tracking program for all county permits.

Lastly, it can be noted that the County last conducted a Source Loading and Management Model (SLAMM) analysis to calculate stormwater runoff volumes, pollution loads, etc. for its portion of the municipal separate storm sewer system (MS-4) of the County in 2009, and anticipates conducting the SLAMM analysis again in 2021. Ozaukee County also plans to utilize the Erosion Vulnerability Assessment for Agricultural Lands (EVAAL) and the Spreadsheet Tool for Estimating Pollutant Loads (STEPL) toolsets in watersheds for which the County received Multi-Discharger Variance funds.

Progress Reporting

Regular meetings are currently held to report progress to the Ozaukee County Natural Resources Committee regarding conservation plans and nutrient management plans that were developed, buffers implemented, contacts made, and educational activities. These meetings are used to evaluate the effectiveness of current practices, to approve and review cost-share contracts, and to change or modify programs to better address current conditions and local priorities.

Water Quality Monitoring

Water quality monitoring is an important means to assess the present condition of water resources and to gauge the effectiveness and progress of land conservation-related activities and best management practices. Unfortunately, due to the high number of variables involved in monitoring water quality, non-standardized parameters and sampling techniques, and the broad spatial and temporal sampling effort, it is often difficult to interpret the data. As a result of ongoing monitoring efforts by a variety of agencies and groups, considerable water quality monitoring information is available on streams within Ozaukee County as described in Chapter 4. While many streams within Ozaukee County have at least some limited water quality monitoring data available, only a few, notably the Milwaukee River, Sauk Creek, Mole Creek, and Ulao Creek, have been studied a number of times and/or at a number of different locations. There is a shortage, and in some instances a total lack, of water quality monitoring information available to the LWM Department on many of the smaller streams within Ozaukee County, and much of the data that are available are anecdotal or otherwise not readily quantifiable.

Ozaukee County supports citizen-based monitoring programs such as Water Action Volunteers. The County also plans to continue to work on collecting water quality data in cooperation with conservancy and environmental organizations, State and Federal agencies, local governments, the Milwaukee Metropolitan Sewerage District (MMSD), adjacent County and local governments, and other groups such as the Southeastern Wisconsin Watersheds Trust, Inc., Milwaukee Riverkeeper, Great Lakes Environmental Center, and SEWRPC. All of these groups work directly or indirectly, through project funding, to collect water quality data.

The principal methods that will be used to evaluate soil erosion and sediment delivery will include State and Federal farm plan monitoring, plan revisions, random field checks, and conducting cropland erosion/transect surveys. Additionally, nonagricultural and shoreline erosion will be monitored through quantification of shoreland permits and determining the effectiveness of construction site best management practices through onsite inspections and cooperation with municipal building inspectors. Environmentally valuable lands will be quantified in the preliminary planning stage by utilizing databases to introduce protective measures for environmental corridor areas and other environmentally important lands identified in the SEWRPC regional natural areas and critical species habitat plan and watershed studies.

Wisconsin Department of Natural Resources Water Quality Monitoring

The Wisconsin Department of Natural Resources (WDNR) also conducts baseline monitoring of streams in Ozaukee County. Department staff conducts fish collections, examines macroinvertebrates, and conducts

habitat assessments at a number of locations throughout Ozaukee County. This information is available online on the WDNR website at dnr.wisconsin.gov/topic/Watersheds/basins.

U.S. Geological Survey Monitoring

The U.S. Geological Survey (USGS) is actively collecting surface water resources data at stream gages on the Cedar Creek near Cedarburg, on the Milwaukee River near Cedarburg, and on the Little Menomonee River near Freistadt. USGS water quality data for these sites can be found online at waterdata.usgs.gov.

Since 2000, the USGS has been studying the water quality of rivers and streams in the MMSD planning area. As part of this large multi-component project, the USGS has collected aquatic community data for algae, invertebrates, and fish every three years at a core 15 sites, three of which are in Ozaukee County as noted above. The USGS uses aquatic community data to assess water quality by computing abundances of the different kinds of organisms found and by computing metrics such as the fish Index of Biotic Integrity. MMSD and/or the USGS have been undertaking regular water quality monitoring at or near these sites and the data is used to compare to the aquatic community data. The USGS has also deployed passive water samplers for synthetic organic chemicals at the 15 sites, most recently in 2016. Depending on the site, there may be other USGS data and publications available.

Within Ozaukee County, the USGS has sampled the Milwaukee River near Cedarburg since 2004. A summary fact sheet on this monitoring will be published in September of 2020. In 2016 and 2019, the USGS sampled aquatic communities at Cedar Creek at the Covered Bridge Park upstream of the USGS stream gage, and passive samplers were deployed at the site in 2016. The USGS sampled invertebrates at the Little Menomonee River stream gage in 2016. The USGS has preliminary data for aquatic communities and passive water samples at this site during 2016, but data from the 2019 sampling at this site may not be available until late 2020/early 2021.

Lake Michigan Beach Monitoring

The Federal Beach Act was passed in October of 2000, requiring States that border coastal or Great Lakes waters to develop beach monitoring and public notification programs. The Beach Act also authorized the U.S. Environmental Protection Agency (USEPA) to provide grants to States that have beaches bordering these coastal waters for the purpose of developing and implementing monitoring and public notification programs. The WDNR and its partners have participated in this grant program since the 2002 swimming season. The Wisconsin Beach Monitoring Program was developed in accordance with USEPA performance criteria. The Washington Ozaukee Public Health Department adheres to the performance criteria for

monitoring, public notification, and reporting. The Washington Ozaukee Public Health Department is responsible for testing the samples and informing Ozaukee County at a frequency determined by the WDNR of bacteria counts so that they can post the appropriate signs for beach advisories. Ozaukee County beaches that are tested regularly include: Cedar Beach, Concordia University, County Road D boat launch beach, Harrington State Park beach north, Harrington State Park beach south, and Upper Lake Park beach. Water quality data are posted on the State website and are updated regularly. The Washington Ozaukee County Public Health Department website is: www.washozwi.gov/Services/Environmental-Health/Beach-Water-Testing. The State of Wisconsin beach website is: www.wibeaches.us/apex/f?p=BEACH:HOME.

Wisconsin's Citizen Lake Monitoring Network

Wisconsin's Citizen Lake Monitoring Network (formerly called Self-Help Lake Monitoring) creates a bond between citizen volunteers statewide and the Wisconsin Lakes Partnership. The Network's goals are to collect high-quality lake monitoring data, educate and empower volunteers, and share the data collected to help inform lake management decisions. Volunteers measure water clarity and may also collect chemistry, temperature, and dissolved oxygen data, as well as identify and map plants or watch for Eurasian Water Milfoil near boat landings.

Numerous ponds in Ozaukee County, particularly along/near Cedar Creek, have been monitored by the Citizen Lake Monitoring Network.

Ozaukee County Water Quality Monitoring

The Ozaukee County Planning and Parks Department also conducts water quality monitoring, particularly along Ulao Creek, and is investigating additional funding opportunities to conduct such monitoring along Mole Creek, due to the current restoration efforts at these locations. A combination of Milwaukee Riverkeeper, Ozaukee County, and other organization's monitoring data will be utilized for future water quality improvement planning, by providing baseline data and highlighting potential pollution hotspots, significant load contributions, and trends overtime.

5.3 SUMMARY

Consistent and thorough evaluation and monitoring of conservation efforts are essential to ensure the effectiveness of the Ozaukee County Land and Water Resource Management Plan. An annual progress report will be the primary method used to evaluate progress of implementing the planned activities outlined in Chapter 4 of this report. The progress report will utilize the standardized units of measurement for

conservation practices and information and education activities prescribed by the Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP). The progress report will consist of a summary of the annual outcomes and accomplishments of planned activities outlined in the workplan. This summary may include, but is not limited to: completed information and education activities; landowners contacted; BMPs designed and installed; conservation and nutrient management plans written or revised; cost-share agreements developed; stormwater and erosion control plans reviewed; compliance monitoring and status; and other planned program results. These annual progress reports will be compiled and forwarded to DATCP and WDNR. Periodic updates will also be posted on the Ozaukee County website. The results of the monitoring and evaluations described in this chapter, and conducted over the term of this plan (2021-2030), will be used to improve the next land and water resource management plan.

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A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR OZAUKEE COUNTY: 2021-2030

ACRONYMS AND GLOSSARY

ACRONYMS

AEA	Agricultural Enterprise Area
ACEP	Agricultural Conservation Easement Program
BMP	Best Management Practice
CFLRP	Collaborative Forest Landscape Restoration Program
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CSP	Conservation Stewardship Program
CWA	Clean Water Act
CWFP	Clean Water Fund Program
DATCP	Department of Agriculture, Trade and Consumer Protection
EQIP	Environmental Quality Incentives Program
EWP	Emergency Watershed Protection Program
FEMA	Federal Emergency Management Agency
FPP	Farmland Preservation Program
FSA	USDA Farm Service Agency
GIS	Geographical Information Services
GLRI	Great Lakes Restoration Initiative
HFRP	Healthy Forests Reserve Program
I&E	Information and Education
LWM	Ozaukee County Land and Water Management Department
LWRMP	Land and Water Resource Management Plan
MMSD	Milwaukee Metropolitan Sewerage District
MS4	Municipal Separate Storm Sewer System

MVD	Multi-Discharger Variance
NMP	Nutrient Management Plan
NPS	Nonpoint Source Pollution
NRCS	USDA Natural Resources Conservation Service
PACE	Purchase of Agricultural Conservation Easements Program
PS	Point Source Pollution
RCPP	Regional Conservation Partnership Program
SEWRPC	Southeastern Wisconsin Regional Planning Commission
SWRM	Soil and Water Resource Management Program
"T"	Tolerable Soil Loss Rate
TMDL	Total Maximum Daily Load
TRM	Targeted Runoff Management Grant Program
TSP	Technical Service Provider
USCOE	United States Army Corp of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USF&W	United States Fish and Wildlife Service
UW-Ext	University of Wisconsin-Extension
UWM	University of Wisconsin-Milwaukee
WCMP	Wisconsin Coastal Management Program
WDNR	Wisconsin Department of Natural Resources
WQMA	Water Quality Management Area

GLOSSARY

303(d) List – The 303(d) list is prepared by the WDNR under requirements of section 303(d) of the Clean Water Act and identifies waters which are not meeting water quality standards, including both water quality criteria for specific substances and their designated uses.

Agricultural Enterprise Area (AEA) – A part of the Wisconsin Farmland Preservation Program administered by DATCP which designates areas of productive agriculture as requested by landowners and local governments.

ATCP 50 – The chapter of *Wisconsin's Administrative Code* that implements the Land and Water Resource Management Program as described in Chapter 92 of the *Wisconsin Statutes*.

Best Management Practices (BMPs) – The most effective practice or combination of practices for reducing nonpoint source pollution to acceptable levels.

Chapter 92 – Portion of the *Wisconsin Statutes* outlining the soil and water conservation, agricultural shoreland management, and animal waste management laws and policies of the State.

Collaborative Forest Landscape Restoration Program (CFLRP) – As administered by the U.S. Forest Service, the federal program is intended to encourage a collaborative, science-based ecosystem restoration of priority forest landscapes.

Clean Water Act (CWA) – Initially enacted in 1948 as the Federal Water Pollution Control Act, and significantly reorganized and expanded in 1972, the Act establishes the basic structure for regulating discharges of pollutants into the waters of the United States and for regulating quality standards for surface waters.

Conservation Plan – A record of decisions and intentions made by land users regarding the conservation of the soil, water and related natural resources of a particular unit of land.

Department of Agriculture, Trade and Consumer Protection (DATCP) – The State agency responsible for establishing statewide soil and water conservation policies and administering the State's soil and water conservation programs. The DATCP administers State cost-share funding for a variety of LWCC operations, including support for staff, materials and conservation practices.

Environmental Protection Agency (EPA) – The agency of the Federal government responsible for carrying out the nation’s pollution control laws. It provides technical and financial assistance to reduce and control air, water, and land pollution, and is responsible for administering the Clean Water Act.

Farmland Preservation Program (FPP) – The program provides Wisconsin landowners the opportunity to claim farmland preservation tax credits through zoning or agreements with DATCP for areas within Agricultural Enterprise Areas (AEAs), includes a process for establishing AEAs, and also includes a process for creating a Purchase of Agricultural Conservation Easements (PACE) program.

Farm Service Agency (USDA FSA) – The federal agency is responsible for farm programs, farm loans, commodity operations, management operations, and state operations in order to provide farmers with a strong safety net through various commodity programs, disaster programs, conservation reserve programs, and the provision of credit and loans to agricultural producers.

Geographic Information Systems (GIS) – A computerized system of maps and layers of data about land including soils, land cover, topography, field boundaries, roads and streams, zoning and land use, etc.

Highly Erodible Land (HEL) – Lands that are over 6 percent in grade. According to the NRCS, a farm field is considered to be HEL if more than one third of that field has land slopes that exceed 6 percent.

Land and Water Management Department (LWM) – The Ozaukee County Land and Water Management Department.

Natural Resources Conservation Service (NRCS) – The NRCS is under the direction of the United States Department of Agriculture (USDA) and is responsible for soil survey inventory and information, farm conservation planning, and providing technical assistance to landowners regarding best management practices.

Nonpoint Source Pollution (NPS) – Pollution resulting from many small and diffuse sources, unlike point source pollution, which results from one identifiable source. Soil erosion, livestock waste, stormwater runoff, nutrients such as nitrogen and phosphorus, and other pollutants are all examples of nonpoint source pollution.

Resource Conservation and Development (RC&D) - USDA program that focuses on utilizing and conserving natural resources for economic development, administered by NRCS.

Southeastern Wisconsin Regional Planning Commission (SEWRPC) – Governmental organization providing regional scale planning services to the seven-county Southeastern Wisconsin Region. These services include land use planning, transportation, environmental (wetlands, engineering, soils, and lake management), economic development, and GIS.

Tolerable Soil Loss (T) – Tolerable soil loss refers to the maximum allowable soil loss rate (tons/acre/year) for individual soil types. This rate refers to the amount of soil loss that can occur annually while the soil still remains agriculturally productive. It does not refer to the time it takes to naturally regenerate the soil.

United States Department of Agriculture (USDA) – Branch of Federal government with responsibilities in the areas of food production, forestry, and wildlife and fisheries.

University of Wisconsin-Extension – The outreach program of the University of Wisconsin that is responsible for formal and informal educational programs throughout the State.

Water Quality Management Area (WQMA) – The area that is within 300 feet of a navigable stream or river or 1,000 feet from a lake. In addition, WQMAs also include lands adjacent to ponds, or areas that are susceptible to groundwater contamination, such as a wetland, sinkhole, or an area that is shallow to bedrock.

Watershed – The geographic area which drains to a particular river, stream, or waterbody.

Wisconsin Department of Natural Resources (WDNR) – The State agency responsible for managing State owned lands and protecting public waters of the State. The WDNR also administers programs to regulate, guide and assist land conservation programs within individual counties, as well as landowners in managing land, water, fish, and wildlife.

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Appendix A

PUBLIC HEARING NOTICE

(September 17 and September 24 ,2020)

**OZAUKEE COUNTY NATURAL RESOURCES COMMITTEE
PUBLIC HEARING NOTICE**

NOTICE IS HEREBY GIVEN that a public hearing will be held at a meeting of the Ozaukee County Natural Resources Committee on Tuesday, October 6, 2020, at 8:00 A.M. in Auditorium of the Ozaukee County Administration Center, 121 W. Main St., Port Washington, to consider the following item(s):

- 1) Request by Brian and Margaret McClaren, Owners, and Paul Grow with DeLeers Construction, Inc., as Agent, to petition the Natural Resources Committee for a Zoning Classification change from Floodplain to Non-floodplain, per Section 7.1300 of the Ozaukee County Shoreland & Floodplain Zoning Ordinance, to recognize the results of a certified survey indicating the 100-year Lake Michigan floodplain.

Affecting the following described real estate: **Town of Belgium**, T12N-R23E in part of the NE 1/4 of SW 1/4 of Section 7.

Tax Key # 02-007-09-012.00. *Site address: 6618 Silver Beach North*

Information regarding this request is on file with the Ozaukee County Department of Land and Water Management, Room 223, Ozaukee County Administration Center, 121 W. Main St., Port Washington.

- 2) Conduct a public hearing on a proposed update to the Ozaukee County Land and Water Resource Management Plan (LWRMP). This update will replace the initial LWRMP adopted by the Ozaukee County Board in 1999. The ten-year plan will be a guide for the Land and Water Management Department in carrying out its duties related to land and water resource protection in Ozaukee County. Adoption of the plan will also help the county qualify for future state and federal grants.

The Ozaukee County Land and Water Resource Management Plan may be viewed online at <https://www.co.ozaukee.wi.us/DocumentCenter/View/14322/DRAFT-2021--2030-Land-and-Water-Plan>. The plan may also be viewed in the Land and Water Management Department offices at 121 W. Main Street, Port Washington, WI 53074. For additional information regarding this hearing, please contact Andy Holschbach at 262-284-8271 or 262-238-8271.

The public and all interested persons are invited to attend this meeting and comment as appropriate. Discussion and action by the Natural Resources Committee will follow the hearing.

Donald Korinek, Chairman
Natural Resources Committee

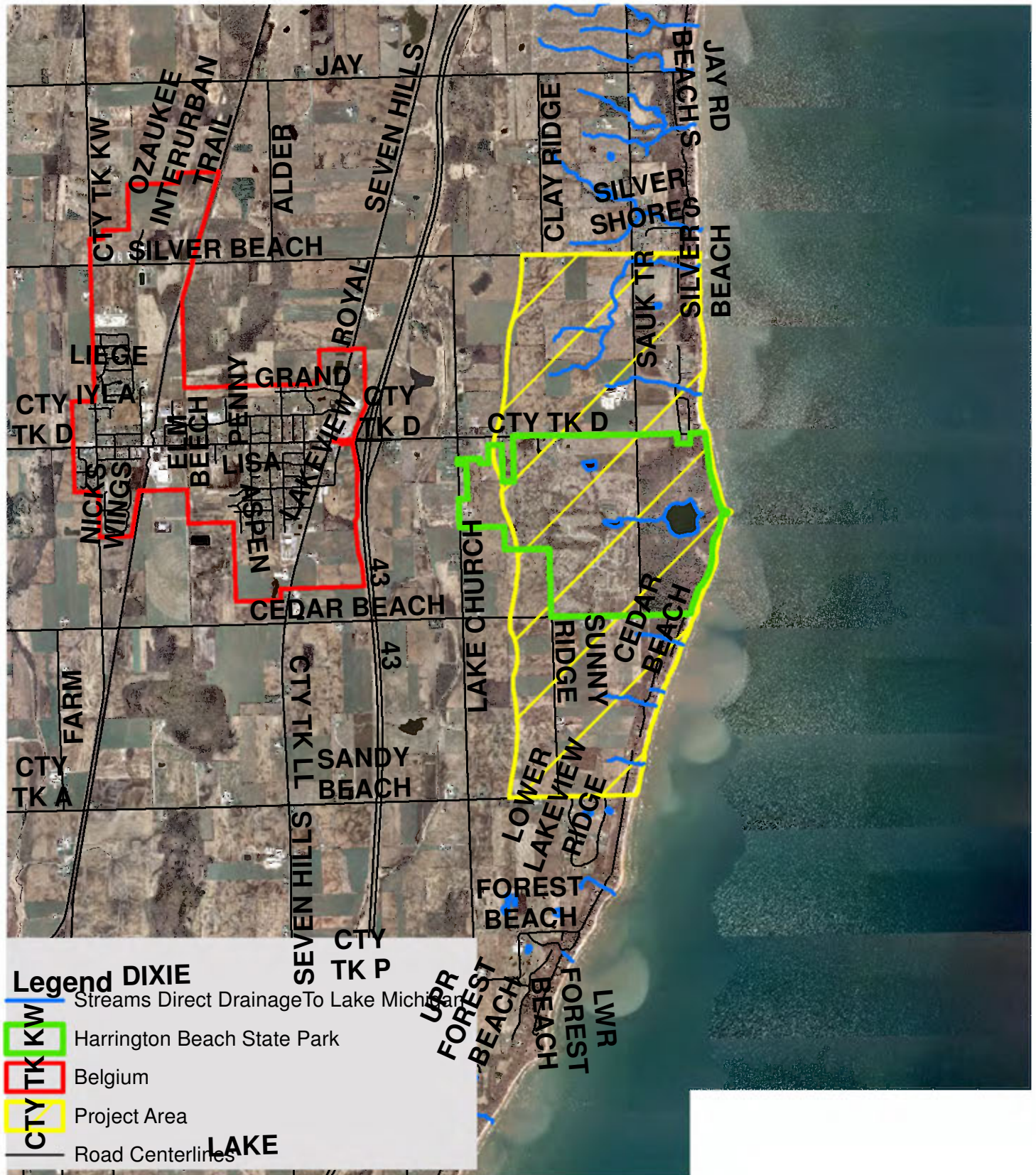
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Appendix B

HARRINGTON BEACH STATE PARK E. COLI SOURCE IDENTIFICATION AND ASSESSMENT PROJECT MAP

Harrington Beach State Park E.coli Source Identification and Assessment Project Map



0 2,000 4,000 8,000 12,000 16,000 Feet

1 inch = 4,000 feet

PRELIMINARY DRAFT

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Appendix C

OZAUKEE COUNTY FISH PASSAGE PROGRAM

- **Fish Migration and Habitat Connectivity:** Many desirable lake resident fish species require access to rivers and streams for lifecycle critical functions (e.g., congregation, spawning, juvenile development). Fish passage impediments in Ozaukee County have impeded and/or precluded upstream migration of some, and in some cases, all, lake resident adfluvial fish. Many Great Lakes species spawn in wetlands, ditches, seasonally flooded areas, and very small streams, habitat types that can commonly be overlooked and underappreciated. Others require sandy or gravelly stream bottoms, large cobbles, or creviced bedrock. Some species require one habitat type for spawning, and a very different type of habitat for young-of-the- year development.

A large variety of accessible habitat is critically important to maintaining or restoring the rich species diversity originally present in the Great Lakes watershed. Moreover, many native Great Lakes fish exhibit great fidelity to their streams, including obscure, seasonal, and under-appreciated habitat areas. Although excellent habitat abounds in the region, it is often biologically dysfunctional, isolated, or physically inaccessible to lake-resident fish on account of migration impediments such as various sized and often functionally obsolete dams, biologically impassable stream crossings, debris, pervious fill, and deteriorated channel morphology. Restoring access (both linear (within stream) and lateral (to adjacent wetlands and floodplains)) to high-quality natural habitat generally costs less and is usually more productive than restoring severely degraded habitat or constructing artificial habitat. Reconnecting isolated portions of watersheds improves biological and genetic diversity of aquatic communities including river resident and adfluvial fish species, and other organism that depend upon these fish for part of their life cycles (e.g. mussels). Combined,

such actions increase the sustainability of imperiled species, a large assemblage of popular game and forage fish, and other aquatic organisms.

- **Fish Passage Impediment and Habitat Inventory:** Habitat needs to be accessible for all critical life stages to be ecologically valuable to a sustainable fishery. For example, a spawning area may be accessible to adults during typical high-water spring flows and provide ideal habitat for juvenile fish to develop, but may become isolated during low water periods preventing young-of-the year to migrate downstream during a critical period. Therefore, ingress and egress to critical habitat are equally important. Various fish species have very different behaviors and physical abilities pass obstacles. Northern pike (*Esox lucius*) is a native potamodromous fish that inhabits nearshore waters of Lake Michigan, the Milwaukee River estuary, and is also a year-round resident of the river itself. These fish commonly enter very small, oftentimes intermittent, streams to access wetlands and seasonally flooded areas where they spawn. Even though this fish can swim very fast, it can do so only for short distances. In fact, northern pike are one of the weakest swimming native fish in passing long stretches of higher velocity water. In addition, it will not leap to pass cascading water features. For these reasons, northern pike are used as a surrogate to evaluate impediments for all species, and northern pike swimming abilities are considered in all fish passage removal or remediation designs. The Ozaukee County Planning and Parks Department routinely conducts aquatic habitat and fish passage impediment inventories, which are completed both remotely (e.g. orthophoto analysis) and “on the ground” in the field. In general, potential northern pike spawning areas are identified by qualitative assessments of: 1. Lateral channel connectivity to riparian areas (e.g. floodplain and wetlands) during regular high flows (i.e., channel entrenchment); 2. Herbaceous hydrophytic vegetation density in the channel, on banks or floodplain, or in a littoral area; and 3. Regular riparian flooding (e.g., evidenced by watermarks on trees, drainage patterns, etc.)

Similar to habitat inventories, field inspections are used to confirm the presence of suspected impediments. Impediment inventories in the field typically include a rapid, “Tier 1” inspection to determine if a suspected impediment (identified remotely) exists. A more detailed “Tier II” assessment, which was developed in conjunction with partners including the US Fish and Wildlife Service, is an ecosystem-based approach to collected detailed impediment data at road and stream crossings to facilitate “no-slope” and “stream simulation” designs for impediment removal or remediation.

To date, Planning and Parks Department staff has inventoried approximately 678 suspected impediments on 42 streams in Ozaukee County in the direct Lake Michigan drainage basin and the Milwaukee River watershed. The inventory information is saved and organized in a Planning and Parks Department GIS database.

- **Fish Passage Impediment Classification and Prioritization:** In general, fish passage impediments are classified as either natural impediments (e.g. natural waterfalls, extremely high gradient stream reaches), small scale impediments (e.g. log and/or debris jams, landowner-constructed stream crossings, reaches of invasive vegetation), or large scale impediments (e.g. low flow dams, improperly placed or sized road and stream crossing culverts or bridges, snowmobile trail crossings, improperly placed stone ford crossings, berms, dikes, levees). The Program typically does not suggest any changes to allow fish migration around natural fish passage impediments. Small scale impediments can be removed or remediated largely with hand labor and hand tools. In general, large scale impediment removals or remediation are addressed with heavy equipment due to the scope and scale of the projects. In general, impediment removal or remediation projects are prioritized based on a number of factors including a Planning and Parks Department- developed Stream Reach Prioritization Methodology, landowner cooperation, site conditions and accessibility, cost, available funding, etc. Connectivity between the AOC and Lake Michigan and identified potential northern pike spawning habitats, as well as potential restorable wetland habitat qualities, is also considered. Impediment removal prioritization also considers the lateral hydrologic connectivity (i.e., the level of channel entrenchment and duration and magnitude of surface hydrology connection between floodplains and channels) of habitat areas to their respective stream channels, the existing quality or restorative potential of riparian wetlands and other suitable northern pike spawning habitats, and the documented occurrences of fish and wildlife species indicative of desirable habitat qualities. In general, full removal of an impediment and restoration of the stream and riparian areas is preferred.
- **Large Scale Impediment / Road Stream Crossing Design:** In general, large scale impediment removals or remediations require detailed design, engineering, hydraulic and hydraulic modeling, and permitting due to the scope and scale of the projects. For most road/stream crossings, the designs generally followed U.S. Forest Service stream crossing protocols and, to the degree practicable, are guided by bankfull channel cross section measurements taken in stable, representative reaches (preferably upstream of the crossing) considered consistent with the anticipated, natural channel morphology of Ozaukee County. In addition, designs include detailed

hydraulic and hydrologic modeling to ensure that the crossing is passable, to the extent possible, to native fish under a variety of flow conditions.

- **Dam Removals:** Several completed dam removal projects on the Milwaukee River in Milwaukee County (e.g., North Avenue Dam, Estabrook Dam) and an ongoing fish passage project at the Kletch Park Dam are restoring aquatic connectivity from Lake Michigan into Ozaukee County. The Lime Kiln Dam was located on the Milwaukee River in the Village of Grafton approximately 30 RM upstream of the river's confluence with Lake Michigan. The Lime Kiln Dam was removed in 2010 by the Ozaukee County Planning and Parks and Highway Departments. Dam removal allowed for full access to 10 Milwaukee River mainstem miles between the Mequon Thiensville Dam and the Bridge Street Dam in the Village of Grafton. The Newburg Dam was located on the Milwaukee River in the Village of Newburg approximately 57 RM upstream of the river's confluence with Lake Michigan. The Newburg Dam was removed in 2012 by the Ozaukee County Planning and Parks and Highway Departments and private contractors. The project reconnected approximately 13 miles of mainstem river up to the Barton Dam in West Bend, allowing for full access to 37 mainstem river miles between the Bridge Street Dam in the Village of Grafton. In addition, the Ozaukee County Planning and Parks and Highway Departments removed a large dam on Mineral Springs Creek in the City of Port Washington in 2016, restoring access to approximately 1 river mile of instream habitat on Mineral Springs creek and restoring connection to Sauk Creek and Lake Michigan.
- **Fishway Construction:** The Mequon-Thiensville Dam (MT Dam) is located on the Milwaukee River in the Village of Thiensville and City of Mequon approximately 20 RM upstream of the river's confluence with Lake Michigan. A nature-like, meandering fishway was constructed in 2010 by the Ozaukee County Planning and Parks Department and private contractors, to allow fish and aquatic life to bypass the 6 ft high dam, reconnecting approximately 32 mainstem river miles between Lake Michigan and the Bridge Street Dam in the Village of Grafton. Modifications to the fishway are planned to address erosion concerns and improve the long-term function and stability of the fishway, while improving conditions for large-bodied fish (e.g., Lake Sturgeon). The Planning and Parks Department has also constructed a nature-like fishway around an earthen dam on the Blue-wing WPA owned by the US Fish and Wildlife Service in the Town of Grafton on Kaul Creek, a tributary to Ulao Creek.
- **Linear Connectivity Outcomes:** The Planning and Parks Department and its partners have reconnected over 150 stream miles and thousands of acres of wetland and floodplain habitat to fish

and aquatic life passage throughout the Lake Michigan Basin and Milwaukee River Watershed, including 87 stream miles directly tributary to the Milwaukee Estuary AOC. As noted above, major projects have included the construction of a nature-like fishway at the Mequon-Thiensville Dam, the removal of two large dams on the Milwaukee River, the removal of a large dam on Mineral Springs Creek (direct tributary to Lake Michigan), the removal or remediation of over 300 impediments to fish and aquatic life passage including 71 large- scale aquatic life passage impediment removal or remediation projects.

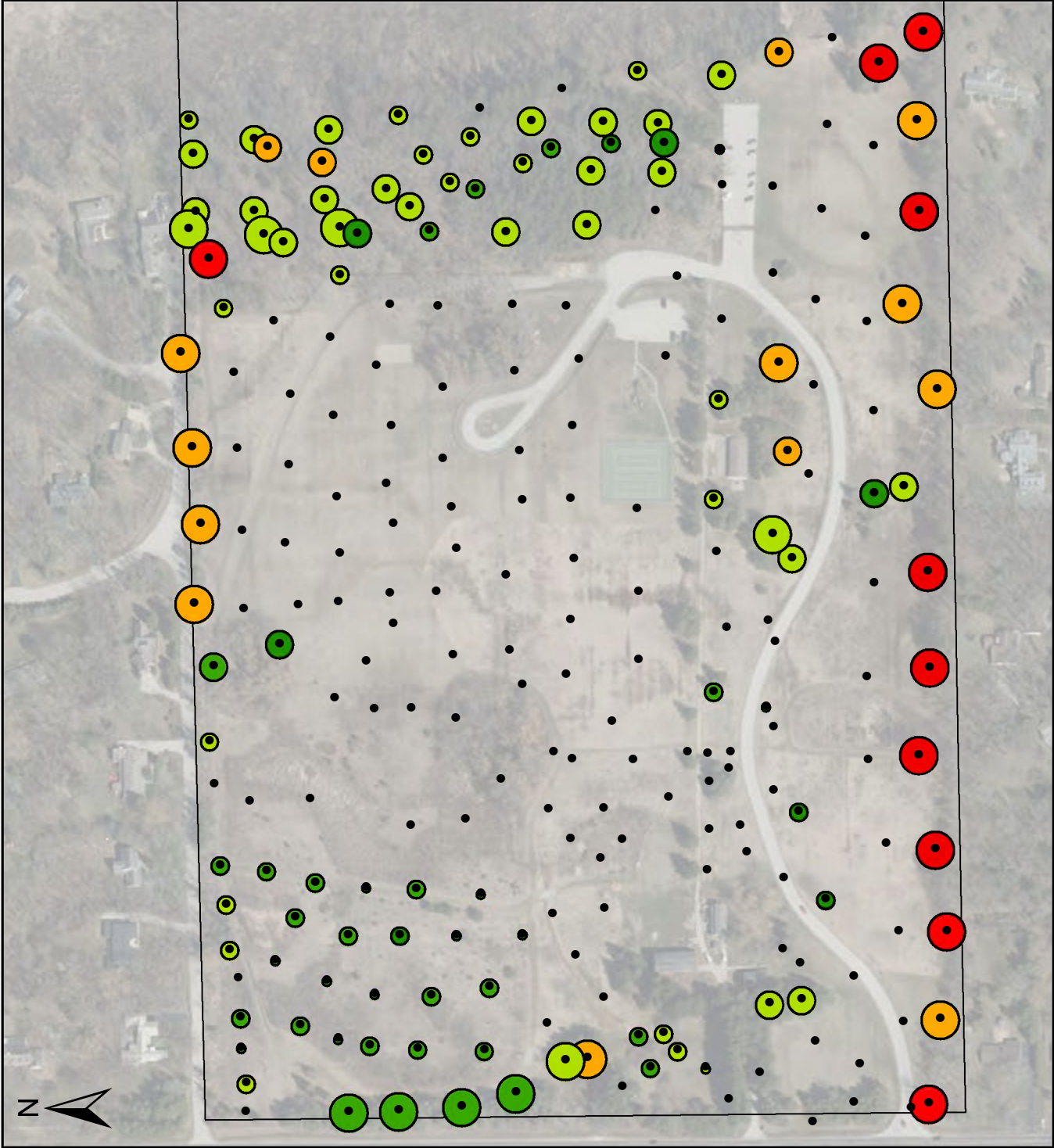
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Appendix D

SAMPLE INVASIVE SPECIES INVENTORIES

Virmond County Park - Common Buckthorn Inventory Density & Canopy Coverage



Invasive species inventories were completed through assigned point locations following transects for maximum coverage over varying habitat and topography. One point was assessed per quarter acre for all invasive species as well as ash trees (representing the presence of emerald ash borer). The map shows the results of the inventoried data for common buckthorn in Virmond County Park. The point color describes the canopy cover and the point size describes the density of common buckthorn observed in the field. Common buckthorn was found throughout the park, and in especially high density and canopy cover in the woodland boundaries of the property. High densities and low canopy cover were observed in areas of the park where previous management had been done and seedlings from existing seed bank were emerging.

Common Buckthorn Present

Density (size)

1 (1-5 Plants)

2 (6-50 Plants)

3 (51-1000 Plants)

4 (>1000 Plants)

Canopy Cover (color)

1 (1-25%)

2 (26-50%)

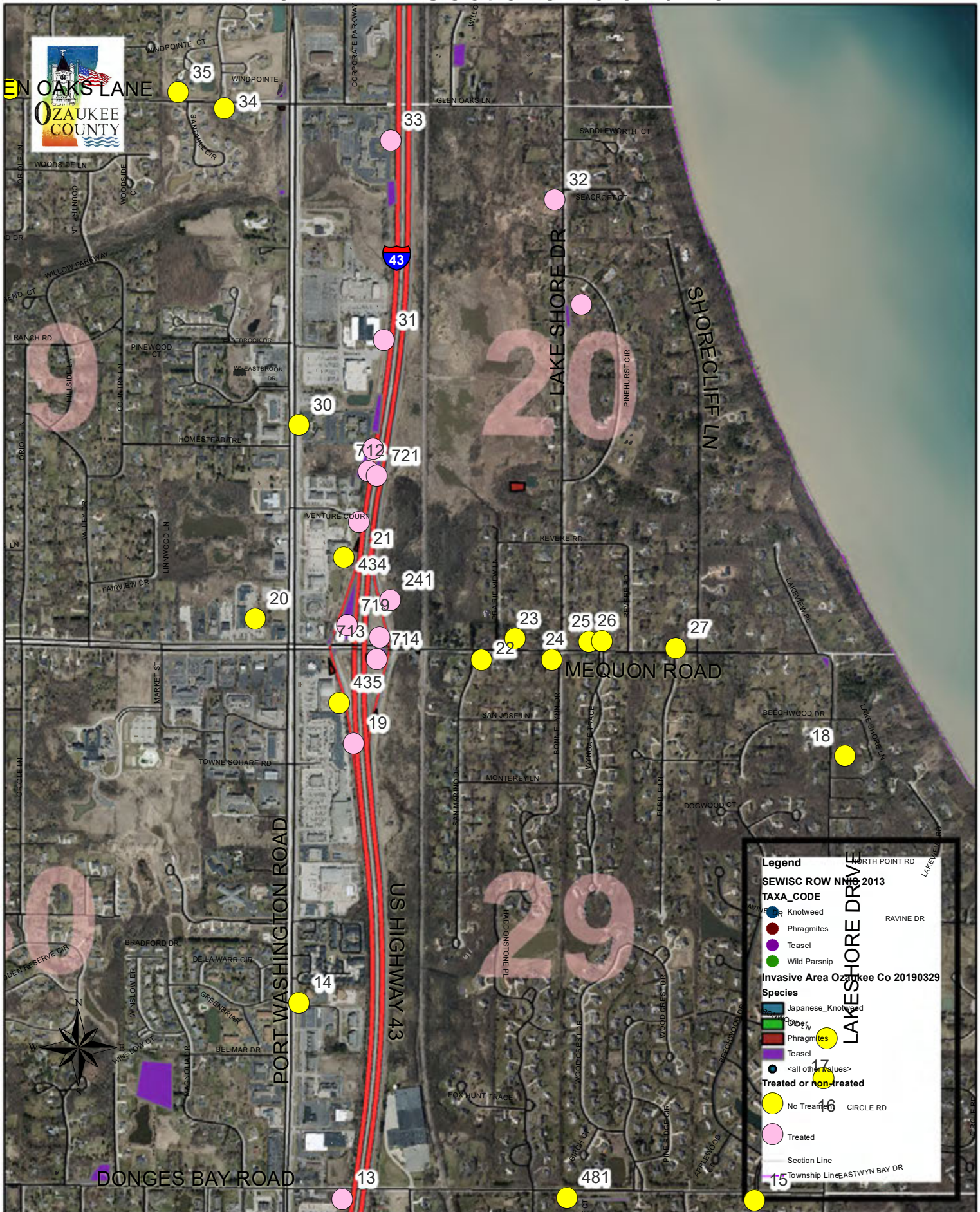
3 (51-75%)

4 (76-100%)

- Common Buckthorn Not Present

Virmond County Park

Invasive Species I-43 Town of Mequon T9NR22E Sections 20 and 29



5/13/2020

PRELIMINARY DRAFT Prepared By: Ozaukee County Land Information Office

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A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR OZAUKEE COUNTY: 2021-2030

Appendix E

WATER QUALITY MONITORING RESULTS, 2016 - 2019

Attachment A: Water Quality Monitoring Results, 2016-2019

Through WDNR River Protection Planning grants awarded in 2016, 2017, 2018, and 2019, in conjunction with a NOAA GLRI grant, National Fish and Wildlife SOGL grant, and two Fund for Lake Michigan grants, the Ozaukee County Planning and Parks Department has established a robust water quality sampling and monitoring program on the Little Menomonee River (LMR), Mole Creek, and Ulao/Kaul Creek. A series of discrete water quality sampling events and continuous water quality monitoring using stationed units has provided data necessary to establish a baseline and provides insight into water quality trends associated with stream and habitat restoration pre- and post-construction, potentially validating the numerous benefits of the Department's restoration projects. The additional water quality information is also useful in watershed planning and implementation of efforts aimed at reducing pollutants (e.g., TMDLs, priority BMP locations) entering these streams and subsequently the Milwaukee River and Lake Michigan.

Measured values from discrete water quality sampling events on the Little Menomonee River occurring from June 2017 until September 2019 and Mole Creek and Ulao/Kaul Creek from September 2016 to October 2019 were summarized for each sampling station and parameter. Twenty-two abiotic parameters were assessed during each sampling event at every station, 5 of which were analyzed by the Wisconsin State Lab of Hygiene (SLOH): *E. coli*, chloride, orthophosphate, total phosphorus, and total suspended solids.

The LMR is approximately 10 miles long and described as a cool-warm headwater natural community in "poor" condition. The LMR originates in southwestern Ozaukee County and flows in a mostly southerly direction to its confluence with the Menomonee River in the City of Milwaukee. The land use surrounding the LMR is primarily agricultural (60%), openlands - including forest and wetland (20%), and suburban/urban residential (20%). This subwatershed is approximately 21.8 square miles and comprises 16% of the Menomonee River Watershed (136 square miles) that spans across Milwaukee, Ozaukee, and Washington Counties (WDNR 2001). Currently, all Ozaukee County water quality monitoring efforts on the LMR are concentrated in Ozaukee County and referred to as the "Upper Little Menomonee." The LMR has several impairments, identified by the WDNR, MMSD, and the Department, with the support of several funding partners such as USEPA, WDNR and FFLM, including chronic/acute aquatic toxicity (e.g. chlorides), degraded biological community, and recreational restrictions (due to pathogens). Past monitoring has detected high levels of creosote, fecal coliform, and total phosphorus. As a tributary to the Menomonee River (and within the Milwaukee River Basin), the LMR watershed is part of the Milwaukee Estuary AOC and is a high priority for restoration projects (WDNR 2017, WDNR 2020).

On the LMR, a total of 13 sampling events occurred at 11 water quality sampling stations: 3 in 2017, 5 in 2018, and 5 in 2019. Throughout the sampling period, total phosphorus concentrations exceeded the Wisconsin water quality standard, established under NR102 (2019), for desirable phosphorus concentration in a stream environment of less than 0.075 mg/L. The average daily maximum and mean conductivity values were significantly above the maximum recommended by USEPA (500 μ S/cm), and average turbidity measurements were above the ideal readings (10 FNU maximum) for the Milwaukee River Drainage Basin as established by the Milwaukee Riverkeeper.

Most notably, mean total phosphorus concentrations in the LMR system ranged from 0.059 to 0.263 mg/L with an average of 0.137 mg/L in 2017; from 0.032 to 0.988 mg/L with an average of 0.123 mg/L in 2018; and, 0.034 to 0.410 mg/L with an average of 0.104 mg/L in 2019. The recommended limit of total suspended solids (TSS) in the Milwaukee River Basin is 12 mg/L; maximum values of TSS concentration exceeded this criterion in all 3 study years with the annual average exceeding 12 mg/L in both 2017 and 2019. Annual turbidity readings followed a similar pattern, with all maximum values exceeding the recommended 10 FNU all 3 study years as well as the annual average values.

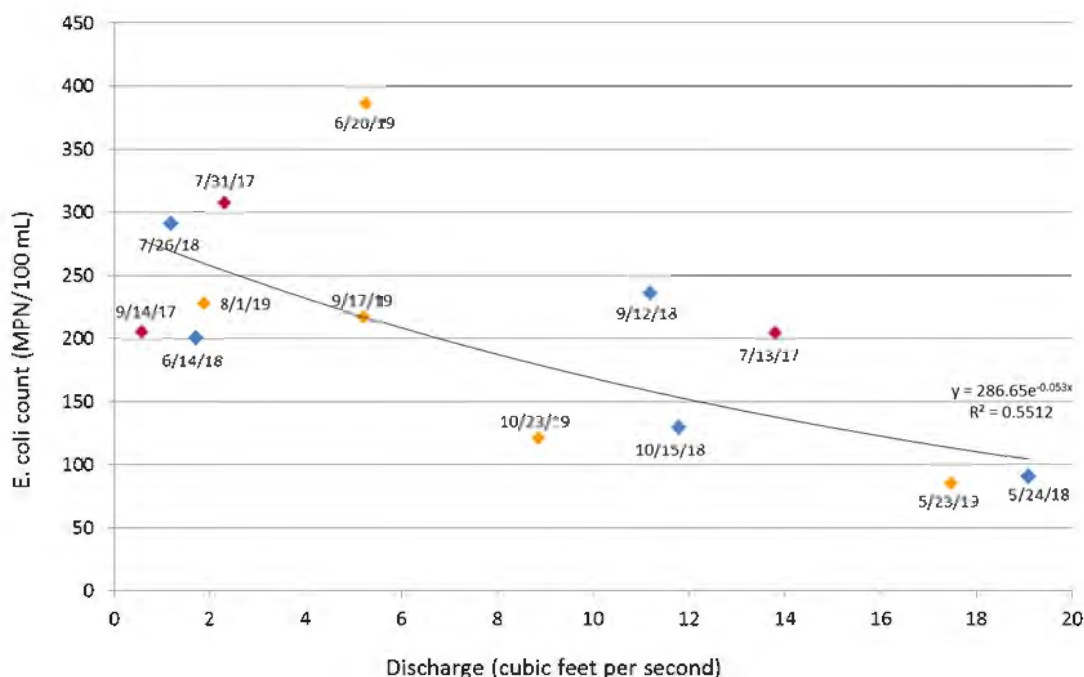
Results from discrete water quality sampling at 11 stations established on the Little Menomonee River, Ozaukee County.

Parameter	Year	Median	Average	Minimum	Maximum
Chloride (mg/L)	2017	53.2	54.3	39.3	77.2
	2018	53.9	55.1	38.0	70.8
	2019	55.4	54.7	34.5	83.3
Orthophosphate (mg/L)	2017	0.045	0.050	0.027	0.104
	2018	0.043	0.045	0.009	0.111
	2019	0.035	0.044	0.009	0.161
Total Phosphorus (mg/L)	2017	0.133	0.137	0.059	0.263
	2018	0.084	0.123	0.032	0.988
	2019	0.090	0.104	0.034	0.410
TSS (mg/L)	2017	13.5	20.3	6.0	112.0
	2018	4.6	7.8	0.0	61.5
	2019	7.5	16.4	2.6	179.0
<i>E. coli</i> (MPN/100mL)	2017	365.0	443.8	140.0	1553.0
	2018	221.0	196.6	36.0	816.0
	2019	204.0	196.5	49.0	970.0
Dissolved Oxygen (mg/L)	2017	6.7	7.1	3.6	17.2
	2018	6.7	7.1	3.6	13.1
	2019	8.4	8.6	4.1	14.4
Conductivity (µS/cm)	2017	851.0	864.3	462.0	1134.0
	2018	873.0	872.4	540.0	1021.0
	2019	836.0	840.3	592.0	1117.0
Turbidity (FNU)	2017	21.8	24.1	5.4	71.5
	2018	7.1	11.0	1.5	60.3
	2019	15.3	21.7	1.2	75.1
TDS (ppm)	2017	423.5	429.2	229.0	545.0
	2018	437.0	433.2	162.0	511.0
	2019	419.0	421.4	296.0	559.0

*Geomean is used for *E. coli* calculation

Wisconsin State Recreational Use Standards state that fecal coliform levels are “not to exceed 400 CFU/100 mL” (colony forming units/100 milliliter sample; WDNR 1973, WDNR & MMSD 2018). Utilizing the permanent USGS discharge gage station located near the sampling station number 10048232 (Mequon 3) allowed for comparison of mean *E. coli* concentrations on a given sampling date and discharge. In the LMR system, *E. coli* counts decrease with increasing stream discharge. Counts are highest during periods of low discharge, with the highest values occurring at the end of June and end of July all three years. Water temperatures are generally highest July through September in Ozaukee County streams.

Comparison of *E. coli* results and discharge per data from the USGS gauge site stationed at Lemke Park near the Mequon 3 water quality sampling station.



Mole Creek is an 8.9 mile stream described as a cool-cold headwater stream in the Milwaukee South Watershed. Although not officially categorized as a cold water stream, it contains a diverse population of cold and cool water fishes and is considered in “good” condition based upon the instream fish habitat (e.g., spawning regions for salmonids) and fisheries (WDNR 2001). The Mole Creek headwaters are located in the Town of Saukville and the creek enters the Milwaukee River in the Town of Grafton, north of the Village of Grafton. The 5,682 acre watershed is composed of nearly 50% agricultural land, 30% open lands, including forest and wetland, 15% residential land, and 6% transportation or industrial land.

A total of 18 sampling events occurred at each of the 6 stations on Mole Creek: 4 in 2016, 6 in 2017, 4 in 2018, and 4 in 2019. In all 4 study years, the average daily maximum and mean conductivity values were significantly above the maximum recommended by USEPA (500 μ S/cm). Mean turbidity measurements generally exceeded the maximum recommended value (10 FNU) for the study region at the upstream sampling locations.

Concentration of total phosphorus ranged from 0.01 to 0.052 mg/L with an average of 0.027 mg/L in 2016; from .004 to 0.045 mg/L with an average of 0.022 mg/L in 2017; from .008 to 0.061 mg/L with an average of 0.030 mg/L in 2018; and, from .012 to 0.088 mg/L with an average of 0.037 mg/L in 2019. Maximum values of TSS exceeded the recommended TMDL of 12 mg/L in 2017, 2018, and 2019; however, the median and average TSS concentrations fell below this criterion. Maximum turbidity readings exceeded the recommended 10 FNU during all 4 study years, with annual average readings above 10 FNU in 2016, 2017, and 2019, but median values only exceeding 10 FNU in 2017 and 2019.

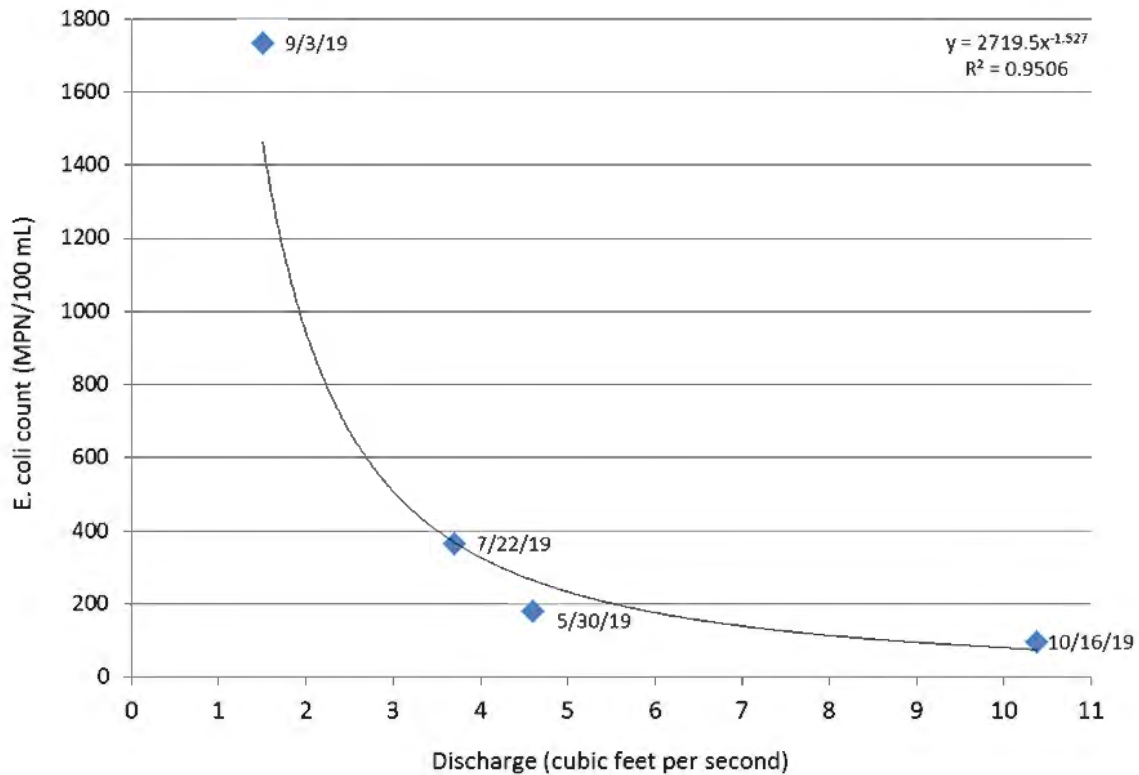
Results from discrete water quality sampling at 6 stations established on Mole Creek, Ozaukee County.

Parameter	Year	Median	Average	Minimum	Maximum
Chloride (mg/L)	2016	51.2	51.1	43.1	62.2
	2017	51.0	48.5	35.2	60.8
	2018	44.1	45.3	39.0	64.1
	2019	41.2	44.0	35.9	65.8
Orthophosphate (mg/L)	2016	0.027	0.027	0.010	0.052
	2017	0.021	0.022	0.004	0.045
	2018	0.026	0.030	0.008	0.061
	2019	0.035	0.037	0.012	0.088
Total Phosphorus (mg/L)	2016	0.027	0.027	0.010	0.052
	2017	0.021	0.022	0.004	0.045
	2018	0.026	0.030	0.008	0.061
	2019	0.035	0.037	0.012	0.088
TSS (mg/L)	2016	4.4	4.4	0.0	10.3
	2017	6.9	9.5	0.0	32.5
	2018	3.3	4.4	0.0	21.5
	2019	7.0	8.6	2.5	20.0
<i>E. coli</i> (MPN/100mL)	2016	461.0	316.1	50.0	1986.0
	2017	365.0	661.5	105.0	34480.0
	2018	301.0	209.0	24.0	1553.0
	2019	233.5	266.8	58.0	2420.0
Dissolved Oxygen (mg/L)	2016	9.5	10.1	9.2	14.3
	2017	8.0	8.0	0.6	11.6
	2018	8.6	8.8	5.9	15.3
	2019	9.8	9.9	5.7	13.5
Conductivity (µS/cm)	2016	859.0	859.5	774.0	945.0
	2017	844.0	831.0	490.0	958.0
	2018	836.5	838.0	753.0	883.0
	2019	778.0	782.7	653.0	865.0
Turbidity (FNU)	2016	5.1	10.8	3.1	39.2
	2017	12.3	14.6	3.8	72.1
	2018	6.4	7.0	1.6	28.1
	2019	12.6	14.0	1.8	33.3
TDS (mg/L)	2016	588.0	546.3	407.0	657.0
	2017	420.5	413.8	242.0	479.0
	2018	419.0	419.2	376.0	443.0
	2019	404.5	437.3	359.0	591.0

*Geomean is used for *E. coli* calculation

E. coli geometric means of Mole Creek were below 400 CFU/100 mL in 2016, 2018, and 2019. However, *E. coli* counts were consistently high, with geometric means above 400 CFU/100 mL in 2017 across all sampling stations; these high values are due to the very high counts occurring at all sites in the September 2017 water samples. Further investigation of a mid-stream water quality station using 2019 data demonstrates *E. coli* counts decreased exponentially with increasing discharge.

Comparison of *E. coli* results and discharge in 2019 at the Mole Creek Hillcrest water quality sampling station.



Ulao Creek, in the Milwaukee River South Watershed, is an 8.6 mile creek described as a cool-warm headwater natural community in "poor" condition. It is designated as an Area of Special Natural Resource Interest. The Ulao Creek headwaters are in the Town of Grafton at the 342 acre Ulao Swamp and the creek enters the Milwaukee River in the City of Mequon. Land use in Ulao Creek's 8,246 acre watershed is primarily agricultural land (44%) and openlands (26%), with 13% residential and 17% industrial and transportation. Ulao Creek is identified as impaired due to chronic aquatic toxicity, degraded biological communities, and acute aquatic toxicity. Pollutants identified as contributing to the impairments include total phosphorus and chloride. Although impaired, Ulao Creek connects to important wetland habitat, namely the 342 acre Ulao Swamp Natural Area (Ozaukee County Park and Open Space Plan, June 2011) containing 28% of the known northern pike spawning habitat in the Milwaukee River watershed.

A total of 18 sampling events occurred at each of the nine stations in the Ulao Creek Watershed: 4 in 2016, 6 in 2017, 4 in 2018, and 4 in 2019. Of the nine sampling stations, two were located on Kaul Creek, a small tributary to Ulao Creek. The annual mean concentration of total phosphorous measured from the collected water samples exceeded the 0.075 mg/L criteria at every station during each sampling year with one exception in 2018. Like the LMR and Mole Creek results, mean conductivity and turbidity values exceeded recommendations during the sampling period (500 μ S/cm and 10 FNU, respectively). Additionally, mean TSS concentrations were above the regional TMDL value of 12 mg/L the Ulao Creek headwaters, both Kaul Creek sampling locations, and Ulao Creek below Kaul Creek two or more study years.

Total phosphorus concentrations trended higher in the Ulao/Kaul Creek system than in LMR or Mole Creek. While the minimum values of each study year fell below the Wisconsin State established 0.075

mg/L maximum concentration, all maximum, mean, and median values exceeded this target number: concentrations ranged from 0.068 to 0.538 mg/L with an average of 0.168 mg/L in 2016; from 0.047 to 0.487 mg/L with an average of 0.151 mg/L in 2017; 0.052 to 1.32 mg/L with an average of 0.255 mg/L in 2018; and, from 0.60 to .970 mg/L with an average of 0.232 mg/L in 2019. Maximum concentrations of TSS exceeded 12 mg/L all four study years; however, the annual average values only exceeded the criterion in 2018 and 2019 while the median values were below 12 mg/L. Turbidity values in the Ulao/Kaul Creek system ranged from 0.9 to 37.4 FNU with an average of 9.8 FNU and median of 4.9 FNU in 2016; from 0.7 to 121.0 FNU with an average of 18.1 FNU and median of 9.8 FNU in 2017; from 0 to 69.0 FNU with an average of 14.1 FNU and 9.3 FNU in 2018; and, from 3.1 to 250.0 FNU with an average of 25.6 FNU and median of 16.0 FNU in 2019.

Results from discrete water quality sampling at 9 stations established on Ulao and Kaul Creek, Ozaukee County.

Parameter	Year	Median	Average	Minimum	Maximum
Chloride (mg/L)	2016	90.3	110.0	43.2	309.0
	2017	73.1	99.2	16.3	206.0
	2018	73.5	100.4	26.4	282.0
	2019	62.5	109.7	11.2	566.0
Orthophosphate (mg/L)	2016	0.070	0.085	0.029	0.216
	2017	0.055	0.061	0.026	0.171
	2018	0.053	0.072	0.002	0.238
	2019	0.055	0.081	0.027	0.321
Total Phosphorus (mg/L)	2016	0.122	0.168	0.068	0.538
	2017	0.119	0.151	0.047	0.487
	2018	0.140	0.255	0.052	1.320
	2019	0.102	0.232	0.060	0.970
TSS (mg/L)	2016	3.3	6.6	0.0	64.0
	2017	6.5	8.1	0.0	31.0
	2018	4.5	14.1	0.0	146.0
	2019	8.0	16.3	2.2	110.0
<i>E. coli</i> (MPN/100mL)	2016	355.0	274.4	30.0	1986.0
	2017	260.0	309.3	13.0	9880.0
	2018	345.0	207.2	2.0	1046.0
	2019	210.0	285.2	40.0	2420.0
Dissolved Oxygen (mg/L)	2016	6.4	6.9	4.0	11.0
	2017	7.2	6.9	0.8	31.2
	2018	7.6	6.7	1.3	10.5
	2019	7.4	7.8	2.6	12.5
Conductivity (µS/cm)	2016	764.0	787.9	594.0	1153.0
	2017	723.0	783.1	442.0	1093.0
	2018	795.0	872.9	516.0	1441.0
	2019	697.5	860.0	450.0	2030.0
Turbidity (FNU)	2016	4.9	9.8	0.9	37.4
	2017	9.8	18.1	0.7	121.0
	2018	9.3	14.1	0.0	69.0
	2019	16.0	25.6	3.1	250.0
TDS (mg/L)	2016	575.0	620.0	423.0	984.0
	2017	361.5	387.8	221.0	546.0
	2018	422.0	440.4	252.0	711.0
	2019	342.5	432.4	225.0	1077.0

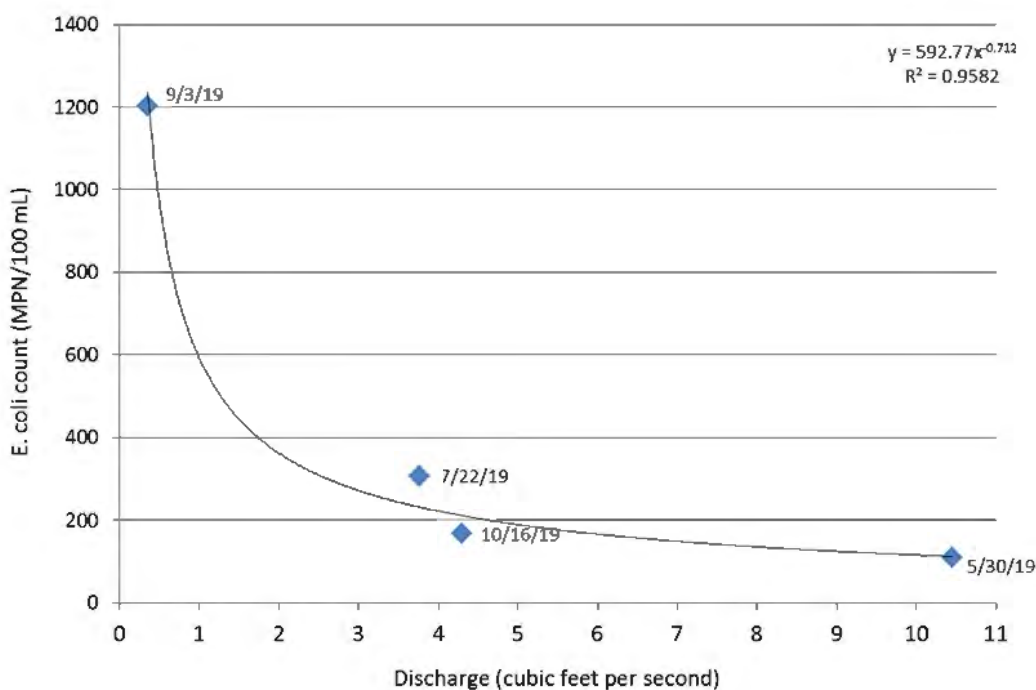
*Geomean is used for *E. coli* calculation

Examining annual geometric means from each water quality sampling station on Ulao and Kaul Creek show *E. coli* counts only exceeded 400 CFU/100 mL at Bonniwell location in 2016. Three of the 9

sampling stations had annual geometric mean values greater than 400 CFU/100 mL in 2017. None of the sampling stations exceeded the target maximum in 2018, and only 2 stations had values above the target maximum in 2019

Investigating *E. coli* values per sampling location per month during each sampling year reveals the highest values generally occur during the warm summer months from July to August. Values were highest at all 9 locations in September 2017. Average water temperature per station was similar for measurements taken in August 2017, August 2018, and July and September 2019. Stations located on Kaul Creek above Ulao Creek and Ulao Creek at Bonniwell exceeded 400 CFU/100 mL most frequently (7 of the 15 months over the 4 sampling years). Using flow data collected simultaneously with water samples at one of the downstream Ulao Creek stations (Gateway) demonstrates a relationship similar to that seen at LMR Mequon 3 and the Mole Creek Hillcrest sampling station: *E. coli* CFUs decreased with increasing discharge.

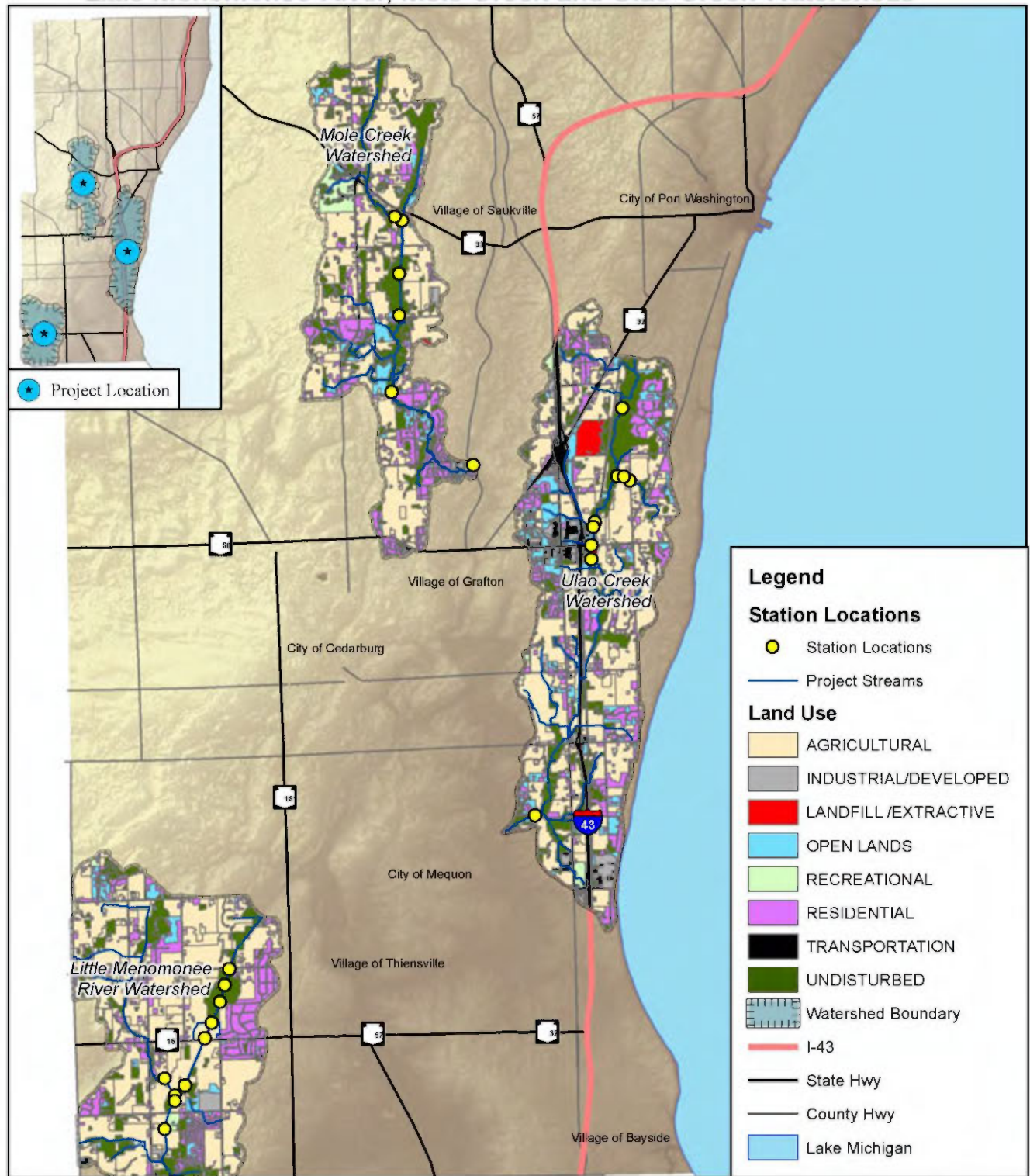
Comparison of *E. coli* results and discharge in 2019 at the Ulao Creek Gateway water quality sampling station.



Specific conductivity in the LMR system, as well as in the Mole Creek and Kaul/Creek systems, consistently measured above the USPEA's maximum recommendation of 500 $\mu\text{S}/\text{cm}$. One measurement (0.68%) of LMR discrete conductivity measurements was below 500 $\mu\text{S}/\text{cm}$. In the Mole Creek data set spanning from 2016-2019, only one discrete measurement was below 500 $\mu\text{S}/\text{cm}$ (1.1% of the sample set). The Ulao/Kaul Creek data set, also ranging from 2016-2019 contained 6 measurements (4.4%) below the recommended maximum value.

The LMR, Mole Creek, and Ulao Creek Watersheds drain predominantly agricultural landscapes. The elevated mean concentrations of total phosphorus, conductivity, and turbidity of the three study streams may indicate high levels of nutrients or other pollutants correlated with land use, soil composition, stream gradient, and quality and quantity of buffer and floodplain vegetation. Additional data collection and further analysis will greatly assist in understanding water quality trends, sources of water quality problems, and management practices that improve water quality (e.g., pre- and post-restoration water quality monitoring).

Water Quality Monitoring Stations and Land Use in the Little Menomonee River, Mole Creek and Ulao Creek Watersheds



0 1.25 2.5 5 Miles



Map Produced By: Ozaukee County
Planning and Parks Department
5/24/2018

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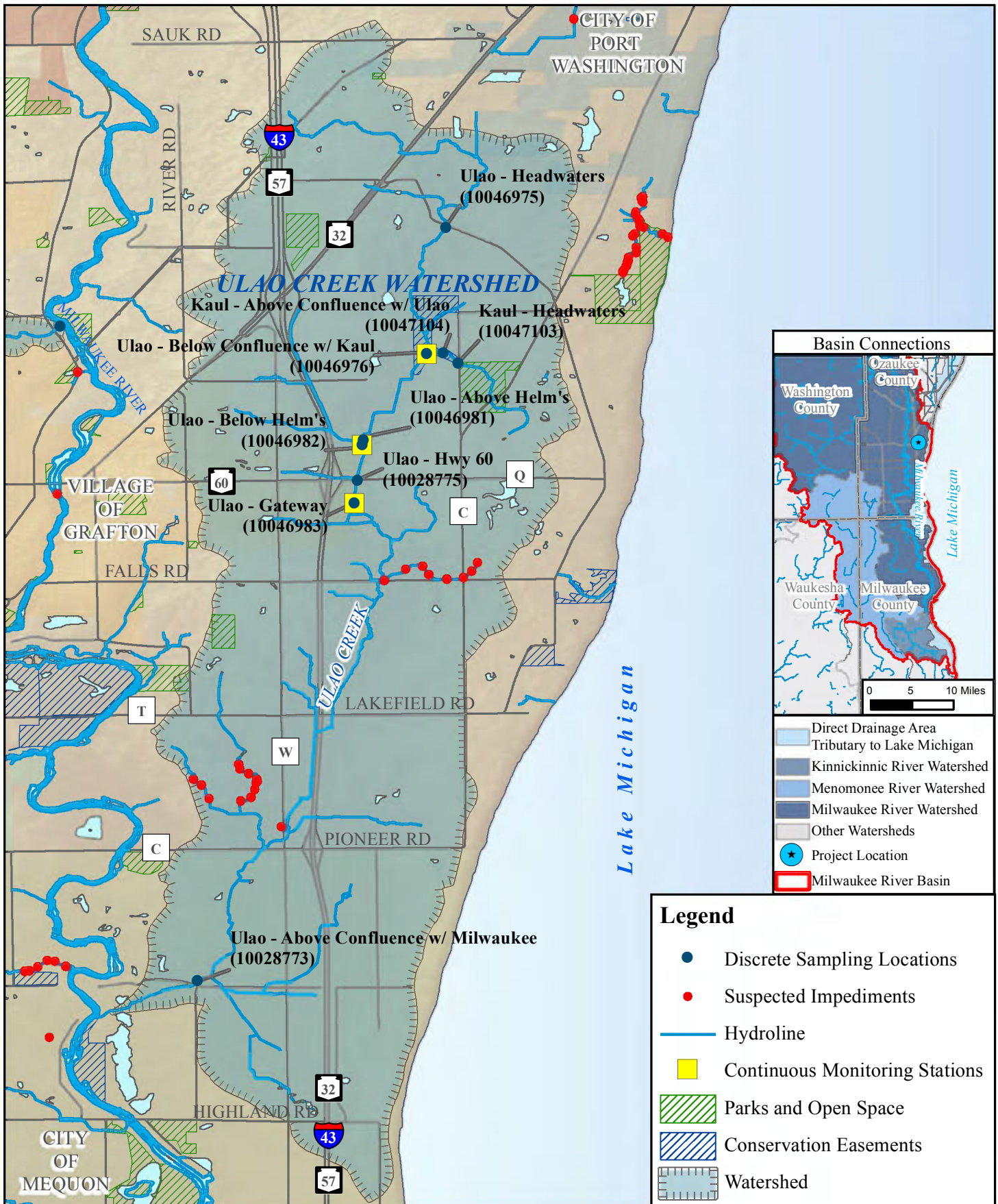
Little Menomonee River and Creek Water Quality Sampling Locations



Mole Creek Water Quality Sampling Locations



Ula Creek Water Quality Sampling Locations



Worldox #255621
Oz Co LWRM Plan
500-1137
County staff/JED
11/6/20

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A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR OZAUKEE COUNTY: 2021-2030

Appendix F

PRIORTIY RANKING AND FACTORS TO GUIDE CONSERVATION ACTIVITIES

Chapter 4 discusses prioritization factors to help guide conservation activities. The factors listed in Chapter 4 and also discussed elsewhere in the Ozaukee County Land and Water Resource Management Plan are set forth in the table below. These factors can be used to create an initial inventory and set priority areas of focus. These areas of focus would indicate where water quality improvements are most needed and where successful implementation of practices can be achieved.

Prioritization Factors	Data Location
1. Phosphorus and TSS Baseline Loading from the Milwaukee River TMDLs	Table 3.4 and 3.5
2. Impaired Waters	Map 3.3 and Table 3.3
3. Nine-Key Element Plan Priority Areas	Map 3.5
4. Groundwater Protection – Depth to Bedrock	Map 2.8
5. Shoreland Zone	Map 2.13
6. Water Quality Initiatives (RCPP & Harrington Beach)	Map ()
7. Active Partnerships (Clean Farm Families, Ulao Creek, Sucker Creek, Friends of Cedarburg Bog)	Table 4.1

Worldox #255689
Oz Co LWRM Plan
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11/11/20; 10/2/20; 9/16/20

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Appendix G

LAND AND WATER CONSERVATION BMP ACHIEVEMENTS (2010 – 2019) SWRM AND TRM FUNDS

This table lists cost share funds that were utilized by Ozaukee County during 2010 - 2019.

Best Management Practices	Number of BMPs Installed through LWCD program and Technical Assistance	Cost Share Funds Supplied (State & Local Funds) Does not include Federal or Landowner contribution
Critical Area Seeding	26	\$34,124
Roof Runoff	3	\$3,405
Well Decommissioning	5	\$2,408
Wetland Restoration	4	\$8,909
Manure Storage	7	\$143,193
Manure Transfer	7	\$115,376
Fencing	3	\$10,257
Underground Outlet	3	\$7,000
Heavy Use Area Protection	5	\$20,485
Subsurface Drain	5	\$13,721
Water and Sediment Control Basin	1	\$7,284
Nutrient Management	97	\$175,619
Waterway System	22	\$93,153
Access Road	6	\$35,525
Stream Crossing	1	\$4,059
Pesticide Management	1	\$7,068
Rock Check Dam	1	\$2,520
Manure Closure	1	\$19,680
Roof Over Barnyard (TRM)	1	\$178,515
Total	173	\$882,301

Source: Ozaukee County Land and Water Management Department and SEWRPC

Worldox #255047
Oz Co LWRM Plan
500-1137
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10/2/20; 9/16/20

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Appendix H

CONSERVATION PRACTICES

This table lists the current technical standards and potential sources of cost-share funding for the conservation practices likely to be utilized in Ozaukee County to meet the agricultural nonpoint pollution performance standards.

Conservation Practice	Practice Code ^a	Potential Funding Source ^b	Standard
Access Road	560	SWRM, EQIP, WHIP	ATCP 50.65
Animal Trails and Walkways	575	SWRM, EQIP	ATCP 50.66
Barnyard Runoff Control Systems	Various	SWRM, EQIP	ATCP 50.64
Contour Farming	330	EQIP	ATCP 50.67
Critical Area Stabilization	342	SWRM, EQIP	ATCP 50.69
Diversion	362	SWRM, EQIP	ATCP 50.70
Field Windbreak	612	EQIP, WHIP	ATCP 50.71
Filter Strips	393	SWRM, EQIP, WHIP, CRP	ATCP 50.72
Grade Stabilization Structure	468	SWRM, EQIP	ATCP 50.73
Heavy Use Area Protection	561	SWRM, EQIP	ATCP 50.74
Livestock Fencing	382	SWRM, EQIP, WHIP	ATCP 50.75
Livestock Watering Facilities	614	SWRM, EQIP	ATCP 50.76
Manure Storage System	313	SWRM, EQIP, TRM	ATCP 50.62
Manure Storage System Closure	360	SWRM	ATCP 50.63
Milking Center Waste Control Systems	Various	SWRM, EQIP	ATCP 50.77
Nutrient Management	590	EQIP	ATCP 50.78
Pesticide Management	595	EQIP	ATCP 50.79
Prescribed Grazing	Various	EQIP	ATCP 50.80
Riparian Buffer	391	SWRM, EQIP, CRP	ATCP 50.83
Roof Runoff System	558	SWRM, EQIP	ATCP 50.85
Roofs	Various	SWRM	ATCP 50.84
Sediment Basin	350	SWRM, EQIP	ATCP 50.86
Sinkhole Treatment	725	SWRM	ATCP 50.87
Streambank and Shoreline Protection	580	SWRM, EQIP, WHIP, TRM	ATCP 50.88
Subsurface Drain	606	SWRM, EQIP	ATCP 50.90
Terrace System	600	SWRM	ATCP 50.91
Underground Outlet	620	EQIP	ATCP 50.92
Wastewater Treatment Strip	635	SWRM, EQIP, TRM	ATCP 50.94
Water and Sediment Control Basin	638	SWRM, EQIP, TRM	ATCP 50.95
Waterways Systems	412	SWRM, EQIP, CRP	ATCP 50.96
Well Decommissioning	351	SWRM, EQIP	ATCP 50.97
Wetland Development or Restoration	657	SWRM, EQIP, WRP, CRP, TRM	ATCP 50.98

^a Practice codes refer to NRCS field office technical guides available at efotg.nrcs.usda.gov/.

^b Potential funding sources:

- CRP = Conservation Reserve Program
- EQIP = Environmental Quality Incentives Program
- SWRM = Soil and Water Management Program
- TRM = Targeted Runoff Management Program
- WHIP = Wildlife Habitat Incentives Program
- WRP = Conservation Reserve Program

Source: Ozaukee County Land and Water Management Department and SEWRPC