Appendix A

Waukesha County Land and Water Resource Management Plan

Waukesha County Land and Water Resource Management Plan 2022 Update

Waukesha County
Department of Parks & Land Use
Land Resources Division

Waukesha County
Land and Water Resource Management Plan
2022 Update

Waukesha County
Department of Parks and Land Use
Land Resources Division

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This plan is also available for viewing and downloading at:
https://www.waukeshacounty.gov/lwclandresourcesplan

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ACKNOWLEDGEMENTS

An advisory committee, many of whom were involved in earlier generations of this plan, was assembled to assist with this Land and Water Resource Management Plan update. These people gave generously of their time and talents to help produce a plan to guide future land and water conservation efforts by Waukesha County. A sincere thank you is extended to all who had a hand in the process, as listed below.

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Cover graphic: Fue Yang, Waukesha County Information Technology

Executive Summary

The Waukesha County Land and Water Resource Management (LWRM) Plan is a long-range planning document intended to guide the activities of the Land Resources Division (LRD) in its efforts to protect and improve local land and water resources for the next 10 years. This plan is mandatory for all counties under s. 92.10 Wisconsin Statutes, with more specific planning requirements contained in Chapter ATCP 50 Wisconsin Administrative Code. In general terms, this plan must describe how Waukesha County will help meet federal and state clean water goals while addressing other local natural resource issues.

Chapter I (Introduction) provides background on the LWRM planning process and how it relates to other local plans and natural resource programs. Chapter II (Resource Assessment) reviews the state of natural resources in Waukesha County, including the classification of various soil and water resources and an evaluation of the major watersheds in the county. This data is used in the rest of the document to plan the direction for future program efforts in this fourth generation LWRM Plan for Waukesha County. The first LWRM plan was adopted by the Waukesha County Board in 1999 as a prototype for the redesigned state program. The second generation LWRM Plan was adopted by the County Board in 2006. The third generation LWRM plan was adopted in 2012 and the fourth generation LWRM plan is being updated through this document.

Planning Process and Goals

The plan goals from the 2012 LWRM Plan update were developed through an extensive nominal group process from a citizen advisory committee with an urban focus and one with a more rural perspective. To stay true to this process, those goals were carried forward to form the foundation for this 2022 plan update. The plan goals are listed below along with the percentage of LRD staff time allocated toward each goal:

1. Control Urban Runoff Pollution and Flooding (37%)
2. Protect the Quality and Quantity of Groundwater (6%)
3. Control Agricultural Runoff Pollution (12%)
4. Educate the Public on Conservation Issues (26%)
5. Preserve Targeted Farmland and Natural Areas (4%)
6. Support Water Monitoring and Improve Public Access to Water Resource Data (13%)
7. Reclaim Active Nonmetallic Mining Sites (2%)

Chapter III, the focal point of this plan, provides some background information on each of these goals, followed by more specific objectives and planned activities for each. It should be noted that the percentages shown above do not adequately represent the overlap that occurs between the goals. For example, the protection of groundwater (Goal #2) and natural areas (Goal #5) are both critical components of urban stormwater regulations administered under Goal #1, where staff time is counted.

Assisting with the preparation of this 2022 plan update was a citizen advisory committee. This committee (see previous page for a list of members) was sent drafts of all four chapters and then met to exchange comments and ideas, which have been incorporated into the final draft presented herein. A public informational meeting and hearing was also held on November 10, 2021, and the final plan approved by the Waukesha County Board on _____ and the County Executive on _____.

Nonpoint Pollution Control (Runoff)

Nonpoint sources of water pollution are the number one reason why water quality suffers in most lakes and streams in the state of Wisconsin and Waukesha County. This type of water pollution washes off the urban and rural landscapes during heavy rains or snowmelt periods and is carried directly to local water resources, usually with no treatment. Wisconsin has been a national leader in addressing this type of water pollution since 1979, and the redesign of the state nonpoint pollution control programs in the late 1990's

was the impetus to requiring county LWRM plans. Chapter NR 151, Wisconsin Administrative Code contains urban and agricultural nonpoint performance standards and prohibitions intended to meet water quality goals. Since counties are the primary local delivery system for state nonpoint programs, one of the key requirements for county LWRM plans is to describe local procedures that will be used to "ensure compliance" with state nonpoint pollution performance standards and prohibitions. These standards, and the procedures planned to implement them, are contained in Chapter IV and are briefly summarized below.

State nonpoint performance standards for rural areas focus on controlling agricultural runoff pollution from crop fields, animal feedlots, manure storage structures, and livestock pastures. This plan describes a systematic approach that will be used, including an information and education program, landowner contacts, land inventory/pollutant modeling, compliance notification, technical assistance, cost-sharing, and referring non-complying sites to DNR for enforcement, if necessary.

Urban nonpoint performance standards focus on controlling erosion from construction sites, managing post-construction runoff from parking lots, streets, buildings and other impervious areas, maximizing infiltration, maintaining vegetative buffers between impervious surfaces and water resources, and preventing polluted runoff through better land management. These standards are implemented through the county (and local) stormwater and erosion control ordinances for new development projects, and MS4 stormwater discharge permits for existing urban areas. Both of these methods rely on an effective information and education program that targets developers, engineers, contractors, municipal staff and the general public. To that end, Waukesha County has executed intergovernmental agreements with 25 local communities to implement a comprehensive stormwater education program to help communities meet this part of the MS4 permit mandate. In a rapidly developing area like Waukesha County, implementing the urban nonpoint performance standards represents the single largest workload for the Land Resources Division.

Conclusion

This plan recognizes that water quality is a direct reflection of land use and management within its watershed and that groundwater and surface water are part of the same hydrologic system - and must be managed that way. Therefore, even though separate goals and objectives are listed for various target resources, the reality is that LRD program efforts are usually intimately intertwined with each other, as well as other programs, agencies and units of government. This is reflected in the large number of working agreements that the LRD has already executed with other groups.

This LWRM plan does not bring light to any "new" resource management issues or represent any shift in county policy or priorities relating to land and water conservation. Rather, it describes how limited county resources will continue to be focused on meeting water quality standards through a wide array of program methods, including education, technical assistance, cost-sharing grants, GIS technology, tax credits, low impact development, partnerships with other agencies and organizations, and regulation. Projected costs to continue existing programs, methods to track progress and impediments to plan implementation are all discussed in Chapter IV. The impediments include excessive state mandated cost-sharing requirements to control agricultural pollution and a continuous decline in state program grants to counties.

Surveys consistently show that clean water and natural resource protection are quality of life issues that are important to county residents and businesses alike. The vision of the Waukesha County Land and Water Resource Management Plan is to provide resource protection without sacrificing other county priorities, such as public safety and job growth. To that end, it is important that conservation programs adapt to changing conditions, but maintain focus on the long-term goals of natural resource protection for the benefit of all who live and work here - now and in the future.

Chapter I. Introduction

Land and Water Resource Management Plan Background

In the mid-1990's, the Wisconsin Legislature was interested in redesigning the state's nonpoint source water pollution abatement programs in order to address certain program shortfalls and looming financial issues. In 1996, during discussions among state agencies and the Wisconsin Land and Water Conservation Board, the Wisconsin Association of Land Conservation Employees (WALCE) proposed a locally led process based on County Land & Water Resource Management (LWRM) Plans. The proposal was to have the state adopt minimum nonpoint pollution performance standards and each county would describe how they will implement the standards through a LWRM plan. The implementation of these plans would be supported by a larger base allocation of grant funds to counties, rather than the previous competitive, and sometimes duplicative state grant processes, including the Priority Watershed Program (DNR) and the Soil and Water Resource Management Program (DATCP). The LWRM planning concept is based on the principle that local leaders and residents are best suited to identify and resolve local natural resource problems.

The WALCE proposal received support from state and federal conservation agencies, the Wisconsin Land and Water Conservation Board and state legislators, and the LWRM planning concept was subsequently signed into law as part of 1997 Wisconsin Act 27 (the 1997-1999 Biennial Budget Bill). Act 27 directed the Wisconsin Department of Natural Resources (DNR) to develop administrative rules that establish agricultural and non-agricultural performance standards to reduce nonpoint source pollution and meet water quality standards. The Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP) was directed to update Administrative Rule ATCP 50 to prescribe the conservation practices to implement the DNR performance standards and to redefine the grant programs available to counties to carry out their new duties.

LWRM plans are intended to function as a local planning process that assesses natural resource conditions and needs, guides decisions on how to meet water quality goals and conservation objectives, measures progress towards meeting those goals, and makes efficient use of local, state and federal resources. The initial round of "prototype" LWRM plans began in 1998, including Waukesha County, which was adopted by the County Board in 1999. The passage of 1999 Wisconsin Act 9 (1999-2001 Biennial Budget Bill) further amended state law by prescribing the minimum requirements of a LWRM plan, transferring county staffing grant funds from DNR to DATCP, and beginning the formal phase-out of the Priority Watershed Program. By 2002, all 72 counties in the state had approved LWRM plans prepared by following a guidance document produced by a statewide work team. In October 2002, after a contentious 5-year rule making process, a series of state administrative rules were finally promulgated by DATCP and DNR, implementing the requirements of 1997 Act 27 and 1999 Act 9. Most notable of this rule package were NR 151 (DNR), which contained the new agricultural and non-agricultural nonpoint pollution performance standards, and ATCP 50 (DATCP), which contained county LWRM planning and related grant requirements.

This is the fourth generation Land and Water Resource Management Plan for Waukesha County, serving as an update to the third generation plan, adopted by the County Board in July 2012. This plan has been prepared in accordance with the requirements under ATCP 50, and is intended to guide the Land Resources Division (LRD) program efforts for the next 10 years.

Plan Requirements

DATCP is statutorily responsible for approving LWRM plans. The Wisconsin Land and Water Conservation Board (LWCB) is responsible for reviewing all county LWRM plans and making approval recommendations to DATCP. In order to be approved, a plan must address the following:

- Assessment of county natural resources, including water quality and soil erosion conditions;
- Water quality objectives derived in consultation with the DNR;
- Applicable performance standards and prohibitions related to the control of soil erosion and water pollution from nonpoint sources;
- Conservation practices needed to meet water quality objectives and to address soil erosion problems;
- A plan to identify priority producers and livestock operations in the county;
- Use of state and local regulations to implement the county plan;
- Encouragement of voluntary implementation of conservation practices through county strategies;
- Procedures to ensure compliance with the nonpoint performance standards and prohibitions;
- A multi-year description of planned activities, including priorities and expected costs;
- A system to monitor the progress of activities described in the plan;
- Information and education related to soil and water resource management strategies;
- Coordination of activities described in the plan with programs of other local, state, and federal agencies;
- Notification of affected landowners and land users of findings about key problems and needed conservation practices;
- Public participation in the planning process, including an advisory committee, public hearing and county board approval.

Looking Back (Major Accomplishments since 2012)

Before planning for the next 10 years, it is important to look back at the previous Waukesha County LWRM plan adopted in 2012 and reflect on progress made and program changes that have occurred. The most prominent program change has been the approval of two Total Maximum Daily Load ("TMDL") plans in Waukesha County; specifically the Rock River (2012) and the Milwaukee River Basin (2018). Impaired waters in Wisconsin are addressed through a TMDL analysis. The TMDL is the amount of a pollutant a waterbody can receive and still meet water quality standards. A more detailed description of the TMDL plans and a list of the pollutants they address are provided in Chapter IV.

A review of the planned activities from the 2012 LWRM plan shows that much progress has been made. While too numerous to list all of the accomplishments, some program highlights and significant accomplishments since 2012 are listed below:

- Issued 776 stormwater permits and conducted over 6,000 construction site erosion control inspections;
- Continued to serve as the only community in the state as an "Authorized Local Program" as approved by the DNR, allowing county stormwater permits to also provide DNR permit coverage under NR 216;
- Provided comprehensive county-wide stormwater education program and implemented intergovernmental agreements with 25 communities to administer the program under the MS4 stormwater discharge permit requirements;
- Hosted 10 annual stormwater workshops for developers, engineers, contractors and municipal officials, consistently filling the 100-200 person capacity and transitioned to online format in 2020 and received high evaluation ratings from participants;
- Completed soil and water conservation teacher training workshops for 208 teachers and completed classroom presentations on nonpoint pollution to over 12,250 students;
- Provided field experience in water quality to 3,747 students;
- Provided training in the use of rain gardens and rain barrels to 755 people;
- Presented to 3,485 individuals other than students – adults, scouts, 4-H groups, etc.;
- Provided training in stormwater management, smart salting, and other topical training to 4,396 professionals, including contractors, developers, municipal officials, etc.;

- Maintained a stormwater database linked to the county GIS-web system and populated it with photos, as-built data and maintenance agreements for over 800 stormwater BMPs;
- Expanded/updated a robust stormwater web page at www.waukeshacounty.gov/stormwater and a public educational web page at www.waukeshacounty.gov/cleanwater.
- Cost-shared the proper abandonment of 169 residential wells to protect groundwater;
- Maintained a GIS database to record agricultural nonpoint compliance checks and mapped all livestock facilities in the county.

Plan Development Process

The plan goals from the 2012 LWRM Plan update were reviewed through an advisory committee. The LRD presented background information on each of the goals along with objectives and planned activities for this 2022 update.

All four draft Chapters were sent to the advisory committee. Membership of the committee, as shown at the front of this plan, included representatives from other local conservation agencies and organizations. The advisory committee met on June 16, 2021 and August 5, 2021. Comments received were incorporated into the final draft presented herein. A public informational meeting and hearing was also held on November 10, 2021. A copy of the public hearing announcement is found in Appendix D.

Relationship to Other Plans

As noted earlier, the goals and objectives described in this plan are often interrelated and involve many other agencies and organizations involved in natural resource management. Below is a list of other planning efforts that are related to and will be coordinated with the implementation of this plan.

Comprehensive Development Plan for Waukesha County (2009)

In 1999, the Wisconsin Legislature enacted a comprehensive development planning initiative. Commonly referred to as "Smart Growth" law, this initiative required any community that enforces a zoning ordinance to adopt a comprehensive plan by January 1, 2010 that is consistent with the zoning ordinance. In response to this law and the on-going need to update existing development plans, Waukesha County, in cooperation with 27 local communities, the Southeastern Wisconsin Regional Planning Commission (SEWRPC) and the University of Wisconsin-Extension (UWEX) completed a comprehensive development plan for Waukesha County in 2009. This plan served as an update to A Development Plan for Waukesha County Wisconsin (1996 - SEWRPC Community Assistance Planning Report No. 209). Under state law, the county plan was required to incorporate comprehensive plans adopted by local communities, coordinating development between the 37 municipalities in the county. The plan included an analysis of population, economy, housing, land use, natural and cultural resources, transportation, community facilities and intergovernmental cooperation. An annual plan update process was also adopted with the plan, which incorporates changes to the plan that are consistent with the adopted planning standards. A copy of the Waukesha County Comprehensive plan is available on the county web site: https://www.waukeshacounty.gov/ctydevplan

Waukesha County Farmland Preservation Plan (2011)

The Wisconsin Legislature adopted significant changes to the state's Farmland Preservation law (Chapter 91 Wis. Stats.) in 2009, commonly referred to as the "Working Lands Initiative". Under these law revisions, every county in the state was required to update their Farmland Preservation Plan, and two new preservation tools were made available – Agricultural Enterprise Areas and Purchase of Agricultural Easement (PACE) grants. Waukesha County completed their plan update in 2011 in accordance with the law, and incorporated the plan as Appendix D to the 2009 Waukesha County Comprehensive Plan. The Farmland Preservation Plan identified farmland to be preserved for agricultural uses in three towns in the county, which made those designated landowners eligible for the Farmland Preservation income tax credit. A copy of the adopted farmland preservation map is presented in Chapter IV.

Regional Water Quality Management Plans (208 Plans)

In 1974, the Southeastern Wisconsin Regional Planning Commission was designated as the water quality planning agency for southeastern Wisconsin pursuant to the terms of Section 208 of the Federal Water Pollution Control Act (P.L. 92-500) also known as the "Clean Water Act". In 1975, the SEWRPC initiated preparation of the Regional Water Quality Management Plan for Southeastern Wisconsin – 2000, which was formally adopted in 1979.

In 1995, the SEWRPC published an update and status report to the original regional water quality management plan. This report describes the implementation activities that had occurred since adoption of the original plan, identified progress on meeting the water quality objectives, and identified issues still needing to be addressed in the ongoing planning process. In 2007, SEWRPC completed 208 plan updates for the Milwaukee River and Root River watersheds in Waukesha County.

Regional Water Supply Planning

SEWRPC recently completed a three-phased multi-agency effort to inventory local groundwater resources, develop a regional groundwater model, and develop and publish a Regional Water Supply Plan for Southeast Wisconsin (2010). The plan is based upon an adopted regional comprehensive plan design year of 2035, recommends a sustainable water supply for every community in southeast Wisconsin. This plan includes several recommendations that affect LRD programs, including encouraging water conservation, infiltration of runoff and protection of groundwater quality from polluted runoff. A copy of the plan is available for purchase or public viewing on the SEWRPC web site: www.sewrpc.org/SEWRPC/Environment/RegionalWaterSupplyPlan.htm.

Regional Stormwater Management and Watershed Protection Plans

Many communities are investing in regional stormwater management planning to coordinate new developments with existing stormwater systems, plan for system upgrades or to satisfy state MS4 stormwater discharge permit requirements. Stormwater management planning by watershed rather than by individual parcel during the development process allows a community to consider the cumulative downstream impacts of land use and stormwater management decisions prior to development. This type of up-front planning can also help coordinate activities between local units of government within the same watershed. Watershed protection planning takes this process a step further. This gets communities to work together toward a common goal of protecting a particular water resource by coordinating land use and stormwater planning along with related program efforts within a watershed. Stormwater planning by watershed is also used to determine options for reducing runoff pollution from existing development, which may be required to satisfy municipal stormwater discharge permits under NR 216 Wis. Admin. Code.

Basin Water Quality Management Plans

The Department of Natural Resources (DNR) also prepares area-wide water quality management plans for drainage basins encompassing Waukesha County. Waukesha County contains portions of five major watershed basins: the Illinois Fox River, Milwaukee River, Root-Pike Rivers, and the Upper and Lower Rock River basins, as shown in Map II-9.

Priority Watershed Plans

From 1979 to 2005, the DNR administered the Nonpoint Source Water Pollution Abatement Program, resulting in the preparation of Priority Watershed plans for several watersheds in Waukesha County. These include the Root River (1980), the Oconomowoc River (1986), the Menomonee River (1991), the Upper Fox River (1993) and the Muskego-Wind Lakes watersheds (1994). Upon adoption, these plans became subset amendments to the Regional Water Quality Plans. The watershed plans identified resource issues of concern and recommended specific nonpoint source pollutant reduction goals by subwatershed. State grants for technical assistance and cost-share dollars were made available to encourage landowners to install conservation practices for water quality improvement. Counties were a primary local delivery system for the program and were provided grants for conservation staff and program support. As noted in

the introduction section of this plan, this program was redesigned by the state legislature in 1997-1999 and state funding for watershed projects was phased out by the end of 2005..

Lake Management Plans

Twenty-two lake organizations in Waukesha County have organized lake districts under Chapter 33 of the Wisconsin Statutes or fall entirely within a municipality with taxing authority for lake management activities. The largest lake in the county, Lake Pewaukee, has an active sanitary district. Many of the other lakes have active lake associations. Collectively these groups represent thousands of county residents who have a vested interest in protecting and improving water quality. Through grants made available through the DNR and other sources, many of these groups have prepared water quality management plans, aquatic plant management plans, lake protection and recreational use plans to address specific concerns on a particular water resource. Many of the activities identified in these plans complement activities identified in the Land and Water Resource Management Plan. During lake management planning and implementation, LRD staff regularly provides technical information, educational services or other resources to the various lake organizations, especially related to stormwater runoff and aquatic invasive species.

Total Maximum Daily Load (TMDL) Plans

TMDL plans is a federally mandated watershed planning program under the Clean Water Act designed to improve water quality in lakes and streams that are not meeting water quality standards. A list of these water resources is called the 303(d) list, named after the applicable section of the federal law. This list is updated every two years by the DNR and reported to the EPA. Under the TMDL planning process, water quality of a specific stream is measured and a plan is developed which establishes the maximum amount of pollution the stream can tolerate to meet water quality standards and water use objectives. Through extensive modeling, a TMDL plan "allocates" tolerable pollutant discharges between point and nonpoint sources throughout the watershed. During plan implementation, pollutant trading can occur between sources. The DNR encourages counties to act as "brokers" of the pollutant trading that can occur. An example is a sewage treatment plant paying for nutrient management planning or a manure storage facility on a farm upstream. A TMDL plan may affect the minimum state nonpoint pollution control standards for both urban and agricultural areas, and therefore may affect other goals in this plan. As of 2021, TMDL plans have been completed for the Rock River and Milwaukee River watersheds. A TMDL is being written for the Illinois Fox and Des Plains Rivers, expected to be completed by 2024.

Waukesha County Strategic Plan (2020-2022)

Every Department within Waukesha County develops its own Strategic Plan in order to identify desired objectives over the course of the next three years. These objectives are considered milestones to be reached, so each one is designed to be Specific, Measurable, Attainable, Realistic and Time bound (SMART). The Strategic Plans, and the SMART objectives within, are guided by Five Pillars of Success, Waukesha County's framework for identifying core priorities and establishing program goals. The Five Pillars are: Customer Service, Quality, Team, Health & Safety, and Finance. They are the basis of a county-wide scorecard to measure performance in these key areas. The Department of Parks and Land Use engaged in an environmental scanning process which gathered information on the forecasted demographics in the County, the needs of businesses for economic development, feedback and expectations of our customers, environmental analysis, and other forecasted influences on our ability to efficiently and effectively provide services.

Waukesha County Park and Open Space Plan

In order to provide a long-term approach to enhancing quality of life through outdoor recreation and open space preservation, Waukesha County continually updates its comprehensive Park and Open Space Plan. The purpose of the Plan is to act as a guide for the acquisition, preservation, development and management of park, recreation and open space lands in the County, specifically for the five-year period from 2018-2022. As an integral component of the Comprehensive Development Plan for Waukesha County, the Waukesha County Park and Open Space Plan serves as a guide for land use decisions pertaining to County-owned parks and open space lands. This plan is an update to the previously adopted 2009 Park

and Open Space Plan. This County Park and Open Space Plan is also designed to meet State planning requirements for outdoor recreation funding programs, thereby affording the County eligibility to apply for, and receive, available State and Federal funds to assist in the acquisition and development of recommended park and open space sites and facilities.

Waukesha County Aquatic Invasive Species Strategic Plan

In February 2017, Waukesha County was awarded a three-year grant to enter into a cooperative AIS education, prevention, and control program with adjacent Washington County. Additional financial support from local lake groups made it possible to complete a Strategic Plan and hire a second intern to monitor boat launches for AIS at several lakes around the County during the summer. This strategic plan includes an overview of Waukesha County waterbodies, describes how AIS can be detrimental to aquatic ecosystems, and pin points where AIS have been identified in the County. This plan also recommends goals and strategies for combating AIS, engaging in AIS education and outreach, and identifying entities responsible for plan implementation. Criteria for the County to assist and facilitate projects as well as criteria defining conditions in which specific treatments are recommended are also provided in the Plan. The Strategic Plan describes how AIS affect recreation, ecology, and the economy of the County as well as the benefits of stopping the spread of AIS. The plan also maps specific AIS in local lakes, informs the public of management options, and provides recommendations for AIS education, prevention, and control.

Coordination with Other Agencies and Partners

During the preparation of this plan, other agencies with a focus on natural resource protection were consulted and given the opportunity to comment on the content and focus of the plan. In particular the DNR was consulted on the priorities contained in the basin water quality management plans. The Natural Resources Conservation Service (NRCS) was also given the opportunity to provide their input. Both of these agencies and other conservation partners participated on the LWRM Plan Advisory Committee and were invited to participate, as shown in Appendix C.

Related Waukesha County Ordinances

Chapter 14 and the Appendices of the Waukesha County Code of Ordinances contain the following ordinances related to management of land and water resources in Waukesha County. A complete copy of the following may be viewed at: https://www.waukeshacounty.gov/globalassets/corporation-counsel/county-code/chapter-14-parks-and-land-use.pdf

Stormwater Management and Erosion Control Ordinance

The Waukesha County Stormwater Management and Erosion Control Ordinance was most recently updated by the Waukesha County Board in March of 2016. The new version of the ordinance incorporated the standards of the Department of Natural Resources administrative rule NR 151 for non-agricultural runoff control. The purpose of the ordinance is to establish regulatory requirements for land development and land disturbing activities aimed to minimize the threats to public health, safety, welfare and the natural resources of Waukesha County from construction site erosion and post-construction stormwater runoff. The LRD administers this ordinance in all unincorporated areas of the county. More details are provided in Chapters III and IV.

Nonmetallic Mining Reclamation Ordinance

The Waukesha County Nonmetallic Mining Reclamation ordinance was adopted in July of 2001. The ordinance is intended to establish effective standards for nonmetallic mine reclamation in accordance with uniform statewide standards under NR 135. The reclamation requirements are intended to rehabilitate nonmetallic mining sites, protect the environment and allow for other post-mining land uses. The LRD administers the ordinance in portions of the county and currently has 17 operations under permit. In addition, some local units of government have adopted their own ordinances based on the statewide

model. More details on the location of regulated sites and the communities that have adopted ordinances are provided in Chapter II.

Waukesha County Zoning Code

The Zoning Code applies to the Townships of Oconomowoc and Ottawa. The Code is designed to provide standards for land development to provide for adequate sanitation, drainage, safety, convenience of access, the preservation and promotion of the environment, property values and general attractiveness. The LRD often provides technical assistance to zoning staff relating to erosion control, stormwater management, soil investigations and basement flooding related issues.

Shoreland and Floodland Protection Zoning Ordinance

The Shoreland and Floodland Zoning Ordinance is state mandated under Chapters NR 115 and NR 116 to protect or improve the quality and aesthetics of lakes and streams. It generally applies to lands in unincorporated Townships and annexed lands within 1,000 feet of a lake and 300 feet of a river or stream and is administered by the Planning and Zoning Division. The LRD often provides similar technical assistance as noted under the zoning code and will assist with updating the code to meet recent revisions to NR 115, including restrictions on impervious surfaces and mitigation planning.

Plan Review and Approval

Following the review of the draft Land and Water Resource Management plan by the advisory committee on June 16, 2021 and August 5, 2021, and the public hearing on November 10, 2021, the plan was presented to the Waukesha County Land Use, Parks and Environment Committee and the Waukesha County Board of Supervisors. At their meeting on _____the Waukesha County Board of Supervisors adopted a resolution of approval for the Waukesha County Land and Water Resource Management Plan 2022 Update. This resolution was then forwarded to the Waukesha County Executive who approved it on _____ (See Appendix G).

In accordance with state law, this plan was also reviewed by the Wisconsin Department of Natural Resources (DNR), the Department of Agriculture, Trade, and Consumer Protection (DATCP) and the Land and Water Conservation Board (LWCB). The LWCB recommended approval at their meeting on_____. The plan was also forwarded to the DATCP Secretary who signed an order approving the Waukesha County Land and Water Resource Management Plan - 2022 Update on _____ (See Appendix H).

Chapter II. Resource Assessment

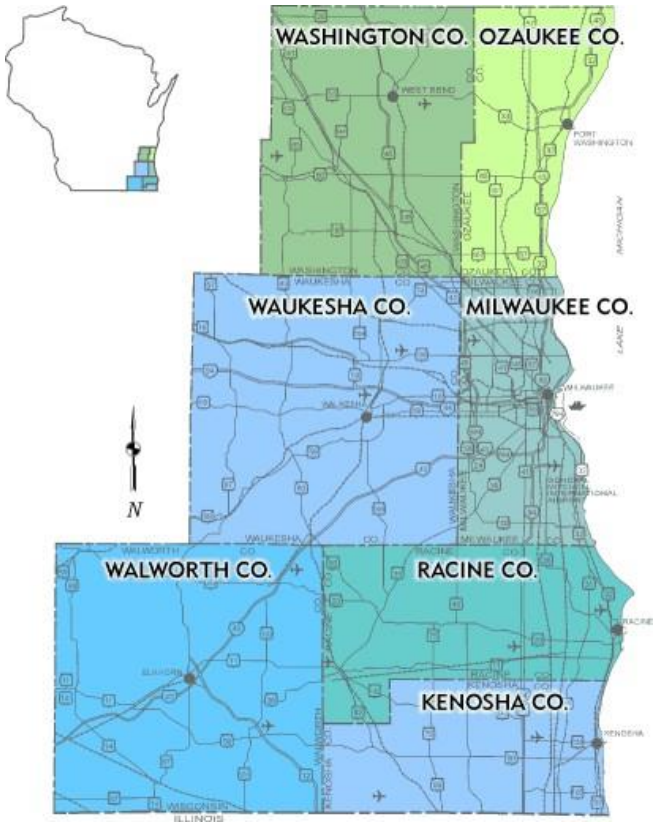
Introduction

Waukesha County is a rapidly urbanizing county bordering the west side of Milwaukee in southeastern Wisconsin, as shown in Figure II-1 below. The county is made up of 16 survey townships, covering approximately 580 square miles or 371,600 acres. Located within its borders are 37 municipalities, including 7 cities, 21 villages and 9 towns, as shown in Map II-1.

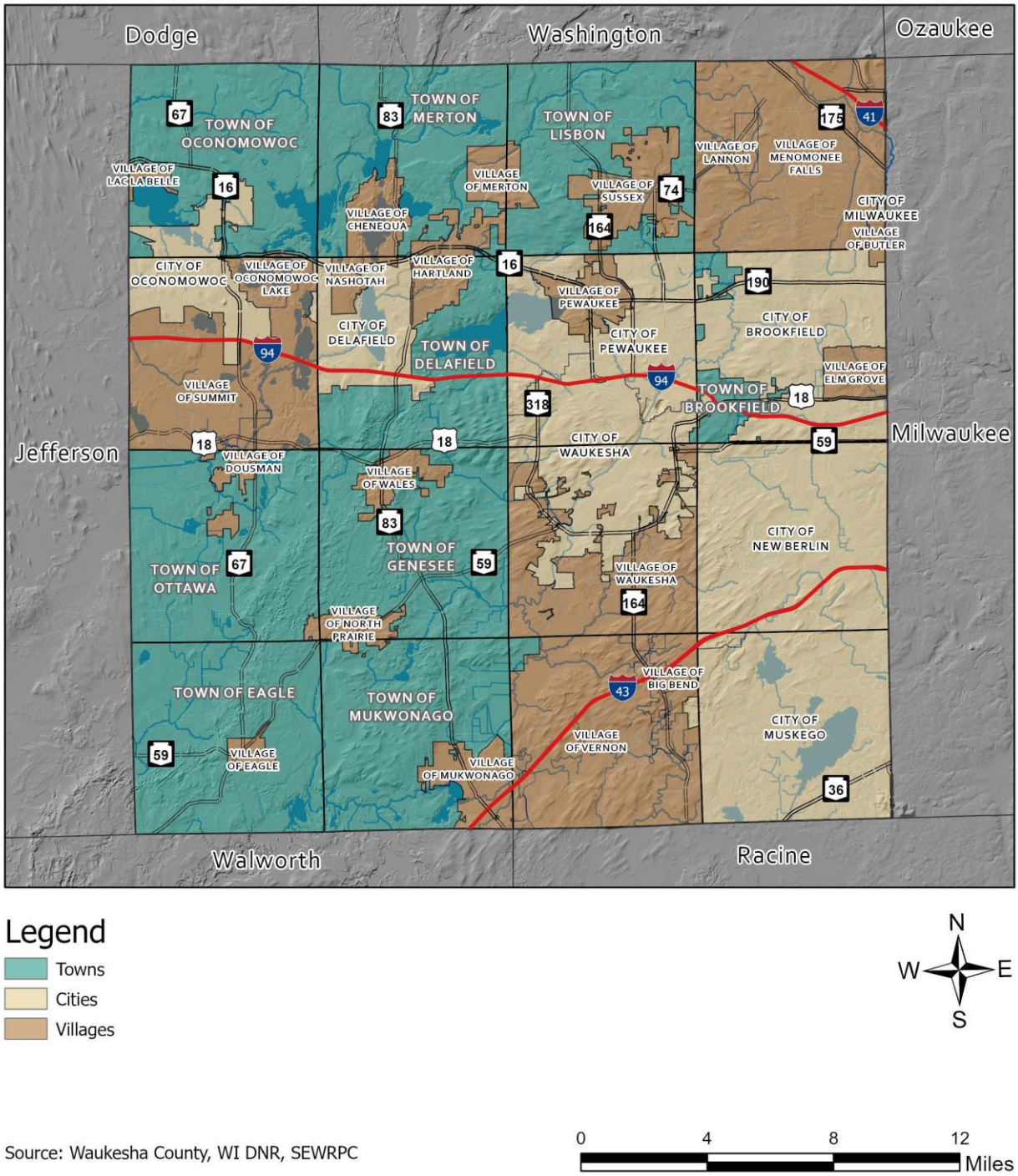
The natural resource base of Waukesha County is one of the most important factors influencing the quality of life and the economy for residents within the county and the region. Without sufficient understanding and recognition of the character and importance of the various elements of the natural resource base, human use and alteration of the natural environment proceeds at the risk of excessive costs in terms of both monetary expenditures and environmental degradation. A sound and meaningful planning effort must therefore acknowledge that natural resources are limited, and that land use decisions be properly adjusted to the natural resource base so that serious and costly environmental problems can be avoided.

This chapter presents descriptive information pertaining to the natural resource base of Waukesha County. This information was used by the LRD and the LWRM Plan Advisory Committees as a basis for identifying resource concerns and generating the goals and objectives presented in Chapter III.

Figure II-1
Location of Waukesha County



Map II-1
Waukesha County Municipalities



Legend
- Towns
- Cities
- Villages

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W E
S

Source: Waukesha County, WI DNR, SEWRPC

0 4 8 12
Miles

Population

Current population estimates for the 37 municipalities and a cumulative total for the county are shown in Table II-1 below. Figure II-2 shows the population growth in Waukesha County between 1960 and 2020, as well as projections for 2035. Figure II-3 shows the number of households (see Appendix for definition) during this same time period. A projection of population and households is important for 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. Note that while the population of the county is projected to increase by 24% to 446,800 by 2035, the number of households is projected to increase by 29% to 174,100 due to the projected lower number of persons per household.

Table II-1
2020 Estimated Municipal Populations in Waukesha County

Municipality		2020 Population Estimates	Municipality		2020 Population Estimates
Town of:	Brookfield	6,744	Village of:	Big Bend	1,491
	Delafield	8,503		Butler	1,803
	Eagle	3,586		Chenequa	588
	Genesee	7,379		Dousman	2,353
	Lisbon	10,564		Eagle	2,104
	Merton	8,469		Elm Grove	5,857
	Mukwonago	7,979		Hartland	9,286
	Oconomowoc	8,706		Lac La Belle	296
	Ottawa	3,936		Lannon	1,264
				Menomonee Falls	38,948
				Merton	3,711
				Mukwonago	7,916
City of:	Brookfield	40,044		Nashotah	1,350
	Delafield	7,181		North Prairie	2,234
	Muskego	25,271		Oconomowoc Lake	598
	New Berlin	40,600		Pewaukee	7,883
	Oconomowoc	17,501		Summit	4,974
	Pewaukee	14,775		Sussex	11,373
	Waukesha	71,952		Vernon	7,621
				Wales	2,616
				Waukesha	9,329
			Waukesha County Total		**406,785**

Source: Wisconsin Department of Administration

The population and household projections were generated by the Southeastern Wisconsin Regional Planning Commission (SEWRPC) as part of the regional land use planning process. These estimates include natural increases in population (births/deaths) and net in-migration to the county from other areas, and represent the intermediate of three projections prepared by SEWRPC.

Figure II-3 shows that the number of households in the County increased by 25% between 2000 and 2020, representing a significant demand for land in the county, especially in the unsewered communities.

Figure II-2
Historical and Projected Population for Waukesha County: 1960-2040

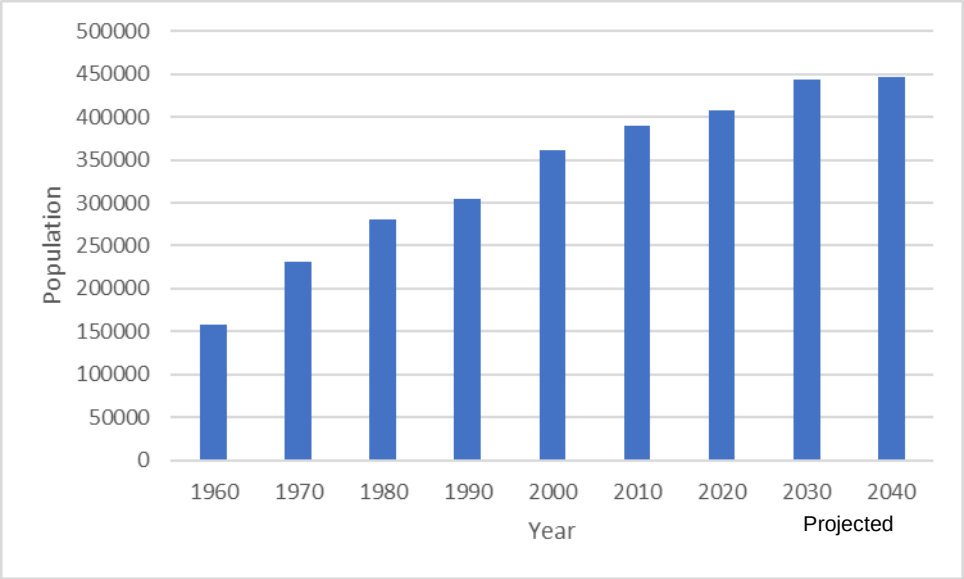
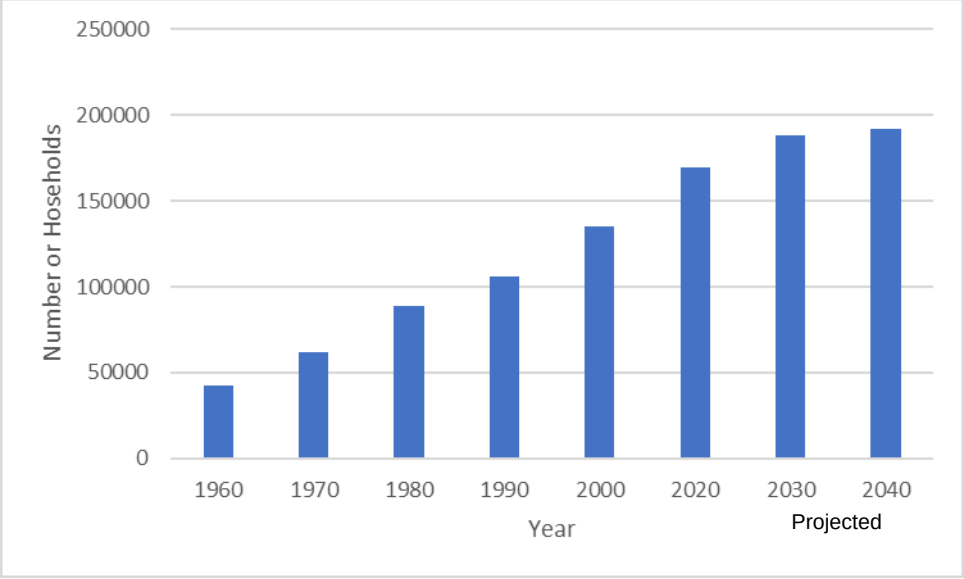


Figure II-3
Historical and Projected Number of Households for Waukesha County: 1960-2040



The remainder of this chapter will review the natural resource features and land use of the county. It should be noted that impacts on many of these resources have been and will continue to be directly or indirectly influenced by the population data presented above.

Geology and Physiography

Topographic elevation in Waukesha County, as depicted in Map II-2, ranges from approximately 730 feet above mean sea level in the extreme eastern portions of the County along tributaries of the Menomonee River in Brookfield, Elm Grove, and Menomonee Falls, to 1,233 feet at Lapham Peak in the Town of Delafield, a variation of over 500 feet. Most of the high points in the County are located along the Kettle Moraine stretching southwest from the Town of Merton to the Town of Eagle.

Four major stages of glaciation, the last of which was the Wisconsin stage, ending approximately 10,000 years ago in the State, have largely determined the physiography, topography, and soils of Waukesha County. As noted above, the dominant physiographic and topographic feature in Waukesha County is the Kettle Moraine, an interlobate glacial deposit formed between the Green Bay and Lake Michigan lobes of the continental glacier that moved in a generally southerly direction from its origin in what is now Canada. The Kettle Moraine, which is oriented in a general northeast-southwest direction across the western half of the county, is a complex system of kames, or crudely stratified conical hills; kettle holes formed by glacial ice blocks that became separated from the ice mass and melted to form depressions and small lakes as the meltwater deposited material around the ice blocks; and eskers, long, narrow ridges of drift deposited in abandoned drainageways. The remainder of the County is covered by a variety of glacial landforms and features, including various types of moraines, drumlins, kames, outwash plains, and lake basin deposits.

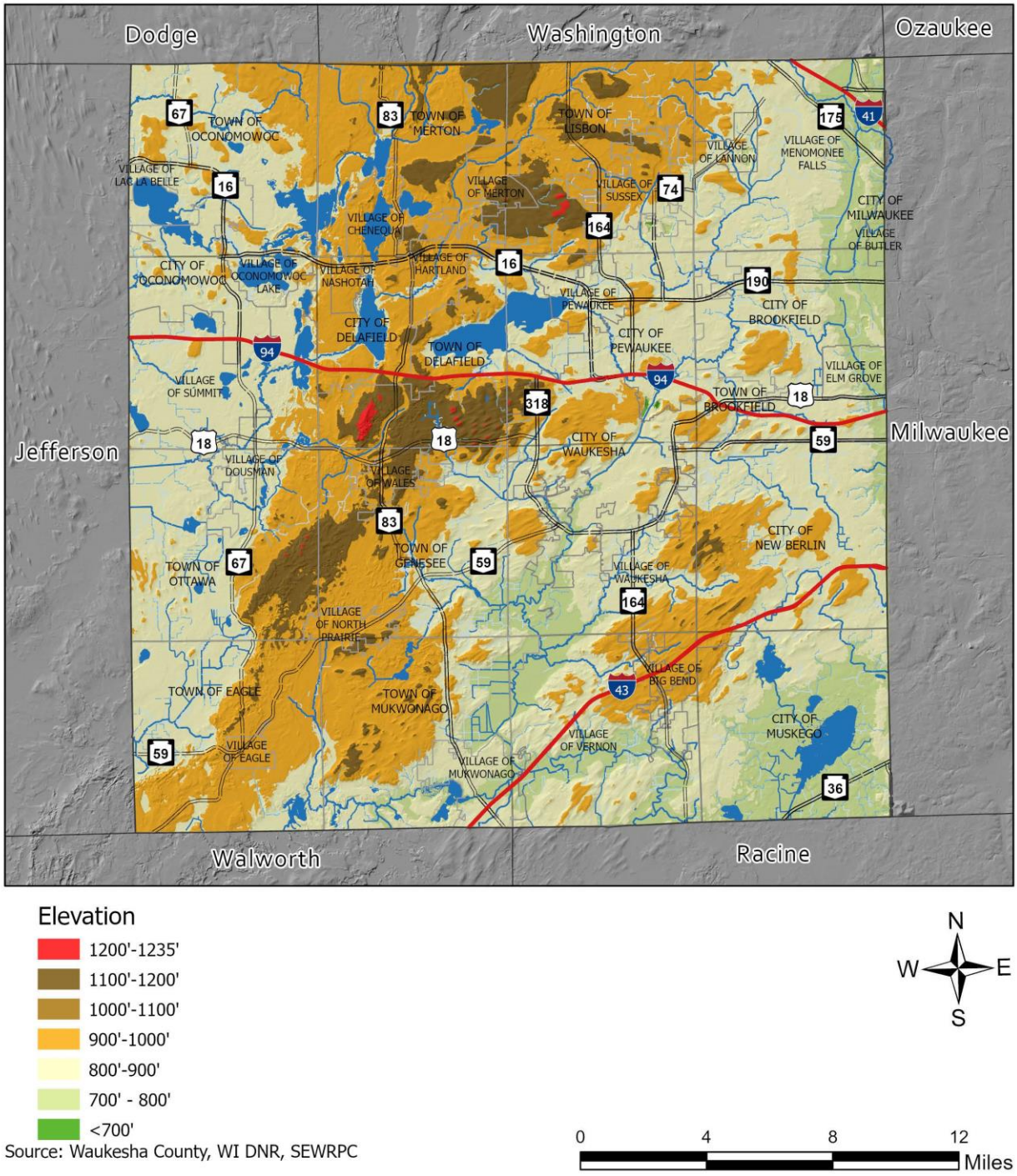
The combined thickness of unconsolidated glacial deposits, alluvium, and marsh deposits overlying bedrock exceeds 50 feet throughout most of the County, as shown in Map II-3. Thicknesses are greatest where glacial materials fill the bedrock valleys and in areas of topographic highs formed by end moraines. The most substantial glacial deposits, from 300 to 500 feet thick, are located in the northwestern part of the County in the lakes area and in portions of the Town of Mukwonago and Village of Vernon. The thinnest glacial deposits, often less than 20 feet thick, are found along an approximately six-mile-wide band traversing the County in a northeasterly direction from the Village of Eagle to the Villages of Lannon and Menomonee Falls.

Bedrock Geology

Bedrock topography was shaped by preglacial and glacial erosion of the exposed bedrock. The consolidated bedrock underlying Waukesha County generally dips eastward at a rate of about 10 feet per mile. The bedrock surface ranges in elevation from about 900 feet above mean sea level, at Lapham Peak, to approximately 500 feet above mean sea level in the eastern portion of the County. The bedrock formations underlying the unconsolidated surficial deposits of Waukesha County consist of Precambrian crystalline rocks; Cambrian sandstone; Ordovician dolomite, sandstone, and shale; and Silurian dolomite. Figure II-4 shows a generalized cross-section of the bedrock geology of Waukesha County. The uppermost bedrock unit throughout most of the County is Silurian dolomite, primarily Niagara dolomite, underlain by a relatively impervious layer of Maquoketa shale, which acts as an aquitard – minimizing groundwater movement into the underlying materials. This is discussed further in the groundwater section. In some of the pre-Pleistocene valleys in the southwestern and central portions of the County, however, the Niagara dolomite is absent and the uppermost bedrock unit is the Maquoketa shale.

Geologic properties can influence the manner in which land is used, since geologic conditions, including the depth to bedrock, can affect the cost and feasibility of building site development and provision of public facilities and infrastructure. As noted in the following sections, the geology of the county can also play a significant role in resource management issues, such as groundwater and mineral extraction.

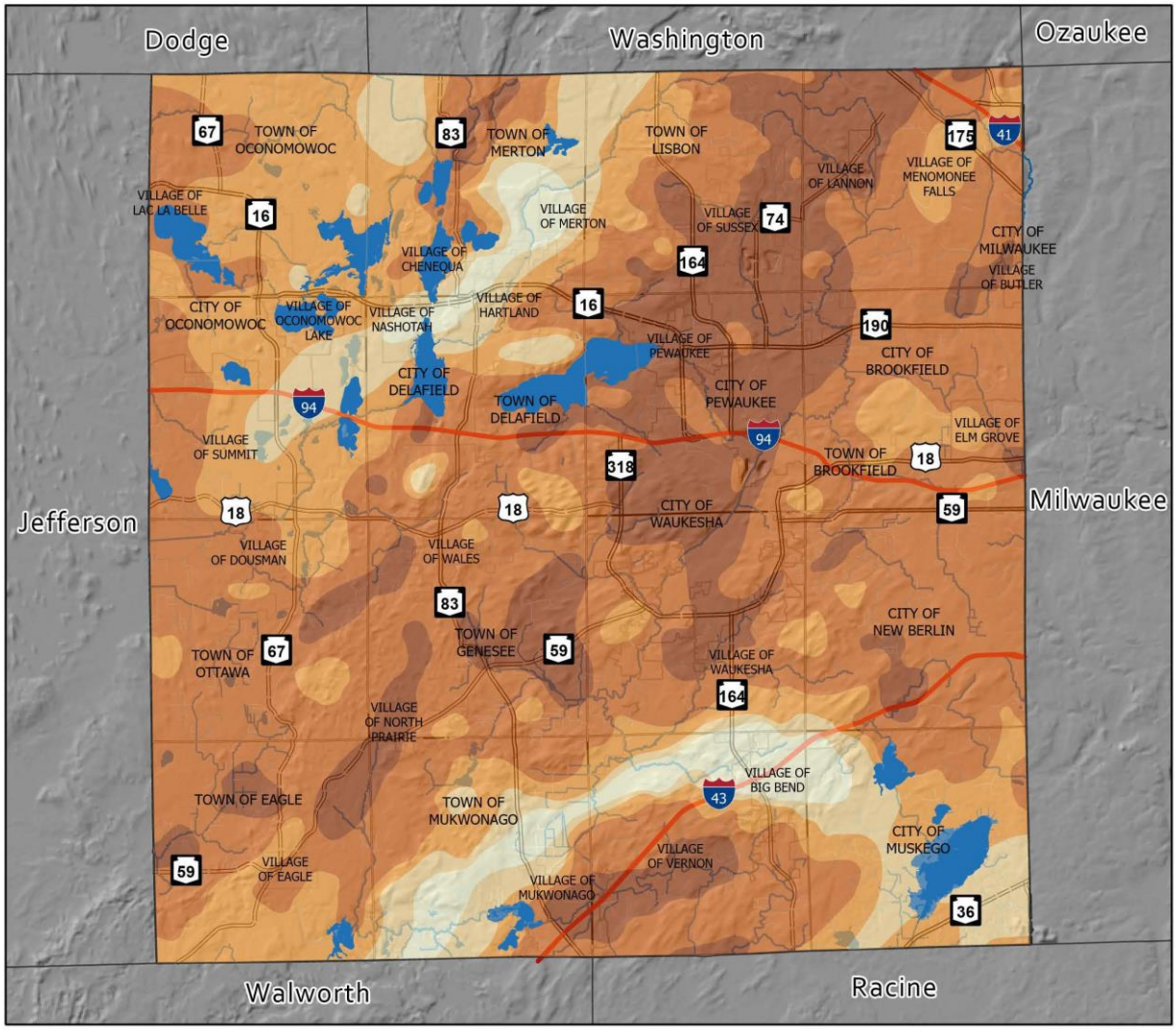
Map II-2
Topography of Waukesha County



Source: Waukesha County, WI DNR, SEWRPC

Map II-3

Generalized Depth to Bedrock: Waukesha County



Generalized Depth to Bedrock

- 0 - 50'
- 50' - 150'
- 150' - 250'
- 250' - 350'
- 350' - 450'
- Water

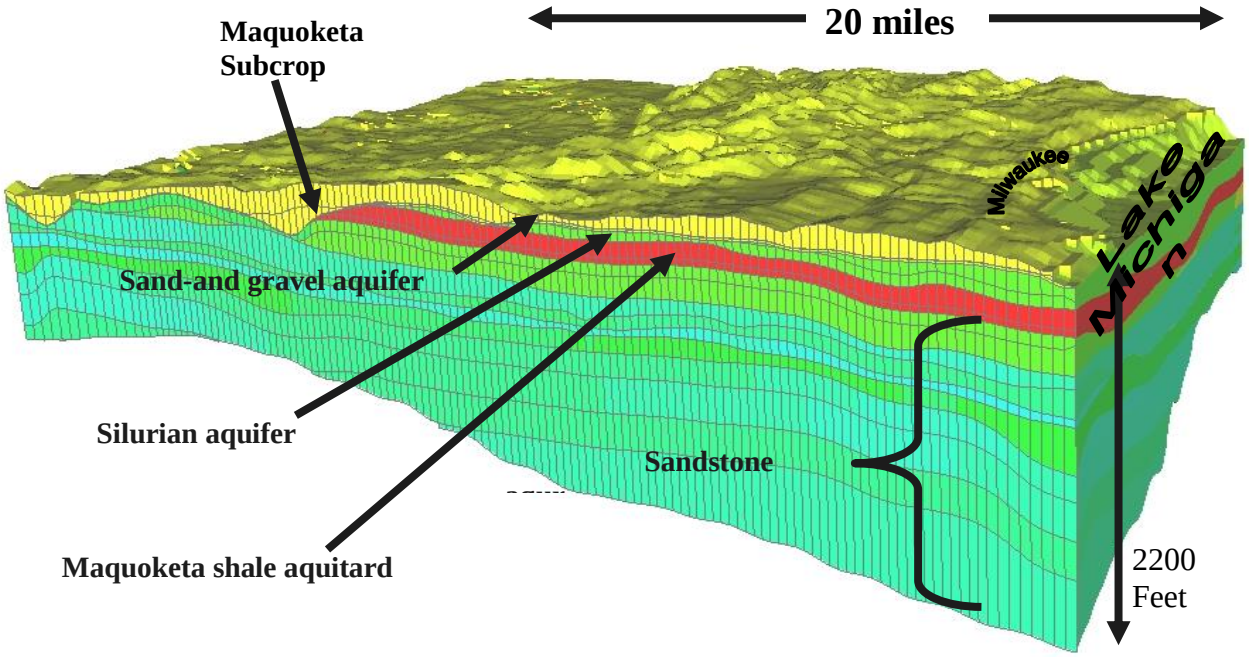
N
W E
S

0 4 8 12 Miles

Source: Waukesha County WI DNR, SEWRPC, NRCS

Figure II-4

General Hydrogeology of Southeast Wisconsin



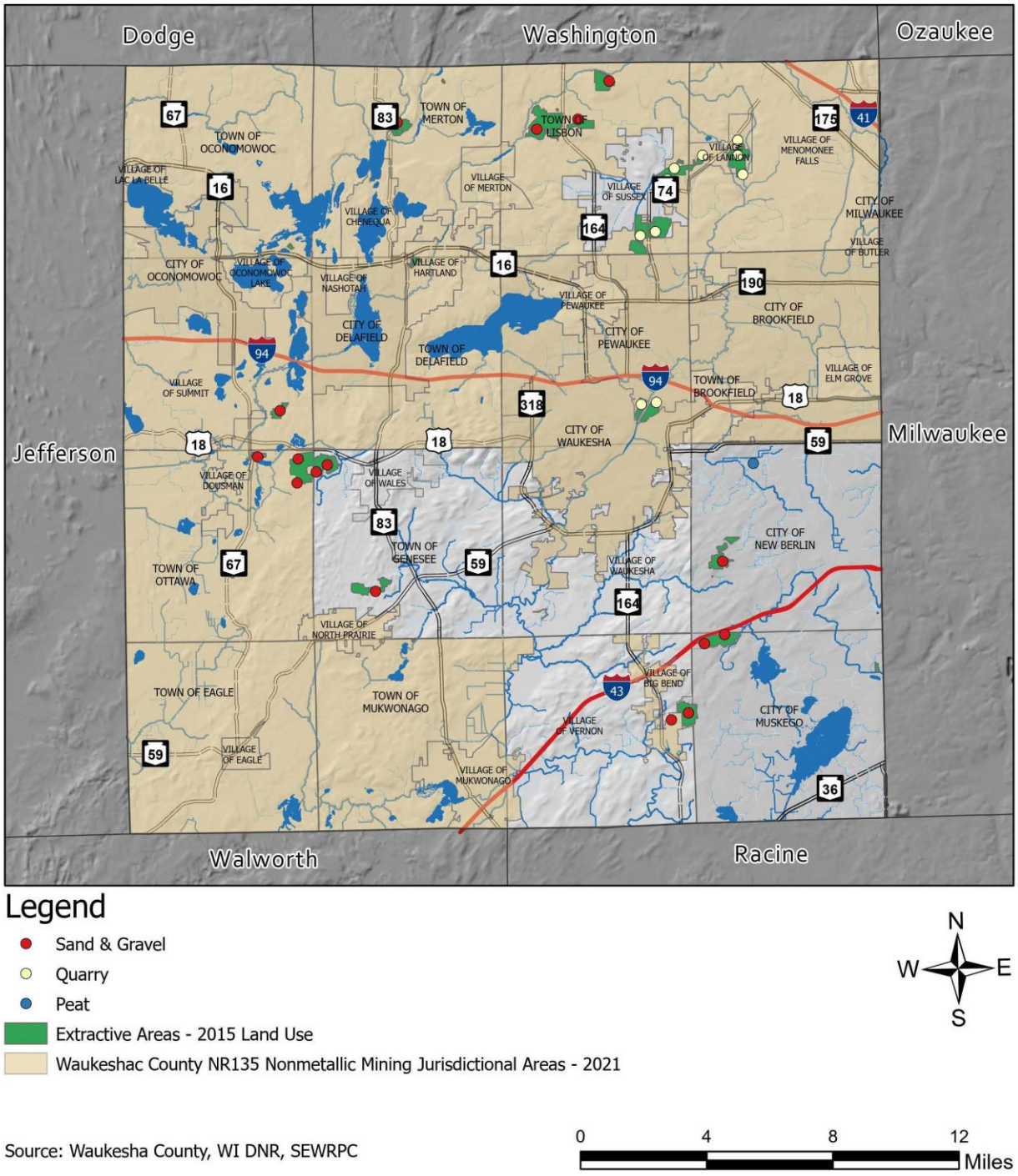
Source: USGS

Nonmetallic Mineral Extraction in Waukesha County

In the case of potential mineral extraction areas, the geologic attributes of the County are a valuable and irreplaceable resource. Local land use planning efforts have recognized this fact by planning for future mine expansions and incorporating code provisions to avoid land use conflicts. The Waukesha County Mineral Extraction Advisory Committee (MEAC) was established in the mid-1990's to help facilitate these efforts.

In 2000 extractive land use in Waukesha County totaled about 4000 acres, or approximately 1.1 percent of the total area of the county. This area consists primarily of lands devoted to the extraction of sand, gravel and stone but also includes lands formerly used for such purposes and which lay idle in 2000. By state mandate, Waukesha County adopted a nonmetallic mine reclamation ordinance in 2001 that required new and existing mines to prepare and implement a reclamation plan. These reclamation plans will be implemented over a period of many years depending on the expected operational lifespan of the quarry or gravel pit. At present there are 28 permitted nonmetallic mining operations in the county, 17 issued by the LRD and 12 by other communities that have adopted reclamation ordinances. The general location and type of mining operation are shown in Map II-4. In total, there are currently 10 active limestone quarries, 17 sand and gravel pits and one peat mining operation in the county.

Map II-4
Extractive Areas of Waukesha County: 2021



Legend

- Sand & Gravel
- Quarry
- Peat
- Extractive Areas - 2015 Land Use
- Waukeshac County NR135 Nonmetallic Mining Jurisdictional Areas - 2021

N
W E
S

Source: Waukesha County, WI DNR, SEWRPC

0 4 8 12 Miles

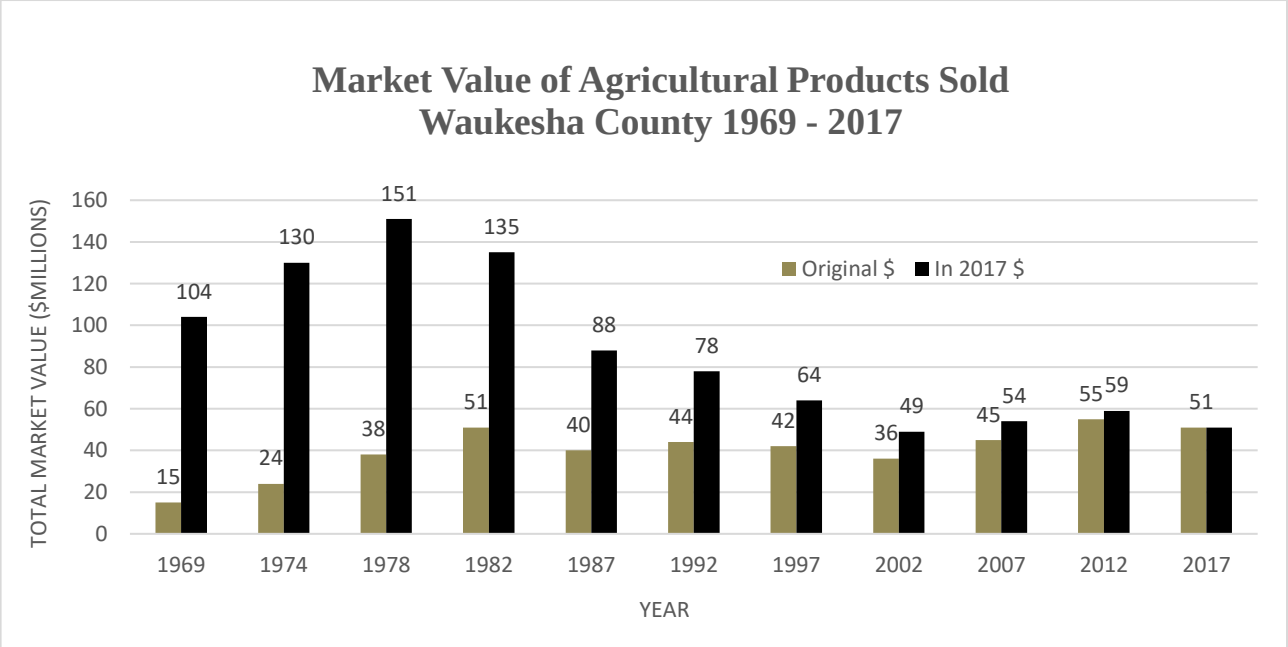
Soils

Soil properties exert a strong influence on the manner in which land is used, since they affect the costs and feasibility of building site development and provision of public facilities. Soils are also an invaluable resource for agricultural and landscaping purposes. Soil surveys have provided definitive data on the physical, chemical, and biological properties of the soils and interpretations of the soil properties for planning, engineering, agricultural and resource conservation purposes. Due to the glaciations of the county, the soil parent material is primarily composed of variations of glacial deposits, with accumulated organics making up most of the lowlands. Soil types vary considerably across the county due to the variations in parent material. For example, the Green Bay glacial lobe left a denser till with higher clay content along the eastern portion of the county, while west of the Kettle Moraine is primarily made up of a more course textured outwash material. Below is a review of some of the soil features, uses and limitations in Waukesha County.

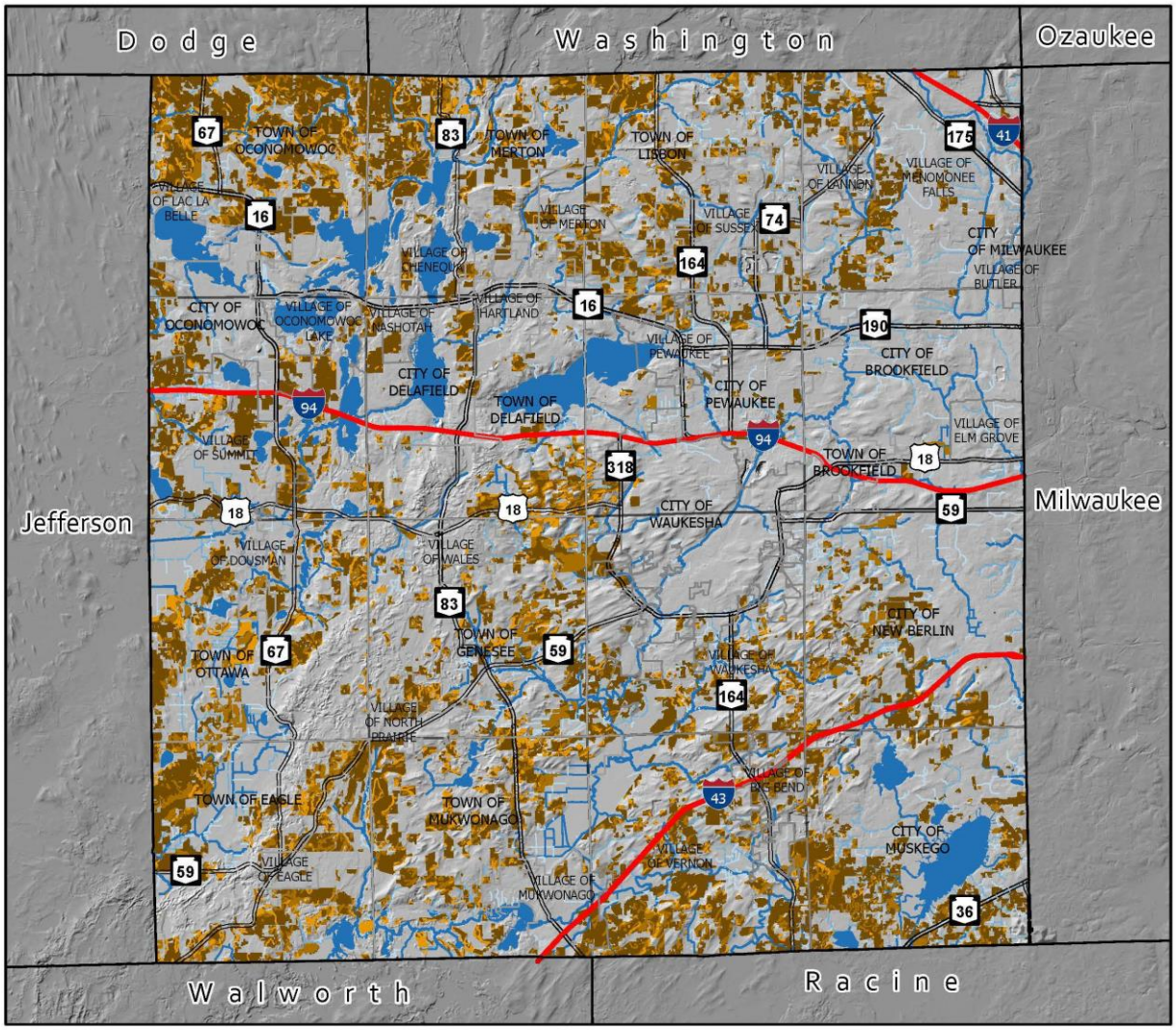
Agricultural Soil Classification and Production

Map II-5 shows the lands in agricultural uses in Waukesha County in 2015 and the classification of those soils for agricultural purposes. This map shows that 76,028 acres or 20% of the county was in agricultural uses in 2015. Of this total, approximately 73% are classified as "prime" agricultural soils, 18% are classified as "Soils of Statewide Importance, and 9% fall into the "other" category, usually due to steep slopes, high groundwater or droughty soils. These inventory results show there has been a dramatic 561% loss in agricultural lands in the county since 1963. More information on the land use changes is provided near the end of this chapter. Figure II-5 shows that the value of agricultural products sold remained relatively steady over the last three decades without an inflationary adjustment. However, when adjusted for inflation, 2017 sales reflect a 66% reduction over the last 40 years. Figure II-6 shows how the 2012 agricultural products sold in the county in the main product categories.

Figure II-5



Map II-5
Agricultural Land Use and Classification - Waukesha County



Legend

- NRCS Prime Agricultural Soils Group
- Soils of Statewide Importance
- Other Soils

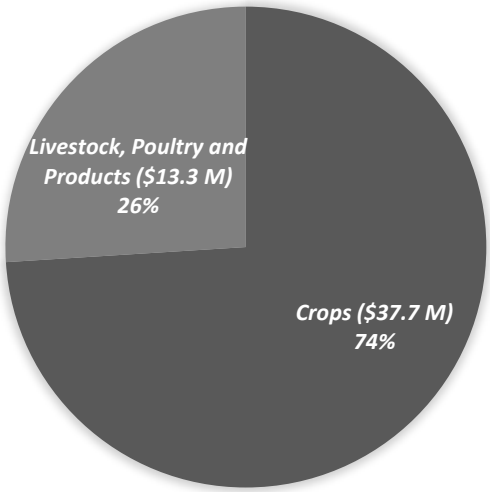
N
W E
S

Source: Waukesha County & NRCS

0 4 8 12
Miles

Figure II-6

PERCENTAGE AND MARKET VALUE OF AGRICULTURAL PRODUCTS SOLD WAUKESHA COUNTY: 2017



Source: USDA, National Agricultural Statistics Service

Soil Erosion Rates

Soils also vary in their individual susceptibility to erosion depending on a number of factors including: parent material, vegetative cover, slope, and most all - management. Tolerable soil loss or "T" for a particular soil is the theoretical maximum rate of soil erosion that will permit a high level of crop production without depleting the soil profile. In Waukesha County, "T" values for the different soil types range from 2-5 tons per acre per year.

For decades, conservationists have used a mathematical formula to estimate the amount of soil lost annually from sheet and rill erosion on cropland. The Universal Soil Loss Equation (USLE) takes into consideration the following factors: rainfall, slope, slope length, soil erodibility, crop rotations and crop practices to arrive at an estimate of soil loss. The Revised Universal Soil Loss Equation – version 2 (RUSLE2) is the current mathematical model also used for soil erosion calculations. It is a software model that incorporates additional years of research in to the soil loss predictions it calculates and is the model prescribed for conservation planning under Chapter ATCP 50 Wisconsin Administrative Code. To determine average soil erosion rates on county cropland, the Land Resources Division conducted its first Transect Survey in the spring of 1999. Normally, this type of survey collects soil loss information for individual cropland fields randomly selected in 0.5-mile intervals along a predetermined driving route in rural areas. However, due to the amount of development in Waukesha County, the interval needed to be shortened to every 0.3-miles in order to obtain the necessary number of sample points for a statistically valid survey.

The methodology has been utilized in other states and has proven to be 90% accurate (+/- 5%) in estimating overall soil erosion rates from cropland. The Transect Survey was repeated in 2001. Both results indicated that nearly 90% of the cropland in Waukesha County is less than or equal to "T" or the tolerable soil loss rate. It should be noted however, that "T" is not a water quality standard. An additional 7% of the cropland was determined to be at 1-2 times the T value. The weighted average tolerable soil loss for

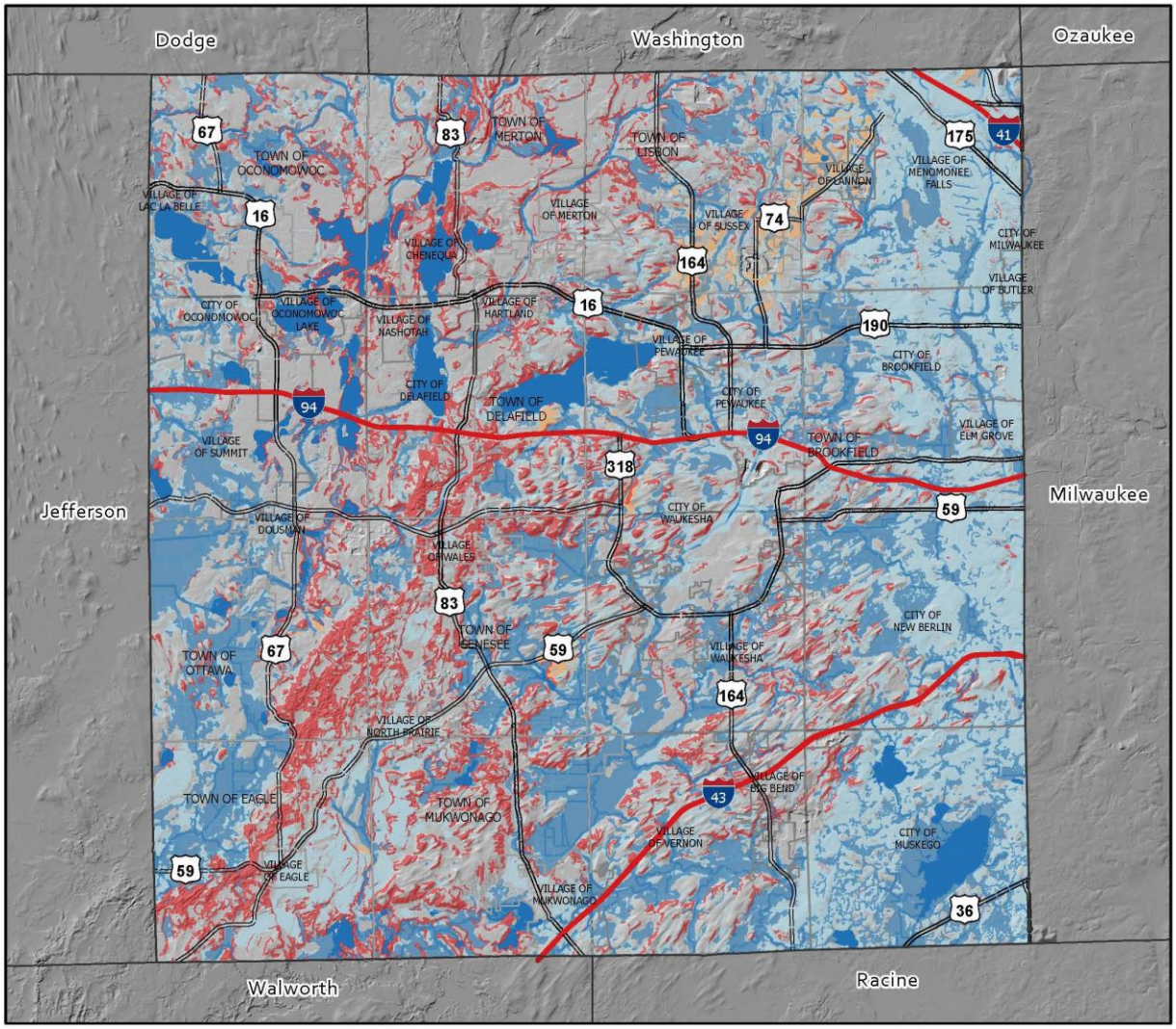
Waukesha County was 4.2 tons per acre. The weighted average tolerable soil loss is based upon the percentage of sample points in the transect survey with different values for "T". For example, the 2001 Transect Survey conducted in Waukesha County indicated that 2% of the sample points had an average tolerable soil loss (T) of two tons per acre per year, 10% had a T of 3 tons/ac, 58% had a T of 4 tons/ac, and 30% had a T of 5 tons/ac. Survey results also indicated that the average soil loss from cropland was 1.5 tons/ac. This is calculated by examining the soil loss at each sample point in the survey. In 2001 there were 677 sample points examined. Due to the continuing loss of sample points to housing developments, the transect survey has been discontinued in Waukesha County. It does indicate however, that soil erosion from lands under development is an ongoing issue to be addressed. Studies have shown that an average construction site with no erosion control measures in place erodes 30 tons of sediment per acre. Much of this is delivered to nearby waterways through efficient delivery systems including road ditches and storm sewers.

Over the years, several programs at the state and federal level have been successful in getting agricultural landowners to do conservation planning for soil loss reduction. These programs include the Oconomowoc River, Upper Fox River, and Muskego-Wind Lakes Priority Watersheds, the Farmland Preservation Program, and the Federal Farm Bill with its conservation planning requirements for Highly Erodible Land (HEL) and the Conservation Reserve Program (CRP). It is believed that these program efforts have contributed to the high percentage of farmland currently within tolerable soil erosion rates.

Soil Limitations for Development

Map II-6 shows the primary soil features that present limitations for land development, including depth to water table and bedrock and steep slopes. Hydric soils generally have seasonal depth to water table of 1 foot or less and are capable of supporting wetland vegetation. A more detailed definition is provided in Appendix A. Poorly drained soils have seasonal depth to water table of 3 feet and are concentrated on the eastern part of the county where many of the soils have a high clay content, often causing a perched water table condition. Shallow water table conditions risk groundwater contamination from on-site septic systems and could cause wetness problems for dwellings with basements. Shallow bedrock conditions pose higher construction costs for basements and also risk groundwater contamination from on-site septic systems because of the lack of a filtering soil layer. Steep slopes represent possible increased grading costs and higher risks for soil erosion during land development activities. Note that steep slopes are concentrated near the Kettle Moraine area. Shallow bedrock is concentrated near the northeast part of the county, where a number of quarry operations are also located, as noted earlier.

Map II-6
Soil Limitations for Development: Waukesha County



Legend

- Hydric Soils
- Hydric Inclusions
- Steep Slopes
- Shallow Bedrock

N
W E
S

Source: Waukesha County, WI DNR, SEWRPC, NRCS

0 4 8 12 Miles

Woodlands & Wetlands

Woodlands

Woodlands have both economic and ecological value and can serve a variety of uses providing multiple benefits. Located primarily on ridges and slopes and along streams and lakeshores, woodlands provide an attractive natural resource, accentuating the beauty of the lakes, streams, and the topography of the County. Under balanced use and sustained yield management, woodlands can, in many cases, serve scenic, wildlife, educational, recreational, environmental protection, and forest production benefits simultaneously. In addition to contributing to clean air and water, groundwater recharge and soil conservation, woodlands contribute to the maintenance of a diversity of plant and animal life and provide for important recreational opportunities.

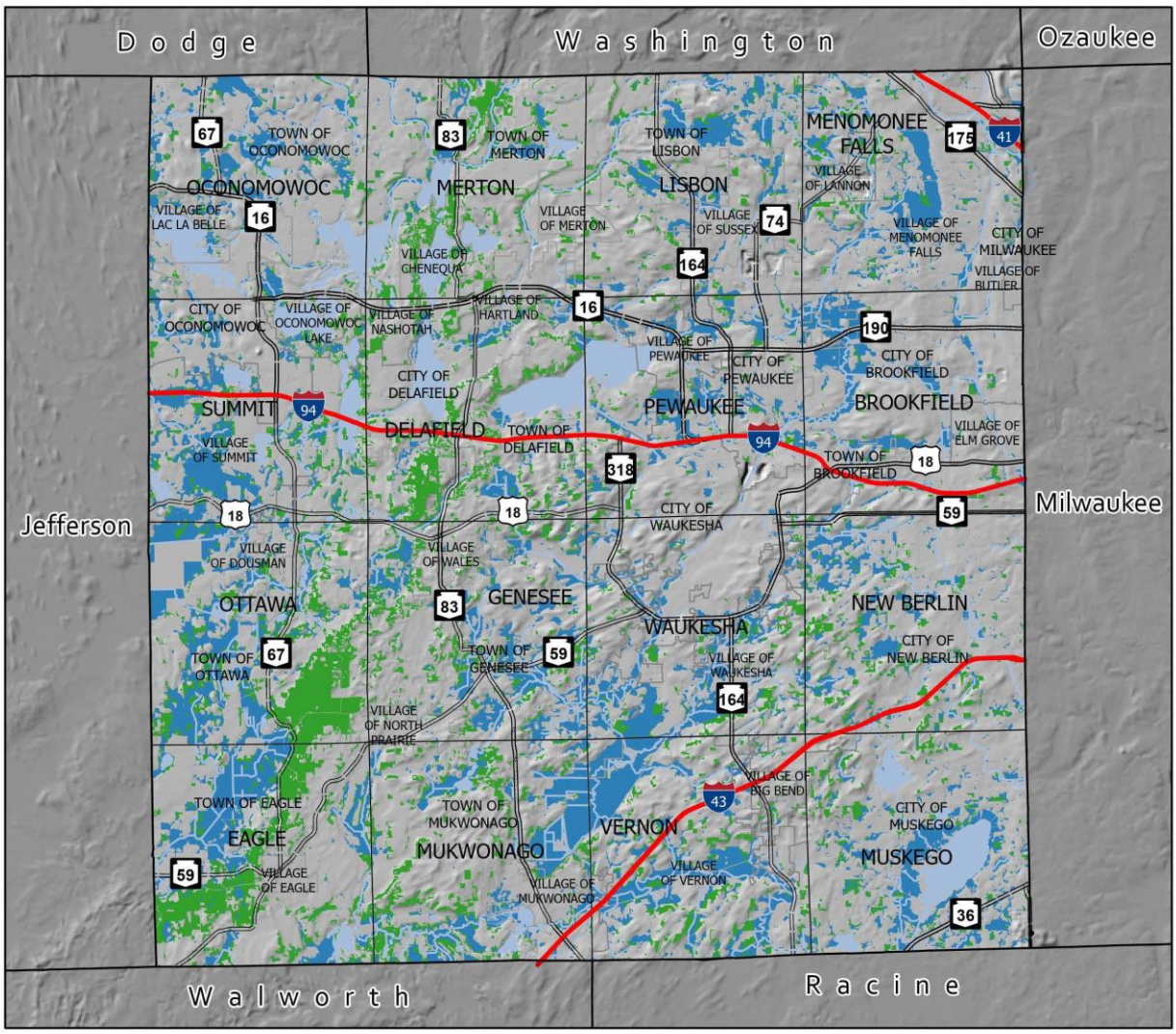
According to the land use inventory prepared by SEWRPC in 2015, woodlands covered approximately 31,827 acres or about 9 percent of the County as shown in Table II-8. As indicated on Map II-7, these woodlands exist in large contiguous areas along the Kettle Moraine in the western half of the County and in scattered small areas throughout the remainder of the County. An update to the woodlands (2020 Land Use) and wetlands will be available in 2023 and the maps will be updated through the Waukesha County interactive mapping system.

Wetlands

Wetlands perform an important set of natural functions, which make them particularly valuable resources lending to overall environmental health and diversity. Wetlands contribute to the maintenance of good water quality by serving as traps that retain nutrients and sediments, thereby preventing them from reaching streams and lakes. They act to retain water during dry periods and hold it during flooding events, thus keeping the water table high and relatively stable. Some wetlands provide seasonal groundwater recharge or discharge. Those wetlands that provide groundwater discharge often provide base flow to surface waters. They provide essential breeding, nesting, resting, and feeding grounds and predator escape cover for many forms of fish and wildlife. These attributes have the net effect of improving general environmental health; providing recreational, research, and educational opportunities; maintaining opportunities for hunting and fishing; and adding to the aesthetics of an area.

Wetlands pose severe limitations for urban development. In general, these limitations are related to the high water table, and the high compressibility and instability, low bearing capacity, and high shrink-swell potential of wetland soils. These limitations may result in flooding, wet basements, unstable foundations, failing pavements, and failing sewer and water lines. Moreover, there are significant and costly onsite preparation and maintenance costs associated with the development of wetland soils, particularly in connection with roads, foundations, and public utilities. As indicated on Map II-7, wetlands are scattered throughout the County and total approximately 57,517 acres or about 15 percent of the County. See Table II-8. Most of these areas are regulated under state and local codes that restrict development.

Map II-7
Major Wetlands and Woodlands in Waukesha County



Legend

2015 Land Use

- Woodlands
- Wetlands

N
W E
S

Source: Waukesha County & SEWRPC

0 4 8 12 Miles

Environmental Corridors and Isolated Natural Resource Areas

The most important elements of the natural resource base of the County, including the best remaining woodlands, wetlands, prairies, wildlife habitat, surface water and associated shorelands and floodlands, and related features, including existing park and open space sites, scenic views, and natural areas and critical species habitat sites, occur in linear patterns in the landscape, termed "environmental corridors." The most important of these have been identified as "primary environmental corridors," which are by definition at least two miles long, 200 feet wide, and 400 acres in area. Primary environmental corridors are generally located along river and major stream valleys, around major inland lakes, and in the Kettle Moraine. The preservation of these corridors is considered essential to the overall environmental quality of the County and the maintenance of its unique cultural and natural heritage and natural beauty. Because these corridors are generally poorly suited for urban development owing to soil limitations, steep slopes, or flooding potential, their preservation will also help to avoid the creation of new environmental and developmental problems.

In addition to primary environmental corridors, other concentrations of natural resources—referred to as "secondary environmental corridors" and "isolated natural resource areas"—have been identified as warranting strong consideration for preservation. Secondary environmental corridors contain a variety of resource features and are by definition at least one mile long and 100 acres in area. Isolated natural resource areas are concentrations of natural resources of at least five acres in size and 200 feet in width that have been separated from the environmental corridor network by urban or agricultural uses.

Groundwater Resources

Groundwater is a vital natural resource of Waukesha County, which not only sustains lake levels and wetlands and provides the perennial base flow of the streams, but also is a major source of water for local communities. In Waukesha County, any discussion of groundwater should be prefaced on which aquifer is being referenced since the issues with each are different. Below is a brief explanation of the local aquifers.

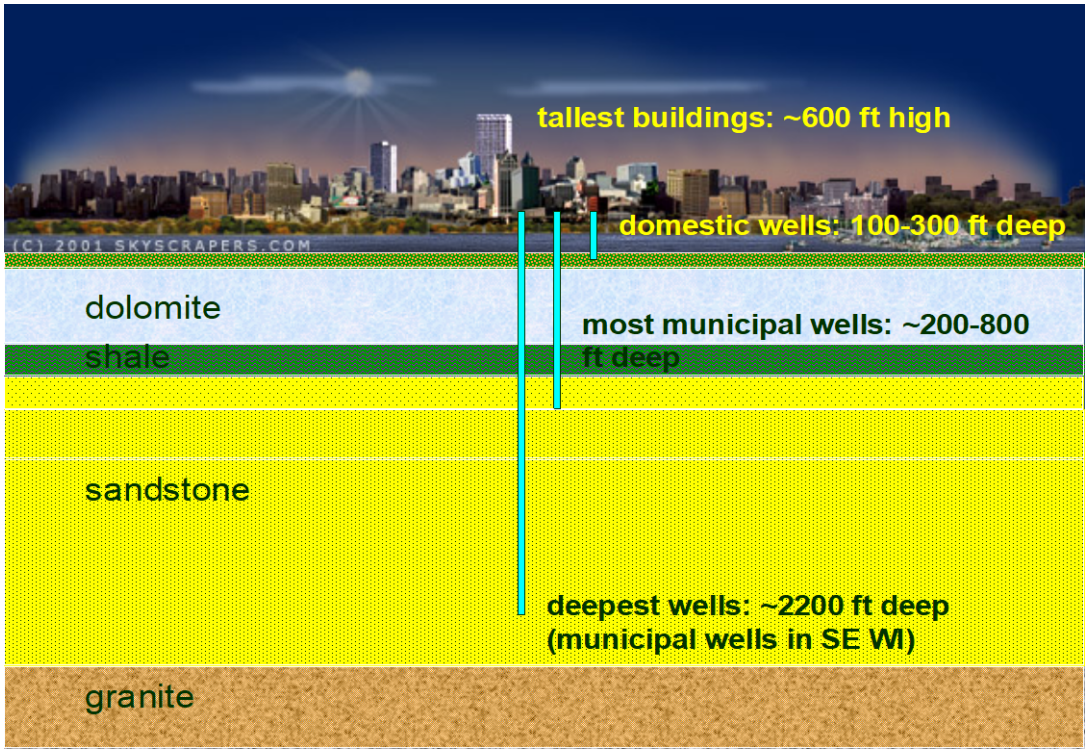
Groundwater Aquifers

Three major aquifers underlie Waukesha County. From the land's surface downward, they are: 1) the sand and gravel deposits in the glacial drift; 2) the shallow dolomite strata in the underlying bedrock; and 3) the deeper sandstone, dolomite, siltstone, and shale strata. Because of their proximity to the land's surface and hydraulic interconnection, the first two aquifers are commonly referred to collectively as the "shallow aquifer," while the latter is referred to as the deep aquifer. The "water table" represents the upper limit of the shallow aquifer, or the beginning of the zone of saturation, and is generally responsible for maintaining stream base flows during dry weather periods and lake water levels in many area lakes. Within most of the County, the shallow and deep aquifers are separated by the Maquoketa shale, which forms a relatively impermeable barrier between the two aquifers (see Figure II-4). That shale layer is absent in the far western portion of the County, representing the recharge area for the deep aquifer. Map II-8 shows a generalized depiction of this recharge area. Figure II-7 depicts the typical well depths as they relate to the groundwater aquifers.

Groundwater Use

The importance of groundwater as a source of water supply in Waukesha County and Southeastern Wisconsin can be shown by analyzing water-use data. According to estimates by the U.S. Geological Survey, water use in Waukesha County in 2005 was approximately 37 million gallons per day (see Table II-2). About 32 mgd, or about 86 percent, was withdrawn from groundwater sources, and 5 mgd, or about 14 percent, from surface water, or Lake Michigan (see Table II-3). Until 2005, nearly all of the water supply in Waukesha County was obtained from the groundwater system. Due to over-pumping of the deep aquifer, the eastern portion of the Village of Menomonee Falls, the Village of Butler, and the eastern portion of the City of New Berlin switched to Lake Michigan water between 1999 and 2005. Table II-3 shows that total water use in the county rose about 19% between 1985 and 2005, from 31 mgd to almost 37 mgd. During this same time period, county population growth was about 29%.

Figure II-7
Relative Well Depths for Waukesha County



Source: SEWRPC

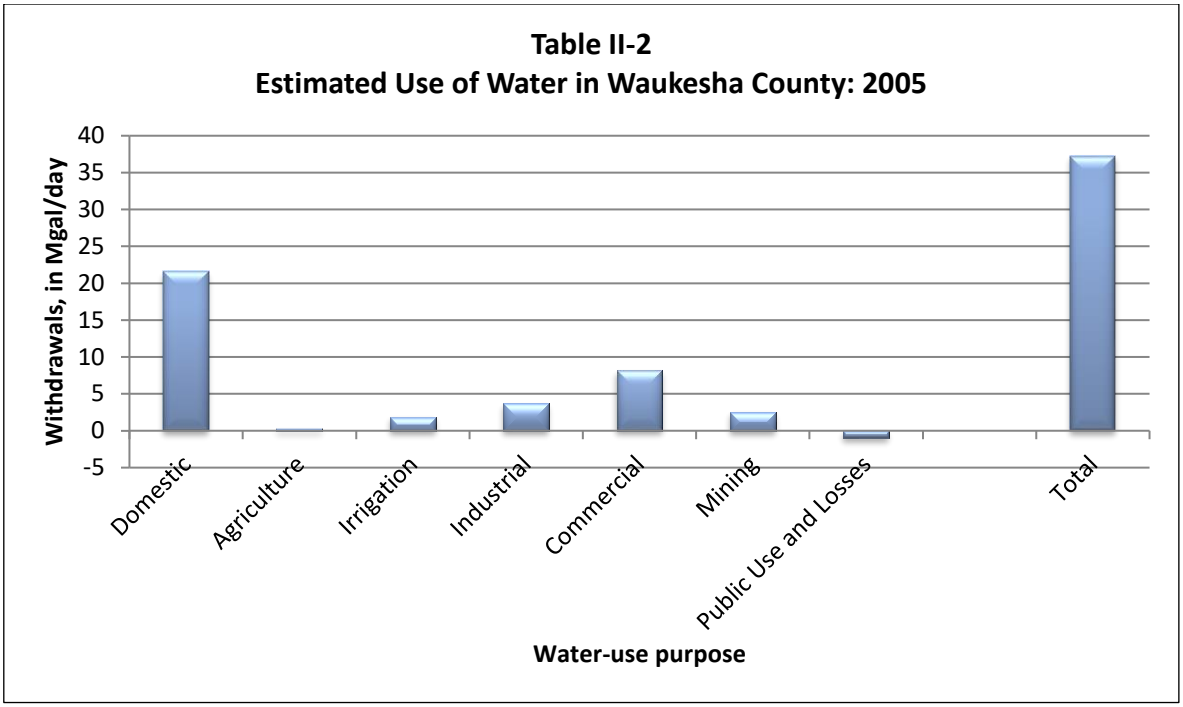
Groundwater Availability

Recharge to groundwater is derived almost entirely from precipitation. Much of the groundwater in shallow aquifers originates from precipitation that has fallen and infiltrated within a radius of about 20 or more miles from where it is found. The deeper sandstone aquifers are recharged by downward leakage of water through the Maquoketa Formation from the overlying aquifers or by infiltration of precipitation beyond the western edge of the County where the sandstone aquifer is not overlain by the Maquoketa Formation and is unconfined (see Map II-8).

On the average, precipitation annually brings about 32 inches of water to the surface area of the County. It is estimated that approximately 80 percent of that total is lost by evapotranspiration. Of the remaining water, part runs off in streams and part becomes groundwater. It is likely that the average annual groundwater recharge to shallow aquifers is 10 to 15 percent of annual precipitation.

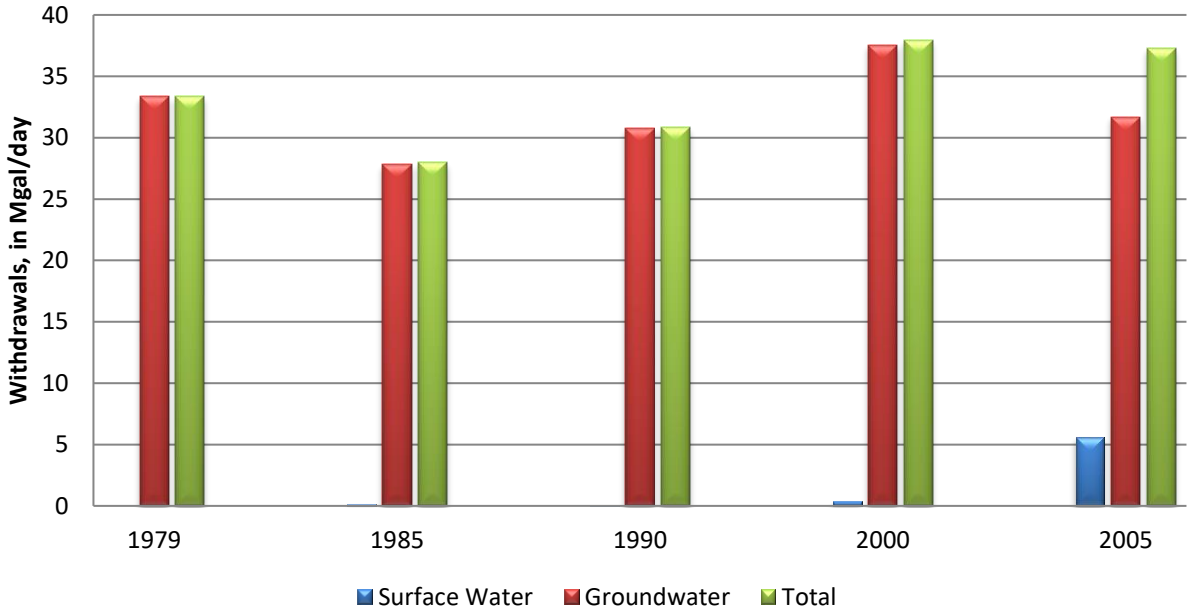
To document the utilization of the shallow aquifers in the County, it may be assumed for example that, on the average, 10 percent of the annual precipitation reaches groundwater. Then, the average groundwater recharge in the County would be about 88 mgd. As previously noted, the estimated daily use of groundwater in 2005 was about 32 mgd, which is about 36 percent of the total amount of groundwater assumed to be recharged in a given year. This indicates that there is an adequate annual groundwater recharge to satisfy water demands on the shallow aquifer system in Waukesha County on a countywide basis. However, the availability on a localized area basis will vary depending upon usage, pumping system configuration, and groundwater flow patterns.

Table II-2
Estimated Use of Water in Waukesha County: 2005



Source: B.R. Ellefson, G.D. Mueller, and C.A. Buchwald, U.S. Geological Survey, "Water Use in Wisconsin, 2005."

Table II-3
Trends in Reported Water Use in Waukesha County: 1979-2005



NOTES: The trends are based on currently available data, but the sources of information and accuracy of data may vary from one reporting period to another. The USGS obtains most of water-use data from files of state agencies, and makes estimates for categories for which data are not reported (private domestic and agricultural uses).

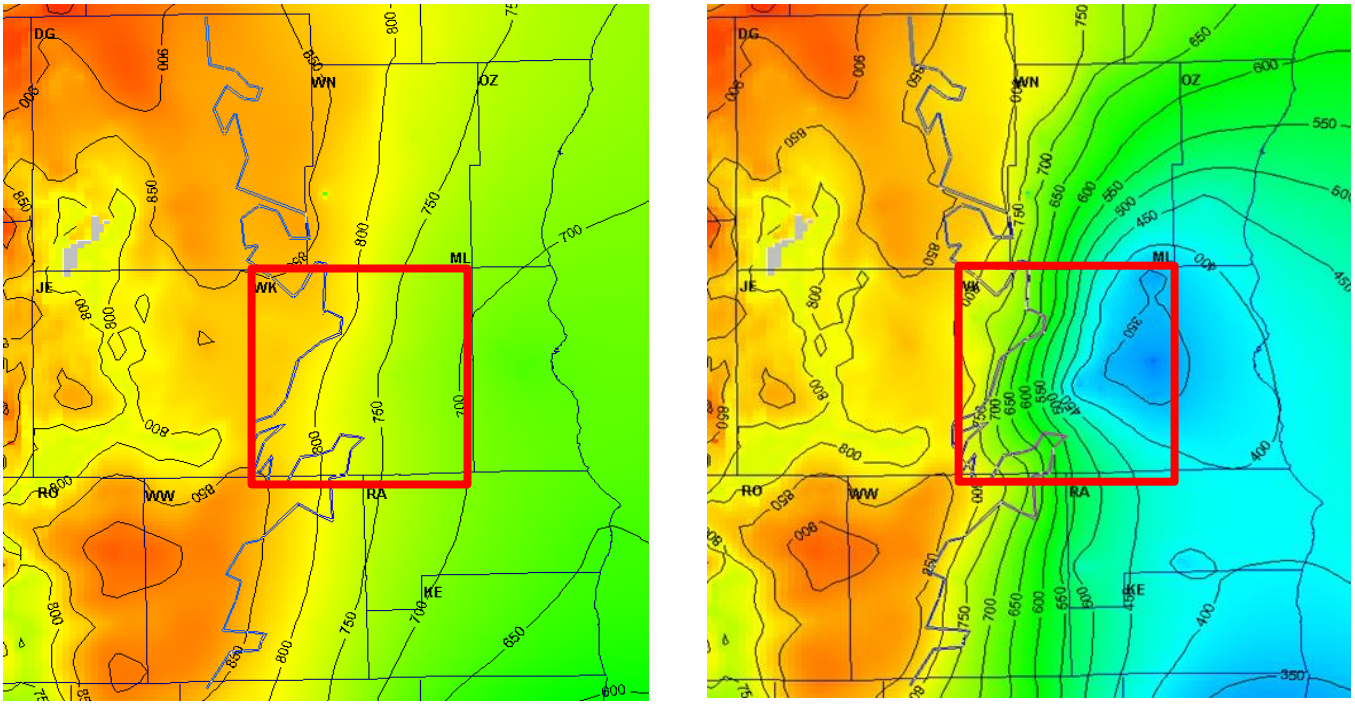
Source: SEWRPC, U.S. Geological Survey, 2005.

The situation is different for the deep aquifers where withdrawals of groundwater cause supply/demand imbalance in areas of concentrated use of groundwater, which has resulted in the declining potentiometric surface and mining of groundwater. Figure II-8 illustrates the cone of depression that has formed in the deep sandstone aquifer in southeast Wisconsin over the past 80 years due to water use in the region.

Figure II-8 shows that the water table elevation in the deep aquifer has dropped over 350 feet in 80 years and that the direction of groundwater flow has actually reversed, drawing water from Lake Michigan rather than draining toward it as it originally did in the early 1900's. The center of the cone of depression slowly progressed to the west and is now near the eastern border of Waukesha County (Brookfield area). Professor Douglas Cherkauer of the University of Wisconsin-Milwaukee, has estimated how much greater the demand is for groundwater from this aquifer than the available supply for Waukesha County, as shown in Table II-4.

Figure II-8
Water Levels in the Sandstone Aquifer in Southeast Wisconsin: 1920-2000
(feet above mean sea level)

1920-1930 1990-2000



Source: SEWRPC

Table II-4
Estimates of Available Groundwater in Waukesha County: 1999

Aquifer	Recharge Area (square miles)	Estimated Recharge Rate (inches per year)	Average Daily Recharge (mgd)	Average Daily Demand (mgd)
Shallow	400	3.1	59	3.5
Deep	100	3.1	14.8	31.5

Source: D.S. Cherkauer, 1999

Radium Concentrations

Certain formations within the Cambrian sandstones in southeastern Wisconsin are known to produce relatively high concentrations of naturally occurring radium, a radioactive metallic element. This naturally occurring radium has been found to exceed U. S. EPA standards in approximately 50 of the 1,300 municipal water supplies in Wisconsin. Most of the water supplies which exceed the radium standard draw water from the deep sandstone aquifer and lie in a narrow band from the Illinois-Wisconsin border through Kenosha, Racine, and Waukesha Counties and north through Green Bay.

Vulnerability to Contamination

Groundwater quality conditions can through improper construction or management be impacted by such sources of pollution on the surface as infiltration of stormwater runoff, landfills, agricultural fertilizer and pesticides (including storage, mixing and loading sites), animal feedlots, manure storage and field application sites, chemical spills, leaking surface or underground storage tanks, silage and crop residue piles, road and parking lot deicing, sumps and dry wells, onsite sewage disposal systems and other below ground waste disposal. The potential for groundwater pollution in the shallow aquifer is dependent on the depth to groundwater, the depth and type of soils through which precipitation must percolate, the location of groundwater recharge areas, and the subsurface geology. Most of Waukesha County exhibits moderate to high potential for contamination of groundwater in the shallow glacial drift and Niagara aquifers. Generally, the areas of the County most vulnerable to groundwater contamination are where both Niagara dolomite and the water table are near the surface.

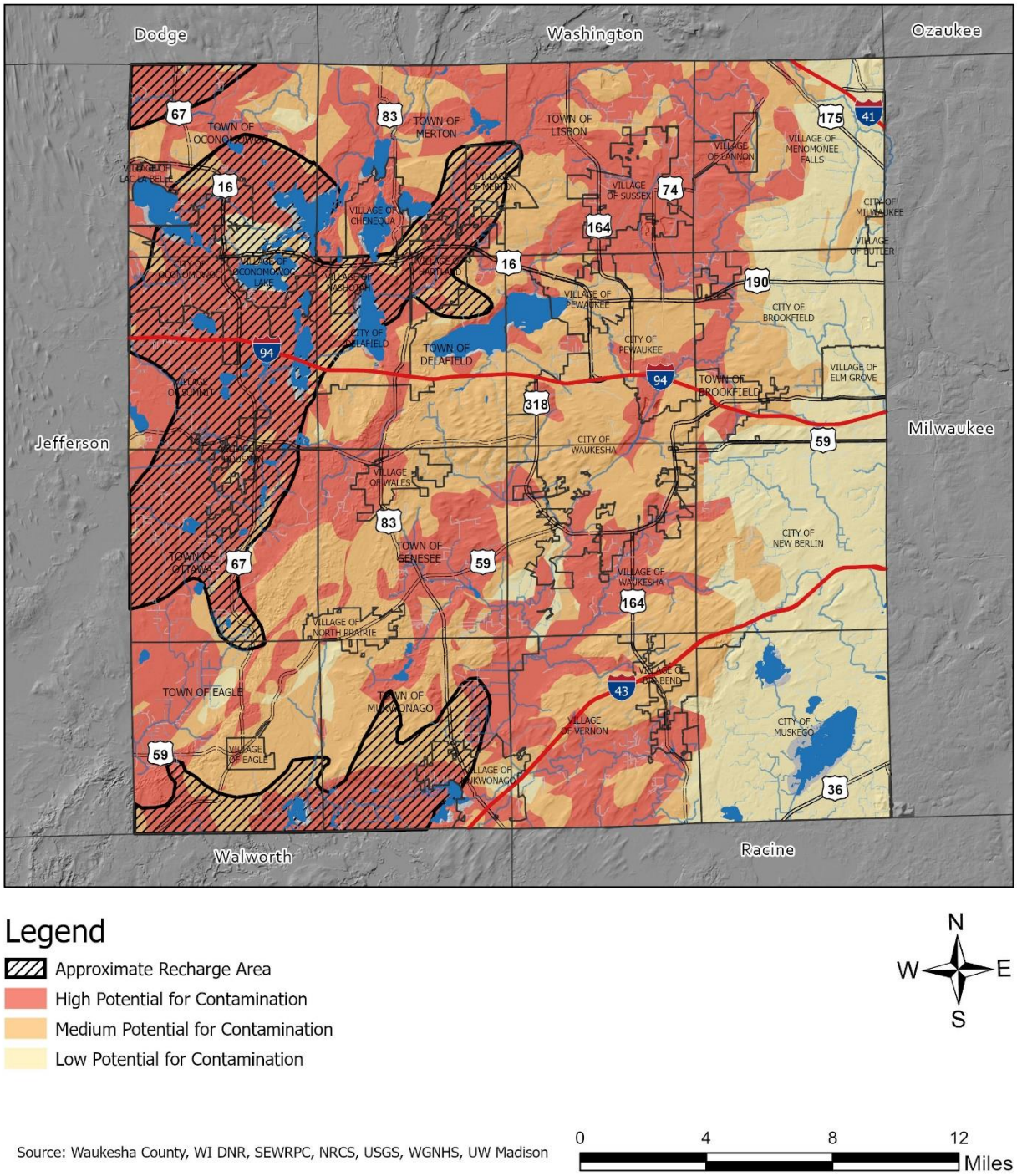
Compared to the deep aquifer, the shallow aquifers are more susceptible to pollution from the surface because they are nearer to the source in terms of both distance and time, thus minimizing the potential for dilution, filtration, and other natural processes that tend to reduce the potential detrimental effects of pollutants. Isolated cases of contamination have been identified in portions of Waukesha County. Such problems can often be traced to runoff pollution sources, septic system discharges, and chemical spills or leakage. Map II-8 shows areas within Waukesha County with groundwater contamination susceptibility, based upon five factors (depth to bedrock, bedrock type, soil permeability, depth to water table and surficial deposits lying on top of bedrock. This map, when used with other information and maps, will help prioritize high risk areas for groundwater protection activities and programs over the next ten years.

In the far western portion of the County, there is no confining impermeable layer of rock between the glacial drift and the sandstone aquifer. This is cause for concern in planning for the future development of that area. Urban development adversely affects both the quantity and quality of recharge water, especially where the aquifer is overlaid by outwash, end moraine, or other highly permeable glacial material. An increase in the area of impervious surfaces such as pavement affects the recharge of the sandstone aquifer by diverting larger amounts of precipitation into surface drainage courses as runoff, rather than allowing it to percolate into the ground. Map II-8 shows the approximate area of the county where the impermeable shale layer does not exist and thus, where recharge of the deep sandstone aquifer occurs, feeding municipal water supplies in the eastern portion of the county.

SEWRPC is currently working on a Chloride Impact Study for the Southeastern Wisconsin Region which will be a comprehensive study of the environmental impacts of the use of chloride on the surface and groundwater resources of the Region. Sources of chloride to be evaluated include road salting and winter deicing, water softening, wastewater treatment plants, industry, and fertilizers. Work began on the study in summer 2017 and to date the Commission staff has focused on the Region-wide monitoring effort. This includes continuous monitoring for specific conductance at 8 stream locations in Waukesha County. Following a detailed site selection process and in-stream monitoring equipment deployment, a two-year comprehensive data collection period began in October 2018 and concluded in October 2020. Monthly grab samples were collected at each site, along with targeted event sampling, to obtain water quality data that include chloride concentrations. Additionally, quarterly sampling was performed at two lakes in Waukesha County (Moose, Little Muskego), collecting temperature, specific conductance, and chloride data at various

depths. The study will transition into the analysis phase upon completion of data collection. The analysis phase will include developing regression relationships for conductance to chloride, a chloride loading analysis and forecasting, summarizing the state-of-the-art for the various sources of chloride, and developing alternate chloride management scenarios.

Map II-8
Groundwater Contamination Potential & Approximate Area of Recharge for the Sandstone Aquifer



Source: Waukesha County, WI DNR, SEWRPC, NRCS, USGS, WGNHS, UW Madison

Water Supply Planning

In response to the growing pressures on community water supplies in southeast Wisconsin, SEWRPC completed a three-phased multi-agency effort to inventory local groundwater resources, develop a regional groundwater model, and develop and publish a Regional Water Supply Plan for Southeast Wisconsin (2010). The plan is based upon an adopted regional comprehensive plan design year of 2035, recommends a sustainable water supply for every community in southeast Wisconsin, and can be found at: http://www.sewrpc.org/SEWRPC/Environment/RegionalWaterSupplyPlan.htm

Drainage Basins and Watersheds

As shown in Map II-9, Waukesha County river systems drain to three major basins, the Rock River Basin on the western side of the county, the Fox River Basin in the center and the Lake Michigan Basin on the eastern part of the county. The Fox River Basin covers the largest area of the county, encompassing about 58 percent of the total surface area. The Rock River Basin encompasses approximately 34 percent and the Lake Michigan Basin accounts for the remaining 8 percent of the county surface area. The Rock and Fox River Basins both lie west of the sub-continental divide and are part of the Mississippi River drainage area. Everything east of the sub-continental divide, including the Menomonee and Root River Watersheds, are part of the Great Lakes-St. Lawrence River drainage system. The sub-continental divide is critical to the water supply issue noted earlier and sanitary sewer planning. This is because water that is pumped from the Great Lakes system is generally required to be returned after use. For water resource planning purposes, each river basin is further divided into watersheds. There are 10 major watersheds in Waukesha County, as shown in Map II-9. The following sections provide additional detail on the watersheds within each basin. Most of the information presented has been compiled from DNR "State of the Basin" reports.

Rock River Basin

In 2012, the US EPA approved a Total Maximum Daily Load (TMDL) for total phosphorus (TP) and sediment (TSS) for the Rock River basin. A TMDL defines the amount of a pollutant a water can receive and still meet water quality standards. Several lakes, rivers, and streams in the Rock River Basin are impaired by excessive phosphorus and sediment concentrations, which lead to nuisance algae growth, oxygen depletion, reduced submerged aquatic vegetation, water clarity problems, and degraded habitat. These impairments adversely affect fish and other aquatic life, water quality, recreation, and navigation. The Rock River TMDL was developed using a watershed framework, where TMDL analysis is simultaneously completed for multiple impaired water bodies in a watershed The TMDL report contains pollutant load allocations both point and nonpoint sources, and some recommended management actions to help restore water quality in the Rock River Basin. Appendix F includes the Rock River TMDL basin and sub-basins. Each sub-basin has a specific TP and TSS load reduction goal to help all waterways in the basin meet water quality standards.

Ashippun River Watershed

The Ashippun River Watershed lies in Dodge, Washington, and Waukesha counties. It covers 69 square miles, of which approximately 16 square miles or 23 percent of the total watershed is located in northwestern Waukesha County. Agriculture is the primary land use and accounts for 57 percent of the land use in the Waukesha County portion of the watershed, according to the Year 2015 SEWRPC land use inventory.

From its headwaters in a small wetland and agricultural area, the Ashippun River flows at a low gradient (6 ft/mile) southwest through Druid Lake in Washington County to the Rock River in Dodge County. The water is stained light brown by tannic acid and the bottom is largely silt. Other than the Ashippun River, none of the major streams in the watershed are found in Waukesha County.

The Ashippun River is classified as a warm water sport fishery. However, little is known about the Ashippun River's water quality or whether the river is meeting its full potential.

The Ashippun River is within the Rock River TMDL basin and was placed on the impaired waters list by Wisconsin DNR in 2014 for total phosphorus. The 2016 assessments showed continued impairment by phosphorus; total phosphorus sample data exceed 2016 WisCALM listing criteria for the Fish and Aquatic Life use, however, available biological data do not indicate impairment (i.e. no macroinvertebrate or fish Index of Biotic Integrity (IBI) scored in the "poor" condition category). This water was also assessed for temperature and sample data did not exceed 2016 WisCALM listing criteria for the Fish and Aquatic Life use. Based on the most updated information, no change in existing impaired waters listing is needed.

Bark River Watershed

This 186-square mile watershed drains portions of Washington, Waukesha, and Jefferson counties and has many natural lakes, some of them large. About 47 percent of the area is in Waukesha County, 45 percent in Jefferson County and the remainder is in Washington County. Many of the watershed's lakes are experiencing heavy development pressure or have extensive development around them. While some wetlands have been drained or filled, a significant amount of wetland remains. The greatest threat to the basin's wetlands is rapid development in Waukesha County.

The watershed is about 20 percent agricultural, but significant rural subdivision development occurs in the Waukesha County portion of the watershed. Of the agricultural lands, about 7 percent have high soil erosion potential. Thus, agriculture use and rural development degrade local surface water quality.

Major streams in the Waukesha County portion of the Bark River watershed include the Bark River, Scuppernong Creek, and Wales Creek. Additional information on each of the streams is included in Table II-5. The Bark River is classified as a warm water sport fishery but is only partially meeting that use, primarily due to urban and rural polluted runoff entering the river and its tributaries. Most of the urban runoff pollution occurs in Waukesha County, where rapid development of urban and suburban "pockets" occurs along and between its many lakes. There are currently two municipal sewage treatment plants that discharge to the Bark River within Waukesha County, the Village of Dousman and the Delafield-Hartland facility, which discharges just downstream from Nagawicka Lake. Both sites are shown in Map II-9.

Scuppernong Creek rises at the edge of the moraines in central Waukesha County. The creek passes through rural areas much of its length, but subdivisions are developing rapidly in the upstream reach near Wales. Numerous drainage ditch inlets carry agricultural runoff to the stream. There are two impoundments on Scuppernong Creek. Historical records suggest the reach from the headwaters to Waterville Lake supported a viable trout population in the early part of the 20th century. Excessive ditching of tributaries and wetlands and the construction of a dam at Waterville, altered stream habitat so it now supports a warm water sport fishery. From the Waterville dam downstream to Dutchman Lake the stream supports a Class I trout fishery due to a large spring that augments flow and lowers stream temperature. Water quality from Dutchman Lake to the old Dousman Millpond is good. There are many springs and the reach supports a warm water sport fishery. Below the Dousman Millpond water quality is poor due to the large sediment load and a much lower gradient. Wales Creek, a small tributary to Scuppernong Creek, is fed by an extensive system of springs; this stream may support a small population of trout.

The Bark River is within the Rock River TMDL basin and from mouth at Rock River to Scuppernong Creek was assessed by Wisconsin DNR during the 2016 listing cycle; total phosphorus sample data exceed 2016 WisCALM listing criteria for the Fish and Aquatic Life use, however, available biological data do not indicate impairment (i.e. no macroinvertebrate or fish Index of Biotic Integrity (IBI) scored in the "poor" condition category). The Bark River from the NW corner of Bark River Parkway to its headwaters was assessed by Wisconsin DNR during the 2018 listing cycle; new total phosphorus and biological (fish Index of Biotic Integrity (IBI) scores) sample data were clearly below the 2018 WisCALM listing thresholds for the Fish and Aquatic Life use. This water was meeting this designated use and was not considered impaired.

Oconomowoc River Watershed

The Oconomowoc River Watershed drains approximately 128 square miles encompassing portions of Dodge, Jefferson, Washington, and Waukesha counties. The Waukesha County portion of the watershed is approximately 63 square miles in size representing 49 percent of the watershed. According to the Year 2015 SEWRPC land use inventory, nearly 25 percent of the Waukesha County portion of the watershed is agricultural. Residential land use comprises another 20 percent in Waukesha County and open water from the many lakes and streams accounts for another 14 percent. From its origin in the Town of Richfield in Washington County, the Oconomowoc River flows in a southwesterly direction through six major lakes for approximately 49 miles before entering the Rock River in the Town of Ixonia, Jefferson County.

There is one sewage treatment plant discharge in the Oconomowoc River from the City of Oconomowoc, approximately 2 miles downstream of Lac Labelle. Major lakes in the Waukesha County portion of the watershed include Beaver, Fowler, Lac LaBelle, Keesus, Moose, North, Oconomowoc, Okauchee, Pine and Silver lakes. In addition to the Oconomowoc River, major streams in the Waukesha County portion of the watershed include Battle Creek, Little Oconomowoc River, Mason Creek, and Rosenow Creek. Rosenow Creek is a designated trout stream and the location of a stream restoration project.

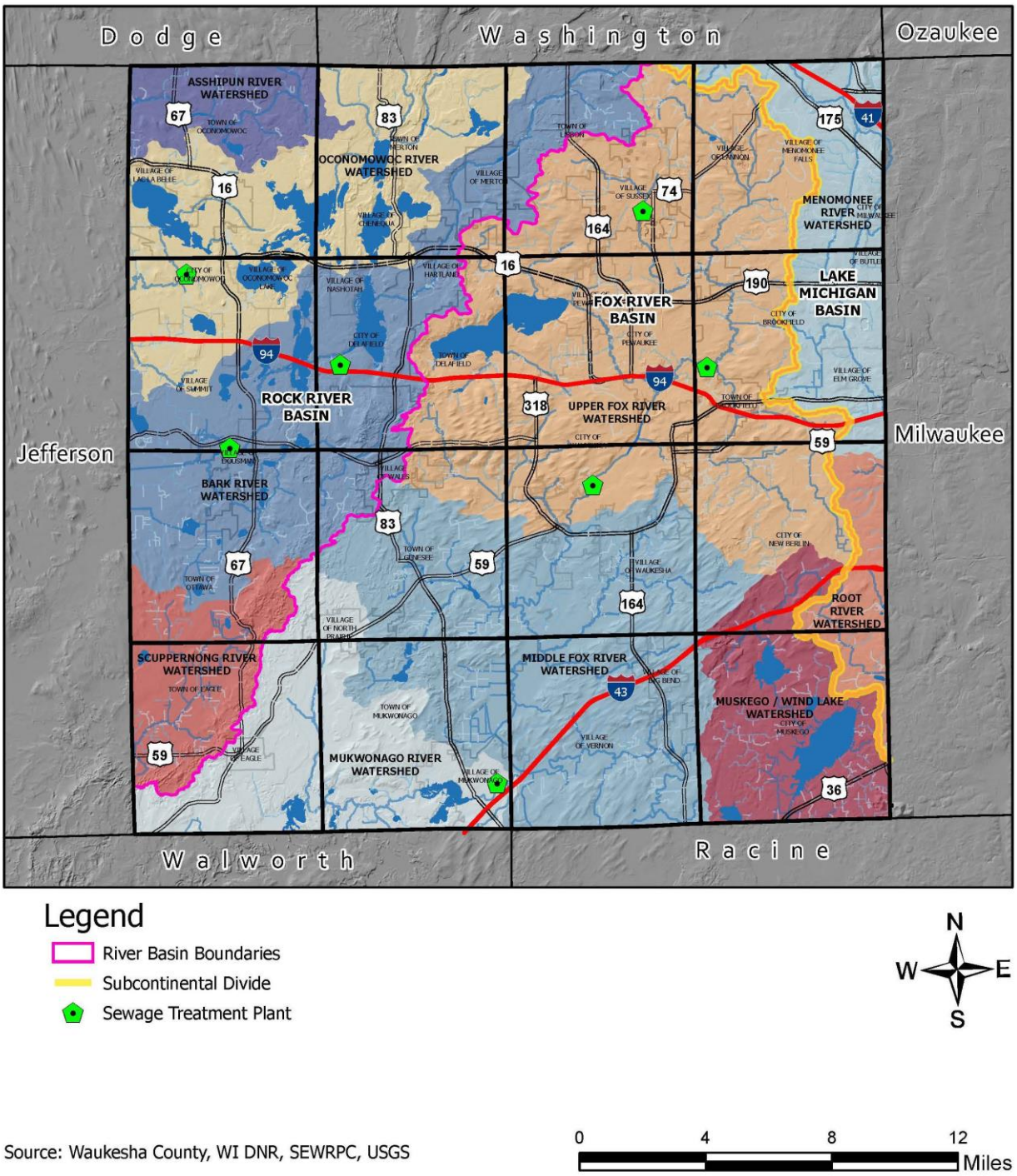
Rapid urbanization of the watershed is continuing, especially on and near lakes. The cumulative effect of this urbanization is threatening water quality and hastening the eutrophication of the lakes.

Battle Creek (miles 1.81-4.56) is a part of the Rock River Basin and is listed as impaired for sediment/total suspended solids. The Rock River Basin TMDLs for phosphorus and sediment were approved by the USEPA September 28, 2011. Battle Creek was assessed again by Wisconsin DNR during the 2018 listing cycle; temperature and new total phosphorus sample data clearly meets 2018 WisCALM listing criteria for the Fish and Aquatic Life use.

Mason Creek (851100, miles 0-6.14) is a part of the Rock River Basin and is listed as impaired for total phosphorus and sediment/total suspended solids. The Rock River Basin TMDLs for phosphorus and sediment were approved by the USEPA September 28, 2011. Mason Creek was assessed again during the 2018 and 2020 listing cycles; new temperature sample data exceed 2018 WisCALM listing criteria for the Fish and temperature sample data exceed 2020 WisCALM listing criteria for the Fish and Aquatic Life use. Based on the most updated information, no change in existing impaired waters listing is needed. Oconomowoc Lake was placed on the impaired waters list due to mercury in fish tissue from 1998 to 2020. Samples showed this lake is covered by the general mercury fish consumption advisory. This lake was evaluated for phosphorus and algae every two years between 2012 and 2022 and these showed a healthy system. Aquatic plant communities were evaluated in two separate years, 2012 and 2017, and were in good condition. This lake is on the Healthy Waters List.

Okauchee Lake and North Lake were both evaluated for phosphorus and algae every two years between 2014 and 2022. Phosphorus levels were found to be too high (total phosphorus sample data exceeded WisCALM listing thresholds for the Recreation use and Fish and Aquatic Life use, however, chlorophyll data do not exceed REC or FAL thresholds). These lakes are covered by a watershed plan: Mason Creek Watershed Protection Plan (2018). Chlorides in Okauchee Lake were also assessed, but did not exceed 2020 WisCALM criteria.

Map II-9
Major Watersheds in Waukesha County



Scuppernong River Watershed

The Scuppernong River is a tributary of the Bark River in Jefferson County. The watershed is bordered on the southeast by the Kettle Moraine State Forest and lies with in portions of three counties: Jefferson, Walworth, and Waukesha. The predominant land use is agricultural though there is significant public ownership in the state forest and two state wildlife areas with large forested tracts and wetland areas. Other wetland areas have been drained for agriculture. Substantial low-density residential and industrial development is occurring throughout the watershed. According to the Year 2015 SEWRPC land use inventory, approximately 3,903 acres or 25 percent of the Waukesha County portion of the watershed is agricultural. Another 4,706 acres or 30 percent is considered wetland and, 4,262 acres or 27 percent is classified as woodland.

Major streams found in the Waukesha County portion of the watershed include the Scuppernong River and Paradise Springs Creek. The Scuppernong River rises at the edge of the interlobate moraine in the Kettle Moraine State Forest. Reproducing populations of brown trout inhabit the upper reaches, but habitat is impaired by old hatchery ponds that discharge warmer water to the stream. From the area just below the hatchery pond to the Waukesha County line, the stream is a Class III trout stream.

Paradise Springs Creek is a Class II trout stream in Waukesha County. Trout rearing ponds were constructed at the headwaters of the stream several years ago, resulting in the degradation of water quality due to warming of the water. All but one pond have been removed. Segments of the stream are ditched and straightened. Recent habitat work has been done to counteract the effects of previous ditching.

The Scuppernong River (stream miles 10.31 - 12.46) is within the Rock River TMDL basin and was assessed during the 2014 listing cycle; total phosphorus sample data exceed 2014 WisCALM listing criteria for the Fish and Aquatic Life use, however, available biological data do not indicate impairment (i.e. no macroinvertebrate or fish Index of Biotic Integrity (IBI) scored in the "poor" condition category). This water was assessed again during the 2016 and 2018 listing cycles; total phosphorus sample data exceed 2016 and 2018 WisCALM listing criteria for the Fish and Aquatic Life use, however, available biological data do not indicate impairment (i.e. no macroinvertebrate or fish Index of Biotic Integrity (IBI) scored in the "poor" condition category).

Fox River Basin

Upper Fox River Watershed

The Upper Fox River Watershed is a 151 square mile drainage area located almost entirely in Waukesha County, with a very small portion (1%) located in Washington County. The Upper Fox River is the principal perennial stream in the watershed. Other significant perennial streams include Brandy Brook, Deer Creek, Pebble Creek, Pewaukee River, Poplar Creek and Sussex Creek.

According to the Year 2015 SEWRPC land use inventory, 26 percent of the watershed is mapped as residential land use. Other land use categories include agricultural (13%), wetlands (15%), and transportation related (12%). Commercial and industrial land uses account for another 7 percent of the land area. There are many incorporated municipalities within the watershed including the Cities of Brookfield, Delafield, New Berlin, Pewaukee, and Waukesha. Also included are the Villages of Hartland, Lannon, Menomonee Falls, Pewaukee, Sussex, and Wales. There are three sewage treatment plant discharges into the Fox River in this watershed. Starting upstream, they are the Village of Sussex, the City of Brookfield and the City of Waukesha, as shown in Map II-9.

The Upper Fox River contains over 80 miles of perennial streams exhibiting a wide range of quality. The Fox River, Frame Park Creek and Zion Creek are listed as impaired waters on the state's 303(d) list. Due to the extent and number of TP and Sediment (TSS) impaired waters in this watershed, a TMDL may be developed by Wisconsin DNR in the next five years.

Zion Creek has been on the State's 303(d) impaired waters list since 1998 for Total Suspended Solids and Total Phosphorus. This stream segment was evaluated in 2018 and 2022 by Wisconsin DNR; chloride, phosphorus, and bacteria indicated a healthy system. Due to morphology of the stream the local DNR stream biologist requested one more year of data before working to delist this creek for phosphorus impairment.

The Fox River (stream miles 113.99 - 121.06, 105.34 - 109.21 and 85.23 - 91.98) are impaired due to one or more pollutants and associated quality impacts. These segments of the Fox River were put on the 303d impaired waters list beginning in 1998 due to elevated total suspended solids, total phosphorus, and/or PCBs. These three segments of the Fox River have been evaluated by Wisconsin DNR during every two-year cycle from 2014 to 2022; elevated phosphorus concentrations above WisCALM listing criteria for the Fish and Aquatic Life use was confirmed repeatedly, however, available biological data do not indicate impairment (i.e. no macroinvertebrate or fish Index of Biotic Integrity (IBI) scored in the "poor" condition category). Assessments during the 2020 listing cycle showed conditions unclear for healthy aquatic communities like plants, fish, and bugs. Frame Park Creek is impaired due to degraded habitat, chronic toxicity, temperature, and low dissolved oxygen, due to point and non-point source discharges since 1998. Historical sediment monitoring and recent Whole Effluent Toxicity, Fish Community, and Habitat surveys support the continued listing of this waterbody by the DNR, with an expansion to the list of pollutants and sources of impairments. The contributing watershed to Frame Park Creek has numerous industries, municipal waste yards, and NPS contributions. These sources of pollutants, along a documented spill and associated fish kill (2006), significant historical habitat modification and stream enclosure, have contributed to the degradation of the biological community of Frame Park Creek. Frame Park Creek is listed on the Impaired Waters List for degraded habitat, chronic toxicity, temperature, and low dissolved oxygen, due to point and non-point source discharges. Historical sediment monitoring and recent Whole Effluent Toxicity, Fish Community, and Habitat surveys support the continued listing of this waterbody, with an expansion to the list of pollutants and sources of impairments.

Poplar Creek (0.00 - 3.64 stream miles) is impaired due to one or more pollutants and associated quality impacts and was first placed on the impaired waters 303d list in 1998. This water was assessed again during the 2018 listing cycle; new total phosphorus sample data exceed 2018 WisCALM listing criteria for the Fish and Aquatic Life use, however, available biological data do not indicate impairment. New biological sample data were assessed, however, no macroinvertebrate or fish Index of Biotic Integrity (IBI) scored in the "poor" condition category.

Coco Creek, which flows into Pewaukee Lake, has the potential to support a cold water community. The Pewaukee River contains a fairly decent forage and gamefish population. Sussex Creek has been impacted by development and mining in the area. This area is severely impacted by development and by increases in the amount of impervious surfaces. This contributes to the “flashy” nature of the streams in this area. Impoundments contribute to decreased fish migration and degraded water quality.

Today, both the main stem and north branch of Frame Park Creek suffer from severe impairments. The majority of wetlands originally present have been drained and filled. The combined effects of stream modifications like channel manipulation, relocation, and enclosure have damaged water and habitat quality. These water bodies are included on WDNR’s statewide list of polluted and impaired waters for degraded habitat, chronic toxicity, temperature, and low dissolved oxygen due to point and non-point source discharges.

Another cold-water resource in the Upper Fox River watershed is Pebble Creek. Pebble Creek, and its major tributary Brandy Brook, drain approximately 18 square miles located in the extreme southwest corner of the Upper Fox River Basin before flowing into the Illinois Fox River just north of State Highway 59. Pebble Creek has the potential to support a coldwater Class I and II brook and brown trout fishery. Although Brook trout have never been recorded in this urbanizing watershed, healthy populations of mottled sculpin, a

coldwater indicator species, have been recorded in the headwaters of this stream system. While the upper portions of the watershed contain coldwater species, the lower portions of Pebble Creek extending from CTH D to the confluence with the Fox River contain northern pike among several other high-quality warm water species (Pebble Creek Watershed Protection Plan, Southeastern Wisconsin Regional Planning Commission, Community Assistance Report No. 284, 2008).

At nearly 2500 acres, Pewaukee Lake is the only lake of significant size in the watershed with a maximum depth of 45 feet and an average depth of 15 feet. It is also one of the largest lakes in southeastern Wisconsin and recognized as one of the top musky lakes in the state. The lake level was naturally controlled until 1838 when a dam was constructed at the lake outlet to power a mill. This resulted in lake levels rising about six feet and the surface area of the lake doubling. Present levels are artificially controlled by a dam at the outlet of the Lake to the Pewaukee River, which then flows about 4.4 miles to its confluence with the Fox River. Water quality data collected over the years indicates fair to very good water quality. However, continued development in the watershed and its subsequent increase in runoff have raised concerns about future pollutant loadings.

Mukwonago River Watershed

The Mukwonago River Watershed covers approximately 86 square miles in Jefferson, Waukesha and Walworth counties. It is the smallest watershed in the Fox River Basin. Approximately 52 square miles or 61 percent of the watershed area lies within Waukesha County. The Villages of Eagle, Mukwonago, North Prairie and Wales are found within the watershed boundary. The Village of Mukwonago has a wastewater treatment plant discharging into the Mukwonago River.

Rural uses cover most of the land area in the watershed. Agriculture is dominant even in the Waukesha County portion where, according to the Year 2015 SEWRPC land use inventory, agriculture accounts for approximately 27 percent of the land use. Residential land use accounts for another 22 percent of the watershed area in Waukesha County followed by woodlands (15%) and wetlands (10%).

There are nearly 50 miles of perennial streams in the watershed. Jericho Creek in the Village of Eagle and an unnamed ditch in the Village of Mukwonago are listed as supporting a cold water aquatic community. In addition, the Mukwonago River is listed as an exceptional resource water in the state. None of the streams in the watershed are listed as impaired on the 303(d) list.

This is perhaps the least disturbed watershed in the Fox River Basin. There are diverse and unique populations of warm water forage fish, game fish, mussels, amphibians and invertebrates. Development of this watershed has increased rapidly in the last few years. Impervious surfaces are becoming more abundant and stormwater runoff is increasing. Many of the historic areas that supported agriculture are now supporting suburban housing development. Concern over the impact of development pressures in the watershed has led to the formation of the Friends of the Mukwonago River, a group dedicated to the protection of the river and its watershed.

Middle Fox River Watershed

The Middle Fox River Watershed is the largest of the Fox River Basin watersheds (248 square miles), encompassing portions of Racine and Waukesha Counties, along with small portions of Milwaukee and Walworth Counties. The Waukesha County portion of the watershed covers 64,579 acres or approximately 100 square miles. In Waukesha County, portions of the Cities of Muskego, New Berlin, and Waukesha lie within the watershed, along with the Villages of Big Bend, Mukwonago, North Prairie, Vernon, Wales and Waukesha.

Agriculture accounts for over 25 percent of the area. Other rural uses include grasslands (18%), wetlands (22%), and forests (8%). Urban areas comprise nearly twenty-three percent of the land use in the watershed.

There are about 40 miles of major perennial streams in this watershed within Waukesha County. Genesee Creek, Mill Brook, Spring Creek and White Creek are listed as cold-water communities. Some streams in the watershed are listed on the 303(d) list. General threats to stream water quality in this watershed include: construction site erosion; habitat modification; ditching and channelization; temperature elevation and stormwater runoff. Due to the extent and number of TP and Sediment (TSS) impaired waters in this watershed, a TMDL may be developed by Wisconsin DNR in the next five years.

Concerns over water resource problems in the Fox River system including navigation, water use conflicts, water quality, flooding and drainage led to the formation of the Southeastern Wisconsin Fox River Commission in 1997 by Wisconsin Act 27 (1997-1999 Budget Bill). This Commission was directed by the enabling legislation to develop an implementation plan to address goals including: 1) Protection and rehabilitation of the water quality of the surface waters and groundwater of the Fox River Basin; 2) protection and enhancement of the recreational use of the navigable waters; and 3) increasing water and boating safety on the same navigable waters. Member of the Commission include city, town, and village officials from communities within the watershed, local residents, representatives from the DNR and SEWRPC, and representatives from Kenosha, Racine and Waukesha Counties. Using grant funds from the Commission, several conservation practices have been installed. These include streambank stabilization projects, grassed waterways, and wetland restoration.

Spring Creek is a tributary to the Fox River in Waukesha County. The creek suffers from low dissolved oxygen levels caused by high phosphorus loads. It has been on the state's 303(d) impaired waters list since 1998 for Total Phosphorus. Assessments in the 2020 and 2022 confirm the listing.

The Fox River (91.98 - 105.34 stream mile segment) is impaired by PCBs, listed in 1998. This segment was listed for phosphorus in the 2014 cycle. Evaluations every two-year cycle from 2014 to 2022 confirmed the phosphorus impairment. The Fox River (47.17 - 85.23 stream mile segment) was also put on the state's Impaired Waters List in the 1998 cycle for PCBs in fish tissue. This river segment was evaluated every two-year cycle from 2012 to 2022; phosphorus was identified as too high in the 2012 cycle and added to the list along with poor biology. Chloride and bug data evaluation showed no impairment. In the 2022 cycle fish communities were shown to be in poor condition, confirming the degraded biology impairment.

Muskego/Wind Lakes Watershed

The Muskego/Wind Lakes Watershed is actually a small portion (41 square miles) of the Middle Fox River Watershed located in Waukesha, Racine, and Milwaukee Counties. The Waukesha County portion of the watershed encompasses approximately 36 square miles and includes portions of the Cities of Muskego and New Berlin.

Agriculture accounts for approximately 23 percent of the land use. Residential land use accounts for another 20 percent of the watershed area in Waukesha County followed by wetlands (15%) and surface water (13%).

Lake Michigan Basin

Menomonee River Watershed

The Menomonee River Watershed covers 136 square miles in portions of Washington, Waukesha, and Milwaukee Counties. The Waukesha County portion of the watershed covers about 37 square miles and includes portions of the Cities of Brookfield and Menomonee Falls as well as the Villages of Butler and Elm Grove. The Menomonee River originates in wetlands near the Village of Germantown in Washington County and runs southeasterly for 32 miles before meeting the Milwaukee and Kinnickinnic Rivers in the Milwaukee Harbor.

Nearly all of the land area in the watershed is within incorporated municipalities. According to the Year 2015 SEWRPC land use inventory, nearly 43 percent of the Waukesha County portion of the watershed is

residential. Other land uses in Waukesha County include: transportation related (16%), wetlands (8%), and agriculture (3%). Commercial and industrial land uses each contribute another 6 percent of the total land uses respectively.

Stream and wetland modification, urban and rural runoff, construction site erosion and industrial point sources of pollution are the major contributors to degraded water and habitat quality within this watershed. Ninety-six miles of streams are found within the watershed. Over eight miles of stream are listed on the 303(d) list as impaired. Many streams in this watershed have been concrete lined or straightened to convey floodwaters off the land faster. Flooding continues to be a major concern in this watershed.

The Menomonee River watershed is within the Milwaukee River basin. This Milwaukee River TMDL includes the Menomonee River, Kinnickinnic River and Milwaukee River watersheds, as well as the Milwaukee Harbor Estuary. The TMDL was approved by the US EPA in 2018. Appendix F shows the portion of Waukesha County within the Milwaukee River TMDL watershed.

A TMDL defines the amount of a pollutant a water can receive and still meet water quality standards. The Milwaukee River TMDL was developed in response to multiple streams in the watershed being impaired from excessive phosphorus, sediment and bacteria concentrations. TP and Sediment pollutants can lead to nuisance algae growth, oxygen depletion, reduced submerged aquatic vegetation, water clarity problems, and degraded habitat. Bacterial pollutants make streams unsafe for fishing and swimming uses. Collectively, these impairments adversely affect fish and other aquatic life, water quality, recreation, and navigation. The Milwaukee River TMDL was developed using a watershed framework, and contains pollutant load allocations both point and nonpoint sources, and some recommended management actions to help restore water quality. Appendix F includes the Milwaukee River TMDL basin and sub-basins. Each sub-basin has a specific TP and TSS load reduction goal to help all waterways in the basin meet water quality standards.

This Menomonee River (stream mile 12.61 - 24.81) was put on the Impaired Waters List for phosphorus during the 2014 cycle and for chloride in the 2018 cycle. Evaluations in the 2020 and 2022 cycles both confirmed the elevated phosphorus and chloride. The phosphorus listing is covered by the Milwaukee River TMDL, approved in 2018.

Root River Watershed

The Root River Watershed is located in portions of Waukesha, Milwaukee, and Racine Counties and encompasses 197 square miles. Only about 13 square miles are within Waukesha County covering portions of the Cities of Muskego and New Berlin. According to the Year 2015 SEWRPC land use inventory, residential land use accounts for 48 percent of the land use in the Waukesha County portion of the watershed. Another 10 percent is agricultural and 14 percent is transportation related.

The headwaters begin in west central Milwaukee and eastern Waukesha counties. From there the river flows southeast ultimately emptying into Lake Michigan in the City of Racine. The watershed is heavily urbanized near the headwaters and mouth. However, the middle portion of the watershed has a large percentage of agricultural land use.

Water quality of the 117 miles of rivers and streams in the Root River Watershed ranges from severely degraded to good. The streams in Waukesha County are classified as supporting only a Limited Forage Fish community or Limited Aquatic Life.

Rivers and Streams

Major steams are perennial streams, which maintain, at a minimum, a small contiguous flow throughout the year except under unusual drought conditions. The 50 major streams in Waukesha County are shown in Map II-10 and described in more detail in Table II-5 below**.** Waukesha County has approximately 306 miles

of major perennial streams. The longest major streams in the county are the Fox (Illinois) and Bark Rivers, with 50.6 and 29.7 stream miles respectively, as measured using the county Land Information System. Twelve of these streams are listed as "impaired" by the Department of Natural Resources, meaning the stream is not meeting water quality standards. These streams have the label 303(d) in the classification code, named after the applicable section of the federal law. More information on each of these streams is contained in the following sections of this plan.

Table II-5
Major Streams of Waukesha County

Stream Name	Watershed	Township	Length (miles)	Classification Code(s)
Ashippun River	Ashippun	Oconomowoc	11.1	FAL, AQ-3 (RSH)
Bark River	Bark	Delafield	29.7	WWSF, FAL, AQ-1 & AQ-2 (RSH)
School Section Ditch	Bark	Ottawa	5.7	FAL
Scuppernong Creek	Bark	Ottawa	12.8	WWSF, COLD, AQ-2 (RSH)
Wales Creek	Bark	Genesee	2.1	COLD
Butler Ditch	Menomonee	Brookfield	3.9	FAL. 303(d)
Dousman Ditch	Menomonee	Brookfield	2	FAL
Lilly Creek	Menomonee	Menomonee Falls	5.1	FAL, 303(d)
Menomonee River	Menomonee	Menomonee Falls	7.8	FAL, AQ-3
Nor-X-Way Channel	Menomonee	Menomonee Falls	1.3	FAL, 303(d)
Underwood Creek	Menomonee	Brookfield	6.9	FAL, 303(d)
Willow Creek	Menomonee	Lisbon	2.3	FAL
Artesian Brook	Muskego-Wind	Vernon	1	FAL
Muskego Creek	Muskego-Wind	Muskego	6.6	WWSF
Krueger Brook	Middle Fox	Vernon	2.1	FAL
Ripple Creek	Middle Fox	Vernon	1	FAL
Horseshoe Brook	Middle Fox	Vernon	1.5	FAL
Mill Brook	Middle Fox	Vernon	5.7	COLD, AQ-2 (RSH)
Pebble Brook	Middle Fox	Vernon	8.7	FAL, AQ-3
Redwing Creek	Middle Fox	Waukesha	1.4	FAL
Mill Creek	Middle Fox	Waukesha	5.1	FAL, AQ-3

Stream Name	Watershed	Township	Length (miles)	Classification Code(s)
Genesee Creek	Middle Fox	Waukesha	6.7	ERW, COLD, AQ-2 (RSH)
Spring Creek	Middle Fox	Mukwonago	6	FAL, 303(d)
White Creek	Middle Fox	Genesee	1.4	COLD
Beulah Lake Outlet	Mukwonago	Mukwonago	1.1	FAL
Mukwonago River	Mukwonago	Mukwonago	10.2	ERW, COLD, FAL, AQ-1 (RSH)
Jericho Creek	Mukwonago	Eagle	5.8	COLD, AQ-2 (RSH)
Battle Creek	Oconomowoc	Summit	2.8	FAL, LFF
Little Oconomowoc	Oconomowoc	Merton	3.5	FAL, AQ-3 (RSH)
Mason Creek	Oconomowoc	Merton	4.5	COLD, AQ-2 (RSH)
Oconomowoc River	Oconomowoc	Merton	14.3	ERW, FAL, AQ-3 (RSH)
Rosenow Creek	Oconomowoc	Oconomowoc	3.5	COLD, AQ-3
Hales Corners Creek	Root	New Berlin	1	LAL
Tess Corners Creek	Root	Muskego	5.5	LFF
Root River	Root	New Berlin	1.5	FAL, 303(d)
McKeawn Spring Creek	Scuppernong	Eagle	0.9	COLD
Paradise Springs Creek	Scuppernong	Eagle	1.6	COLD
Scuppernong River	Scuppernong	Eagle	7.4	COLD, FAL, AQ-2 (RSH)
Audley Creek	Upper Fox	Delafield	1.2	FAL
Brandy Brook	Upper Fox	Genesee	5	COLD, AQ-3
Deer Creek	Upper Fox	Brookfield	6.6	LAL, 303(d)
Fox (Ill River)	Upper Fox	Waukesha	50.6	FAL, 303(d), AQ-2 (RSH)
Frame Park Creek	Upper Fox	Waukesha	1	LFF, 303(d)
Lannon Creek	Upper Fox	Menomonee Falls	5.4	FAL, 303(d)
Pebble Creek	Upper Fox	Waukesha	6.9	COLD, FAL, AQ-3
Pewaukee River	Upper Fox	Pewaukee	6.4	FAL, AQ-3 (RSH)
Poplar Creek	Upper Fox	Brookfield	8	FAL, 303(d), AQ-3 (RSH)
Sussex Creek	Upper Fox	Brookfield	6.6	FAL, 303(d)

Stream Name	Watershed	Township	Length (miles)	Classification Code(s)
Coco Creek (East Br.)	Upper Fox	Pewaukee	2	FAL, AQ-3
Coco Creek (West Br.)	Upper Fox	Pewaukee	4.8	COLD, AQ-3
Zion Creek	Upper Fox	Delafield	1.6	LFF, 303(d)
Meadow Brook Creek	Upper Fox	Pewaukee	3.14	FAL, 303(d)

Total Miles = 310.7

Classification Codes

COLD = Includes surface waters capable of supporting a community of cold water fish and other aquatic life.

WWSF/FAL = Fish & Aquatic Life. Default classification equivalent to Warm Water Sport Fish Community.

LFF = Limited Forage Fishery. Surface waters capable of supporting only a limited community of forage fish.

LAL = Limited Aquatic Life. Marginal surface waters that support only a limited aquatic life community.

303(d) = Water body appears on the Wisconsin Impaired Waters list.

ERW = An Exceptional Resource Water as defined by Chapter NR102 of the WI Administrative Code.

AQ-1 = Identifies Aquatic Areas of statewide or greater significance.

AQ-2 = Identifies Aquatic Areas of countywide or regional significance.

AQ-3 = Identifies Aquatic Areas of local significance.

RSH = Rare Species Habitat. Aquatic areas which support endangered, threatened, or "special concern species" officially designated by the DNR.

Lakes

Major inland lakes are defined as those with a surface area of 50 acres or larger, a size capable of supporting reasonable recreational use with minimal degradation of the resource. Waukesha County contains all or portions of 33 major lakes with a combined surface area of approximately 14,000 acres, or 21.9 square miles, or about 3.8 percent of the total area of the County. This represents about 38 percent of the combined surface area of the 101 major lakes in the seven-county Southeastern Wisconsin Region, more than any other county in the Region. Thirty of the major lakes are located entirely within the County, while three major lakes, Lake Denoon, Golden Lake, and Lake Five, are located only partly within the County. In addition to the major lakes, there are 47 other named water bodies with lake characteristics referenced in the DNR publication, “Wisconsin Lakes”, PUBL-FM-800 91. The 80 total named lakes in Waukesha County are presented in Map II-10 and described in Table II-6.

Because lake water quality is significantly affected by surrounding land use and cover, urban development and agricultural activity on land that drains into lakes and streams has led to a decline in water quality on many lakes in Waukesha County. Water quality often changes as a result of increasing levels of such nutrients as nitrogen and phosphorus entering a lake. Nitrogen is usually the limiting nutrient for rooted aquatic plants while phosphorus is considered the limiting nutrient for algae growth. Eutrophication is the condition reached by lakes when the accumulation of nutrients produces increasing amounts of aquatic plants. As the resulting lush aquatic plant growth dies each year, organic deposits fill in the lake. This is a natural process that is generally more prevalent in warm, shallow lakes, such as Big Muskego Lake, than in colder, deep lakes, such as Oconomowoc Lake. However, the process can be greatly accelerated by additional nutrients from inadequate or failing onsite sewage disposal systems, lawn fertilizers, agricultural runoff containing fertilizer and animal wastes, construction site runoff, and street debris.

The trophic status of most major lakes in Waukesha County is also presented in Table II-6. The trophic state serves as an indicator of overall water quality, taking into consideration water clarity, phosphorus content, algae content and regional location in Wisconsin**. A mesotrophic lake shows some signs of eutrophication. The presence of a greater amount of nutrients than in an oligotrophic lake results in lowered clarity and**

the presence of aquatic plants. Swimming and boating can be enjoyed on this type of lake without limitations. A eutrophic lake has relatively large amounts of aquatic plants because of higher nutrient levels. The water may be cloudy because of suspended algae cells, dying plants may produce unpleasant smells, and mats of plants may interfere with swimming and boating. These lakes are generally shallow, with mucky bottoms. Eutrophic lakes can be excellent warm-water fishing lakes for such fish as bass and bluegills.

All surface waters in the state of Wisconsin can be classified into one of several biological use objectives classification categories. The classification categories include:

- Cold Water Communities (COLD): Includes surface waters capable of supporting a community of cold water fish and other aquatic life or serving as a spawning area for cold water fish species.

- Warm Water Sport Fish Communities (WWSF): Includes surface waters capable of supporting a community of warm water sport fish or serving as a spawning area for warm water sport fish. This category is the default listing for all streams that have not been formally classified according to the process outlined in meeting the federal Clean Water Act goals. Is also the equivalent of full fish and aquatic waters (FAL) classification.

- Warm Water Forage Fish Communities (WWFF): Includes surface waters capable of supporting an abundant diverse community of forage fish and other aquatic life.

- Limited Forage Fishery (LFF): Includes surface waters of limited capacity because of low flow, naturally poor water quality or poor habitat. These surface waters are capable of supporting only a limited community of forage fish and aquatic life.

- Limited Aquatic Life (LAL): Includes surface waters severely limited because of very low or intermittent flow and naturally poor water quality or poor habitat. These surface waters are capable of supporting only a limited community of aquatic life.

Map II-10
Surface Water Resources of Waukesha County

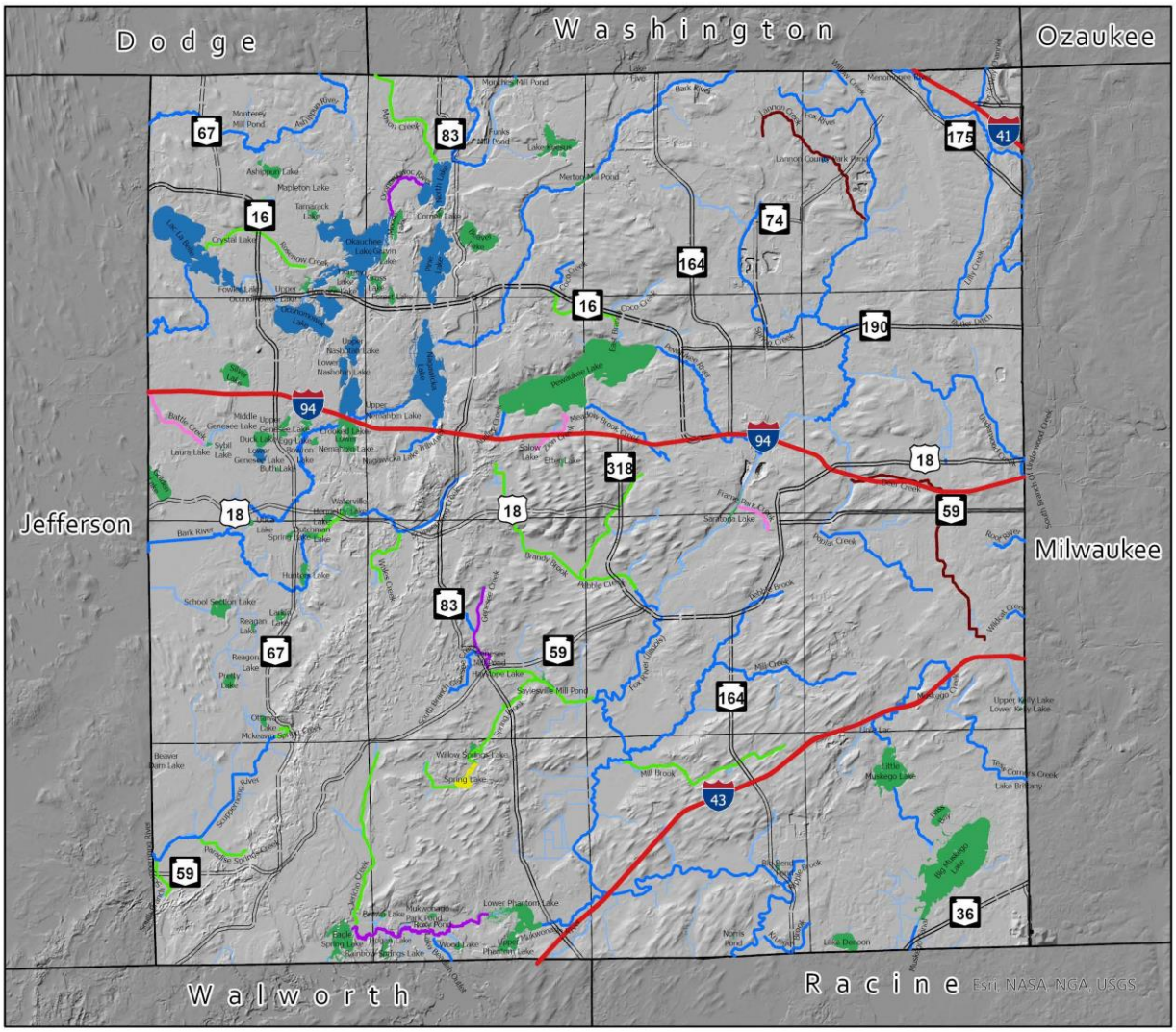


Table II-6
Named Lakes in Waukesha County

Lake	Watershed	Township	Surface Area (acres)	Max. Depth (feet)	Lake Type	Trophic State	Classification Code(s)
Ashippun Lake*	Ashippun	Oconomowoc	83	40	SP	Mesotrophic	FAL, AQ-2 (RSH)
Bass Bay	Muskego-Wind	Muskego	100	23		Eutrophic	FAL, AQ-3
Beaver Dam Lake	Bark	Eagle	36		SE	Eutrophic	FAL
Beaver Lake	Oconomowoc	Merton	316	49	SP	Mesotrophic	FAL, AQ-3 (RSH)
Big Bend Pond	Middle Fox	Vernon	7	10	SP	N/A	FAL
Big Muskego Lake*	Muskego-Wind	Muskego	2,260	4	DG	Eutrophic	FAL, AQ-2 (RSH)
Bowron/Widgeon Lake	Bark	Summit	25	25	SP	Eutrophic	FAL, AQ-3 (RSH)
Brown Lake	Mukwonago	Mukwonago	12	15	SP	Eutrophic	FAL
Buth Lake	Bark	Summit	4	5	SE	N/A	FAL
Cornell Lake	Oconomowoc	Merton	16	12	DG	Mesotrophic	FAL
Crooked Lake	Bark	Summit	58	16	DG	Mesotrophic	FAL, AQ-2 (RSH)
Crystal Lake	Oconomowoc	Oconomowoc	17	30		N/A	FAL
Duck Lake	Bark	Summit	12	1	SE	N/A	FAL, AQ-3 (RSH)
Dutchman Lake	Bark	Ottawa	33	43	SE	Eutrophic	FAL, AQ-2 (RSH)
Eagle Spring Lake*	Mukwonago	Eagle	311	8	DG	Eutrophic	FAL, AQ-2 (RSH)
Egg Lake	Bark	Summit	2	3	SE	N/A	FAL
Etter Lake	Upper Fox	Delafield	11	5	SE	Eutrophic	FAL
Florence Lake	Oconomowoc	Oconomowoc	21	48	SE	Mesotrophic	FAL
Forest Lake	Oconomowoc	Merton	41	17	SE	Eutrophic	FAL, AQ-3 (RSH)
Fowler Lake*	Oconomowoc	Oconomowoc	99	50	DG	Mesotrophic	COLD, AQ-3
Garvin Lake	Oconomowoc	Merton	17	36	SE	Mesotrophic	FAL
Golden Lake	Bark	Summit	250	46	SP	Mesotrophic	FAL, AQ-2 (RSH)
Grass Lake (Mud)	Oconomowoc	Merton	33		SE	N/A	FAL
Henrietta Lake	Bark	Summit	15	7	SE	Eutrophic	FAL, AQ-3 (RSH)
Hogan Lake	Mukwonago	Mukwonago	8	3	SE	N/A	FAL
Hunters Lake	Bark	Ottawa	57	46	SP	Mesotrophic	FAL, AQ-2 (RSH)
Lake Denoon*	Middle Fox	Muskego	162	55	SE	Mesotrophic	FAL, AQ-3 (RSH)
Lake Five	Oconomowoc	Merton	102	23	SE	Mesotrophic	FAL, AQ-3
Lake Keesus*	Oconomowoc	Merton	237	42	SP	Mesotrophic	FAL, AQ-3
Lac La Belle*	Oconomowoc	Oconomowoc	1,117	45	DG	Eutrophic	FAL, 303(d), AQ-3
Larkin Lake	Bark	Ottawa	57	4	SP	N/A	FAL, AQ-3 (RSH)
Leota Lake (Laura)	Oconomowoc	Summit	8	11	DG	N/A	FAL
Linnie Lac*	Muskego-Wind	New Berlin	6	6	DG	Eutrophic	FAL
Little Muskego Lake*	Muskego-Wind	Muskego	506	65	DG	Mesotrophic	FAL, 303(d)
Lower Genesee Lake	Bark	Summit	66	45	SP	Mesotrophic	Cold, AQ-3 (RSH)
Lower Kelly Lake	Root	New Berlin	3	36	SE	Eutrophic	FAL
Lower Nashotah Lake	Bark	Summit	90	43	SP	Oligotrophic	Cold, AQ-2 (RSH)
Lower Nemahbin Lake	Bark	Summit	271	36	DG	Eutrophic	FAL, AQ-2 (RSH)
Lower Phantom Lake*	Mukwonago	Mukwonago	433	12	DG	Oligotrophic	FAL, AQ-1 (RSH)
Menomonee Park Pond	Upper Fox	Menomonee Falls	15	50	SP	N/A	FAL
Merton Millpond	Bark	Lisbon	38	8	DG	Eutrophic	FAL, AQ-2 (RSH)
Middle Genesee*	Bark	Summit	109	40	SE	Mesotrophic	FAL, AQ-3 (RSH)
Monches Millpond	Oconomowoc	Merton	16	4	DG	Eutrophic	FAL
Monterey Millpond	Ashippun	Oconomowoc	30	8	DG	N/A	FAL
Moose Lake	Oconomowoc	Merton	81	61	SP	Oligotrophic	FAL, AQ-3 (RSH)

Lake	Watershed	Township	Surface Area (acres)	Max. Depth (feet)	Lake Type	Trophic State	Classification Code(s)
Mukwonago Park Pond	Mukwonago	Mukwonago	1	5	SP	N/A	FAL, AQ-3 (RSH)
Nagawicka Lake	Bark	Delafield	957	90	DG	Mesotrophic	FAL, AQ-1 (RSH)
Norris Foundation Pond	Middle Fox	Vernon	3	8	DG	N/A	FAL
North Lake*	Oconomowoc	Merton	439	78	DG	Mesotrophic	FAL, AQ-2 (RSH)
Oconomowoc Lake	Oconomowoc	Oconomowoc	804	62	DG	Mesotrophic	FAL, 303(d), AQ-2 (RSH)
Okauchee Lake*	Oconomowoc	Oconomowoc	1,187	94	DG	Eutrophic	FAL, AQ-2 (RSH)
Ottawa Lake	Scuppernong	Ottawa	28	16	SP	Mesotrophic	FAL, 303(d) AQ-2 (RSH)
Pewaukee Lake	Upper Fox	Delafield	2,493	45	SP	Mesotrophic	FAL, AQ-2 (RSH)
Pine Lake	Oconomowoc	Merton	703	85	SP	Oligotrophic	FAL, AQ-2 (RSH)
Pretty Lake*	Bark	Ottawa	64	35	SE	Mesotrophic	FAL
Rainbow Springs Lake	Mukwonago	Mukwonago	25	16	SE	Eutrophic	FAL, AQ-3 (RSH)
Reagon Lake	Bark	Ottawa	16	10	SP	Eutrophic	FAL, AQ-3 (RSH)
Roxy Pond	Mukwonago	Mukwonago	17	3	SP	Hypereutrophic	FAL
Saratoga Lake	Upper Fox	Waukesha	24	6	DG	N/A	FAL
Saylesville Millpond	Middle Fox	Genesee	45	4	DG	Eutrophic	FAL, AQ-3 (RSH)
School Section Lake*	Bark	Ottawa	125	8	DG	Eutrophic	FAL, AQ-2 (RSH)
Scuppernong Creek Pond	Bark	Ottawa	20	5	DG	N/A	FAL
Silver Lake	Oconomowoc	Summit	222	44	SE	Mesotrophic	FAL, AQ-2 (RSH)
Spahn Lake	Bark	Summit	4	5	SE	N/A	FAL, AQ-3 (RSH)
Spring Lake	Middle Fox	Mukwonago	105	22	SP	Eutrophic	ORW, AQ-2 (RSH)
Spring Lake (Dousman)	Bark	Ottawa	14	8	SE	Eutrophic	FAL, AQ-3 (RSH)
Sybil Lake	Bark	Summit	2		SE	N/A	FAL
Tamarack Lake	Oconomowoc	Oconomowoc	30	15	SE	Eutrophic	FAL
Tierney Lake	Oconomowoc	Oconomowoc	15	5	DG	Eutrophic	FAL
Upper Genesee Lake	Bark	Summit	37	27	SP	Mesotrophic	FAL, AQ-3 (RSH)
Upper Kelly Lake	Root	New Berlin	12	9	SP	Eutrophic	FAL
Upper Nashotah Lake	Bark	Summit	133	53	SP	Oligotrophic	FAL, AQ-2 (RSH)
Upper Nemahbin Lake*	Bark	Summit	283	61	DG	Mesotrophic	FAL, AQ-2 (RSH)
Upper Oconomowoc Lake	Oconomowoc	Oconomowoc	43	11	DG	Eutrophic	FAL
Upper Phantom*	Mukwonago	Mukwonago	110	29	SP	Mesotrophic	FAL, AQ-1(RSH)
Utica Lake	Bark	Summit	14	25	SP	Mesotrophic	FAL, AQ-3
Waterville Lake	Bark	Summit	68	12	DG	Eutrophic	FAL, AQ-3 (RSH)
Willow Spring Lake*	Middle Fox	Mukwonago	46	13	DG	Eutrophic	FAL, AQ-3 (RSH)
Wood Lake	Mukwonago	Mukwonago	20	22	SP	Mesotrophic	FAL, AQ-3 (RSH)

Classification Codes

Cold = Supports a cold water community either naturally occurring or artificially stocked.

FAL = Fish & Aquatic Life. Default classification equivalent to Warm Water Sport Fish Community.

303(d) = Water body appears on the Wisconsin Impaired Waters List

ORW = An Outstanding Resource Water as defined by Chapter NR102 of the WI Administrative Code.

AQ-1 = Identifies Aquatic Areas of statewide or greater significance.

AQ-2 = Identifies Aquatic Areas of countywide or regional significance.

AQ-3 = Identifies Aquatic Areas of local significance.

RSH = Rare Species Habitat. Aquatic areas that support endangered, threatened, or "special concern" species designated by DNR.

* = Lake has a Lake Management District formed under Chapter 33 Wisconsin Statutes.

Lake Type

Drainage lake (DG): Impoundments and natural lakes with the main water source from stream drainage.

Seepage lake (SE): Landlocked. Water level maintained by groundwater table and basin seal. May have intermittent outlet.

Spring lake (SP): Groundwater fed lakes always with an outlet of substantial flow.

Outstanding and Exceptional Resource Waters

Chapter NR 102 of the Wisconsin Administrative Code lists water quality standards for all surface waters in the state of Wisconsin. The two highest classification categories are Outstanding Resource Waters (ORW) and Exceptional Resource Waters (ERW).

An outstanding resource water (ORW) is defined as a lake or stream which has excellent water quality, high recreational and aesthetic value, high quality fishing, and is free from point source or nonpoint source pollution. The only outstanding resource water in Waukesha County is Spring Lake.

An exceptional resource water (ERW) is defined as surface waters which exhibits the same high quality resource values as outstanding resource waters, but which may be impacted by point source pollution or have the potential for future discharge from a small sewer community. Exceptional resource waters found in Waukesha County include specific portions of the following streams:

Genesee Creek	(Above STH 59)
Mukwonago River	(From Eagle Springs Lake to Upper Phantom Lake)
Oconomowoc River	(From below North Lake to Okauchee Lake)

Impaired Waters List (303d)

The Department of Natural Resources (DNR) is required every two years to submit a list to the Environmental Protection Agency (EPA) which identifies waters which are not meeting water quality standards, including both water quality criteria for specific substances or the designated biological and recreational uses. This list is known as the "impaired waters list" or simply the "303(d) list" in reference to the particular section of the Clean Water Act.

Table II-7 shows all the water resources in Waukesha County that were included on the Wisconsin 303(d) list as of 2021. The list includes 15 stream reaches and 4 lakes which suffer from a variety of pollutants and impairment indicators, as shown in Table II-7. Most of the pollutants are nonpoint sources, with the exception of PCBs, which come primarily from industrial sources and bioaccumulate in the environment.

Many of the water resources on the 303(d) list have been targeted by water pollution control programs, as discussed in previous sections of this plan. However, in urban areas, it is very difficult and often prohibitively expensive to control nonpoint pollution sources to a level that will bring the water resource into compliance with water quality standards. To address urban and agricultural runoff, the Wisconsin DNR has issued Municipal Separate Storm Sewer System (MS4) permits to multiple municipalities within Waukesha County and has also developed TMDL plans for some of the water resources in the County.

Table II-7
303(d) Listed Impaired Waters in Waukesha County: 2020

Water Body	Start Mile	End Mile	Pollutant	Impairment Indicator
Ashippun River	0	33.17	Total Phosphorus	Impairment Unknown
Butler Ditch	0	2.9	Chloride, Fecal Coliform	Recreation Restrictions, Pathogens, Chronic Aquatic Toxicity
Coco Creek	0.51	2.36	Unknown Pollutant	Degraded Biological Community
Deer Creek	0	8.09	Sediment/Total Suspended Solids, Elevated Water temp, Total Phosphorus	Elevated Water Temps, Degraded Habitat, Excess Algal Growth
Fox River (Illinois)	47.17	105.34	Total Phosphorus, PCBs	Impairment Unknown, PCB Contaminated Fish Tissue

Water Body	Start Mile	End Mile	Pollutant	Impairment Indicator
Fox River (Below Barstow Impoundment)	105.34	109.21	PCBs, Total Phosphorus, Sediment/Total Suspended Solids	PCB Contaminated Fish Tissue, Degraded Habitat, Low DO
Lower Barstow Impoundment (Fox River, Saratoga Lake)			PCBs, Mercury, Total Phosphorus, Sediment/Total Suspended Solids	PCB Contaminated Fish Tissue, Mercury Contaminated Fish Tissue, Low DO, Turbidity
Fox River, Upper Barstow Impoundment	110.29	113.99	PCBs, Total Phosphorus, Sediment/Total Suspended Solids	Contaminated Fish Tissue, Low DO
Fox River	113.99	130.55	PCBs, Total Phosphorus, Sediment/Total Suspended Solids	PCB Contaminated Fish Tissue, Low DO
Frame Park Creek	0	1.26	PAHs, Total Phosphorus, Sediment/Total Suspended Solids, Unspecified Metals	PAHs Contaminated Fish Tissue, Low DO, Chronic Aquatic Toxicity, Elevated Water Temp, Degraded Habitat
Lac La Belle			PCBs, Total Phosphorus	PCB Contaminated Fish Tissue, Impairment Unknown
Lilly Creek	0	4.70	Chloride, Fecal Coliform	Recreational Restrictions, Pathogens, Chronic Aquatic Toxicity
Master Disposal Drainage Channel	0	0.99	Unknown Pollutant	Chronic Aquatic Toxicity
Meadow Brook Creek	0	3.14	Chloride	Chronic Aquatic Toxicity
Menomonee River	12.61	24.81	Chloride	Chronic Aquatic Toxicity, Acute Aquatic Toxicity
North Lake			Total Phosphorus	Impairment Unknown
Nor-X-Way Channel	0	4.9	Unknown Pollutant, Chloride	Elevated Water Temp, Chronic Aquatic Toxicity
Okauchee Lake			Total Phosphorus	Impairment Unknown
Poplar Creek	0	8.06	Total Phosphorus, Unknown Pollutant	Low DO, Impairment Unknown
Root River	25.80	43.69	Total Phosphorus, Chloride, Sediment/Total Suspended Solids	Low DO, Degraded Biological Community, Chronic Aquatic Toxicity, Acute Aquatic Toxicity
Scuppernong River	10.31	12.46	Total Phosphorus	Impairment Unknown
South Branch of Underwood Creek	0	1.11	Chloride	Chronic Aquatic Toxicity, Acute Aquatic Toxicity
Tess Corners Creek	0	7.30	Total Phosphorus	Impairment Unknown
Underwood Creek	2.84	8.54	Chloride	Chronic Aquatic Toxicity, Acute Aquatic Toxicity
Unnamed Stream (R21eS18)	0	2	Total Phosphorus	Impairment Unknown
Unnamed (Local Water)	0	4.18	Total Phosphorus	Impairment Unknown
Unnamed (Local Water)	0	4.45	Chloride	Chronic Aquatic Toxicity
Upper Kelly Lake			Total Phosphorus	Impairment Unknown, Excessive Algal Growth
Zion Creek	0	1.65	Sediment/Total Suspended Solids, Total Phosphorus	Elevated Water Temp, Degraded Habitat, Low DO

Land Use

SEWRPC conducts a regular land use inventory of southeast Wisconsin that is intended to serve as a relatively precise record of land use at selected points in time, using aerial photographs augmented by field surveys as appropriate. The first regional land use inventory was prepared by SEWRPC in 1963 and has been updated every five years following the preparation of new aerial photography. While aerial photography was completed in the spring 2015.

Land Use Trends

There is no ambiguity regarding the land use trends in Waukesha County. The numbers and maps tell the story well. Table II-8 shows the changes in land use that occurred in Waukesha County from 1963 to 2015. It shows the rate of land conversion from rural to urban uses during the 1990s was about 3000 acres per year, or about 4.7 square miles per year – more than any other decade since SEWRPC has been collecting land use data. Figure II-9 shows the loss in dairy farms in the county from 1969 to 2017 according to USDA. The NET loss during this period was 95% of the dairy farms, with only 22 dairy still in operation in 2017.

The generalized land use inventory conducted by Waukesha County in 2015 shows the rate of land conversion increased to almost 6 square miles per year during the first decade of the new millennium. The 112,741acres that remained in agricultural or rural land uses in 2015 represents a 25% loss of the agricultural lands since the first Farmland Preservation Plan was adopted by the Waukesha County Board in 1984 – a loss of 55,516 acres in three decades.

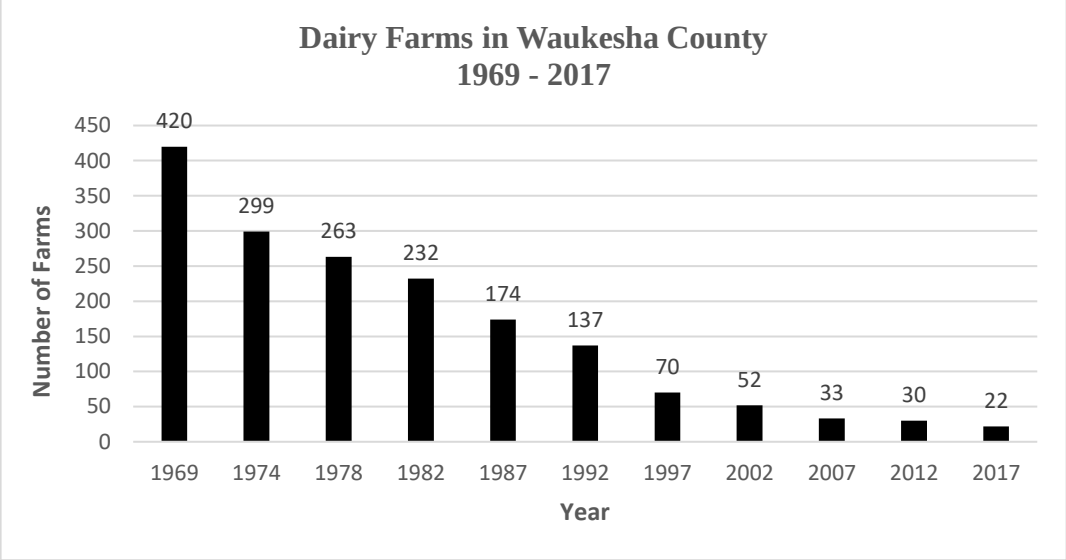
Table II-8
Change in Land Use in Waukesha County: 1963-2015

Land Use Category[a]	1963	1970	1980	1990	2000	2010	2015
Urban							
Residential	28,148	35,476	50,745	59,247	75,221	83,864	86,015
Commercial	1,197	1,831	2,754	3,827	5,351	6,504	6,780
Industrial	924	1,758	2,747	3,802	5,525	5,972	5,950
Transportation, Communication, and Utilities	16,079	18,545	21,867	22,805	30,001	31,360	32,654
Governmental and Institutional	2,550	3,587	4,037	4,215	4,887	5,638	5,840
Recreational	3,311	4,605	5,756	6,465	8,253	9,399	9,360
Unused Urban Land	8,509	8,516	8,017	7,025	7,806	4,655	4,783
Subtotal Urban	60,718	74,318	95,923	107,386	137,044	147,392	151,382
Nonurban							
Natural Areas							
Surface Water	16,076	16,461	16,753	16,878	16,891	18,076	18,066
Wetlands	52,588	51,660	51,233	51,978	52,661	57,555	57,517
Woodlands	31,181	30,818	29,472	29,584	28,931	30,496	31,827
Subtotal Natural Areas	99,845	98,939	97,458	98,440	98,483	106,127	107,410
Agricultural	200,241	184,390	161,558	142,428	112,611	95,207	76,028
Unused Rural and Other Open Lands	10,786	13,943	16,651	23,336	23,397	21,917	36,713
Subtotal Nonurban	310,872	297,272	275,667	264,204	234,491	223,251	220,151
Total	371,590	371,590	371,590	371,590	371,535	370,643	371,533

[a]Off-street parking is included with the associated land use.

Source: SEWRPC.

Figure II-9

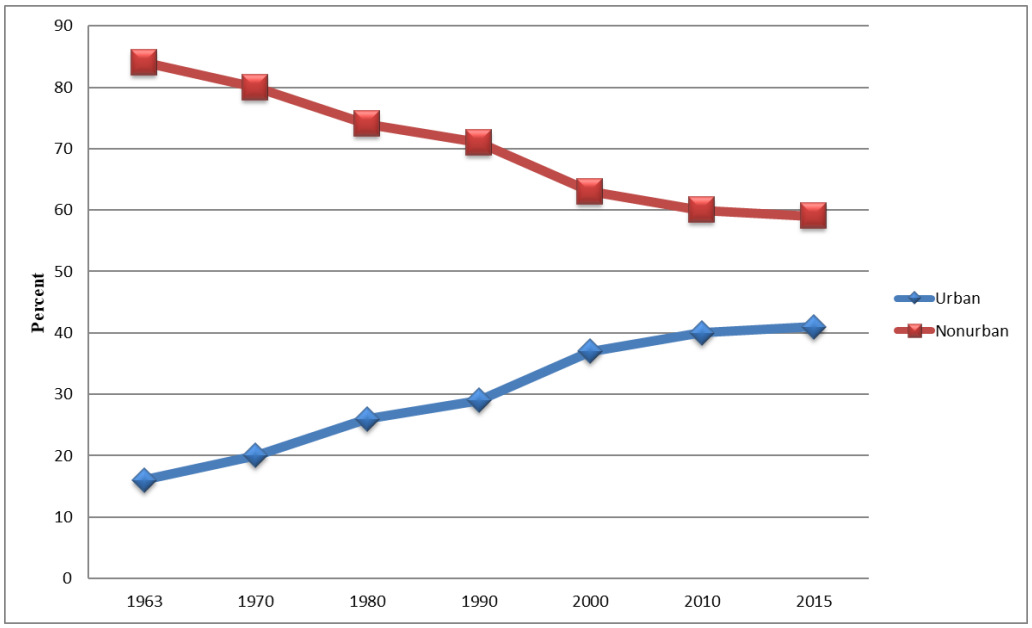


Source: USDA, National Agricultural Statistics Service

Map II-11 shows the pattern and area of land conversion from rural to urban uses from 1963-2010. In general, since 1963 the acres of land in urban categories have almost tripled from 60,718 acres in 1963 to 174,621 acres in 2010, an increase of about 290%. Much of the increase can be attributed to the amount of land used for residential purposes.

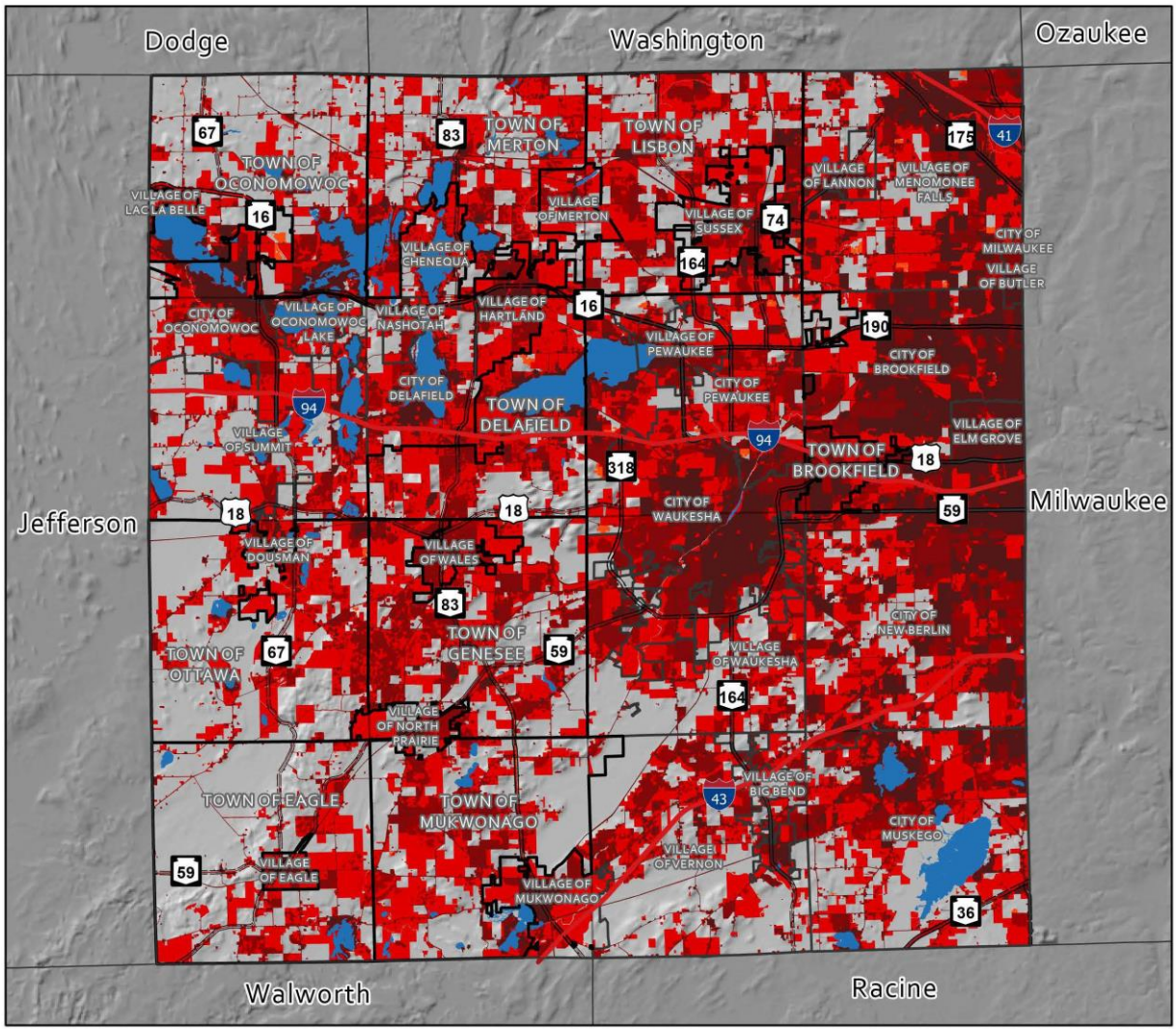
Figure II–10 charts the acres of developed lands against the rural lands from 1963-2015. It shows in 1963 the land use ratio was about 84% rural to 16% developed, while in 2015, it is very near 50/50 ratio with the rural portion closely split between natural areas and agricultural lands. Map II-12 shows how these three very general land use categories are distributed in the county as of 2015.

Figure II-10
Land Use Trends in Waukesha County: 1963-2015



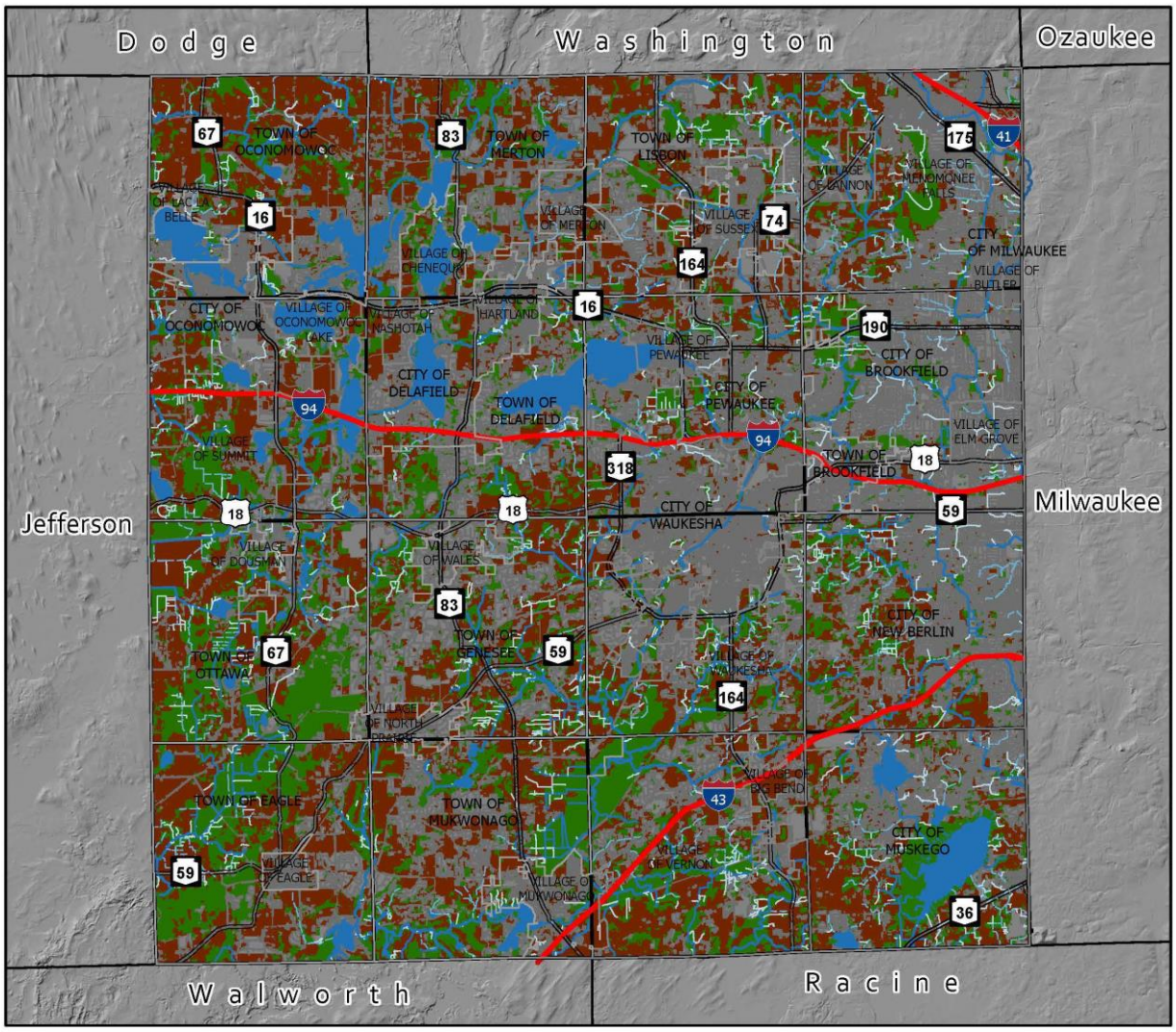
Source: SEWRPC and Waukesha County

Map II-11
Rural to Urban Land Use Conversion in Waukesha County: 1963-2015



Source: Waukesha County, WI DNR, SEWRPC

Map II-12
Agricultural Lands, Developed Lands and Natural Areas
Waukesha County: 2015



Legend

- Natural Areas (29% of County)
- Agricultural Lands (30% of County)
- Developed Lands (41% of County)

N
W E
S

Source: Waukesha County & SEWRPC

0 4 8 12 Miles

Exotic and Invasive Species

Waukesha County, like many other counties around the state of Wisconsin, has become home to a number of exotic and invasive species of plants and animals. These pests invade lakes, rivers, forests, wetlands and grasslands. They displace native species, disrupt ecosystems, and affect people's livelihoods and quality of life. They hamper boating, swimming, fishing, hunting, hiking, and other recreation and take an economic toll on commercial, agricultural, forestry, and aquacultural resources.

As invasive species rapidly multiply and take over, the result is a loss of diversity of our native plants and animals. Nearly half of the species on the federal Threatened or Endangered species lists are at risk primarily because of invasive species. Chapter NR 40, Wisconsin's Invasive Species Identification, Classification and Control Rule helps citizens learn to identify and minimize the spread of plants, animals and diseases that can invade our lands and waters and cause significant damage.

Aquatic invasive species (AIS) have been recognized as a serious problem in Wisconsin and Waukesha County. In 2017, the Waukesha County Aquatic Invasive Species Strategic Plan was developed. The plan provides and overview of overview of Waukesha County waterbodies, describes how AIS can be detrimental to aquatic ecosystems, and pin points where AIS have been identified in the County. This plan also recommends goals and strategies for combating AIS, engaging in AIS education and outreach, and identifying entities responsible for plan implementation.

Summary

While presenting a general overview of the local natural resource features, population growth, land use data, MS4 Permits and agricultural/cropland/livestock operations, this chapter brings light to the urbanizing pressures faced in Waukesha County and some existing programs to control/reduce urban and agricultural runoff pollution. The source of water pollution in most county watersheds is runoff from urban lands and construction sites, although some watersheds still have significant agricultural land use. These pressures played a key role in the identification of resources issues and concerns and the formulation of the goals, objectives and activity plan presented in Chapter III.

Chapter III. Goals, Objectives and Planned Activities

In general terms, the overall goal of the Waukesha County land and water resource management program is to meet state water quality standards and water resource objectives while also addressing local resource issues of concern. This chapter describes more specific program goals, objectives, planned activities and estimated staff resources to be assigned to each goal over the next 10 years by the Land Resources Division. The LRD plans to achieve its goals and objectives through the use of a wide variety of program methods, including but not limited to: information and education, conservation planning and technical assistance, cost-sharing grants, geographic information system (GIS) technology, tax credits, partnerships with other agencies and organizations, and the enforcement of county ordinances and state conservation compliance rules. Many of these program methods are intended to facilitate the installation and maintenance of conservation practices to protect or improve water quality. Further details on all these methods are provided in the remainder of this chapter and in Chapter IV.

Water Resources Objectives

As noted above, a guiding principle for the development and implementation of this plan is to protect and improve the water resources of Waukesha County. Water quality is important for public health, recreation, local property values and many other reasons. Chapter II summarized the condition of local lakes and streams and their watersheds based on available data and reports from the Wisconsin Department of Natural Resources (DNR) and the Southeastern Wisconsin Regional Planning Commission (SEWRPC). In general, the data shows that many of the lakes and streams in the county are only partially meeting water quality standards or supporting their potential biological use classification. This is true regardless if they are classified as a warm water forage fish community, a warm water sport fish community, or a cold-water community. With the exception of those waters identified in Section NR 104.06 Wisconsin Administrative Code, all water resources in the County are expected to meet the water quality standards associated with the classifications shown in Tables II-5 and II-6 and be fully compliant with the fishable and swimmable goals established by the federal Clean Water Act.

The noted reports also describe the impairment factors that prevent these water resources from reaching their full potential. These factors include, but are not limited to: low dissolved oxygen, degraded habitat (i.e. streambank erosion, channelization, developed shores), contaminated fish tissue (i.e. mercury, PCBs), elevated water temperature, recreational restrictions due to pathogens (i.e. fecal coliform, e-coli), chronic aquatic toxicity, contaminated sediment (i.e. Polycyclic aromatic hydrocarbons or PAH's), and turbidity (i.e. suspended solids). The other most commonly listed pollutants are phosphorous and sediment, which can originate from both agricultural and urban landscapes. Sewage treatment plant discharges are also a significant source of phosphorous, although enacted state regulations address this concern. Invasive species are also widespread in the county, both in the aquatic and terrestrial environments.

Plan Goals

As noted in Chapter I, the overall program goals were carried over from the 2006 and 2012 plans as the foundation for this 2022 plan update, as listed below:

1. Control Urban Runoff Pollution and Flooding
2. Protect the Quality and Quantity of Groundwater
3. Control Agricultural Runoff Pollution
4. Educate the Public on Conservation Issues
5. Preserve Targeted Farmland and Natural Areas
6. Support Water Monitoring and Improve Public Access to Water Resource Data
7. Reclaim Active Nonmetallic Mining Sites

It should be noted that, while all of the resource issues or goals identified by the advisory committee were determined to be important, fiscal constraints, state mandates and other local program commitments would limit the LRD's ability to commit to all the goals and objectives identified by the advisory committee. These facts also played a role in establishing the level of staff resources assigned to each goal.

Plan Objectives and Planned Activities

For each of the seven plan goals noted above, more specific objectives and planned activities were developed and are described in this section. Background information is first provided on each of the program goals, how they apply to Waukesha County, and the subsequent objectives that were derived from them. The background information often references the resource assessments provided in Chapter II. The objectives and planned activities were drafted by the LRD and reviewed by the plan advisory committee, as described in Chapter I.

A guiding principle behind the entire plan is to build partnerships with other conservation agencies and organizations whenever practical to help achieve program goals or objectives. To avoid unnecessary redundancy, all partnerships are not described in detail under each planned activity, but some key partnerships are noted either in the activity description or the program notes to the right. All agency, organization and program acronyms used in the following sections are defined in Appendix A.

After each goal is a projected level of staff and budget resources that will be assigned to that goal on an average annual basis. The staff projections are based on Land Resources Division 2022 staffing levels of approximately 6.15 full-time equivalents (FTE) available to work on land and water resource management programs. One FTE is equal to 2080 hours of work, but may actually be distributed to any number of employees, full or part time. As noted in Chapter IV, this assumed staffing level does not represent any commitment by Waukesha County, and is in fact subject to changing program and department demands, county budgets and level of state funding that is maintained during the planning period.

All activities listed are high priority unless there is an (M) listed after the activity description. High priority means that the activity represents a core function of the LRD or an existing commitment and will be completed unless significant funding shortfalls are encountered. The (M) designation is to represent a medium priority, which means the activity is considered important, but may experience delays in implementation depending on available funding, staff resources, and the amount of time required to complete high priority activities. No low priority items are listed in the activity plan since they would represent activities that are not likely to be accomplished due to limited resources. All references to the LRD web site can be found at: www.waukeshacounty.gov/landconservation. All references to the Waukesha County GIS-web site are at: www.waukeshacounty.gov/GIS

Program notes are includes after each planned activity to provide some additional context for the activity and to reference progress made on the activity since the 2012 LWRM Plan. Since this is a long-range planning effort (10 years), the level of detail for planned activities was purposely kept to a minimum to allow for changing conditions, consistent with the statutory intent of LWRM plans. Some detail was added solely to satisfy DATCP planning requirements, but the majority of details are reserved for annual internal LRD work plans. At that point, measurable outcomes are assigned to specific staff members as much as possible and used for annual performance reviews. The LWRM plan provides the framework for this more detailed level of planning to occur later. Chapter IV includes more detail on how progress on implementing this plan will be reviewed annually and modified as needed to meet the constantly changing program demands, public policies and mandates.

Goal 1: Control Urban Runoff Pollution and Flooding

Background:
Urban runoff is the number one source of water pollution in most watersheds in Waukesha County. Local development pressures are very strong, resulting in over 5 square miles per year of new development over the last 3 decades.

To address these issues, local governments, including Waukesha County, have adopted construction site erosion control and stormwater management ordinances, with similar cross-compliance requirements in local zoning codes. To help prevent basement flooding, many of these ordinances - including Waukesha County's - also include technical standards requiring new basements to be built well above the highest groundwater levels. Enforcing these ordinances currently represents the single largest workload for the LRD and the top priority in this plan. Improving these efforts make up some of the objectives stated below. Since many stormwater management best management practices (BMPs) have now been in place for 10-30 years, BMP maintenance has also become a program priority.

Subsequent to the 2006 LWRM Plan, Waukesha County, along with 30 of 37 other communities within the county, was issued a Municipal Separate Storm Sewer System (MS4) stormwater discharge permit by the DNR under NR 216. This permit contains a number of requirements designed to reduce nonpoint pollution from existing county-owned land, roads, buildings and other infrastructure. Some of these permit requirements are included in the objectives below, while a more detailed explanation of the MS4 permit program and how it affects Waukesha County is provided in Chapter IV.

Other objectives under this goal reflect the need for a more proactive approach to urban runoff management, such as watershed protection planning and low impact development. Nationwide, studies have shown that increasing impervious surfaces in a watershed can have a dramatic impact on the water quality of a stream. The Center for Watershed Protection, in cooperation with the US EPA, has published summaries that show with as little as 10% of a watershed being covered by impervious surfaces, negative impacts are usually found in the receiving body of water. Some common examples include: poor water quality; sedimentation; reduced fish and aquatic insect populations; streambank erosion; expanding floodplains; and reduced base flows. Historically, by the time a watershed is covered with 25% or more impervious surfaces, most streams are severely degraded and devoid of any significant aquatic life. The challenge is to prevent this from occurring through better planning.

Instead of only responding to development proposals one at a time, watershed protection planning takes a proactive approach to future land development and stormwater management. It allows communities in a watershed to plan and work together toward a common goal of protecting a water resource through coordinated planning, educational efforts, land acquisitions, regulations, land and infrastructure management, and other institutional changes. For example, this type of planning can result in selecting sites for regional stormwater facilities to be built before development occurs, or identifying areas that need to be preserved or even acquired for protection.

Another type of watershed planning underway in portions of Waukesha County is called Total Maximum Daily Load (TMDL) planning. This federally mandated program under the Clean Water Act is designed to improve water quality in lakes and streams that are not meeting water quality standards. A list of these water resources is called the "impaired waters list" or 303(d) list, named after the applicable section of the federal law. This list is updated every two years by the DNR and reported to the EPA. Under the TMDL planning process, water quality of a specific stream is measured and modeled, and a plan is developed which establishes the maximum amount of pollution the stream can tolerate on a daily basis to meet water quality standards and water use objectives. Through extensive modeling, a TMDL plan "allocates" tolerable pollutant discharges between point and nonpoint sources throughout the watershed. During plan implementation, pollutant trading can occur between sources. The DNR encourages counties to act as "brokers" of the pollutant trading that can occur. An example is a sewage treatment plant paying for

nutrient management planning or a manure storage facility on a farm upstream. A TMDL plan may affect the minimum state nonpoint pollution control standards for both urban and agricultural areas, and therefore may affect other goals in this plan.

Goal 1 - Control Urban Runoff Pollution and Flooding (2.4 FTE and 37% of annual budget)		
Objectives	**Planned Activities**	**Program Context/Progress Notes**
A. Enforce State Non-Agricultural Nonpoint Pollution Performance Standards through the County Stormwater Management & Erosion Control Ordinance		
	1. Review new land divisions, development and construction plans, issue permits, conduct inspections and carry out enforcement activities.	Depending on development activity, the LRD has averaged 50-100 Stormwater permits each year.
	2. Maintain "Authorized Local Program" status under s. NR 216.415 Wis. Adm. Code to streamline state and local stormwater permitting.	County ALP status was approved by DNR starting 1/1/2011 – the first in Wisconsin. Applies to construction sites > 1 acre and allows county SW permit to also provide NR 216 coverage.
	3. Maintain intergovernmental agreements with local communities to coordinate ordinance enforcement efforts.	LRD currently has 25 agreements with local communities, executed 2006-2009. Five town and four village versions include ordinance enforcement coordination provisions.
	4. Use county Development Review Team meetings to coordinate project review comments with other county departments early in the site planning process.	Coordinates reviews with Planning & Zoning, Public Works and Towns. Avoids the ping-pong of projects between plan review authorities.
B. Maintain County Stormwater & Erosion Control Ordinance and update as needed		
	1. Incorporate NR 151 and NR 216 updates to stormwater performance standards, prohibitions and other applicable mandated program changes.	A copy of the county stormwater ordinance is available on the LRD web page. The ordinance was updated in 2016 to reflect changes in state codes.
	2. Incorporate ordinance improvements based on LRD redline tracking of enforcement experiences and code clarifications.	The LRD maintains an internal red-lined version of the ordinance to track ordinance interpretations and possible future changes.
	3. Continue consulting with the Waukesha County Stormwater Advisory Committee on major code updates.	This advisory committee is prescribed in the county Stormwater Ordinance.

Goal 1 - Control Urban Runoff Pollution and Flooding (2.4 FTE and 37% of annual budget)		
Objectives	**Planned Activities**	**Program Context/Progress Notes**
C. Maintain compliance with County MS4 Stormwater Discharge Permit issued by DNR for all existing county-owned land and infrastructure		
	1. Complete annual MS4 permit technical requirements relating to illicit discharge detection, BMP inspections and maintenance, pollution prevention, storm sewer system/outfall mapping, etc.	The requirement for a 40% Total Suspended Solids reduction was removed by the state legislature, and reverted to 20%. TMDLs are superseding where they have been developed.
	2. Complete annual DNR reporting requirements relating to stormwater program accomplishments and ordinance administration efforts.	This report is combined with the annual ALP report required under A.2. above.
	3. Complete mandated urban nonpoint pollution educational program.	See Goal #4 below for details.
D. Facilitate stormwater best management practice (BMP) maintenance		
	1. Update sample BMP maintenance agreement documents on LRD web page and provide to permit applicants.	Samples are now available in MS Word format so they can be easily adapted to each site.
	2. Continue requiring all new BMP maintenance agreements to be recorded at the Register of Deeds during a new land division, and all BMP as-built documents to be recorded as an addendum.	This addendum process was adopted by the LRD in 2006 and will be continued.
	3. Continue collecting and loading BMP photos, as-built plans and maintenance data into the county stormwater BMP database.	For permits issued prior to 2006, LRD back-scanning is on-going and nearly complete as of 2021.
	4. Optimize and promote public access to stormwater BMP data and images through the county GIS web application.	As of 2021, data and images for over 800 BMPs are displayed on the county GIS-web site. Map IV-3 provides a recent snap shot of the data points. Future plans are discussed under Goal 6.
	5. Offer local community staff login access to the stormwater database and GIS system to allow editing and uploading of BMP data and maintenance inspections.	One community has been trained to date. No charges are involved for using the system.
	6. Maintain model BMP maintenance ordinance language on the LRD web site and encourage local community adoption and enforcement.	The county developed this model ordinance in 2010. However, counties do not have the special assessment authority needed to enforce it.

Goal 1 - Control Urban Runoff Pollution and Flooding (2.4 FTE and 37% of annual budget)		
Objectives	**Planned Activities**	**Program Context/Progress Notes**
	7. Publish sample BMP inspection forms and use them in BMP inspections conducted by the LRD on request, or in cooperation with a local government.	LRD completed sample BMP inspection forms which are published on the County's website. Existing intergovernmental agreements with towns & villages also cover BMP inspections.
	8. Include BMP maintenance in educational workshops and presentations. Provide copies of BMP maintenance fact sheets.	The LRD has covered BMP maintenance in workshops during 2010, 2011 and 2012, 2013, 2014, 2017, 2019, 2020 and 2021.
E. Provide stormwater-related technical and cost-sharing services to other county departments and local organizations		
	1. Coordinate stormwater ordinance enforcement and MS4 permit compliance activities among county Parks and Public Works projects.	An interdepartmental agreement was executed in February 2012, as required under the county MS4 permit and ALP. The Departments of Parks and Land Use and Public Works meet annually to review projects.
	2. Assist with stormwater and erosion control planning, design and cost-sharing for county infrastructure and land management projects.	This includes county-owned parkland and existing and new county buildings, parking lots and roads.
	3. Provide Planning and Zoning staff with technical recommendations relating to stormwater, erosion control, impervious surface mitigation under NR 115 and basement/groundwater separation.	These recommendations are incorporated into zoning permits, land division approvals, conditional use permits and other zoning actions.
	4. Assist nonprofits, lake organizations, and other local governments with stormwater and erosion control planning, design and cost-sharing upon request.	An example is the LRD working agreement executed with the Fox River Commission, which resulted in numerous BMPs being installed as shown on their web site: www.SEWFRC.org
	5. Provide local schools technical and cost-sharing assistance with rain garden, outdoor classroom designs, and other related services.	This is offered as part of the LRD Green Schools program and grants. See Goal 4 for more details.
F. Prevent flooding of homes and businesses from surface and groundwater		
	1. Encourage communities to plan and zone hydric soils, internally drained and other flood-prone areas to protective categories.	Hydric soil thematic maps have been posted on the county GIS-web site.

Goal 1 - Control Urban Runoff Pollution and Flooding (2.4 FTE and 37% of annual budget)		
Objectives	**Planned Activities**	**Program Context/Progress Notes**
	2. Enforce 1-foot basement/groundwater separation requirement in the county stormwater ordinance. Encourage other communities to adopt similar requirements.	LRD policies require detailed soil profile evaluations using USDA classification system to identify highest groundwater levels by redoximorphic and other soil features.
	3. Enforce 50-foot horizontal and 2-foot vertical flood setback requirements in the county stormwater and floodplain zoning ordinances.	In response to past flooding problems, the LRD has published detailed procedures for un-mapped floodplains and internally drained areas.
	4. Use Emergency Assistance Program grant funds when available to assist landowners and communities in flood remediation and prevention projects.	EAP Grants are available for low-moderate income home owners that suffer from flood damage.
	5. Continue cost-sharing the operation of stream flow gauges on the Fox, Menomonee, Mukwonago and the Bark Rivers, as well as funding other floodplain modeling efforts.	The county has been sponsoring flow gauges in Waukesha, Menomonee Falls, Mukwonago and Rome for many years. The County would consider offering cost-sharing for the gage on the Bark River Nagawicka Rd.
G. Promote and demonstrate watershed protection planning to guide and coordinate land use and stormwater program efforts among communities in a watershed		
	1. Continue promoting and assisting local community groups and SEWRPC on developing watershed protection plans.	Support implementation of completed watershed plans through educational efforts, community group activities, land acquisition and ordinance enforcement.
	2. Direct future development away from environmentally sensitive areas, such as environmental corridors, wetlands, steep slopes, or shallow water table or bedrock.	These areas are identified in the adopted 2009 County Development Plan and in a series of thematic maps on the county GIS-web system.
H. Promote and demonstrate low impact development techniques and innovative stormwater BMPs		
	1. Support conservation designs in zoning and stormwater ordinances and land division reviews.	County zoning code has lot density credits for preservation of natural areas and implemented treated impervious surface provisions in the Shoreland Zone.
	2. During stormwater permit reviews, encourage developers to use rain gardens, bioretention, native plantings, constructed wetlands, green roofs, buffers, recycled products, and other low impact BMPs.	On–going effort to treat stormwater as an amenity to site landscaping and to reduce waste on construction sites.

Goal 1 - Control Urban Runoff Pollution and Flooding (2.4 FTE and 37% of annual budget)		
Objectives	**Planned Activities**	**Program Context/Progress Notes**
	3. Use low impact development BMPs and techniques on county infrastructure and land management projects, as outlined in the County Sustainability Plan.	An example is a bioretention basin at the Grounds Maintenance Building
I. Ensure water protection efforts are based on the sensitivity of the resource		
	1. Develop and populate a water resource geodatabase on the county GIS-web so permit applicants have access to data.	See Goal #6 for details.
	2. Base stormwater permit reviews on the sensitivity of the receiving water, providing extra protection to outstanding and exceptional water resources, cold water streams, lakes and other sensitive areas.	This is currently required in the county Stormwater ordinance. The more sensitive streams are also listed in the ordinance.
	3. Ensure compliance with stormwater and erosion control standards in adopted TMDL plans in target watersheds.	TMDL plans have been approved for the Rock River and Milwaukee River basins. A TMDL for the Illinois Fox & Des Plains River basin is expected in 2024.
	4. Encourage or require variable width buffers along water resources based on sensitivity, site conditions, code requirements (NR 115) & wildlife habitat.	The width of the buffer is determined by the function desired (water quality, pollutant removal, thermal mitigation or wildlife habitat).

Goal 2: Protect the Quality and Quantity of Groundwater

Background:

Concern for the quality and quantity of groundwater in Waukesha County has taken the front stage over the past decade. As noted in Chapter II, the deep sandstone aquifer provides drinking water for many of the larger communities in the county, but over-pumping groundwater has caused the water table to drop over 600 feet from natural levels in the eastern part of the county. As the water table dropped, levels of naturally occurring pollutants such as radium began to rise in municipal water supplies, with some exceeding the U.S. EPA standards for drinking water. A long legal battle over this issue has resulted in a court order for the City of Waukesha to reduce radium levels in their water supply to comply with EPA standards by 2018.

The groundwater in the county's shallow aquifer is more easily accessed and is the primary water source for thousands of homes beyond the reach of municipal water supplies. However, the shallow aquifer is also more susceptible to contamination and any drawdown from over-pumping would drop water levels in local lakes and wetlands and reduce stream base flows. Legal battles have already occurred where high-capacity shallow municipal wells were proposed near lakes and groundwater recharge areas.

To avoid these types of issues and plan for future water supplies in SE Wisconsin, SEWRPC completed a three-phased multi-agency effort to inventory local groundwater resources, develop a regional groundwater model, and develop and publish a Regional Water Supply Plan for Southeast Wisconsin (2010). The plan is based upon an adopted regional comprehensive plan design year of 2035, recommends a

sustainable water supply for every community in southeast Wisconsin, and can be found at: http://www.sewrpc.org/SEWRPC/Environment/RegionalWaterSupplyPlan.htm

For some communities, the Regional Water Supply Plan recommends switching from a deep aquifer groundwater supply to a shallow aquifer or surface water supply – namely Lake Michigan. This type of switch would not only provide a sustainable supply of water to the community, but would also allow the region's deep aquifer to recover from decades of over-pumping. While switching to Lake Michigan for a community water supply may be supported by a tremendous amount of science, it does introduce a level of complexity in the administrative and political arenas due to the adoption of the Great Lakes - St. Lawrence River Basin Water Resources Compact ("Great Lakes Compact") in 2008. Being enacted by the legislatures of all eight states bordering the Great Lakes, as well as the United States Congress and two Canadian provinces, this regional law trumps all other laws relating to the use and "diversion" of water from the Great Lakes basin. Under the Great Lakes Compact, any water diverted outside of the basin must be returned after use and only communities straddling the watershed boundary or located in a county that straddles the watershed are eligible for diverting Great Lakes water. The Compact also established a water diversion application process, requiring all applications to comply with strict technical criteria and be approved by all eight Great Lakes states. A diversion application for Lake Michigan water was submitted by the City of Waukesha in 2010 was approved by the DNR in 2021 and is under construction.

Given the importance of groundwater as a resource and vital asset to support many communities in the region, Waukesha County has been working cooperatively with the City of Waukesha and a number of local businesses and other groups since 2006 to promote local water conservation efforts. This organization started locally, but has grown to a statewide group called the Wisconsin Water Conservation Coalition.

Goal 2 - Protect the Quality and Quantity of Groundwater (0.4 FTE and 6% of the annual budget)		
Objectives	**Planned Activities**	**Program Context/Progress Notes**
A. Promote water conservation. *		
	1. Include water conservation education on LRD web page and in presentations to schools, civic groups, and general public.	See Goal #4 for details.
B. Protect groundwater recharge areas and encourage stormwater infiltration. *		
	1. Promote the use of county stormwater infiltration potential maps to guide land use and stormwater management concept planning.	Thematic maps are available as a data layer on the county GIS-web site.
	2. Enforce groundwater recharge protection and infiltration standards in the county stormwater ordinance – especially in the western recharge zone for the deep aquifer.	The county stormwater ordinance defines these areas and the standards.
	3. Include explanations of county deep and shallow aquifers, their importance to community water supplies, and current trends and potential threats to the aquifers in public outreach activities.	See Goal #4 for details on outreach efforts.

Goal 2 - Protect the Quality and Quantity of Groundwater (0.4 FTE and 6% of the annual budget)		
Objectives	**Planned Activities**	**Program Context/Progress Notes**
C. Minimize the impacts on groundwater from nutrients, pesticides, road salt and other contaminants contained in urban and agricultural stormwater runoff. *		
	1. Implement and periodically update MS4 pollution prevention plans for county facilities, including highway maintenance substations with salt storage areas.	The county has developed and implemented pollution prevention plans at highway substations and reduced road salt use through salt brine applicators.
	2. Enforce stormwater pretreatment and groundwater/bedrock separation restrictions in stormwater permits and demonstrate BMPs on county land.	A compacted 2-foot clay liner was installed in the stormwater pond treating runoff from the Courthouse campus.
	3. Include pollution prevention and treatment information on the LRD web site and in educational workshops.	Pollution prevention planning has been a topic at the 2018 and 2021 annual county stormwater workshops.
	4. Promote and provide technical and financial assistance in proper well abandonment (urban & rural).	SWRM cost-sharing funds were used to abandon 191 local wells since 2012.
	5. Assist DNR with investigating and resolving well contamination cases upon request.	The LRD can help locate the source of the well contamination and make recommendations to prevent it.
D. Promote the implementation of the SE Wisconsin Regional Water Supply Plan to protect surface and groundwater resources.		
	1. Track progress on plan implementation and impacts on local groundwater supplies and include in education and outreach efforts.	See Goal #4 for details on outreach efforts.

* This objective reflects a recommendation of the SE Wisconsin Regional Water Supply Plan, SEWRPC, 2010.

Goal 3: Control Agricultural Runoff Pollution

Background:

According to DNR and EPA reports, agricultural runoff is the largest source of water pollution in most watersheds in Wisconsin and nationally. This goal reflects a state mandate under Chapters NR 151 and ATCP 50 Wisconsin Administrative Code for all counties to ensure landowner compliance with state agricultural nonpoint pollution performance standards and prohibitions. The state nonpoint standards address soil erosion and nutrient runoff from cropland as well as barnyard runoff and manure handling practices for livestock operations. Details on these standards are provided in Chapter IV. State administrative rules also prescribe specific cost-sharing requirements that must be met before a landowner can be required to comply with the state standards. The minimum cost-share rate is generally 70%, except

in cases of economic hardship, whereby 90% cost-sharing is required. The cost-sharing requirement does not apply to landowners who receive the state Farmland Preservation income tax credit.

A 2015 agricultural land use inventory conducted by SEWRPC shows there were 76,028 acres in agricultural uses, or about 20% of the county landscape, not including woodlands, wetlands, lakes or rivers. Since the 1990's, conservation plans have been developed for a large percentage of county farmland due to the owner or operator participating in USDA programs, the state Farmland Preservation tax credit, or previous Priority Watershed projects. A transect survey conducted by LRD staff in 2001 showed that approximately 90% of county cropland was at or below "tolerable" (T) soil erosion rates, the state and federal standard that would maintain soil productivity indefinitely. In 2002, the "T" value was also adopted as one of the above noted state nonpoint pollution performance standards. While compliance with "T" value is mandatory under state law, the NRCS will not participate in enforcement efforts. In fact, conservation plans prepared for USDA programs cannot be used by LRD staff to determine landowner compliance with state standards without the written permission from the landowner.

The LRD has also inventoried livestock operations in the county and found very few significant threats to local water resources. Map IV-4 shows the general location of 78 livestock facilities with more than 40 animal units. Only 16 of these 78 are located within a water quality management zone (300 feet of a river or 1000 feet of a lakeshore). The state Nutrient Management technical standard (NRCS 590) includes Phosphorous Index limits for individual farm fields.

As noted in Chapter II, development pressures are a daily fact of life for agricultural producers in Waukesha County. There is still a considerable amount of agricultural production in the county. Therefore, if problem fields or livestock facilities are located in an area planned for future development, consideration needs to be given whether to invest a significant amount of limited public resources to address short-term agricultural runoff issues. Because of this, the total LRD resources allocated to this goal are much less than most other county land conservation departments in the state and agricultural nonpoint compliance activities are focused on the "priority farms" noted in A.2. below. Having said this, all farms in the county must meet the NR 151 performance standards and are therefore subject to enforcement action for noncompliance. Further details on agricultural nonpoint compliance efforts are provided in Chapter IV.

Goal 3: Control Agricultural Runoff Pollution (0.8 FTE and 12% of the annual budget)		
Objectives	**Planned Activities**	**Program Context/Progress Notes**
A. Implement state agricultural performance standards and prohibitions.		
	1. Utilize a web GIS based tracking system to track nonpoint compliance evaluations of local farms.	This simplifies the data entry for compliance evaluations.
	2. Target "priority farms", including Farmland Preservation zoned areas, county-owned cropland, Water Quality Management Areas (WQMAs) and sensitive watersheds or subwatersheds.	See Chapter II for the location of sensitive watersheds or subwatersheds. See Chapter IV for further details on compliance activities.
	3. Contact landowners to complete compliance evaluation process.	On-going. See Chapter IV for further details. Determine conservation compliance for 25% of Farmland Preservation Program participants annually (approx. 15 farms per year).

Goal 3: Control Agricultural Runoff Pollution (0.8 FTE and 12% of the annual budget)		
Objectives	**Planned Activities**	**Program Context/Progress Notes**
	4. Record/map compliance status of farms and facilities in GIS tracking system.	On-going. See Chapter IV for further details.
	5. Offer landowner technical assistance and cost sharing, if available.	Ensure 2,500 acres of preserved farmland meets NR 151 requirements for tolerable soil loss and has a valid nutrient management plan.
	6. After landowner takes compliance steps, re-evaluate and update tracking system and landowner documentation.	Notify the landowner that they must maintain future compliance without cost-sharing.
	7. If a non-compliance issue poses a significant threat to water quality, refer to the DNR for possible enforcement. Pursue a DNR/LRD working agreement to handle ag runoff complaints/referrals.	To date, DNR has chosen not to enter into a working agreement with the LRD due to regional DNR staff shortages. However, DNR/LRD staff still work together on ag runoff issues and talks will continue on a future working agreement.
	8. Promote and implement BMPs in agricultural areas as needed to comply with adopted TMDL plans. Implementing Adaptive Management Plans through agreements with permitted municipalities.	An agreement has been signed with the Village of Mukwonago to assist in implementing their Adaptive Management Plan.
B. Promote natural buffers between agricultural lands and water resources to protect water quality, wildlife habitat, and groundwater recharge.		
	1. Promote available federal and state and local cropland set-aside programs to eligible landowners.	Waukesha County has entered into an Intergovernmental Agreement with the Village of Mukwonago to help implement their Adaptive Management Plan.
	2. Incorporate state tillage setback and/or buffer standard into the agricultural compliance evaluations under A above.	NR 151 has a 5-foot tillage setback.
	3. Assist Parks division with buffer planning and design as part of greenway land acquisitions and county-owned land management efforts.	The county has adopted a standard cross-section for greenway acquisition, which includes buffer areas. See Goal 5 for details. Waukesha County has developed Conservation Standards for County-owned cropland.

Goal 4 – Educate the Public on Conservation Issues

Background:

Information and education efforts are an important part of any conservation program. Gaining public acceptance of the various program goals is a minimal step, but getting target audiences to take action such as adopting a conservation practice is much more difficult. Since 2006, one of the driving factors for the Waukesha County information and education program has been maintaining compliance with the MS4 stormwater permits issued to 30 of the 37 local communities, including the county. One of the

requirements of an MS4 permit is for the community to implement a stormwater information and education program. To gain efficiencies and effectiveness of these program efforts, the LRD developed a comprehensive intergovernmental stormwater education program, which was approved by DNR. The LRD then offered to lead program implementation for local communities through a dedicated staff position, in exchange for an annual fee. While four communities bordering Milwaukee County had already committed to an education program under an earlier Phase I permit, the other 25 communities accepted the county offer and executed intergovernmental agreements to carry out the approved program. Since the vast majority of activities listed below are tied to the MS4 education program, their implementation is contingent on the continuation of the intergovernmental agreements.

It should be noted that since 1990, the LRD has also served as the "Responsible Unit" for 25 local communities under state recycling law (Chapter 287 Wis. Stats.). As a component of this law, the LRD is also charged with implementing a comprehensive recycling and waste reduction information and education program. Since some of the recycling and stormwater educational program efforts overlap and even complement each other, the LRD has been integrating these efforts as much as possible. Most of the recycling program education efforts are not listed below.

Goal 4 – Educate the Public on Conservation Issues (1.7 FTE and 26% of the annual budget)		
Target Audience & Topics	**Planned Education Activities**	**Program Context/Progress Notes**
A. Target Audience: Developers, engineers, and local government officials **Primary Topics**: Nonpoint pollution, groundwater, stormwater planning, construction site erosion control planning, plan implementation, regulations, soil investigations, BMP design, installation and maintenance, MS4 permit compliance, low impact development, flood control, natural area protection, pollution prevention, and invasive species control		
	1. Continuously update and improve stormwater ordinance forms, check lists, guidance documents, sample plans, etc.	Distribute them to permit applicants and use them in plan reviews.
	2. Host or co-host annual workshops with topics/theme selected by a community planning committee.	The LRD has hosted or co-hosted annual workshops for the past 21 years, with an average attendance of 100 people.
	3. Maintain LRD web page with up-to-date stormwater program materials, workshop presentation archives, and special event announcements.	The past 5 years of workshop presentations are maintained on the LRD web page.
	4. Improve electronic communications with target audience for information exchange and program/event announcements.	On-line sign-up for workshops is available and ability to subscribe to other program emails.
	5. Coordinate field tours of available BMP demonstration sites.	Done in cooperation with local communities.
	6. Provide presentations upon request to other agencies or organizations.	Includes the Metropolitan Builders Association and UW-Milwaukee.

Goal 4 – Educate the Public on Conservation Issues (1.7 FTE and 26% of the annual budget)		
Target Audience & Topics	**Planned Education Activities**	**Program Context/Progress Notes**
B. Target Audience: General public **Primary Topics**: Nonpoint pollution, groundwater, water conservation, public health impacts of water pollution, rain gardens, rain barrels, home composting, shoreland management, volunteer stream monitoring, natural area preservation, invasive species control/prevention, BMP maintenance, and household hazardous waste management.		
	1. Partner with other groups on I/E material and presentation development and marketing.	Work with UWEX and DNR on program materials with statewide application. Examples include Wisconsin Saltwise and the EE Cooperative.
	2. Host/co-host targeted public workshops and presentations through a regular schedule or by request through the county speaker's bureau.	Workshops are scheduled annually at the Retzer Nature Center or other county facilities.
	3. Set up displays and tend booths at community events.	LRD displays are also provided for community halls.
	4. Sponsor the Adopt-A-Drain initiative for storm drain maintenance.	LRD facilitates the Adopt-A-Drain initiative through the County Interactive Mapping system.
	5. Write and distribute news releases on special events.	For local newspapers
	6. Write and distribute seasonal newsletter articles for community newsletters.	On-going through the MS4 program.
	7. Conduct targeted mailings of educational materials and event announcements.	LRD maintains a number of targeted mailing lists.
	8. Maintain robust LRD educational web pages and provide information and brochures on request.	On-going.
	9. Make recycling and stormwater information available to local businesses.	Developed Business Toolkits which are available on our website.
	10. Promote and support household and agricultural hazardous waste collection sites in the County.	The LRD maintains several HHW sites with year-round availability while also coordinating several additional 1-dat collection sites each year.
	11. Maintain data and maps on web-GIS system for home building limitations and BMP maintenance information.	Soil thematic maps are available on GIS-web for wet soils, shallow bedrock and steep slopes.

Goal 4 – Educate the Public on Conservation Issues (1.7 FTE and 26% of the annual budget)		
Target Audience & Topics	**Planned Education Activities**	**Program Context/Progress Notes**
	12. Coordinate a comprehensive aquatic invasive species ("AIS") education, prevention and monitoring program.	Partner with local lake groups, maintain the AIS strategic plan and train Clean Boats Clean Waters ("CBCW") watercraft inspectors.
C. Target Audience: Rural land owners and farm operators **Primary Topics**: Agricultural nonpoint performance standards, buffers, wetland restoration, farmland preservation, conservation programs and cost-sharing opportunities		
	1. Conduct one-on-one contacts and distribute educational materials.	On-going as part of conservation compliance checks.
	2. Present information at local farm group meetings upon request.	Example is the local Farm Bureau chapter.
	3. Conduct target mailings for priority farms.	See Goal #3 for details.
D. Target Audience: Teachers, students, school administrators and youth groups **Primary Topics**: Nonpoint pollution, groundwater, soil and water conservation, rain gardens, waste reduction and recycling, water quality monitoring, composting, invasive species control, outdoor classrooms and managing stormwater on school grounds		
	1. Conduct annual teacher training workshops for current and prospective teachers.	Developed materials for Citizen Science in the Classroom, Green and Healthy Schools and EE Cooperative Curriculum
	2. Deliver classroom presentations to coincide with curriculum.	On-going by request.
	3. Sponsor water quality monitoring events for school groups.	LRD provides all monitoring equipment and student training.
	4. Partner with area colleges and school districts to provide technical tours, activities, and training for perspective and current facility maintenance personnel and administration.	Create a new initiative to align facility management with conservation best management practices.

Goal 5 – Preserve Targeted Farmland and Natural Areas

Background:

Preserving farmland and natural areas are quality of life issues that show up in public opinion surveys in many forms, such as a desire to: preserve the rural character of the county, recharge our local drinking water supplies, avoid land use conflicts, minimize flooding, provide food and fiber for local markets, attract

quality employees, encourage business investment, or provide wildlife habitat. In 2011, the Waukesha County Board of Supervisors adopted Addendum D to the 2009 Waukesha County Comprehensive Plan, which serves as an update to the 1984 Waukesha County Agricultural Land Preservation Plan. This updated "Farmland Preservation Plan" contains specific preservation criteria for contiguous rural land areas and individual parcels within those areas, consistent with Wisconsin's farmland preservation law revisions enacted in 2009. Under the revised state law, Farmland Preservation Plans must be consistent with locally adopted comprehensive plans and new tools were created, including "Agricultural Enterprise Areas" (AEA) and "Purchase of Agricultural Conservation Easements" (PACE) grants. More details on these programs are provided in Chapter I. Chapter IV contains an overview of the agricultural resources in Waukesha County and the areas designated for preservation under the county's 2011 plan update. Map IV-5 shows the portions of Waukesha County that would be eligible to apply for AEA and PACE, assuming other program requirements are met. The county Farmland Preservation Plan includes 10,264 acres or 11% of county farmland in a farmland preservation category. An additional 24,738 acres or 27% of farmland is delineated for possible future AEA designation, which would require a locally led process to revise land use plans. It should be noted that 2011 Act 32 (2011-2013 State Budget Bill) eliminated most state funding for PACE grants, but retained DATCP program authority for these permanent farmland preservation easements.

Also included in the 2009 Waukesha County Comprehensive Plan are a number of planning goals, objectives and standards relating to the preservation of environmental corridors, wetlands, floodplains and other environmentally sensitive natural areas. Associated county zoning codes are designed to prevent unnecessary loss of these lands through a number of tools such as residential lot density calculations, grading limitations, and conditional use permit criteria. The county stormwater ordinance also contains restrictions on grading in environmentally sensitive areas. SEWRPC has done extensive mapping of natural areas and published a series of reports with specific recommendations on how they should be preserved. SEWRPC also uses these reports in requests for sanitary sewer extensions and amendments to regional water quality management plans. County ordinances often contain cross-references to these SEWRPC reports and maps.

Waukesha County also maintains a large nature-based park system, including eight developed parks with staff located at the facility year-round, four other major parks scheduled for future development, and a comprehensive system of recreational trails. The county Park and Open Space Plan was updated in 2018 and includes the identification of proposed land acquisitions for expansion of parks, greenways and trails. Historically, the majority of county parkland acquisitions have occurred as dedications of greenways during the development review process. However, since 2000 the county has also budgeted $1 million each year for new land acquisitions through a dedicated revolving fund. As of 2018, the county parks system consists of 4,858 acres of parkland and 2,786 acres of greenways, totaling approximately 2% of the county area. An integral component to the Waukesha County Park and Open Space Plan is the acquisition of greenways. The vision is to create a system of corridors along the County's major rivers and streams, which will protect and improve water quality as well as the natural resource land features along those water courses. In addition, the greenways will connect major state, county and local parkland providing recreational and educational opportunities.

Goal 5 – Preserve Targeted Farmland and Natural Areas (0.2 FTE and 4% of the annual budget)		
Objectives	**Planned Activities**	**Program Context/Progress Notes**
A. Assist Planning and Zoning Division and local governments with preserving prime farmland in accordance with the 2011 adopted county Farmland Preservation Plan		

Goal 5 – Preserve Targeted Farmland and Natural Areas (0.2 FTE and 4% of the annual budget)		
Objectives	**Planned Activities**	**Program Context/Progress Notes**
	1. Assist with Farmland Preservation zoning outreach efforts in designated areas.(M)	State law requires Waukesha County and local communities to update their farmland preservation zoning ordinances every 10 years.
	2. Assist with GIS analysis of soils, land use, or other criteria as needed to evaluate proposed amendments to farmland preservation areas.	The 2009 WCCP contains specific procedures to consider plan revisions on an annual basis.
	3. Assist with processing applications for Agricultural Enterprise Areas and Purchase of Agricultural Conservation Easements or similar grants.	The county assisted with a successful AEA Expansion in 2018.
	4. Enforce state conservation compliance requirements for landowners claiming the Farmland Preservation tax credit.	See Goal #3 for details.
B. Minimize negative agricultural impacts from growing communities and wildlife populations		
	1. Ensure county stormwater permits prevent cropland damages from increased runoff volumes and peak flows from new impervious surfaces.	Cropland damage from urban stormwater runoff is a common problem in the county. Preventive standards are included in the county SW ordinance.
	2. Continue participating in the Wildlife Damage Abatement and Claims Program, to allow local farmers to obtain financial relief from crop damage and abatement technical assistance.	The county has maintained a contract with USDA-WS to provide these services since 2002.
C. Enforce county ordinances to protect existing natural areas		
	1. Evaluate sensitivity of natural areas proposed for disturbance, requesting expert technical assistance when needed and referencing SEWRPC maps and publications.	County ordinances require mapping these areas for development reviews and often reference SEWRPC data and reports for environmental corridors and other natural areas.
	2. Prevent unnecessary grading activity near natural areas and direct stormwater BMP construction outside floodplains and environmental corridors.	This is included in the guiding principles of the stormwater ordinance.
	3. Require invasive species control in all site restoration work and native plantings in stormwater facilities.	The LRD has adopted BMP planting certification procedures, including a transect survey of plants.

Goal 5 – Preserve Targeted Farmland and Natural Areas (0.2 FTE and 4% of the annual budget)		
Objectives	**Planned Activities**	**Program Context/Progress Notes**
	4. Require cleanup of solid waste disposal sites in natural areas as a condition of other permits.	This is a standard ordinance requirement for new developments.
D. Protect and restore wetlands and natural areas, using available cost-sharing programs.		
	1. Evaluate potential sites for wetland restoration, targeting farmed hydric soils. Use to prioritize landowner contacts.	The LRD has completed a county-wide GIS analysis of potential sites.
	2. Assist with site assessments and wetland restoration project implementation on county-owned parkland. Create an inventory of possible wetland mitigation bank sites.	An inventory of potential wetland mitigation bank sites on County-owned land was included in the 2018 Park and Open Space Plan.
	3. Contact private landowners and encourage wetland restoration efforts through partnerships with conservation organizations.	This is dependent on landowner interest and the availability of cost-sharing funds. NRCS Wetland Reserve Program and the US Fish & Wildlife Service are two potential funding sources.
	4. Assist other agencies and organizations with locating possible wetland mitigation sites on private lands to satisfy wetland fill regulatory requirements.	An inventory of potential wetland mitigation bank sites on private land was included in the 2018 Park and Open Space Plan.
	5. Encourage wetland restoration through watershed protection planning efforts and county park/greenway acquisitions.	The WDNR has an inventory of potentially restorable wetland areas on the Surface Water Data Viewer.
	6. Use wetland restoration as a potential adaptive management/nutrient trading BMP for TMDL plan implementation.	An Intergovernmental Agreement with the Village of Mukwonago was signed for implementation of their Adaptive Management Plan.

Goal 6 – Support Water Monitoring and Improve Public Access to Water Data

Background:

Monitoring water quality can be a powerful tool for tracking long-term trends and "ground-truthing" assumed impacts of land use changes and pollution control practices installed. Past citizen surveys conducted by the LRD show that an equal number of people think water quality is getting better versus getting worse or staying the same. In general, a shortage of water quality monitoring information makes it impossible to say who is right. While newer technologies offer great efficiencies, the competition for limited public funds remain an obstacle for implementation. One solution to this problem is to encourage volunteer citizen monitoring.

Since 2001, the LRD has been promoting, training and supporting citizen volunteer water quality monitoring of county streams in cooperation with groups such as the Rock River Coalition, Pewaukee River Partnership,

and Water Action Volunteers (WAV). Through these partnerships, citizens are trained how to monitor streams for temperature, turbidity, dissolved oxygen, and stream flow and how to conduct biotic index and habitat assessments. The data collected is entered into the WAV Internet database for future reference. While filling a data gap, this program also serves as a powerful educational tool for program participants and their families. Further details on the program are provided in Chapter IV.

Improving public access to water data has been a long-term goal of the LRD for over 20 years. It would help developers, land managers and the general public to better understand and appreciate local water resources and comply with related regulations. While evolving GIS technologies now make this goal more achievable, it remains a challenging long-term project.

Goal 6 – Support Water Monitoring and Improve Public Access to Water Data (0.8 FTE and 13% of the annual budget)		
Objectives	**Planned Activities**	**Program Context/Progress Notes**
A. Promote and sponsor water monitoring efforts		
	1. Promote stream gauges and agency monitoring of county lakes and streams to track water quality trends and provide data for floodplain regulations.	The county funds several USGS stream gauges on the Menomonee, Bark, Fox and Mukwonago Rivers.
	2. Conduct annual citizen stream monitoring training (level 1 & 2) and provide equipment and materials to volunteer monitoring teams. Assist with lake monitoring upon request.	As of 2022, the LRD is sponsoring 20 volunteer stream monitoring teams. More details on the program are provided in Chapter IV.
	3. Provide quality control of citizen monitoring through team site visits and checking data entry on WAV web site.	This is part of the support the LRD provides monitoring teams.
	4. Maintain LRD web site with current information about the monitoring program and links to available monitoring data.	On-going effort.
	5. Monitor the spread of AIS countywide	Conduct lake surveys, collect samples, install AIS signs, educate boaters and compile AIS data/maps.
B. Improve accuracy, usability and public access to water resource data		
	1. Build and maintain a water resource geodatabase on the county GIS-web system to allow easy public access and use of water resource data.	Each year, the LRD will focus on incremental steps in the process.
	2. Link water graphics layers to DNR water resource classification data.	This will allow local access to the DNR data without a duplication of effort.

Goal 6 – Support Water Monitoring and Improve Public Access to Water Data (0.8 FTE and 13% of the annual budget)		
Objectives	**Planned Activities**	**Program Context/Progress Notes**
	3. Add surface and groundwater water monitoring data points and links to associated monitoring and gauging data.	Links could be made to USGS and DNR monitoring data web sites.
	4. Add dam locations and link to DNR dam database.	May also add updated photos to the inventory.
	5. Continue to update stormwater BMP data, photos and maintenance inspection results.	On-going effort as part of the stormwater permit termination process.

Goal 7 – Reclaim Active Nonmetallic Mining Sites

Background:

Mines can negatively impact lakes, streams and well water and cause land use conflicts, even after the mine is no longer active. In 2000, the Department of Natural Resources adopted statewide nonmetallic mine reclamation requirements through the promulgation of Chapter NR 135 Wisconsin Administrative Code. Under this rule, all counties in the state were required to adopt and enforce nonmetallic mining reclamation ordinances. All other municipalities had the option of adopting and enforcing these requirements. In response to this mandate, the Land Resources Division convened a workgroup to assist with drafting the Waukesha County Nonmetallic Mining Reclamation Ordinance. The workgroup completed the task in May of 2001 and the Waukesha County Board adopted the county Nonmetallic Mining Reclamation Ordinance in July 2001. Presently, the LRD regulates 17 mining sites in six different communities in the county, as shown on Map II-4. Each permit requires compliance with an approved reclamation plan, based on a locally approved post-mining land use plan. Because this program represents an ongoing workload for LRD staff, it is included here as a goal even though it was not identified as a resource issue of concern during the nominal group process with the Citizens Advisory Committees. It should be noted that In Waukesha County, high land values encourage mine reclamation as much as any state or local regulation.

In 2004, the LRD opened a county-wide yard waste composting facility in conjunction with sand and gravel mining on county-owned land in the Town of Genesee. Private contractors operated both facilities. The county is paid annually for the mining rights, while the contractor was paid for yard waste composting services. State recycling grants helped support the composting operation. The composting operation ended in 2013. The finished compost is being used as a topsoil substitute to reclaim the mine, following approved plans and permits. Mining is currently permitted through 2021 with reclamation planned for 2022.

Goal 7 – Reclaim Active Nonmetallic Mining Sites (0.2 FTE and 2% of the annual budget)		
Objectives	**Planned Activities**	**Program Context/Progress Notes**
A. Enforce the county nonmetallic mine reclamation ordinance.		
	1. Review plans, issue permits, inspect sites and enforce ordinance provisions. Make approved reclamation plans more accessible to the general public.	The LRD is in the process of building a GIS application to allow public access to the 16 approved reclamation plans under county jurisdiction.
B. Reclaim county gravel pit and prepare to sell property for industrial activities.		
	1. Reclaim the site utilizing compost from former yard waste composting operation as a topsoil substitute. Construct stormwater management facilities.	Prepare the property for development in accordance with the approved end land use plan.

Chapter IV. Plan Implementation and Evaluation

As noted in Chapter I, one of the requirements for county LWRM plans is to describe procedures that will be used to implement the nonpoint pollution performance standards and prohibitions under NR 151. Another plan requirement is to estimate costs associated with LWRM plan implementation. This chapter is intended to satisfy both of these requirements.

Urban Nonpoint Pollution Performance Standards

As noted in Chapter III, urban runoff pollution is the leading cause of many county lakes and streams not meeting water quality standards or water use objectives. Chapter III also noted that Chapter NR 151 Wisconsin Administrative Code contains a number of urban nonpoint pollution performance standards for new construction, which are being implemented through the County Stormwater Management and Erosion Control Ordinance. A general summary of the standards, as of 2012 is provided below:

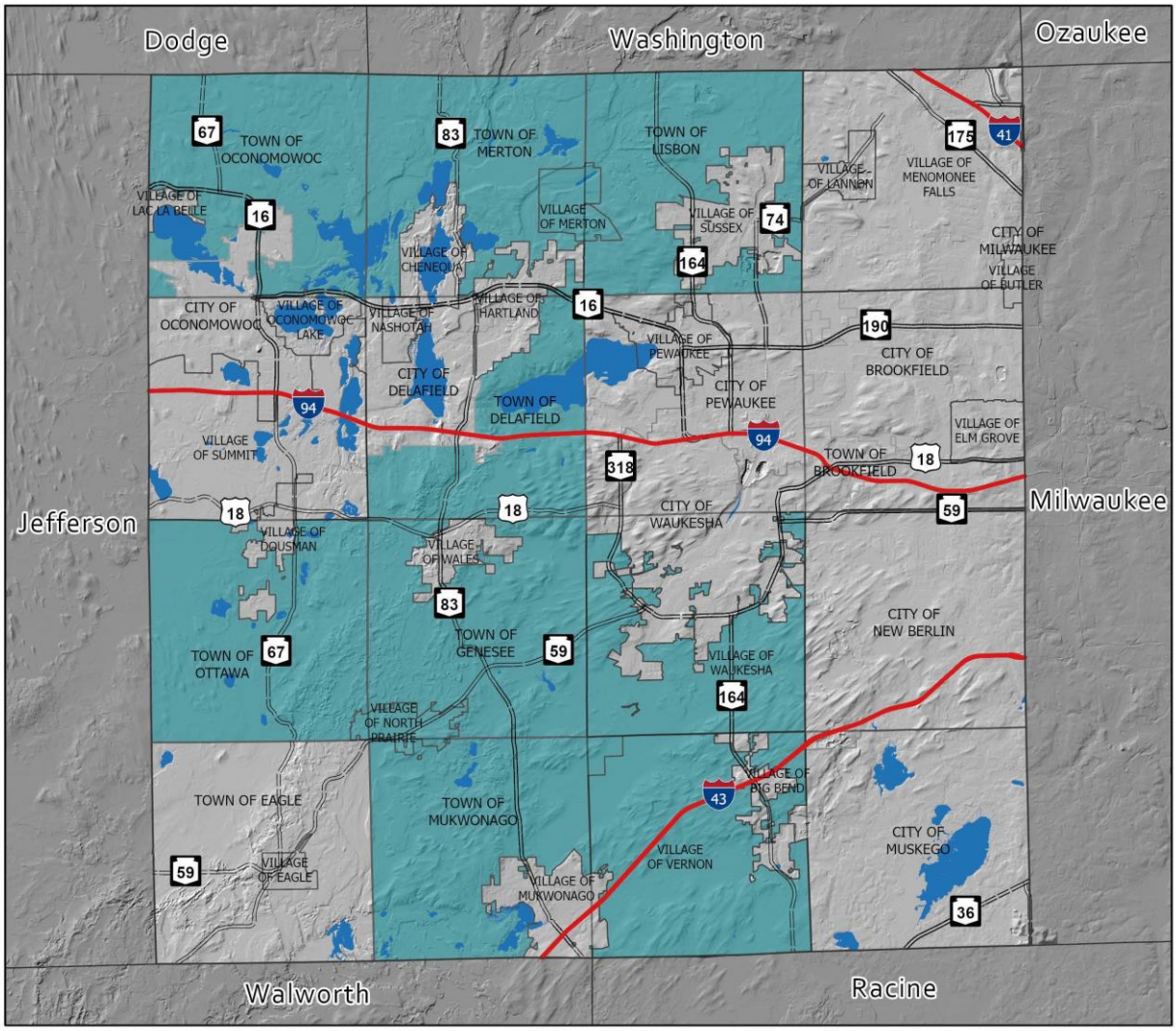
- Control 80% of sediment from construction sites.
- Control 80% of post-construction total suspended solids (TSS) from new developments and 40% from redevelopments.
- Maintain pre-development peak discharge rates for the 1-year and 2-year, 24 hour design storm for new developments.
- Infiltrate 90%, 75% or 60% of pre-development runoff volumes for new development with low, moderate or high imperviousness respectively.
- Maintain protective areas (10-75 feet) between new impervious surfaces and lakes, streams, and wetlands.
- Control petroleum runoff (visible sheen) from fueling and vehicle maintenance areas.

A list of urban best management practices to be utilized to meet state performance standards is contained in Appendix E.

Waukesha County Stormwater Management & Erosion Control Ordinance

As a condition of a Priority Watershed program grant, Waukesha County adopted a construction site erosion control ordinance in 1992. This ordinance was updated in 1998 to include post-construction stormwater management requirements for new development, following standards agreed to by the Waukesha County Stormwater Advisory Committee. As a result of a redesign of the state's nonpoint program, urban nonpoint performance standards were subsequently promulgated in 2002 under Chapter NR 151 Wisconsin Administrative Code. New stormwater discharge permit standards were also promulgated in 2004 under Chapter NR 216. The Waukesha County Stormwater Management and Erosion Control Ordinance was updated in 2005 to meet these new state standards. A copy of the county ordinance is available at www.waukeshacounty.gov/stormwater. Map IV-1 shows the jurisdiction of the county Stormwater Ordinance as of 2012. Enforcement of this ordinance remains the number one workload item for the LRD through the LWRM planning horizon. An overview of the Stormwater Permit program is presented in Figures IV-1. A simplified summary of the Stormwater Permit process is shown in flow chart form in Figure IV-2. It should be noted that Stormwater Permits are usually linked with other permit processes, and for larger projects, the review is often a cycle of submittals and responses, depending on the quality of plans submitted. Depending on the local economy, on average the LRD has issued 50-100 permits per year.

Map IV-1
Jurisdiction of the Waukesha County
Stormwater Management & Erosion Control Ordinance



Legend

Stormwater Ordinance Jurisdiction

N
W E
S

Source: Waukesha County, WI DNR, SEWRPC

0 4 8 12 Miles

Figure IV-1
Overview of Stormwater Permit Program

WHEN: Proposed land development activity that will expose soil to erosion (grading or filling) or increase stormwater runoff (add rooftops & pavement) and meets any of the following permit thresholds:

- Disturbing 300 lineal feet of ground for new buried utility, pipe (unless plowed outside of ditch line)
- 3000 square feet land disturbing activity (bldgs./grading)
- All new "subdivisions" (as defined by local codes)

→ Erosion Control Plan Required

- All new local road construction
- All sites where at least ½ acre of impervious surface is added to the landscape (rooftops, pavement, etc.)
- Other sites that may cause off-site sediment or stormwater runoff problems (as requested)

→ Stormwater Mgt. Plan also Required

WHY: To minimize water pollution, flooding, and other negative impacts of urbanization on downstream water resources (lakes, streams, wetlands & groundwater) and property owners. Aimed to control soil erosion and sedimentation during construction and manage the discharge of stormwater after an urban development is complete. Pursuant to *Waukesha County Code Chapter 14, Article VIII – Stormwater Management & Erosion Control.*

WHO: The Waukesha County Department of Parks and Land Use - Land Resources Division issues permits.

HOW: To obtain a permit, the applicant must prepare erosion control and/or stormwater management plans, as noted above. The contents of these plans depend on the size and complexity of the site. For erosion control plans on sites one acre or less, a short checklist of plan requirements is on the application form. For all stormwater management plans and erosion control plans for larger sites, published check lists and other technical guidelines are available. A submittal must include:

- Signed application, including list of project contacts
- Permit fee and financial assurance (see fee schedule)
- Site map (see checklist #!)
- Erosion control plan (preliminary or final – see checklist #2)
- Stormwater management plan (preliminary or final – see checklist #3)
- Narrative/support materials on plan, soil test, BMP designs, construction sequence, etc.
- Other applicable items, such as a stormwater BMP maintenance agreement

For new land divisions under county approval authority and certain zoning approvals, the LRD must issue a **Preliminary Review Letter** prior to approval of a Preliminary Plat. Obtaining conceptual/general review comments on these plans will facilitate other plan review processes. It also allows the applicant to proceed through those processes without committing the resources needed to complete final engineering designs and construction plans or line up contractors, which are all needed to obtain a permit. Prior to approval of a Final Plat, the LRD must issue a **Certification of Compliance** with the Stormwater Ordinance to verify that all deed restrictions, setbacks, BMP maintenance agreements and other recorded items are complete.

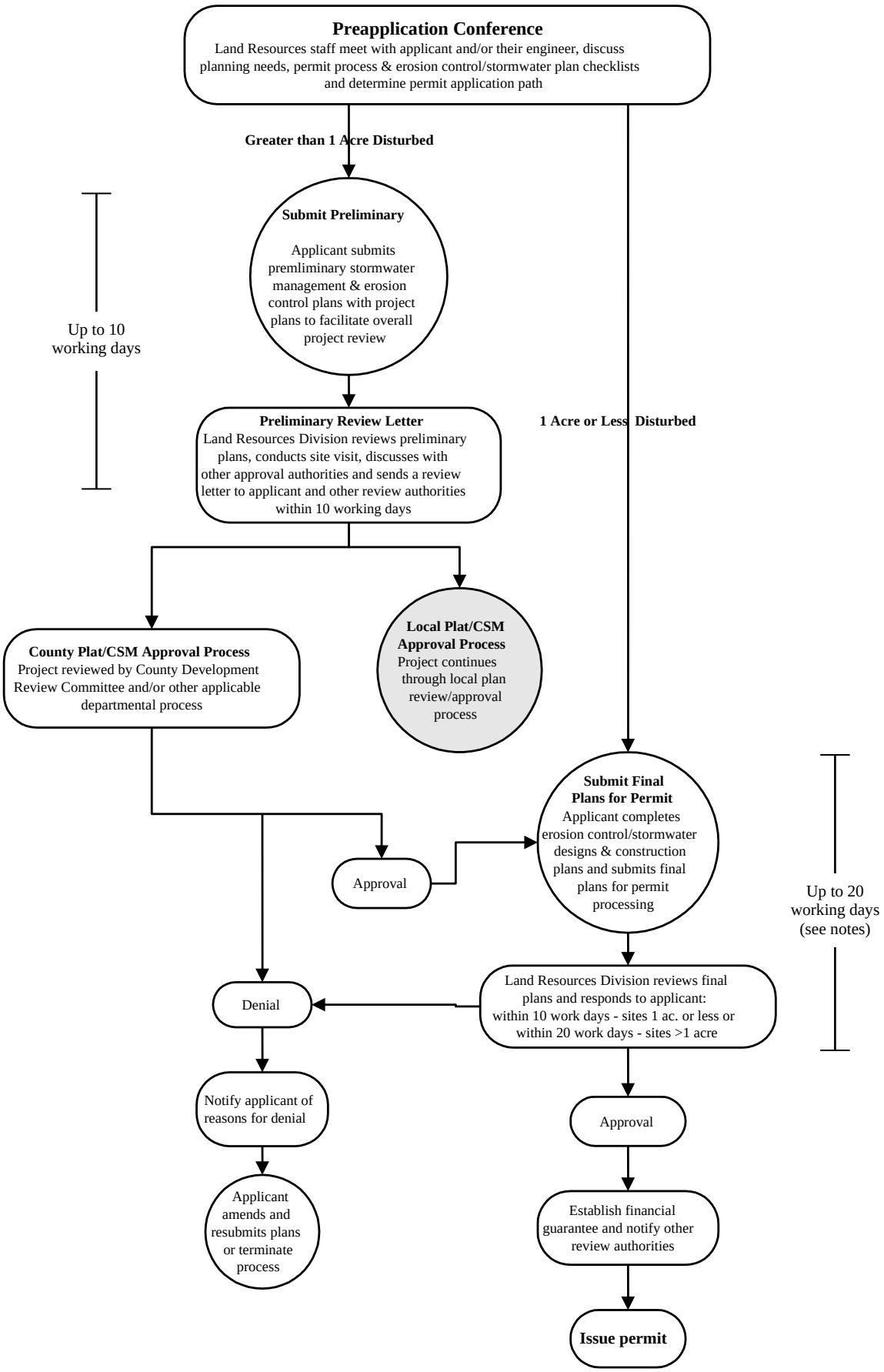
Variance or Appeal

- An appeal of a decision by Land Resources staff must be made in writing and submitted to the Board of Adjustment within 20 days of the date of decision. (Staff will assist you.)

TIME: Staff must approve or deny applications within:

- 10 working days of submittal/resubmittal for sites that disturb less than 1 acre; or
- 20 working days of submittal/resubmittal for sites that disturb 1 acre or greater.

Figure IV-2
Stormwater Management Permit Process Flow Chart



Municipal Separate Storm Sewer System (MS4) Stormwater Discharge Permits

Chapter NR 216 Wisconsin Administrative Code requires discharge permits for community storm sewer systems, which collect runoff from existing urban development in the community. The DNR issues general MS4 permits and requires communities to apply for coverage. In general, these permits apply to all communities with a contiguous population density of 1000 people per square mile. Phase 1 of these permit requirements was first applied in the early 2000's to five communities on the eastern edge of Waukesha County – Menomonee Falls, Brookfield, Elm Grove, Butler and New Berlin. These five communities were permitted along with other contiguous Milwaukee area communities draining to the Menomonee and Root River Watersheds. Eight more communities in the county were issued MS4 permit coverage under Phase 1 as the Upper Fox River Watershed Group (upstream from Waukesha). In 2006, Waukesha County and 17 other local communities obtained MS4 permit coverage under the Phase 2 of the program.

As of June 2021, the Wisconsin DNR, under NR 216, Wis. Adm. Code, has issued MS4 permits to the following municipalities within Waukesha County. Map IV-2 and Table IV-1 show which communities in Waukesha County were issued MS4 permits under both Phase 1 and 2. MS4 permits require municipalities to reduce polluted storm water runoff from urban areas by implementing storm water management programs with best management practices and annually report to DNR on accomplishments. Implementing a Municipal storm water management program is a core requirement of MS4 permits and cover a wide array of activities that occur within a municipality. The Land Resources Division serves as the MS4 permit contact for Waukesha County and is charged with leading all MS4 permit compliance activities among county departments. All MS4 permits contain requirements for the following:

Public Education and Outreach - The MS4 permit specifies that public education and outreach programs be developed to encourage the public and businesses to modify their behaviors and procedures to reduce storm water pollution.
Public Involvement and Participation - In addition to public education and outreach, the MS4 permit requires municipalities to encourage participation from individuals to prevent storm water pollution. Some examples of public involvement are volunteer stream monitoring, storm drain stenciling, presenting information to established community groups, or planting a community rain garden.
Illicit Discharge Detection and Elimination - Storm sewers that carry rain water runoff are not intended for other fluids and waste material. These pollutants are illicit discharges and may have the potential to harm people, animals and aquatic life in the downstream rivers, lakes and wetlands. Municipalities are required to develop programs to identify, prevent, and eliminate illicit discharges to their storm sewer systems. The DNR has developed additional illicit discharge detection and elimination guidance [PDF] to assist municipalities with this requirement.
Construction Site Pollutant Control - Municipalities are required to develop a soil erosion control ordinance and enforce it on construction sites. Municipalities may use state-recommended technical standards for methods and products used to control erosion and prevent sediment-laden water from discharging into a lake, stream or wetland.
Post-Construction Storm Water Management - Municipalities are required to develop a post-construction ordinance and enforce it to ensure that areas of new and redevelopment will include structural measures to control pollutants, control peak flow, maintain infiltration, and establish vegetated protective areas adjacent to waterways and wetlands. Municipalities may use state-recommended technical standards for post-construction storm water management practices.
Pollution Prevention Practices for the Municipality - MS4 storm water programs are to include practices to prevent pollutants from municipally-owned transportation infrastructure, maintenance

areas, storage yards, sand and salt storage areas, and waste transfer stations entering the storm sewer system.

Developed Urbanized Area Standard - Municipalities are required to control the Total Suspended Solids (TSS) carried in storm water from existing urban areas as compared to no controls. Many municipalities have already achieved the state standard of 20 percent TSS. Compliance with the standard is achieved by implementing a system of practices and activities, which has been verified by a storm water computer model.

Storm Sewer System Maps - Municipalities covered by an MS4 permit area are required to maintain a map of the storm sewer system. These maps identify storm sewer conveyances such as pipes and ditches, and also identify roads, streams and lakes.

Authorized Local Program (ALP)

To improve regulatory efficiencies, Waukesha County applied for Authorized Local Program status under Chapter NR 216, which was approved by DNR starting January 1, 2011. ALP status allows a Waukesha

County Stormwater Permit to also provide DNR permit coverage under NR 216 for a construction site that disturbs greater than one acre. This one-stop-shop for state and local stormwater permit coverage is something the local development community supports because it simplifies and speeds up the permit process. To meet ALP requirements, the county must screen all NR 216 permit applications for the following:

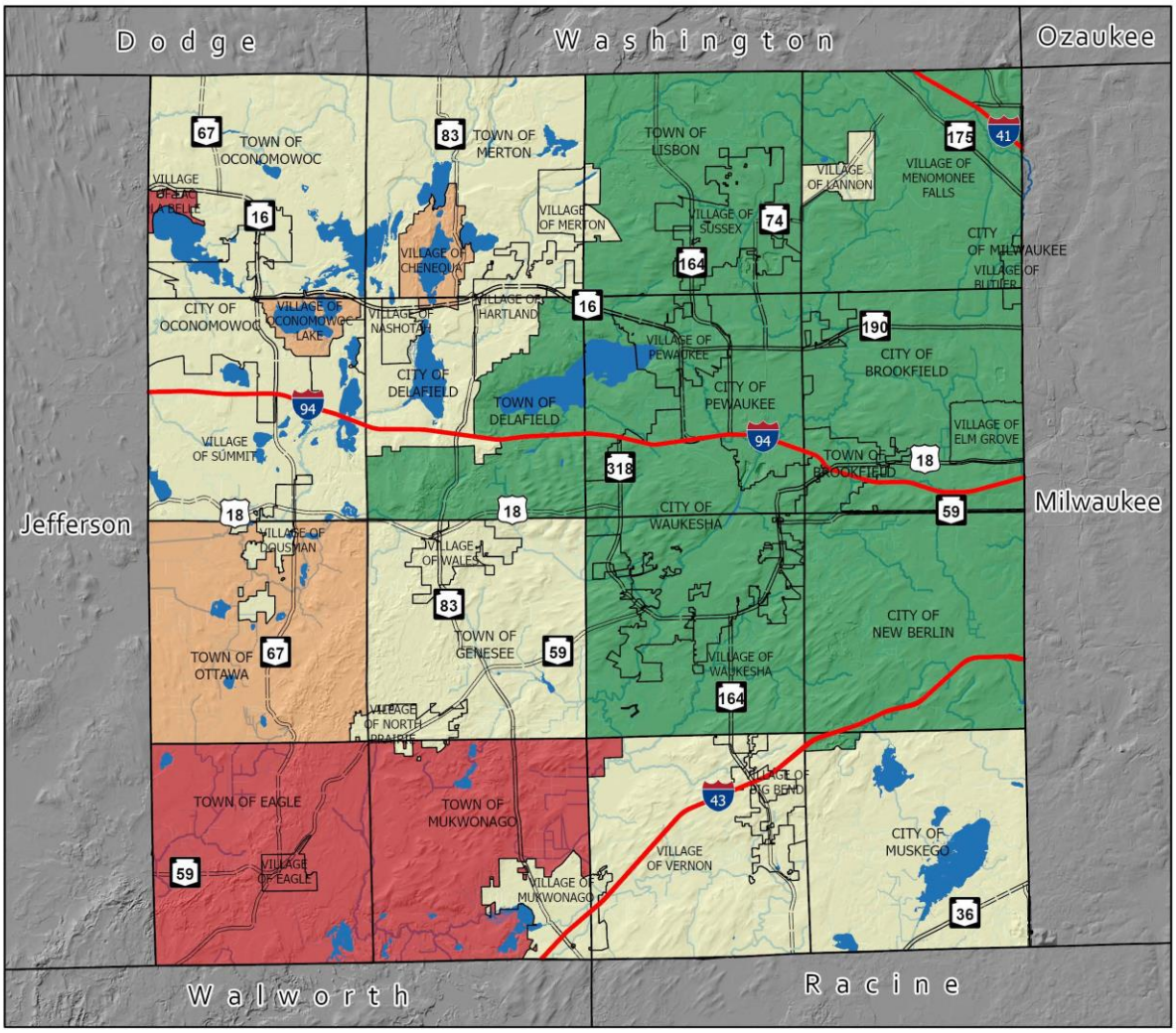
- Potential wetland water quality impacts to ensure compliance with Chapter NR 103 Wis. Adm. Code or a county ordinance that is at least as restrictive;
- The presence of endangered or threatened resources protected under s. 29.604 Wis. Stats., and Chapter NR 27 Wis. Adm. Code;
- Impacts on historical properties that are listed properties or on the list of locally designated historic places under s. 44.45 Wis. Stats.

When potential impacts are found, the LRD contacts the designated regulatory authority and must withhold issuing a county Stormwater permit until the issue has been resolved. During the first year of ALP status, the LRD issued joint state/county permit coverage for 10 new construction projects. While this number is low due to the recession in 2011, the time saving merits of the program have been demonstrated, and the LRD plans to maintain ALP status. Some improvements are planned for posting Stormwater permit data on the county GIS-web site and possibly the pass-through of state and local administrative fees for the above noted screening processes.

Intergovernmental Agreements

From 2005-2009, Waukesha County executed intergovernmental agreements with 25 local units of government to carry out certain MS4 permit requirements. The driving factor in these agreements was the MS4 permit requirement for each community to implement a stormwater information and education program. The LRD offered communities a DNR pre-approved information and education program and a designated staff person to coordinate program implementation efforts in exchange for an annual fee based on community population. For 2012, the community annual fees ranged from $1,174 to $4,700, but are subject to an annual fee increase based on actual program costs.

Map IV-2
MS4 Discharge Permits under NR216



Legend

- Phase I Community (14)
- Phase II Community (18 including Waukesha County)
- Exempted Communities (3)
- MS4 Permit Not Required (4)

*Townships - Only portions meeting the Urbanized Area designation by the EPA

Source: Waukesha County, WI DNR, SEWRPC

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Table IV-1
Communities in Waukesha County Issued Municipal Separate Storm Sewer System (MS4) Permits Under Chapter NR 216 and that have Executed an Intergovernmental Agreement with Waukesha County: 2012

Phase 1 Communities			Phase 2 Communities		
Cities	**Towns**	**Villages**	**Cities**	**Towns**	**Villages**
Brookfield	Brookfield*	Butler	Delafield*	Genesee*	Big Bend*
New Berlin	Delafield*	Elm Grove	Muskego*	Merton*	Dousman*
Pewaukee*	Lisbon*	Menomonee Falls	Oconomowoc*	Oconomowoc*	Hartland*
Waukesha*	Waukesha*	Pewaukee*		Vernon*	Lannon*
		Sussex*			Merton*
					Nashotah*
					North Prairie*
			County		Mukwonago*
			Waukesha County		Summit*
					Wales*

* Communities that executed an intergovernmental agreement with Waukesha County

For seven towns where the county stormwater ordinance applies (all except Brookfield), the intergovernmental agreements also contain provisions aimed to improve ordinance administration and enforcement, set erosion control policy for municipal road right-of-ways, and to improve tracking and maintenance of stormwater best management practices. For four villages (Merton, North Prairie, Vernon and Waukesha), the intergovernmental agreements also cover enforcement of the county stormwater ordinance within the village, with one agreement (Merton) also covering 1-2 family home construction sites through the Wisconsin Uniform Dwelling Code (Chapter SPS 321). The LRD will continue to encourage intergovernmental cooperation on all MS4 permit requirements.

Stormwater Database

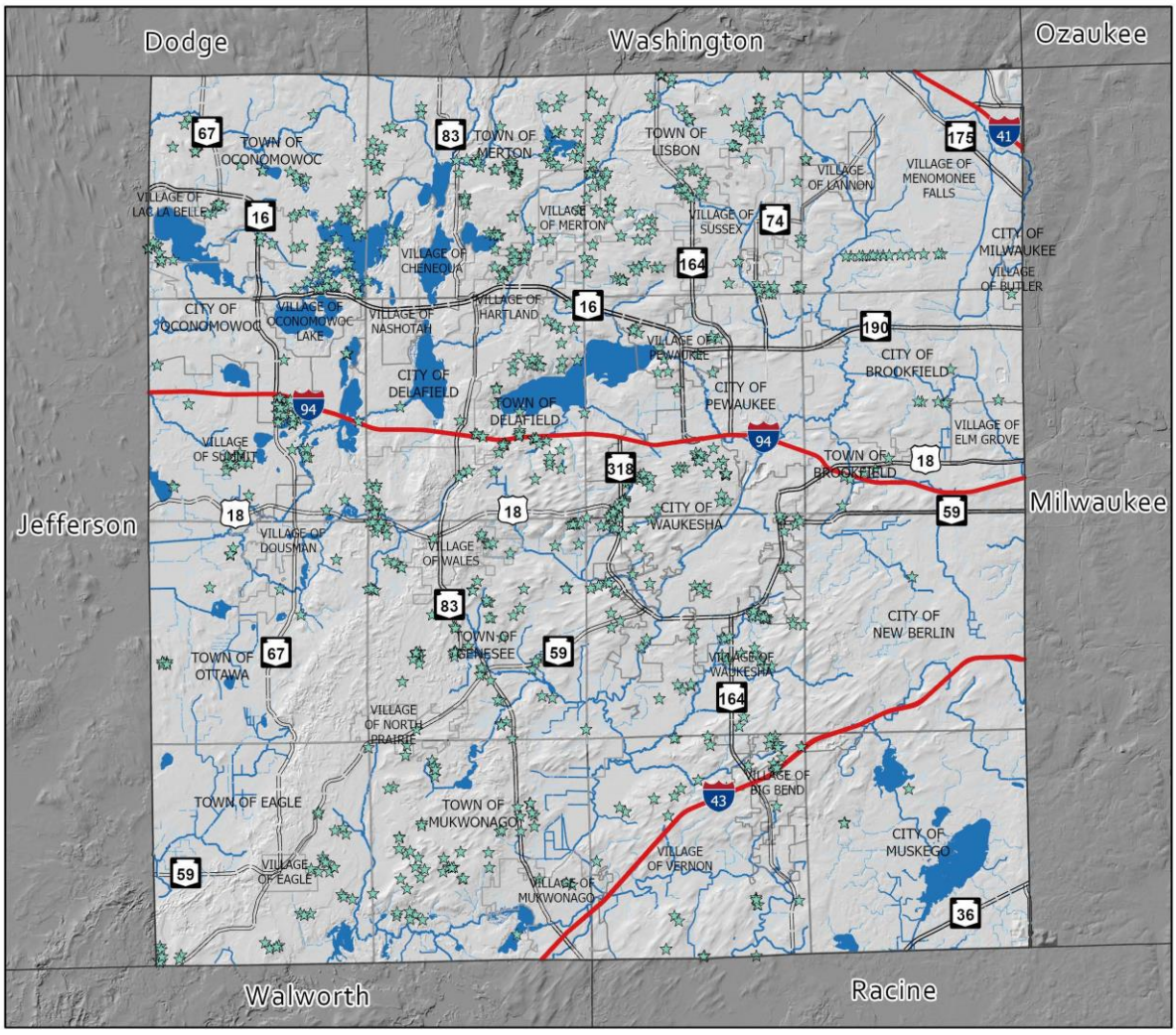
In 2005, using seed money from a DNR urban nonpoint grant, the LRD rolled out a robust database application that tracks stormwater permits, project notes, financial assurances, and BMP installation and maintenance. The application runs on a web browser interface with the supporting database running on Microsoft SQL Server. The application is designed to automate and improve stormwater permit record keeping and enforcement efforts, including a detailed tracking of contact notes for all active permits. The application is also designed to improve public access to stormwater BMP design, installation and maintenance data. The system includes links to a county imaging system that stores copies of BMP maintenance agreements, photographs, and scans of BMP design and installation data or BMP inspection reports. Since 2006, most of these images are created when the stormwater BMP maintenance agreement is recorded on the property through the Register of Deeds office – a county Stormwater permit requirement. For BMPs installed prior to 2002, the LRD is in the process of back-scanning available BMP data.

There are also two types of GIS links in the stormwater database application – a point for locating installed BMPs, and a polygon for locating active construction site stormwater permit boundaries. As of July 2021, the county GIS system contains records for over 800 installed stormwater BMPs, as shown in Map IV-3. The public can click on any BMP point on the GIS map and view or download all available data

and images. Authorized users can also log into the system and upload additional images to the system such as photographs, as-built documents or BMP inspection reports. The LRD will continue encouraging more communities to get trained in the use in this part of the system.

Stormwater permit tracking on the GIS system is designed to coordinate regulatory efforts between the field and the office, and between the DNR and the LRD under the Authorized Local Program. When the LRD receives a permit application, the property boundary is digitized and linked to the permit number in the database. Authorized users can log in and view or enter permit information and find the current status of any permit. As of 2012, this part of the system is the least developed and is planned to be improved upon in the next year with the new GIS system that was recently installed.

Map IV-3
Stormwater Best Management Practices in the Waukesha County Database



Source: Waukesha County, WI DNR, SEWRPC

Agricultural Nonpoint Pollution Performance Standards

As noted in Chapter III, agricultural runoff pollution is a leading cause of water pollution in most of the watersheds in the state. Chapter III also noted that Chapter NR 151 Wisconsin Administrative Code contains a number of agricultural nonpoint pollution performance standards for cropland erosion and nutrient applications, barnyard runoff, and livestock waste management. A general summary of the statewide agricultural nonpoint pollution standards is provided below:

- 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.
- Clean water runoff must be diverted away from contacting feedlots, manure storage facilities, and barnyards in water quality management areas (areas within 300 feet of a stream, 1000 feet from a lake, or areas susceptible to groundwater contamination).
- All new or substantially altered manure storage facilities must meet current engineering design standards to prevent surface or groundwater pollution.
- All cropland tillage must be setback 5-20 feet from the ordinary high water mark of any lake or stream.

The following manure management prohibitions also apply statewide:

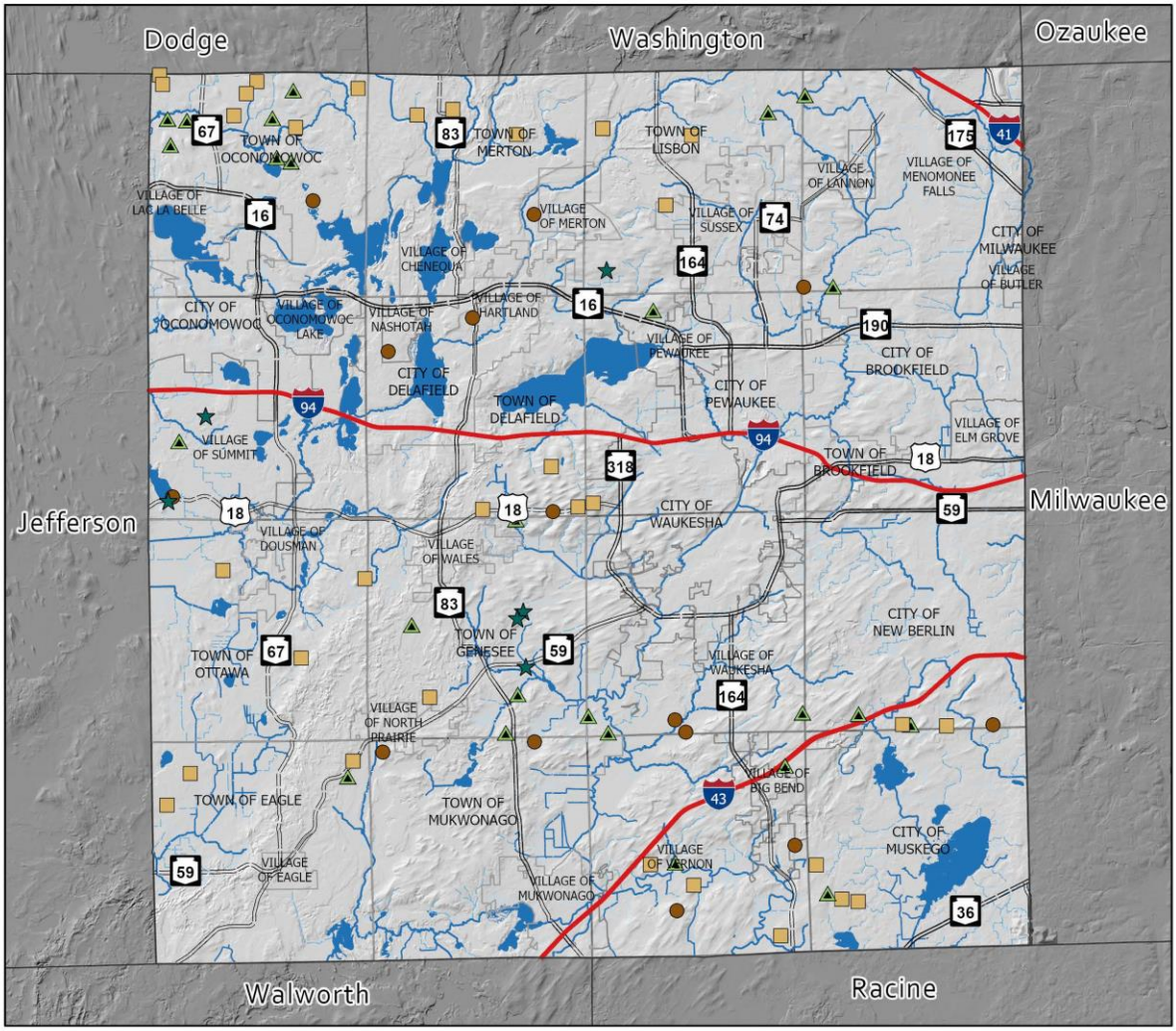
- No direct runoff from animal feedlots to "waters of the state".
- No overflowing manure storage facilities.
- No unconfined manure piles in shoreland areas (areas within 300 of a stream, 1000 feet from lakes).
- No unlimited livestock access to "waters of the state" where the livestock prevent sustaining an adequate vegetative cover.
- Soil erosion rates on all cropland must be maintained at or below "T". *[Note: "T" is the tolerable erosion rate for each soil type to maintain its productivity indefinitely. T-values generally range from 3-5 tons per acre per year and are documented in the NRCS Technical Guide.]*

Agricultural Nonpoint Implementation Procedures

State administrative rules prescribe specific cost-sharing requirements that must be met before a landowner can be required to comply with the above noted agricultural nonpoint pollution performance standards. The minimum cost-share rate is generally 70%, except in cases of economic hardship, whereby 90% cost-sharing is required. The cost-sharing requirement does not apply to landowners who receive the state Farmland Preservation income tax credit.

A 2015 land use inventory conducted by SEWRPC shows there were 76,028 acres in agricultural uses. The LRD has also inventoried livestock operations in the county and found very few significant threats to local water resources. Map IV-4 shows the general location of 78 livestock facilities with more than 40 animal units. Only 16 of these 78 are located within a water quality management zone (300 feet of a river or 1000 feet of a lakeshore). The state Nutrient Management technical standard (NRCS 590) includes Phosphorous Index limits for individual farm fields, but the local level of compliance is unknown.

Map IV-4
Livestock Operations with Greater Than 40 Animal Units: Waukesha County



As noted in Chapter II, development pressures are a daily fact of life for agricultural producers in Waukesha County. There is still a considerable amount of agricultural production in the county, therefore, if problem fields or livestock facilities are located in an area planned for future development, consideration needs to be given as to whether to invest a significant amount of limited public resources to address short-term agricultural runoff issues. Because of this, the total LRD resources allocated to this goal are less than most other county land conservation departments in the state and agricultural nonpoint compliance activities are focused on the "priority farms" described in step 2 below. Having said this, all farms in the county must meet the NR 151 performance standards and are therefore subject to enforcement action for noncompliance.

Many counties are implementing the above noted agricultural nonpoint standards through a county ordinance or a working agreement with the DNR. A working agreement would document the procedures that will be followed by the LRD and DNR for a public complaint or an LRD referral of an agricultural nonpoint problem, as noted in step 6 of the procedures listed below. Since the 2006 LWRM plan was adopted, the LRD has requested a working agreement with DNR, but local stormwater workload issues have prevented it from getting done. The LRD will continue to pursue such a working agreement in the future. Regardless, the implementation steps detailed below would likely evolve as program experience and fiscal demands may dictate. In the following sections, the term "landowner" is used generically to describe the person responsible for compliance with the above noted standards.

Step 1. Conduct information and education activities.

The LRD will distribute information and educational material prepared by the DNR, DATCP and LRD to relevant landowners through one-on-one contacts, the LRD web page or other methods that may become available. The educational materials will be designed to achieve the following objectives:

- Educate landowners about Wisconsin's agricultural performance standards and prohibitions, 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.

Step 2. Select and evaluate parcels for compliance with standards and prohibitions (Priority Farms Strategy).

The LRD will use the county GIS system and Farmland Preservation Program participant lists to identify priority farms for compliance determinations. Farmland Preservation Program participants are the highest priority since they must comply with the nonpoint standards to be eligible for the state income tax credit. Map IV-5 shows where farms are eligible to claim the FPP credit under the 2011 revisions to the Waukesha County Farmland Preservation Plan. LRD will conduct annual spot-checks to determine compliance on 25% of Farmland Preservation Program income tax credit claimants with a goal of determining compliance on all Waukesha County FPP participants within a 4-year cycle. A GIS database is used to record the results of farm compliance checks, track progress on implementing performance standards, identify priority farms, and generate reports. More specifically, the GIS system is used to identify livestock operations within the Water Quality Management Areas (300 feet from a stream or 1000 feet from a lake). The latest available color digital orthophotos and land ownership data are used as a base map for initial

screening, combined with 1-foot contour maps and water resource layers. Digital land units from the USDA-Farm Service Agency may be used to delineate field boundaries. This information is supplemented with an LRD generated digital map of existing farm operations and water resource classification data. Information from the Soil Survey may also be used to identify potential groundwater problems. Other high priority landowners for compliance checks will include citizen complaints and targeted watersheds through other partnerships – but only if the lands are not slated for development in the adopted community comprehensive plan.

Once the list of landowners is created, LRD staff conducts a records inventory search for files related to conservation planning within the department. This is an initial review to determine potential compliance with the performance standards based on past or present program participation. If no records are found, or if the records are found to be out of date with existing farming operations, an on-site farm visit will be scheduled. It should be noted that as of 2009, NRCS conservation planning records cannot be used by the LRD to determine landowner compliance without the written permission of the landowner.

Step 3. Document and report compliance status.

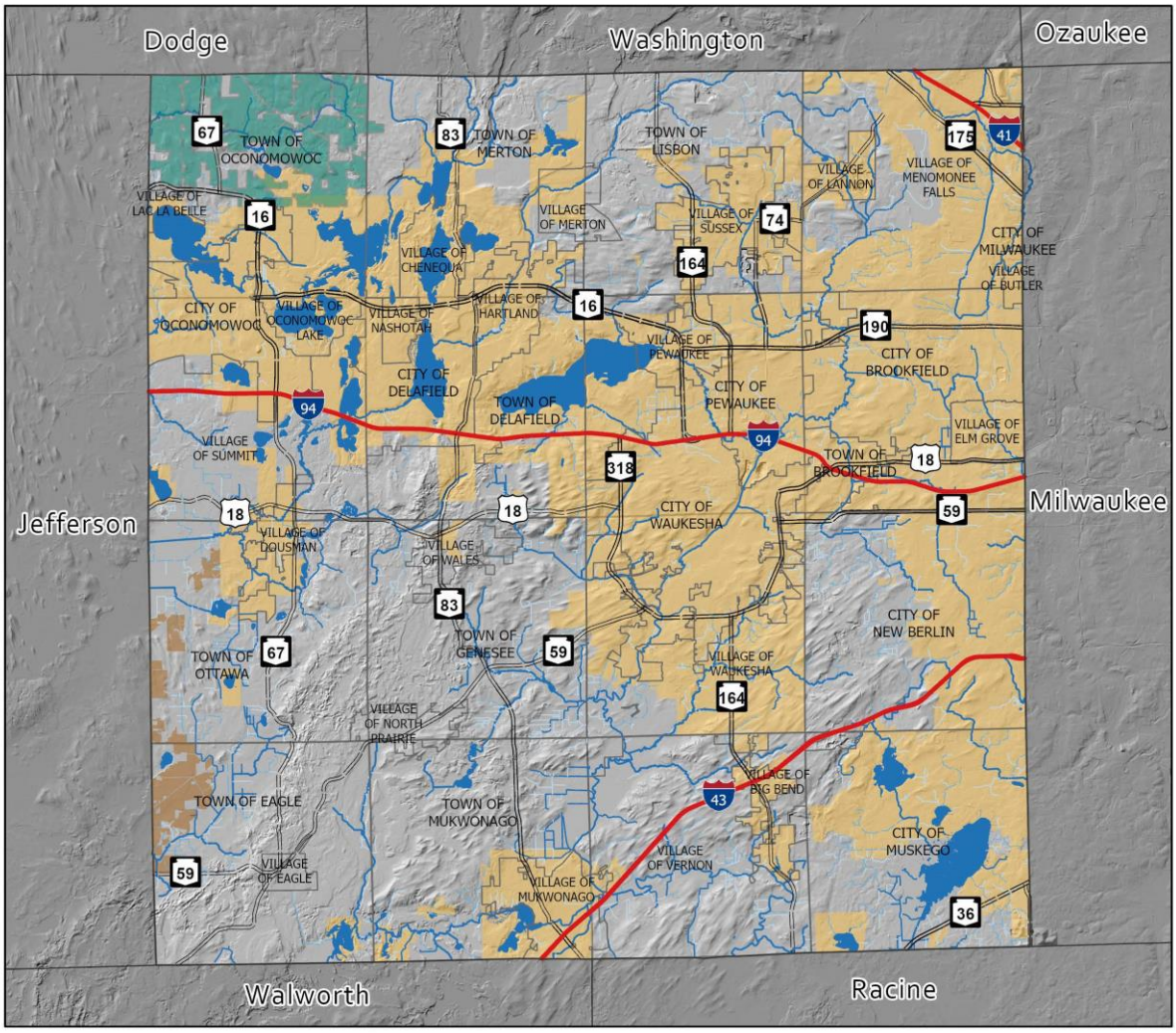
Following completion of records review and on-site evaluations, a **NR 151 Status Report** will be prepared and issued to owners of the parcel evaluated. This report will convey at a minimum:

- Current status of compliance of individual parcels with each of the performance standards and prohibitions.
- Corrective measure options and rough cost estimates to comply with each of the performance standards and prohibitions for which a parcel is not in compliance.
- Eligibility for cost sharing.
- Grant funding sources and technical assistance available from federal, state, and local government, and third party service providers.
- An explanation of conditions that apply if public cost share funds are used.
- A timeline for completing corrective measures, if necessary.
- Process and procedures for contesting evaluation results to the county.
- A copy of performance standards, prohibitions and technical design standards.

All evaluations and compliance information will be kept as public record in accordance with the procedures documented by the Waukesha County Department of Parks and Land Use.

If a landowner agrees with the initial compliance determination and no corrective actions are required, a **Letter of NR 151 Compliance** will be issued (See Step 5) and the site mapped and GIS database populated. If a landowner disagrees with the initial compliance determination, the landowner may meet and discuss concerns with the LRD regarding the compliance determination process and results. If, after discussing the NR 151 Status Report with the LRD, the landowner still disagrees with conclusions of the LRD, the landowner may choose to follow the appeals process to be detailed in the anticipated working agreement between the LRD and the DNR.

Map IV-5
Farmland Preservation Plan for Waukesha County



Legend

- Agricultural Enterprise Area (AEA) - 2021
- Farmland Preservation Areas - 2021
- Sewer Service Area

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Source: Waukesha County, SEWRPC, WDNR & DATCP

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Step 4. Offer or arrange for technical assistance. Offer available cost sharing as needed to install or implement best management practices (BMPs).

If a site is determined to be out of compliance with the state standards, technical assistance and cost sharing will be offered to the landowner to upgrade the site(s) and 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 E. If no cost sharing is available, a landowner is not required to comply until such time that cost sharing becomes available. However, if cost sharing is offered, and a landowner still refuses to make the corrective actions needed to bring the site into compliance, future cost sharing is not required.

Step 5. Administer funding and technical assistance. Re-evaluate parcel.

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 for 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 is now in compliance with the relevant performance standards or prohibitions. If the site is in compliance, the **NR 151 Status Report** will be updated to include a **Letter of NR 151 Compliance.** This would serve as official notification that the site has been determined to now 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 remains in compliance for perpetuity without additional cost sharing being required.

Step 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 LRD would refer the case to the DNR for further enforcement, depending on the outcome of the working agreement described earlier.

Step 7. Monitor compliance with state standards and prohibitions

Monitoring progress on implementing the performance standards and prohibitions will be done using the Waukesha County GIS Ag Compliance Tracking database. This may be done as random spot checks or through operation and maintenance checks on sites previously cost shared. Results will be reported as needed to meet state grant requirements.

Estimated Program Costs

Since this plan does not have the authority to establish fiscal policy for the county, the estimated costs provided below are solely intended to satisfy state LWRM planning requirements and do not in any way show anticipated LRD budgets. Due to the current fiscal constraints imposed by state and local policy makers, it is 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 6.15 FTE in 2022). The 5-year cost estimates contained in Tables IV-2 and IV-3 are based on historical inflationary costs to maintain existing program efforts and staffing levels. Even though this plan is written with a 10-year planning horizon, cost projections are limited to 5 years because fiscal projections beyond that period have proven to have limited value. For example, the 2012 LWRM Plan estimated minimum state cost-share funding needed to support LRD staff in accordance with statutory cost-sharing rates. However, by 2022, the state was already approximately $100,000 short of their statutory obligation in this funding category.

The landowner cost-sharing estimates in Table IV-2 and IV-3 are partially based on a statutory requirement of 70% cost-sharing and are dependent on landowner needs to comply with the state performance standards and other voluntary efforts such as wetland restorations, as described earlier in this chapter and Chapter III. Since 90% of cropland is estimated to already comply with the erosion control requirements, and there are few significant livestock operators in the county, these costs are estimated to be nominal compared to most other Wisconsin counties. However, if a standard is established for stream buffers, and nutrient management standards are enforced, these costs would be much higher than shown. Further details on this issue are provided in the last section of this chapter describing impediments to plan implementation.

Table IV-3 is provided to demonstrate the future state grant needs to continue supporting existing program efforts, based on current state statutory obligations. Under section 92.14 Wisconsin Statutes, the Department of Agriculture, Trade and Consumer Protection is directed to provide each county $100,000 per year for landowner cost sharing grants, plus base staff funding for an average of three conservationists at a rate of 100% for the first position, 70% for the second position and 50% for the third position. Average salary increases and inflationary costs represent the increases shown each year. Cost-sharing is assumed to be available from federal and state sources at equal levels in Table IV-3.

The cost estimates outlined in this chapter represent the best estimates of the LRD 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 LRD 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.

Table IV – 2
Estimated Total Costs for Plan Implementation: 2022-2026

Cost Category	2022	2023	2024	2025	2026
LRD Staff (S&B)	$586,900	$616,200	$647,000	$679,400	$713,400
Operating Expenses	$171,500	$175,900	$178,400	$182,000	$185,600
Landowner BMP Cost-Sharing	$150,000	$150,000	$150,000	$150,000	$150,000
Total Costs	$908,400	$942,100	$975,400	$1,011,400	$1,049,000

Table IV – 3
Estimated Minimum State Costs to Support Plan Implementation 2022-2026
Under Funding Formulas Contained in Section 92.14 Wisconsin Statutes

State Cost-share Category	2022	2023	2024	2025	2026
LRD Staff (statutory obligation/s. 92.14)	$267,000	$280,400	$294,400	$308,700	$324,100
Landowner BMPs - 70% Cost-Sharing	$100,000	$100,000	$100,000	$100,000	$100,000
Total State Costs	$367,000	$380,400	$394,400	$408,700	$424,100

Monitoring and Evaluation

Monitoring and evaluating program efforts are important to ensure program effectiveness and accountability in the expenditure of public funds. Waukesha County currently uses a variety of methods to monitor and evaluate progress on program efforts, including land inventories, GIS/database maintenance, surveys, advisory committees, annual reviews and progress reports, and water quality monitoring.

Measuring progress for nonpoint pollution control programs has been identified as a serious challenge in several state legislative audits since the late 1980's. Past program efforts have focused on tracking best management practices installed to control nonpoint pollution and associated expenditures involved. Modeling has also been used to estimate pollution reduction accomplished by the installation of practices. Actually measuring changes in water quality is the best way to track progress, but it is very expensive. Also, due to the high number of variables involved in monitoring water quality, it is often difficult to interpret the data. Below is more detail on some of the methods Waukesha County uses to monitor and evaluate the success of implementing plan activities.

Advisory Committees

The county maintains several advisory committees that are periodically asked to review program efforts and plan future activities. One example is the LWRM Plan Advisory Committee, which was used to develop and update this plan. Another example is the Stormwater Advisory Committee, which is codified in the Stormwater Ordinance as the official group responsible for advising the LRD on ordinance updates and the development of technical guidelines related to ordinance administration. As noted in Chapter III, the Stormwater Education Advisory Committee meets twice each year to review progress on educational efforts and plan future events. A subcommittee of this group also helps plan the annual stormwater workshop. The Mineral Extraction Advisory Committee is consulted when updates are made to the Nonmetallic Mine Reclamation ordinance or to resolve related conflicts that may arise during the regulation of local mines. A common theme to all these advisory committees is giving the affected industries and other interested parties an opportunity to evaluate county program efforts and offer suggestions for improvement or ideas for future program efforts.

Water Quality Monitoring

Monitoring water quality can be a powerful tool for tracking long-term trends and "ground-truthing" assumed impacts of land use changes and pollution control practices installed. However, as noted above, it is very expensive and difficult to do. One solution to this problem is to encourage volunteer citizen monitoring.

Citizen Stream Monitors

Since 2002, the LRD has been very active in encouraging citizen volunteer water quality monitoring of the streams in Waukesha County. The LRD, in cooperation with groups such as the Rock River Coalition, Pewaukee River Partnership, and Water Action Volunteers (WAV) have held annual training sessions to teach interested citizens how to monitor streams for temperature, turbidity, dissolved oxygen, stream flow and how to conduct biotic index and habitat assessments. The data collected is entered into an Internet accessible database (SWIMS) that will be useful for monitoring future trends in stream condition.

There are currently 20 teams of volunteer monitors around the county. The stream sites being monitored on a regular basis are listed in Table IV-4 and shown on Map IV-6. As staff time allows, the LRD will continue to help train volunteer teams and facilitate data collection.

Table IV-4
Volunteer Stream Monitor Locations

Stream Name	Location	Watershed	Active Monitoring
1. Golf Course Creek	Lac La Belle Dr.	Oconomowoc River	No
2. Battle Creek	Golden Lake Rd.	Oconomowoc River	No
3. Oconomowoc River	Beach Rd.	Oconomowoc River	No
4. Oconomowoc River	West Shore Dr.	Oconomowoc River	No
5. Mason Creek	Petersen Rd.	Oconomowoc River	Yes
6. Little Oconomowoc River	Petersen Rd	Oconomowoc River	No
7. Rosenow Creek	Nature Hill Intermediate School	Oconomowoc River	Yes
8. Bark River	Genesee Lake Rd.	Bark River	Yes
9. Bark River	Hillside Rd.	Bark River	No
10. Bark River	Hwy C	Bark River	Yes
11. Bark River	Nixon Park - Hartland	Bark River	Yes
12. Scuppernong Creek	Ice Age Trail	Bark River	Yes
13. Scuppernong Creek	UW Field Station	Bark River	Yes
14. Jericho Creek	Hwy LO	Mukwonago River	Yes
15. Genesee Creek	Carroll College property	Middle Fox River	Yes
16. Spring Brook	Holiday Rd.	Middle Fox River	Yes
17. Pebble Creek	Kame Terrace	Upper Fox River	Yes
18. Pebble Creek	Hwy TT	Upper Fox River	Yes
19. Brandy Brook	Hwy DT	Upper Fox River	Yes
20. Pewaukee River	Lindsay Rd.	Upper Fox River	Yes
21. Pewaukee River	Village Park near Capitol Dr.	Upper Fox River	Yes
22. Pewaukee Lake Outfall	Behind Main St.	Upper Fox River	Yes

Stream Name	Location	Watershed	Active Monitoring
23. Pewaukee River	Hwy M near Hammel Bldg.	Upper Fox River	Yes
24. Pewaukee River	Hwy J & I-94	Upper Fox River	Yes
25. Pewaukee River	Hwy F	Upper Fox River	Yes
26. Coco Creek	Capitol Dr.	Upper Fox River	Yes
27. Coco Creek	Yench Rd.	Upper Fox River	Yes
28. Meadowbrook Creek	Hwy SS	Upper Fox River	Yes
29. Zion Creek	Oakton Rd.	Upper Fox River	Yes
30. Deer Creek	Ryerson Dr.	Upper Fox River	Yes
31. Sussex Creek	Lindsay Rd	Upper Fox River	Yes
32. Sussex Creek	Sussex Government Center	Upper Fox River	Yes
33. Fox River	EB Shurts Prairie Ave.	Upper Fox River	Yes
34. Retzer Creek	Retzer Nature Center	Upper Fox River	Yes
35. Scuppernong River	Hwy Z	Scuppernong River	Yes
36. Ashippun River	Norwegian Rd.	Ashippun River	Yes
37. Unnamed Trib to Lake Denoon	Public Access Trail	Muskego/Wind Lake	Yes

Source: Waukesha Co. LRD

Wisconsin's Citizen Lake Monitoring Network

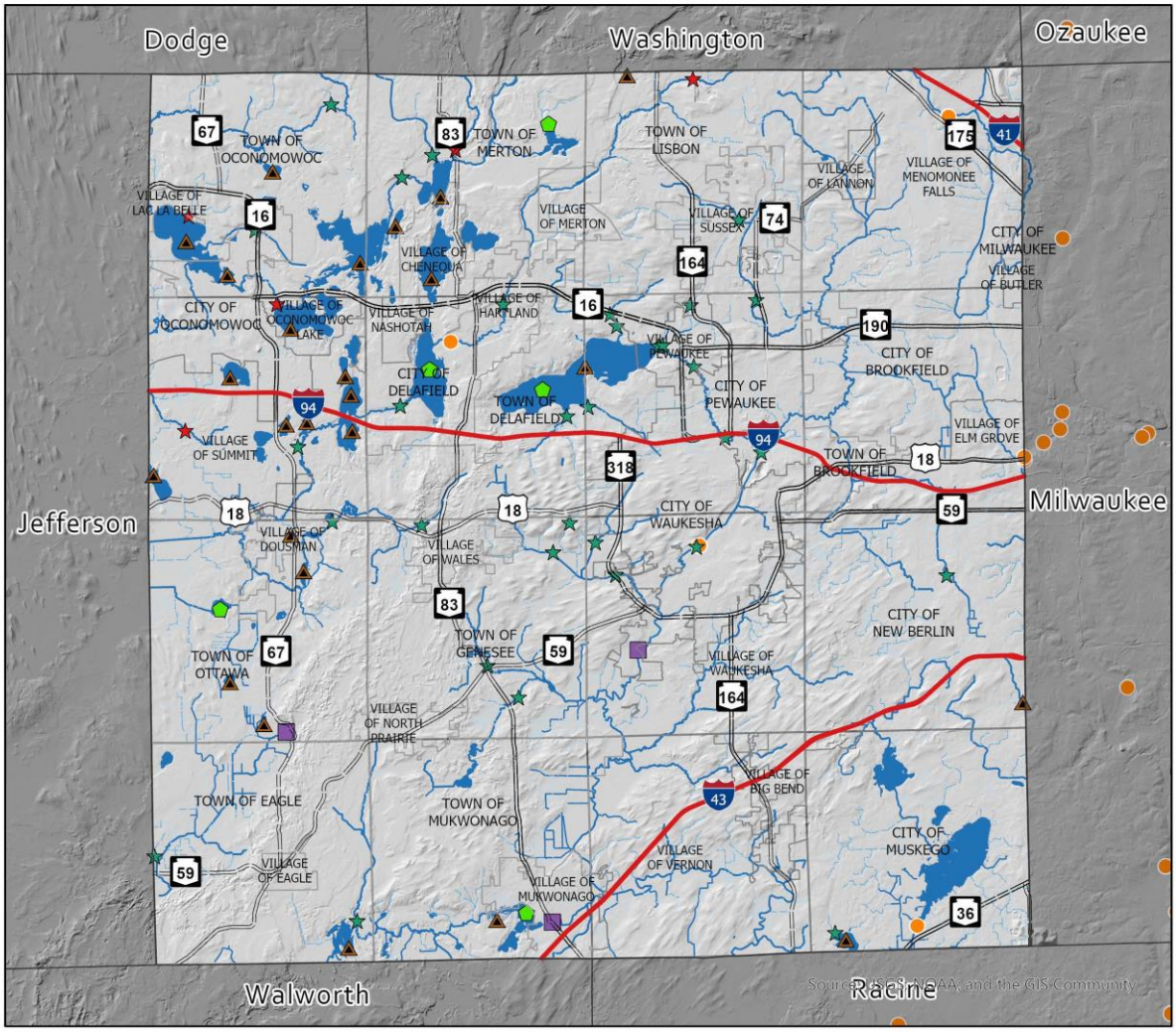
Wisconsin's Citizen Lake Monitoring Network began in 1986 as one component of the Department of Natural Resources Lake Management program. The Program is designed as a data collection program on some of Wisconsin's 15,000 lakes and serves as a citizen education program about lakes in general. Each volunteer learns about his or her own lake by collecting the data and through a detailed report he or she receives at the end of the sampling season.

The Program was designed with six specific objectives in mind:

1. To teach citizen volunteers some concepts of basic limnology, how lakes "work" and to increase their understanding of the water quality of their lake in particular.
2. To teach citizens about basic lake sampling techniques, specifically how to use a Secchi disc carefully, regularly, and according to set procedures.
3. To document changes in lake clarity over time by tallying the data on a centralized computer system.
4. To differentiate between normal and seasonal variations in water clarity and long-term trends over time. In this way we can judge whether water clarity and, presumable water quality, is getting better, getting worse, or staying the same.
5. To compare the water clarity data for all of the lakes in the program on both a regional and statewide basis.
6. To collect data accurately over time in order to make sound lake management decisions.

Volunteer monitors may measure water clarity using a Secchi disk or may elect to do chemical analysis as well as water clarity readings. The 24 lakes in Waukesha County with Citizen Lake Monitoring as of 2021 are shown in Map IV-6.

Map IV-6
Water Monitoring Sites in Waukesha County



Legend

- DNR WAV Citizen Stream Monitoring (3)
- Citizen Water Monitoring Sites - Active (31)
- Citizen Water Monitoring Sites - Inactive (6)
- DNR Citizen Lake Monitoring Network Lake (25)
- DNR Longterm Trend Baseline Lake (5)
- Live Stream Gauges

N
W E
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Source: Waukesha County, SEWRPC, WDNR & USGS

0 4 8 12 Miles

Agency Water Quality Monitoring

The Department of Natural Resources conducts baseline monitoring of streams in Waukesha County, which rotates annually in accordance with regional program planning. DNR also conducts fish surveys, examines macroinvertebrates, and conducts habitat assessments at a number of locations around the county. Public access to much of this data is available through the DNR's web site.

The United States Geological Survey (USGS) also collects water resources data on lakes and streams in Waukesha County and at numerous locations around Wisconsin. The type of data collected varies depending on program and project scope but includes historic and current stream flow on selected water bodies, water quality, and lake stage data. They regularly partner with other agencies and local interest groups to collect information on the condition of surface and groundwater resources.

Map IV-6 shows locations of USGS stream gage stations and lakes that have recently been monitored as part of an ongoing lake stage and water quality monitoring program. Water quality at each lake is monitored in February, April, June, July and August. Dissolved oxygen concentration, temperature, pH level, and specific conductance are determined in each lake. The objective of this long term monitoring program is to determine lake stage and water quality at these and other selected lakes in order to be able to detect chemical or biological changes that may take place over time.

More information on the variety of data collected by the USGS and the ability to view real-time stream gage data can be found at the USGS website: http://wi.water.usgs.gov/.

DNR Long-term Trend Baseline Lake Monitoring

Department of Natural Resources staff also conducts long-term trend baseline lake monitoring of five lakes in Waukesha County each year. These lakes are monitored for total phosphorus, chlorophyll A, secchi depth, temperature profiles, dissolved oxygen profiles, pH profiles and conductivity profiles. Once a year in late summer these lakes are also monitored for color, alkalinity, nitrate, nitrite, total Kjeldahl-N, calcium and magnesium. The lakes with baseline monitoring include: Lake Keesus, Pewaukee Lake, Lower Phantom Lake, Nagawicka Lake and School Section Lake. These lakes are shown on Map IV-6.

GIS/Database Tracking Systems

The LRD has developed a web-based database for tracking stormwater permits and the long-term maintenance of stormwater practices. This system will continue to be used to monitor compliance with the urban nonpoint performance standards and to generate annual reports of activity such as plans reviewed, permits issued, inspections conducted and enforcement action. In addition, a GIS link to this database allows mapping of the sites where permits have been issued or stormwater BMPs have been installed. BMP inspection reports can be uploaded to track maintenance.

For the agricultural performance standards, a similar GIS database has been developed to track compliance status by land parcel. This system has been updated to be web-based and to track the installation of agricultural BMPs. As noted earlier, the LRD has conducted a Transect Survey to determine general cropland erosion rates throughout the county. While this methodology is good for an overview of compliance, the LRD has not repeated the survey since 2001 due to its limited use. Extensive land development in the county has also resulted in the loss of many of the cropland sampling points, making a statistical valid survey difficult to repeat.

Annual Reports/Performance Evaluations

As a condition of state grants or regulations, the LRD must submit annual reports on the progress of local program efforts. Examples include annual reports to demonstrate MS4 permit compliance (DNR), to maintain Authorized Local Program status (DNR) or to meet grant requirements for the Soil and

Water Resource Management grant (DATCP). All of these provide an opportunity to evaluate the previous year's program efforts. As noted in Chapter III, the LRD also uses the planned activities in this document as a starting point to develop more detailed annual staff goals, which are then used for performance evaluations at the end of the year.

Taken together, the various monitoring, evaluation and reporting methods described above will be used to continuously evaluate the implementation of this plan and make future program changes, as needed to keep program efforts true to the goals described in Chapter III.

Impediments to Plan Implementation

State Funding Cuts for County Program Delivery

As noted throughout this plan, counties are the primary local delivery system for state land and water conservation programs. Section 92.14(6) Wisconsin Statutes directs DATCP to provide program grants to counties to support an average of three conservation staff per county at a cost-shared rate of 100/70/50%. As of 2022, the state was approximately $2 million short of meeting even the base level of staff funding.

Summary

Counties are held accountable for the implementation of their Land and Water Resource Management Plans, including the nonpoint performance standards. Counties have a vested interest in protecting the local land and water resource base and will continue to adapt to the program rules and funding challenges they face.

Appendix A
Glossary of Terms Commonly Used in This Plan

303(d) Waters: A list submitted to the U.S. Environmental Protection Agency which identifies waters that do not meet water quality standards for specific substances or the designated use. Also referred to as the List of Impaired Waters. The list is required under the Clean Water Act and is prepared by the Wisconsin Department of Natural Resources.

Alluvium: Soil or rock material, such as gravel, sand, silt, or clay deposited by flowing water.

Animal Waste Management: A group of practices including barnyard runoff management, nutrient management, and manure storage facilities designed to minimize the effects of animal manure on surface and groundwater resources.

Aquifer: Underground water reservoirs found within layers of permeable rock, sand or gravel.

Basin: A large geographic area comprised of many small watersheds.

Basin Water Quality Management Plan (208 Plan): A plan to document water quality conditions in a drainage basin and make recommendations to protect and improve water quality. Each basin in Wisconsin must have a plan prepared for it, according to Section 208 of the Clean Water Act.

Best Management Practice (BMP): Structural and nonstructural measures, practices, techniques or devices employed to avoid or minimize sediment or other pollutants carried in runoff.

Buffer Strips: Strips of grass, shrubs, trees and other vegetation between disturbed areas and a stream, lake or wetland.

Conservation Easement: A legal document that limits the use of land for purposes such as farming, open space, or wildlife habitat. A landowner may sell or donate an easement to a government agency or a private land trust.

Conservation Plan: A record of the decisions and intentions made by land users regarding the conservation of the soil, water and related natural resources of a particular unit of land.

Conservation Reserve Program (CRP): A provision of the federal Farm Bill that takes eligible cropland out of production and puts it into grass or tree cover for 10-15 years.

Conservation Reserve Enhancement Program (CREP): Program partnership between USDA, DATCP, and Waukesha County that enhances the conservation payments of the regular CRP.

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-sharing funds for a variety of LCC operations, including support for staff, materials and conservation practices.

Department of Natural Resources (DNR): The state agency responsible for managing and protecting land, water and air resources of the state. DNR also administers programs to regulate, guide, and assist Land Conservation Departments and individual land users in managing land, water, fish and wildlife. The DNR administers state cost-sharing funds for priority watershed projects, Targeted Runoff

Management (TRM) grants, Lake Planning and Protection grants, and Urban Nonpoint Source Construction and Planning grants.

Environmental Corridor (Primary and Secondary): A composite of the best individual elements of the natural resource base including surface water, streams, and rivers and their associated floodlands and shorelands; woodlands, wetlands and wildlife habitat; areas of groundwater discharge and recharge; organic soils, rugged terrain and high relief topography; and significant geological formations and physiographic features.

Environmental Protection Agency (EPA): The federal agency responsible for enforcing federal environmental regulations. The EPA delegates some of its responsibilities for water, air, and solid waste pollution control to state agencies.

Erosion: The process of detachment, transport and deposition of soil, sediment or rock fragments by action of water, wind, ice or gravity.

Eutrophication: The process by which lakes are enriched with nutrients, increasing the production of rooted aquatic plants and algae. The extent to which this has occurred is reflected in a lake's trophic classification: oligotrophic (nutrient poor), mesotrophic (moderately productive), and eutrophic (very productive and fertile).

Exotic Species: A non-native species introduced from another geographic area.

Farm Service Agency (FSA): Part of the United States Department of Agriculture, the FSA administers agricultural assistance programs including price supports, production controls and conservation cost-sharing.

Groundwater: Water that flows below the ground surface through saturated soil, glacial deposits or rocks.

Household: A household includes all persons who occupy a housing unit—defined by the Census Bureau as a house, an apartment, a mobile home, a group of rooms, or a single-room that is occupied, or intended for occupancy, as separate living quarters.

Hydric Soil: A soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part.

Impaired Waters: See 303(d) Waters.

Impervious Surface: An area that releases all or a large portion of the precipitation that falls on it, except for frozen soil. Conventional rooftops and asphalt or concrete sidewalks, driveways, parking lots and streets are typical examples of impervious surfaces.

Infiltration: The movement of precipitation or runoff into or through the soil.

Infiltration System(s): A device or practice such as a basin, trench, rain garden or swale designed specifically to encourage infiltration of precipitation or runoff.

Invasive Plants: Primarily non-native, aggressive plants that out compete and displace native plants in an ecosystem.

Land and Water Conservation Board (LWCB): The statutorily defined advisory body to the Department of Agriculture, Trade, and Consumer Protection. Consists of three local elected officials, four appointees of the Governor, and leaders from the DNR, DATCP, and DOA. Oversees the approval of county land and water resource management plans.

Land Resources Division (LRD): The Land Resources Division of the Waukesha County Department of Parks and Land Use.

Milligrams per Liter (mg/l): A measure of the concentration of a substance in water. For most pollution measurements this is the equivalent of "parts per million."

Natural Resources Conservation Service (NRCS): Part of the United States Department of Agriculture, the NRCS provides soil survey, conservation planning and technical assistance to local land users.

Nonpoint Source Pollution: Pollution which sources cannot be traced to a single point such as a municipal or industrial wastewater treatment plant discharge pipe. Nonpoint sources include eroding farmland and construction sites, urban streets, and barnyards. Pollutants from these sources reach water bodies in runoff, and can best be controlled through proper land management.

Nutrient Management Plan: A guidance document that that provides fertilizer and manure spreading recommendations for crop fields based on soil test results and crop needs.

ORW/ERW: DNR classifies streams and lakes as Outstanding Resource Waters (ORW) and Exceptional Resource Waters (ERW) as listed in NR102.10 and NR 102.11. ORW waters have excellent water quality and high-quality fisheries and do not receive wastewater discharges. ERW waters have excellent water quality and valued fisheries but may already receive wastewater discharges.

Phosphorus: A key plant nutrient that, when reaching lakes in excess amounts, can lead to over fertile conditions and algae blooms.

Point Source Pollution: Sources of pollution that can be traced back to a single point, such as a municipal or industrial wastewater treatment plant discharge pipe.

Priority Farms: Farms identified by the county for having excessive runoff from soil erosion and/or manure runoff resulting in existing or potential water quality problems.

Regional Stormwater Management Plan: A planning document, adopted by a local unit of government, which coordinates stormwater management activities for an entire drainage area or watershed, including future land development activities within the watershed. The plan may prescribe the use of BMPs for individual development sites and for selected points within the watershed to meet the goals and objectives of the plan.

Revised Universal Soil Loss Equation-Version 2 (RUSLE2): An equation used to estimate the amount of soil lost annually per acre from crop fields. It takes into consideration the following factors: rainfall, slope, slope length, soil erodibility, crop rotations, and crop practices (NRCS Agricultural Handbook 537).

Riparian: Belonging, living, or relating to the bank of a lake, river, or stream.

Riprap: Broken rock, cobbles, or boulders placed on the bank of a stream or lakeshore to protect it against erosion.

Runoff: Water from rain, snowmelt, irrigation or construction dewatering, not absorbed by the soil, that flows over the ground surface and returns to streams and lakes. Runoff can collect pollutants from air or land and carry them to receiving waters.

Sediment: Soil particles suspended in and carried by water as a result of erosion.

Stormwater BMP: Any best management practice that is designed to collect or manage the quantity or quality of stormwater runoff for an indefinite time period. Examples include, but are not limited to: wet or dry detention basin, infiltration trench or basin, bio-retention basin, stilling basin, green roof, filter strip, artificial wetland, or any combination of these or other permanent stormwater management practices.

Suspended Solids: A measure of the particulate matter in a water sample, usually expressed in milligrams per liter.

Technical Standard: A document that specifies design, predicted performance and operation and maintenance requirements for a material, device or method.

Tolerable Soil Loss (T-Value): The maximum average annual rate of soil erosion for each soil type, measured in tons per acre, per year, that will permit a high level of crop productivity to be sustained economically and indefinitely.

Total Maximum Daily Loads (TMDL): The maximum amount of a pollutant that can be discharged into a stream without causing a violation of water quality standards.

Trophic Status: The level of productivity of a lake as measured by phosphorus content, algae abundance, and depth of light penetration.

Turbidity: Having suspended or stirred up particles, referring to a lack of water clarity. Turbidity is usually closely related to the amount of suspended solids (sediment or algae) in water.

Variance: Government permission for a delay or exception in the application of a given law, ordinance, or regulation. Also see water quality standard variance.

Watershed: The geographic area that drains to a particular river, stream or water body.

Water Quality Standards: The legal basis and determination of the use of a water body and the water quality criteria; (physical, chemical, or biological traits of a water body) that must be met to make it suitable for a specified use.

Water Quality Standard Variance: When natural conditions of a water body preclude meeting all conditions necessary to maintain full fish and aquatic life and swimming, a variance may be granted.

Wetlands: An area 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.

Wetland Reserve Program (WRP): A provision of the federal Farm Bill that compensates landowners for voluntarily restoring and protecting wetlands on their property.

Wildlife Habitat Incentives Program (WHIP): Federal program to help improve wildlife habitat on private lands.

Appendix B
References Used to Develop This Plan

Southeastern Wisconsin Regional Planning Commission Memorandum Report No. 145 (draft), Lake and Stream Resources Classification Project for Waukesha County: 2000, May 2005.

Southeastern Wisconsin Regional Planning Commission Planning Report No. 42, A Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin, September 1997.

Southeastern Wisconsin Regional Planning Commission Planning Report No. 48, A Regional land Use Plan for Southeast Wisconsin, June 2006.

Southeastern Wisconsin Regional Planning Commission Technical Report No. 37, Groundwater Resources of Southeastern Wisconsin, June 2002.

Southeastern Wisconsin Regional Planning Commission Community Assistance Planning Report No. 58, 2nd Edition, A Lake Management Plan for Pewaukee Lake, May 2003.

United States Department of Agriculture, Census of Agriculture (1969-2017).

Waukesha County Departments of Parks and Land Use and UWEX, A Comprehensive Development Plan for Waukesha County, February 2009. Includes Appendix D, Waukesha County Farmland Preservation Plan Update, October 2011.

Wisconsin Agricultural Statistics Service, United States Department of Agriculture, Wisconsin Department of Agriculture, Trade and Consumer Protection, Wisconsin Agricultural Statistics, 2005.

Wisconsin Department of Natural Resources, The State of the Southeast Fox River Basin, February 2002.

Wisconsin Department of Natural Resources, The State of the Milwaukee River Basin, August 2001.

Wisconsin Department of Natural Resources, The State of the Rock River Basin, April 2002.

Wisconsin Department of Natural Resources, The State of the Root-Pike River Basin, May 2002.

Wisconsin Department of Natural Resources, Nonpoint Source Control Plan for the Muskego-Wind Lakes Priority Watershed Project, October 1993.

Wisconsin Department of Natural Resources, Nonpoint Source Control Plan for the Upper Fox River Priority Watershed Project, November 1993.

Wisconsin Department of Natural Resources, Nonpoint Source Control Plan for the Oconomowoc River Priority Watershed Project, 1986.

Wisconsin Department of Natural Resources, Nonpoint Source Control Plan for the Menomonee River Priority Watershed Project, March 1992.

Appendix C
Invitation to the LWRM Plan Advisory Committee

Paul Farrow
County Executive

Dale R. Shaver
Director

Waukesha County

Department of Parks and Land Use

VIA EMAIL

Date: May 28, 2021

To: Waukesha County Land and Water Resource Management Plan Advisory Committee

From: Alan Barrows, Land Resources Manager

Re: Virtual Advisory Committee Meeting #1
Wednesday, June 16, 2021; 10:00 AM – 12:00 PM, via Microsoft Teams

Greetings,

A "virtual" meeting of the Waukesha County Land and Water Resource Management Plan Advisory Committee will held on June 16, 2021 from 10:00 AM until 12:00 PM via Microsoft Teams.

The purpose of the Advisory Committee Meeting is to review draft updates to chapters 1 and 2 of the Waukesha County Land and Water Resource Management ("LURM") Plan. This planning process establishes long-range plans for the County's conservation programs. This update will be the fourth generation of the LURM plan. Many of you have been involved in the planning process for previous versions of the LURM plans. Below is a hyperlink to the current (2012) LURM plan on the County's website for your reference.

https://www.waukeshacounty.gov/landandparks/land-and-water-conservation/resources-management-plan/

Chapters 1 and 2 of the LURM plan include the plan 'Introduction' and Waukesha County's 'Resource Assessment'. The Land Resources Division staff are currently working on updates to those chapters. Copies of draft chapters 1 and 2 will be distributed one week in advance of the meeting for your review. I would greatly appreciate you taking the time to review the draft chapters.

If you are unable to attend the meeting, please provide comments regarding the updated chapters by email. If your comments are received ahead of the meeting, they will be shared with the other advisory committee members.

A second "virtual" advisory committee meeting will be held in July to review draft updates to chapters 3 and 4, which include 'Goals, Objectives and Planned Activities' and 'Plan Implementation and Evaluation'.

Thank you for your assistance in this important process. The second page of this memo includes a list of the people on the advisory committee. Please feel free to contact me with any comments or questions at (262) 896-8307 or abarrows@waukeshacounty.gov.

Land Resources Division
515 W Moreland Blvd., AC 260 • Waukesha, Wisconsin 53188-3878 • Phone: (262) 896-8300 • Fax: (262) 896-8298
Land & Water: www.waukeshacounty.gov/lwcnews • Recycling: www.waukeshacounty.gov/rrw • LIS: www.waukeshacounty.gov/lis

Appendix D
Notice of Public Hearing

Notice of Public Hearing

Waukesha County
Land and Water Resource Management Plan

Notice is hereby given that on Wednesday, November 10, 2021 starting at 2:00 PM, the Waukesha County Department of Parks and Land Use – Land Resources Division will conduct an informational meeting followed by a public hearing on the 2022 update to the Waukesha County Land and Water Resource Management Plan

This fourth generation Land and Water Resource Management Plan is an update to the current plan adopted by the Waukesha County Board in 2012. The updated plan will guide county land and water conservation program efforts for the next 10 years. Adoption of the plan will also help the county qualify for future state and federal grants. The informational meeting and public hearing will be held:

Wednesday, November 10, 2021 at 2:00 PM
Room 255/259, Waukesha County Administration Center
515 W. Moreland Blvd., Waukesha WI 53188

The Waukesha County Land and Water Resource Management Plan may be viewed online at www.waukeshacounty.gov/landandparks/land-and-water-conservation/resources-management-plan. The plan may also be viewed in Room 260 of the Waukesha County Administration Center. For additional information regarding this hearing, please contact Alan Barrows of the Waukesha County Land Resources Division at 262-896-8300. All interested parties will be heard.

Note: A quorum of the Waukesha County Land Use, Parks and Environment Committee may attend the above noted meeting for informational purposes only. No business will be conducted.

Publication Dates: October 27th and November 3rd, 2021

Appendix E
Conservation Practices Used for Plan Implementation

The following table lists the current technical standards and potential sources of cost-share funding for each of the conservation practices that may be used to comply with state agricultural and non-agricultural nonpoint pollution performance standards.

Conservation Practice or Activity	Technical Guide Practice Code	Potential Funding Sources (non-local)
Agricultural Conservation Practices		
Access road	560	LWRM, EQIP, WHIP
Animal trails and walkways	575	LWRM, EQIP
Barnyard runoff control systems	Various	LWRM, EQIP
Closure of waste impoundments	360	LWRM, EQIP
Contour farming	330	EQIP
Critical area planting	342	LWRM, EQIP
Diversion	362	LWRM, EQIP
Fence	382	LWRM, EQIP, WHIP
Filter strip	393	LWRM, EQIP, WHIP, CREP, CRP
Grassed waterway	412	LWRM, EQIP, CREP, CRP
Heavy use area protection	561	LWRM, EQIP
Lined waterway or outlet	468	LWRM, EQIP
Manure transfer	634	LWRM, EQIP
Milking center waste control systems	Various	LWRM, EQIP
Nutrient management	590	EQIP
Prescribed grazing	Various	EQIP
Riparian forest buffer	391	WHIP, CREP, CRP
Roof runoff structure	558	LWRM, EQIP
Sediment basin	350	LWRM, EQIP
Streambank and shoreline protection	580	LWRM, EQIP, WHIP, TRM
Subsurface drain	606	LWRM, EQIP
Tree/shrub establishment	612	EQIP, WHIP
Underground outlet	620	LWRM, EQIP
Waste storage facility	313	LWRM, EQIP, TRM
Wastewater treatment strip	635	LWRM, EQIP
Water and sediment control basin	638	LWRM, EQIP, TRM
Watering facility	614	LWRM, EQIP
Well decommissioning	351	LWRM, EQIP

Conservation Practice or Activity	Technical Guide Practice Code	Potential Funding Sources (non-local)
Urban Conservation Practices		
Bioretention for infiltration	1004	TRM*
Channel erosion mat	1053	-
Compost	S100	-
De-watering	1061	-
Ditch checks	1062	-
Construction site diversion	1066	-
Dust control	1068	-
Infiltration basin	1003	TRM*
Infiltration trench	1007	TRM*
Grading practices for erosion control	1067	-
Land application of anionic polyacrylamide	1050	-
Mulching for construction sites	1058	-
Non-channel erosion mat	1052	-
Proprietary stormwater sedimentation devices	1006	TRM*
Rain Gardens	1009	TRM*
Sediment bale barrier	1055	-
Sediment basin	1064	TRM*
Sediment trap	1063	-
Seeding	1059	-
Silt fence	1056	-
Silt curtain	1070	-
Stone tracking pad and tire washing	1057	-
Storm drain inlet protection for construction sites	1060	-
Turbidity barriers	1069	-
Vegetative buffer for construction sites	1054	-
Vegetated infiltration swales	1005	
Water application of polymers	1051	-
Wet detention pond	1001	TRM*

LWRM = Land and Water Resource Management Program
EQIP = Environmental Quality Incentives Program
WHIP = Wildlife Habitat Incentives Program
WRP = Wetland Reserve Program
CREP = Conservation Reserve Enhancement Program
CRP = Conservation Reserve Program
TRM = Targeted Runoff Management (*Grants not available to fund BMP's for new development projects.)

Appendix F
TMDL Total Phosphorus and Total Suspended Solids Load Reductions

Milwaukee River TMDL Reductions by Reach

Reach	TP Target (mg/L)	Annual Allowable TP Load for Reach (lbs/year)	TSS Target (mg/L)	Annual Allowable TSS Load for Reach (lbs/year)	Average TP Percent Reduction for MS4	Average TSS Percent Reduction for MS4
MN-1	0.075	1,398	12	223,786	59%	58%
MN-4	0.075	363	12	58,058	45%	55%
MN-5	0.075	316	12	50,631	69%	63%
MN-6	0.075	711	12	113,773	65%	67%
MN-7	0.075	365	12	58,344	60%	63%
MN-8	0.075	457	12	73,067	53%	62%
MN-10	0.1	3,036	12	222,942	23%	59%
MN-11	0.075	597	12	95,580	58%	65%
MN-12	0.075	679	12	108,574	73%	75%
MN-13	0.075	454	12	72,671	66%	71%
MN-14	0.1	718	12	53,449	43%	56%

Note: Percent reduction is calculated as the average of the monthly percent load reductions from baseline. Baseline MS4 loads reflect 20% TSS reduction from no controls (and associated reduction of TP).

Milwaukee River TMDL Percent Reductions from Baseline Load

	Required Average Percent Reduction of TP from Baseline Load		Required Average Percent Reduction of TP from Baseline Load	
Reach	Agricultural	Non-Permitted Urban	Agricultural	Non-Permitted Urban
MN-1	46%	60%	46%	59%
MN-4	30%	-	43%	-
MN-5	58%	-	51%	-
MN-6	45%	-	42%	-
MN-7	-	-	-	-
MN-8	-	-	-	-
MN-10	-	-	-	-
MN-11	45%	-	54%	-
MN-12	53%	-	61%	-
MN-13	47%	-	58%	-
MN-14	-	-	-	-

Note: Percent reduction is calculated as the average of the monthly percent load reductions from baseline.

Rock River TMDL Required Average Percent Reduction of TP from Baseline Load

Reach	Waterbody Name	Waterbody Extents	Nonpoint Source	MS4	WWTF	Non-Permitted Urban Percentage of Baseline Load*
21	Rock River	Oconomowoc River to Mile 270	27%	10%	0%	3%
22	Flynn Creek	Mile 0 to 6	30%	-	-	0%
23	Oconomowoc River	Mason Creek to Flynn Creek	29%	12%	-	2%
24	Mason Creek	Mile 0 to 5.2	39%	11%	-	0%
25	Oconomowoc River	Battle Creek to Mason Creek	52%	64%	77%	33%
26	Battle Creek	Mile 2.1 to 4.6	32%	35%	-	13%
55	Bark River	Mile 35 to 41	54%	68%	79%	14%
56	Bark River	Scuppernong River to Mile 35	33%	19%	6%	2%
59	Steel Brook, Scuppernong River, Bark River	Rock River to Steel Brook, Spring Creek	41%	54%	67%	4%

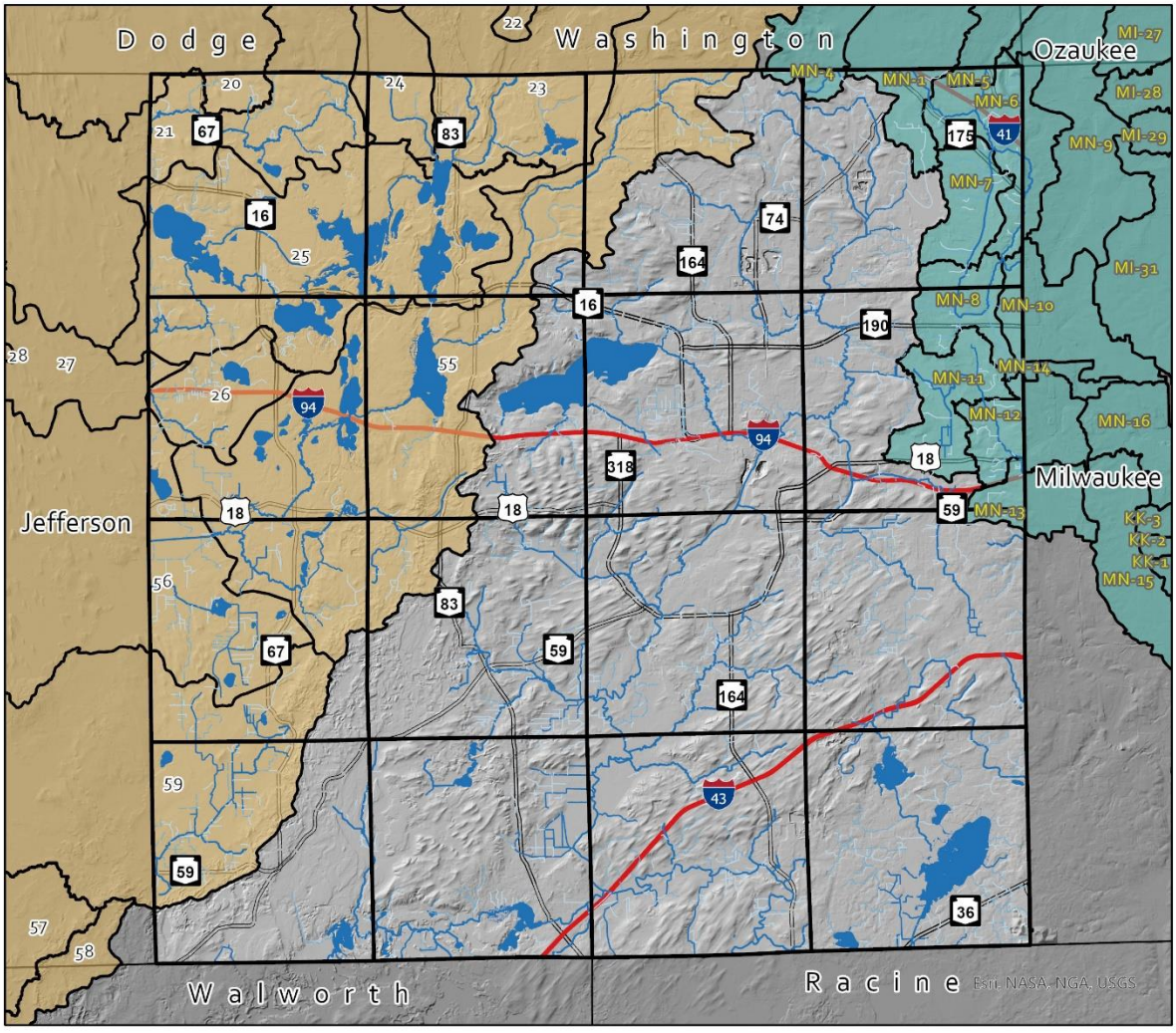
*Note that the non-permitted urban percentage of baseline load is not a percent reduction. This column is shown to facilitate division of nonpoint source load between agricultural and non-permitted urban sources.

Rock River TMDL Required Average Annual Percent Reduction of TSS from Baseline Load

Reach	Waterbody Name	Waterbody Extents	Nonpoint Source	MS4	WWTF	Non-Permitted Urban Percentage of Baseline Load*
21	Rock River	Oconomowoc River to Mile 270	19%	0%	0%	3%
22	Flynn Creek	Mile 0 to 6	36%	-	-	0%
23	Oconomowoc River	Mason Creek to Flynn Creek	33%	11%	-	1%
24	Mason Creek	Mile 0 to 5.2	43%	12%	-	0%
25	Oconomowoc River	Battle Creek to Mason Creek	29%	32%	17%	26%
26	Battle Creek	Mile 2.1 to 4.6	26%	29%	-	9%
55	Bark River	Mile 35 to 41	39%	43%	28%	11%
56	Bark River	Scuppernong River to Mile 35	24%	0%	5%	1%
59	Steel Brook, Scuppernong River, Bark River	Rock River to Steel Brook, Spring Creek	31%	15%	1%	3%

*Note that the non-permitted urban percentage of baseline load is not a percent reduction. This column is shown to facilitate division of nonpoint source load between agricultural and non-permitted urban sources.

APPENDIX F - MAP 1
TMDL REACHSHEDS
WAUKESHA COUNTY



Legend

- Rock River TMDL Reachsheds
- Milwaukee River TMDL Reachsheds

N
W E
S

Source: Waukesha County, WI DNR, SEWRPC

0 4 8 12 Miles

Appendix G
Waukesha County Board Approval of this Plan

Appendix H
DATCP Approval of this Plan