# Green Lake County Land & Water Resource Management Plan

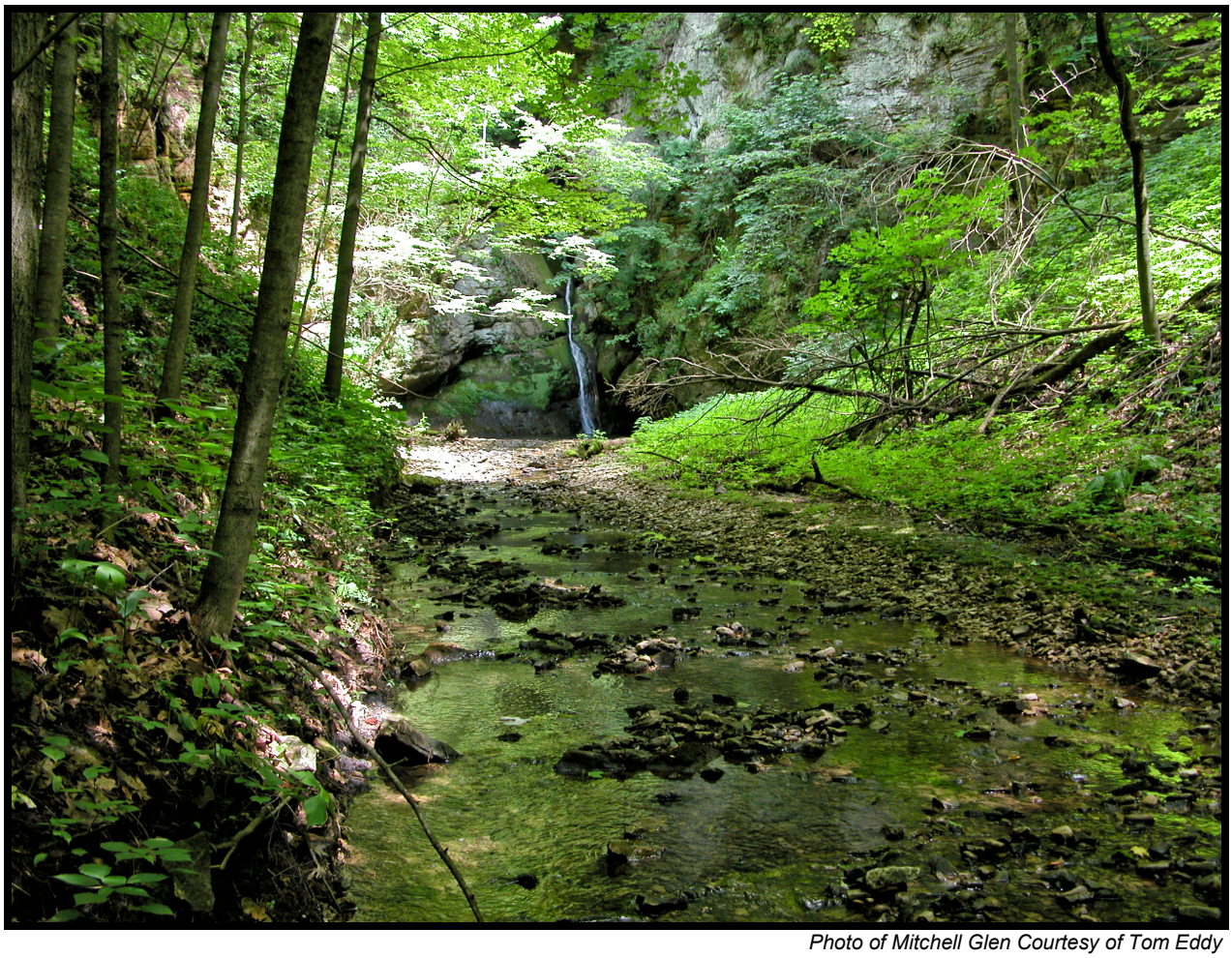

*Photo of Mitchell Glen Courtesy of Tom Eddy*

## October 2018

# ACKNOWLEDGEMENTS


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## MAPS

**APPENDIX**

# Chapter 1

# Introduction

## Plan Development

The Green Lake County Land and Water Resource Management Plan (LWRMP) concept evolved from a long-stated need to establish a locally driven process that ensured local decision making and increased program delivery mechanisms. It also ensures the utilization of local, state and federal funds for greater effectiveness toward the protection of land and water resources. The first Land and Water Resource Management Plan was developed in 1999, with subsequent five year updates in 2005 and 2011. The current LWRMP is being developed to provide direction for protecting and improving Green Lake County's land and water resources for the next ten years or 2018 – 2028.

The Land and Water Resource Management Plan is empowered by Chapter 92.10 of the Wisconsin Statutes. The basic concepts of this statute is meant to:

- Drive a locally led process for plan development and implementation,
- Provide flexibility in granting programs,
- Drive a comprehensive watershed based conservation effort without excessive planning,
- Reward innovation and cost effectiveness,
- Seamlessly integrate programs and funding sources, making use of a wide variety of implementation tools, and
- Be evaluated in a meaningful manner.

Chapter 92 is the enabling legislation that provides counties, through the Land Conservation Committee, the formal authority to develop a plan that provides structured means that will integrate and leverage available programs, funds, and other resources to:

- Guide the process for resource management planning and decision making,
- Compile information for evaluating land and water resource conditions,
- Develop a multi-year work plan to address land and water resource problems by watershed,
- Strengthen partnerships with landowners, other agencies, municipalities, and organizations,
- Integrate efforts with other county and basin level Natural Resource Management Plans,
- Assist with Township and County comprehensive land use planning efforts,
- Develop effective information and education strategies that will strengthen and maintain community support for the planned Land and Water Resource Management Plan goals and objectives, and
- Track progress toward the achievement of the plan's goals and objectives.

The driving force behind the development of the Green Lake County Land and Water Resource Management Plan is the opportunity to establish a true locally driven process. That means individual citizens, units of government, and local, state, and federal agency representatives must work together to develop a framework which positively integrates natural resource management programs and funding sources, and provides the necessary flexibility to allocate staff and financial resources where they will do the most toward accomplishing resource management objectives.

The Green Lake County Land and Water Resource Management Plan was compiled from information that included local programs, county programs, basin programs, state programs and federal programs.

## Public Opinion

As a precursor to developing our first Land and Water Resource Management Plan in 1999, the Land Conservation Department, with assistance from the Development Guide Citizen's Advisory Committee conducted a Lake Management and Land Use Survey in 1997. The information from this survey is still relevant in 2018. The survey attempted to measure attitudes and perceptions regarding lake-use and management in the county. The summarization of the Total Survey Results demonstrate that:

- Most people feel that water clarity is satisfactory and water quality is good.
- Although no significant problems exist because of the usage of the lakes, there is a substantial concern that traffic congestion, litter and noise have all increased, and that water quality and boating safety have declined. Some concern is evident that fish/wildlife habitat is suffering.
- Although most people are not very knowledgeable on land use issues, they feel land use planning is very important and that land uses need to be regulated by the government.
- Most people agree that the government should provide for adequate green-space surrounding the lakes. Conservation developments can provide the opportunity for green-space and lessen the burden for local government to provide the green-space.
- They strongly agree that the county needs a development plan/guide to manage growth and minimize the negative effects of various uses.

## Plan Participation

Citizens and technical staff were invited to be part of the Green Lake County Advisory Committee Meeting. In addition, the Land Conservation Committee were also included as part of the planning process. Advisory Committee members were asked to commit to attending two group meetings which were held on January 18th, 2018 and February 7th, 2018. The agendas of the planning meetings can be viewed at http://www.co.green-lake.wi.us/meetings.html.

The focus of the first group meeting was to inventory committee members as to what their resource management concerns of the county are. The results of that survey were used as a guideline to incorporate what the goals need to be that address these concerns. Another focus of that meeting was to review and modify the goals from the 2011 LWRMP in order to reflect recent land and water resource concerns. Current goals were updated to reflect the Committee's input.

In the second Advisory Committee meeting, the members was divided in to two groups. Each group analyzed the updated goals and brainstormed objectives as to how the goals could be achieved. Using an open discussion format, final objectives to achieve the current goals were solidified from the Advisory Committee Members. Finally, the Land Conservation Department staff members reviewed the former resource concerns from the first meeting to make sure that they were incorporated in the final goals and objectives for the latest LWRMP.

A draft copy of the Land and Water Resource Management Plan was placed on the Green Lake County website for public review. Public participation in the conservation of Green Lake County's natural resources has been a long-standing trend. A variety of citizens, organizations and government units have contributed insight and guidance to the County Land Conservation Department and the County Land Conservation Committee.

A public hearing to accept comments on the 2018 revision of the Land and Water Resource Management Plan was held on July 26, 2018 at the Green Lake County Courthouse in Green Lake. See *Appendix Seven* for a copy of the Class II public hearing notice.

The 2019 plan revision is anticipated to be approved by the Land and Water Conservation Board on October 2nd, 2018 (See *Appendix Nine*) and the Green Lake County Board of Supervisors on December 18th, 2018 (See *Appendix Eight*).

## Related Resource Management Plans

In developing this Land and Water Resource Management Plan, issues, concerns, needs, goals and objectives from previous natural resource management plan documents were reviewed. All of those documents are listed in the reference section of this plan; however, there were some key documents with specific data, observations and objectives that served a larger role. These include:

- Surface Water Resources of Green Lake County (1971)
- Green Lake County Resource Conservation Program (1976)
- Green Lake County Farmland Preservation Plan (2016)
- Green Lake County Comprehensive Plan (2016)
- Big Green Lake Priority Watershed Project (1992)
- Big Green Lake Nine Key Element Plan (2018)
- Beaver Dam River Priority Watershed Project (1993)
- Upper Rock River Water Quality Management Plan (1995)
- The State of the Rock River Basin (2002)
- Upper Rock River Watershed Management Plan-Upper Rock River Watershed Appendix (2002)
- Rock River TMDL (2012) / Updated (2018)
- Little Green Lake Lake Management Plan (2018)
- The Upper Fox River Basin's Analysis of Demographic, Composition, Public Goods and Natural Resources (1997)
- The State of the Upper Fox River Basin (2001)
- Fox River Basin Headwaters Ecosystem – An Ecological Assessment for Conservation Planning (2002)
- Lake Puckaway Comprehensive Management Plan (2017)

It is important to recognize that these documents were developed with a great deal of public participation. Many of the concerns, ideas, and recommendations voiced by those people are incorporated in this document.

## Basin Team Coordination

Green Lake County is a strong proponent of addressing natural resource issues at the basin level. Staff in the Land Conservation Department is involved in the Upper Fox River and Upper Rock River WDNR Geographic Management Units (GMU). It is anticipated that Green Lake's plan will address many of the same issues as these two basins. By factoring in their goals with the goals of the community, the Land and Water Resource Management Plan will succeed in developing a plan that integrates the ecosystem components of a natural boundary with grassroots planning and implementation.

**Upper Fox River Basin Priorities:** The Department of Natural Resources, *The State of the Upper Fox Basin Plan,* was completed in 2001. The Basin Plan and the LWRM plan share similar water quality goals and objectives. In consultation with the DNR Staff in writing the LWRM plan common water quality priorities were identified. The Department of Natural Resources water quality priorities from the State of the *Upper Fox Basin Plan* include:

- Continued implementation of the Winnebago Comprehensive Management Plan.
- Limit nutrient, sediment, and organic loading to waterways from point and nonpoint sources.
- Update formal stream classifications (NR104).
- Provide information and education on animal waste management to the agriculture industry.
- Conduct habitat evaluation on dredged streams.
- Participate in the Smart Growth Initiative with local governments.
- Properly regulate land spreading of septage.
- Reduce the discharge of untreated stormwater to waters of the state.
- Provide information and education to the construction industry on sediment control techniques and requirements.
- Provide information and education on aquatic exotic species that currently exist in the basin as well as those that may be introduced to the basin.

In addition, the Wisconsin Department of Natural Resources (WI DNR), in collaboration with the US EPA and CADMUS (EPA's contractor), are developing total maximum daily loads (TMDLs) for total phosphorus (TP) and total suspended solids (TSS) for surface waters located in the Upper Fox Basin (which includes Lake Winnebago) and the Wolf River Basin. The resulting TMDLs will provide the basis for calculating effluent limits in WPDES permits for municipal and industrial wastewater facilities; determining TSS (and/or TP) reductions for municipal stormwater runoff (ie. MS4 permits); addressing agricultural and urban stormwater runoff; and possibly affect general permit effluent requirements.

**Upper Rock River Basin Priorities (2002):** Surface and groundwater, land use/planning, environmental protection, and natural area preservation.

In 2011, The Department of Natural Resources (DNR) has developed a Total Maximum Daily Load (TMDL) to address sediment and phosphorus pollution in the Upper and Lower Rock River watersheds in southcentral Wisconsin.

## County Cooperation

Green Lake County LCD works together with neighboring counties when landowners' properties lie within two counties. Continued efforts will be made to further increase collaboration and communication between Counties.

In addition, cooperation with other federal, state and local government is a cornerstone to the success of the implementation of the LWRMP. Green Lake County LCD is committed to working together with not only the government agencies, but any non-profit organizations and lake and river groups that share the same goals of protecting our natural resources.

## Plan Goals for 2018-2028

Based on public input gathered through the County's comprehensive plan survey, public meetings, committee meetings and review of past land and water resource documents the following goals for the revised LWRM plan have been prepared. The goals are categorized under four resource concerns that summarize the issues affecting the County. Within the plan, objectives and action items are identified in an effort to meet each goal.

### Goal 1 – WORK TOWARD MEETING THE LONG TERM GOAL OF 15% OR GREATER SEDIMENT DELIVERY REDUCTION WITH THE FOLLOWING WORK PLAN OBJECTIVES FOR THE 2019-2029 PERIOD

Objective 1*:* Reduce rural sediment loading through further adoption of agronomic conservation practices and soil health.
Objective 2: Reduce rural sediment loading through the installation of structural Best Management Practices (BMPs).
Objective 3: Reduce sediment loading from streambank and shoreline erosion.
Objective 4: Promote and encourage implementation of conservation within the shoreland management areas.
Objective 5: Reduce sediment loading through construction site and storm water management.
Objective 6: Rely on the partnerships between agencies and organizations and their tools.

### Goal 2 – WORK TOWARD MEETING THE LONG TERM GOAL OF 15% OR GREATER PHOSPHORUS DELIVERY REDUCTION WITH THE FOLLOWING WORK PLAN OBJECTIVES FOR THE 2019-2029 PERIOD

Objective 1: Reduce nitrogen and phosphorous loading through nutrient management planning and manure management BMPs.
Objective 2: Reduce phosphorus runoff from developed lakeshore properties.
Objective 3: Reduce phosphorous runoff from urban sources through storm water management.
Objective 4: Reduce legacy phosphorus from streams, lakes, and wetlands.
Objective 5: Rely on the partnerships between agencies and organizations, and their tools.

### Goal 3 – PRESERVE AND RESTORE HABITAT

Objective 1: Maintain or increase total acres of native plantings and vegetation in upland and wetland areas.
Objective 2: Decrease present and future fragmentation of natural habitat.
Objective 3: Protect prime farmland.
Objective 4: Protect and establish in-lake habitat

### Goal 4: PROTECT GROUNDWATER RESOURCES

Objective 1: Protect groundwater quality.
Objective 2: Protect groundwater quantity.

# Chapter 2
# County Setting, Natural Resources and Trends

## General Characteristics

Named after the deepest natural inland lake in Wisconsin, Green Lake is located in the southeastern part of central Wisconsin mostly in the Upper Fox River Basin. The county is one of the smallest in the state with a total of 226,816 acres. There are ten townships that are predominantly agricultural in nature, and one large municipality--the city of Berlin. A population density of about 52 persons per square mile is higher than one finds in a typical agricultural county. This is a reflection of the county's recreational importance, and an indication of the growing influence of manufacturing and service industries. Part of Green Lake County's recreational importance stems from the 19,630 acres of open water in lakes and rivers, which among other things supports large game fish populations. Dairy farming accounts for the majority of the county's agricultural revenue, but vegetable crops and livestock produce many cash receipts as well.

## History

Long before Europeans even dreamed of a "New World" the region now known as Green Lake County was home to the American Indians. The large number of antiquities: burial mounds, effigy mounds, garden plots, and food caches, clearly indicate that the county was one of the Native American's favorite gathering and hunting grounds. (Titus, 1930) Green Lake's fertile soils provided natural foods and abundant habitat for migratory waterfowl, deer, turkey, and other game animals.

Green Lake's water resources played an important role in developing the county. The Fox River brought the first explorers, traders, and missionaries into the area, including such famed explorers as Perrot, Joliet, and Marquette. The large, navigable river soon brought permanent settlers into the region, and consequently was used to bring their produce to market. Smaller waterways were harnessed for their power, and as a result the county grew. Nearly every modern day city or village developed around sawmills or gristmills. For example, the Village of Dartford, later named Green Lake, began to develop in 1845 after Anson Dart partially raised the level of the lake with the dam he built for his sawmill. The village of Marquette grew around the sawmill Hiram McDonald built on the Grand River in 1836. The water resource brought permanent settlers, but it also brought tourists. The recreational aspects of Green Lake's water resources have been pivotal for the development of the area ever since David Greenway opened a summer resort in 1867. Even today tourism is a leading factor in the economy.

Early settlers stayed in Green Lake County partially because of the rich soil and partially because of the vast system of marshes, prairies, and savannas. This landscape meant that plowing could begin with very little eradication of timber. Through extensive use of the plow and dredge they soon converted the landscape into one of the more productive agricultural regions of the state. Agriculture in the county did not develop along specialized lines, and the landowners cultivated a vast array of crops. In fact, Wisconsin's first commercial cranberry production began in the marsh near Berlin in 1860. Today, dairy farming is the major producer of cash receipts, but the county also raises fine quality livestock and ranks relatively high among Wisconsin's production of vegetable crops.

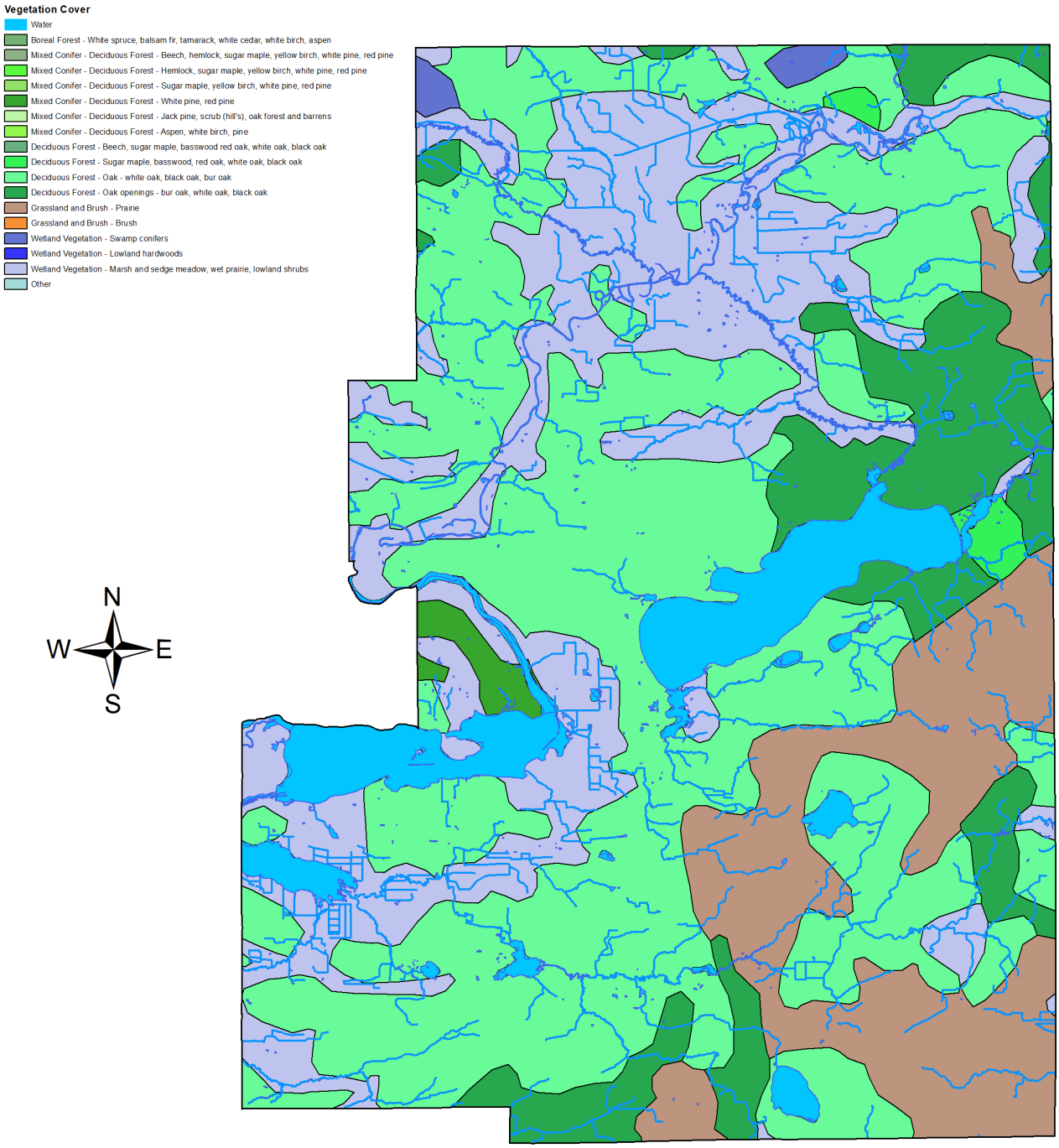
## Natural Resources

The natural resources of Green Lake County produce part of the ecological services that are critical to the functioning of the life-support system within the basin and beyond. These life supporting ecosystem services include erosion control and sediment retention, habitat for resident and transient populations of animals, nutrient cycling, disturbance regulation, waste treatment, and opportunities for recreation. These services contribute to human welfare and therefore represent part of the total economic value of the county as well as the Upper Fox and Upper Rock River Basins. The only ecosystem service consistently measured in monetary terms is opportunities for recreation, and that brings in tens of millions of dollars in revenue each year. We should rely on straight-line logic to tell us that we absolutely cannot afford to waste resources. Efficient use and protection of our natural resources will ensure that healthy ecosystem functions continue for present and future generations.

# Green Lake County

## Original (Pre-Settlement) Vegetation Cover

1999




Green Lake County

Map 1

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Land Conservation



Scale

Miles

1 0.5 0 1 2 3

## Geology & Topography

Green Lake County lies within two of Wisconsin's geographical provinces—the central plains on the northwest, and the eastern ridges and lowlands on the southeast half of the county.

The central plain area lies in an extinct glacial lakebed. It is characterized by a flat to gently rolling topography and averages an elevation of 760 to 800 feet above sea level. It has sandy soils or marsh underlain by sandstone bedrock. This area has a large number of wetland complexes, which makes it difficult to farm unless drained and managed. Except for Lake Puckaway and a few potholes, the region is devoid of lakes. The Fox River flows through the area from southwest to northeast, and tributary streams enter it at right angles from northeast and southwest.

The eastern ridges and lowlands to the southeast are characterized by a relatively rough topography consisting of a series of ridges separated by wide valleys. The entire area is covered by an unpitted glacial outwash plain, and has well drained soils underlain by dolomite and sandstone bedrock. This makes it some of the best land for agriculture. Wetlands are present but far more scattered than those of the central plain region. Eleven of the twelve named lakes found in Green Lake County are located in this region. Primary stream flow is from east to west with the Grand River being the major stream present.

## Surface Water Resources

Green Lake County lies within two of the country's major watersheds. The majority of the county lies within the Upper Fox River Basin and contributes to the Great Lakes watershed. A very small portion of the southeastern corner of Green Lake County drains into the Upper Rock River Basin, which contributes to the Mississippi watershed. Precipitation is the principal source of water, most of which percolates downward to groundwater aquifers. Locally, groundwater moves toward nearby rivers and streams, with an overall general movement toward the northwest. It flows into the Fox River, then through the large wetlands in the northwestern part of the county, then through the Winnebago pools, and eventually into Green Bay.

Surface waters make up approximately 7.5 percent of the total area of the county. There are 36 lakes, which make up 17,488 of the 19,630 acres of water. Almost all of the lakes are very fertile, shallow eutrophic or hyper-eutrophic lakes that suffer from excessive aquatic plant growth or algae blooms. Green Lake is an exception. Partly because it is one of the deeper natural inland lake between New York's Finger Lakes and the Rocky Mountains, it has comparatively better water quality and lower nutrient levels in the water column and bottom sediments. There are currently four named lakes in the county listed on the DNR's 303(d) list that are not meeting the DNR water quality standards. Refer to page 16 for a complete county record of lakes on the 303(d) designated list.

The county has 58 streams, which have a surface area of 1,070 acres and cover 217 miles. The Fox River with an average width of 160 feet and an area of 806 acres is the largest stream present, accounting for 75% of the total stream area. Snake Creek, White Creek and Assembly Creek are the only viable trout streams remaining in the county and are designated Exceptional Resource Waters (ERW). At the other end of the spectrum, Wuerchs Creek, Hill Creek, Roy Creek and Silver Creek, which all discharge into Green Lake, are listed on the DNR's 303(d) list as impaired waters not currently meeting the DNR water quality standards. Refer to page 16 for a complete county record of rivers on the 303(d) designated list and rivers on the ERW list.

## Wetland Resources

In 1938, there was an estimated 59,000 acres of wetlands in Green Lake County. Many of these were diverted to agriculture and housing, and in 1976 approximately 32,000 acres remained. Today 44,000 acres are classified as wetlands; although, this increase may be misleading due to the change in definition of wetland. The 44,000-wetland acres are classified as both shrub and wooded swamps or bogs, or shallow or deep fresh marshes. The county is also fortunate enough to have a calcareous fen near Berlin, a rare groundwater driven wetland type of regional importance.

Green Lake contains portions of two of the five larger wetland complexes in the Upper Fox River Basin: the White-Puchyan wetland complex of 9,828 acres, and the Grand River Marsh of 5,526 acres. Large un-fragmented wetland areas are relatively uncommon. They are extremely important because they create a habitat for animal populations that cannot survive in such small, fragmented areas that have come to dominate our humanized landscape.

In addition to providing habitat and food for game fish, waterfowl and other species of wildlife, wetlands perform many of the ecosystem services that we cannot perform, or perhaps only with great cost. Wetlands are important buffers that maintain water quality--trapping sediments and retaining and removing nutrient runoff. They absorb or hold vast quantities of water and thereby regulate fluctuations in the water supply on which we depend. Wetlands minimize flood hazards by storing excess runoff and reducing the speed at which water moves through the watershed. In addition, wetlands recharge aquifers, anchor shorelines, retain heavy metals, provide recreation, education and research, and maintain biodiversity, open space and aesthetic values.

Wetlands' natural functions are a critical part of the ecological mosaic, and they are a great value to society. Nevertheless, Green Lake County is faced with the loss of this precious resource due to agriculture drainage and urban development. Wetland loss caused by agricultural drainage has been reduced due to the 1985 Swampbuster provision of the Farm Bill. Still, there is continuing nationwide pressure from development interests to weaken wetland legislation. Wetland filling will continue to be an increasing threat to wetland areas as the pressures of non-agricultural land use becomes more intensive.

## Woodland Resources

Prior to the growth of agricultural importance, the county contained a mixture of white pine, maple, basswood, oak and hickory forest. Today, 11% of Green Lake County is covered with forests. They are composed of a wide variety of hardwoods and softwoods, with a few conifer plantations. Most forests contain exotic "weed" species such as honeysuckle and buckthorn, and most are small, privately owned tracts used mainly for farm woodlots. The woodlands are important in terms of providing habitat for various species of wildlife, and providing some soil conservation through wind protection. Unfortunately, poor management practices, such as grazing by cattle and deer, have resulted in the destruction of their ecosystem functions. Poorly managed forests have low wood production, greater erosion, and elimination of natural reproduction cycles of native forest species. In order to maintain the benefits of programs such as the CRP, better timber management and proper utilization of the county's woodlands will be necessary.

## Wildlife Resources

Wildlife resources have played an important role in the history and development of the county. Before and during early settlement, hunting, fishing, and trapping were essential to human survival and the growth of the area. Today, they provide significant recreational opportunities. Although much of the wildlife's habitat has been reduced or degraded, the county still has an abundance of fish and wildlife. This relative abundance is due to the large contiguous area of forest and wetlands that are essential to preserving high levels of biodiversity.

Nearly all streams and lakes in Green Lake County contribute directly to the welfare of some type of wildlife. Muskrats are the most common aquatic fur-bearing animals, followed in abundance by mink and beaver. A few otter may be present as well. Deer are also common and have become problematic because of overgrazing of forest lands and damage to agricultural crops. Pheasant are present, and turkeys have been successfully reintroduced to the area. In the spring significant numbers of Canada geese concentrate around marshlands and shallow lakes while in the fall they concentrate around the Grand River Marsh and Green Lake.

Decreasing wildlife habitat (both in quantity and quality) is a wildlife management problem. Some of the culprits responsible for habitat destruction include; intensive cultivation, wetland drainage, early spring hay mowing, roadside brush cutting, streambank pasturing, invasion of exotic species, and urban development. An increase in hunting pressure also contributes to wildlife management problems. Through sound educational programs and economic assistance programs some of these problems may be overcome. Control of invasive exotic species has been addressed for some problems (purple loosestrife) but much more work will need to be done in the future.

## Fishery Resources

Green Lake attracts hundreds of residents and non-residents a year due to its excellent fishery resources. Ten of Green Lake's named lakes support significant fisheries; including walleye, largemouth bass, northern pike, bluegill, cisco, and perch. Green Lake is famous throughout the Midwest for excellent lake trout fishing. In addition to the species found in the county's lakes, most of the county's streams contain smallmouth bass, channel catfish, crappie, pumpkinseed, and perch. Unfortunately, the problematic common carp are found in many of the lakes and streams. Over the past twenty years, our lakes partnership has orchestrated the removal of over one million pounds of carp from Big Green Lake and its estuaries. These carp removals have kept carp in-check and allowed more desirable game fish to out compete a smaller ratio of carp. In addition, the GLSD operates and maintains automated air bubble carp gates at both estuary bridges (A & K).

As with wildlife, the loss of habitat is the greatest threat to Green Lake County's fish species. Among other factors, erosion, siltation and high turbidity are combining to make the system uninhabitable for finer game fish. The disturbance of spawning areas through silt dredging has reduced fish numbers as well. Carp also contribute to the overall degradation of available game fish habitat. Currently, the annual quota is 25,000 Lake Trout being stocked into Big Green Lake from the Fish Rearing Facility. This quota will continue for the foreseeable future and ensures e cold water fishery for many years to come.

## Unique Natural Areas

Important natural areas in Green Lake County have been identified by state and local officials and have the highest environmental quality. Of the natural areas in the county, those areas having unique environmental characteristics that contain rare species and high-quality natural communities (See *Appendix Five*) are:

• The upper Fox River located southwest of Princeton has been identified as a regionally significant preservation area. This area, composed mostly of private ownership, should be kept in as natural a state as possible.

• The Snake Creek Corridor northwest of Green Lake has been identified as a regionally significant corridor. Snake Creek, the spring-fed stream that names the corridor, originates from the lower slope of a rocky escarpment that's timbered with scattered oak woodlands and red cedar glades. The threadlike meander winds northeasterly for about four miles through a mosaic of shrub-fringed marshes, sedge meadows, tamarack swamps, low prairies, and fens before it becomes a tributary of the Puchyan River, draining into the Fox River and eventually into Lake Michigan at Green Bay.

Extensive wetlands had kept the Snake Creek area largely undeveloped. A railroad grade to usher in rail service had been built through here in 1871 and was discontinued in 1979 when the Chicago and Northwestern Railroad Company sold the ties and tracks for salvage, and offered the abandoned right-of-way to adjacent landowners and other prospective buyers. In 1980, the Izaak Walton League bought 1.75 miles of abandoned railroad between Green Lake and Princeton with matching funds from the late Clarence F. Busse, a teacher and amateur naturalist. The 66-foot-wide corridor and adjoining ¾-mile segment owned by Badger Mining Corporation formed a 14 ¼-acre parcel. The community pitched-in to transform the rail bed to a trail which is known as The Snake Creek Wetland's Trail. The Izaak Walton League eventually gifted the trail to Badger Mining Corporation in 2017and today it remains open to the public to enjoy the unique beauty of the Snake Creek Corridor.

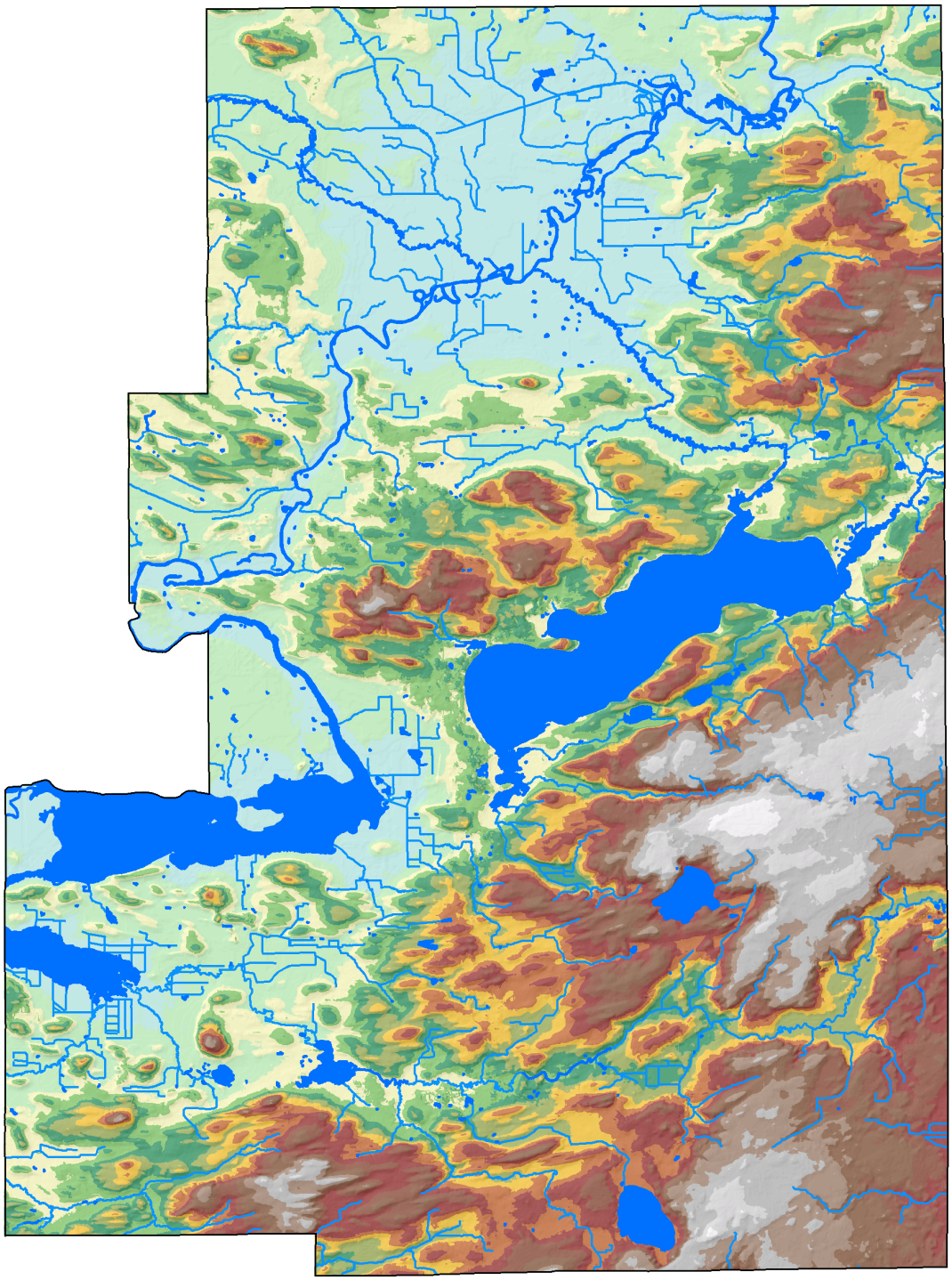
• The Mitchell Glen area located southeast of Green Lake has long been recognized as a natural resource preservation area. The 12-acres of Mitchell Glen conservancy land includes 500+ feet of frontage on Glen Creek and features a microclimate that supports certain plants more typical of northern Wisconsin. Formerly owned by S. D. Mitchell, this spectacular site was formed 12,000 years before present when post-glacial meltwater eroded the sandstone bedrock, resulting in a steep-sided and timbered gorge. Mitchell Glen is home to one of the few intact maple-basswood climax forests in Green Lake County. The unique geological formations and spring-fed stream are part of a high-quality corridor that supports outstanding biodiversity.

LIMITED ACCESS ONLY: Public access is limited to two guided tours annually. Contact the Green Lake Sanitary District office to sign up for a tour. Telephone: 920.295.4488; Email: glsd@glakesd.com The cover of 2018 LWRMP features a photo of Mitchell Glen which was submitted by Tom Eddy.

# Green Lake County

## Shaded Relief/Land Elevation

1998




**Height (feet)**

- 748 - 768
- 769 - 784
- 785 - 807
- 808 - 830
- 831 - 856
- 857 - 883
- 884 - 906
- 907 - 929
- 930 - 951
- 952 - 971
- 972 - 991
- 992 - 1,014
- 1,015 - 1,034
- 1,035 - 1,053
- 1,054 - 1,089

Green Lake County

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Scale

Miles

1 0.5 0 1 2 3

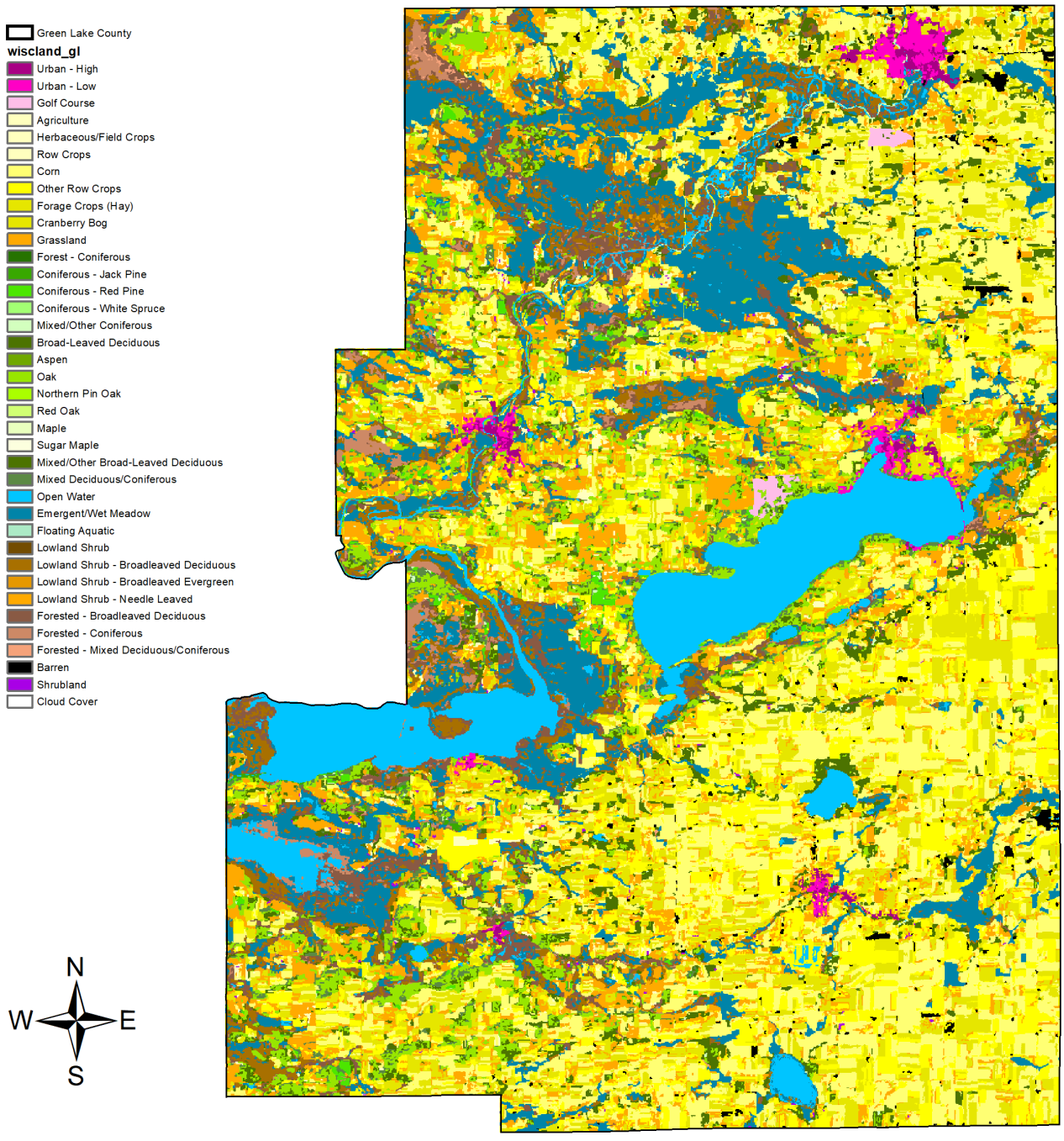
Map 2

Land Conservation

# Green Lake County

## Land Use

2016




Green Lake County

Map 3

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Land Conservation



Scale

Miles

1 0.5 0 1 2 3

## Soils

Individual soil types directly influence land uses and management, and therefore, significantly impact other natural resources and ecosystem services. The Green Lake Land and Water Conservation Department uses detailed descriptions of each soil type, including soil patterns, relief and drainage features to determine cropland erosion estimates and sediment load calculations. This in turn, determines the type and extent of agricultural practices and management techniques to recommend.

**Plano-Mendota-St. Charles Association**
Ranging from well drained and moderately well drained soils, having nearly level to gentle slopes. A silt loam and silt clay loam comprise the upper subsoil, and a heavy sandy loam form the lower subsoil, all layered over calcareous gravelly or very gravelly sandy loam glacial till. The association is on glaciated uplands where the soils formed in wind-blown silts and the underlying glacial till. This association covers about 30 percent of the county. Sheet and rill erosion is prevalent on these soils due to intensive farming. Erosion control practices include contour farming, strip cropping, and reduced tillage.

**Kidder-Rotamer-Grellton Association**
Well-drained soils, ranging from nearly level to steep slopes. Soils contain loam, clay loam or sandy clay loam in the upper subsoil and a loam subsoil over calcareous, gravelly sandy loam glacial till. This association is on glaciated upland consisting of ground moraine made up of swales, rounded hills and drumlins. Throughout these areas, stones and boulders are common on the surface and in the soils. This association covers about 27 percent of the county. Erosion can be severe on these soils if not properly managed and gullies form on areas with rolling land. Conservation practices for controlling gullying include water and sediment control basins.

**Lapeer-Mecan-Okee Association**
Well drained to somewhat excessively drained soils with gentle to steep slopes containing a surface layer of loamy fine sand over a sandy loam subsoil. Calcareous, gravelly sandy loam or gravelly loamy sand glacial till lies beneath. This association is on glaciated uplands consisting of ground moraine made up of swales, rounded hills and drumlins. Throughout the association, stones and boulders are common on the surface and in the soil. This association covers about 7 percent of the county. Wind erosion is common on these soils where clean tillage is used. Conservation practices used to control wind erosion include windbreaks, conservation tillage and strip cropping.

**Oakville-Brems-Granby Association**
Including well-drained, moderately well drained, and poorly drained soils with nearly level to steep slopes that have fine sand subsoil underlain by fine and medium sand. This association is on outwash plains and terraces. It consists of low hills and swales. It covers about 9 percent of the county.

**Boyer-Oshtemo-Gotham Association**
Includes well drained and somewhat excessively drained, nearly level to steep soils with a subsoil mainly of loamy fine sand, sandy loam, and loamy sand underlain by sand or stratified sand and gravel outwash. It is on outwash plains and terraces and consists of low hills and swales and occasional kettle holes. It covers about 6 percent of the county. Wind erosion is common on these soils when clean tillage is used. Windbreaks and conservation tillage are conservation practices that are used to control erosion on these soils.

**Willette-Poy-Poygan Association**
Ranging from poorly and very poorly drained, nearly level soils that have a silty clay or clay subsoil over sand or calcareous clay or silty clay. It is in drainage ways, old lake basins and flood plains. They have an organic layer of well-decomposed muck about 30 inches thick. This makes up 11 percent of the county.

**Adrian-Houghton Association**
Very poorly drained, nearly level organic soils underlain by sandy, or clayey material or marl. It is in drainage ways, depressions, and old lake basins and on flood plains. They have an organic layer of highly decomposed muck about 4 feet thick. It makes up 10 percent of the county.

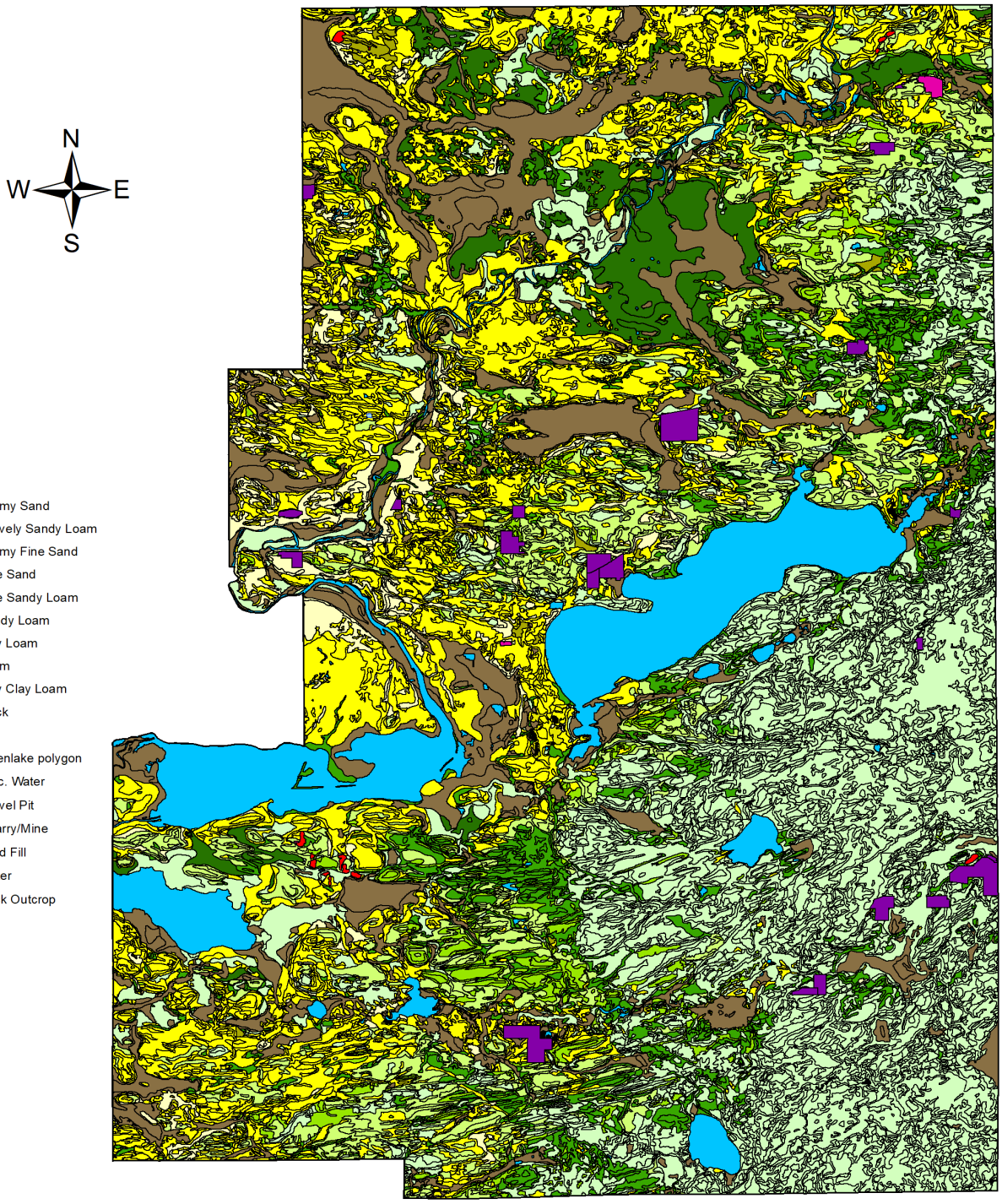
## Mineral Resources

Sandstone underlies approximately 70 percent of the county. Prairie du Chien dolomite forms a fairly wide band of bedrock from Berlin south to Green Lake then through Markesan to the county line. To the East lies a band of Galena-Platteville limestone and dolomite. Outcrops of granite are found near Berlin, Kingston, and north of Princeton.

# Green Lake County

## Soils & Surface Water

2018




Green Lake County

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Scale

Miles

1 0.5 0 1 2 3

Map 4

Land Conservation

## Ground Water Resources

Ground water is available in the county from glacial deposits and bedrock aquifers. Water from these aquifers is hard, and iron is a problem in some places. While no major groundwater pollution problems exist, some wells have detected Atrazine levels above the health advisory standards. Therefore Atrazine prohibition areas within the county have been established and care must be taken to maintain the quality of this abundant resource. (The availability of water from glacial deposits is estimated at 5 to 10 gallons per minute. Availability is estimated at 10 to 100 gallons per minute northwest of a line that extends generally from the City of Berlin to the City of Princeton and a small area that runs northeast form Lake Puckaway through and beyond Green Lake.) Nitrate pollution is also a concern. UWEX has tested for well nitrate levels over the past several years documenting areas where the problems exist. Other potential problems include the decline of water levels between areas of closely spaced wells or areas of heavy industrial or municipal pumping, and the pollution of water in bedrock aquifers. Potential for groundwater contamination is greatest where dolomite bedrock is close to the surface or in areas where water percolates very quickly

## Land Use Trends

Agriculture dominated land use during the past century and will continue to dominate in the years to come. During the latter part of the 19th century and the early part of the 20th century, the amount of land committed to farming varied between 90 and 95 percent of the total land area. It reached its highest point in 1945 when 216,568 acres of land was in production. The amount of land devoted to agriculture has steadily declined, and today only 17% or 154,595 acres of land remains in production (Ag. Stats. 2012). Of this, 99,700 acres are cropland.

An increasing amount of land in Green Lake County is being used for nonagricultural use. The county's population growth rate is not exceptional, but due to its lakes, streams, woodlands, and wetlands, the number of summer homes is increasing. Green Lake County, which has traditionally been a popular vacation ground, is gaining popularity for home sites and recreational areas for expanding population of southeastern Wisconsin and northern Illinois. Sprawling developments without controls, especially in the riparian zone of streams and lakes, contribute to the loss of habitat and degradation of our natural resources.

The LCD along with the GLSD have been promoting conservation based developments in land that is being developed in close proximity to Green Lake. It is the intent by providing the assistance that developers are made aware of various practices that can be implemented to minimize the negative impacts from development. The LCD staff time required to provide this assistance is limited and considerations may need to be made if future assistance is to continue.

Land use planning to control urban development is recommended to help communities develop within their natural and financial limits. Some planning measures include:

- Preservation of farmland, open spaces, and wooded areas,
- Preservation of wetlands and similar wildlife habitat,
- Preservation of open vegetated drainage ways for filtration and stormwater management,
- Establishment of vegetated buffers along stream corridors to filter surface water
- Promotion of conservation developments

## Agricultural Trends

Green Lake County has a diverse agricultural economy. Grain production now accounts for the largest portion of total farm receipts and dairy production takes a close second. Vegetable receipts continue to grow in importance. (Ag. Stats. 2012)

According to the Wisconsin Department Agriculture, Trade and Consumer Protection (DATCP) agricultural statistics, from 2007 to 2012 Green Lake County have seen some potential trends changing in agriculture:

- A 16% decrease in the number of farms, from 723 to 608.
- A 29% increase in average farm size from 197 acres to 254 acres.
- A 3% increase in all cattle from 22,791 to in 23,461.
- A 14% decrease in alfalfa and hay fields from 15,364 acres to 13,220 acres.
- A 20% increase in row crops from 60,586 acres to 72,998 acres.
- A 9% increase in vegetable crops from 10,605 acres to 11,560 acres.

# Chapter 3

# Land and Water Resource Conditions

## Basin Geography

To efficiently and effectively address nonpoint source pollution, it is necessary to establish priorities and define a course of actions. This is not possible unless the water and land resource conditions are assessed. The following summaries provide descriptive characteristics and quantitative assessments of the type and extent of the water resource.

Although these assessments are based on water resource conditions that are unique to Green Lake County, it must also be noted that there are strong communications and working relationships with neighboring counties to foster common goals and objectives for resource improvements throughout the entire basin.

**Upper Fox River Basin:** Most of the County is located in the Upper Fox. Green Lake County Watersheds include:

- Fox River-Berlin Watershed
- Green Lake – previously a DNR funded priority watershed
- Upper Grand River Watershed – previously a USDA-EQIP funded priority watershed
- Lower Grand River Watershed
- Buffalo and Puckaway Lakes Watershed
- Fox River-Rush Lake Watershed
- White River Watershed
- Mecan River Watershed
- Swan Lake Watershed

**Upper Rock River Basin:** Approximately 10 square miles of the County are located in the Upper Rock. Green Lake County Watersheds include:

- Beaver Dam River Watershed – previously a DNR funded priority watershed
- Upper Rock River Watershed

A map of each watershed within Green Lake County is provided and is summarized on page 17.

## Exceptional Resource Waters:

- Snake Creek in the Fox-Berlin Watershed
- White Creek in the Green Lake Watershed
- Assemble Creek in the Green Lake Watershed

## 303(D) Rivers – Water not currently meeting water quality standards

- Harrington Creek in the Fox River-Berlin Watershed
- Puchyan River in the Fox River-Berlin Watershed
- Grand River in the Upper and Lower Grand River Watersheds
- Hill Creek in the Green Lake Watershed
- Roy Creek in the Green Lake Watershed
- Silver Creek in the Green Lake Watershed
- Wuerchs Creek in the Green Lake Watershed
- South Branch Rock River in the Upper Rock River Watershed

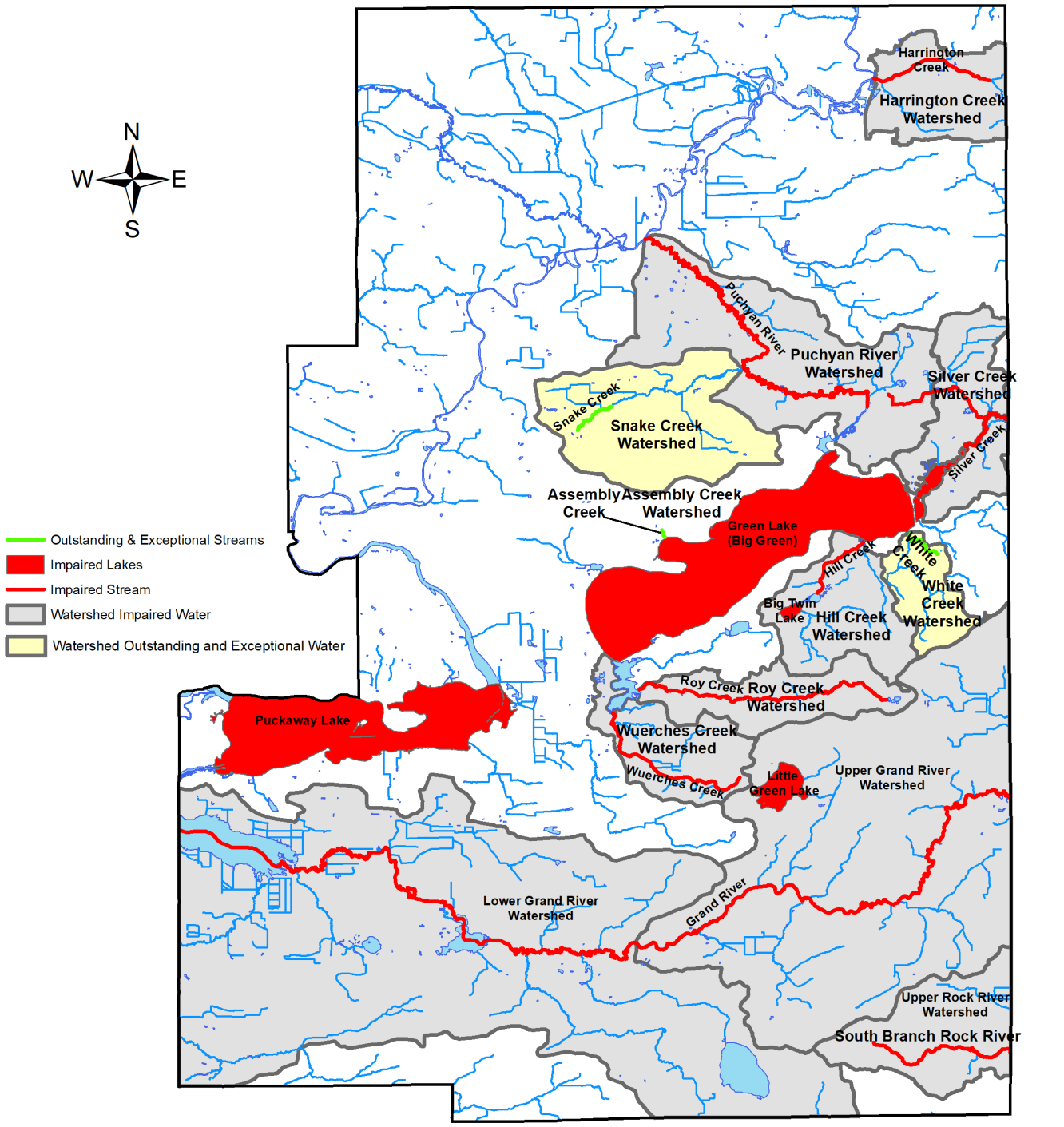
## 303(D) Lakes – Water not currently meeting water quality standards

- Green Lake in the Green Lake Watershed
- Big Twin in the Green Lake Watershed
- Little Green Lake in the Upper Grand River Watershed
- Lake Puckaway in the Buffalo and Puckaway Lakes Watershed

# Green Lake County

## 303D Impaired & Outstanding and Exceptional Waters

2018

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Scale

Miles

1 0.5 0 1 2 3

Map 5

Land Conservation

## TABLE 3.1: GREEN LAKE COUNTY 303D IMPAIRED WATERS

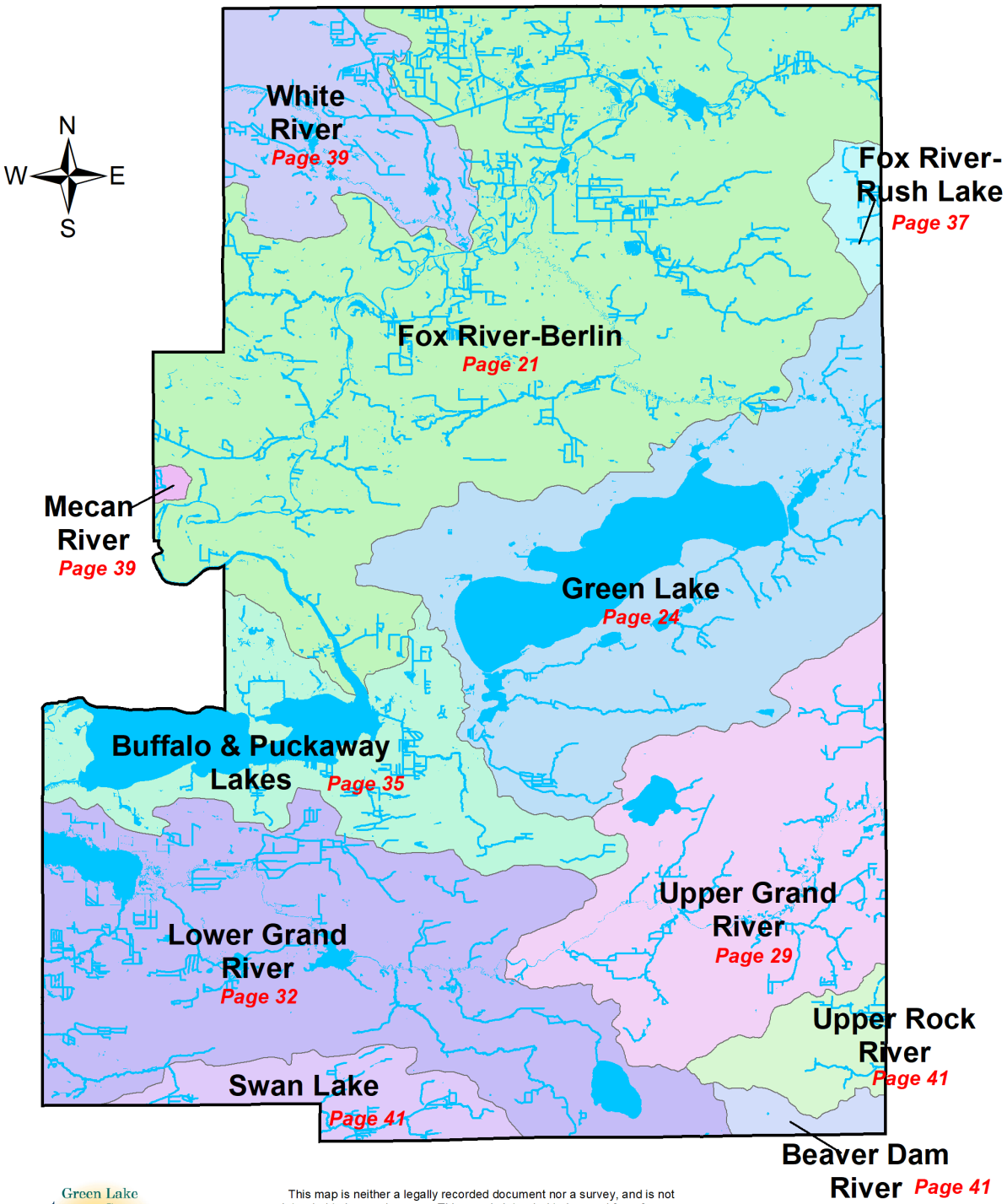
| Official Name (Click for Details) | Local Name (Click for Map) | Start Mile | End Mile | WBIC | Water Type | County | Pollutant | Impairment | Status | Priority |
|---|---|---|---|---|---|---|---|---|---|---|
| Puchyan River | Puchyan River | 0.00 | 13.96 | 145200 | River | Green Lake | Unknown Pollutant | Elevated Water Temperature | 303d Listed | Low |
| Puckaway Lake | Puckaway Lake | | | 158700 | Lake | Green Lake, Marquette | Total Phosphorus | Eutrophication, Water Quality Use Restrictions, Excess Algal Growth | TMDL Development | High |
| Twin Lakes | Big Twin Lake | | | 146500 | Lake | Green Lake | Total Phosphorus | Excess Algal Growth | TMDL Development | High |
| Green Lake | Green Lake (Big Green) | | | 146100 | Lake | Green Lake | Total Phosphorus | Low DO | TMDL Development | High |
| Hill Creek | Hill Creek | 0.00 | 1.84 | 146200 | River | Green Lake | Total Phosphorus | Degraded Biological Community | 303d Listed | High |
| South Branch Rock River | Rock River, South Branch | 3.58 | 19.68 | 869800 | River | Fond Du Lac, Green Lake | Total Phosphorus | Low DO | TMDL Approved | Not Applicable |
| Little Green Lake | Little Green Lake | | | 162500 | Lake | Green Lake | Total Phosphorus | Low DO, Eutrophication, Water Quality Use Restrictions, Degraded Habitat, Excess Algal Growth, Elevated pH | TMDL Development | High |
| Unnamed | Wuerches Creek | 0.00 | 4.40 | 148300 | River | Green Lake | Total Phosphorus | Low DO, Elevated Water Temperature | TMDL Development | High |
| Grand River | Grand River | 21.00 | 43.00 | 159300 | River | Fond Du Lac, Green Lake, Marquette | Total Phosphorus | Impairment Unknown | 303d Listed | High |
| Unnamed | Unnamed Trib to Silver Creek | 0.00 | 2.93 | 146900 | River | Green Lake | Total Phosphorus | Degraded Biological Community | 303d Listed | High |

| Official Name (Click for Details) | Local Name (Click for Map) | Start Mile | End Mile | WBIC | Water Type | County | Pollutant | Impairment | Status | Priority |
|---|---|---|---|---|---|---|---|---|---|---|
| Grand River | Grand River | 0.00 | 21.00 | 159300 | River | Green Lake, Marquette | Total Phosphorus | Degraded Biological Community | TMDL Development | High |
| Roy Creek | Roy Creek | 0.00 | 7.18 | 148200 | River | Green Lake | Total Phosphorus | Degraded Biological Community | TMDL Development | High |
| Silver Creek | Silver Creek | 0.97 | 12.41 | 146800 | River | Fond Du Lac, Green Lake | Total Phosphorus | Impairment Unknown | Addition | High |
| Silver Creek | Silver Creek Mouth | | | 146800 | Lake | Green Lake | E. coli | Recreational Restrictions - Pathogens | 303d Listed | Low |
| Green Lake | Green Lake (Big Green) | | | 146100 | Lake | Green Lake | PCBs | Contaminated Fish Tissue | 303d Listed | Low |
| Puckaway Lake | Puckaway Lake | | | 158700 | Lake | Green Lake, Marquette | Sediment/Total Suspended Solids | Degraded Habitat | TMDL Development | High |
| Roy Creek | Roy Creek | 0.00 | 7.18 | 148200 | River | Green Lake | Sediment/Total Suspended Solids | Degraded Habitat | TMDL Development | High |
| Silver Creek | Silver Creek | 0.97 | 12.41 | 146800 | River | Fond Du Lac, Green Lake | Sediment/Total Suspended Solids | Elevated Water Temperature, Degraded Habitat | TMDL Development | High |
| Hill Creek | Hill Creek | 0.00 | 1.84 | 146200 | River | Green Lake | Sediment/Total Suspended Solids | Degraded Habitat | TMDL Development | High |
| Harrington Creek | Harrington Creek | 0.00 | 2.97 | 143700 | River | Green Lake | Sediment/Total Suspended Solids | Degraded Habitat | TMDL Development | High |
| South Branch Rock River | Rock River, South Branch | 3.58 | 19.68 | 869800 | River | Fond Du Lac, Green Lake | Sediment/Total Suspended Solids | Degraded Habitat | TMDL Approved | Not Applicable |
| Unnamed | Wuerches Creek | 0.00 | 4.40 | 148300 | River | Green Lake | Sediment/Total Suspended Solids | Degraded Habitat | TMDL Development | High |

# Green Lake County

## Watersheds

2018




Green Lake County

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Land Conservation



Cartographer: Justin Hansen

07-08-2005

Scale

1 0.5 0 1 2 3 Miles

Map 6

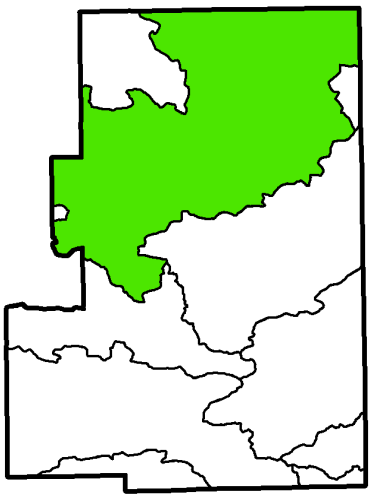
**TABLE 3.2: SUMMARY OF WATERSHED TABLES**

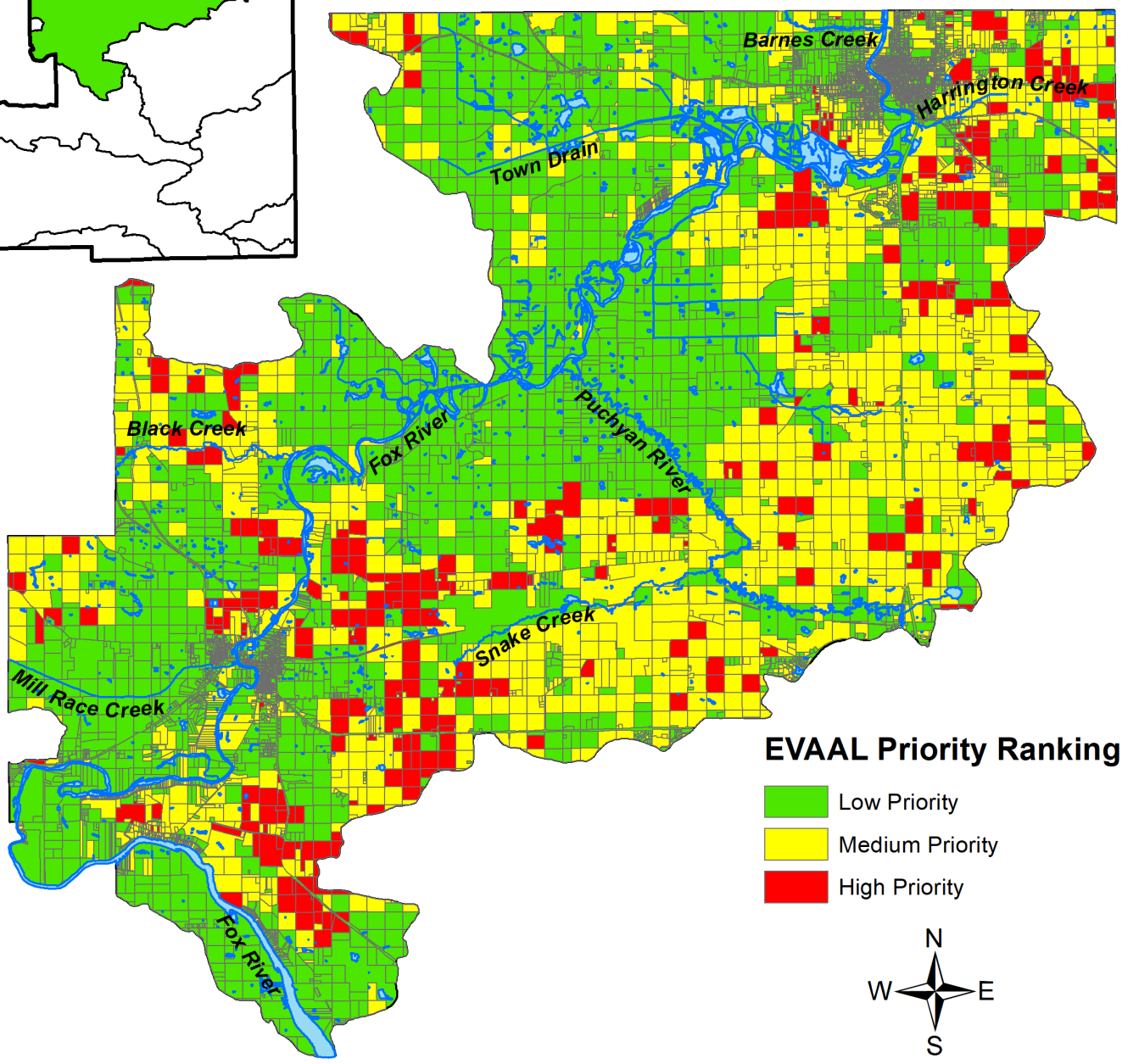
| **Watershed** | **Cropland** (acres within Green Lake County) | **EVAAL High Priority Parcels** (acres within Green Lake County) | **Streambank/ Shoreline** (miles within Green Lake County) | **Area in 300 ft Buffer** (acres within Green Lake County) | **Cropped Area in 300 ft Buffer** (acres within Green Lake County) |
|---|---|---|---|---|---|
| Fox River-Berlin | 29,747 | 8,753.4 | 321 | 16,450 | 3,935 |
| Green Lake | 12,690 | 2,262.5 | 122 | 6,554 | 2,352 |
| Upper Grand | 16,647 | 1,751.7 | 67 | 4,357 | 1,949 |
| Lower Grand | 14,328 | 3,329.7 | 138 | 8,032 | 2,340 |
| Buffalo/Puckaway | 8,187 | 1,908.1 | 80 | 4,145 | 984 |
| Fox River-Rush Lake | 3,002 | 437.5 | 5 | 367 | 184 |
| White River | 2,593 | 1,526.9 | 69 | 4,344 | 447 |
| Mecan River | 200 | 65.2 | <1 | 55 | 29 |
| Swan Lake | 4,502 | 540.8 | 14 | 1,042 | 495 |
| Beaver Dam | 2,456 | 24.0 | 1.3 | 11 | 11 |
| Upper Rock | 3,547 | 196.7 | 8 | 558 | 446 |
| **TOTAL** | **99,700** | **20,796.5** | **825** | **41,904** | **13,162** |

# Green Lake County

## Fox River-Berlin Watershed

2018






**EVAAL Priority Ranking**

- Low Priority
- Medium Priority
- High Priority

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Green Lake County

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Land Conservation



Scale

1 0.5 0 1 2 3 Miles

Map 7

# UPPER FOX RIVER WATERSHED

**The following descriptions have been taken from the 1995 Upper Fox River Basin's Water Resources draft. A few references were made to Green Lake County's Water Resources (1971) when no other data was available.**

## Fox River-Berlin Watershed - UF06

**(Map 7)**

This large watershed lies in northern Green Lake County, southeastern Waushara and southwestern Winnebago counties. The total drainage is 199.2 square miles with 129.5 square miles located in Green Lake County. (Only Green Lake County's portion is shown on map 7.) It is Green Lake's biggest watershed, and a major contributor of phosphorus to Lake Winnebago. (The Fox River-Berlin Watershed and the Fond du Lac River watershed account for 30% of the phosphorus that enters Lake Winnebago.) Field reconnaissance did not locate bad nonpoint source pollution sources and there are not the intense agricultural practices immediately adjacent to streams. Therefore, bad nonpoint source sites may be located uplands away from surface water, though there appears to be a significant amount of acreage in the federal Conservation Reserve Program (CRP). Many wetland complexes exist within the watershed, particularly adjacent streams. A calcareous fen is located near Berlin.

Berlin with an estimated population of 5242, is the largest city in the Fox-Berlin watershed, as well as in Green Lake County. Berlin operates an activated sludge wastewater treatment facility, which discharges into the Fox River. It contributes an estimated 1000 pounds of phosphorus per year. While the population is not growing rapidly, there is construction activity, and on site erosion may be a problem. There is a USGS river flow station in Berlin on the Fox River.

**Puchyan River** (15 miles) is a major tributary of the Fox River and the outlet of Green Lake. The Puchyan is listed as a 303(d) water not currently meeting water quality standards (Wisc. Dept. of Natural Resources). A small impoundment is located on this stream just below Green Lake. The Puchyan contains turbid, hard water. Carp, redhorse, suckers and forage fish are the most common fish species present. Smallmouth bass, northern pike and trout are occasionally found in small numbers, while walleyes are present during spring spawning runs. Large numbers of Canada geese use this river during spring and fall migrations. Muskrats are common near marshy areas and a few puddle ducks nest along the stream. Open marsh, upland hardwood, and farm pasture are primary shoreland types, and bank erosion is light. The wastewater treatment plant (WWTP) of the City of Green Lake (480 lbs./yr. phosphorus load) enters the Puchyan River.

**Snake Creek** (7 miles) is a small tributary to the Puchyan River. The upper 1.3 miles is a class I trout stream (WDNR, 1980) and is an Exceptional Resource Water (ERW). An in stream habitat assessment indicated habitat conditions as being "fair" (WDNR, 1995). Trout and smallmouth bass are present. Shrub marsh, open meadow, and cultivated crops are common shoreline types. The stream goes through a wetland complex that provides it with good protection from agricultural nonpoint source impacts, although there is grazing in the wetlands at one location.

**Barnes Creek** (13 miles) is a medium brown, hard water stream that enters the Fox River just below Berlin. Little is known about existing water quality or fisheries. Streambank pasturing and poor storm water management has caused heavy erosion with an estimated 3.5 T/A/YR. A number of barnyard/feedlots may be contributing sediment and nutrients to surface water. The upper reaches have been ditched in many places.

**Black Creek** (13 miles) contains very dark brown water that is relatively infertile when compared to other streams in the county. Most wildlife and fish are relatively scarce, but geese are common. Streambank vegetation consists primarily of cultivated crops, pasture, and upland hardwood forest.

**Harrington Creek** (3 miles) is listed as a 303(d) water not currently meeting water quality standards (Wisc. Dept. of Natural Resources). It is a small tributary to the Fox River on the south edge of Berlin. The stream flows through a larger wetland complex that includes a calcareous fen--a unique type of wetland complex. Fens are dependent on upwelling of groundwater rich in calcium and Magnesium bicarbonates; often having plants that are uncommon or rare. Regrettably, this marsh has been filled with some foundry wastes and has recently been partially developed. Harrington Creek is also rated a Limited Forage Fishery stream, and it receives wastewater discharge from National By Products animal processing plant (WDNR SCR-Files, 1995).

**Fox River** (31 miles) is characterized as a larger stream with a low gradient. An 1855 account of the Fox River in what is now Green Lake County states that the clear flowing water supported small-mouth bass and wild rice, an indicator of good water quality. Today, the water is turbid due to erosion from farm fields and the drainage of wetlands. Ducks and geese while still present along the river no longer blacken the sky as they did a hundred years ago. The river still has an impressive warm water sport fishery, but the abundance of carp indicates a water quality problem. The WDNR is doing long term trends monitoring along the river in Berlin. The City of Princeton's WWTP enters the Fox. (960 lbs./yr. phosphorus load)

Soil erosion is a major contributor to habitat and water quality deterioration. In spite of this, the Fox is still probably the most important recreational stream in the county. Fishing pressure is very heavy especially near the abandoned lock sites. Boating pressure and hunting pressure is also heavy. Citizens are concerned about the impacts of boating pressures on streambank erosion. It has been suggested that no wake zone ordinances be established on certain portions of the river, for example near Oxbow Trail in Princeton.

**TABLE 3.3 a: Land Use**

| Land use | Estimated total | Percent* |
|---|---|---|
| Cropland | 29,747 acres | 36% |
| Grassland | 14,253 acres | 17% |
| Urban/barren | 2,600 acres | 3% |
| Wetland | 21,000 acres | 25% |
| Woodland | 8,400 acres | 10% |

**TABLE 3.3 b: EVAAL Priorities and Agricultural Shoreland Management Areas**

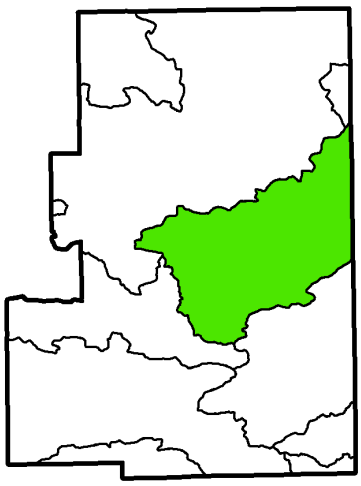
| | |
|---|---|
| EVAAL High Priority Parcels | 8,753.4 acres |
| Streambank/shoreline | 321 miles |
| Area in 300' Buffer | 16,450.2 acres |
| Cropped Area in 300' Buffer | 3,934.5 acres |

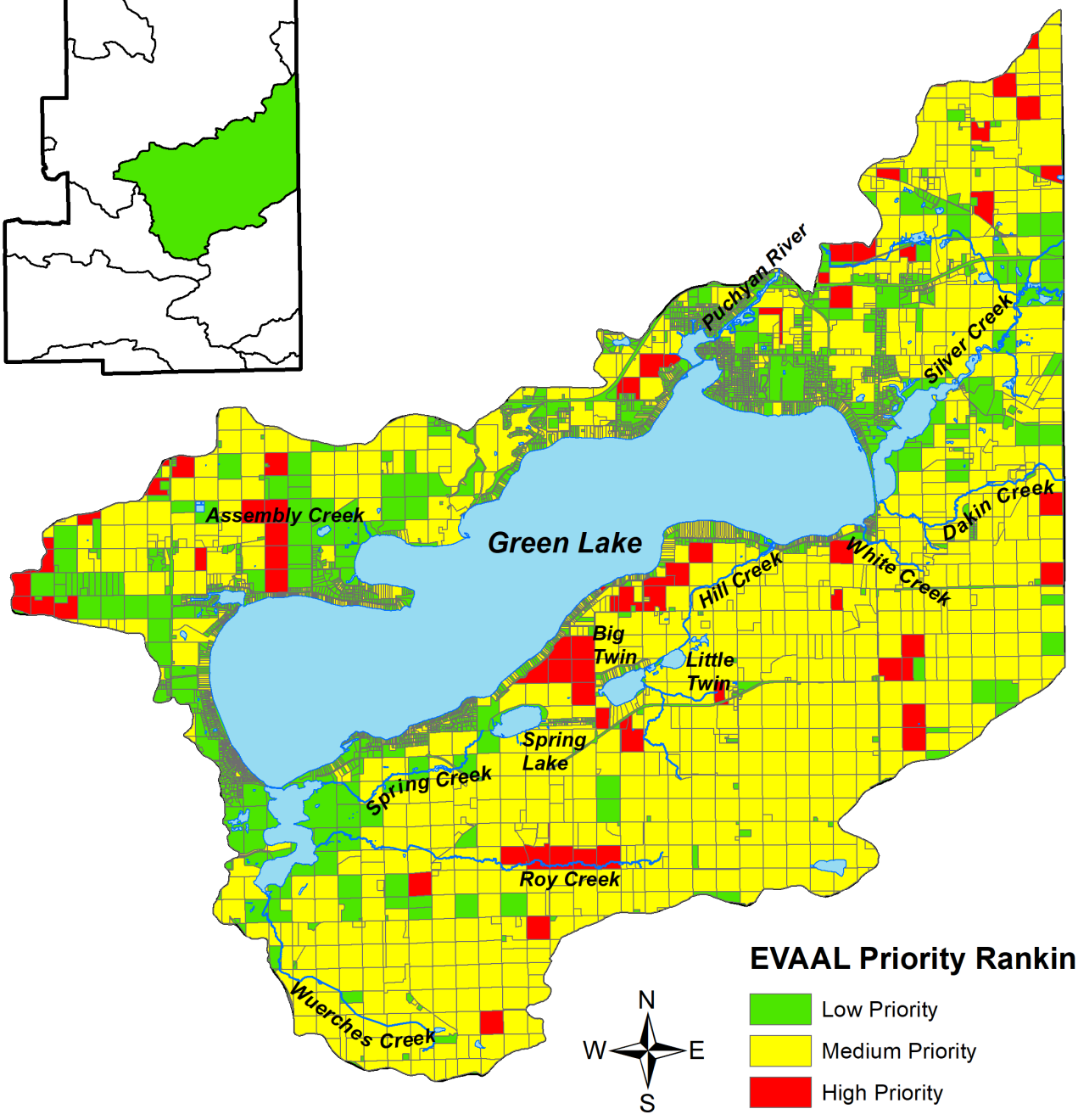
Both tables estimated using Arcview USGS maps with a 1:24,000 scale. *100% includes water area.

# Green Lake County

## Green Lake Watershed

2018






**EVAAL Priority Ranking**

- Low Priority
- Medium Priority
- High Priority

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Green Lake County

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Land Conservation



Scale

1 0.5 0 1 2 3 Miles

Map 8

# Green Lake Watershed – UF07

(Map 8)

The Green Lake Watershed is located in Green Lake and Fond du Lac Counties (Fond du Lac portion omitted from map). The total drainage is approximately 114 square miles with 71.4 square miles located in Green Lake County. (Only Green Lake County's portion is shown on map 8.)

The watershed was a priority watershed from 1981 until 1992 under the Wisconsin Nonpoint Source Water Pollution Abatement Program. Traditionally, Green Lake was considered to have good water quality. However, long term trend monitoring indicated the lake was moving toward a more nutrient rich tropic state. The mesotrophic trend was traced to high annual sediment loading from direct runoff and surrounding tributaries. The primary objective of the project was to reduce sediment and nutrient loading to Green Lake by installing and implementing Best Management Practices (BMPs). These practices helped reduce agricultural impacts, though dense forests with abnormally high concentrations of Buckthorn and other invasive vegetation along with roadside gullies continue to significantly impact Green Lake. The program did not attain all of its goals, but it did result in a significant improvement in the level of nonpoint source control. It is an excellent example of how state, local, and federal agencies along with partners from the private sector, can work together to achieve common goals.

In February of 2013, the Wisconsin DNR approved an updated Lake Management Plan (LMP) for Big Green Lake. The approved LMP was developed by the LMP Team and the team is currently implementing the specifics of the lake's plan. In addition to the approved plan which can be found on file at each of the local LMP Team Partners (GL County LCD, GLSD, GLA), the LMP also updated the LMP in January 2018 to receive approval from the Environmental Protection Agency (EPA-Nine Key Elements).

**Dakin Creek** (3.4 miles) Historically a spring fed class II trout stream (WDNR, 1980) located on the southeast end of Green Lake. It had a good aquatic macroinvertebrate population that supported a native brook trout population (Fassbender et.al., 1971). Today, the LMP Team is actively making major improvements to this tributary, including the stocking of brook trout targeted for 2019. Dakin Creek water is clear, hard, and highly productive. Watercress and other aquatic plants are common near the source. Mitchell's Glen, a small gorge some 60 feet deep is located on a small tributary of the creek. This area is unique because it contains some uncommon alpine plant species and a 40-foot waterfall. (It is also a historic Native American village site.) Much of the creek is in a near wilderness condition, a unique resource that is presently found in Green Lake County. It is designated an Environmentally Sensitive Area by the Upper Fox River Basin's Analysis of Demographic Composition, Public Goods and Natural Resources.

**Hill Creek** (2 miles) is listed as a 303(d) water not currently meeting water quality standards (Wisc. Dept. of Natural Resources). It is an outlet of Little Twin Lake that flows in a northeasterly direction into Green Lake. The stream contains clear, hard water often polluted with barnyard drainage and other nonpoint runoff. Bank erosion is responsible for serious fish and game habitat destruction. Hill Creek, while containing no permanent fishery, allows fish to occasionally enter Green Lake from the Twin Lake system. The 1992, WDNR stream analysis listed this creek as having "fair" water quality. GLSD recently installed (November 2017) a USGS monitoring station on Hill Creek approximately 1,000 feet before this stream outlets into Big Green. The monitoring station along with the recent surge of BMPs in this watershed should begin to pay water quality improvement dividends immediately.

**Roy Creek** (8 miles) is listed as a 303(d) water not currently meeting water quality standards (Wisc. Dept. of Natural Resources). It is a tributary to Green Lake containing clear, hard water. The stream contains no fish other than a few forage minnows. The streambank consists of upland hardwoods, farm pasture, and cultivated crops. The stream supports little in the way of wildlife. Many Native America antiquities are located near the creek indicating its importance to the pre-white era inhabitants of the region. The WDNR rated Roy Creek as having "poor" water quality in 1992. Recent improvements to Roy Creek include: restored streambanks, multitude of sub-watershed BMPs and USGS monitoring station should begin to show water quality improvements in the coming years.

**Silver Creek** (14 miles) is listed as a 303(d) water not currently meeting water quality standards (Wisc. Dept. of Natural Resources). It rises in northwestern Fond du Lac County and flows west to Green Lake. It drains the largest of Green Lake watershed's sub-watershed, which happens to be heavily agricultural and includes an urban area: Ripon. The creek contains turbid, hard water and a bottom consisting of silt and sand. Phosphorus and Suspended Sediment monitoring done since the completion of the priority watershed project in 1992 indicates that significant loads are carried into Green Lake (WDNR, 1995-6). Ripon's Wastewater Treatment Plant (WWTP) opened their updated treatment plan in 2004 discharging approximately 2074 lbs of phosphorus. Prior to 2004, Ripon's Wastewater Treatment Plant discharged approximately 3000 lbs of phosphorus per year.

Silver Creek has been listed in the 303(d) list as water not currently meeting water quality standards. Over the past 20 years, phosphorus discharges have been substantially reduced. Although the amount of water volume coming from Silver Creek has increased in the past 20 years, the portion of phosphorus contained in this stream water has decreased by fifty percent. These positive developments can be traced to three items in particular: First, the renovated Ripon WWTP. Second, the restored Silver Creek Estuary. And third, the recent influx of Green Lake and Fond du Lac BMPs being installed in the Silver Creek and Dakin Creek Sub-Watersheds.

**Spring Creek** (3 miles) originates at Spring Lake and flows through the County Park marshland before it empties into the southwest end of Green Lake. Canada geese use the area as a rest stop during spring and fall migration. Spring Creek is 2.2 miles long and receives water from open meadows, gullies and agricultural croplands. In the DNR's most recent stream monitoring study (2014), Spring Creek was meeting the State's water quality criteria for a healthy unimpaired tributary. Spring Creek flows into the K estuary, and then, into Big Green Lake.

**White Creek** (one mile) is a spring fed creek and is classified as a class I trout stream. The DNR has listed 1,11 miles of the creek as an exceptional water of the state. The stream flows northwest into Green Lake at a gradient of 114.4 feet per mile from a watershed of 3.05 square miles. Indian burial mounds, effigy mounds, and ancient food caches are common along the streambank. Watercress is also present. The creek receives drainage from woodland, cash cropping and barnyard/feedlots. Some agricultural BMPs have been implemented in portions of the White Creek sub-watershed. In 2011, the White Creek USGS monitoring station was removed; however, it was reinstalled in 2017. Over the next several years, the LMP Team will use the USGS monitoring station to verify the positive impact of the multitude of BMPs recently installed in this sub-watershed. The Lake Management Plan (LMP) Team believes the current USGS data/information will show water quality improvements when compared to historical data/information from 20 years ago.

Siltation has been a problem in the lake near the outlet of White Creek and dredging has been conducted in 1988 and 1998-99. Dredging was also conducted in 2002 and 2005. The WDNR classified White Creek as "fair" in their 1992 water quality analysis. Since the installation of a sediment basin in 2005 dredging has not occurred on White Creek.

**Wuerchs Creek** (6 miles) is listed as a 303(d) water not currently meeting water quality standards (Wisc. Dept. of Natural Resources). It is also listed as a high priority 303(d) stream. It is a continually flowing stream that enters the Green Lake County Park marsh area. The upstream impacts of nutrient input and streambank degradation caused the WDNR to classify this creek as "poor" in its 1992 stream system habitat report. Wuerches Creek is a priority stream and sub-watershed for our LMP Team. The current LMP has recently implanted a number of BMPs in this sub-watershed and many more will be forthcoming in the bear future (3-5 years). Wuerches also flows into the K estuary, and then, into Big Green Lake. The topography of this sub-watershed makes this area an ongoing challenge.

**Assemble Creek** (0.2 miles) is listed as an exceptional water of the state (Wisc. Dept. of Natural Resources). The stream is a spring fed creek that runs through a conservancy property which is owned and maintained by the Green Lake Sanitary District. The conservancy property in question is a 24 acre parcel of land with approximately 1,100 feet of water frontage on Big Green Lake. Assembly Creek meanders through the GLSD's conservancy property and feeds Big Green in the section of the lake known as Norwegian Bay. The Lake Management Team has worked to restore the assembly Springs conservancy property, the property has undergone an extensive removal of buckthorn, native plantings have been added (2,000 native plants added along the lake shoreline in 2016) throughout the property along with a 1 mile nature walking trail which is open to the public year-round.

**Green Lake** has an area of 7,346 acres and it is the deepest natural inland lake in Wisconsin with a maximum depth of 236 feet. The lake is mesotrophic and supports both cold and warm water fisheries (two-story fishery). The water has a residence time of 21 years (Donahue study, 1978). Recent USGS changes/improvements (2017) allow us to monitor 90+ percent of the tributary waters entering Big Green Lake in addition to the extensive on-lake USGS monitoring which was installed in 2004. Having data/information for 90+ percent of water entering the lake has allowed us to accurately track the phosphorus reducing BMPs which have been installed aggressively over the past six years (2012-2017).

Green Lake is situated in a large pre-glacial valley formed by the action of some forgotten river. The Cary glacier scoured this valley depositing a large recessional moraine across its western end and was successful in damming a glacial river causing it to flood. A dam built in the late 1890's on the outlet maintains the water level about five feet higher than the natural lake basin. The installation of the dam on the lake still continues to wreak havoc on the natural ecosystem functions of the lake.

The watershed of Green Lake is mostly in agriculture. Habitat assessments indicate that BMPs have substantially reduced sediment and nutrient loading to the lake. The Green Lake Priority Watershed Project resulted in control of cropland soil erosion and a high reduction of nutrient runoff from barnyards. By 1988, five sub-watersheds had fully achieved or exceeded their nonpoint source pollution reduction goals. The habitat assessment and soil analysis revealed additional sources of nutrients and sediments, including bare forest floors resulting from dense forest canopies, extensive intermittent gully systems, and down-cutting through the rich silt loam topsoil causing streambank erosion.

Nearly half of the watershed is located in Fond du Lac County. The City of Ripon is located along Silver Creek, the main tributary to the lake. The City's waste treatment plant discharges to Silver Creek, along with many of the City's storm sewers. Cooperation with Fond du Lac County and the City of Ripon is being pursued to reduce impacts to Green Lake. Monitoring programs have been established on many of the tributaries to Green Lake to further determine where major sources of pollutants are coming from. Several of the tributaries are located on the EPA's "Impaired Waters" list (aka 303d List) and are likely contributing to the degradation of Green Lake's water quality.

Land use is a problem around Green Lake. Estimates of over 800 dwellings directly along the lakeshore contribute to the eutrophication or enrichment of the water. Erosion control, particularly from developments may add excessive sediments and nutrients to the lake. Much of the shoreline is already developed and the remaining undeveloped areas are under extreme development pressure. One of the last parcels with a good expanse of undeveloped shoreline was recently sold to developers. Continued protection of the undeveloped shoreline should be pursued via conservation easement, purchase, or other means.

The Green Lake Sanitary District and Green Lake Conservancy have made exceptional progress in obtaining 15 key parcels of land in the watershed. 200 acres has been purchased by the conservancy since its inception in the mid-1990s.

- 15 conservancy properties acquired and protected over the past twenty years
- Over 250+ acres of environmentally sensitive areas (wetlands, water frontage, etc.)
- Over 20,000 feet of water frontage on streams and lake
- Improved water quality benefits
- Green Space for Perpetuity
- Wildlife and Fishery benefits

The Big Green Lake Shoreline Restoration Program (RSVP) started in 1998 has restored over 100 properties on Big Green Lake (10% of properties on the lake) which include over 12,000 feet of water frontage. Projects have included privately owned residential frontage as well as publicly owned municipal frontage. In addition to the actual shoreline projects completed, RSVP has certified over 15 businesses to understand and complete shoreline restoration projects. Certification workshops are scheduled as needed. At this point, RSVP is self-sustaining (certified businesses) and the program originator, GLA and GLSD, continue to provide partial cost-sharing for projects meeting program requirements (i.e. native plants, minimum sized buffers, etc.).

Sensitive areas, particularly areas important to fish spawning and rearing or having significant plant diversity, have been identified. The shore area of Norwegian Bay, with its stand of Hardstem Bulrushes, is one of those areas. The Green Lake Sanitary District, along with 3 of the 4 surrounding townships has established an Ordinance that regulates use, equipment, and operation of boats and activities near this area.

The Green Lake Sanitary District aggressively attacked the Purple Loosestrife problem in the Green Lake Watershed. The Green Lake Sanitary District coordinates the efforts of local high school biology students to aggressively control the spread of Purple Loosestrife and the monitoring of the waters of Green Lake and its tributaries. Further success of this program may encourage expanding the Purple Loosestrife control to other areas in Green Lake County. An extensive amount of biotic indexing is done on the local Green Lake tributaries by student lake volunteers that are part of the Green Lake Sanitary District's "Partners in Education" program.

The lake has an adopted and DNR approved Lake Management Plan (see information above). In addition, an AIS plan has been developed as part of the approved LMP. Green Lake is the destination of many transient boaters arriving from out of state, or other large waters, such as the Winnebago Pool Lakes or Lake Michigan, and are more likely to transport AIS from these waters. The lake also attracts thousands of boats each year, further increasing the likelihood of the introduction of new AIS species. Many AIS species are already present in the lake, including Eurasian Watermilfoil (EWM), Curlyleaf Pondweed (CLP), Asian Jellyfish, and Zebra Mussels. As part of an aquatic invasive plant management program, chemical treatments have been used in the past to target areas of EWM and CLP with good success. In addition, the Green Lake Association sponsored a 4 year Clean Boats / Clean Water grant from 2007-2011 which educated thousands of boaters on limiting the spread of AIS. Golden Sands RC&D. with support from the Lake Management team, has secured several grants to continue the program on Green Lake.

Species likely to be of concerns may be Rusty Crayfish, Spiny Waterflea, VHS, and others. The potential impact of these species warrants additional resources to be utilized on this lake. One such project is the installation of two boat wash stations located on Dodge Memorial Park and County K Park. The project is in the planning stage as of the summer of 2018, so at this point the feasibility and acceptance of these boat wash stations is unknown.

Other issues of concern include manure spreading within the watershed, carp management, nuisance aquatic plant management, shoreline erosion, and nutrient loading. The Sanitary District owns and operates two mechanical weed harvesters to maintain navigation channels within the estuaries of the lake and the City of GL millpond. Much of the main body of the lake is too deep to support rooted aquatic plants.

**Big Twin Lake** is one of three small lakes located one mile south of Green Lake. An intermittent inlet connects it with Little Twin Lake. Big Twin Lake supports a sport fishery of largemouth bass, walleye, northern pike, perch, bluegill, crappie, and white sucker. Many ducks use the lake for nesting and as a resting area during migration. The lake is a popular fishing destination year-round, and receives mild duck hunting pressure in the fall. The lake has a current Lake Management Plan and an Aquatic Plant Management Plan. The lake is mildly infested with Eurasian Watermilfoil (EWM) and Curlyleaf Pondweed (CLP). The LWCD received an AIS grant in 2008, and have actively been managing EWM and CLP via chemical treatment. There has also been an on-going educational effort to prevent other AIS species from entering the lake. Twin Lakes is a popular lake for transient boaters coming directly from Big Green Lake, one mile to the north, which contains many invasive species. Twin Lakes has also been the subject of several AIS studies. The Land Conservation Committee supports the continuation of AIS related work. Big Twin Lake has comprehensive plant surveys completed. The lake has a good diversity of plant species, however the frequency of occurrence is low for many species. An evaluation of the lakes fishery is recommended. About a third of the lake shore is moderately developed, with the remaining two-thirds being mostly natural. Continued protection of the undeveloped shoreline is recommended. In 2017, the Twin Lake Association updated their lake management for Big and Little Twin Lakes along with Spring Lake and is awaiting final review and approval by the Wisconsin DNR.

**Little Twin Lake** is located a short distance east of Big Twin and connected to it by a channel through a cattail stand. The lake level in both lakes is affected by the presence of a small dam at the outlet. Hill Creek drains both lakes during peak runoff periods but may dry up in late summer on low precipitation years. A small dam and fish barrier is constructed on the outlet to prevent carp from returning from Green Lake. The major importance of this lake is the spawning habitat provided for the fish from Big Twin. The Twin Lakes Association is working with the Department of Natural Resources and biologists to formulate a long-range plan for improving the lakes. The lakeshore is mostly undeveloped, and consists mainly of riparian wetland. The lake receives light fishing pressure and moderate duck hunting pressure.

**Spring (Spirit) Lake** is one of three small lakes located one mile south of Green Lake. Spring Lake is a 62 acre lake. It has a maximum depth of 42 ft. Fish in the lake include panfish, largemouth bass, northern pike, and walleye. The shoreline is mostly undeveloped and has a marl bottom. Continued protection of the undeveloped shoreline should be pursued via conservation easement, purchase, or other means. Spring Lake is a unique lake, in that is maintains an almost unaltered shoreline, even though it is in close proximity to other highly developed areas. The outlet to this lake is Spring Creek, which drains west to the Inlet of Green Lake. Additional studies are recommended for this lake. There is little water quality data available and presence of AIS should be determined.

**TABLE 3.4 a: Land Use**

| Land use | Estimated total | Percent* |
|---|---|---|
| Cropland | 12,690 Acres | 28% |
| Grassland | 12,310 Acres | 27% |
| Urban/barren | 1,430 Acres | 3% |
| Wetland | 2,000 Acres | 4% |
| Woodland | 5,500 Acres | 12% |

**TABLE 3.4 b: EVAAL Priorities and Agricultural Shoreland Management Areas**

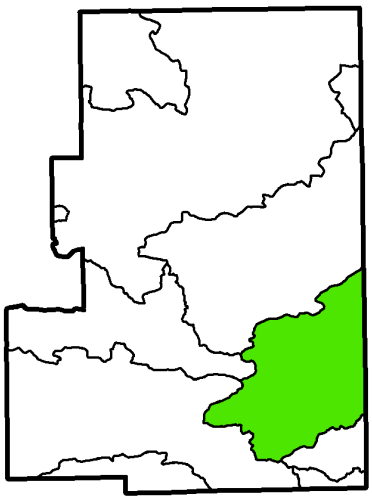
| | |
|---|---|
| EVAAL High Priority Parcels | 2,262.5 acres |
| Streambank/shoreline | 121.6 miles |
| Area in 300' Buffers | 6,553.7 acres |
| Cropped Area in 300' Buffers | 2,351.7 acres |

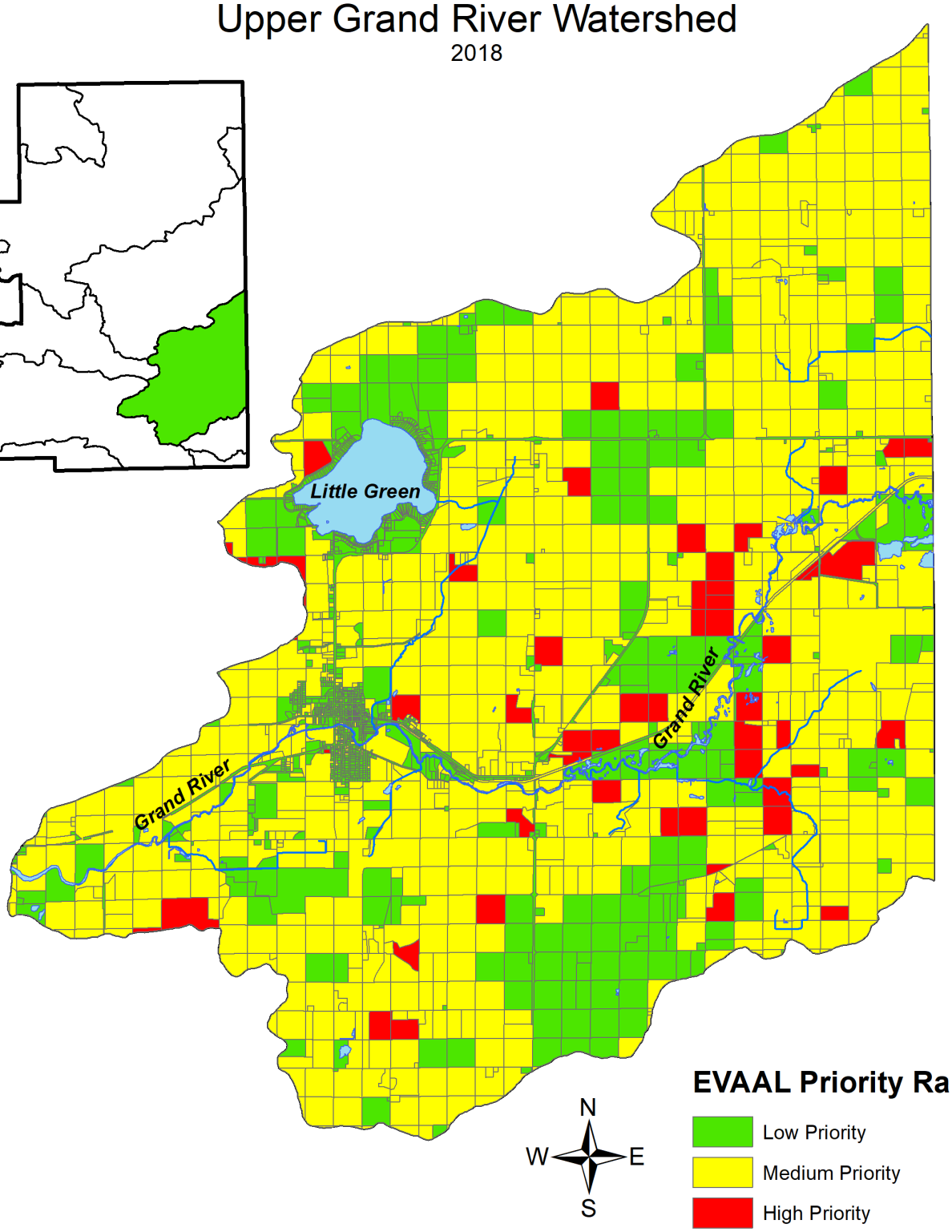
Both tables estimated using Arcview USGS maps with a 1:24,000 scale. *100% includes water area

# Green Lake County

## Upper Grand River Watershed

2018






**EVAAL Priority Ranking**

- Low Priority
- Medium Priority
- High Priority

Green Lake County

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Land Conservation



Scale

0.7 0.35 0 0.7 1.4 2.1 Miles

Map 9

# Upper Grand River Watershed – UF12

(Map 9)

The Upper Grand River Watershed is located in Fond du Lac and Green Lake counties. It is 39,651 acres in size and contains 85 miles of rivers and streams, 41 acres of lake and 2,973 acres of wetlands. (Green Lake County portion shown on Map 9.) The watershed is dominated by agriculture (76%) and grasslands (8%) and is ranked high for nonpoint source issues affecting groundwater and medium for nonpoint source issues affecting streams. The Upper Grand River Watershed in Green Lake County was one of 21 watersheds selected in 1998 as an EQIP watershed project. The 5-year signup period for the project (1998-2002) allocated funding of over $680,000 for BMP installation.

**Ecological Landscapes**

The Upper Grand River Watershed is located in two ecological areas: the Southwest Glacial Plains and the Central Sand Hills. The Southeast Glacial Plains Ecological Landscape makes up the bulk of the non-coastal land area in southeast Wisconsin. This Ecological Landscape is made up of glacial till plains and moraines. Most of this Ecological Landscape is composed of glacial materials deposited during the Wisconsin Ice Age, but the southwest portion consists of older, pre-Wisconsin till with a more dissected topography. Soils are lime-rich tills overlain in most areas by a silt-loam loess cap. Agricultural and residential interests throughout the landscape have significantly altered the historical vegetation. Most of the rare natural communities that remain are associated with large moraines or in areas where the Niagara Escarpment occurs close to the surface. Historically, vegetation in the Southeast Glacial Plains consisted of a mix of prairie, oak forests and savanna, and maple-basswood forests. Wet-mesic prairies, southern sedge meadows, emergent marshes, and calcareous fens were found in lower portions of the Landscape. End moraines and drumlins supported savannas and forests. Agricultural and urban land use practices have drastically changed the land cover of the Southeast Glacial Plains since Euro-American settlement. The current vegetation is primarily agricultural cropland. Remaining forests occupy only about 10% of the land area and consist of maple-basswood, lowland hardwoods, and oak. No large mesic forests exist today except on the Kettle Interlobate Moraine which has topography too rugged for agriculture. Some existing forest patches that were formerly savannas have succeeded to hardwood forest due to fire suppression. The Central Sand Hills Ecological Landscape is located in central Wisconsin at the eastern edge of what was once Glacial Lake Wisconsin. The landforms in this Ecological Landscape are a series of glacial moraines that were later partially covered by glacial outwash. The area is characterized by a mixture of farmland, woodlots, wetlands, small kettle lakes, and cold water streams, all on sandy soils. The mosaic of glacial moraine and pitted outwash throughout this Ecological Landscape has given rise to extensive wetlands in the outwash areas, and the headwaters of coldwater streams that originate in glacial moraines. The growing season is long enough for agriculture but the sandy soils limit agricultural productivity somewhat. Historic upland vegetation consisted of oak-forest, oak savanna, and tallgrass prairie. Fens were common in this Ecological Landscape and occurred along with wet-mesic prairie, wet prairie, and rare coastal plain marshes. Current vegetation is composed of more than one-third agricultural crops, and almost 20% grasslands with smaller amounts of open wetland, open water, shrubs, barren, and urban areas. The major forested type is oak-hickory, with smaller amounts of white-red-jack pine, maple-basswood, lowland hardwoods, aspen-birch, and spruce-fir.

**Grand River** (22.0 miles) Biotic index information taken below Markesan indicates only “fair” water quality. (Burbach, 1998) The Markesan Wastewater Treatment Plant (WWTP) discharges an estimated 1320 pounds of phosphorus per year. Observations made by the WDNR staff indicate that the stream may have reaches of good water quality and habitat; (WDNR, 1995) however, agricultural practices may be affecting the river.

The nature of the shoreline varies according to adjacent land use. Most common shoreline types are open marsh, farm pasture, cultivated cropland, and upland hardwood.

**Little Green Lake** (462.4 acres) has a maximum depth of 28 feet. It has a drainage area of about 3.33 square miles. The watershed surrounding the lake is primarily agricultural. The shoreline is heavily developed and there is a danger of valuable fish spawning areas and riparian wetlands being destroyed. This could cause severe and permanent damage to the quality of the lake, which already has a history of excessive algae and/or aquatic weed growth resulting in summer fish kills and navigation problems.

Chemical treatment and mechanical plant harvesting have historically been used to manage Aquatic Invasive Species (AIS) and nuisance native species for the purpose of navigation. The Little Green Protection and Rehabilitation District (LGPRD) has adopted a lake management plan (LMP) and an aquatic plant management plan (APM) to address the plant populations within the lake. The Little Green Lake Protection and Rehabilitation District started a plant harvesting program in 2004 and own their own harvesting equipment. Current AIS species of concern include Eurasian watermilfoil and curlyleaf pondweed. . The protection of natural wooded areas surrounding the lake should be pursued, either through conservation easement, purchase, or other methods. Some of these forests and riparian wetland contain unique plant communities, which should be preserved.

According to past phosphorus loading studies (Ramaker, 1999, Onterra 2016), large amounts of phosphorus are released from bottom sediments and possibly littoral zones during the summer. The effectiveness of the lake destratification project should continue to be evaluated and modified as necessary. Appraisal of phosphorus release from the littoral zone is needed. The lake is borderline hyper-eutrophic and has a history of poor water quality. However, recent observations indicate fluctuating changes in water clarity. Although this might be temporary, a continuation of long range water quality appraisals is recommended.

Little Green Lake Watershed has seen several major projects implemented since 1999 including the installation of large retention basins in 2000 and 2008, a lake aeration in 2003, and a sewer project that was completed in 2000. The lakeshore is highly developed in many areas, with hard armament at the water's edge and little natural vegetation along the shoreline. Shoreline restoration and buffer installation are recommended. In 2017, the Little Green Lake Association updated their lake management and is awaiting final review and approval by the Wisconsin DNR.

**TABLE 3.5 a: Land Use**

| Land use | Estimated total | Percent* |
|---|---|---|
| Cropland | 16,647 acres | 59% |
| Grassland | 2,353 acres | 8% |
| Urban/barren | 860 acres | 3% |
| Wetland | 2,500 acres | 9% |
| Woodland | 950 acres | 3% |

**TABLE 3.5 b: EVAAL Priorities and Agricultural Shoreland Management Areas**

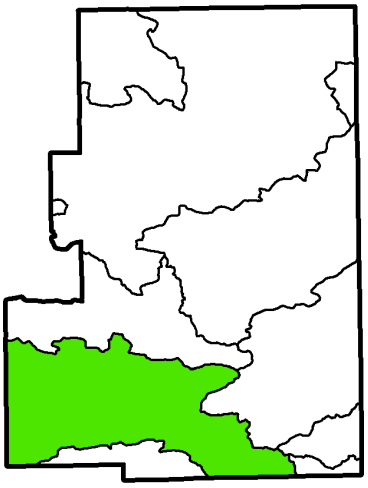
| | |
|---|---|
| EVAAL High Priority Parcels | 1,731.7 acres |
| Streambank/shoreline | 67 miles |
| Area in 300' Buffers | 4,356.6 acres |
| Cropped Area in 300' Buffers | 1,948.7 acres |

Estimate using Arcview USGS maps with a 1:24,000 scale. *100% includes water area.

# Green Lake County

## Lower Grand River Watershed

2018



**EVAAL Priority Ranking**

- Low Priority
- Medium Priority
- High Priority

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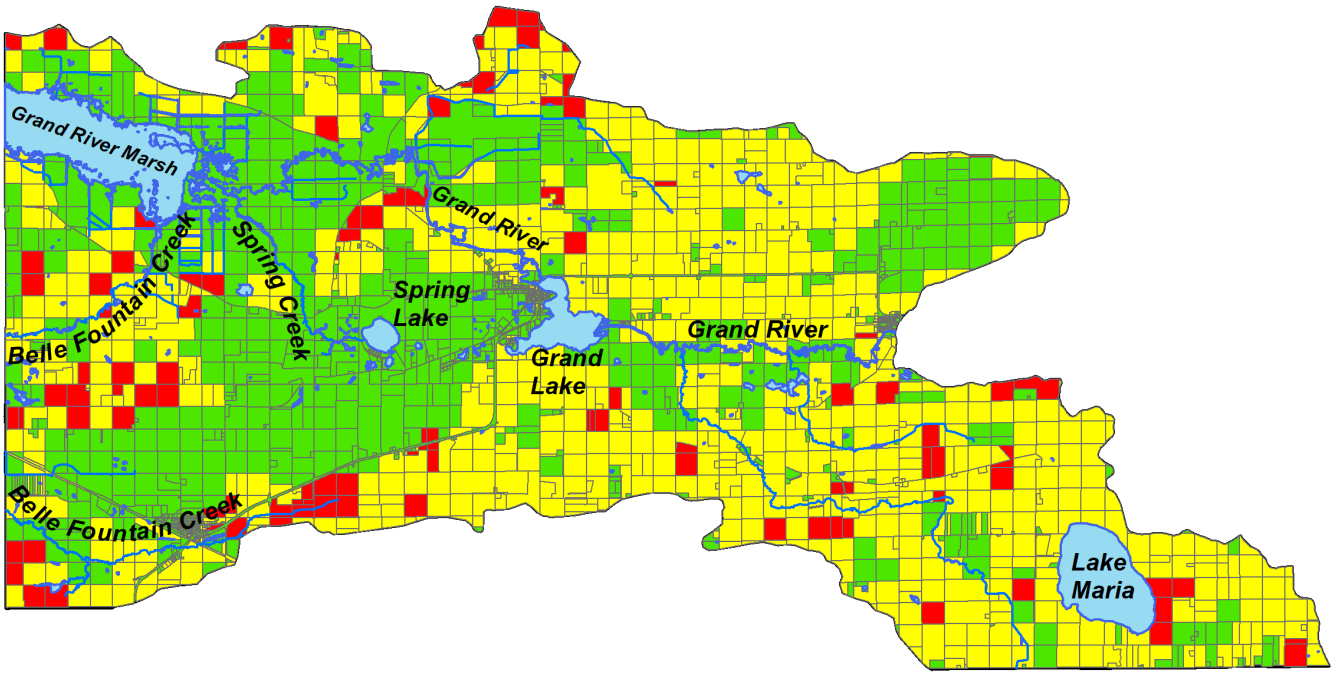


Green Lake County

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Land Conservation



Scale

1 0.5 0 1 2 3 Miles

Map 10

# Lower Grand River Watershed – UF11

(Map 10)

The Lower Grand River includes the Grand River and its tributaries from its confluence with the Fox River in Marquette County to where the old dam was in Manchester. The watershed's total drainage is 109 square miles with 65 located in Green Lake County. (Green Lake County portion shown on Map 10.)

The Lower Grand River Watershed is located primarily in Green Lake County, but also in Marquette, Columbia and Dodge counties. It is 70,011 acres in size and includes 185 miles of streams and rivers, 1,264 acres of lakes and 13,715 acres of wetlands. The watershed is dominated by agriculture (44%), wetlands (19%), forest (17%) and grassland (14%) and is ranked high for nonpoint source issues affecting groundwater.

**Ecological Landscapes**

The Lower Grand River Watershed is covered primarily by the Central Sand Hills Ecological Landscape which is located in central Wisconsin at the eastern edge of what was once Glacial Lake Wisconsin. The landforms in this Ecological Landscape are a series of glacial moraines that were later partially covered by glacial outwash. The area is characterized by a mixture of farmland, woodlots, wetlands, small kettle lakes, and cold water streams, all on sandy soils. The mosaic of glacial moraine and pitted outwash throughout this Ecological Landscape has given rise to extensive wetlands in the outwash areas, and the headwaters of coldwater streams that originate in glacial moraines. The growing season is long enough for agriculture but the sandy soils limit agricultural productivity somewhat. Historic upland vegetation consisted of oak-forest, oak savanna, and tallgrass prairie. Fens were common in this Ecological Landscape and occurred along with wet-mesic prairie, wet prairie, and rare coastal plain marshes. Current vegetation is composed of more than one-third agricultural crops, and almost 20% grasslands with smaller amounts of open wetland, open water, shrubs, barren, and urban areas. The major forested type is oak-hickory, with smaller amounts of white-red-jack pine, maple-basswood, lowland hardwoods, aspen-birch, and spruce-fir.

**Belle Fountain Creek** (12.3 miles) is a tributary to the Grand River. The stream is clear with little sediment build up and provides habitat for northern pike and walleye during spring spawning movements. Much of the stream bank is pastured, though part of the stream lies within the Grand River Marsh Wildlife area. Cattle watering along the stream's tributaries have created erosion problems.

**Lower Grand River** (21.0 miles) The 1991 version of the Upper Fox River Basin plan identified problems as wetland drainage, agricultural nonpoint source pollution and an over abundance of carp. (Fix and Eagan, 1990) The entire river system above the Kingston dam was chemically treated to remove carp. This reach of the Grand River has a dam forming the Grand Lake at Kingston.

**Spring Creek** (2.0 miles) is a clear hard water outlet of Spring Lake located just west of Kingston. The stream is a tributary of the Grand River. Sand, silt, detritus, and muck are common bottom materials while open marsh is the predominant shoreline type. Apparently only forage fish are present. Caddisfly larvae are common. About two and one-half miles of stream are located in the Grand River Marsh Wildlife Area.

**Grand Lake** (241.9 acres) is an impoundment of the Grand River. The Grand Lake Improvement Association was formed to 2016 to address ongoing issues with invasive species, excessive plant growth, and nutrification Green Lake County Land Conservation Department received a grant to conduct baseline ecological monitoring, and develop a lake management plan. In 2017, the Grand Lake Improvement Association developed their lake management and is awaiting final review and approval by the Wisconsin DNR.

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**Lake Maria** (563.1 acres) discharges thru an outlet on the northwest corner into the Grand River system. Due to the shallowness, the lake is subject to winterkills and thus few sport fish survive. The lake is used heavily by many species of waterfowl, especially in the spring when an estimated 5,000 migrants stop here. Active management for waterfowl should be explored. Water levels had historically been artificially altered by a make-shift rock dam at the outlet, which impacted emergent plant growth throughout the lake. In 2010 the blockage at the outlet was removed, and water levels returned to near historical levels. A large increase in emergent plant vegetation resulted. The lake is located in an agricultural watershed, and agricultural runoff may affect water quality. Most of the shore is natural, with very little shoreland development.

**Spring Lake** (65.2 acres) is a hard water, spring fed lake that outlets into the Grand River. It supports the most diversified fisheries of any lake in the county. Common species include northern pike, perch, largemouth bass, bluegill, rock bass, white bass, yellow bass, rainbow trout, carp, and white sucker, not to mention other less common species. Carp and sucker activity has caused a problem by keeping the water turbid and uprooting plants. Marsh birds, and migrating ducks are common game species that also use the lake.

**Grand River Marsh** (1,446.5 acres) is an artificial impoundment created by a dam beginning in 1958. The Grand River Marsh has long provided excellent habitat for a variety of wildlife and migratory waterfowl. Current management programs include wetland and oak savannah restoration. Water level manipulation to provide quality waterfowl habitat and deep water marsh habitat is the primary goal in the Main Impoundment, but an excellent fishery has responded to the current water management regime.

**TABLE 3.6 a: Land Use**

| Land use | Estimated total | Percent* |
|---|---|---|
| Cropland | 14,328 acres | 34% |
| Grassland | 10,672 acres | 26% |
| Urban/barren | 220 acres | 0.5% |
| Wetland | 5,500 acres | 13% |
| Woodland | 5,300 acres | 13% |

**TABLE 3.6 b: EVAAL Priorities and Agricultural Shoreland Management Areas**

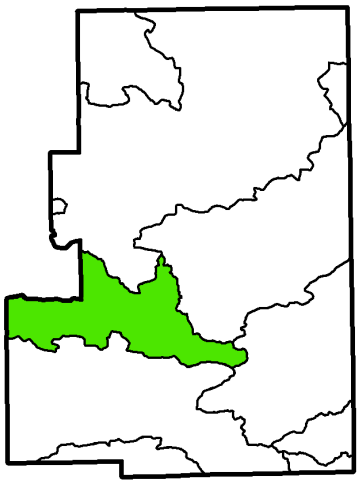
| | |
|---|---|
| EVAAL High Priority Parcels | 3,329.7 acres |
| Streambank/shoreline | 138.4 miles |
| Area in 300' Buffer | 8,031.7 acres |
| Cropped Area in 300' Buffer | 2,339.9 acres |

Estimated using Arcview USGS maps with a 1:24,000 scale. *100% includes water area.

# Green Lake County

## Buffalo & Puckaway Lakes Watershed

2018



**EVAAL Priority Ranking**

- Low Priority
- Medium Priority
- High Priority

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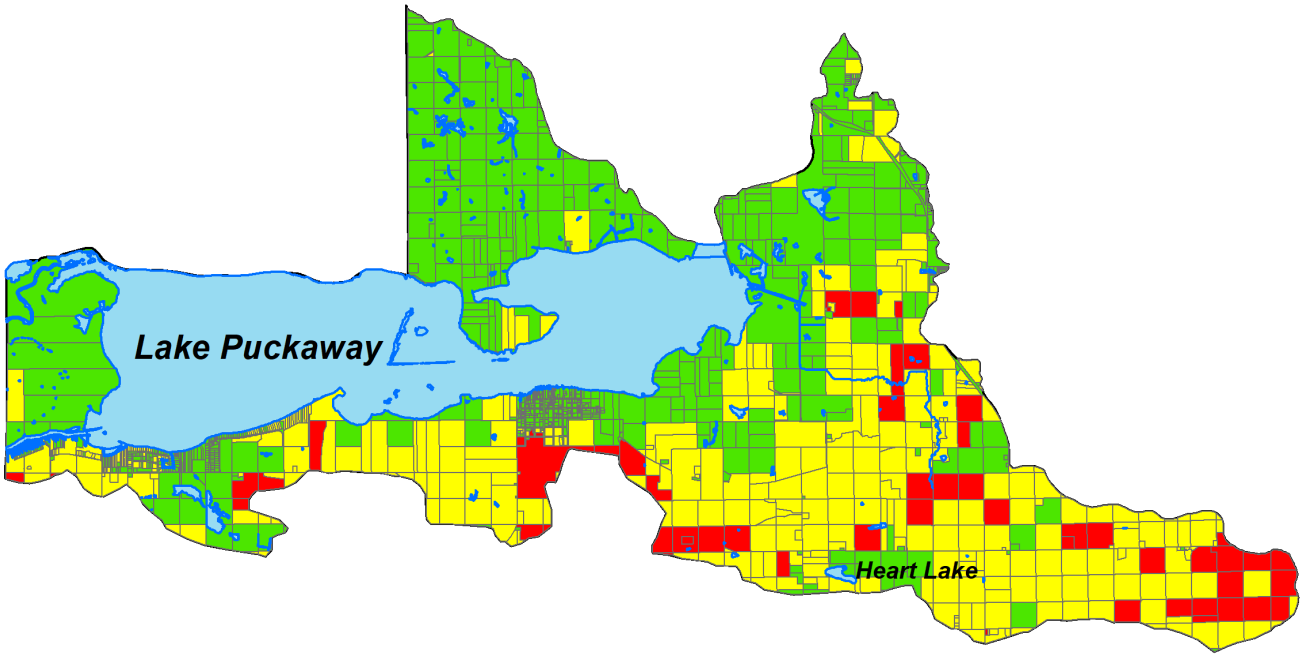


Green Lake County

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Land Conservation



Scale

1 0.5 0 1 2 3 Miles

Map 11

## Buffalo & Puckaway Lakes Watershed – UF10

(Map 11)

This watershed is 232 square miles and covers parts of Columbia, Marquette and Green Lake Counties. 33.7 square miles are located in Green Lake County. (Green Lake County portion shown on Map 11.)

**Fox River** (45 miles) is the principle stream in the watershed. The river and associated impoundments (Buffalo Lake and Lake Puckaway) have a diverse warm water sport fishery. The river also flows through two important state wildlife areas. (See Fox River-Berlin watershed data for downstream information.)

**Heart Lake** is a small (18 acre) seepage lake located about four miles northeast of Kingston. The water is clear but is subject to severe algae blooms. Most of the lakeshore is owned by the state. It was once used as a fish rearing pond. It has confirmed populations of both Curly Leaf Pondweed and Eurasian Watermilfoil.

**Lake Puckaway** is a shallow drainage lake of the Fox River. It has an area of 5039 acres and a maximum depth of 5 feet. Wild rice, an indicator of good water quality, once was the dominant plant. The long term impacts of agriculture in the basin, and stabilized water levels have altered the lake by severely reducing plant growth which has led to increased internal nutrient loading and sediment resuspension. The lake is hypereutrophic with elevated phosphorus levels, leading to occasional severe algal blooms during the summer. Recent studies have shown a steady decline in emergent and floating leaf aquatic plants, and important habitat component for many fish and bird species. The lake's recently developed management plan has goals to stabilize and reestablish these historic plant beds. Lake Puckaway also has a rookery of Great Blue Herons, Egrets, Common Terns, Fosters Terns, Black Terns, Pelicans, and Double-Crested Cormorants. Many cranes and other waterfowl also exist in this area. Cormorants have been managed by the USFWS since 2008 due to their increasing numbers and damage to island vegetation. Three species of terns found on this lake are threatened species, and methods should be developed to provide adequate habitat to retain the viability of these species on Lake Puckaway. In 2017 the Lake Puckaway Protection and Rehabilitation District (LPPRD) completed a lake management plan update.

**TABLE 3.7 a: Land Use**

| Land Use | Estimated Total | Percent* |
|---|---|---|
| Cropland | 8187 acres | 38% |
| Grassland | 200 acres | 1% |
| Urban/barren | 100 acres | 0.5% |
| Wetland | 5300 acres | 25% |
| Woodland | 1000 acres | 5% |

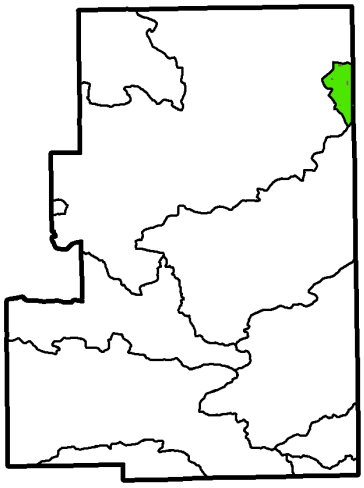
**TABLE 3.7 b: EVAAL Priorities and Agricultural Shoreland Management Areas**

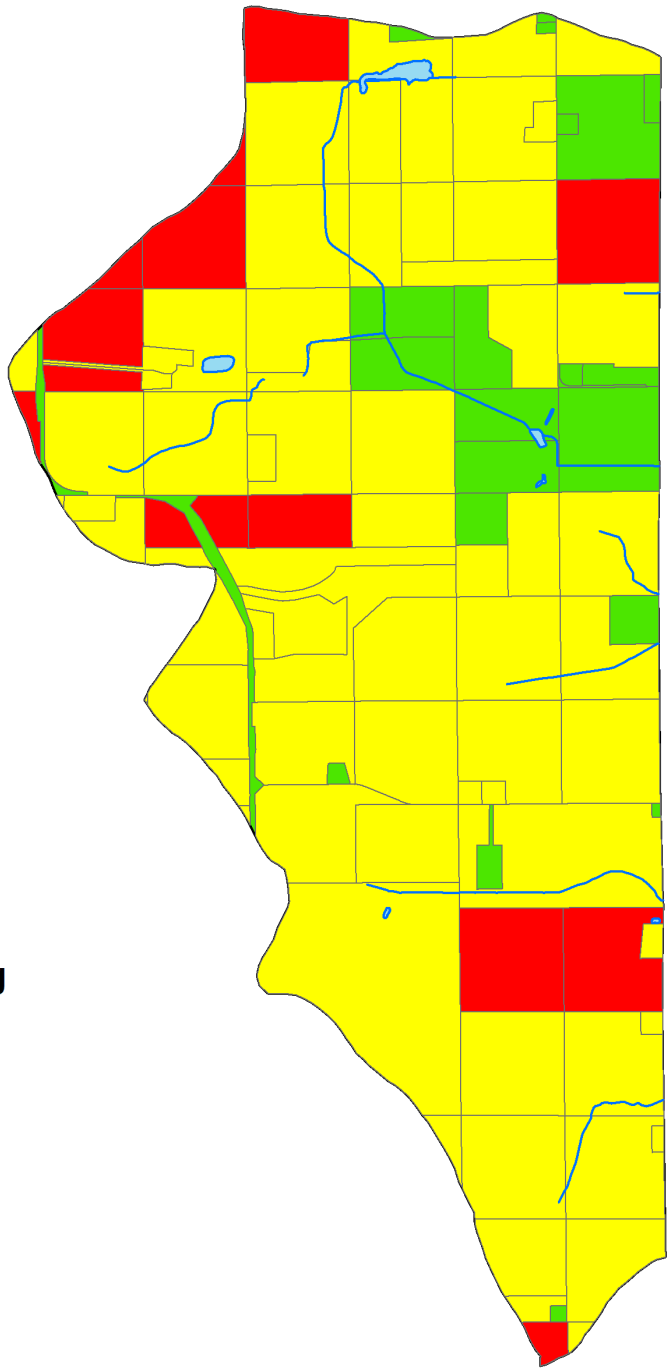
| | |
|---|---|
| EVAAL High Priority Parcels | 1,908.0 acres |
| Streambank/shoreline | 80 miles |
| Area in 300' Buffers | 4145.4 acres |
| Cropped Area in 300' Buffers | 984.2 acres |

# Green Lake County

## Fox River-Rush Lake Watershed

2018





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**EVAAL Priority Ranking**

- Low Priority
- Medium Priority
- High Priority

Green Lake County

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Land Conservation



Scale

0.25 0.125 0 0.25 0.5 0.75 Miles

Map 12

## Fox River-Rush Lake Watershed – UF05

(Map 12)

Most of this watershed lies in Winnebago County but Green Lake County overlies a small section of this large watershed, making up about 5 of the 125 square miles. (Green Lake County portion shown on Map 12.) Many wetland complexes lie in this watershed, with the Rush Lake complex being the largest and most important. The Rush Lake/Waukau Creek sub-watershed was listed as a Nonpoint Source priority area in the Lake Winnebago Comprehensive Management Plan of 1998. This was based on high critical soil erosion rates in excess of 5.2 ton/acre/year. Land use in this watershed, including the section in Green Lake County is primarily agricultural in nature with small dairy operations and cash grain farms as the primary means.

**TABLE 3.8 a: Land Use**

| Land Use | Estimated Total | Percent* |
|---|---|---|
| Cropland | 3,002 acres | 85% |
| Grassland | 0 acres | 0% |
| Urban/barren | 60 acres | 2% |
| Wetland | 230 acres | 7% |
| Woodland | 200 acres | 6% |

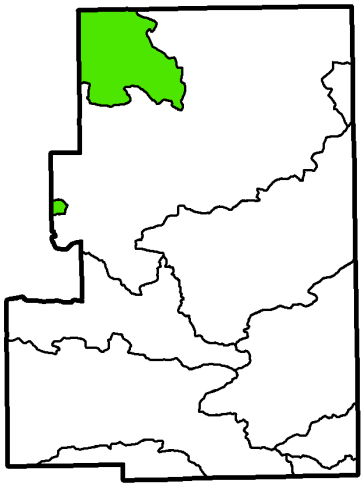
**TABLE 3.8 b: EVAAL Priorities and Agricultural Shoreland Management Areas**

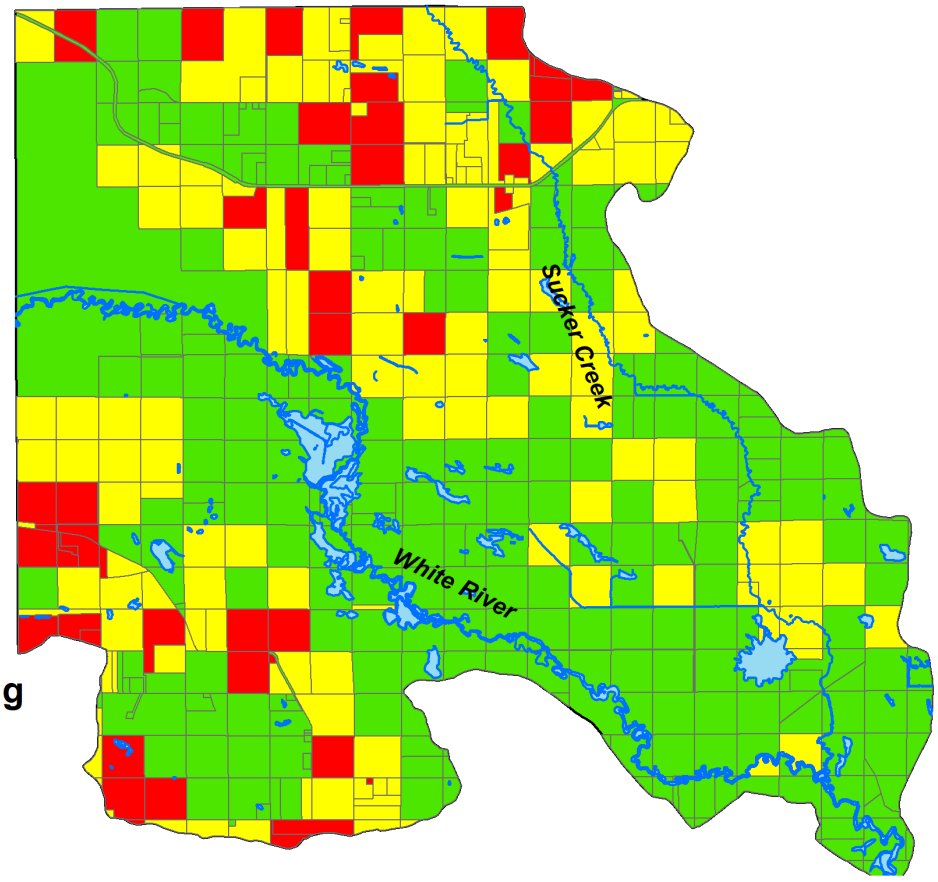
| | |
|---|---|
| EVAAL High Priority Parcels | 437.5 acres |
| Streambank/shoreline | 4.7 miles |
| Area in 300' Buffers | 366.7 acres |
| Cropped Area in 300' Buffers | 183.8 acres |

# Green Lake County

## White River Watershed & Mecan River Watershed

2018



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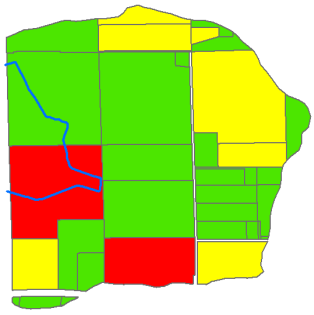
### EVAAL Priority Ranking

- Low Priority
- Medium Priority
- High Priority

### White River Watershed



### Mecan River Watershed

Green Lake County

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Land Conservation



Scale

0.6 0.3 0 0.6 1.2 1.8 Miles

Map 13

## White River Watershed – UF08

(Map 13)

This watershed is located in the northwest corner of Green Lake, northeast Marquette and southern Waushara counties with 21 of the 160.5 square miles located in Green Lake. (Green Lake County portion shown on Map 13.)

**White River** (32 miles) Above the White River Flowage is a class I trout stream (WDNR, 1980) and it is an Exceptional Resource Waters. Some potential nonpoint source threats exist to the stream from agricultural practices near the stream. Below the flowage the river is considered a warm water fishery (Poff and Threinen, 1963). The river flows through a large wetland complex below the Neshkoro Millpond, including the White River Marsh State Wildlife area. The wetland complex seems to assimilate the discharge of the Silver Lake Sanitary District, with estimated phosphorus loads of 900-lbs./yr. without any noticeable adverse impacts.

**Sucker Creek** (20 miles) is a dark brown hard water stream that drains a large portion of the White River Marsh. The stream contains a limited fishery consisting of forage minnows. Bank vegetation is mostly open marsh and shrub, and muskrats, geese, and ducks are common.

**TABLE 3.9 a: Land Use**

| Land Use | Estimated Total | Percent* |
|---|---|---|
| Cropland | 2,593 acres | 22% |
| Grassland | 1,307 acres | 11% |
| Urban/barren | 0 acres | 0% |
| Wetland | 6,500 acres | 48% |
| Woodland | 1,400 acres | 10% |

**TABLE 3.9 b: EVAAL Priorities and Agricultural Shoreland Management Areas**

| | |
|---|---|
| EVAAL High Priority Parcels | 1,526.9 acres |
| Streambank/shoreline | 69.3 miles |
| Area in 300' Buffer | 4,343.9 acres |
| Cropped Area in 300' Buffer | 446.9 acres |

## Mecan River Watershed – UF09

(Map 11)

A small portion of this watershed, about a half a square mile, lies in Green Lake County (Green Lake County portion shown on Map 11.) Many of the streams in the watershed that tributary to the Mecan support high quality cold water fisheries.

**Black (Millrace) Creek** is a man-made ditch running from the Mecan River, an Exceptional Water Resource to the Fox River at Princeton. It was originally constructed in 1857 and was used to provide waterpower for a gristmill. Shoreline vegetation consists of shrub marsh, open meadow, cultivated crops, and lawns.

**TABLE 3.10 a: Land Use**

| Land Use | Estimated Total | Percent* |
|---|---|---|
| Cropland | 0 acres | 0% |
| Grassland | 200 acres | 63% |
| Urban/barren | 16 acres | 0.5% |
| Wetland | 110 acres | 34% |
| Woodland | 40 acres | 1% |

All tables estimated using ArcView USGS maps with a 1:24,000 scale. *100% includes water area.

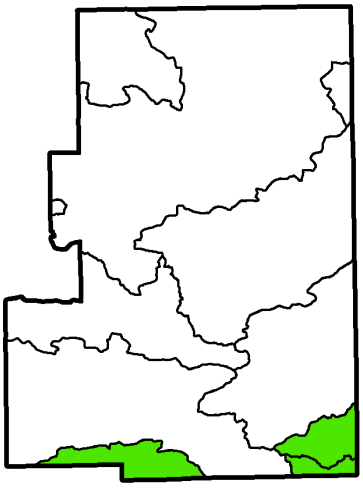
**TABLE 3.10 b: EVAAL Priorities and Agricultural Shoreland Management Areas**

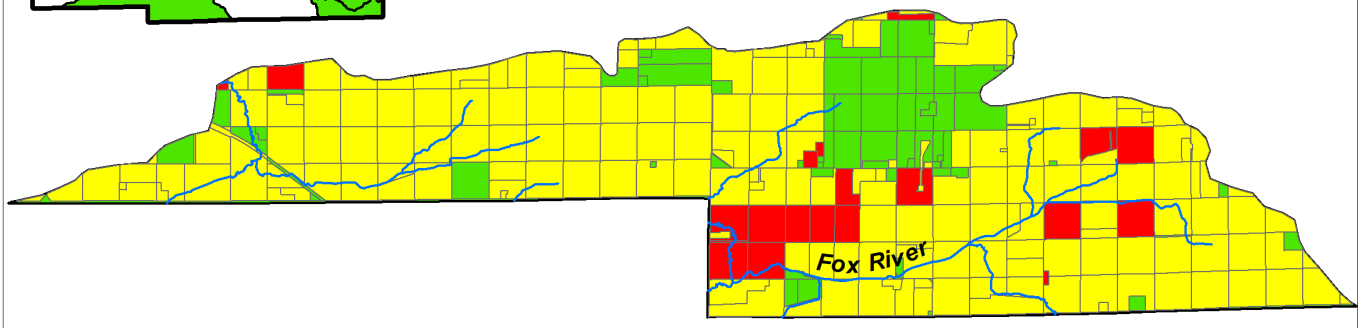
| | |
|---|---|
| EVAAL High Priority Parcels | 65.2 acres |
| Streambank/shoreline | 0.77 miles |
| Area in 300' Buffer | 54.6 acres |
| Cropped Area in 300' Buffer | 28.7 acres |

# Green Lake County

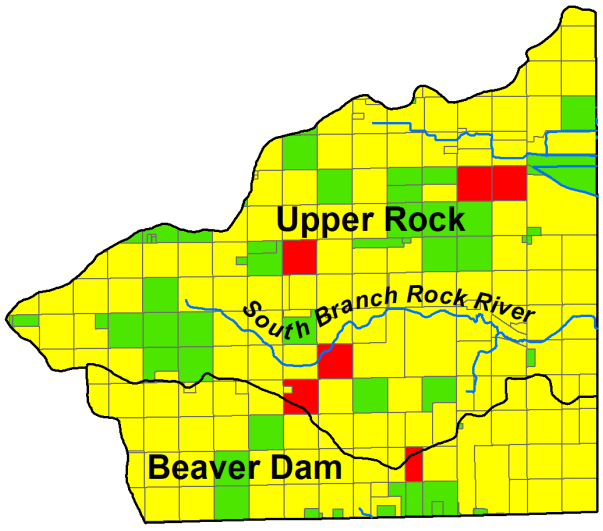
## Swan Lake, Upper Rock, & Beaver Dam River Watersheds

2018






**Swan Lake Watershed**




**EVAAL Priority Ranking**

- Low Priority
- Medium Priority
- High Priority

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**Upper Rock/Beaver Dam River Watersheds**

Green Lake County



Scale

0.7 0.35 0 0.7 1.4 2.1 Miles

Map 14

## Swan Lake Watershed – UF15

(Map 14)

This watershed is 81 square miles and includes the headwaters of the Fox River. A small part of it lies within southern Green Lake County—about 19 square miles. (Green Lake County portion shown on Map 14.) Agricultural nonpoint source pollution problems are present with animal waste management, stream bank trampling, and farm field runoff. The watershed had wetland complexes but no public wildlife areas.

**Fox River** (34 miles) The headwaters of the Fox start in Green Lake County. A Fox-Wolf Basin study indicates that phosphorus loading from the Fox River to Park Lake is six times the threshold amount considered excessive.

**TABLE 3.11 a: Land use**

| Land use | Estimated total | Percent* |
|---|---|---|
| Cropland | 4,503 acres | 37% |
| Grassland | 100 acres | 1% |
| Urban/barren | 30 acres | 0.3% |
| Wetland | 650 acres | 5% |
| Woodland | 1,100 acres | 9% |

**TABLE 3.11 b: EVAAL Priorities and Agricultural Shoreland Management Areas**

| | |
|---|---|
| EVAAL High Priority Parcels | 540.3 acres |
| Streambank/shoreline | 13.6 miles |
| Area in 300' Buffer | 1,041.7 acres |
| Cropped Area in 300' Buffer | 495.2 acres |

Both tables estimated using Arcview USGS maps with a 1:24,000 scale. *100% includes water area.

# UPPER ROCK RIVER WATERSHED

The following descriptions were taken from the 1995, Upper Rock River Basin's Water Quality Management Plan. For further updates refer to the 2002, The State of the Rock River Basin publication #WT-668-2002.

## Beaver Dam River Watershed – UR03

(Map 14)

The Beaver Dam River Watershed has a small segment lying in Green Lake County. Three square miles of the Drew Creek watershed is located in Green Lake County. (Green Lake County portion shown on Map 14.) Land use is primarily agricultural, with dairy farming and cash grain cropping predominating. 95% is comprised of cropland. Pollution runoff effects are severe on most streams and lakes, and this sub-watershed flows primarily to Fox Lake. The Beaver Dam Watershed was selected for a priority watershed project in 1990.

**TABLE 3.12 a: Land Use**

| Land use | Estimated total | Percent* |
|---|---|---|
| Cropland | 2456 acres | 95% |
| Grassland | 0 acres | 0% |
| Urban/barren | 0 acres | 0% |
| Wetland | 0 acres | 0% |
| Woodland | 37 acres | 2% |

**TABLE 3.12 b: EVAAL Priorities and Agricultural Shoreland Management Areas**

| | |
|---|---|
| EVAAL High Priority Parcels | 24 acres |
| Streambank/shoreline | < 1 mile |
| Area in 300' Buffers | 11.3 acres |
| Cropped Area in 300' Buffers | 11.3 acres |

Both tables estimated using Arcview USGS maps with a 1:24,000 scale. *100% includes water area.

# Upper Rock River Watershed – UR12

## South Branch of Rock River

(Map 14)

A bit more than seven square miles of this watershed lies in Green Lake County. (Green Lake County portion shown on Map 14.) As in most other watersheds in this basin, the streams have low gradients. The primary land use is agricultural. The Horicon Marsh and many sizeable wetland complexes exist within this watershed. The Upper Rock River Basin's Water Quality Management plan recommends that this watershed is a high-priority candidate for future pollution abatement programs.

**South Branch Rock River** (3 miles) is listed as a 303(d) water not currently meeting water quality standards (Wisc. Dept. of Natural Resources). A small part of this river lies in Green Lake County. It then flows east for 17 miles through Fond du Lac County, and eventually through the Horicon Marsh—a wildlife refuge of State, National, and International importance. Only the lower three miles of the river have been classified, but the samples upstream indicate that the water supports tolerant forage fish. Cropland erosion, wetland loss, streambank and riparian zone erosion and livestock access to streambanks are responsible for the water quality, and hence the life forms present. Waterfowl heavily impacts this river.

**TABLE 3.13 a: Land Use**

| Land use | Estimated total | Percent* |
|---|---|---|
| Cropland | 3,548 acres | 79% |
| Cropland | 752 acres | 17% |
| Urban/barren | 0 acres | 0% |
| Wetland | 70 acres | 1.5% |
| Woodland | 20 acres | 0.5% |

**TABLE 3.13 b: EVAAL Priorities and Agricultural Shoreland Management Areas**

| | |
|---|---|
| EVAAL High Priority Parcels | 196.7 acres |
| Streambank/shoreline | 7.8 miles |
| Acres in 300' Buffers | 558.2 acres |
| Cropped Acres in 300' Buffers | 445.5 acres |

Estimated using Arcview USGS maps with a 1:24,000 scale *100% includes water area.

# Chapter 4

## Estimated Rural Nonpoint Source Pollutant Loading

## POLLUTANT LOADING

The ecological balance of waterways in Green Lake County and the entire Fox-Wolf Basin and Upper Rock River Basin are significantly degraded by nonpoint source pollution. Currently, about 82% of the phosphorus and sediment loading that leads to degradation is due to land management practices. The principal nonpoint sources include:

- Phosphorus runoff from farm fields and livestock operations.
- Sediment delivery from cropland and construction sites.
- Sediment eroded from shorelines, streambanks, and drainage ditches.

### Sediment Loading

Sediment adversely impacts water resources in a number of ways. Sediment influences light penetration, and therefore reduces the amount of photosynthetic activity. The decrease in water clarity also makes it difficult for predators to locate prey. Sediment also degrades habitat by causing water temperatures to rise—warm water cannot hold as much oxygen as cold water and therefore cannot support as much fauna—and sediment eliminates bottom habitat critical for aquatic insects and fish spawning. In addition, high sediment concentrations abrade fish gills making the fish more susceptible to disease. Finally, sediment serves as the transport mechanism for a large portion of the total phosphorus loading.

**Cropland Sediment Loading**
In Green Lake County intensive agricultural practices, mainly tilling, but also confined dairy herds, create a considerable amount of soil loss. This is due to the fact that anytime soil is left unprotected by sod cover or crop residue the opportunity for erosion exists. Sheet, rill, and gully cropland erosion are the primary source of sediments that are carried downstream. Still, not all soil loss is carried into our waterways.

**T, Soil Loss and Sediment Delivery**
The relationship between these three factors is sometimes misunderstood, both “T” value and soil loss have been greatly misused over the years. Below are the definitions of each followed by an explanation of how these values were considered in this document:

“T” Value
“T”, or Tolerable Soil Loss, is an estimate of the amount of soil that can be lost from a cropped field on a continual basis and still retain an adequate level of soil productivity. This value is strictly based on soil type.

Soil Loss
This is the estimated amount of soil that is moving from one place to another on the landscape. It is calculated using the Revised Universal Soil Loss Equation 2 (RUSLE 2) and it provides a value that can be compared to “T”. It tells us how much soil is moving around the landscape but it does not tell how much sediment is actually being delivered to surface water.

Sediment Delivery
This is the estimated amount of soil that is actually being delivered to surface water; therefore, it is the most relevant in terms of water quality. It is the only measurement that estimates actual amounts of soil reaching surface water.

"T" has been used as the standard for a number of state and federal programs. Green Lake County's 1988 Soil Erosion Plan estimates the average "T" rate to be 3.8 tons/acre/year. Approximately 22,900 acres were estimated to erode at or above that tolerable rate (*See Appendix Two*). Unfortunately, "T" is not the most appropriate measurement for this plan. In order to achieve the water quality goals in this plan it is necessary to think in terms of less than "T" even at the reduced "T" level of 2.2 tons/acre. The important factor is the trend of reduced soil erosion rates. It would appear that farmers are maintaining sound land management principles. The progressive farmers are masking the negative impacts of farmers who still have erosion levels above "T".

Green Lake County's Land Conservation Department has conducted a Geographic Information Systems (GIS) Transect Survey each year since 1999. This analyzes slope, soil type, residue management, crop, and conservation practices of 820 sites within the county. The data has been calculated to determine an estimated soil loss of cropland. From 1999 to present, the annual soil loss calculated using the Green Lake County Transect Survey data has been trending slightly downward to a 2017 soil loss rate of 1.7 tons/ac./yr (See *Appendix Three*). To calculate sediment delivery, a representative watershed (White Creek) was used to compare the estimated soil loss with actual USGS data collected at the mouth of the stream. After the analysis was completed, it was estimated that 19% of soil loss reaches the surface water. This information will be used throughout Green Lake County for calculating sediment delivery.

**Source 2 – Shoreline Sediment Loading**

Green Lake County contains 824 miles of shorelines and streambanks; therefore, erosion from these sources continues to be important. Erosion of these areas is caused by high water levels, wave action, boating pressure, and ice shoves. There have been improvements made to shoreline and streambank erosion control but statistically these changes have not been significant enough to document any change from the 1999 figures.

It is estimated that shoreland erodes at 10.8 ton/mile/year in the glacial till soils and 18 tons/mile/year in outwash plain soils.

**TABLE 4.1: SEDIMENT DELIVERY* IN GREEN LAKE COUNTY** tons/yr. - 2017

| | UPLAND** | STREAMBANK/ SHORELINE*** | TOTAL |
|---|---|---|---|
| Green Lake | 5,212 | 1,606 | 6,818 |
| Fox River-Berlin | 6,045 | 4,597 | 6,642 |
| Upper Grand River | 7,263 | 1,206 | 8,469 |
| Lower Grand River | 4,125 | 1,840 | 5,965 |
| Buffalo & Puckaway Lakes | 2,247 | 861 | 3,108 |
| White River | 608 | 748 | 1,356 |
| Swan Lake | 932 | 245 | 1,177 |
| Fox River-Rush Lake | 1,515 | 97 | 1,612 |
| Mecan River | - | 8 | 8 |
| Beaver Dam River | 776 | 0 | 776 |
| Upper Rock | 951 | 85 | 1,036 |
| **TOTAL** | **29,674** | **11,293** | **40,967** |

* Does not include urban sources. **Land use areas were estimated using Arcview data. ***Included all streambank/shoreline on USGS quadrangle

## Phosphorus Loading

Phosphorus is one of the essential nutrients for plant growth. When phosphorus concentrations rise, water bodies experience nuisance plant growth. Excessive growth causes severe oxygen fluctuations--aquatic plants produce oxygen as they photosynthesize in the daylight, but consume oxygen at night as they respire. Large swings in these daily levels of dissolved oxygen can stress fish and other aquatic life. Also, excessive plant growth in the streams can restrict water flow and increase sedimentation rates, which impacts oxygen and temperature levels. As stated above, oxygen and temperature levels impact the aquatic environment.

High phosphorus concentrations can cause dense algae populations (blooms) and can therefore be a major cause of eutrophication in lakes. The densities of these blooms vary according to the amount of nutrient loading, temperature, and wave action. The blooms affect aesthetics interfere with boating, swimming, and other recreational use of the waters, and further impact water quality and aquatic life. The blooms reduce sun light penetration, which prevents more desirable rooted aquatic plants from growing. Aquatic insects, fish, waterfowl, and wildlife all depend on these rooted aquatic plants for survival. In addition, when the algae and aquatic plants die they consume oxygen during decomposition that can contribute to fish kills.

**Source 1 - Phosphorus Loading from Cropland Sediment**
It is important to note that the majority of phosphorus reaches waterways through soil erosion and dissolved phosphorous. Phosphorous from manure, sludge, and other fertilizer application attaches to soil particles and wash into waterways. If soil erosion is reduced then phosphorus loading is less of a problem. From the same representative watershed (White Creek), actual USGS data collected showed that there is 1.5 pounds of phosphorus per ton of soil. This information will be used throughout Green Lake County for calculating phosphorus loading.

**Source 2 - Phosphorus Loading from Streambank and Shoreline Sediment**
For consistency within the Upper Fox River Basin, Green Lake County will use a value of 0.75 pounds of phosphorus per ton of sediment for shoreline sediment. The logic for this reduction is based on the fact that much of the sediment in shoreline erosion originates in the subsoil layer of the soil profile. The subsoil generally has significantly less particulate phosphorus than the topsoil. Phosphorus loading from streambank erosion will remain at 1.5 pounds of phosphorus per ton of sediment erosion due to the similar soil characteristics of the rich lowland soils to the fertile upland soils.

**Source 3 - Phosphorus Loading from Animal Lot Runoff/Manure and Sludge Spreading**
Manure contains several components that adversely affect the water quality and aquatic life, mainly phosphorus. The major sources of manure in a watershed are runoff from barnyards that have inadequate or non-existing runoff systems, and runoff from improperly field-spread manure. Spreading sludge from wastewater treatment plants also contributes to phosphorus loading.

Green Lake County's LCD and the GLSD have compiled data on the number of barnyards in the Green Lake Watershed. A GIS data layer of livestock facilities was assembled. From this information, phosphorus levels for each livestock facility can be produced. In early 2011 the Green Lake Association has started a project to list and detail all BMPs that have been installed in the Big Green Lake Watershed. This information will be in a GIS format and placed on the Green Lake County and Green Lake Association websites. This information will be used to track and monitor barnyards progress in meeting and maintaining compliance for NR 151 performance standards.

**TABLE 4.2: PHOSPHORUS LOADING* IN GREEN LAKE COUNTY** lbs./yr - 2017

| PHOSPHORUS . | CROP | STREAMBANK/ SHORELINE | BARNYARD | TOTAL |
|---|---|---|---|---|
| Green Lake | 7,818 | 2,409 | 1,317 | 14,899 |
| Fox River-Berlin | 9,068 | 6,895 | 1,779 | 17,198 |
| Upper Grand River | 10,894 | 1,809 | 1,814 | 18,527 |
| Lower Grand River | 6,188 | 2,760 | 949 | 9,321 |
| Buffalo & Puckaway Lakes | 3,370 | 1,291 | 719 | 6,099 |
| Fox River-Rush Lake | 2,273 | 146 | 309 | 3,716 |
| White River | 912 | 1,122 | 186 | 1,721 |
| Mecan River | 0 | 12 | 0 | 7 |
| Swan | 1,398 | 368 | 221 | 2,344 |
| Beaver Dam | 1,164 | 0 | 144 | 1,745 |
| Upper Rock | 1,426 | 127 | 216 | 2,290 |
| TOTAL | 44,511 | 16,939 | 7,654 | 69,104 |

***Does not include urban sources or point pollution.**

## URBAN POLLUTANT LOADING

The urban area in Green Lake County is considerably less than the rural area, but the urban pollutant load is still significant. Urban water pollution begins when development alters natural processes. Removing vegetation and replacing it with streets, rooftops and driveways greatly decrease the amount of water soaking into the soil. Storm sewers are used to carry the water directly into nearby waterways. Storm sewer systems are designed to remove water from developed areas quickly during storms, which thereby allows pollutants, such as sediment, phosphorus, heavy metals, pet wastes, street wastes and road salt, to reach streams and lakes at a "rapid transit" pace.

**TABLE 4.3: AVERAGE URBAN LOADS FOR WISCONSIN** lbs./**acre/year**

| **POLLUTANT** | **LAND USE** | | | | | |
|---|---|---|---|---|---|---|
| | Residential | Institutional | Commercial | Industrial | Open space | Freeway |
| **Solids** | 400 | 650 | 1,900 | 1,750 | 46 | 3,000 |
| **Phosphorus** | 0.326 | 0.266 | 1.256 | 0.756 | 0.156 | 1.5165 |

Table by Wisconsin Department of Natural Resources Water Resource Management.

### Sediment Loading from Construction Sites

Eroding construction sites are a leading urban cause of water quality problems in Wisconsin. For every acre under construction, about a dump truck and a half (approximately 25 tons) of soil washes into a nearby lake or stream, unless the builder properly uses erosion controls.

### Road Salt

Salt used for highway deicing is composed of more than 95 percent sodium chloride (NaCl). Storm water can dislodge or dissolve salt and carry it into surface waters or infiltrate into groundwater. Snow piles dumped into waterways or piled near surface waters also deliver sodium chloride and the associated deicing materials. Once delivered to waters, chlorides form a saline layer along the bottom that prevents normal mixing. This can lead to reduced oxygen levels in bottom waters and increase nutrient release from sediments. Increased chloride levels may also release mercury from contaminated sediments. On land, high concentrations of sodium and chloride lead to deterioration of soil structures, resulting in decreased permeability, loss of vegetation, and increased erosion.

The 1999 Land & Water Resource Management plan advisory committee addressed road salt as a county concern. As of 2011 few methods if any have come along to encourage the replacement of road salt that is used on public roads.

### Pollutants from Lawn and Garden Care

The pressure to have a perfectly manicured lawn has clouded a number of issues and contributed to the problems in local streams and lakes. For example, nutrient applications containing phosphorus has become a widespread practice even though many soils already contain enough phosphorus for a healthy lawn. Lawn fertilizer containing phosphorus can no longer be applied to lawns as of April 1, 2010 unless it is for a new lawn or the soil test results show a phosphorus deficiency. Routine insecticide and herbicide applications are common though they should only be used as the very last resort. These unneeded pesticides and nutrients can be expensive, and ultimately runoff directly into nearby waterways.

### Pollutants from Poor Auto Maintenance

Good auto maintenance pays in the long run, but poor auto maintenance can seriously harm our waters. Anything that drips from a motor vehicle-oil, gas, antifreeze-can wash into storm sewers. These materials are toxic to aquatic life. Dumping them into a storm sewer has almost unthinkable consequences. Education efforts such as storm sewer stenciling is an easy way to educate the public.

### Municipal and Industrial Discharge

The urban population also contributes to phosphorus loading through industrial and municipal phosphorus discharge. Much of this point source pollution has been addressed throughout the years yet locally can still be a major source problem but still ranks small in comparison to nonpoint pollution—especially in Green Lake County. According to the Fox-Wolf Basin Resource Strategies 1998 report the entire Fox-Wolf Basin's industrial and municipal point sources contribute an estimated 307,300 pounds of phosphorus per year. Green Lake County produces an estimated 6720 pounds of that total. (From Fox-Wolf Basin Resource Strategies, 1998) Cost effective nutrient trading strategies between point and nonpoint pollution are a part of an overall way to reduce nutrient loadings to the waters of Green Lake County.

## GROUND WATER ISSUES

Ground water is available in the county from glacial deposits and bedrock aquifers. The availability of water from glacial deposits is estimated at 5 to 10 gallons per minute. Northwest of a line that extends generally from the City of Berlin to the City of Princeton: and a small area that runs northeast from Lake Puckaway through, and beyond Green Lake, availability is estimated at 10 to 100 gallons per minute. Most groundwater in the county is drawn from sedimentary bedrock aquifers. Yields from properly constructed wells range from 10 to over 500 gallons per minute. Quality of the water is generally adequate for domestic, municipal, and industrial use.

Unused and improperly abandoned wells are a significant threat to groundwater quality. If not properly filled with impermeable material, abandoned wells can directly channel contaminated surface water or soil into groundwater. Water that gets into abandoned wells bypass the purifying action that normally takes place in the upper layers of soil. Many improperly abandoned wells are threatening groundwater.

Wells must be properly filled when they are removed from service. They are removed from service for a number of reasons, including construction of a replacement well, destruction of the building being served, failure of the well to produce safe water, failure to meet the State Well Code (NR812) standards, or when a community water system is extended into an area.

After wells are removed from service they are seldom used. They often get forgotten after a property transfer and, in time, may get covered by buildings. Sometimes all traces of old wells disappear. Such wells can cause groundwater contamination. The wells can provide points of entrance, and possible sources of contamination into aquifers. For example, unused wells near animal yards and sewage absorption fields provide direct access for the entrance of contamination into the groundwater.

After a well gets covered, it is very difficult, if not impossible, to find it and determine if it's causing contamination. When new wells are constructed in an area with improperly abandoned wells, they may have to be cased much deeper or to alternate aquifers to provide safe water. These problems can be avoided by the proper closure of wells.

The Wisconsin Geological and Natural History Survey shows that since 1936 approximately more than 2,900 well constructions have been reported in Green Lake County. Not all of those can be located, nor are they all in use.

### Nitrates

The presence of nitrate in a water analysis is a danger signal. Large amounts of nitrates are dangerous to infants because it is related to methemoglobinemia, or "blue baby disease". Even small amounts of nitrate make the water supply suspect. Nitrate is an indication that the water supply may also be contaminated with bacteria and pollution. The primary sources of nitrogen are farming/landscaping through excessive or improper use or storage of manure, commercial fertilizer use, land development through inadequate stormwater management and erosion protection, on-lot septic systems through improper siting, design, and maintenance, and airborne sources. These sources enter ground water through improperly abandoned wells, sinkholes, more permeable soils, and high bedrock or ground water.

### Atrazine

Atrazine is a herbicide, which is a member of the chemical family of triazines, and used chiefly to control grasses and broadleaf weeds in numerous crops, and to control perennial weeds and grasses in industrial, home and garden settings. It is the most widely used herbicide in the U.S. It enters ground water from direct entry into a well through accidental chemical spills, improper storage near wells, or agricultural land application. The United States Environmental Protection Agency states that no adequate studies are available on the risks to human health, but animal experiments have shown that it adversely effects the heart, lungs, liver, kidney, spleen, adrenal glands, and brain. The Wisconsin State Laboratory of Hygiene states that it may pose a cancer risk if it is present in amounts above the advisory level in drinking water.

# Chapter 5

# Reduction Goals

## NONPOINT SOURCE POLLUTION CONTROL GOALS

The long-term goal stated in 1999 plan was a 35% reduction in sediment and phosphorus to surface waters in Green Lake County over the next 10 years. This goal was based on the goals on the *Green Bay Remedial Action Plan* that called for a 50% reduction, and the *Winnebago Comprehensive Management Plan* that called for a 33% reduction. Green Lake County chooses to coordinate the goals of this plan with surrounding counties that share the Upper Fox River Basin.

With the 2005 and 2011 plan revisions, the Land and Water Conservation Department maintained the goal of a 35% reduction of sediment and phosphorus as a long term goal. Steady progress has been made throughout the years with reducing soil loss on cropland mainly due to the fact that more farmers have adapted reduced tillage systems, leaving more residue on the surface after planting. In addition, although cattle numbers have declined with the loss of many smaller farms, the farms that are left have become increasingly larger. Alfalfa production has increased to feed the animals, thus decreasing soil loss on the cropland.

Other important factors in Green Lake County's nonpoint source pollution control is the fact that the Green Lake watershed was chosen as a USDA National Water Quality Incentive (NWQI) project in 2011 and has continued to install Best Management Practices (BMP's) until it's final signup year of 2018. Over 100 BMP's have been installed in that period of time reducing sediment delivery by 2,529 tons of sediment per year and phosphorus by 4,910 pounds.

With the adaption of good sound conservation farming practices, along with the success of the Green Lake NWQI project and annual BMP projects installed using the DATCP cost sharing, the Transect survey showed a reduction from 1.2 tons/ac/yr on cropland from 1999 (2.8 tons/ac/yr) to 2017 (1.7 tons/ac/yr). In addition, we are still confident though using the 19% sediment delivery figures from estimated soil loss numbers.

### Sediment Reduction Goals

Reducing sediment delivery by 35% from our initial plan in 1999 has required widespread implementation of residue management practices, structural BMP's, streambank and shoreline stabilization and incorporation of grass buffers. Using our transect data, along with reductions from BMP's, the 2017 sediment delivery numbers show that the 35% reduction goal set in 1999 has been exceeded, with an estimated reduction of 37%. With these goals achieved, the Advisory Committee set new goals for the next ten years with a 15% reduction. This is a realistic goal, but still achieves a great reduction due to the fact that many of the prior practices were "the low hanging fruit".

With the incorporation of our Green Lake Buffer Program, along with the continued CREP acres, buffers should be a large contributing factor to sediment reduction over the next 10 years. Buffers are designed to slow water runoff, provide shelter and stabilize riparian areas. They provide a filter system, which can reduce up to 80 percent of sediment, 40 percent of phosphorus, reduce nitrates and remove up to 60 percent of pathogens from runoff. Buffers also result in fish and wildlife habitat.

Residue management practices will continue to be utilized which can reduce soil erosion up to 90%. They also increase the health and structure of the soil and thus its productivity. In addition to these practices, structural BMPs will be applied in areas where their installation will reduce sediment loads substantially.

**TABLE 5.1 SEDIMENT DELIVERY REDUCTION**

| SOURCE | 1999 LOAD (0% met) | 2011 LOAD (17% met) | 2017 LOAD (37% met) | 2028 GOAL (additional 15% goal) |
|---|---|---|---|---|
| CROPLAND | 53,040 tons/yr. | 41,675 tons/yr. | 29,674 tons/yr. | 25,223 tons/yr. |
| SHORELINE | 11,901 tons/yr. | 11,901 tons/yr. | 11,293 tons/yr. | 9,599 tons/yr. |
| **TOTAL** | **64,941** | **53,576** | **40,967** | **34,822** |

## Phosphorus Reduction Goals

Reducing phosphorus by 35% from our initial plan in 1999 has required widespread implementation of nutrient management and the installation of waste storage facilities and barnyard runoff practices. Using our transect data, along with reductions from BMP's, the 2017 phosphorus numbers show that the 35% reduction goal set in 1999 has been exceeded, with an estimated reduction of 36%. With these goals achieved, the Advisory Committee set new goals for the next ten years with a 15% reduction. This is a realistic goal, but still achieves a great reduction due to the fact that many of the prior practices were "the low hanging fruit".

This plan continues to stress the importance of reducing sediment and thereby the phosphorus that is attached to it. Green Lake County has determined that 1.5 pounds of phosphorus are attached to each ton of soil. In 2017, 65% of cropland in Green Lake County have nutrient management plans developed using the phosphorus based 590 specification. We will continue to have farmers develop phosphorus based 590 nutrient management plans which should assist in reducing phosphorus delivery to Green Lake County waters.

**TABLE 5.2: PHOSPHORUS REDUCTION**

| **SOURCE** | **1999 LOAD** (0% met) | **2011 LOAD** (18% met) | **2017 LOAD** (36% met) | **2028 GOAL** (additional 15% goal) |
|---|---|---|---|---|
| CROPLAND | 79,560 lbs./yr. | 62,513 lbs./yr. | 44,511 lbs./yr. | 37,834 lbs./yr. |
| SHORELINE | 17,852 lbs./yr. | 17,852 lbs./yr. | 16,939 lbs./yr. | 14,398 lbs./yr. |
| ANIMAL LOT | 10,381 lbs./yr. | 7,758 lbs./yr. | 7,654 lbs./yr. | 6,504 lbs./yr. |
| **TOTAL** | **107,793** | **88,123** | **69,104** | **58,738** |

**Soil Erosion and Sediment Delivery from Urban Development**
Green Lake County is reducing urban pollutants through the adoption of County Code Chapter 284 – Construction Site Erosion Control and Stormwater Management, as well as through increased educational efforts.

## WORK PLAN: 2018–2028 GOALS - These are a comprehensive list of activities over the next 10 years.

### Goal 1 – WORK TOWARD MEETING THE LONG TERM GOAL OF 15% OR GREATER SEDIMENT DELIVERY REDUCTION WITH THE FOLLOWING WORK PLAN OBJECTIVES FOR THE 2018-2028 PERIOD.

**Objective 1*:* Reduce rural sediment loading through further adoption of agronomic conservation practices and soil health.**

- Inventory properties using the latest computer technology and field visits to provide technical and cost share assistance to landowners that have moderate to severe erosion problems.
- Promote agronomic practices that reduce erosion and encourage soil health.
- Provide research and educational programs to landowners on the benefits of no-till and cover crop practices that encourage soil health.
- Increase adoption of Managed Grazing Systems.
- Pursue grant funding to support agronomic practice and soil health adoption.
- Update farm conservation plans every four years.
- Implement and promote Farmland Preservation Program (FPP) and Ag Enterprise Areas (AEA).
- Implement NR151 Agricultural Performance Standards.
- Increase and maintain Conservation Reserve Program (CRP) acres when possible.
- Implement Soil Health Assessment Program.
- Continue to conduct Transect Surveys for monitoring County soil loss data.

**Objective 2: Reduce rural sediment loading through the installation of structural Best Management Practices (BMPs)**.

- Target 50% of LWRM allocation funds to install structural BMPs.
- Run the Erosion Vulnerability Assessment for Agricultural Lands (EVAAL) county wide and identify critical sites.
- Install structural BMPs in conjunction with supporting agronomic practices.
- Pursue grant funding to support structural BMP installation.
- Assist local lake groups in the planning and installation of BMPs that support their lake management plans.
- Inspect structural BMPs every four years or after major runoff events to make sure they are functioning properly.
- Assist local lake groups to implement operations and maintenance plans similar to the Green Lake Sanitary District to encourage installation of BMPs with perpetual maintenance agreements

**Objective 3: Reduce sediment loading from streambank and shoreline erosion.**

- Target 10% of LWRM allocation funds to install streambank and shoreline erosion control.
- Stabilize shorelines and streambanks through use of BMPs.
- Pursue grant funding to support streambank and shoreline BMP installation.
- Utilize current stream inventory data to locate areas with the most significant streambank erosion problems.
- Inventory all streams and rivers within the county for stream health.
- Utilize current lakeshore inventory data to locate areas with the most significant shoreline erosion problems.
- Adopt grazing management recommendations and reduce access of livestock from streams and rivers.
- Increase education efforts on the impacts of sediment loading through streambank and shoreline erosion.

**Objective 4: Promote and encourage implementation of conservation within the shoreland management areas.**

- Implement the Green Lake Buffer Program.
- Promote the Conservation Reserve Enhancement Program (CREP) in the eligible area.
- Promote the Revitalization of Shoreline Vegetation Project (RSVP) in eligible areas.
- Educate farmers about restricted grazing benefits in shoreland areas.
- Promote and expand the DNR Healthy Lake Initiative Program.

**Objective 5: Reduce sediment loading through construction site and storm water management.**

- Enforce Construction Site Erosion Control and Stormwater Management – Green Lake County Code Chapter 284 on applicable areas.
- Revise ordinance to reflect the most current standards and specifications.
- Help residents control erosion through education and fact sheets.
- Work with local and state road construction agencies to control site erosion.
- Work with cities to update storm water management plans.

**Objective 6: Rely on the partnerships between agencies and organizations and their tools.**

- Continue to support and assist lake groups by offering LCD representation at monthly and annual meetings.
- Assist local lake groups in the planning and installation of BMPs that support their lake management plans.
- Work with any other agencies or organizations that have programs that reflect the goals of the Land and Water Resource Management Plan.
- Encourage local lake groups to attend LCC meeting annually to update the county on the state of their lake.
- Met annually with Non-Government Organizations to collaborate ideas and solutions that relate to sustaining our natural resources within the County.
- Assist in the development of Farmer Led Councils when requested.

**Goal 2 – WORK TOWARD MEETING THE LONG TERM GOAL OF 15% OR GREATER PHOSPHORUS DELIVERY REDUCTION WITH THE FOLLOWING WORK PLAN OBJECTIVES FOR THE 2018-2028 PERIOD**

**Objective 1: Reduce nitrogen and phosphorous loading through nutrient management planning and manure management BMPs.**

- Target 35% of LWRM allocation funds to install structural waste management BMPs.
- Enroll 1,000 acres/year of cropland for nutrient management planning.
- Raise awareness to producers, local cooperatives, and independent crop consultants of the benefits of nutrient management.
- Pursue grant funding to support adoption of nutrient management and manure management BMPs.
- Enforce Animal Waste Management Ordinance – Green Lake County Code Chapter 275 on applicable areas.
- Manage winter spreading on frozen land that is susceptible to runoff.
- Install manure storage facilities where a nutrient management plan documents the need.
- Install tile management systems on qualified sites.

**Objective 2: Reduce phosphorus runoff from developed lakeshore properties.**

- Utilize current lakeshore inventory data to locate areas with the most significant shoreline erosion problems.
- Educate citizens on the Healthy Lawn Program, phosphorus spreading, and proper leaf management.
- Expand RSVP and Healthy Lakes Initiative throughout the County.

**Objective 3: Reduce phosphorous runoff from urban sources through storm water management.**

- Enforce Construction Site Erosion Control and Stormwater Management – Green Lake County Code Chapter 284 on applicable areas.
- Increase storm water infiltration from private landowners within urban areas.
- Educate municipalities of the benefits of storm water management.

**Objective 4: Reduce legacy phosphorus from streams, lakes, and wetlands.**

- Gather information concerning legacy phosphorus amounts in impaired and exceptional streams and rivers within the county.
- Utilize proven methods to remove or control legacy phosphorus within our lakes, rivers and streams.

**Objective 5: Rely on the partnerships between agencies and organizations, and their tools.**

- Utilize future Total Maximum Daily Load (TMDL) for Upper Fox River Watershed for phosphorus load reductions.
- Collaborate and assist lake groups with plan development.
- Work with any other agencies or organizations that have programs that reflect the goals of the Land and Water Resource Management Plan.

## Goal 3 – PRESERVE AND RESTORE HABITAT

**Objective 1: Maintain or increase total acres of native plantings and vegetation in upland and wetland areas.**

- Encourage and prioritize the planting of native vegetation along streambanks/shorelines
- Educate landowners of the importance of maintaining and restoring wetlands.
- Promote the eradication of invasive species and noxious weeds.
- Support the implementation of native planting programs through other agencies.
- Support the protection of riparian and isolated wetlands.

**Objective 2: Decrease present and future fragmentation of natural habitat.**

- Enforce the Comprehensive Plan for Green Lake County.
- Implement Green Lake Buffer Program in the most cost effective way.
- Maintain and restore wetlands.
- Protect and establish corridors for wildlife.
- Recommend planting native vegetation in any areas eligible.
- Support conservation easements.

**Objective 3: Protect prime farmland.**

- Enforce the Comprehensive Plan for Green Lake County.
- Promote enrollment in the Farmland Preservation Program of land in zoned townships.
- Promote enrollment of Ag Enterprise Areas in non-zoned townships.
- Encourage soil health practices.
- Support conservation easements.

**Objective 4: Protect and establish in-lake habitat**

- Continue supporting the County's Aquatic Invasive Species Coordinator position.
- Install boat-washing stations at Sunset and Dodge parks on Green Lake to control invasive species.
- Assist local lake groups in the planning and installation of in-lake BMPs that support their lake management plans
- Promote Healthy Lakes program.

## Goal 4: PROTECT GROUNDWATER RESOURCES

**Objective 1: Protect groundwater quality.**

- Target 5% of LWRM allocation funds to properly abandon wells.
- Locate and identify previously abandoned wells in the county and those needing abandonment.
- Identify Karst rock areas in order to safely utilize nutrient applications.
- Promote BMP's that infiltrate storm water, divert clean water, and buffer conduits to groundwater.
- Develop well testing program through the Land Conservation Department to monitor groundwater quality.
- Educate property owners, well contractors, and other citizens about proper well abandonment.
- Continue to offer Clean Sweep Program to properly dispose of hazardous waste.
- Develop GIS groundwater layer.
- Support Private Onsite Wastewater Treatment System (POWTS) inventory and maintenance.

**Objective 2: Protect groundwater quantity**

- Promote proper and wise use of limited groundwater supplies.
- Locate and identify existing high capacity wells.
- Support legislative rules that look at the comprehensive effects of high capacity wells.
- Educate landowners on irrigation water management.
- Promote infiltration and soil health BMPs
- Explore countywide groundwater protection plan

# Chapter 6

## Plan Implementation Strategy

To meet the goals set forth by this plan, landowners must comply to set standards and implement Conservation Practices or commonly known as Best Management Practices through various cost-share programs. To meet the standards some properties will require installation of structural practices while others will require changes in land management and cropping techniques. NR 151 establishes the requirements to which landowners comply with these standards. The Green Lake County LCD's role is to assist landowners in planning, designing, installing, and approving management plans and practices to meet NR 151 standards. This plan also acknowledges and will utilize existing programs and ordinances to meet the NR 151 standards.

## NON-POINT POLLUTION PERFORMANCE STANDARDS

The Wisconsin Department of Natural Resources (WDNR) has developed performance standards for agricultural and non-agricultural nonpoint sources of pollution. Green Lake County will assist in directing the implementation strategies and evaluating pollution reduction goals set forth in this plan.

**Agricultural Standards and Prohibitions outlined in Chapter NR 151 of the Wisconsin Administrative Code**

For farmers who grow agricultural crops:

- Meet tolerable soil loss (T) on cropped fields, and
- Follow a nutrient management plan using the phosphorus index strategy designed to limit entry of nutrients into waters of the state (groundwater and surface water), and
- Allow a tillage setback within 5 feet of the top of the channel of surface waters.

For farmers who raise, feed, or house livestock:

- Divert water from the well when well is located downslope of lot, and
- Prevent direct runoff from feedlots or stored manure into waters of the state, and
- Limit livestock access to waters of the state to avoid high concentrations of animals and maintain adequate or self-sustaining sod cover along waterways, and
- Follow a nutrient management plan for manure and other nutrient application using the phosphorus index strategy, and
- Allow no significant discharge of process wastewater to waters of the state.

For farmers who have, or plan to build, a manure storage structure:

- Maintain structures to the maximum operating level (mol) to prevent overflow,
- Repair or upgrade any failing or leaking structures that pose an imminent health threat or that violate groundwater standards,
- Close abandoned structures not used for a period of 24 months according to accepted standards, and
- Meet technical standards for newly constructed or substantially altered structures.

For farmers with land in a water quality management area (300 feet from a stream, 1000 feet from a lake, or in areas susceptible to groundwater contamination):

- Do not stack manure in unconfined piles, and
- Divert clean water away from feedlots manure storage areas, and barnyards located within this area, and
- Allow no unlimited livestock access to waters of the state in locations where high concentrations of animals prevent the maintenance of adequate or self-sustaining vegetative cover.

### Nutrient Management Plans

To meet the nutrient management standards, farmers may hire an agronomist or prepare their own nutrient management plans if they complete a DATCP-approved training course or otherwise demonstrate that they are qualified. In 2017, over 65% of the agricultural acres in the county had a nutrient management plan. The goal for the next 10 years is to increase the amount of planned acres. These plans must:

- Rely on soil nutrient tests from a DATCP-certified laboratory,
- Comply with the NRCS Nutrient Management Standard 590 as directed by ATCP 50 (Register January 2018).
- Follow the recommendations for nutrient applications in the Soil Test Recommendations for Field, Vegetable and Fruit Crops, UWEX publication A-2809, unless there are circumstances that justify more than the recommended application, and
- Include additional management practices to reduce runoff of phosphorus.

In 2019 the LCD will be purchasing a Nutrient Management Module from Transcendent Technologies which will tract the status of the participant's Nutrient Management Plans. This program will make the nutrient management component of the NR 151 standards easier and more efficient to organize, tract and report. It works in conjunction with the FPP and Farm inventory modules previously purchased.

## AGRICULTURAL SHORELAND MANAGEMENT

### Conservation Reserve Enhancement Program

The Conservation Reserve Enhancement Program (CREP) is a state-federal multi-year land retirement United States Department of Agriculture (USDA) program developed by states and targeted to specific state and nationally significant water quality, soil erosion, and wildlife habitat problems. This program applies to all land in Green Lake County except land in the Town of Seneca. The program has had a very slow start in Green Lake County due to the fact that only four towns (Berlin, Brooklyn, Green Lake, and Mackford) were initially included in the project area. In 2005, five additional towns (Kingston, Manchester, Marquette, Princeton, and St. Marie) were added to the eligible area, leaving the Town of Seneca as the only ineligible township.

Signup has been disappointing for this program and the goals of the program have fallen way below expectations. Landowners are encouraged to plant crops to maximize their farm income and that appears to be a direct conflict with the CREP program.

### Green Lake Buffer Program

The Green Lake Buffer Program is a county funded multi-year land retirement program developed by the Green Lake County Land Conservation Department. Its provisions are similar to the CREP program, but the rules have been modified to promote longer contracts (25 years) and additional incentives. This program was created in January of 2018 and will be fully implemented after a summer intern inventories eligibly sites and ranks them according to priority. This program applies to all land in Green Lake County.

## OTHER PROGRAMS

### Animal Waste Management Ordinance

Green Lake County has had an Animal Waste Management Ordinance since 1985. It addresses all livestock facilities with existing or planned manure storage facilities. This ordinance adopted under s. 92.16, Stats. shall prohibit any person from constructing a manure storage system unless that person obtains a permit from the county and develops a nutrient management plan that complies with s. ATCP 50.04(3). The system must also comply with NRCS technical guide standards 313 and 634 along with applicable DNR requirements under s 281.65(4)(g)5., Stats. Currently the county only issues 1 - 2 permits per year on average.

Regulations address the location, design, construction, alteration, operation, and maintenance of all animal feedlots and livestock waste storage facilities, including abandonment of storage facilities.

This ordinance was revised in 2015 to include compliance of the following NR 151 standards: Manure management prohibitions, manure storage facilities performance standards, process wastewater handling performance standards and nutrient management requirements. Like other counties' plans, the new ordinance will provide recommendations for the development of a reasonable, environmentally effective, and enforceable approach to regulating manure storage facilities. The Animal Waste Management Ordinance can be viewed on the Green Lake County Land Conservation Department website.

**Shoreland Zoning Ordinance**

The administration and enforcement of this ordinance is mandated under Chapter 59 of the Wisconsin Statutes. The administration and enforcement is provided through the County Land Use Planning and Zoning Department. The intent and purpose of the ordinance is to further the maintenance of safe and healthful conditions; prevent and control water pollution; protect spawning grounds, fish and aquatic life; control building sites, placement of structure and land use and reserve shore cover and natural beauty. The Shoreland Zoning Ordinance applies to those areas as defined in Chapter 59.692 (1) (b) as being the area between the ordinary high water mark of navigable waters for the following distances:

- One thousand feet (1,000') from a lake, pond or flowage. If the navigable water is a glacial pothole lake, this distance shall be measured from the high water mark of the lake.
- Three hundred feet (300') from a river or stream or to the landward side of the floodplain, whichever distance is greater.

The Shoreland Zoning Ordinance was revised in the fall of 2016 can be viewed on the Green Lake County Land Use Planning and Zoning Department website.

**Farmland Preservation Program**

This program is to provide for soil and water conservation standards and procedures to be followed by participants joining in the Wisconsin Farmland Preservation Program (FPP). In 2017, 65% of the agricultural land is enrolled in the program (. A goal for the next 10 years is to increase the amount of enrollment, thus increasing our nutrient management planned acres.

In 2017 Green Lake County LCD purchased 2 tracking modules from Transcendent Technologies to run FPP more efficiently. The first is a FPP Management Module that tracks Certificates of Compliance by parcel to monitor compliance and the second is a Farm Inventory Management Module which tracks site inspections by parcels and integrates the information into the FPP Management Module. Both programs will greatly assist the LCD staff in organizing, tracking and reporting progress for the almost 300 participants of FPP in Green Lake County.

This is perhaps one of Green Lake County's most influential land conservation programs, because it addresses all cropland not just Highly Erodible Land (HEL). This is important in Green Lake County due to the low amount of HEL and large amount of land with slopes of 2% to 6% which is farmed intensively in some areas. In addition, it is the main tool the LCD uses for compliance of the NR 151 state agricultural performance standards and prohibitions incorporated into ATCP 50, Wis. Admin. Code.

Conformance with these standards and procedures will be necessary for landowners to establish and maintain eligibility for farmland preservation tax credits under section 71.09 (11) and 92.10I5 (6).

This shall apply to:

- Landowners who claim a farmland preservation tax credit for which they are eligible because their land is located in a district zoned exclusively for agricultural use or have a FPP contract in unzoned towns.

Landowners must:

- Meet the soil and water conservation standards that comply with the current NR 151 state agricultural performance standards and prohibitions incorporated into ATCP 50, Wis. Admin. Code.

The majority of time that the Land Conservation Department will spend with NR 151 standards will occur through status reviews of the Farmland Preservation Program participants. Status reviews are completed a minimum of every 4 years. Landowners are sent a current status report which informs the landowner if they are meeting NR 151 requirements which then allows them to continue to receive the program payments.

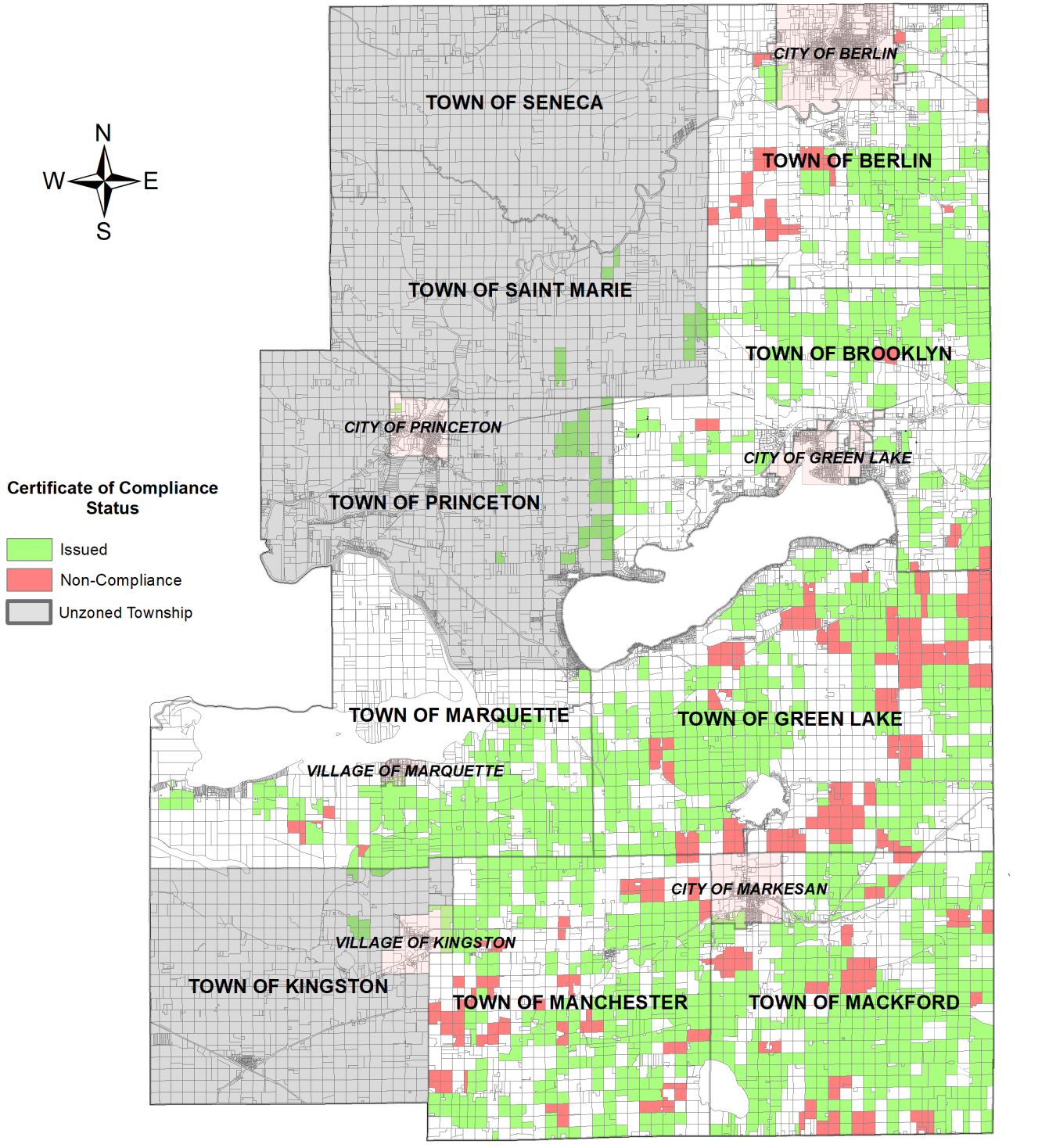
For landowners not meeting NR 151 standards or County ordinances, a notice of the problem will be mailed to the landowner stating that the standards have not been met or that they are in violation of the ordinance. The Green Lake County Land Conservation Department shall prepare a conservation plan with the landowner including a schedule of implementation. The Green Lake County Land Conservation Department must provide a notice of availability of funds to the landowner when funds are available to implement or install the necessary practices. A minimum of one year must elapse after the landowner's plan and schedule has been developed before beginning any enforcement action. The one-year deadline for enforcement action may be extended upon agreement between the landowner and the Green Lake County Land Conservation Department.

The Green Lake County LCD must provide along with the notice of the problem: a list of pertinent best management practices and associated average costs per unit as provided by the Green Lake County LCD; a written statement informing the landowner of the right to appeal the decision; and the appeals procedure.

# Green Lake County

## Farmland Preservation Participants

2018




Green Lake County

This map is neither a legally recorded document nor a survey, and is not intended to be used as one. This map is intended to be used for reference purposes only. The map accuracy has been obtained from sources believed to be reliable; however, Green Lake County is not responsible for any inaccuracies herein contained. Use of this map is at the individuals own risk.

Scale

1 0.5 0 1 2 3 Miles

Map 15

Land Conservation

**Construction Site Erosion Control and Stormwater Management – Green Lake County Code Chapter 284**

This applies to land disturbing and land developing activities within Green Lake County, but it does not pre-empt more stringent storm water management requirements in some municipalities. The purpose of this chapter is to set forth storm water requirements and criteria that will prevent and control water pollution. Its purpose is to diminish the threats to public health, safety, welfare, and aquatic life due to runoff of storm water from development or redevelopment.

Ordinance objectives:

1. Control erosion and pollutants during land disturbance and development activities by:
   - Treating turbid water in temporary sediment basins, grit chambers, etc.
   - Properly disposing of all wastes and building materials,
   - Preventing or removing sediment from being tracked on to private or public roads,
   - Protecting drain inlets from turbid water/sediment,
   - Controlling site erosion by diverting channelized and sheet flow runoff, minimizing bare soil area, constructing sediment basins, installing sediment control measures, stabilizing soil storage piles, and protecting storm sewer inlets.

2. Manage quantity of storm water discharge by:
   - Controlling peak flow rates of storm water discharge from the site, and
   - Maximizing infiltration of storm water runoff from driveways, sidewalks, rooftops, and landscaped areas.

3. Manage quality of storm water discharge by:
   - Trapping, filtering, or otherwise preventing the release of particulate materials,
   - Reducing pollutant loading, protecting stream habitat,
   - Avoiding discharge of urban storm water pollutants to natural wetlands,
   - Pre-treating infiltration storm water to prevent groundwater contamination, and
   - Locating storm water ponds and infiltration devices sufficiently separated from supply wells.

The construction Site Erosion Control and Storm Water Management requirements can be viewed on the Green Lake County Land Conservation Department website.

**County-Wide Installation of Best Management Practices**

While this plan targets priority areas in the county, many landowners outside of the priority areas have resource problems that will require the assistance of the LCD for the installation of conservation practices also known as Best Management Practices. Best Management Practices control nonpoint sources of pollution and can be used to help landowners meet minimum NR 151 performance standards. Generally these practices use standard specifications included in the Natural Resources Conservation Service (NRCS) Field Office Technical Guide. In some cases additional specifications may apply.

Appendix Four lists potential Best Management Practices that are most often used to control nonpoint sources of pollution and briefly defines each one. Financial assistance may be available to offset the cost of installing most of the practices listed. Assistance rates and options may vary based on the source of funding for a given project. More detailed descriptions of the practices can be found in USDA NRCS Technical Guide IV.

## IDENTIFYING PRIORITY SITES

The Green Lake County Land Conservation Committee decided that the following criteria should be established to determine priority sites for Land and Water cost-share funding from DATCP. As other funds are discovered it is likely that they would be distributed using this criteria. Grants that are received for specified watersheds or water bodies from various programs obviously are dedicated to these areas.

**Priority Breakdown of Land and Water Funds by Practice (structural practices) for 2011-2015.**

| | |
|---|---|
| Cropland Erosion Control - | 50% |
| Livestock Waste Management Facilities - | 35% |
| Streambank/Shoreline Erosion - | 10% |
| Well Abandonment - | 5% |

A breakdown of Land and Water funds by priority category paid out can be found in *Appendix Six*.

## PRIORITY FARM/AREA STRATEGY

The following priority farm/area strategy is based on Chapter 3 resource assessment:

**Priority Area 1:** ***EVAAL High Priority Parcels*** The Wisconsin Department of Natural Resources Bureau of Water Quality has developed the Erosion Vulnerability Assessment for Agricultural Lands (EVAAL) toolset to assist watershed managers in prioritizing areas within a watershed which may be vulnerable to water erosion and contribute to downstream surface water quality problems. This is the latest and most detailed tool to identify high priority erodibility sites within the county.

**Priority Area 2:** ***Agricultural Shoreland Management Area*** Agricultural Shorelland Management Areas are identified as any land that is located within 1,000 feet of a lake and any land that is located within 300 feet of the edge of a sinkhole, an intermittent stream, or perennial stream or river. Fields that intersect the Agricultural Shoreland Management Area retain high priority.

**Priority Area 3:** ***303(d) Impaired Waters & Exceptional Resource Waters***
303(d) impaired waters are those that are not meeting the WI DNR water quality standards. Currently in Green Lake County Hill Creek, Roy Creek, Silver Creek, and Wuerchs Creek in the Green Lake Watershed are EPA 303(d) impaired rivers. Upper Rock River, Harrington Creek, and the Upper and Lower Grand River are also 303(d) impaired rivers. 303(d) impaired lakes include Green Lake, Big Twin, Little Green Lake and Lake Puckaway.

An exceptional resource water is a lake, stream or flowage having excellent water quality, high recreational and aesthetic value and high quality fishing, but may be affected by point source pollution or have the potential for future discharge from a small sewer community. Snake Creek, White Creek and Assemble Creek are listed on the DNR's exceptional resource waters list. These lists can change from year to year due to new waterways nominated for inclusion on the 303(d) list and/or the potential of official delisting of a waterbody due to correction of its impairments (See map on page 16).

**Priority Area 4:** ***Green Lake Watershed***
Green Lake Watershed is chosen due to its extreme importance as a high quality water resource. Extensive monitoring and research has been conducted with the assumption that dramatic changes in the adoption of conservation systems will show documented changes from the monitoring stations. The financial support of the Green Lake Sanitary District also creates a program that will keep implementation momentum if state funding becomes less available in the coming years.

## PRIORITY FARM/CONSERVATION STRATEGY

**Priority 1:** ***Nutrient Management***
This Best Management Practice when properly implemented and followed can provide substantial water quality improvement as well as positive income creation for farmers. The Additional measures may be required within the Big Green Lake Watershed if 590 Nutrient Management Plans are unable to prevent manure runoff events from cropland.

**Priority 2:** ***Soil Erosion Control Practices***
No-till planting is a practice that still creates tremendous soil saving benefits. Other structural practices are still needed to address ephemeral and rill erosion.

**Priority 3:** ***Livestock Waste Management***
Due to limited funds, livestock waste management is the third priority. EQIP is a program that we direct landowners to for livestock waste management cost-sharing.

The ranking sheet for the county carries out the priorities listed above (*See Appendix One*). The ranking sheet will rank landowners for cost sharing assistance. It is not meant to evaluate landowners for the NR 151 agriculture performance standards. The ranking sheet gives the highest priority to one specific area but it does not exclude any area in the county. While the EVAAL high priority parcels are the highest priority, other factors could give a higher ranking to a different geographic area if the applicant scores higher than the other priorities. Two ranking periods will occur annually. The first ranking will be completed by March 15 and the second ranking by July 15.

The Land Conservation Department developed a performance standards tracking database. The database is geo-referenced so that tracking can be reviewed using the GIS functions available to the Land Conservation Department. This database, which has the ability to produce a report for landowners and operators, can also produce forms and reports for the Land Conservation Department to monitor progress toward NR 151 agriculture performance standards and the goals established in the Land and Water Resource Management Plan. We are currently working on fixing some of the problems with this program.

Status reviews, currently, are conducted for farmers participating in the Farmland Preservation Program. They will also be conducted in the Priority Farm Strategy Areas. For landowners not participating in the Farmland Preservation Program or in the Priority Farm Strategy Areas, status reviews will be conducted from complaints or areas that LCD staff observes possible NR 151 compliance problems.

A copy of all status reviews will be sent to landowners and land operators where a status review has been performed for lands that they own or operate. For those found to be out of compliance with NR 151 performance standards, the landowner will be notified and the following information will be given in writing:

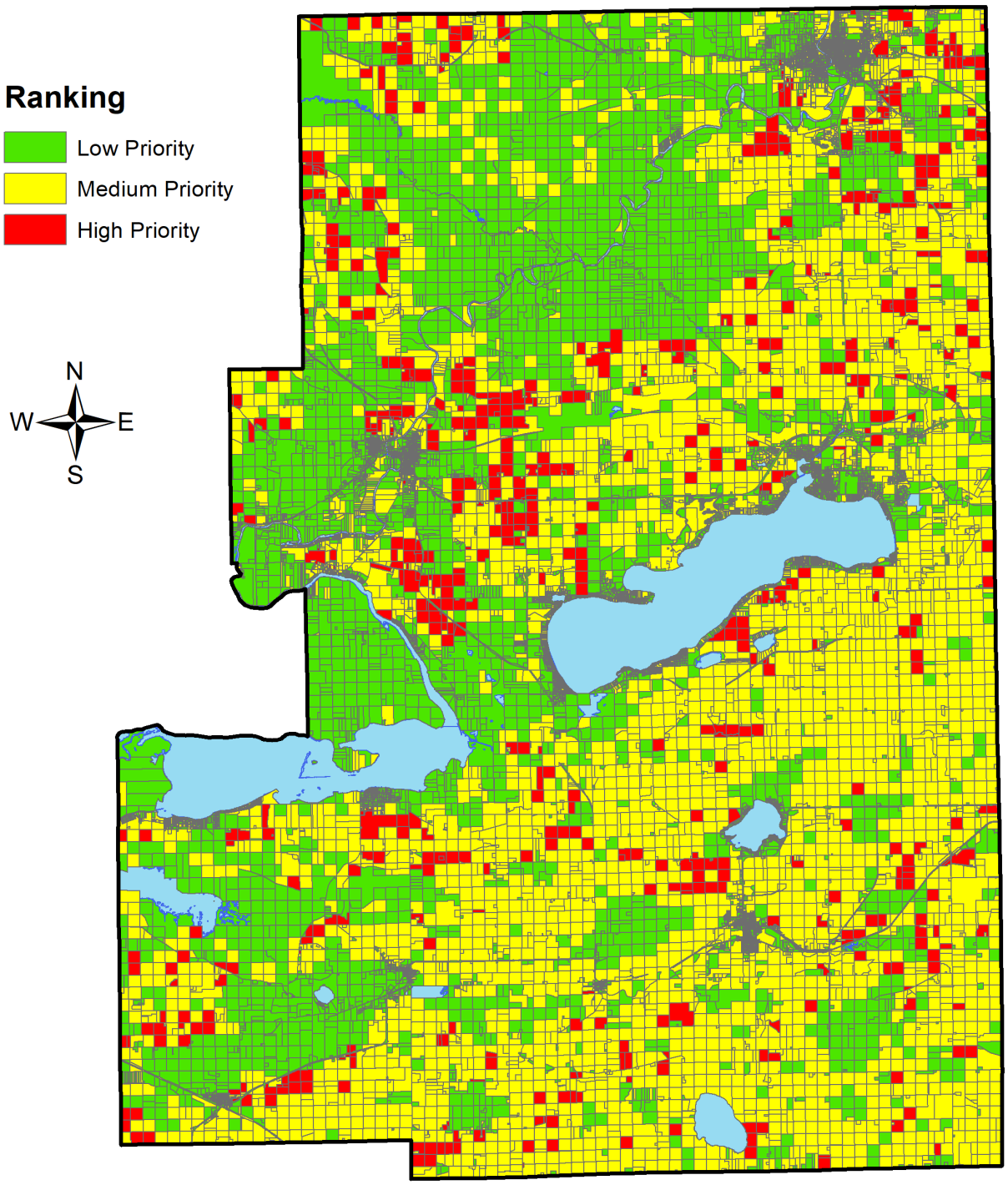
- A statement explaining the compliance issues.
- The corrective measures needed to achieve compliance.
- A timeline for achieving compliance.
- The status of eligibility for cost-share assistance.
- The funding sources available and technical assistance to be received.
- An explanation of technical standards and maintenance requirements.
- A signature page attached to findings report indicating whether the landowner agrees or disagrees with the report.
- A copy of performance standards and prohibitions and any applicable technical standards.
- Landowners disagreeing with the status review report shall be given a notice of process and procedure for appealing the findings of the LCD.
- Appeals will be directed to the Green Lake County Land Conservation Committee.

Landowners who are in violation of the agriculture performance standards will be referred to the Nonpoint Source Coordinator for the Department of Natural Resources – Northeast Region.

# Green Lake County

## EVAAL Priority

2018




This map is neither a legally recorded document nor a survey, and is not intended to be used as one. This map is intended to be used for reference purposes only. The map accuracy has been obtained from sources believed to be reliable; however, Green Lake County is not responsible for any inaccuracies herein contained. Use of this map is at the individuals own risk.

Land Conservation



Scale

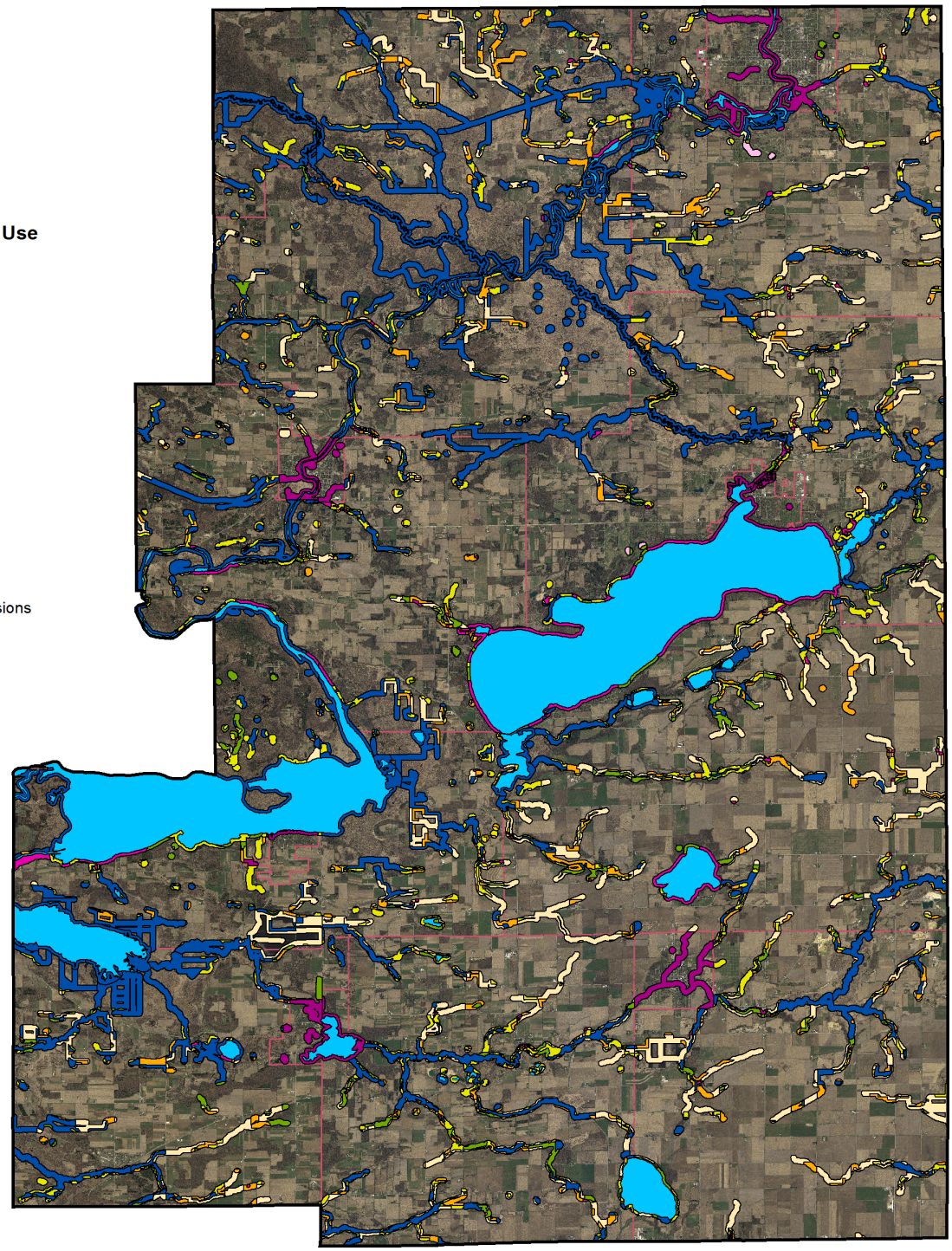
1 0.5 0 1 2 3 Miles

Map 16

# Green Lake County

## Agricultural Shoreland Management Areas

2000




**300' Buffer Land Use**

**Land Cover**

- Row Crop
- Forage
- Forest
- Grassland
- Wetland
- Open Water
- City
- Residential
- Golf Course
- Park
- Cemetery
- Minor Civil Divisions

Green Lake County

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Land Conservation



Scale

1 0.5 0 1 2 3 Miles

Map 17

# IMPLEMENTATION BUDGET

## Financial Assistance Administration

Financial assistance is available to landowners and local units of government with priority sites to help offset the cost of installing BMPs. The Land Conservation Department distributes funding to landowners after practices have been completed and inspected; or in the case of conservation tillage, after residue checks following planting. To qualify for financial assistance, landowners must meet eligibility criteria defined by the program from which they are receiving funds. The Land Conservation Committee will prioritize applications for financial assistance. Two ranking periods will occur each year. The first ranking will be done by March 15 and the second ranking by July 15.

To receive financial assistance, landowners must enter into a cost-share agreement with the Land Conservation Department. Cost-share agreements are binding documents that secure funds for implementing an individual or group of conservation practices. Structural practices with cost-share amounts greater than $14,000 have the agreement attached to the deed of the property. Non-structural practices such as conservation tillage and nutrient management are not recorded with the deed.

Local, state, or federal permits may be needed prior to the installation of some practices. Areas in which permits are generally required include zoned wetlands and the shoreline areas of lakes and streams. These permits are needed whether the activity is a part of the county program or not. The cost-share recipient is responsible for acquiring the needed permits prior to the installation of practices.

The Land Conservation Department is responsible for enforcing compliance of cost-share agreements. The Land Conservation Department will insure that practices installed through the program are maintained in accordance with their operation and maintenance plan for the appropriate length of time.

## Cost Containment Procedures

Cost containment procedures are identified in this plan to control the costs of installing BMPs where the cost-share funding is administered by the Land and Water Conservation Department. The County will use cost estimation, bidding, average costs, and flat rates. These procedures and cost lists can be obtained from Land and Water Conservation Department.

**Cost Estimation:** Projects expected to cost $10,000 or less will require a cost estimate from the landowner or land user and the cost-share agreement will then be developed based on the estimate and average costs for the practice from previous years.

**Bidding:** A bidding procedure should be used for constructed practices expected to cost greater than $10,000. Landowners are required to seek three bid requests. Three bid packets will be supplied by the Land Conservation Department to the landowner or land user.

In the event it is impractical to establish competitive bidding procedure for all or some of the practices, the department director will authorize use of one or more of the following containment procedures to substantiate the cost of a practice or practices:

- Average costs for similar practices installed in the region during preceding years.
- Acceptable, regionally established cost range for a practice based on past experience.
- Specified maximum payment for a practice, regardless of cost.
- Use of department employees or agents to design, construct, or install a practice to minimize public costs.
- Other cost containment procedures as determined by the department.

If the landowner or land user is required to obtain bids, the bidding procedure shall meet at least the following minimum standards:

- All bids shall be faxed, emailed or delivered by the bid deadline to the Land Conservation Department office.
- A bid opening shall be announced at a specific time. Bids may be reviewed for a period of no longer than one week from opening. The landowner will select the bid and the Land Conservation Department will establish the reimbursable cost-share contract amount.
- The amount of the cost-share grant shall be based on the lowest qualified bid.
- The landowner or land user may select a contractor that submitted a higher bid only if the landowner or land user pays the difference. The landowner or land user may not select a contractor that did not bid on the project

**Average Costs:** The department may make cost-share payments based on the average cost of a cost-share practice, regardless of its actual cost. The department shall determine average costs per unit of materials and labor, or average costs of completed components, based on a survey or review of itemized costs for cost-shared practices installed during the preceding years.

**Flat Rates:** Flat rate payments will be authorized for non-structural conservation practices. Incentive practice rates are also included as a flat rate cost-share practice.

The value of in-kind services provided by the landowner shall be established by bid, maximum payment, or average cost method for a measurable work product.

## OTHER PROGRAM INTEGRATION

The reduction goals of this plan will be achieved through full implementation of all federal, state, county and local soil and water conservation programs. The following are brief descriptions of each applicable program.

**Conservation Reserve Enhancement Program (CREP)**
The Conservation Reserve Enhancement Program is a joint, state-federal land retirement conservation program targeted to address state and nationally significant agriculture-related environmental effects. This voluntary program uses financial incentives to encourage farmers to enroll in contracts of 10 to 15 years in duration to remove lands from agricultural production. All areas in Green Lake County are eligible except for the Town of Seneca. Agricultural Shoreland Management areas are the targeted lands.

**Conservation Reserve Program (CRP)**
The Conservation Reserve Program is a federal program that was developed to assist landowners in voluntarily converting highly erodible and environmentally sensitive cropland from the production of annual crops to less intensive uses such as permanent grass, legumes, forbs, wildlife cover or trees. Regular sign-ups occur only as announced by the Secretary of Agriculture. Most cases involve offers of entire fields. Applications are available at the Farm Service Agency.

Continuous sign-up is primarily for partial fields and small plots. The sign-up is ongoing and covers priority practices such as filter strips, riparian buffers, shelterbelts, field windbreaks, grassed waterways and shallow water areas for wildlife.

**Environmental Quality Incentives Program (EQIP)**
The intent of the EQIP program is to provide a voluntary conservation program for farmers who face serious threats to soil, water and related natural resources. The federal program administered through the NRCS provides technical, financial and educational assistance primarily in designated priority areas. Currently all land in Green Lake County is eligible for this program.

**Exceptional Resource Waters Programs (ERW)**
Chapter NR 102 states that these waters deserve special protection because of their water quality, fisheries, wildlife and recreational values. NR 207 restricts the amount of wastewater discharged into them. These waters are targeted for WDNR funding.

**Lake Management Planning Grant Program**
The Wisconsin Lake Management Planning Grant Program is a WDNR funded program that was developed to provide financial assistance to qualified lake organizations or local governments to collect and analyze data concerning the physical, chemical and biological health of their lakes. Grant money can also be used to investigate watershed conditions, review ordinances and conduct social surveys to gauge local concerns and perceptions as they relate to lake use and water quality. The end product of most Lake Management planning grants is a comprehensive lake management plan that addresses local concerns and analyzes alternatives for lake and watershed management. The LCD and county Lake Districts have received grants through this program.

**Lake Protection Grant Program**
Through the WDNR funded Lake Protection Grant Program qualified lake organizations can apply for funds to carry out a variety of Lake Protection projects. The state-share is 75%. Eligible projects include the purchase of lands critical to a lake ecosystem, restoration of important wetlands, and the development of regulations and ordinances designed to protect and enhance water quality.

**River Protection Planning Grant Program**
River protection planning WDNR grants provide state cost-sharing assistance to eligible sponsors for the collection, assessment and dissemination of information on riverine ecosystems, to assist in developing organizations to help manage rivers, to assist the public in understanding riverine ecosystems and to create management plans for the long term protection and improvement of riverine ecosystems.

**River Protection Management Grant Program**
River protection management WDNR grants provide state cost-sharing assistance to eligible sponsors for implementing a specific activity or set of activities, other than planning activities, to protect or improve a river ecosystem.

**Notice of Intent/Discharge Cost-Share Grants**
The DNR and the Department of Agriculture, Trade and Consumer Protection (DATCP) offer cost-share funding grants to governmental units working with owners and operators of livestock operations to meet pollution control requirements imposed by the WDNR.

**Partners for Fish and Wildlife**
Partners for Fish and Wildlife restore wetlands, grasslands, and threatened and endangered species habitats. Land that is eligible must be degraded but able to be restored to wetlands or grasslands that provide habitat for endangered and/or threatened species. Up to 100% may be cost-shared.

**Wetland Reserve Program (WRP)**
The Wetland Reserve Program is a voluntary federal program established to help landowners restore and protect wetlands on their property. To be eligible, land must have been drained for farming or pasture and is possibly restorable to natural wetland conditions. Land adjacent to restorable acreage is also eligible if it contributes to wetland functions and values.

**Wildlife Damage Abatement and Claim Program**
The Wildlife Damage Abatement and Claim Program is a federal USDA program that provides abatement and claim assistance to landowners receiving wildlife damage. The damage must be caused by deer, bear, or geese to commercial seedlings, orchard trees, crops or agricultural land, nursery stock, apiaries, or livestock. Landowners are eligible for practices such as fencing, shooting permits, cannons, etc. Green Lake County has a history of deer damage problems that appear to be growing in their complexity.

**Wildlife Habitat Incentive Program (WHIP)**
The Wildlife Incentive Program is a federal funded program that develops or improves fish and wildlife habitats on privately owned land. Almost any type of land is eligible, including agricultural and non-agricultural land, woodlots, pastures, and streambanks. Some practices installed include seeding to native grasses, in stream structure, etc. with up to 75% cost sharing for restoration costs.

**Wisconsin Farmland Preservation Program (FPP)**
The goals of the state Farmland Preservation Program are to preserve farmland through local planning and zoning, promote soil and water conservation, and provide tax relief to participating farmers. To be eligible, all cropland and facilities associated with the farm must be in compliance with the Agricultural Performance Standards and meet certain zoning requirements.

**Targeted Runoff Management Grant Program**
The Targeted Runoff Management (TRM) Grant Program is a DNR program that offers competitive grants for local governments for the control of pollution that comes from diffuse sources, also called “nonpoint source (NPS)” pollution. Grants from the TRM Program reimburse costs for agricultural or urban runoff management practices in targeted, critical geographic areas with surface water or groundwater quality concerns.

**Aquatic Ecosystem Restoration**
(Section 206, - 1996 Water Resource Development Act of 1996)

The U.S. Army Corps of Engineers may provide cost sharing assistance to carry out projects for aquatic ecosystem restoration and protection projects, for purpose of improving the environment.

**Emergency Streambank and Shoreline Erosion Protection**
(Section 14, of Flood Control Act 1946)
The U.S. Army Corps of Engineers may provide cost sharing in one locality during any fiscal year for the construction repair, restoration and modification of unstable conditions caused by streambank and shoreline erosion which calls for prompt action to eliminate the threat to public health and safety, and to prevent interruption of vital services.

**Green Lake County Trails and Paths**
There is a desire by local organizations, some of those being the Green Lake Association, the Green Lake Conservancy, the Green Lake Sanitary District, the City of Green Lake, Green Lake Greenways and others, to promote the public's travel to the 15 Conservancy Lands and local parks located on or near the waters of Green Lake. It is desired where possible to make these natural sites accessible by both motorized and non-motorized means of transportation requiring multi use trails for walking and biking to these sites. Many of these Conservancy Lands have been in part funded with WDNR grants and it is envisioned to connect these lands via a multi-use trail.

**USDA Farm Service Agency**
Stabilizing farm income, helping farmers conserve land and water resources, providing credit to new or disadvantaged farmers and ranchers, and helping farm operations recover from the effects of disaster are the missions of the U.S. Department of Agriculture's Farm Service Agency (FSA).

## Cooperating Agencies and Organizations **(Programs explained on pp. 61-63)**

- **Farm Service Agency -** The Farm Service Agency (FSA) administers farm commodity, crop insurance, credit, environmental, conservation, and emergency assistance programs for farmers and ranchers. Their programs relevant to this plan include Conservation Reserve Enhancement Program, Continuous Conservation Reserve Program, Crop Loss Disaster Assistance Program, Agricultural Market Transition Act Program, Crop Loan Deficiency Payments, and CRP General Signups.

- **Green Lake Association -** The Green Lake Association (GLA) is a private nonprofit organization committed to conservation and preservation of Green Lake's natural resources. GLA's mission is to ensure that Green Lake remains one of the premier lakes in the Midwest by actively promoting the conservation of the area's natural scenic beauty and intrinsic character. The GLA is also a large participant in public hearings regarding land and water issues, and monitor agencies and committees to ensure their decisions protect Green Lake's character.

- **Green Lake Conservancy -** The Green Lake Conservancy (GLC) is a community-based nonprofit, tax exempt land trust whose mission is to preserve, protect, and enhance the aesthetic, ecological, and recreational qualities of the greater Green Lake Watershed. Work is done in partnership with the GLSD, WDNR, GLA, and Green Lake County. They have purchased a number of critical parcels of land valuable for ecosystem functions. They continue to look for additional sites, easements, and donations.

- **Green Lake County Farm Bureau -** The Green Lake County Farm Bureau (FB), with over 700 members, is involved in local, state and national affairs making it a true grassroots organization. The purpose of the Farm Bureau is to improve net income of farmers, improve public understanding of agriculture, develop farm leaders, and improve rural life.

- **Green Lake Sanitary District -** The Green Lake Sanitary District (GLSD) has received numerous lake protection grants in the past 5 years. Grants implementing BMP installations including structural BMPs along with nutrient management planning have helped the LWCD to meet additional CMP installation goals.

  The GLSD in conjunction with the Land Conservation Department and other lake organizations plan to continue to pursue funds through the lake planning and protection grant programs to protect Big Green Lake. The future grant funds will be used to continue to implement BMPs that maintain, protect, and improve the water quality of Big Green Lake.

The GLSD's definition of BMPs include: normally understood practices (i.e. high residue management, grassed waterways, scrapes, etc), acquisition of conservancy properties strategically located or designated as sensitive areas/endangered areas, water quality monitoring work and other projects specified in more detail within this document (i.e. Winter Manure Runoff Project, Conservation Development Work, etc.).

- **Lake Puckaway Protection & Rehabilitation District -** The Lake Puckaway Protection & Rehabilitation District (LPPRD) recently received a Wisconsin Waterways Commission grant to help protect important waterfowl concentration sites. They are also working on dam reconstruction on the Fox River, and are involved in a large fish-stocking program. An updated Lake Management Plan was completed in 201

- **Land Use Planning and Zoning** - The Land Use Planning and Zoning Department (LUPZ) administers and enforces the County's land use ordinances, applicable chapters of the Wisconsin Administrative Code, and Wisconsin Statutes. Basic ordinance responsibility covers general zoning, shoreland zoning, floodplain zoning, private sewage, land division, and nonmetallic mining reclamation.

  This Department provides assistance for all permit applications, public hearing applications, concerns of violations, and basic land use information. The goal of these services is to promote the use of land in harmony with its neighboring uses and natural resources, and to protect the public's safety and interest in the location of structures and uses.

  Another service offered to the community is assistance to municipalities with creating and executing land use development goals they have locally envisioned. To achieve these goals, land use plans, ordinances, and other applicable regulations are administered, enforced, and updated when necessary. Assistance is provided for review of land divisions and analysis of development proposals affecting land use.

- **Little Green Lake Protection and Rehabilitation District -** The Little Green Lake Protection and Rehabilitation District (LGLPRD) have provided much support to the land conservation program in the county. They provided piggyback cost-share funds for various nonpoint projects in the watershed. The district manages the invasive species in the lake with the guidance from the WDNR. Several embankment ponds have been installed throughout the years to trap and prevent sediment and phosphorus from entering the lake, with the most recent large water and sediment basin for the lake was installed in 2009.

- **Natural Resources Conservation Service –** The Natural Resources Conservation Service (NRCS) provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment. Some of the NRCS responsibilities that relate to this plan include NWQI, WHIP, WRP, EQIP, and technical assistance for CRP, Continuous CRP and CREP.

- **Rock River Watershed Coalition -** The mission of the Rock River Watershed Coalition (RRWC) is to educate and provide opportunities for people of diverse interests to work together to improve the environmental, recreational, cultural and economic resources of the Rock River Basin. It is an opportunity for farmers, businesses, local governments, sporting clubs, conservation groups, and communities to work together on water quality problems in the basin.

- **Golden Sands Resource Conservation & Development -** The mission of the Golden Sands Resource Conservation & Development (Golden Sands RC&D) is to manage natural and human resources in ways consistent with sound conservation principles by working across county lines to address local concerns in the twelve-county area (which includes Green Lake County) of Central Wisconsin. Green Lake County continues to financially support the Regional Aquatic Invasive Species Coordinator who assists in controlling the invasive species in our county.

- **Grand Lake Improvement Association** – A new citizen based organization established in 2016, the Grand Lake Improvement Association was created with the assistance of County staff. The Lake Association collaborated with the County LCD and hired consultant to create a lake management plan, which will be the basis for future improvements within the Grand Lake Watershed.

- **Twin Lakes Association -** The Association is a group of approximately 50 individuals and businesses who have an interest in maintaining the quality of Twin Lakes as a recreational resource as well as an amazing habitat for wildlife. The purpose of the Association is to preserve and protect Twin Lakes and its surroundings, and to enhance the water quality, fishery, boating safety, and aesthetic values of Twin Lakes, as a public recreational facility for today and for future generations.

- **U.S. Army Corps of Engineers -** This is the Federal Government's largest water resources development agency. A prime mission of the Army Corps of Engineers (ACE) is to strive for environmental sustainability. The corps recognizes the interdependence of life and the physical environment. The Corps proactively considers environmental consequences of its programs and acts accordingly. The Corps seeks balance and synergy among human development and natural systems by designing economic and environmental solutions that reinforce one another.

- **University of Wisconsin Extension -** The Green Lake County University of Wisconsin Extension Office (UWEX) provides educational programs and assistance to all people in Green Lake County. It is an integral part of the university's knowledge based delivery system to the people of the State of Wisconsin. Extension's mission is to focus university knowledge and expertise upon human needs and problems. The extension office agents teach using many methods. These include home and farm visits, telephone calls, seminars, workshops, tours, newsletters, news releases, radio, television, satellite and the educational telephone network (ETN).

- **Wisconsin Department of Natural Resources -** The Wisconsin Department of Natural Resources (WDNR) is dedicated to the preservation, protection, effective management, and maintenance of Wisconsin's natural resources. It is responsible for implementing the laws of the state and, where applicable, the laws of the federal government that protect and enhance the natural resources of our state. It is the one agency charged with full responsibility for coordinating the many disciplines and programs necessary to provide a clean environment and a full range of outdoor recreational opportunities for Wisconsin citizens and visitors.

- **Wings Over Wisconsin -** Wings Over Wisconsin (WOW) is a nonprofit organization dedicated to natural resource restoration, preservation & education. They work with private landowners, developing cooperative habitat and cost-sharing agreements. They help restore grasslands, woodlands, and wetlands, and acquire land.

# BUDGET

## FINANCIAL ASSISTANCE BUDGET

Table 5-1 shows the LWRM funds fall short of the needed dollars thus showing the importance of leveraging other program funds to work towards our goals.

### TABLE 6-1: PLAN IMPLEMENTATION

| CATEGORY | 2012-2017 Projection Costs | 2012-2017 Actual DATCP Funding | 2018-2028 Projection Costs | 2018-2028 Projected DATCP Funding |
|---|---|---|---|---|
| **Upland Sediment Delivery Control*** | $ 1,039,680 | $ 221,501 | $ 1,090,740 | $ 285,000 |
| **Shoreline Erosion Control**** | $ 307,532 | $ 47,435 | $ 212,000 | $ 199,500 |
| **Animal Waste Management***** | $ 651,637 | $ 265,540 | $ 405,000 | $ 337,000 |
| **Well Abandonment** | $ 7,806 | $ 7,806 | $ 28,500 | $ 28,500 |
| **Total** | $ 2,006,655 | $ 542,282 | $ 1,736,240 | **$ 850,000** |

* Assuming $65/Ton to $360/Ton ($212/Ton average) of sediment reduced. Based on Green Lake County LCD conservation practices implemented between 2012 and 2017.
** Taken from Agricultural Shoreline Management Data using 120' buffers. *** Includes nutrient management ($28,000 seg funds annually) and structural practice

## ADMINISTRATIVE BUDGET

The Land Conservation Department will attempt to use existing staff to achieve the goals of this plan. Currently there are six full-time employees. The department moved to new office facilities in 2011 and room is available for staff expansion if funding became available. At the time of this plan, much discussion is focused on possible staff cuts due to budgetary constraints.

### TABLE 6-2: GREEN LAKE COUNTY LCD – STAFF COSTS

| YEAR | 2011 (available hrs) | 2017* (available hrs) |
|---|---|---|
| **LCD staff** | *$471,664 (12480)* | *$493,100 (12480)* |
| **Contracted Professionals and LTE** | *$ 6,000* | *$ 6,000* |
| **Total** | *$477,664* | *$477,664* |

* Estimated figures.

Staff costs from 2011 to 2017 have gone from $471,664 to $493,100. Green Lake County will receive $133,963 from DATCP for staff in 2017. Green Lake County Government has remained very dedicated towards funding the Land Conservation Department.

## OTHER AGENCIES

Many agencies and organizations work towards the same goals as the LCD. In fact, these agencies and organizations provide funding sources for programs within the county. Some are listed below.

### TABLE 6-3: GREEN LAKE COUNTY - AGENCY FUNDS FOR LISTED PROGRAMS

| SOURCE | PROGRAMS | Dollars/year To Green Lake County (approx.) |
|---|---|---|
| WDNR | Lake Management Planning Grants & Lake Protection Grants | $15,000 |
| DATCP | Farmland Preservation Program | $300,000 |
| DATCP | SWRM | $85,000 |
| Green Lake Sanitary District | Local Cost-Share | $25,000 |
| USDA | EQIP | $45,000 |
| USDA | CRP | $350,000 |
| USDA | Farm Program Assistance | $4,000,000 |
| USDA | Crop Insurance | $4,000,000 |
| WDNR | Wildlife Damage Program | $60,000 |

# Chapter 7

## Information and Education Strategy (I&E)

## BACKGROUND

Many people are not aware of their own contribution to nonpoint pollution. Building awareness is the first step in adopting the Best Management Practices (BMPs) that reduce nonpoint pollution. Before people adopt BMPs they must first recognize the drawbacks to their current management practices and the impact they have on the resources around them. Then people must feel that implementing BMPs is manageable and worthwhile. Only then will they consider changing their current practices.

Generally speaking, there are three major barriers that prevent landowners from adopting soil and water conservation Best Management Practices (BMP).

| | |
|---|---|
| **Knowledge Barriers** | Not having the necessary information to make an informed decision about a new management practice. |
| **Skill Barriers** | Not having the management ability to adopt a new practice. |
| **Attitude Barriers** | Not supporting either the need to adopt a practice or the belief that the practice will accomplish the goal. |

Three tools will be used to overcome these barriers and encourage landowners to adopt new practices:

1. Monetary Assistance (Ch. 6)
2. Information and Education
3. Ordinances (Ch. 6)

The Information and Education strategy is fundamental for influencing current activities because it provides awareness and helps change attitudes.

## INFORMATION AND EDUCATION STRATEGY

### Goal 1 – RAISE AWARENESS AND KNOWLEDGE

**Objective 1:** Inform residents about the new NR 151 pollution agriculture performance standards for Wisconsin and their impact on landowners in Green Lake County.

**Objective 2:** Inform residents about the ecological, recreational, and economic value of clean streams, wetlands, and lakes with healthy, native plants and animals.

**Objective 3:** Inform residents about rural and urban sources of runoff pollution.

**Objective 4:** Inform residents about storm sewers and the effect of their runoff.

**Objective 5:** Offer solutions for preventing runoff pollution and retaining clean streams, wetlands, and lakes.

**Objective 6:** Raise awareness of available funding sources for programs, and whom to contact for help.

**Objective 7:** Notify landowners of their pollution loading determinations.

Landowners must be made aware of existing problems and solutions, and they must gain the ability to implement new strategies. Therefore, the following activities will be utilized on a yearly basis to raise awareness and knowledge.

- **One on One Contact With Landowners**
  There is no better way to convince landowner to adopt new practices than having a technician actually spend time with them on their property. This is not always possible due to the lack of staff hours. Landowners on identified critical sites will warrant an individual farm visit from qualified technical staff. At least five critical sites will be visited per year to establish future plans. Status reviews also are a productive way to discuss with landowners farm conservation goals and progress on their farm.

- **Media**
  Newspapers and radio are two important sources for distributing information. Local news releases will describe water resources and impacts of nonpoint source pollutants, and programs targeted at controlling nonpoint source pollutants. News coverage would include current activities and progress.

- **Pamphlets**
  Green Lake County Resource Managers (DNR, NRCS, FSA, UWEX, and LWCD) publish many useful pamphlets. The LWCD has pamphlets on BMPs and conservation programs. Local organizations also put out a wide variety of exceptional resource pamphlets a year. Coordinating these pamphlets, and making them readily available show the commitment the community shares to conserving Green Lake County's natural resources. Also a locally developed handbook was developed by LWCD and UWEX to assist farmers who are writing their Nutrient Management Plan.

- **Direct Mailings**
  Through the Green Lake County Land Information Department, a mailing list of all landowners in the Water Quality Management areas will be generated. Direct mailings will be done each year to specific groups of landowners.

  All of the Lake Associations and many other organizations in the county, send out newsletters each year. The LWCD and these organizations cooperate to use the individual newsletters to spread information about relevant programs.

- **Workshops**
  Educational workshops will be conducted to further this plan. Awareness of soil and water conservation issues is critical to implementation of remedial measures. Not only does the LCD hold workshops, but other organizations in Green Lake County do as well. Workshops get people involved, and give them the skills and information they need to become stewards of the land. Field tours are also an excellent way to reach out to landowners.

- **Field Days**
  Holding field days on various conservation topics targeting landowners, farmers, and other citizens is an excellent way to raise their awareness on natural resource issues. Important topics include soil health, cover crops, no-till, and implementing a variety of BMP's.

## GOAL ACCOMPLISHMENTS

Accomplishing the goals of the I & E strategy will require a collaborative effort between the Green Lake County LCD, UW-Extension, the University of Wisconsin-Madison, local conservation clubs, and many other agencies and groups.

## Evaluation

As part of the annual accomplishment report, the county will prepare a summary of its information and education efforts over the year. The report will address how the I & E strategy was implemented, how residents participated, and how successful the adopters were with their new BMPs.

**Evaluating Strategy Implementation**
The staff will summarize the I & E activities they accomplished during the year. If the strategy was used to select and plan activities, it can be seen as an indication that the strategy should be working. Whether the activities actually reached their intended audiences and whether they caused participants to successfully change their behavior can be measured by evaluation participation rates and the BMP adoption process.

**Evaluation Participation Rates**
Since the strategy depends on activities to get people aware and involved, participation at activities can help evaluate the success of the I & E efforts. Participation means more than just attendance at field days and volunteer events, but also includes newsletter readership, requests for information, and signed cost-share agreements. If residents are attending planned I & E events and signing cost share agreements, I & E activities are probably having their desired impact. If residents never call the LWCD office to learn more about the project or attendance at field days and demonstrations are consistently low, this would probably indicate that new activities were needed.

Evaluating I & E success based primarily on participation can be misleading since participation is not an indicator of successful BMP adoption. For example, just because someone attended a demonstration does not mean that they learned what the staff wanted them to and just because a farmer installs a BMP does not mean that they are using it successfully. To determine if the I & E Strategy is causing residents to successfully adopt BMPs involves monitoring the performance of the participants.

Committing all LWRM funds each year also demonstrates that our program is stimulating landowner interest.

**Evaluation the BMP Adoption Process**
Evaluating the adoption process involves keeping careful records of the successes and failures in the beginning of the projects that participants had with the BMPs along with documentation of their performance with the new BMP. This means that the staff will continue working with participants after a BMP is installed to ensure that the practice has been adopted successfully. Success means that the BMP benefits both the participants operation and water quality.

The first step of monitoring the adoption process involves evaluating I & E activities as they occur. Such techniques include informal discussion with participants, confidential discussion, observations, and polls. The staff will use the information gathered to improve each activity.

The second step of monitoring the adoption process involves determining if the I & E objectives are being achieved. The same techniques described above can be used to evaluate the objectives.

More formal, and time-consuming ways to evaluate include phone surveys, focus groups, and examining performance records.

# Chapter 8

## Progress Measurement and Evaluation

For this Land & Water Resource Management Plan to be successful, it is imperative to regularly measure and evaluate the extent to which the goals are being achieved. It is through this process that needed adjustments or revisions in the plan goals and objectives can be made. The evaluation process includes checks on pollutant load reduction, administrative reporting, water resource monitoring, and various spot-checking.

## POLLUTANT LOAD REDUCTION

Specific rural source, sediment and phosphorus loads are identified in Chapter Four. Chapter Five discusses sediment and phosphorus reduction goals. Achieving these goals requires the installation of all applicable Best Management Practices, regardless of program. It requires close communications with cooperating agencies to accurately track the installation and associated pollutant load reduction of those particular BMPs.

The methods to be used to provide quantitative measurements of pollutant load reduction are:

**Cropland Sources –** Where and when possible sediment delivery modeling will continue to be used throughout the implementation process. In addition, the Green Lake LCD will conduct a yearly transect survey, and continue spot-checking conservation plans. The latter two are our most reliable methods to determine progress.

**Shoreline and Streambank Sources –** The Land Conservation Department tracks the extent and location of shoreline and stream bank protection projects it provides technical and financial assistance on. Detailed figures on sediment and phosphorus load reductions will be obtained from those particular projects.

**Livestock Waste Management –** The BERT model is accepted as the appropriate method for barnyard runoff systems. BERT provides a one number rating based on a single event assessing phosphorus load reductions from nutrient management practices will be recorded as actual changes in the amount of phosphorous applied. Phosphorus calculations will be tracked using spreadsheet and database programs developed by the LCD.

## MONITORING OF PLANNED ACTIVITY PROGRESS

The most measurable component of each objective will be monitored.

### Goal 1 – WORK TOWARD MEETING THE LONG TERM GOAL OF 15% OR GREATER SEDIMENT DELIVERY REDUCTION WITH THE FOLLOWING WORK PLAN OBJECTIVES FOR THE 2018-2028 PERIOD.

**Objective 1*:* Reduce rural sediment loading through further adoption of agronomic conservation practices and soil health.**

> **Method:** One-on-one contact, field days, news articles, and publications to educate landowners to the benefits of residue management, cover crops and soil health on crop production.
>
> **Evaluation:** Assessment of annual Transect Survey results and on-site status reviews.

**Objective 2: Reduce rural sediment loading through the installation of structural Best Management Practices (BMPs)**.

> **Method:** Report all conservation practice installations into a standard reporting system.
>
> **Evaluation:** Compare year to year progress and evaluate sediment and phosphorus reductions versus cost of practices installed.

**Objective 3: Reduce sediment loading from streambank and shoreline erosion.**

**Method:** Continue to inventory the remaining streams in the county and utilize the existing stream and shoreline inventory results to target highest priority sites.

**Evaluation:** Update ArcMap data to show progress and keep record of sediment and phosphorus savings into a standard reporting system.

**Objective 4: Promote and encourage implementation of conservation within the shoreland management areas.**

**Method:** Locate all high and medium qualified buffers within the county for the best utilization of the Green Lake Buffer Program funds.

**Evaluation:** Update ArcMap data to show progress and keep record of sediment and phosphorus savings into a standard reporting system.

**Objective 5: Reduce sediment loading through construction site and storm water management.**

**Method:** Develop an updated ordinance and work with Land Use Planning and Zoning department to achieve maximum enforcement.

**Evaluation:** Keep records to show number of permits and the sediment and phosphorus reductions.

**Objective 5: Rely on the partnerships between agencies and organizations and their tools.**

**Method:** Invite all individual lake groups annually to LCC meeting for updates.

**Evaluation:** Work with all lake groups to achieve their individual lake management goals.

**Goal 2 – WORK TOWARD MEETING THE LONG TERM GOAL OF 15% OR GREATER PHOSPHORUS DELIVERY REDUCTION WITH THE FOLLOWING WORK PLAN OBJECTIVES FOR THE 2018-2028 PERIOD**

**Objective 1: Reduce nitrogen and phosphorous loading through nutrient management planning and manure management BMPs.**

**Method:** Enforcement of Farmland Preservation Program nutrient management planning (NMP) requirements via annual NMP checklists and semi-annual NMP review by LCD staff. Hosting self-prescribed NMP courses annually.

**Evaluation:** Track acres via farm records to determine the total acreage under current NMP.

**Objective 2: Reduce phosphorus runoff from developed lakeshore properties.**

- **Method:** Educate citizens on the Healthy Lawn Program, phosphorus spreading, and proper leaf management through newsletter and newspaper articles.

**Evaluation:** Send out short questionnaire to evaluate changes in habits and analyze progress.

**Objective 3: Reduce phosphorous runoff from urban sources through storm water management.**

**Method:** Report the number of violations of the stormwater management ordinance and methods to obtain compliance.

**Evaluation:** Create an annual report of the number of violations. Document the impacts of the violations.

**Objective 4: Reduce legacy phosphorus from streams, lakes, and wetlands.**

**Method:** Gather information concerning legacy phosphorus amounts in impaired and exceptional streams and rivers within the county.

**Evaluation:** Analyze gathered data and explore the latest technology to remove legacy phosphorus and document results.

**Objective 5: Rely on the partnerships between agencies and organizations and their tools.**

**Method:** Invite all individual lake groups annually to LCC meeting for updates.

**Evaluation:** Assist all lake groups to achieve their individual lake management goals.

## Goal 3 – PRESERVE AND RESTORE HABITAT

**Objective 1: Maintain or increase total acres of native plantings and vegetation in upland and wetland areas.**

**Method:** Educate landowners concerning the importance of planting native vegetation along streambanks/shorelines using the Green Lake County Buffer Program and the RSVP program.

**Evaluation:** Record annual acres including total sediment and phosphorus savings.

**Objective 2: Decrease present and future fragmentation of natural habitat.**

**Method:** Attend one Land Use Planning and Zoning Committee meeting per year to speak on the importance of comprehensive planning and preventing parcel divisions.

**Evaluation:** Record meeting attendance and the impact.

**Objective 3: Protect prime farmland.**

**Method:** Promote enrollment in the Farmland Preservation Program of land in zoned townships through the media and personal visits.

**Evaluation:** Track acres via farm records to determine the total acreage under current FPP.

**Objective 4: Protect and establish in-lake habitat**

**Method:** Promote the eradication of invasive species and noxious weeds by supporting Golden Sands AIS Coordinator.

**Evaluation:** Invite Golden Sands AIS Coordinator to the LCC meeting annually to update eradication progress.

## Goal 4: PROTECT GROUNDWATER RESOURCES

**Objective 1: Protect groundwater quality.**

**Method:** Cost-share all properly abandoned wells.

**Evaluation:** Annually report the number of properly abandoned wells.

**Objective 2: Protect groundwater quantity**

**Method:** Educate landowners on irrigation water management through the media and personal visits.

**Evaluation:** Record number of contacts and results of promotion.

## ADMINISTRATIVE REPORTING

**Accomplishments –** An annual accomplishment report will be completed annually and submitted to DATCP.

**Financial reporting** (all funds under LCD responsibility) **–** The meeting will also evaluate total year-end and cumulative payments for BMP installation, total funds encumbered in project cost-share agreements under LWCD responsibility. Other funds appropriated for the implementation of the Land and Water Resource Management Plan. This includes applicable staff and other related administrative support costs. It is based on the inputs and phosphorus delivered downstream of the concentrated livestock area or buffer.

## WATER RESOURCE MONITORING

It is generally agreed that surface and lake water monitoring is needed to adequately determine the extent of progress being made toward meeting specific goals and objectives. Limited funds and a requirement for extensive staff time to properly evaluate water quality changes preclude monitoring each watershed within the County. Green Lake County will rely instead on monitoring that is currently being done. This includes the following categories: Whole Stream Monitoring, Signs of Success, and Single Source Monitoring. The WDNR, the U.S. Geological Survey-Water Division, and the University of Wisconsin have formed a team of experts to develop and direct evaluation of monitoring activities within each category.

Green Lake County will also utilize data from additional Monitoring Programs.

**Self-Help Monitoring Program –** This program gives citizens an active role in Lake Management activities and assists the WDNR with basic data collection. The Self-Help Monitoring Team consists of volunteers who collect water quality data on a regular basis to track lake health and guide Wisconsin's Lake Management Program. They collect data on phosphorus, potassium, sediment, fecal coliform, Enterococcus, macrophytes, transparency, Chlorophyll, and other lake characteristics. They also help educate lake property owners about lake ecology and water quality while building a long-term information base on a large number of Wisconsin Lakes. Green Lake, Little Green Lake, Lake Puckaway, and the Twin Lakes have Self-Help monitoring programs.

**Monitoring Stations –** The USGS has a monitoring station on the Fox River in Berlin (Hydrologic unit 04073500) and Princeton (Hydrologic unit 04073365). The GLSD has gauging stations and automatic samplers on White Creek (Hydrologic Unit 04030201), and the Inlet of Green Lake (Hydrologic Unit 04073468), and a gauging station on the outlet of Green Lake. The GLSD also performs manual random samples around Green Lake including Silver Creek (Hydrologic Unit 040734644) near Ripon.

The Upper Rock River Basin has proposed Base-Line monitoring of fisheries, insects and habitat on representative waters. They plan to monitor up to 14 sites per year, repeating each station every five years. It is the goal of both the Basin and the County that these representative water sites overlap priority areas to properly monitor resource management activities.

The WDNR has already started Base-Line monitoring in Green Lake. They measure fish assemblages and water quality in various locations every year, repeating locations every five years.

# Appendix One

## Ranking Sheet

## Green Lake County Land and Water Plan - Ranking Sheet

*October 2018*

| | |
|---|---|
| **Owner's Name** | |
| **Address** | |
| **Farm Number** | **Tract** |

**A Priority Farm/Area Strategy**

1 ***Is the Conservation Treatment Unit located***

1a EVAAL priority? (H=100 pts, M=50 pts or L=0 pts)

1b Within the Water Quality Management Area (WQMA)? 50 pts
(300 ft of a USGS delineated stream or 1000 ft of a WDNR identified lake?)

1c Within a 303d, Outstanding (ORW) or Exceptional Resource Water (ERW) Watershed? 50 pts

1d Within the Green Lake Watershed? 50 pts

**B Nutrient Management**

2 ***Nutrient Management Planning***

| | | | | |
|---|---|---|---|---|
| 2a | Planned acres within the WQMA | | x 2 pts = | 0 |
| 2b | Planned acres outside the WQMA | | x 1 pts = | 0 |

**C Soil Erosion Control Practices (based on the most recent State approved soil erosion model)**

3 ***Sheet/Rill Erosion (Average for the Conservation Treatment Unit)***

| | | | | |
|---|---|---|---|---|
| 3a | Existing Soil Loss | | tons/acre | |
| 3b | Soil Loss After (-) | | tons/acre | |
| 3c | Soil Savings | 0 | tons/ac/yr | *(transfer to lines 3d and 3e)* |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3d | 0 | Tons/Ac/Yr x | | Acres within the WQMA | 0 | x 2 pts | 0 |
| 3e | 0 | Tons/Ac/Yr x | | Acres outside the WQMA | 0 | x 1 pt | 0 |

4 ***Gully and Streambank Erosion (Average Annual Loss)***

| | | | | |
|---|---|---|---|---|
| 4a | Gully erosion within the WQMA (tons/yr) | | x 2 pts = | 0 |
| 4b | Gully erosion outside the WQMA (tons/yr) | | x 1 pt = | 0 |

**D Livestock Waste Management**

5 ***Barnyards/Feedlots***

| | | | | |
|---|---|---|---|---|
| 5a | "BERT" Score (Before) | | | |
| 5b | "BERT" Score (After) | | | |
| 5c | Barnyard Improvement Score (Subtract line 5b from 5a) | 0 | x 4pts = | 0 |

5d Implementation of planned practices will address: (5 pts each)

| | | | |
|---|---|---|---|
| 5e | Overflow of storage structures | | |
| 5f | Unconfined manure stacking within the WQMA | | |
| 5g | Direct runoff from feedlots or stored manure to waters of the state | | |
| 5h | Unlimited livestock access to the waters of the state | | |
| 5h | Diverting clean water from feedlots/barnyards within the WQMA | | |
| 5j | Abandonment of unused manure storage structures | | |

**E Ground Water Resources**

| | | | | | |
|---|---|---|---|---|---|
| 6a | Well Abandonment (25 pts/each) | | Number of wells: | | |
| 6b | Sink Hole Treatment (10 pts/each) | | Number of sink holes: | | |

**F Fish and Wildlife Resources**

7a Fish/Wildlife Habitat Improvements (20 pts)

**G Total Resource Management**

8a Will installation of practices bring farm into NR 151 compliance? (25 pts)

*Ranking sheet may be modified by LCD/LCC, contact for most recent version*

**TOTAL** 0

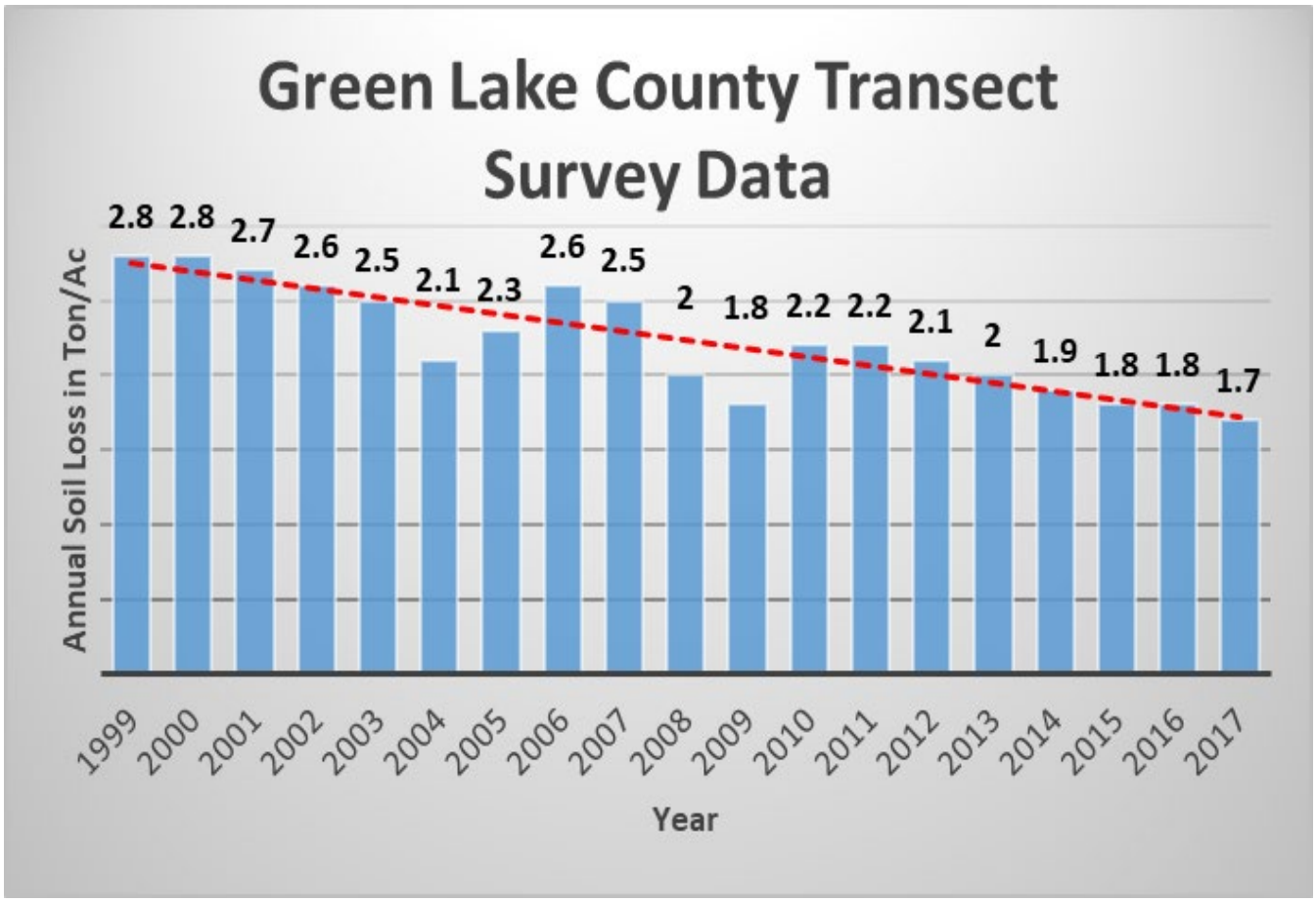
# Appendix Two

## Soil Erosion Control Plan--1988

| Township | Acres eroding above the tolerable rate |
|---|---|
| Berlin | 2,400 |
| Brooklyn | 2,200 |
| Green Lake | 4,600 |
| Kingston | 1,900 |
| Mackford | 3,100 |
| Manchester | 3,800 |
| Marquette | 1,800 |
| Princeton | 1,100 |
| Seneca | 1,000 |
| St. Marie | 1,000 |
| | 22,900 |

# Appendix Three

## Transect Survey – 1999 to 2017 Data



# Appendix Four

## Best Management Practices

**Agricultural Sediment Basins.** A structure designed to reduce the transport of sediment of other pollutants eroded from agricultural fields to surface waters and wetlands.

**Barnyard Abandonment or Relocation.** Relocation of an animal lot from a critical site such as floodway to suitable site to minimize the amount of pollutants from the lot to surface or groundwater.

**Barnyard Runoff Management.** Structural measures to redirect surface runoff around the barnyard, and collect, convey or temporarily store runoff from the barnyard.

**Buffers.** Permanently vegetated areas immediately adjacent to lakes, streams, and wetlands that filter pollutants from nonpoint sources.

**Cattle Mounds.** Cattle mounds are earthen mounds used in conjunction with feeding and dry lot operations and are intended to provide a dry and stable surface area for cattle.

**Closure of Waste Storage Facility.** Manure storage systems abandonment is the proper abandonment of leaking and improperly sited manure storage systems, including: a system with bottom at or below groundwater level; a system whose pit fills with groundwater; a system whose pit leads into the bedrock; a system which has documented reports of discharging manure into surface or groundwater due to structural failure; and a system where there is evidence of structural failure. The practice includes proper removal and disposal of wastes, liner materials, and saturated soils as well as shaping, filling, and seeding of the area.

**Contour Farming.** The farming of sloped land so that all operations from seed bed preparation to harvest are done on the contour.

**Contour Strip Cropping.** Growing alternating strips of row crops and grasses or legumes on the contour.

**Critical Area Stabilization.** The Planting of suitable vegetation on non-point source sites and other treatment necessary to stabilize eroding lands.

**Cropland Protection Cover (Green Manure).** Cropland protection covers are close-growing grasses, legumes or small grain grown for seasonal soil erosion protection and soil improvement.

**Easements.** Easements are legally binding restrictions on land titles. Easements are purchased to provide permanent vegetative cover.

**Field Diversions.** A channel constructed across the slop with a supporting ridge on the lower side, to divert excess water to safe outlets in other areas

**Grade Stabilization Structure.** A structure used to reduce the grade in a channel to protect the channel from erosion or to prevent the formation or advance of gullies.

**Grassed Waterways.** A natural or constructed channel shaped, graded and established with suitable cover as needed to prevent erosion by runoff waters.

**High Residue Management.** A system which leaves at least 30 percent of the ground covered with crop residue after crops are planted.

**Intensive Grazing Management (Rotational Grazing).** Intensive grazing management is the division of pastures into multiple cells that receive a short but intensive grazing period followed by a period of recovery of the vegetative cover. Rotational grazing systems can correct existing pasturing practices that result in degradation and should replace the practice of summer dry-lots when this practice results in water quality degradation.

**Lake Sediment Treatment.** Lake sediment treatment is a chemical, physical, or biological treatment of polluted lake sediments. Sources of pollution to the lake must be controlled prior to treatment of lake sediments. Treatment does not include dredging.

**Land Acquisition.** The purchase of land or the interest in land which is contributing or will contribute non-point pollution or for the construction of an urban structural practice.

**Livestock Exclusion from Woodlots.** The exclusion of livestock from woodlots to protect the woodlots from grazing by fencing or other means.

**Manure Storage Facility.** A structure for the storage of manure for a period of time that is need to reduce the impact of manure as a non-point source of pollution. Livestock operations where this practice applies are those where manure is winter spread on fields that have a high potential for runoff to lakes, streams and groundwater. The facility is needed to store and properly spread manure according to a management plan.

**Milking Center Waste Control System.** A milking center waste control system is a piece of equipment, practice or combination of practices installed in a milking center for purposes of reducing the quantity or pollution potential of the wastes.

**Nutrient Management.** The management and crediting of nutrients from all sources, including legumes, manure, and soil reserves for the application of manure and commercial fertilizers. Management includes the rate, method and timing of the application of all sources of nutrients to minimize the amount of nutrients entering surface and groundwater. This practice includes manure nutrient testing, routine soil testing, and residual nitrogen soil testing.

**Pesticide Management.** The management of the handling, disposal and application of pesticides including the rate, method and timing of application to minimize the amount of pesticides entering surface and groundwater. This practice includes integrated pest management scouting and planning.

**Roofs for Barnyard Runoff Management and Manure Storage Facilities.** Roofs for barnyard runoff management and manure storage facilities are a roof and supporting structure constructed specifically to prevent rain and snow from contacting manure.

**Shoreline and Streambank Stabilization.** The stabilization and protection of stream and lake banks against erosion and the protection of fish habitat and water quality from livestock access.

**Shoreline Buffers.** A permanently vegetated area immediately adjacent to lakes, streams, channels and wetlands designed and constructed to manage critical non-point sources or to filter pollutants from non-point sources.

**Structural Urban Best Management Practices.** These practices are source area measures, transport systems and end-of-pipe measures designed to control storm water runoff rates, volumes and discharge quality. These practices will reduce the amount of pollutants carried in runoff and flows destructive to stream habitat. These measures include such practices as infiltration trenches, porous pavement, oil water separators, sediment chambers, sand filtration units, grassed swales, infiltration basins and detention/retention basins.

**Terraces.** A system of ridges and channels with suitable spacing and constructed on the contour with a suitable grade to prevent erosion in the channel.

**Wetland Restoration.** The construction of berms or destruction of the function of tile lines or drainage ditches to create conditions suitable for wetland vegetation.

# Appendix Five

## Rare Species and High-Quality Natural Communities in Green Lake

**References made to:** Wisconsin Natural Heritage Inventory-1996, and A vascular flora of Green Lake County, Wisconsin - T. Eddy, 1996, and Wisconsin Endangered and Threatened Species-1999 on the WDNR web site

**Additional resources include:** Thomas R. Schultz's observations, Dr. Eric Ratering's observations, Thomas L. Eddy's observations.

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ENDANGERED**:** Continued existence in Wisconsin is in jeopardy.
THREATENED**:** Appears likely, within the foreseeable future, to become endangered.
SPECIAL CONCERN**:** Species for which some problem of abundance or distribution is suspected by not yet proven.

## ANIMALS

ENDANGERED

- Forester's Tern *(Sterna forsteri)* 1994
- Red-Necked Grebe *(Podiceps grisegena)*
- Western Slender Glass Lizard *(Ophisaurus attenuatus attenuatus)**
- Powesheik Skipperling *(Oarisma powesheik)*
- Queen Snake *(Regina septembittatta)* 1978
- Caspian Tern *(Sterna caspia)* 1990
- Blanchard's Cricket Frog *(Acris crepitans blanchardi)* 1919

THREATENED

- Acadian Flycatcher *(Empidonax virescens)* 1988
- Bell's Vireo *(Bireo belli)* 1979
- Cerulean Warbler *(Dendroica cerulea)* 1988*
- Great Egret *(Casmerodius albus)*
- Greater Prairie-Chicken *(Tympanuchus cupido)* 1981
- Osprey *(pandion haliaetus)* 1981
- Red-Shouldered Hawk *(Buteo lineatus)* 1983
- Blanding's Turtle *(Emydoldea blandingii)* 1981*

SPECIAL CONCERN

- Black-Crowned Night-Heron *(Nycticorax nycticorax)* 1988
- Merlin *(Falco columbarius)* 1915
- Broad-Winged Skipper *(Poanes viator)*
- Karner Blue Butterfly *(Lycaeides melissa samuelis)* 1993**
- Two-Spotted Skipper *(Euphyes bimacula)*
- Lake Chubsucker *(Erimyzon sucetta)*
- Lake Herring (*Coregonus artedi)* 1909
- Lake Sturgeon *(Acipenser fulvercens)* 1991*
- Least Darter *(Etheostoma microperca)* 1925
- Redside Dace *(Clinostomus elongatus)* 1928
- Weed Shiner *(Notropis texanus)* 1925
- Black Tern (*Chlidonias niger)* 1990
- Western Grebe *(Aechmophorus occidentalis)* 1990
- Common Moorhen *(Gallinula chloropus)* 1990
- Least Bittern *(Ixobrychus exilis)* 199

## PLANTS

ENDANGERED

Soft-Leaf Muhly *(Muhlenbergia richardsonis)* 1989
Lake-Cress *(Armoracia lacustis)* 1921*

THREATENED

Brittle Prickly-Pear *(Opuntia fragilis)* 1990
Pale Green Orchid *(Platanthera flava var herbiola)* 1980
Prairie Parsley *(Polytaenia nuttallil)* 1986
Small White Lady's-Slipper *(Cypripedium candidum)* 1986
Sticky False-Asphodel *(Tofieldia glutinosa)* 1986
Tussock Bulrush *(Scirpus cespitosus var callosus)* 1986
Wooly Milkweed *(Asciepias lanuginosa)* 1986 ***

SPECIAL CONCERN

Common Bog Arrow-Grass *(Triglochin maritimum)* 1986
Downy Willow-Herb *(Epilobium strictum)* 1975 ***
Lesser Fringed Gentian *(Gentianopsis procera)* 1986
Low Nutrush *(Scleria verticillata)* 1989
Virginia Meadow-Beauty *(Rhexia virginica)* 1932
Robbins Spikerush *(Elocharis robbinsii)* 1984 ***
Slender Bog Arrow-Grass (*Triglochin palustre)* 1986
Whip Nutrush *(Scleria triglomerata)* 1980
Slim-Stem Small-Reedgrass *(Calamagrostis stricta)*
Pale Beardtongue *(Penstemon pallidus)*

## NATURAL COMMUNITIES

Springs and Spring Runs, Hard 1979
Wet-Mesic Prairie 1986
Calcareous Fen 1990
Wet Prairie 1986
Emergent Aquatic 1981
Southern Sedge Meadow 1988
Floodplain Forest 1979
Shrub-Carr 1979
Tamarack Fen 1979
Southern Dry Forest 1981
Dry Prairie 1978
Shaded Cliff 1976
Bedrock Glade 1990
Mesic Prairie 1979
Northern Dry-Mesic Forest 1979

* Indicates: a candidate for federal listing.
** Indicates: Federally Endangered or Threatened.
*** Indicates: no known species vouchers in Green Lake County.

The date following the species and natural community names notes the most recent year the occurrence was recorded by the Wisconsin Natural Heritage Inventory

# Appendix Six

## Land & Water Funds Appropriated

DATCP cost-share for the installation of Best Management Practices has been awarded to Green Lake County since 2000. The amount of funding over these years has varied. Below is a breakdown of how the funding has been awarded according to the four priority categories as listed on page 55 of this plan.

| | **Cropland Erosion 50%** | **Livestock Waste Mgt Facilities 35%** | **Streambank/ Shoreline Erosion 10%** | **Well Abandonment 5%** |
|---|---|---|---|---|
| 2011 | 73% | 3% | 22% | 2% |
| 2012 | 61% | 22% | 14% | 3% |
| 2013 | 42% | 54% | 3% | 1% |
| 2014 | 79% | 19% | 0% | 2% |
| 2015 | 30% | 25% | 44% | 1% |
| 2016 | 61% | 9% | 26% | 4% |
| 2017 | 76% | 5% | 13% | 5% |

Land & Water funds of $676,990 were paid to county landowners from 2000 – 2010. Below is the breakdown by watershed of where payments were made.

| Watershed | | |
|---|---|---|
| Beaver Dam River | $1,483 | 0.4 % |
| Big Green Lake | $167,630 | 42.6 % |
| Buffalo & Puckaway Lakes | $0 | 0.0 % |
| Fox River - Berlin | $57,038 | 14.5 % |
| Fox River - Rush Lake | $0 | 0.0 % |
| Lower Grand River | $62,921 | 16.0 % |
| Mecan River | $0 | 0.0 % |
| Swan Lake | $7,127 | 1.8 % |
| Upper Grand River | $82,015 | 20.9 % |
| Upper Rock River | $13,460 | 3.4 % |
| White River | $1,540 | 0.4 % |
| Total | $393,214 | 100.0 % |

# Appendix Seven

## Public Hearing Notification

A public hearing was held on July 26, 2018. A Class II public hearing notice was posted in the Berlin Journal Newspapers. No public comments were given at the hearing.

### PUBLIC HEARING NOTICE

PLEASE TAKE NOTICE that pursuant to 92.10(6)(c) Wis. Stats. The Green Lake County Land Conservation Committee will hold a public hearing on the proposed revision of the 2018 Green Lake County Land and Water Resource Management Plan.

PLEASE be further advised that this public hearing will be held at 9:00 AM on Thursday, July 26th, 2018 in the UW Extension Training Room #0914, in the Green Lake County Government Center, 571 County Road A, Green Lake, WI 54941.

Prior to the public hearing, a draft of the proposed 2018 Land and Water Resource Management Plan revision may be viewed at the office of Land and Water Conservation or online at http://www.co.green-lake.wi.us under the Land Conservation Department tab.

All interested persons wishing to be heard at the public hearing are invited to attend. Written comments will be accepted by the LCC Committee until 4:30 PM on July 25th, 2018. Comments can be emailed to lcd@co.green-lake.wi.us or mailed to the Green Lake County Land Conservation Department, 571 County Road A, Green Lake, WI 54941.

Paul Gunderson, County Conservationist

*Publish: July 19 and 26, 2018*

# Appendix Eight

## County Board Approval

**RESOLUTION NUMBER 42-2018**

**RESOLUTION RELATING TO 2018 LAND AND WATER RESOURCE MANAGEMENT PLAN APPROVAL**

The County Board of Supervisors of Green Lake County, Green Lake, Wisconsin, duly assembled at its regular meeting begun on the 18th day of December, 2018, does resolve as follows:

**WHEREAS,** under s. 92.10(6), Wis., Stats. counties are required to prepare a county land and water resource management plan; and,

**WHEREAS,** this comprehensive plan is an analysis of land and water resource issues and needs within the county; and,

**WHEREAS,** this plan integrates all of the various land and water conservation programs administered by the Green Lake County Land Conservation Department; and,

**WHEREAS,** an official public hearing was conducted on July 26th, 2018; and,

**WHEREAS,** pertinent public comments have been incorporated into the plan; and,

**WHEREAS,** this plan was presented to the Wisconsin Land and Water Conservation Board and approved on October 2nd, 2018;

**NOW THEREFORE BE IT RESOLVED** by the Board of Supervisors of Green Lake County that the 2018 Green Lake County Land and Water Resource Management Plan be adopted and approved for implementation.

Fiscal note: no fiscal impact to the County

Majority vote is needed to pass.

Roll Call on Resolution No. 42-2018

Ayes 17, Nays 0, Absent 2, Abstain 0

Passed and ~~Adopted~~/~~Rejected~~ this 18th day of December, 2018.

County Board Chairman

ATTEST: County Clerk

Approve as to Form:

Corporation Counsel

Submitted by Land Conservation Committee:

Robert Schweder, Chair

Katie Mehn

Patti Garro

Bill Boutwell

Arnold Dahlke, FSA Representative

# Appendix Nine

## DATCP Approval

STATE OF WISCONSIN
DEPARTMENT OF AGRICULTURE TRADE AND CONSUMER PROTECTION
2811 Agriculture Drive, P.O. Box 8911
Madison, WI 53708-8911

| | |
|---|---|
| IN THE MATTER OF THE COUNTY LAND AND WATER RESOURCE MANAGEMENT PLAN FOR GREEN LAKE COUNTY REVIEW IN 2023 | LWCB DOCKET NO. 047-00000-L-18-A-1018 ORDER APPROVING THE REVISED PLAN THROUGH DECEMBER 31, 2028, CONTINGENT ON LWCB |

INTRODUCTION

The State of Wisconsin Department of Agriculture, Trade and Consumer Protection ("department"), having consulted the State of Wisconsin Land and Water Conservation Board ("LWCB"), makes the following findings of fact and conclusions of law and enters the following order under s. 92.10(4), Wis. Stats.

FINDINGS OF FACT

(1) Paragraphs (1) through (7) from the "Findings of Fact" in the August 25, 2011 Order approving the revised plan through December 31, 2015, *In the Matter of the County Land and Water Resource Management Plan for Green Lake County,* LWCB Docket No. 11- 17-24-000-L-1, are incorporated by reference as if fully set forth herein. A copy of the Order is on file at the Land and Water Resource Bureau of the Wisconsin Department of Agriculture, Trade and Consumer Protection at 2811 Agriculture Drive, Madison, WI 53708-8911.

(2) On August 25, 2011, the department approved the Green Lake County land and water resource management ("LWRM") plan until December 31, 2015, as more fully described in Docket No. 11-17-24-000-L-1.

(3) On April 30, 2015, upon the LWCB's recommendation, the department extended the approval of the Green Lake County LWRM plan through December 31, 2018, as more fully described in Docket No. 047-00000-L-15-E-0415.

(4) On June 25, 2018, Green Lake County submitted its revised LWRM plan for LWCB and department review, and requested department approval of its revised plan through December 31, 2028.

(5) The revised LWRM plan referenced in Finding of Fact (4) ("revised LWRM plan") meets the requirements ins. 92.10(6), Wis. Stats., and ss. ATCP 50.12 and ATCP 50.30(3), Wis. Admin. Code, as documented in the plan approval checklist prepared by the department.

(6) The LWCB adopted additional criteria for recommending the approval of a LWRM plan for a ten year period and for the LWCB's five-year review of a LWRM plan approved for 10 years. The applicable criteria are set forth in a guidance available on the DATCP LWRM plan webpage.

(7) On October 2, 2018, upon finding that Green Lake County met all criteria for a ten year plan approval, the LWCB recommended the approval of the revised LWRM plan through December 31, 2028, contingent on Green Lake County submitting to a five-year review by the LWCB in 2023.

(8) On December 18, 2018, the Green Lake County Board approved the revised Green Lake County LWRM plan.

CONCLUSIONS OF LAW

(1) The department, working in consultation with the LWCB, may approve a LWRM plan for a period not to exceed ten years, in accordance with s. ATCP 50.12(5) Wis. Admin. Code.

(2) In order to be approved by the department, a county land and water resource management plan must comply with the standards specified under s. 92.10, Wis. Stats.

(3) The revised Green Lake County LWRM plan complies with. 92.10(6), Wis. Stats., and ss. ATCP 50.12 and ATCP 50.30(3), Wis. Admin. Code and may be approved by the department.

(4) The LWCB recommended approval of the revised LWRM plan for a ten year period after finding that the revised LWRM plan meets applicable criteria.

(5) Based on Findings of Fact (1) through (8) above, the department should issue an order approving the revised LWRM plan for a term ending December 31, 2028, subject to the LWCB review specified in Finding of Fact (7).

ORDER

NOW, THEREFORE, IT IS ORDERED that:

1) Pursuant to s. 92.10, Wis. Stats., the revised Green Lake County LWRM plan is approved through December 31, 2028.

2) This order is contingent on a LWCB review in 2023, in which the county must meet the LWCB requirements as established in the most current LWCB guidance, for the five-year review of a LWRM plan approved for ten years.

3) If the department receives a finding from the LWCB that Green Lake County has failed to meet the LWCB guidance, this order is automatically modified to approve the plan only through December 31, 2023. The county will be notified of this modification and is responsible for submitting a revised land and water resource management plan for department approval to continue its eligibility for department grant funding.

4) As a condition of this plan approval, Green Lake County must file with the department an annual work plan that describes planned activities and includes benchmarks for priority activities. Green Lake County may remain in compliance with this requirement by updating its work plan by no later than April 15th of each year during the period of the plan approval specified in this Order.

Dated this 20th day of December, 2018

STATE OF WISCONSIN
DEPARTMENT OF AGRICULTURE, TRADE
AND CONSUMER PROTECTION

By Sheila Harsdorf
Sheila E. Harsdorf, Secretary

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# BIBLIOGRAPHY


Arc News, 1999, User Conference, Vol. 21 No. 2.

Ball, J. 1982, Wisconsin Department of Natural Resources: Madison, Wisconsin, Stream Classification Guidelines for Wisconsin.

Bluemke, John C., May 1983, Green Lake County Farmland Preservation Plan.

Bumby, Mary Jane, 1992, The 114 Sq. Mile Watershed of Big Green Lake, Wisconsin.

Burbach, David, 1999, Water Quality Protocol for Physical and Chemical Testing of Upper Grand River Project.

Eddy, Thomas L., October 1999, On the Trail of the Snake Creek

Fassbender, Ronald L., and Linden M. Nelson, 1970, A Selected bibliography of the Fox River and Connected Lakes.

Green Lake Association, Delta Institute, February 2016, Green Lake Agricultural Stewardship Program

Green Lake County Land Conservation Committee and Development Guide Citizen's Advisory Committee, April 1997, Lake Management and Land Use Survey Results.

Green Lake County Land Conservation Department, August 2015, Green Lake County Animal Waste Management Ordinance – Chapter 275, Wisc. Stats. 92

Green Lake County Land Conservation Department, 1992, Green Lake County Conservation Standards for Farmland Preservation, Wisc. Stats. 92.105 and 71.09(11).

Green Lake County Land Conservation Department, April 2017, Green Lake County Department of Land Conservation 2017 Annual Report.

Green Lake County Land Conservation Department, 1985, Green Lake County Soil Erosion Control Plan.

Green Lake County Land Conservation Department, May 1999, Green Lake County Storm Water Management and Erosion Control Ordinance – Chapter 284, Wisc. Stats. 59.69.

Green Lake Sanitary District, January 2013, A Lake Management Plan for Green Lake

Green Lake Sanitary District, Donohue & Associates, 1978, A Plan for the Protection of Big Green Lake.

Green Lake County Soil and Water Conservation District, 1976, Resources Conservation Program.

Green Lake County Land Use Planning and Zoning Department, February 2016, Green Lake County Comprehensive Plan,

Green Lake County Land Use Planning and Zoning Department, February 2016, Green Lake County Farmland Preservation Plan,

Green Lake County Land Use and Zoning Department, September 2016, Green Lake County Shoreland Protection Ordinance - Chapter 338.

Fox-Wolf Basin Nonpoint Source Pollution Abatement Initiative, 1998.

High Performance Systems Inc., 1997, Stella Software.

Lake Puckaway Protection & Rehabilitation District, September 2017, Lake Puckaway Comprehensive Lake Management Plan.

State of Wisconsin, 1997-98, Farmland Preservation, Chapter 91.

State of Wisconsin, 1995-96, Soils and Water Conservation and Animal Waste Management, Chapter 92.

Titus, William A. 1930, History of the Fox River Valley, Lake Winnebago, and the Green Bay Region.

Tuller, Stu, July 1999, Nonpoint Source News-Notes, EPA Urges States to Upgrade NPS Programs, p 4-5.

United States Department of Agriculture Soil Conservation Service, September 1977, Soil Survey of Green Lake County, Wisconsin.

UW Extension Office, Green Lake County Property & Insurance Committee, December 2014, Green Lake County Parks and Recreation Plan

University of Wisconsin-Green Bay, Fall1997, Upper Fox River Basin: An Analysis of Demographics Composition, Public Goods and Natural Resources.

Upper Fox River Partners, December 1998, Upper Fox River Basin Mediated Modeling Project.

U.S. Army Corps of Engineers—Detroit District, May 1999, Fox/Wolf River Basin Interest Group.

U.S. Army Corps of Engineers—Detroit District, May 1999, Continuing Authorities Program.

Water Quality Topic Development Team, 1999, TMDL Fact Sheet.

Wisconsin Farm Bureau, 1999, Farm Bureau Programs, Services, and Representation.

Wisconsin Department of Natural Resources, 1996, Upper Fox River Water Quality Management Plan.

Wisconsin Department of Natural Resources, Fix, Steven M and Lloyd Lewis Eagan, 1990, Upper Fox River Water Quality Management Plan.

Wisconsin Department of Natural Resources, December 1995, Upper Rock River Basin Water Quality Management Plan.

Wisconsin Department of Natural Resources, April 2002, The State of the Rock River Basin publication #WT-668-2002.

Wisconsin Department of Natural Resources, October 2001, The State of the Upper Fox River Basin publication #WT-665-2001.

Wisconsin Department of Natural Resources, 1994, Wisconsin Water Quality Assessment Report to Congress.

Wisconsin Department of Agriculture, Trade & Consumer Protection, 2012, Wisconsin Agricultural Statistics.

Wisconsin Department of Natural Resources—Kroner, Ron, Joe Ball, and Mike Miller, September 1992, Big Green Lake Priority Watershed Project, WR-312-92.

Wisconsin Department of Natural Resources, July 1987, Lower Green Bay Remedial Action Plan.

Wisconsin Department of Natural Resources, September 1993, Lower Green Bay Remedial Action Plan 1993 Update.

Wisconsin Department of Natural Resources, July 1994, Nonpoint Source Control Plan for the Beaver Dam River Priority Watershed Project.

Wisconsin Department of Natural Resources—Panuska, John, July 1999, Lake Water Quality Model Study for Big Green Lake, Green Lake Co., Wisconsin.

Wisconsin Department of Natural Resources, 1971,Surface Water Resources of Green Lake County.

Wisconsin Department of Natural Resources—Water Division, January 1999, 303d Waters & Outstanding and Exceptional Resource Waters in Wisconsin