Morrison County

Five Year Focus Plan

Comprehensive Local Water Plan

One Plan- Five Watersheds

2017-2022

"Managing, Protecting, and Enhancing the Water and Land Resources for the use and enjoyment of the citizens and visitors of Morrison County"

ACKNOWLEDGMENTS

2017 Water Plan Update
Morrison County, Minnesota

Prepared by the Morrison Soil and Water Conservation District with the direction and assistance of the Morrison County Water Planning Task Force.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Morrison Soil and Water Conservation District (SWCD) assumed the task of the local water plan update in April of 2009. A ten year plan was approved by MN Board of Water and Soil Resources (BWSR) in 2010 with an update due in 2015. However, due to workload and the action by the County to conduct and develop an updated Comprehensive Land Use Plan (Comp Plan), a request was made for a 2 year extension. The BWSR Board approved the extension in October of 2015.

In the five year period since the 2010 plan was approved, BWSR began encouraging One Watershed One Plan (1W1P) to be the new operational guideline. Application for a pilot plan was not approved in 2014 but it is recognized that watershed planning is the new norm and the SWCD has already been actively involved in multiple watershed planning efforts. However, Morrison County has five major watersheds, not one, and each of those five watersheds have Watershed Restoration and Protection Strategies (WRAPS) plans either completed, or in the process so this updated plan will focus strategies and objectives by watershed, within the jurisdiction of Morrison County.

In addition, in 2015 the County was mandated to develop an Aquatic Invasive Species Plan (AIS), and that will be addressed under Surface Waters and added as a reference of this update.

A survey has been distributed in the local newspaper, to all lake associations, at multiple civic meetings, to all township officials, and is available on our website. Response to the survey has been moderately active. The priority concerns to be addressed in the implementation of this plan remain as:

- Protect the quality and manage the quantity of groundwater resources
- Protect the quality and manage the quantity of surface water resources
- Promote and implement sound land use practices that reduce the impacts on all water resources

It is important to the Morrison County Board of Commissioners, the Morrison County Land Services Department, and to Morrison SWCD that the Morrison County Comprehensive Land Use Plan and the Morrison County Local Water Plan (LWP) be simultaneously written to be supporting documents in land use decision making. In addition, when compatible, it clearly defines the focus and goals of the protection of lakes, rivers, streams, and wetlands as well as ground water for the safety of our citizens.

Since the approval of the 2010 LWP, several other plans have become available as resources when making sound land use decisions. Those plans are identified in the body of this document but include any and all Total Maximum Daily Load (TMDL) and Watershed Restoration and Protection Strategy (WRAPS) completed and approved for the five watersheds. Wellhead Protection Plans (WHP) and Drinking Water Supply Management Area (DWSMA) plans are also available for required communities. Continued training with all local units of government and their appointed boards and commissions is vital in learning to use available resources in their decision making process. When doing so, a scientific approach will balance the outcomes.

It will be the focus of this plan to provide guidance and coordination to all resource protection efforts as well as a format for sharing the information to the public. Furthermore, it is the purpose of this

plan, and the Morrison SWCD, to act as a vehicle to bring the partners together regularly, to plan, report, and take actions to meet the goals and objectives outlined in this plan.

Since the Local Water Plan (LWP) by resolution can be the District's Comprehensive Plan, it now truly encompasses the SWCD goals as well as the goals of comprehensive water planning.

The task force felt strongly about the need to identify and protect the water bodies that are not "impaired" and therefore give as much or more emphasis to protection as well as restoration.

Since the last generation plan, there has been a greater focus and data collected on the ground water, both in quantity and quality. Greater information is available on the Department of Natural Resources (DNR) and Minnesota Pollution Control Agency (MPCA) websites that now connects groundwater levels to surface water. This update will express an equal emphasis on groundwater as well as surface water protection.

Based on the public feedback, agency comments, and current priorities, the 5-year overall goals and costs of this plan are:

- Protect and provide high quality groundwater resources for the citizens and visitors of Morrison County. Total projected cost of implementation--$1,005,000.00
- Preserve and ensure adequate quantity of the groundwater resources for the citizens and visitors of Morrison County. Total projected cost of implementation $100,000.00
- Protect, enhance, and maintain the quality of all surface waters in Morrison County (lakes, rivers, streams, and wetlands). Total projected cost of implementation--$2,325,000.00
- Ensure that land use decisions are compatible with natural resource protection. Total projected cost of implementation--$6,725,000.00

BACKGROUND AND PURPOSE OF LOCAL WATER PLANNING

Water management in Minnesota developed as a result of the statewide drought in the late 1970s which caused the legislature to encourage more effort at the local level to develop and implement local water management plans to better preserve and protect water and related land resources. County water planning efforts began in earnest in the late 1980s as state funding assisted local units of government in developing their water plans. Water planning developed under the legislative authority and mandate of the Comprehensive Local Water Management Act (Minnesota Statutes, Chapter 103B). The purpose of Local Water Planning, by statute, is:

- To identify existing and potential problems and opportunities for the protection, management, and development of water and related land resources; and
- Develop objectives and carry out a plan of action to promote sound hydrologic management of water and related land resources, effective environmental protection and efficient management.

BWSR has oversight responsibilities to ensure that local water plans are prepared and coordinated with existing local and state efforts and that plans are implemented effectively. All parts of Minnesota have state-approved and locally adopted plans in place. These local plans focus on priority concerns, defined goals and objectives, and measurable outcomes. BWSR provides financial assistance to Local Governmental Units (LGUs) through the Natural Resources Block Grant (NRBG).

WATER PLANNING HISTORY IN MORRISON COUNTY

The first or "original" Morrison County Comprehensive Local Water Plan was completed and adopted in 1995. Implementation of the plan began immediately. Under the second and third plans we began collaborating and doing some pilot projects that have now become standard practice.

The 4th generation plan was an effort to co-write the County Comprehensive Land Use Plan and marry it with the Local Water Plan. While great in length and substance, it was almost too large to reference when needed and two consultants were used and therefore, continuity didn't actually follow. Due to staff changes and loss of history with existing staff at the county, the request was made to the SWCD to re-write the 5th generation plan and take over administration.

The fifth plan, while shorter in length attempted to capture our multi-year accomplishments and detail the goals yet to be achieved and/or continued. It was the first time the plan began being actively used by the county board, Board of Adjustment (BOA), and Planning Commission (PC) in all land use decisions.

This sixth generation update will focus on concerns raised in the past six years and substantiate how each watershed drives some common goals and some unique concerns but collaborates with the longer range Minnesota Pollution Control Agency (MPCA) and watershed planning efforts.

It is an ambitious goal to attempt to get all other units of government to give the plan the same focus as the Morrison County governmental officials. While the Morrison County Local Water Plan has been formally adopted by each municipality in the county, it is not known whether they actively adhere to the goals and objectives of the plan. If not approved, they are required to write their own, and as yet, no municipality has chosen to do so. However, many municipalities have now completed their Drinking Water Supply Management Plans (DWSMA) and Wellhead Protection (WHP) plans mandated by Minnesota Department of Health (MDH). Consideration for those plans implementation and land use decisions within those boundaries will be included in this update.

The most recent plan (2010-2020) was a comprehensive planning initiative to coordinate the County Comprehensive Land Use Plan with the Local Water Plan to make sure land use decisions led to the protection and enhancement of Morrison County's natural resources. The County Board of Commissioners, Planning Commission, and the Board of Adjustment use both documents as a guidance in land use decision making.

While this document is officially an update, so many changes have occurred since 2010 that many of the objectives are more directive and the watershed concept is driving how we do business. Watershed planning is not unique to this county. We've been cooperating and working together with adjacent counties for over 20 years on different watersheds. Still from a working function, each county delivers the goals within their boundaries purely to administer in a timely and efficient manner.

COUNTY BASICS:

Morrison County has an area of 737,783 acres. Approximately 202,000 acres (27.4%) are forested, 198,500 acres (26.9%) are pasture and grasslands, 150,300 acres (20.4%) are row crop agriculture, 122,100 acres (16.5%) are wetlands, 19,700 acres (2.7%) are open water, and 45,200 (6.1%) are urban and other uses.

The scope of this plan is the entire area of Morrison County, which includes 16 cities and 30 townships, and 53,000 acres of military base (Camp Ripley).

From 2000 to 2010 the population in Morrison County increased by 4.7%, the 34th fastest growing county of Minnesota's 87 counties. Much of this growth was concentrated in the cities of Royalton, Pierz, and Randall, with Bellevue, Little Falls, and Agram Townships also showing two figure increases. The following maps shows the breakdown of Cities/Townships and population increases by minor watershed:

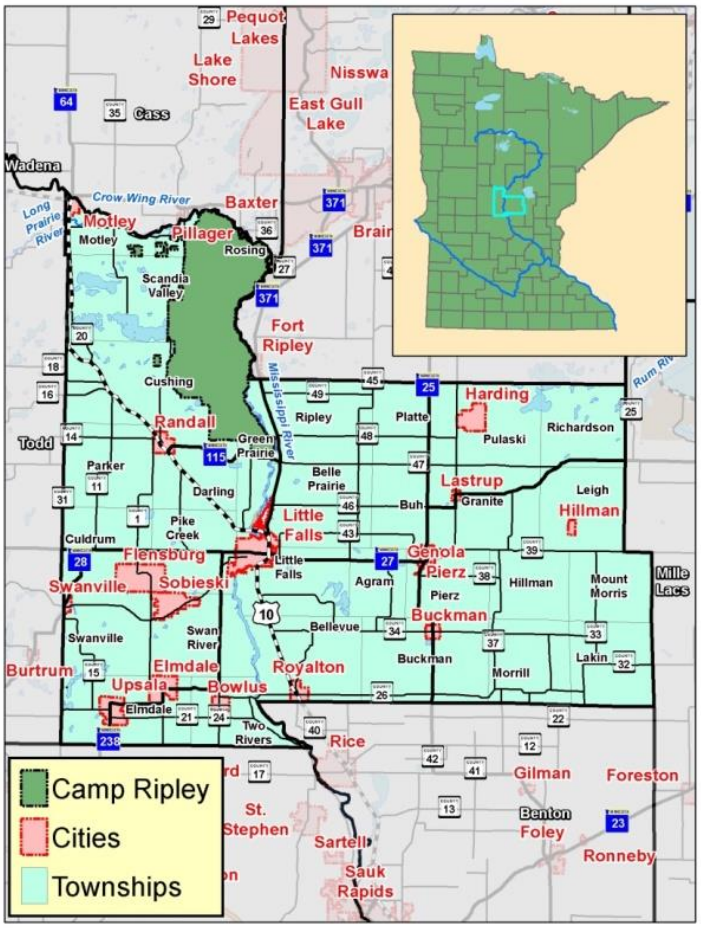


Figure 1 - Morrison County Cities and Townships Map

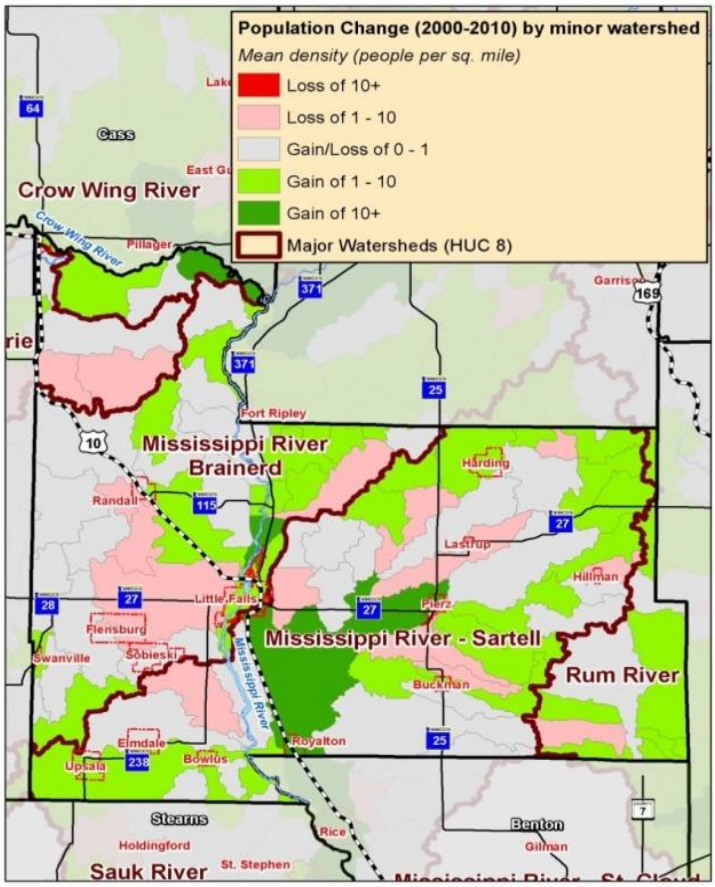


Figure 2 - 2000-2010 Morrison County Population Change by Minor Watershed Map

EVALUATION OF PAST PLAN EFFORTS AND PARTNER UPDATES

While prior to 2010 the water planning efforts of the county ebbed and waned, in the six years hence, the County and SWCD have made every effort to have the plan drive workload and land use decisions. An 8 county training session was held by five different watershed teams to teach land use decision makers how to use LWPs, WRAPS, and TMDL plans, and other scientifically based plans as a tool to make better land use decisions. Over 130 people attended the October 2015 training session and feedback was very positive. This training effort was a cooperative goal organized through the 8 county watershed planning teams.

Other accomplishments and/or factors have resulted from water planning in the past six years include:

- **Aquatic Invasive Species Planning (AIS):** Funding was appropriated to each county to conduct an analysis and put forth a plan on how to deal with Aquatic Invasive Species (AIS). Morrison County has experienced limited invasive species, but there is Eurasian Milfoil in Lake Alexander and Fish Trap Lake has now been identified with Zebra mussels. The Mississippi River's chemical analysis is underway, but DNR reports finding of Zebra mussels from the mouth of Pine River to Upper St. Anthony Falls and tributaries within the reach. The plan primarily focuses on education and working with lake associations and public landings for proper signage and warnings of prevention of spreading. See referenced Morrison AIS plan. The Lake Improvement Districts (LIDs) are in the process of amending their plans and seeking additional funding assistance to control invasive species. A station was added to the annual 6th grade Water Festival showing how easily Zebra mussels can attach to boats and docks. Students were also instructed on other emerging issues now known and the importance of AIS. At this time, decontamination units are not planned. The County (Land Services Department) is working closely with the LIDs and Lake Associations (LAs) and is part of a multi-county media blitz to raise awareness.

- **Lake Improvement Districts (LIDs):** Five lakes have now been approved by the County to form LIDs. (Lake Alexander, Sullivan Lake, Fish Trap Lake, Crookneck Lake, and the newest Lake Shamineau). The LIDs primary focus is to monitor and reduce aquatic invasive species in their lakes and to conduct individual septic system inspections. Curly-leaf pond weed control and Eurasian watermilfoil has been monitored by the DNR. Lake Alexander LID is also monitoring Eurasian watermilfoil. Lake Shamineau LID is conducting extensive studies to determine if water levels can be controlled in any effective manner. The LIDs annual plans and efforts will be monitored by the County and DNR to assure the taxation is appropriate and that activities match their plans. They will be encouraged to expand their scope of work as time and funding progress and as new stressors are identified. Fish Trap Lake has had the presence of Zebra mussels identified in 2015 so the spread will be of concern. Several of the associations conduct clarity monitoring on their own but all are becoming very active in land use decisions and their possible impacts. (*LID plans are available at the Morrison SWCD office, the Morrison County Auditor's office, or on line at each LIDs website*)

- **Feedlot Program:** Natural Resource Conservation Service (NRCS) and the SWCD continue to assist feedlot producers to assure their compliance. Where the SWCD can only assist pollution sites, NRCS can be more expansive. The Minnesota Department of Agriculture (MDA) AgBMP loan program is available for water quality projects and pollution abatement with over $750,000 dollars in a revolving loan fund administered by the SWCD. This loan fund is not exclusive to

agricultural producers and is also available for minimum tillage, well replacements when found to be contaminated, septic upgrades or replacement, and other water quality practices. Nutrient management is still incorporated in all federally or state assisted feedlot abatements. When the county processes applications for feedlot expansions or new feedlots, an Environmental Review is required to be conducted by the SWCD. Nutrient management plans are also required before approval and conditions set that are site specific to assure compliance.

- **Feedlot Registration Update:** The Morrison County Land Services Department completed a feedlot registration update in 2014. There are currently 618 registered feedlots with more than 50 animal units in non-shore land areas or 10 animal units in shore land areas. The County is currently targeting feedlots that have never been formally inspected and feedlots located within the MDA priority townships for elevated nitrates. Since 2011, a total of 42 feedlots have completed an environmental fix and returned to compliance with water quality discharge standards. Pollution abatements from feedlots are one of the most expensive practices and therefore the SWCD/NRCS diligently seek funding to assist the producers in meeting their compliance issues.

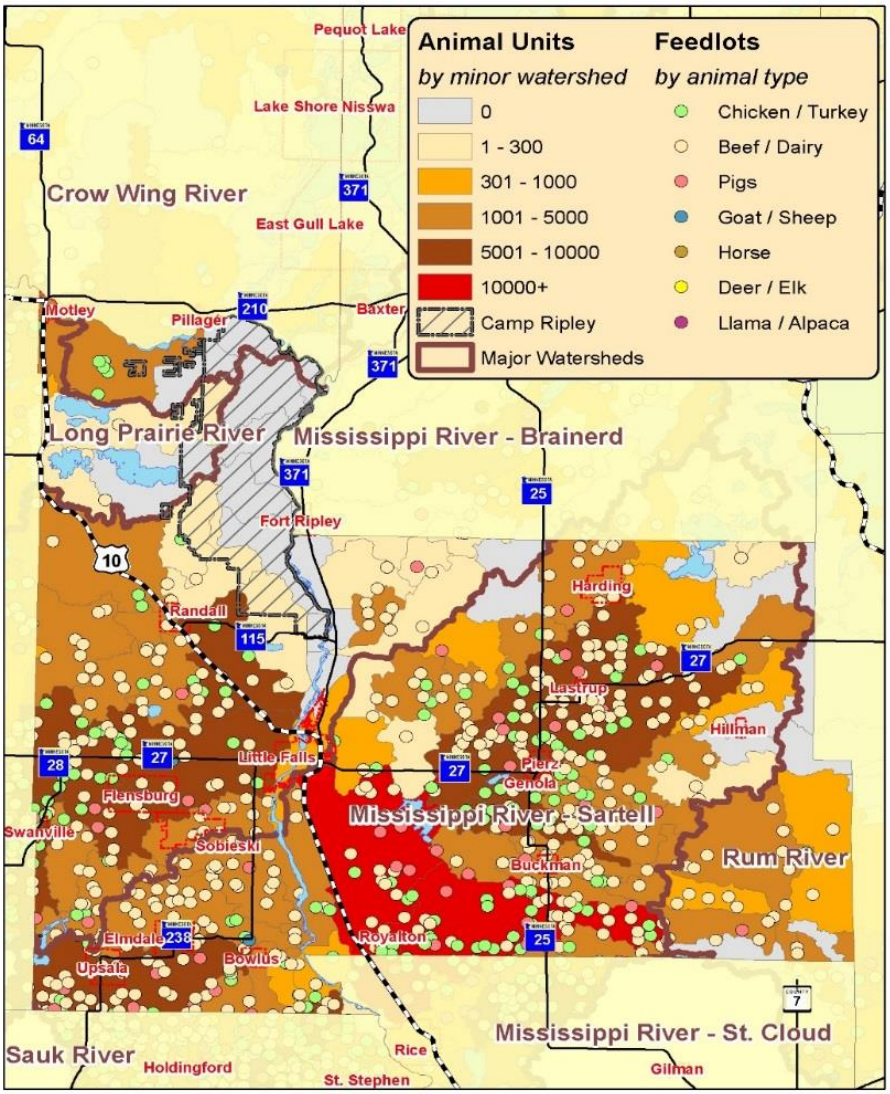


Figure 3 – Morrison County Feedlots Map

- **Sub-Surface Treatment System Inventory (SSTS):** Fish Trap Lake Association requested help in evaluating their septic systems. A Clean Water Fund (CWF) grant was awarded by BWSR in 2013 and the Morrison County Land Services Department began by determining which systems had not had a compliance inspection within five years. All of those with no recent records were examined by a licensed septic inspector and nearly 25% of the 254 tested, were found to be non-compliant. Once identified and notified of the results, the landowners were given one year to bring their septic systems into compliance. This failure rate equated to 14% of all the systems on Fish Trap Lake. There were enough remaining funds from that grant to jump start a septic inventory of Agram Township where an overwhelming 52% of private wells tested, have shown high nitrates. (> 10 ppm, drinking water standard) The same process took place in 2016 with Morrison County Land Services Department taking the lead. 151 septic systems were inspected. 99 were in compliance. 51 were not in compliance. 1 imminent health threat was found. The same process is in place to reach compliance.

- **Surface Water Assessment Grant Monitoring (SWAG**): An application for the Mississippi River Brainerd and Mississippi River Sartell (Major watersheds 10 and 15) was not approved in January 2016.

- **County Comprehensive Land Use Plan (Comp Plan):** Adopted August 9, 2016 strengthened language on AIS prevention and groundwater focus in addition to developing shore land standards.

- **Impaired Waters List:** In recent years the number of surface waters on the MPCA 303d impaired waters list for Morrison County has increased. A 2-Year Monitoring Plan, for the Mississippi River--Brainerd and Mississippi River--Sartell began monitoring in spring 2016. After monitoring for two years, the WRAPS will be written and then a TMDL plan, if warranted, will be developed. Aitkin SWCD has taken the lead on Mississippi River Brainerd and Morrison SWCD on the Mississippi River Sartell. Watershed planning meetings have already begun identifying sites for monitoring and some chemical analysis has been collected but will continue. Monthly cohort meetings are held to assist in public awareness and to coordinate competing interests and data.

  See individual impaired waters list by watershed at:
  https://www.pca.state.mn.us/water/watersheds/mississippi-river-brainerd
  https://www.pca.state.mn.us/water/watersheds/mississippi-river-sartell
  https://www.pca.state.mn.us/water/watersheds/long-prairie-river
  https://www.pca.state.mn.us/water/watersheds/crow-wing-river
  https://www.pca.state.mn.us/water/watersheds/rum-river
  https://www.pca.state.mn.us/water/sentinel-lakes
  https://www.pca.state.mn.us/water/large-river-monitoring
  https://www.pca.state.mn.us/water/statewide-mercury-reduction-plan

- **Army Compatible Use Buffer (ACUB):** Camp Ripley began their Army Compatible Use Buffer (ACUB) program in 2004. 72% of the buffer is in Morrison County. To date, over 22,500 acres (200 contracts) have been secured through easements with BWSR (Morrison, Crow Wing, and Cass Counties). 19 parcels totaling approximately 1,920 acres were acquired through fee title by the Department of Natural Resources (DNR).

  The ACUB program compliments the Morrison County Local Water Plan by encouraging green space in perpetuity, reducing numbers of septic systems, impervious surfaces, etc. It also prevents fragmentation of habitat and farmland.

  The Mississippi River borders Camp Ripley for 18 miles on the east side. The Crow Wing River borders the entire northern boundary of Camp Ripley for 11 miles on the north. The Nokasippi River, Little Nokasippi River, Little Elk River, Pillager Creek, Fletcher Creek, and many lakes and wetlands are within the ACUB zone as well.

  While Camp Ripley is only one of nearly 80 military bases in the United States, with an existing ACUB program, funding has remained strong, attracting over $26,000,000 federal funds to date. Along with federal funding through the Department of Defense (DOD) and the National Guard Bureau (NGB), 6 funding allocations have been granted through the Lessard-Sams Outdoor Heritage Council (LSOHC) with over $6.9 million awarded to further the protection. The state LSOHC funds are targeted toward riparian properties on the Mississippi and Crow Wing Rivers and are additionally aimed at protecting forested lands from conversion to agricultural production.

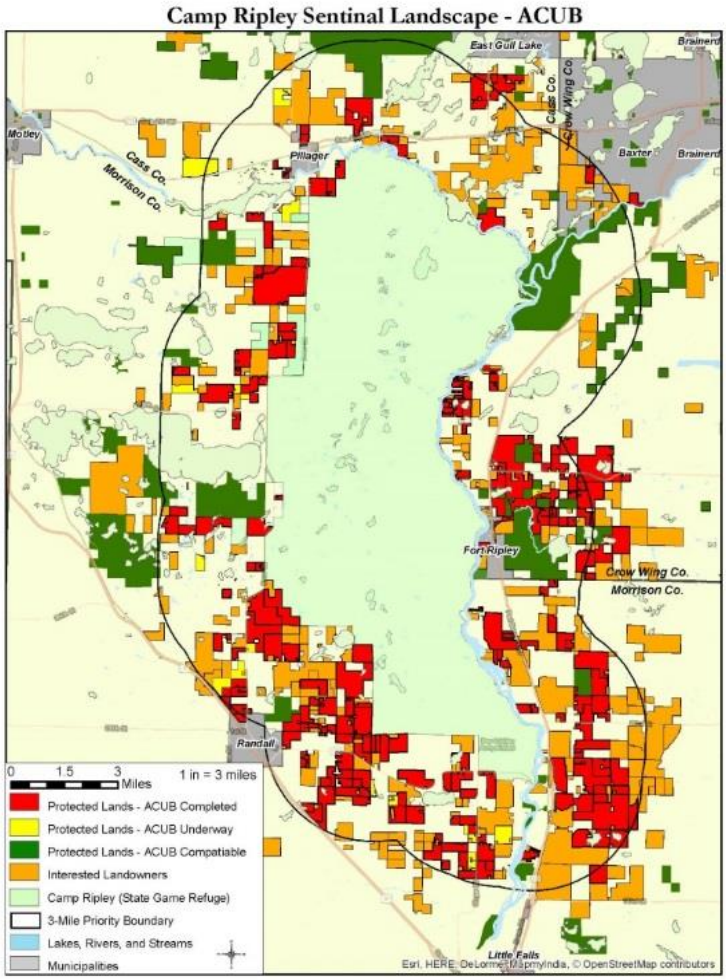


Figure 4 – Army Compatible Use Buffer Map

- **Camp Ripley Sentinel Landscape Designation**
  In July of 2016 Camp Ripley was designated by the U.S. Department of Agriculture (USDA), U.S. Department of Defense (DOD), and the U.S. Department of Interior (USDOI) as a Sentinel Landscape. Camp Ripley, a State of MN National Guard training facility, is now one of six federally designated Sentinel Landscapes in the country. From the Sentinel Landscape webpage: "*Sentinel Landscapes are working or natural lands important to the Nation's defense mission – places where preserving the working and rural character of key landscapes strengthens the economies of farms, ranches, and forests; conserves habitat and natural resources; and protects vital test and training missions conducted on those military installations that anchor such landscapes."*

  This federal designation falls closely on the heels of the 2015 MN Legislatures work led by Representative Ron Kresha in the House and Senator Paul Gazelka's in the Senate to pass a bill designating Camp Ripley as a State Sentinel Landscape with a team of state and local agency partners tasked to develop the footprint or map of such a designation. Throughout 2015-2016 this team worked to consider Camp Ripley, local, state and federal partner priorities within the greater Camp Ripley landscape. The team considered what programs and practices added value to all of the partners and private landowners within the Camp Ripley Sentinel Landscape (CRSL) while protecting the vital training mission of Camp Ripley.

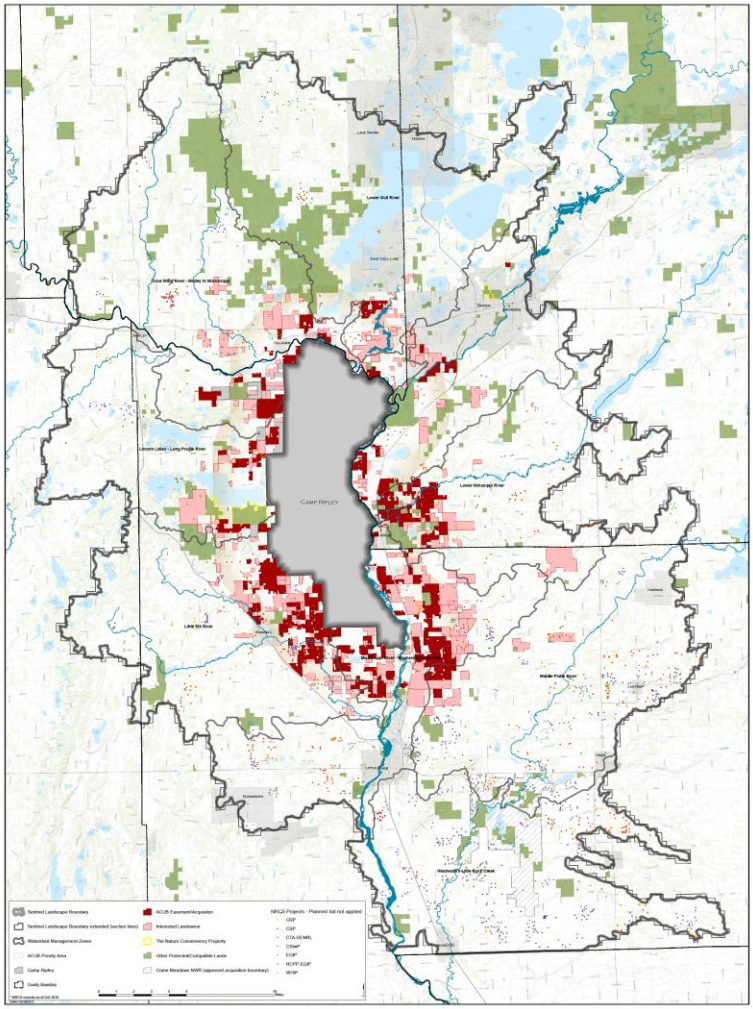


Figure 5 – Camp Ripley Sentinel Landscape

- **Camp Ripley Wellhead Protection Plan:** Camp Ripley completed an update to their Wellhead Protection Plan in 2013. Six abandoned wells were sealed in the cantonment and training areas, infiltration basins were added, and vulnerability assessments were conducted on surface and ground water. A new addition to the Education Center included 3 - 20,000 gallon cisterns to capture rainwater for irrigation, thus reducing the storm water run-off from being discharged to the Mississippi River. Camp Ripley's current activity includes a comprehensive water study of their distribution system to assess the feasibility of effluent reuse and expand their storm water retention capabilities. They have set a goal of "Net Zero" runoff in their storm water management plan.

- **Little Rock Creek/Lake TMDL Projects:** Phase II of the Little Rock Creek TMDL project was completed in September of 2009. A Stressor Identification Report was published. Phase III of the Little Rock Creek TMDL began in the spring of 2010. The product of Phase III is the TMDL Report and Implementation Plan which was completed by 2013.

  The Little Rock Lake TMDL project began in 2008 and was expected to be completed in 2015. The EPA upheld the findings and the TMDL was approved in 2016. Dissolved Oxygen, Nitrate, Temperature and Fish Bio-assessment were identified stressors in the TMDL. The Implementation Plan incorporates both TMDL projects (Little Rock Creek and Little Rock Lake). Benton SWCD is the lead agency for both projects.

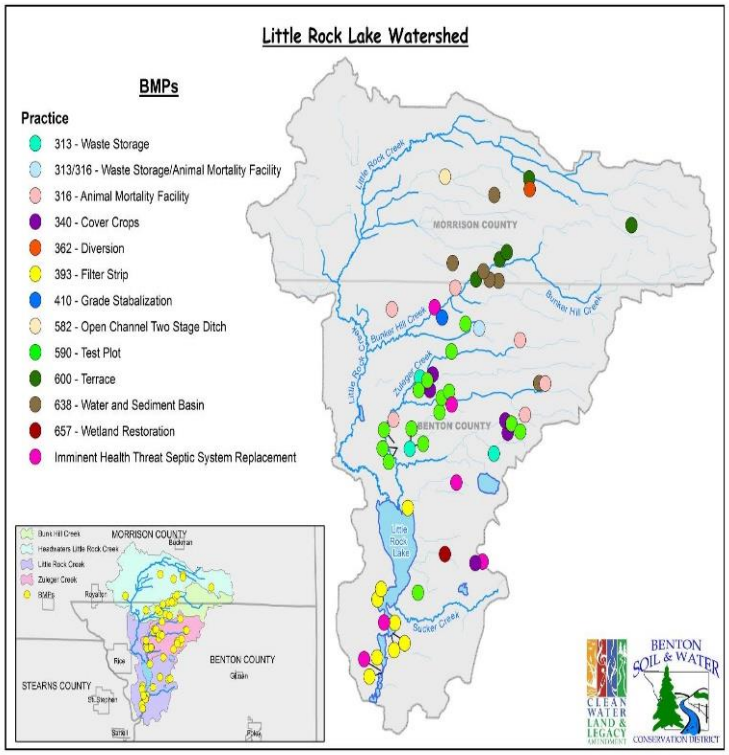


Figure 6 - Little Rock Watershed BMPs

Morrison SWCD/NRCS have continued to promote BMP projects within this watershed. 26 Continuous Conservation Reserve Program (CRP) contracts are active in the Little Rock Creek watershed, which abandon agricultural use within 150' of both sides of watercourses. 4 feedlot sites that had very high pollution ratings were also fixed with Feedlot Water Quality funds (FWQ) and Environmental Quality Incentive Program (EQIP) funding.

Benton SWCD has been very successful in receiving Clean Water Funds multiple years. In sharing those funds within the watershed, Morrison County has completed approximately 13 projects in the watershed since 2012 for primarily water and sediment control structures. This effort continues in cooperation with both SWCDS (Benton and Morrison) as Benton continues receiving grant funds. In addition the area has been targeted by the Sentinel Landscape Plan utilizing existing and new funding awarded by the Region Conservation Partnership Program (RCPP) which becomes available summer of 2017. This grant expands the use of Conservation Stewardship Program (CSP) and EQIP programs.

According to a DNR study conducted by Division of Ecological and Water Resources in 2014, water consumption in the Little Rock watershed has risen by 185% in the past 25 years in comparison to 35% increase for the rest of the state. This increase is may be attributed to numerous high capacity irrigation wells within the watershed. However this percentage is somewhat skewed due to the high number of irrigation systems that had been operating for many years, but found to not be permitted.

Multiple irrigation management meetings have been conducted by Benton SWCD and DNR studying the effects groundwater use may have on surface water flow. Controversy will be ongoing for some time and conclusions and findings will continue to be targeted in this county's water plan. In 2016 a Project Advisory Team (PAT) was created to advise in the development of a DNR sustainability plan and make recommendations to the DNR for this sensitive groundwater management area.

- **Morrison Landfill Groundwater Monitoring:** Morrison County Public Works continues to monitor wells around the landfill complex. They test for a matrix of contaminants prescribed by their permit with the MPCA. Morrison County Solid Waste Department participates in the MPCA pilot leachate recirculation project which treats the leachate and speeds up the decomposition of waste in the landfill. Morrison County Public Works Department continues the remediation of the groundwater contamination from the State's Super fund listed closed landfill. The remediation activities are prescribed through the county's permit with the MPCA. The contaminated groundwater is collected, then pumped and land applied at the landfill site. The county now utilizes a new state-of-the-art phased landfill system for solid waste disposal.

- **Little Falls Utility Extensions:** The City of Little Falls installed 10 miles of sewer and water which extended public utilities to the heavily populated residential area just north of Little Falls in Belle Prairie Township. This enabled many homes with shallow sand point wells to have a better and safer water supply. Many homes in that area have tested high in nitrates for many years, but that trend is decreasing due to the number of homes that have now hooked onto a municipal source for sewer and water.

- **Wellhead Protection Plans:** The City of Little Falls, Camp Ripley, City of Royalton, and City of Pierz have completed their Wellhead Protection Plans (WHPP) and identified their Drinking Water Supply Management Areas (DWSMA). Several more communities are also engaged in the process or have completed their plans including Bowlus, Buckman, Randall, and Swanville.

- **Little Falls Stormwater Management Plan:** The City of Little Falls with assistance from the Mississippi Headwaters Board (MHB) has developed a long term stormwater management plan. As a part of that effort, the SWCD funded multiple rain gardens installed in 2016 using Clean Water 2013 remaining funds, and the City has asked for more assistance. A Clean Water Fund (CWF) application was submitted in 2016 for another round of funding but was not funded. MHB, the City of Little Falls, and the SWCD will continue to collaborate on funding assistance for the stormwater structures. The gardens serve as an educational opportunity to homeowners and other property owners when addressing run-off control.

- **Groundwater Nutrient Monitoring:** In 2008, the MDA published a study of fertilizer and nitrogen monitoring results which included several townships in Morrison County. The data is available on their website at: www.mda.state.mn.us/townshiptesting Morrison SWCD partnered with

MDA for several years in this initiative. Several townships have been identified for further protection due to the threat of unsafe drinking water standards. (Agram, Culdrum, Belle Prairie, Buh, Bellevue, Swan River, Elmdale, Little Falls, Ripley,Two Rivers, and Swanville Townships)

- **Water Festival:** The sixth grade Water Festival continues for all county sixth graders in the County. The annual event held at Camp Ripley hosts 400-500 students annually with learning stations presented by numerous agency staff (Camp Ripley, DNR Fisheries, MPCA, Land Services Department, NRCS, USFWS, SWCD, and the MN Science Museum). 2016 marked the festival's 23rd year. Stations vary and provide students with a fun and exciting learning experience that enhances their knowledge and awareness of the importance of conservation and water resources. Each school sets aside the September dates on their school calendar. Aquatic Invasive Species has been added as a station since 2015.

Figure 7 – Photo Water Festival Learning Station (1 of 7 Stations)

WATER PLANNING FUTURE

The public and state legislature is demanding that financial resources be wisely spent with measurable outcomes. The people have a "right to know" that the 2008 Clean Water, Land, and Legacy Amendment increase in sales tax is being spent in the manner it was intended. The vote for the Amendment, in light of the economic climate at that time, was a statement of how important water quality is to our state's residents. The funding applications are highly competitive and Morrison County continues to seek funding to further the Morrison County Water Plan goals and objectives.

Public agencies and private organizations must continue to work together to meet the common goals, and to assure the public that projects funded accomplish a measurable benefit and that duplication efforts cease.

The purpose of this plan, and the direction of the Morrison SWCD, is to identify goals and provide guidance to the public and Morrison County in an effort to improve and protect the water quality and quantity in Morrison County and our surrounding watershed neighbors. This will give Morrison SWCD the tools needed to become a leader in the effort by bringing the partners together regularly to plan, report, and take necessary actions to meet the goals and objectives outlined in this plan. Local Water Planning is perhaps the most critical driving force of implementation by all partners, yet is woefully underfunded by the state.

Morrison County is a transitional county, with the southern half of the country primarily agricultural, and the northern half beginning the forested and lakes region of the state. Therefore, that same division shows impairments versus protection priorities. This makes planning unique. The efforts for protection should at least equal, if not exceed remediation of impaired waters. This plan will emphasize our protection strategy for clean lakes and rivers as well as how to address our impaired waters.

An extended element of planning must take into consideration the understanding and frequency of climate variables. The cause and effect large storm events have on lakes, rivers, infrastructure, property damage has brought a larger focus on strategies to address flooding and erosion.

The accomplishments will be posted on the County and SWCD websites and in legislative reports so the public can stay informed of what is being done to improve and protect the water resources of Morrison County.

PRIORITY CONCERNS ESTABLISHED

Through the evaluation of the surveys received, the numerous meetings held with the Taskforce, the priority concern categories remained as they had been in previous plans--Ground Water, Surface Water, and Land Use. The categories were slightly modified as the result of community and Taskforce discussions:

- Protect and provide high quality groundwater resources for the citizens and visitors of Morrison County.
- Preserve and ensure adequate quantity of groundwater resources for the citizens and visitors of Morrison County.
- Protect, enhance, and maintain the quality of all surface waters in Morrison County (lakes, rivers, streams, and wetlands).
- Ensure that land use decisions are compatible with natural resource protection**.**

While the priorities stated are broad in nature, the objectives will be more specific in the implementation plan.

ASSESSMENT OF PRIORITY CONCERNS

Protection of Ground Water Quality

Over the past many years the District holds two nitrate clinics each year in May and October. The results of all wells tested, shows on average15% of the wells consistently show high nitrates (greater than 10 ppm) exceeding the Public Health drinking water standard. Livestock operations are increasing in size and irrigation permitting has grown considerably as per Morrison County Land Services Department statistics and the MN DNR Department of Ecological and Water Resources (EWR). While there are fewer feedlots, the operations are greater in size, as evidenced by the County Land Services Department records, and the number of Environmental Reviews conducted by the Morrison SWCD annually. The manure management and whether there are adequate acres for application has risen as a concern amongst elected officials and resource agencies. In working with the producers on their Environmental Reviews and Nutrient Management Plans, we find much of the manure actually leaves the county, but the need to assure that applicable rates are being followed is a continued concern, particularly in the sandy soils areas. There has been considerable agricultural growth (livestock facilities) in concentrated areas, namely Buh, Culdrum, Buckman, and Agram Townships. (feedlot inventory conducted by Morrison County Land Services Department) Whether the growth of these two factors is having an adverse impact on groundwater is in question.

Township	Total Wells Tested	Year Tested	Min	Max	% of Wells Tested Greater than 10 ppm
Agram	109	2013	<0.03	40.8	52%
Belle Prairie	101	2013	<0.03	39	18%
Bellevue	135	2013	<0.03	43.7	11%
Buh	52	2013	<0.03	31.2	12%
Culdrum	58	2013	<0.03	28.2	14%
Swan River	70	2013	<0.03	40.9	11%
Elmdale	148	2015	<0.03	70.3	9%
Little Falls	281	2015	<0.03	48.5	7%
Ripley	106	2015	<0.03	18.1	16%
Two Rivers	113	2015	<0.03	37.8	12%
Swanville	49	2015	<0.03	25.8	12%
Total	**1,222**	**2013- 2015**	**<0.03**	**70.3**	**15%**

Table 1. MDA Nitrate Analysis of Morrison Townships tested (<10 ppm safe standard)

Rural residential growth continues in agricultural zoned areas. Several platted developments have been approved in agricultural neighborhoods. Most rural plat developments utilize private septic and well systems, so it becomes necessary to recognize the potential competing uses of ground water, both in quantity and quality for both agricultural and residential needs.

Protection of Ground Water Quantity

During the process of seeking public input, the noticeable increase in irrigation systems within the county, rose to the top of concerns. Besides the potential of well interference to rural residential homes, it may also affect another irrigator's needs. The largest concern is whether the aquifers recharge quickly enough to handle the demand.

The cities located near areas showing an increase of appropriation permits being issued, are becoming concerned about the reliability of their own public supply. This is a quality and quantity issue. To that end, it was important to get the support of all governing bodies for a Geologic Atlas of the county. The Geo-Atlas Part A is complete, Part B should be finalized in 2018. It's a critical missing link in land use and groundwater appropriation decision making and will enable the county and other developers the ability to conduct scenario planning.

Protection and Management of Surface Water Resources

With 97 DNR Public Waters inventoried, lakes and hundreds of miles of rivers and streams covering nearly 18,000 acres, focus naturally is given to their continued health and management.

Rural residential growth and second tier development, (not shoreland adjacent but within the impact zone) has occurred around most general development lakes and some environmental lakes. Many of the older established cabins and homes are considered nonconforming because they do not meet current structure setbacks from the ordinary high water level or from property lines since they were built well before shore land ordinances were adopted. As shown in the study of septic systems surrounding Fish Trap Lake (Clean Water Fund project 2013 -15). Out of the 254 systems inspected; 190 systems were in compliance, 63 systems were NOT in compliance and 1 was an Imminent Threat to Public Health. This might conclude that other lake development might show the same. As is true in other counties, the demand for lakeshore property has meant that anything that could be developed reasonably, has been and what remains may have severe site limitations on how it could be used. Balancing "property rights" with what is environmentally sustainable, is a problem facing all lake protection efforts.

Shore land residents continue to want to convert small/seasonal cabins into large year-round homes. Increasing the impervious surface on smaller and larger lots can be a greater threat to surface waters. It is a continued goal of the Land Services Department and the SWCD to encourage residents to minimize the impact of surface run-off into lakes by establishing vegetative buffers and minimizing impervious surface. The county ordinance provisions regarding vegetation removal is quite restrictive and restorations required in after-the-fact permits does not always meet the desired outcome.

Landowners are often frustrated to learn that their desired plans may not meet setbacks, vegetation removal and impervious surface standards. Buffer areas in and out of the water are priority protection zones. When ice heaves and flooding damage a structure, it often helps a landowner understand why the standards have been established. The disturbance of aquatic vegetation often leads to the spreading of other invasive species. DNR Enforcement Officers are now charged with Invasive Species control. The County and DNR educational materials are made available to lake associations, resorts and local businesses to distribute to users and home owners to encourage best management practices on their shorelines and recreational watercraft use.

References to the BWSR Climate Change report will bring new directives to planning from new construction to changes on existing development.

Lake Associations and Lake Improvement Districts have requested assistance to meet their goals. We encourage lake residents/associations to work closely with DNR Divisions of Fisheries, Aquatic Plant Management, and Ecological and Water Resources to scientifically approach aquatic plant management.

The state's river systems have their own unique issues compared to lakes. Often running through agricultural land, there may be feedlots, grazing, and cropping history on the shoreline. Morrison County is a transitional county. Agriculture is still the predominant land use in the southern half, but the northern half of the county begins the lakes and forested region of the state. The MN Buffer Law enacted in 2015 Legislative Session will require buffering many shorelines from cropping to the water's edge. Many river conditions are addressed in this document by watershed initiatives.

Ninety-four riparian feedlots have been identified through the Morrison County feedlot inventory conducted by the Land Services Department. The feedlots are systematically coming into compliance through funding programs, low interest loans, and the technical and enforcement assistance of SWCD, NRCS, and County Feedlot Officer. Funding and need have not matched and the progress is slower than desirable, but Morrison County feedlot operators have been very progressive in trying to reach compliance as funding becomes available.

The MN Wetland Conservation Act (WCA) sequencing process has definitely saved many wetlands in the 25 years of implementation. With the SWCD serving as the LGU, it allows the county to distance itself from the discussions of land rights. However, by following the priority set in the water plan of riparian wetlands being a high priority for protection, it further restricted allowing any more than exempted impacts whenever possible. At present, we actually have a net gain of wetlands due to the number of wetland restorations that have been enrolled in the state banking program, or completed through enrollment in another federal or state program. Buffering high quality wetlands should be treated equally with lake protection.

It will be imperative to continue the efforts of monitoring and developing plans to address the waters that have been listed as impaired by the MPCA. Equally, the protection of non-impaired waters cannot be lost in the funding priorities.

The following is the most recent MPCA impaired waters map and list for Morrison County. MPCA designates certain reaches of rivers, but for the purpose of this plan we identify the water body and the contaminant. See the Impaired Waters Map in the map section for locations.

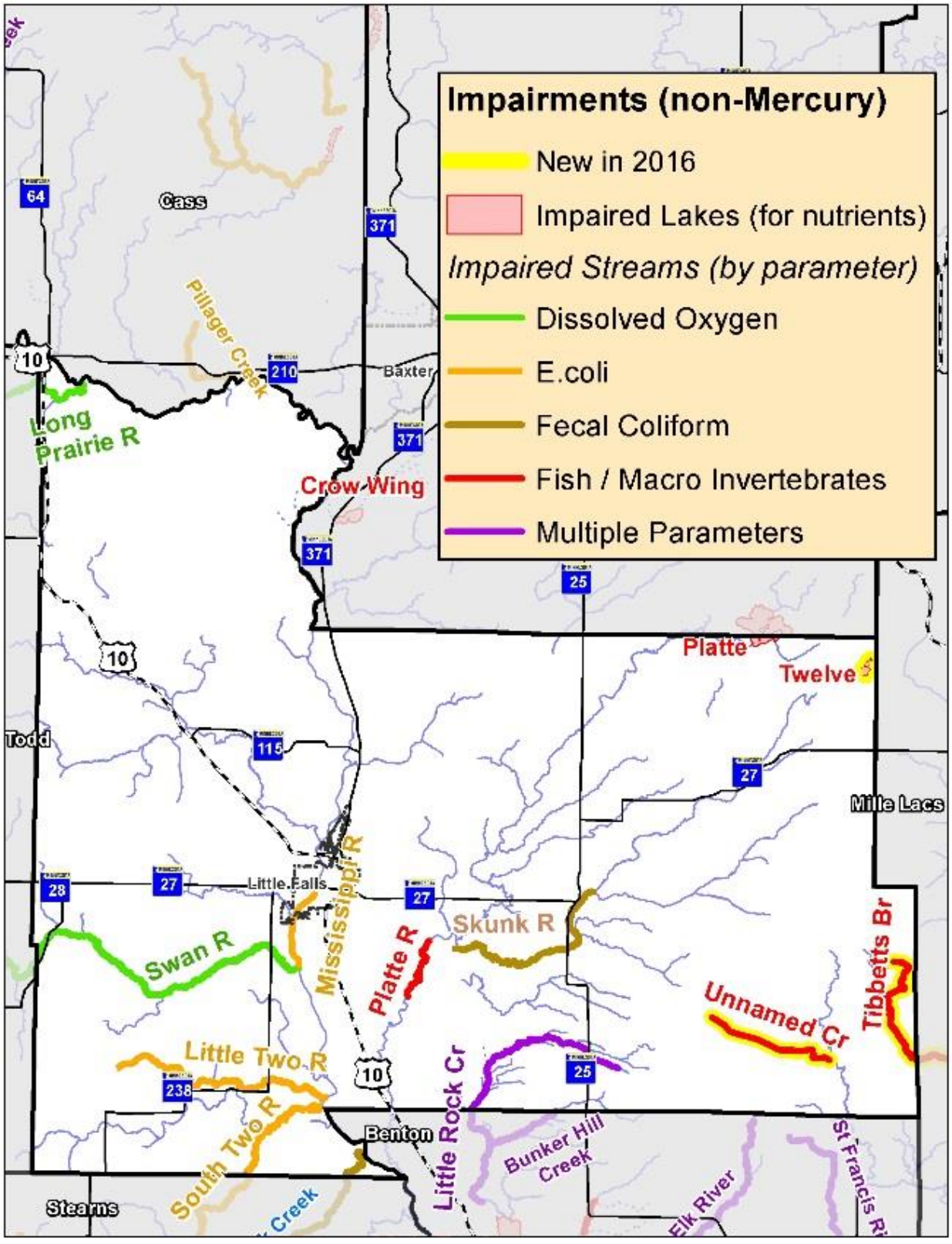


Figure 8 - Morrison County Impaired Waters

Table 2 - Clean Water Act Section 303 [d] List of Impaired Waters--Morrison County

Name	Water Body	Year Added	Unit ID	HUC 8	Watershed	Affected Use	Pollutant or Stressor	TMDL Start	TMDL Approved
Crow Wing R	Long Prairie R to Mississippi	1998	070101 06-721	07010106	Crow Wing River	Aquatic Consumption	Mercury in fish tissue		2008
Crow Wing R	Mosquito Cr to Long Prairie R	1998	070101 06-508	07010106	Crow Wing River	Aquatic Consumption	Mercury in fish tissue		2008
Long Prairie R	Fish Trap Cr to Crow Wing R	1994	070101 08-501	07010108	Long Prairie River	Aquatic Life	Dissolved oxygen		2005
Long Prairie R	Fish Trap Cr to Crow Wing R	1998	070101 08-501	07010108	Long Prairie River	Aquatic Consumption	Mercury in fish tissue		2007
Mississippi R	Crow Wing/Morrison County border to Swan R	1998	070101 04-658	07010104	Mississippi River - Brainerd	Aquatic Consumption	Mercury in fish tissue		2007
Swan River	Headwaters Big Swan Lk to Mississippi	2010	070101 04-502	07010104	Mississippi River - Brainerd	Aquatic Life	Dissolved oxygen	2016	
Little Rock Cr	T39 R30W S22, south line to T38 R31W S28, east line	2010	070102 01-548	07010201	Mississippi River-Sartell	Aquatic Life	Dissolved oxygen	2013	
Little Rock Cr	T39 R30W S22, south line to T38 R31W S28, east line	2002	070102 01-548	07010201	Mississippi River-Sartell	Aquatic Life	Lack of cold water assemblage	2013	
Little Rock Cr	T39 R30W S22, south line to T38 R31W S28, east line	2010	070102 01-548	07010201	Mississippi River-Sartell	Drinking Water	Nitrates	2013	
Little Two R	Headwaters to Mississippi	2014	070102 01-516	07010201	Mississippi River-Sartell	Aquatic Recreation	Escherichia coli		2014
Platte River	Rice-Skunk Lakes Dam to Unnamed Cr (above RR bridge)	2002	070102 01-546	07010201	Mississippi River-Sartell	Aquatic Life	Fishes bioassessments	2016	
Skunk River	Hillman Cr to Platte R	2008	070102 01-521	07010201	Mississippi River-Sartell	Aquatic Recreation	Fecal Coliform	2016	
Two River	North & South Two R to Mississippi	2014	070102 01-523	07010201	Mississippi River-Sartell	Aquatic Recreation	Escherichia coli		2014
Tibbetts Brook	T40 R28W S25, west line to T40 R2W S36, west line	2016	070102 07-676	07010207	Rum River	Aquatic Life	Fishes bioassessments	2013	
Unnamed Cr	Headwaters to W Br Rum R	2016	070102 07-667	07010207	Rum River	Aquatic Life	Aquatic macroinvertebrate bioassessments	2013	
Alexander	Lake or Reservoir	2016	49-0079-00	07010108	Long Prairie River	Aquatic Consumption	Mercury in fish tissue		
Shamineau	Lake or Reservoir	2012	49-0127-00	07010108	Long Prairie River	Aquatic Consumption	Mercury in fish tissue		2013
Cedar	Lake or Reservoir	2002	49-0140-00	07010201	Mississippi River-Sartell	Aquatic Consumption	Mercury in fish tissue		2007
Sullivan	Lake or Reservoir	1998	49-0016-00	07010201	Mississippi River-Sartell	Aquatic Consumption	Mercury in fish tissue		2008
Twelve	Lake or Reservoir	2016	49-0006-00	07010207	Rum River	Aquatic Recreation	Nutrient/eutrophication biological indicators	2013	

Following is a list of waters that are <u>not</u> presently impaired but warrant protection measures:

<u>Lakes</u>

Peavy Lake
Fish Trap Lake
Twin Lakes
Green Prairie Fish Lake
Pierz Fish Lake
Pine Lake
Stanchfield Lake
Round Lake
Lena Lake
Crookneck Lake
Ham Lake

<u>Wild Rice Producing Lakes/Streams</u>

Platte Lake
Hannah Lake
Sullivan Lake
Placid Lake
Pelkey Lake
Mississippi River
Peavy Lake
Skunk Lake
Mud Lake
Long Lake
Rice Lake

<u>Other Rivers/Streams</u>

Pike Creek
Big Mink
Hay Creek
Little Mink Creek
Fletcher Creek

Waters with Invasive Species

<u>Lakes/Streams</u>

Milfoil	**Zebra Mussels**
Lake Alexander	Fish Trap Lake
Lake Shamineau	Mississippi River

Integration with the County Comprehensive Plan

Promoting and Implementing Sound Land Use Practices that Reduce Impacts on Water Resources

The county has adopted a 2016 Comprehensive Land Use Plan (Comp Plan) update which, in part, seeks to assist in implementing this Water Plan by prioritizing protection of the Mississippi River as a primary drinking water source for cities beginning south of Morrison County to the Gulf, as well as all river systems throughout the County, preservation of critical habitats, preservation of ground and surface water resources, and sustainable shore land development. It attempts to balance property rights and the protection of Morrison County's natural resources. Excerpts from the Resource Protection section of the Comp Plan can be found in Appendix A. A vital component of this goal is the continued training of County and City Officials, Planning Commissions and Boards of Adjustment.

PRIORITY CONCERNS: GOALS AND OBJECTIVES

Based on the public feedback, agency comments, and current priorities, the table below shows the priority concerns, objectives, and action steps that were identified for inclusion into the 2017-2022 Water Plan. The following pages summarize each of these in more detail.

Priority Concern: GROUNDWATER

GOAL 1: ***Protect and provide high quality groundwater resources for the citizens and visitors of Morrison County***

Objective A	Increase the available background information of the County's groundwater resources, and continue to research new information as it become available.
Objective B	Support cities in developing public information programs aimed at public awareness in the protection of public water supply in the well head protection communities.
Objective C	Prevent groundwater contamination from both current and abandoned wells by assisting landowners in methods to protect their own drinking water sources for both humans and livestock.
Objective D	Continue to regulate subsurface sewage treatment systems (SSTS) in the County.
Objective E.	Support cities in managing above ground tanks within the DWSMA for the protection of aquifers.
Objective F	Support cities in their continued solid waste programs and educational efforts on the proper disposal of hazardous waste and recycling programs for the preservation of the drinking water aquifer.
Objective G	Work to establish a coordinated spill response plan for the Transportation Corridor through joint training and spill notification.
Objective H	Support Source Water/Wellhead Protection planning by communities.
Objective I	Maintain and promote existing cooperative partnerships that monitor groundwater.

GOAL 2: *Preserve and ensure adequate quantity of the groundwater resources for the citizens and visitors of Morrison County*

Objective A Improve groundwater understanding, awareness, and protection relating to irrigation and consumptive needs for residents and producers.

Objective B Create an educational and training program upon completion of the Geologic Atlas.

Objective C Participate and assist in groundwater protection efforts by the DNR and/or other entities.

Objective D Utilize the Geologic Atlas, when completed in commenting and developing irrigation management plans.

Priority Concern: SURFACE WATER

GOAL: *To protect, enhance, and maintain the quality of all surface waters in Morrison County (lakes, rivers, streams, and wetlands)*

Objective A Reduce impacts of agricultural run-off from feedlots and farming practices by implementing the MN Buffer law on all protected waters and public ditches.

Objective B Ensure that land use decisions for shore land development take environmental impacts and climate change trends into consideration.

Objective C To provide coordination in the fight against aquatic invasive species by developing proactive solutions aimed at educating and empowering local citizens.

Objective D Protect and enhance the County's wetlands through continued administration of the MN Wetland Conservation Act.

Objective E Assist Lake Associations and Lake Improvement Districts in developing lake protection plans that work to minimize development impacts, improve water quality, and wildlife habitat.

Objective F To improve, maintain, and ensure clean and healthy rivers in Morrison County.

Objective G To increase protection of lakes and rivers from floodwaters by promoting storage of floodwaters on the landscape.

Objective H Prioritize minor watershed protection utilizing risk data.

Objective I Complete and implement the developing Morrison County Comprehensive Drainage Management Plan and maintain the culvert inventory being conducted.

Objective J To provide assistance and support in the management of stormwater, erosion, and sediment control.

Objective K To develop a strategy and awareness of river connectivity.

Priority Concern: LAND USE AND DEVELOPMENT

GOAL: ***To ensure that land use decisions are compatible with natural resource protection***

Objective A	Reduce impacts of agricultural run-off from feedlots and farming practices.
Objective B	Ensure that land use decisions for shore land development and plat development take environmental impacts into consideration.
Objective C	Reduce the loss of natural habitat and enhance natural habitat communities when possible.

IMPLEMENTATION PLAN

The following goals, objectives, and actions are a general template of the strategy to be undertaken in implementing this plan. All actions in the following section will be reviewed by the Morrison County Local Water Plan Task Force and updated as necessary. An annual work plan, developed by the task force, will determine funding levels, lead agency, and targeted work areas depending on resources and funding available at the time. Quantities and achievements will be measured and reported on an annual basis in the Minnesota Board of Water and Soil Resources "e-LINK" reporting system as well as our annual report published on the web sites: www.morrisonswcd.org and www.co.morrison.mn.us

Priority Concern: GROUNDWATER

Goal 1: ***Protect and provide high quality groundwater resources for the citizens and visitors of Morrison County***

Wise stewardship of the groundwater resource in Morrison County is of the utmost importance, especially since much of the County has sandy soils that allow water (and contaminants) to infiltrate from the surface to the groundwater relatively quickly. Spills and leaks from underground petroleum fuel tanks are common sources of soil and groundwater contamination. Chlorinated cleaning solvents are another significant source of contaminants. High nitrogen and pesticides and herbicides are additional concerns for potential groundwater contamination. Poorly functioning septic systems can also contribute excess nitrogen and phosphorus to the soil and groundwater.

Objective A: Increase the available background information of the County's groundwater resources

Action 1: Support the development of a county Geologic Atlas and Regional Hydrologic Atlas.
Lead: SWCD

Action 2: Use the atlas to identify and inventory sensitive areas of the county. Ensure the distribution and sharing of the digital Atlas to other agencies for their use and applications.
Lead: Morrison County Land Service Department and Morrison SWCD

Action 3: Sponsor two workshops to present the completed atlas to the public and provide training on use.
Lead: SWCD/DNR

Action 4: SWCD will request state agency assistance in evaluating existing groundwater quality and quantity monitoring being done in the county and how it can be improved and organized locally to support ongoing groundwater protection activities.
Lead: SWCD

Objective Partners: SWCD, County. Board, Land Services Department, Planning Commission, Board Of Adjustment, DNR EWR, MN Geologic Survey
Financial: Local, state, and federal grants; in-kind staff time ($15,000 annually)
Timeframe: Duration of plan
Measurable Results:

- Complete a geological and hydrological atlas for Morrison County.
- Develop a listing of sensitive groundwater areas and distribute to local, state, and federal agencies.
- Deliver two geological atlas workshops.
- Compile useable groundwater monitoring information and distribute for use in local decision making.

Objective B: Develop and implement public information programs aimed at public awareness in the protection of public water supply in the well head protection (WHPP) communities. Little Falls, Camp Ripley, Bowlus, Randall, Rich Prairie (Pierz), and Royalton (Motley and Upsala not on board as yet)

Action 1: Implementation of public information programs on WHPP communities will include:

- Signage identifying the DWSMA boundary
- Mailings to rural and urban residents with information on WHPP.
- Utilize web sites
- Media
- Presentations to local service organizations

Lead: Municipalities with completed DWSMA plans

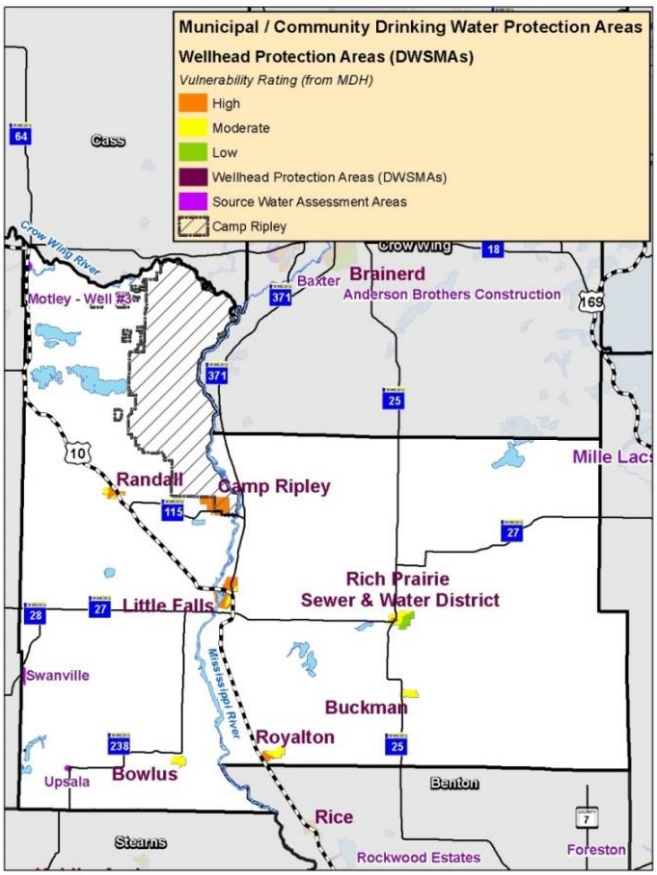


Figure 9 - Drinking Water Vulnerability Ratings

Action 2: Promote agricultural Best Management Practices that reduce the potential for groundwater contamination such as irrigation management, fertilizer and herbicide management.
Lead: NRCS/SWCD/Morrison County Feedlot Officer

Objective Partners: SWCD, NRCS, Cities, Land Services Department, MDH, (MDA), MPCA
Financial: State and federal grants; in-kind staff time ($1,000,000 annually)
Timeframe: Duration of plan
Measurable Results:

- Presentations and mailings delivered to the residents of three jurisdictions annually
- 5 prescribed grazing plans per year
- 5 nutrient management plan per year
- 5 conversion to no-till / strip till plan per year
- 10 cover crop plan every other year
- 4 agricultural waste facility improvement every other year

Objective C: Prevent groundwater contamination through both current and abandoned wells.

Action 1: Promote and utilize cost share to seal unused wells in priority areas (wellhead protection areas and sensitive groundwater areas).
Lead: SWCD

Action 2: Promote materials that address the potential impacts of abandoned wells and the costs and process to seal properly. Distribute through media/events and web site.
Lead: SWCD

Action 3: Continue to investigate Class V wells located in wellhead protection communities within the DWSMA. Present educational information to property owners on impacts, mitigation and Environmental Protection Agency (EPA) reporting requirements. Notify MDH of locations of potential Class V wells.
Lead: Cities with DWSMA plans

Action 4: Cities as well as rural entities will obtain and distribute educational brochures describing proper well maintenance and operation to provide landowners within the DWSMA.
Lead: Cities

Objective Partners: Cities, MPCA, MDH, SWCD
Financial: State and Federal grants, in-kind staff ($10,000 annually)
Timeframe: Duration of Plan
Measurable Results:

- Seal 25 unused wells
- Distribute abandoned well information to all county residents
- Survey all DWSMA cities for Class V wells
- Distribute Class V well information to all high risk landowners

Objective D: Continue to regulate Subsurface Sewage Treatment Systems (SSTS) in the County.

Action 1: Implement a plan to identify SSTS in priority areas, such as high water table, wellhead protection areas, excessively sandy soils, heavy soils.
Lead: Morrison County Land Services Department

Action 2: Morrison County Land Services Department completion of compliance inspections of all SSTS within a DWSMA that do not have current inspections.
Lead: Morrison County Land Services Department/Cities

Action 3: Promote low interest loan programs to assist in upgrades of failing SSTS, targeting priority areas.
Lead: Morrison County Land Services Department

Action 4: Continue to require septic inspections and Certificate of Compliance for building permit applications.
Lead: Morrison County Land Services Department

Action 5: Require all new constructions and all failing SSTS to connect to the municipal sewage treatment system in DWSMA where possible.
Lead: Morrison County Land Services Department/Cities

Action 6: Work cooperatively with lake organizations to distribute educational materials and information to public regarding SSTS operation and maintenance. Maintain supply of brochures.
Lead: Morrison County Land Services Department

Action 7: Publish SSTS BMP information on both county and SWCD website.
Lead: Morrison County Land Services Department

Action 8: Hold bi-annual designer, installer workshops.
Lead: Morrison County Land Services Department and SWCD

Objective Partners: County Land Services Department, SWCD, MPCA, MDA.
Financial: Federal and State Grants & in-kind contributions ($150,000 annually)
Timeframe: Duration of Plan
Measurable Results:

- Intersect SSTS locations with priority area map to create high priority SSTS database
- Compliance inspections of all SSTS current within DWSMA's
- Low interest SSTS loan information distributed to all landowners in high priority areas
- Upgrade ten failing systems for low-income residents
- Track septic installs, upgrades, and maintenance as part of all land use permits
- Conduct or host one septic-related workshop every other year
- Maintain factsheets, ordinances, and other septic information online

Objective E: Manage above ground tanks within the DWSMA for the protection of the aquifer.

Action 1: Look for new above ground tanks within the DWSMA and develop an education program to show need for protective barriers to prevent ground water contamination in the event of a leak or spill.
Lead: Morrison County Land Services Department/Cities

Action 2: Investigate past cleanup efforts for existing contaminants in the soil. Work with MPCA on site closure for known contaminants.
Lead: Morrison County Land Services Department/Cities/MPCA/Solid Waste

Action 3: Continue oversight and awareness of existing above and below ground tanks for potential contamination issues.
Lead: MPCA

Objective Partners: Morrison County Land Services Department, MPCA, MDH, WHPP cities
Financial: Federal, State Grants, In-kind ($10,000 annually)
Timeframe: 2017-2019
Measurable Results:

- All new above ground tanks in DWSMA identified and education program developed
- 5 old cleanup sites reviewed for contaminated soils
- Continued oversight and awareness of above and below ground tanks updated

Objective F: Support continued solid waste programs and educational efforts on the proper disposal of hazardous waste and recycling programs for the preservation of the drinking water aquifer.

Action 1: Support pesticide waste and waste container collection dates and locations. Notify land owners within the DWSMA of these dates and locations. Provide information on hazardous waste management and wellhead protection in these mailings.
Lead: County Solid Waste Department/Cities

Action 2: Follow up on permitted Ag Chemical and Industrial Hazardous Waste sites to determine the status of use. Survey sites for potential contamination of the soil and /or groundwater.
Lead: MPCA

Action 3: The Wellhead protection communities will participate in the priority setting local work group meetings conducted by the Cities with cooperative support from the SWCD, supporting programs within the DWSMA.
Lead: Cities

Objective Partners: SWCD, MPCA, County Solid Waste Department, WHPP Cities
Financial: Potential state grants and In-kind ($5,000 annually)
Timeframe: Duration of plan
Measurable Results:

- Hold 2 waste pesticide collections annually
- Follow-up and surveys on 2 permitted waste sites annually
- 3 WHPP work group meetings held

Objective G: Work to establish a coordinated spill response plan for the transportation corridor through joint training and spill notification.

Action 1: Establish working relationship with and coordinate spill response efforts with other agencies such as MNDot, Burlington Northern Santa Fe Railroad (BNSF), MPCA and other potential parties.
Lead: County Emergency Services

Action 2: Maintain a process to respond to emergency spills, potential fertilizer or manure storage damage.
Lead: County Emergency Services, MDA, County Feedlot Officer, MPCA

Objective Partners: County Emergency Services, MPCA, MnDOT, BNSF, MPCA, Cities, SWCD, MDA
Financial: Partners In-kind ($2,000 annually)
Timeframe: Duration of plan
Measurable Results:

- Annual meetings to adopt and/or update the emergency spill response plan

Objective H: Support Source Water/Wetland Protection Planning and implementation.

Action 1: Participate in wellhead protection plan (WHPP) development and implementation efforts to assist public water suppliers protect the community drinking water supply.
Lead: Cities, MDH, MPCA

Action 2: Assist and support the review of comprehensive plans and ordinances by local government to make sure State approved WHPP maps and plan concerns are included to provide the basis for the use of local controls if needed to protect drinking water supplies.
Lead: MDH

Action 3: Work with appropriate entities to identify aquifer thresholds to maintain adequate water supply for consumptive use.
Lead: DNR/SWCD

Action 4: Promote wetland restorations in critical recharge areas and flood zones. Encourage the restoration and maintenance of native vegetation (trees, brush, ground cover) in these areas.
Lead: SWCD

Action 5: Collect and test water samples for quality in all wellhead protection areas.
Lead: Cities, SWCD

Objective Partners: SWCD, MDH, Cities Public Works, MPCA, DNR-EWR, MN Rural Waters Agency, Land Services Department., MN Geological Survey, NRCS
Financial: State Grants & In-kind ($5,000 annually)
Timeframe: Duration of plan
Measurable Results:

- 4 WHPP developed, annual Public Water Supply/WHPP meeting held
- 4 WHPP plans updated the appropriate maps and data
- Groundwater thresholds for 5 aquifer areas identified
- 3 recharge area wetlands preserved/restored
- 150 water samples collected annually from WHPP's

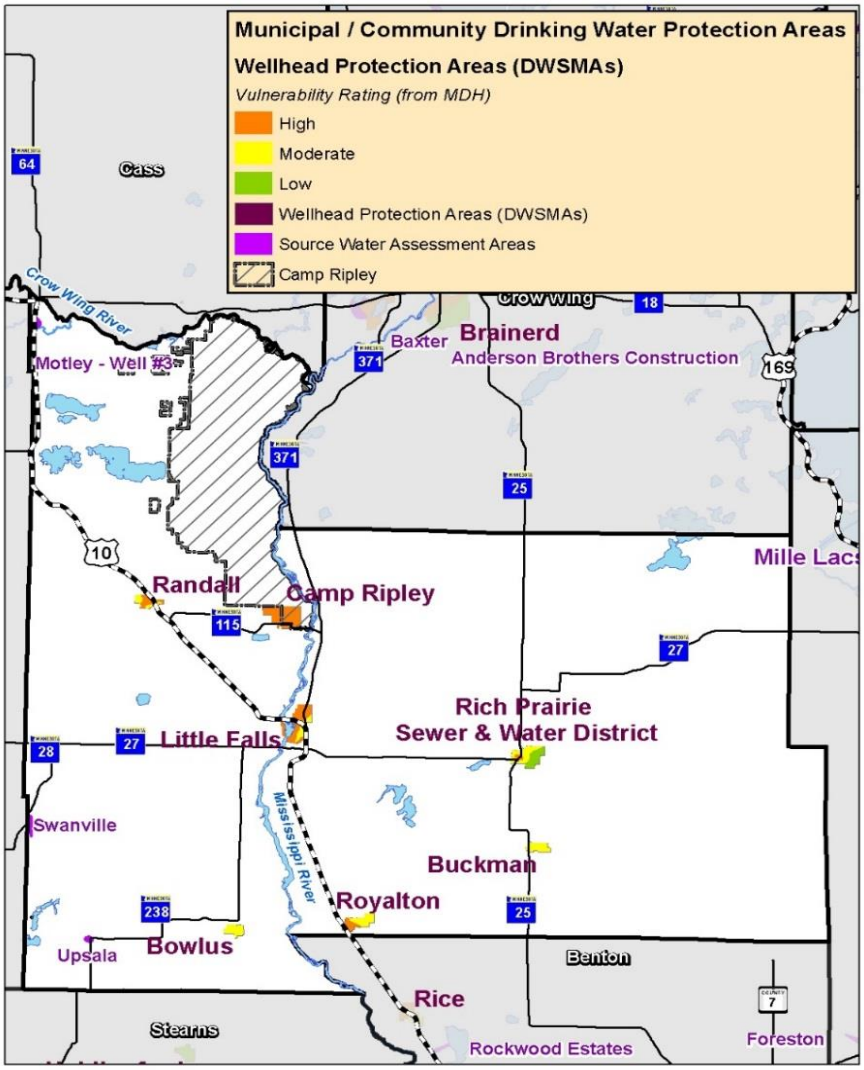


Figure 10 – Drinking Water Protection Areas

Objective I: Maintain and promote existing cooperative partnerships to monitor groundwater.

Action 1: Continue to monitor 15 United States Geologic Survey wells to measure static water levels in irrigation areas and around the county landfill.
Lead: DNR

Action 2: Hold annual nitrate clinics for county residents and provide public with information on private well testing and safe drinking standards.
Lead: SWCD/MDA

Action 3: Provide regular news releases on radio and newspapers with groundwater concerns.
Lead: SWCD

Action 4: Continue to work with the Little Rock Watershed Partnership for groundwater and surface water sustainability.
Lead: DNR

Objective Partners: DNR-EWR, County Solid Waste, MDH, Land Services Department., MN Geologic Survey, **Financial:** In-kind ($5,000 annually)
Timeframe: Duration of plan
Measurable Results:
All monitoring wells monitored

- Bi-Annual nitrate clinic held
- 5 news releases on groundwater issues published annually.
- 3 meetings held with Little Rock Watershed Partnership

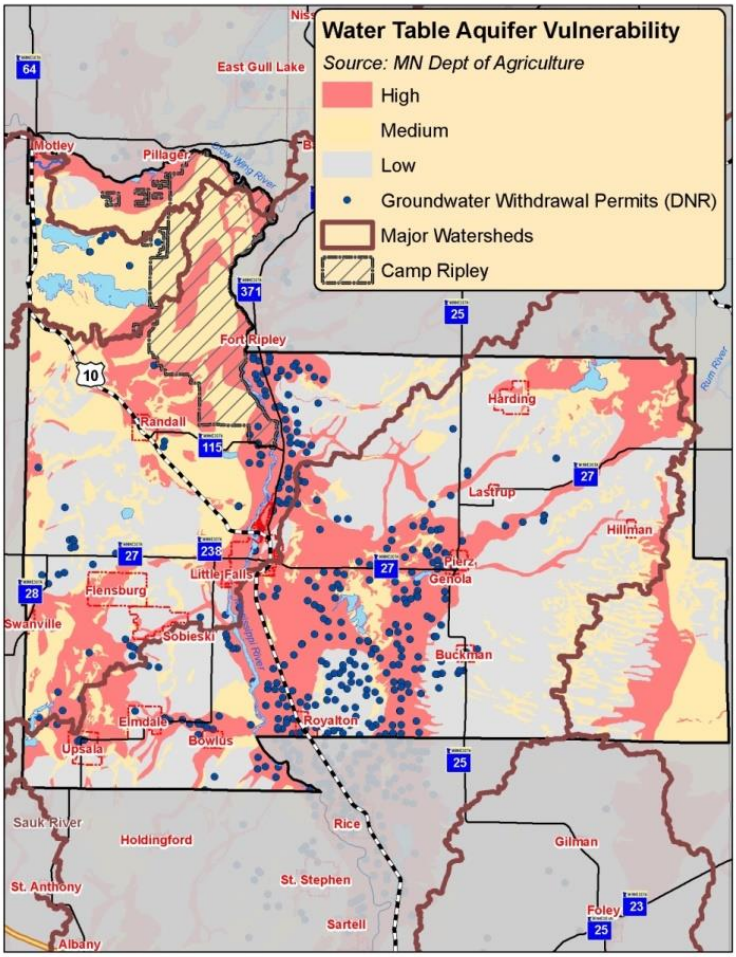


Figure 11 – Aquifer Vulnerability Map

GOAL 2: ***Preserve and ensure adequate <u>quantity</u> of the groundwater resources for the citizens and visitors of Morrison County.***

Objective A: Improve groundwater understanding, awareness and protection relating to irrigation practices.

Action 1: Strive to determine if groundwater appropriation is having an effect on surface waters and wetlands in Little Rock Creek and possibly other heavy use areas.
Lead: DNR-Ecological Services

Action 2: Participate in the Little Rock Creek Sustainable Groundwater Use Planning Project where increased demands for irrigation is being analyzed.
Lead: DNR, Morrison and Benton SWCD's, Morrison/Benton County Irrigators

Action 3: Work with municipalities and agricultural community to conserve water use and implement irrigation BMPs. Promote the newly installed weather station and irrigation scheduler program to give the agricultural community a second opinion on the soil moisture status of a given field.
Lead: Morrison and Benton SWCDs

Action 4: Review irrigation logs and permits to ensure proper procedures are maintained in Little Rock Watershed. Review of permits by DNR in Little Rock Creek Planning Project Area my commence in the future; the plan has not been completed to date.
Lead: DNR-EWR

Action 5: Assess ground water resources; determine long term trends, impacts of pumping and climate, plan for water conservation on major aquifers of the county as identified in the atlas.
Lead: MN Geological Survey

Action 6: Continue to write conservation plans for new irrigators and work with existing irrigators to encourage low pressure systems.
Lead: SWCD,NRCS

Action 7: Evaluate the impacts of windbreak removal for irrigation systems to promote development of soil loss ordinance.
Lead: SWCD/Morrison County Board of Commissioners

Action 8: Conduct a study considering appropriation permitting and land use decisions to evaluate the relationship between groundwater quantity and demand, and determine conflicts. DNR currently is not conducting a separate study outside of its current roles and efforts. Additional efforts would be considered by Department management.
Lead: SWCD, County, DNR
Objective Partners: Morrison and Benton SWCD's, Land Services Department., MN Geologic Survey, DNR-EWR, Cities, NRCS

Financial: State Grants and In-kind ($20,000 annually)
Timeframe: Duration of Plan
Measurable Results:

- 2 surface/groundwater studies launched
- Participate in Little Rock Creek Sustainable Groundwater Use Planning Project
- 3 water conservation initiatives established
- Water conservation plans for all new irrigators
- Update 20 existing irrigation plans
- Complete windbreak removal study
- Pursue a soil loss ordinance in Morrison County

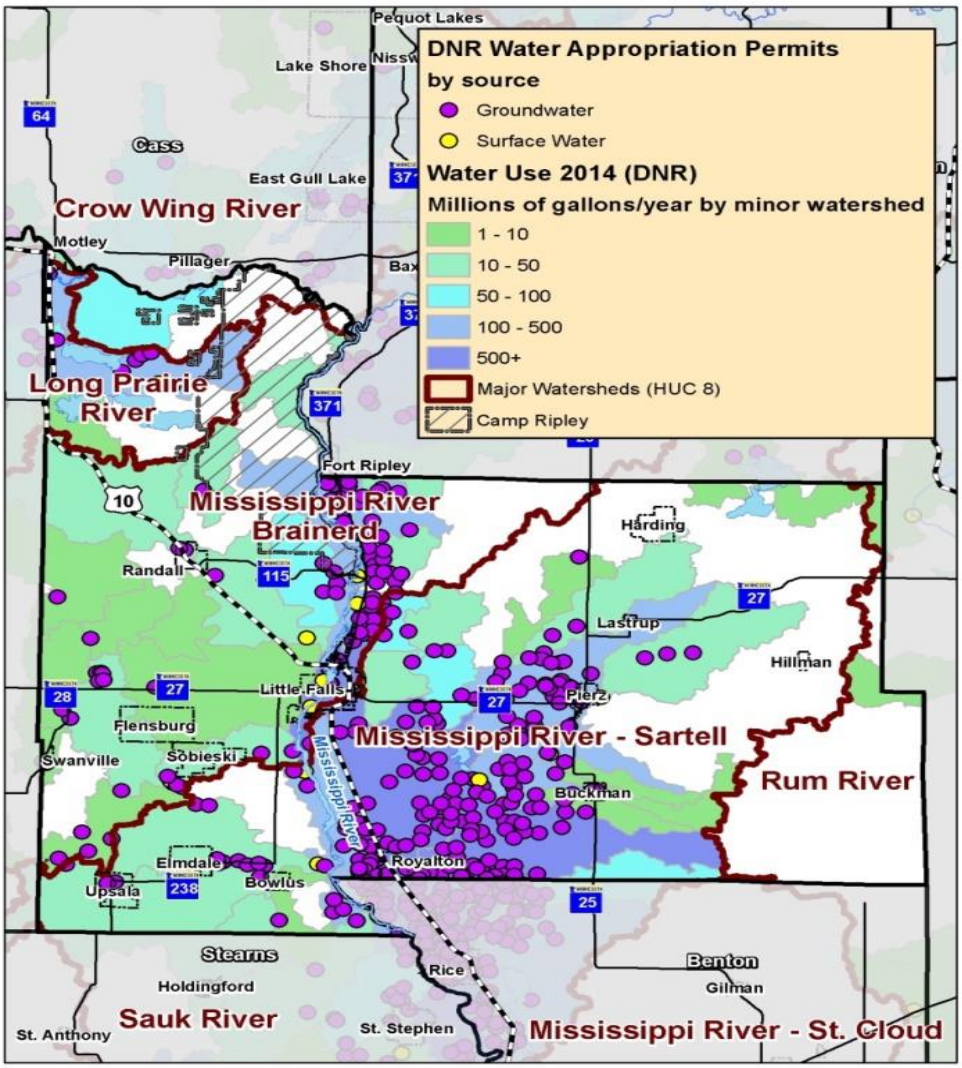


Figure 12 – County High Capacity Water Use Map

Priority Concern:

SURFACE WATER

Goal: ***To protect, enhance, and maintain the quality of the lakes, rivers, streams, and wetlands in Morrison County.***

Clean abundant water is vital to the future of Morrison County. Our health, safety and general welfare are all influenced in a large degree by our water resources. Protecting these resources is the primary purpose of water planning. With 97 protected lakes and hundreds of miles of rivers and streams covering 18,000 acres, focus naturally is given to their continued health and management.

Unlike lakes, rivers of the County run through agricultural lands. In Morrison County, we have many older riparian feedlots and pasturing situations that need to be continually addressed.

Morrison County is a transition county. Agriculture is still the predominant land use, but the County begins the lakes and forested region in the State approximately the northern half of the County.

Objective A: Reduce impacts of agricultural run-off from feedlots and farming practices.

Action 1: Per the requirements of Minnesota Statutes, Chapter 103F.48, *Riparian Practices and Water Quality Protection (Buffer Law)*, assist 700 Morrison County landowners with the establishment and/or compliance of riparian buffers along public waters and public ditches. 50-foot buffers are required adjacent to public waters by November 1, 2017. 16.5-foot buffers are required adjacent to public ditches by November 1, 2018.
Lead: SWCD

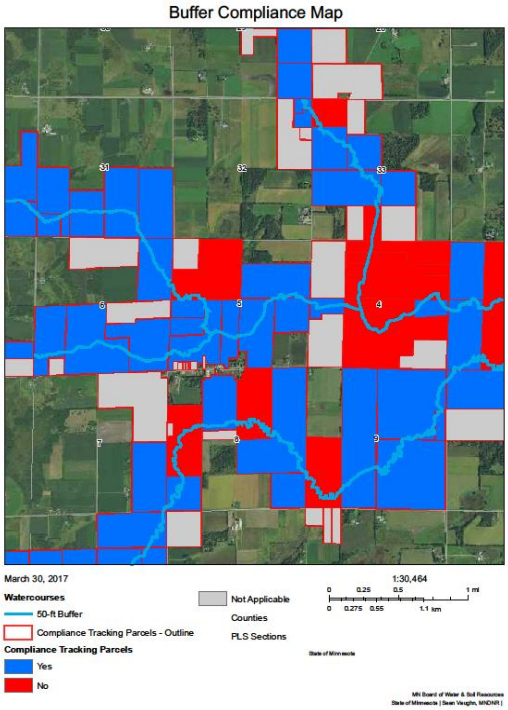


Figure 13 – BuffCAT Compliance/Non-Compliance Mapping Tool

Action 2: Recommend and approve these additional waters to be considered for buffer compliance.

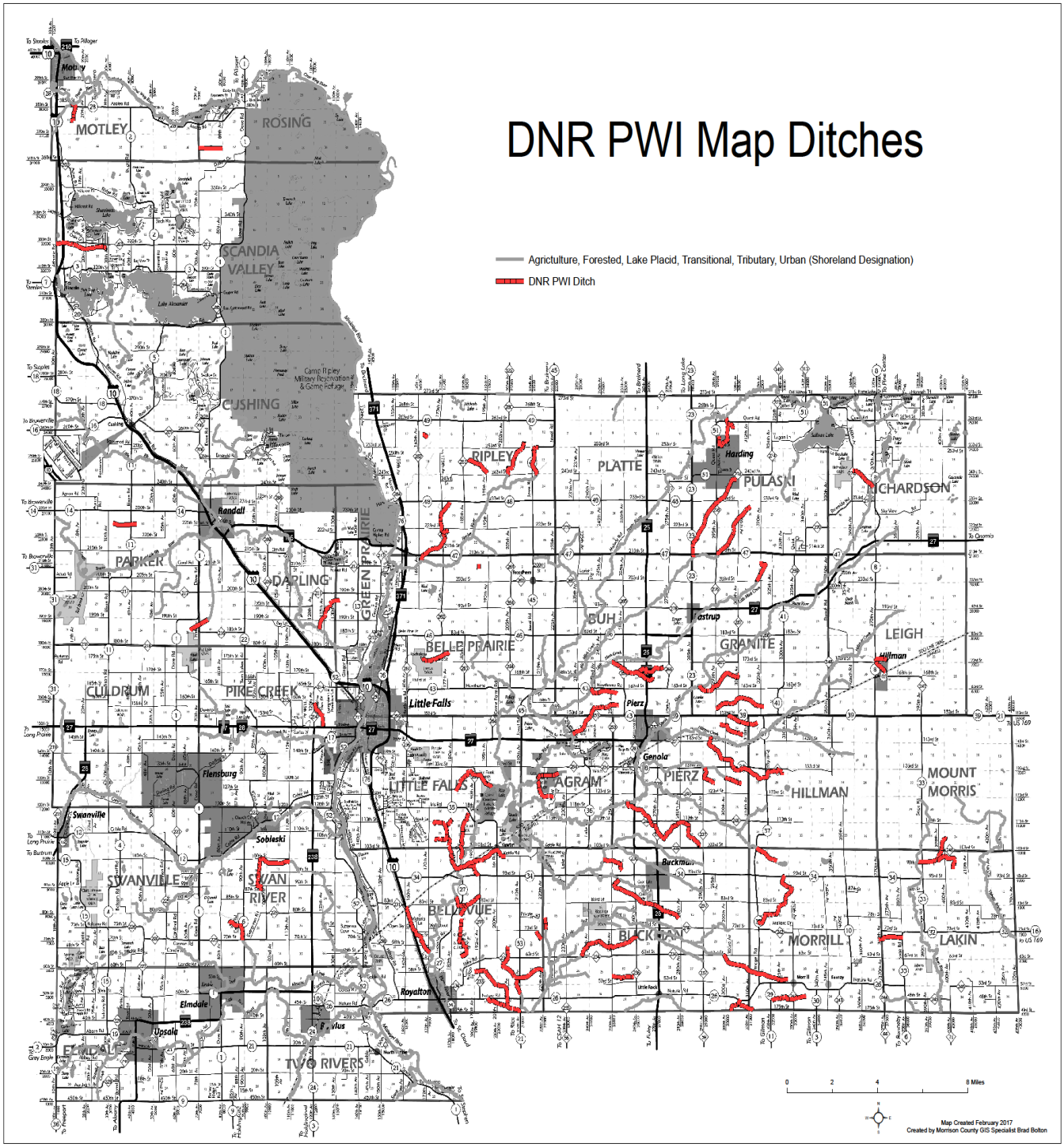


Figure 14 – DNR PWI Map-- Ditches

Action 3: Continue to monitor affected landowners and enforce the Buffer Law as necessary.
Lead: County or BWSR, SWCD

Action 4: Bring all non-compliance riparian feedlots into compliance by offering technical and financial assistance. (EQIP and CWF funding).
Lead: NRCS, SWCD, County Feedlot Officer

Action 5: Develop and implement a long term strategy involving farm management to minimize excess phosphorus runoff in the Little Rock Watershed. *(Little Rock Lake TMDL)*
Lead: Morrison and Benton SWCDs, NRCS

Action 6: Encourage nutrient management practices for manure application through federal and state programs.
Lead: NRCS

Action 7: Encourage buffer strips and riparian plantings along cropland fields adjacent to other waters and/or road right of ways that drain into public waters.
Lead: SWCD, NRCS

Action 8: Maintain state, federal, and county rules regarding setbacks for structures, applications, and feedlots.
Lead: NRCS, County Feedlot Officer, SWCD

Action 9: Hold landowner/producer workshops for manure/nutrient management.
Lead: NRCS, SWCD

Action 10: Cooperate with all local and state agencies to resolve pollution issues in a manner that provides agricultural sustainability.
Lead: SWCD

Action 11: Support the implementation of Best Management Practices to improve habitat, flows and water quality in the headwaters of the Rum River.
Lead: SWCD, Mille Lacs SWCD

Objective Partners: Morrison and Benton SWCD's, BWSR, County Feedlot Officer, NRCS, County Board, MDA
Financial: State and Federal grants ($100,000 annually)
Timeframe: Public Waters Buffers—11/1/17; public ditch buffers—11/1/18; additional protection waters and other actions—duration of plan
Measurable Results:

- Buffer law implemented within prescribed time limits
- Landowners affected by the buffer law monitored and appropriate enforcement actions taken.
- All riparian feedlots in compliance
- A farm management strategy developed for the Little Rock Watershed and implemented on 5 farms
- Nutrient management practices implemented on 10 farms

Objective B: Ensure that land use decisions for shoreland development take environmental impacts into consideration.

Action 1: Assure that developers have secured their Non-Point Discharge Elimination Systems (NPDES) permits before approving building/Conditional Use Permits/Variances.
Lead: Morrison County Land Services Department

Action 2: Hold 1 training session for elected and appointed officials on storm water management and BMPs in shore land development utilizing the BWSR Climate Change Trends Report.
Lead: SWCD/Land Services Department/BWSR

Action 3: Work towards county ordinance provisions that prohibit vegetative removal in shore-land impact zones and require run-off abatement in all variance and conditional use permits.
Lead: Land Services Department, SWCD

Action 4: Continue establishing a septic inspection process for critical areas.
Lead: Land Services Department

Objective Partners: SWCD, MPCA, Land Services Department, BWSR, DNR-EWR, Lake Associations
Financial: State and local grants ($10,000 annually)
Timeframe: Duration of plan
Measurable Results:

- All developers have approved NPDES and or County permits as required
- One storm-water training session held
- Draft riparian vegetation protection language presented to the County Board
- A septic system inspection process similar to that completed around Fish Trap Lake and developed for Agram Township (Corrective action incorporated)

Objective C: To provide coordination and assist in implementation of the Morrison AIS Plan in the fight against aquatic invasive species Aquatic Invasive Species (AIS) by developing proactive solutions aimed at educating and empowering local citizens.

Action 1: Assess the County's resources and risk of AIS introduction.
Lead: Land Services Department

Action 2: Increase public awareness and participation on prevention to include updated signage, social media, website and displays.
Lead: Land Services Department

Action 3: Increase available resources and leverage partnerships.
Lead: Land Services Department

Action 4: Broaden knowledge of and participation in early detection and rapid response activities.
Lead: Morrison County Land Services
Department, SWCD, DNR Divisions of Aquatics, Enforcement, EWR

Objective Partners: SWCD, County Board, Lake Associations, MHB, Wildlife Forever
Financial: State and local grants, volunteers ($25,000 annually)
Timeframe: Duration of plan
Measurable Results:

- AIS risk assessment completed and AIS prevention priorities developed
- Utilize MHB social media campaign and Wildlife Forever's "Clean, Drain, and Dry" materials and signs to increase AIS prevention awareness
- Enlist and enroll volunteers from 5 high priority lake associations in the Extension "AIS Detector Program"

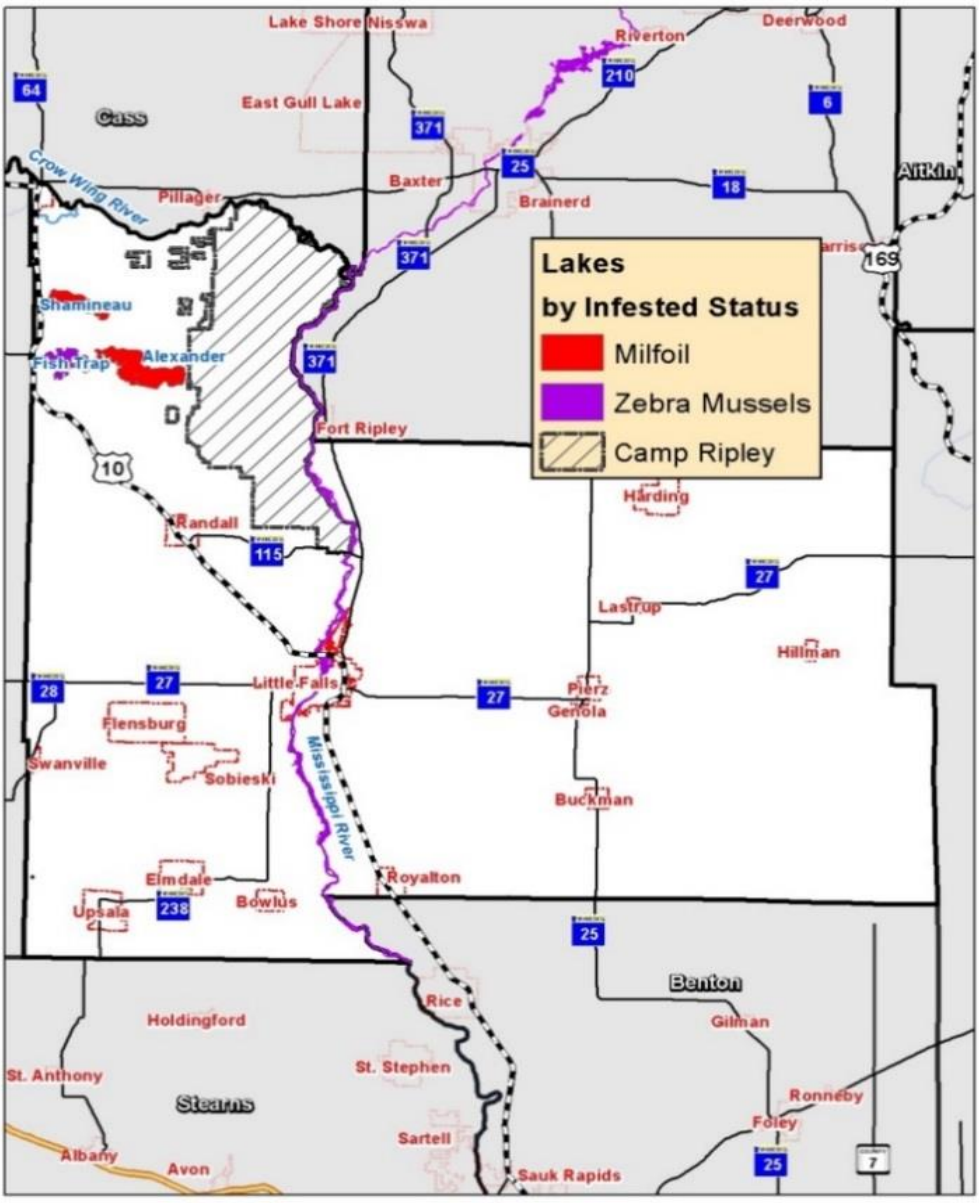


Figure 15 - AIS Infested Lakes Map--Morrison County

Objective D: Protect and enhance the County's wetlands.

Action 1: Reduce impacts to wetlands by administering MN Wetland Conservation Act (WCA), and encouraging vegetative buffers around wetlands.
Lead: SWCD

Action 2: Encourage wetland restorations, prioritizing flood management areas, water recharge area.
Lead: SWCD

Action 3: Hold bi-annual contractor trainings sessions to help developers identify wetlands
Lead: SWCD, Technical Evaluation Panel

Action 4: Continue to publicize via radio and educational opportunities, the rules and regulations concerning wetland impacts.
Lead: SWCD

Action 5: Work with elected officials to require wetland delineations for all new development.
Lead: SWCD

Action 6: Hold realtor training sessions on wetlands rules/county ordinances.
Lead: SWCD, Land Services Department

Objective Partners: SWCD, BWSR, Land Services Department, DNR-Wildlife, DNR-EWR, DNR-Enforcement, USFWS, NRCS
Financial: In-Kind Contributions (60,000 annually)
Timeframe: Duration of plan
Measurable Results:

- WCA administered efficiently and effectively
- 3 wetland restorations completed
- 1 wetland identification training sessions held annually
- 20 WCA radio spots aired, 5 general WCA presentations delivered to schools and civic groups
- Rules established requiring wetland delineations on new development
- Bi-annual realtor wetland training sessions held over duration of plan

Objective E. Assist Lake Associations and Lake Improvement Districts in developing and maintaining good lake protection plans.

Action 1: Conduct follow-up and support to Lake Improvement Districts (LIDs) to assure they are carrying through with their plans and reports to County Commissioners.
Lead: SWCD/County Auditor

Action 2: Host an annual meeting for lake associations and LID's to provide funding information and have DNR-Enforcement present shoreland management rules.
Lead: SWCD

Action 3: Establish a schedule of monitoring to facilitate water quality trend analysis.
Lead: SWCD

Action 4: Monitor, maintain, and enhance healthy aquatic vegetation on all lakes.
Lead: SWCD, Lake Associations

Action 5: Protect and enhance wild rice lakes (Twelve, Coon, Rice, Skunk, and others identified by DNR).
Lead: SWCD, DNR, BWSR

Action 6: Provide low interest loan info to lakeshore owners to encourage septic upgrades.
Lead: Land Services Department.

Action 7: Apply for Clean Water Fund (CWF) grant to achieve monitoring and implementation goals.
Lead: SWCD

Action 8: Support continued lake water quality monitoring.
Lead: SWCD

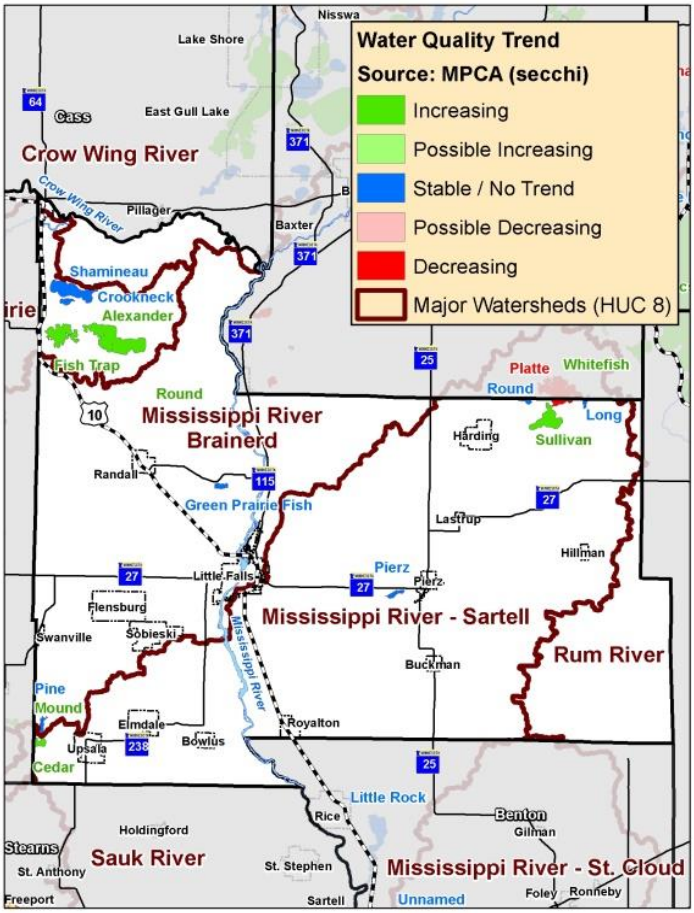


Figure 16 - Water Quality Trend Map

Objective Partners: SWCD, LID's, DNR-EWR, DNR-Fisheries, DNR-Enforcement, MPCA, BWSR, Land Services Department, Lake Associations
Financial: LID funds, State and County Grants, In-kind ($60,000 annually)
Timeframe: Duration of plan
Measurable Results:

- LID's submit complete annual reports to the County Board
- 5 LID annual meetings held
- Water quality monitoring program established on all high priority lakes with declining water quality
- Aquatic vegetation monitored on10 high priority lakes with high probability of infestation, 5 enhancement projects completed
- 4 wild rice lake enhancement projects completed
- Low interest loan program information sent to lakeshore owners on 10 high priority lakes with declining water quality and a high number of septic systems >10 years old
- 4 septic systems upgraded using low interest loan funds
- CWF grant application submitted
- Continued nutrient monitoring of high priority lakes with declining water quality

Objective F. Improve, maintain, and ensure clean and healthy lakes and rivers in Morrison County.

Action 1: Support Benton SWCD in the Little Rock Lake and Little Rock Creek TMDL recommendations.
Lead: SWCD

Action 2: Apply for Native Buffer Funding for critical area restorations and secondary buffering initiatives.
Lead: SWCD

Action 3: Hold annual Lake and River Day for BMP education.
Lead: SWCD

Action 4: Target cost share programs and funding sources to critical areas with declining water quality as determined by water quality monitoring.
Lead: SWCD

Objective Partners: SWCD, Land Services Department, BWSR, DNR-EWR, DNR-Fisheries, NRCS, Benton SWCD
Financial: State Grants and In-kind contributions ($40,000 annually)
Timeframe: Duration of plan
Measurable Results:

- Annual participation in Little Rock Lake and Little Rock Creek WRAPS projects
- 8 native buffer projects completed on critical erosion sites
- 5 annual River Days held
- 20 cost shared projects in critical impaired and protected waters areas

Objective G: Increase protection of lakes and rivers from floodwaters.

Action 1: Assist Federal Emergency Management Agency (FEMA) in their update of new floodplain maps for Morrison County. Adopt new floodplain maps and incorporate them into the GIS map system.
Lead: SWCD

Action 2: Target funding sources to critical flood areas (Little Elk, Bellevue Twp. Swan River, Skunk R, Platte R, Lake Shamineau, Fletcher Creek, Mississippi River).
Lead: SWCD

Objective Partners: SWCD, DNR, BWSR, FEMA, CWF, County Land Services Department, County Emergency Services, County GIS Department
Financial: Federal and County ($30,000 for project)
Timeframe: 2017-2019 for floodplain maps
Measurable Results:

- Flood funding targeted to critical flood areas
- Local input provided to FEMA for review
- New floodplain maps adopted by the County

Objective H: Prioritize minor watersheds for protection.
For more information, see Appendix B and the Morrison County SWCD website at: www.morrisonswcd.org

Action 1: Review minor watershed data and gain input from local stakeholders.
Lead: SWCD

Action 2: Impanel the Water Plan Task Force to set minor watershed protection priorities.
Lead: SWCD

Action 3: Determine priority projects in those minor watersheds and develop a priority implementation list.
Lead: SWCD

Action 4: Seek State and local funding to support those projects.
Lead: SWCD

Action 5: Implement 10 minor watershed protection projects.
Lead: SWCD

Objective Partners: SWCD, County Land Services Department, Lake Associations, Lake Improvement Districts, DNR, BWSR, MPCA, Farm organizations, LWP Task Force
Financial: Federal, State, and local grants, local staff time, volunteer ($50,000 annually)
Timeframe: Duration of plan
Measurable Results:

- Local partner input received for consideration by the Water Plan Task Force
- Minor watersheds prioritized
- Priority minor watershed protection projects identified and an implementation list developed
- Project funding acquired from Federal, State and local grants
- 10 priority projects completed

Objective I: Complete and implement the Morrison County Comprehensive Drainage Management Plan.

Action 1: Complete culvert inventory and prepare documents for each township.
Lead: SWCD, Morrison County Public Works

Action 2: Maintain culvert inventory and create a website accessibility

Action 3: Train contractors in the use of the database

Action 4: Tie culvert information into Lidar mapping tool to develop a hydrology model showing project impacts for local government decision makers.
Lead: SWCD

Action 5: Provide assistance and support in the management of stormwater, erosion, and sediment control
Lead: SWCD, Morrison County Public Works

Action 6: Study and comprehend the hydrology and storm water management through evaluating watershed changes in surface water elevations in Morrison County.

Action 7: Develop necessary regulation and/or ordinances on culvert sizing and tile drainage.
Lead: SWCD, Townships, Morrison County Public Works, Morrison County Land Services

Objective Partners: SWCD, Land Services Dept., County Board, DNR-EWR, LCCMR
Financial: State and local grants ($100,000 annually)
Timeframe: 2017-2019
Measurable Results:

- Culvert inventory completed and hydrologic model developed
- Ordinance drafted and adopted by the County Board
- Inventory Completed and Maintained

Objective J: River Connectivity

Action 1: Seek funding and assist in the installation of a Fish Ladder on the Mississippi River in the City of Little Falls.

Objective Partners: City of Little Falls, DNR Divisions of Fisheries, EWR, SWCD, Minnesota Power
Financial: State and City Parks and Recreation Grants ($70,000)
Timeframe: 2017-2019
Measurable Results:

- Installation of a fish ladder for recreational and tourist availability
- Improve the fish connectivity between above the Little Falls dam and below the dam.

PRIORITY CONCERN: LAND USE AND DEVELOPMENT

GOAL: ***To ensure that land use decisions are compatible with natural resource protection.***

The Morrison County Land Services Department is the lead agency for administrating the Land Use Ordinance to protect, preserve and enhance the lakes, rivers, forests and agricultural land for future generations. Both the Land Use Ordinance and this Water Plan will go hand in hand in making land use decisions for the protecting and improving Morrison County.

Objective A: To assure all riparian feedlot producers are in full compliance.

Action 1: Apply for and prioritize all funding sources to address the most critical pollution sites.
Lead: SWCD, NRCS

Action 2: Maintain technical assistance capabilities to assist landowners.
Lead: SWCD, NRCS, County Feedlot Officer

Action 3: Continue serving as environmental advisor member to the Planning Commission (PC) and Board of Adjustment (BOA).
Lead: SWCD, County Feedlot Officer

Action 4: Continue environmental reviews for feedlot changes.
Lead: SWCD, Morrison County Land Services Department

Action 5: Enforce manure stockpiling rules.
Lead: Land Services Department, County Feedlot Officer

Action 6: Promote pasture management, nutrient management, and residue management through state and federal programs.
Lead: NRCS, SWCD

Objective Partners: Morrison County Land Services Department, SWCD, BWSR, NRCS, County Feedlot Officer, West Central Technical Service Area Staff (WSTSA), MPCA, PC, BOA
Financial: Federal and State Funding, In-Kind, Landowners, ($300,000 annually)
Timeframe: Duration of plan
Measurable Results:

- Cost-share feedlot pollution control practices on 20 feedlots
- Technical staff compliment maintained
- Continued representation on PC and BOA
- Environmental reviews on all feedlot changes on Tier 2-4 feedlots
- Manure stockpile rules enforced
- State and federal programs used to promote pasture management, nutrient management, and residue management

Objective B: Reduce the pressure and impact of shore-land, rural residential and marginal land development.

Action 1: Enact ordinances that minimize the over-development of sensitive areas.
Lead: Morrison County Land Services Department, SWCD

Action 2: Support the Camp Ripley Army Compatible Use Buffer (ACUB) Program.
Lead: SWCD

Action 3: Work with the Sentinel Landscape Coordinating Committee to identify the boundaries of the Camp Ripley Sentinel Landscape and develop a suite of tools and programs to provide technical and financial assistance to interested landowners within roughly 10 miles of the Camp.
Lead: SWCD, The Nature Conservancy (TNC), Camp Ripley

Action 4: Encourage the state to re-establish the Re-Invest in Minnesota (RIM) program statewide to protect high quality habitat such as wild rice and to protect undeveloped properties around non-impaired and impaired waters.
Lead: SWCD, BWSR

Action 5: Apply for state funding to purchase conservation easements on undeveloped shore land and forestland.
Lead: SWCD

Action 6: Require conditions on developments to address potential impacts.
Lead: Land Services Department, Morrison County Board, BOA, PC

Action 7: Develop and implement cooperative monitoring of land use changes.
Lead: Land Services Department

Action 8: Support DNR shore-land rules regarding dock and boathouse rules.
Lead: Land Services Department, Morrison County Board

Objective Partners: SWCD, Land Services Department., County Board, PC, BOA, BWSR, NRCS, DNR, Camp Ripley
Financial: Federal and NGU, In-kind contribution ($1,000,000 annually)
Timeframe: Duration of plan
Measurable Results:

- Enact over-development standards
- PC and BOA required conditions to address impacts on developments
- Continue easement opportunities in the ACUB program
- Assist landowners in the Sentinel Landscape area with Best Management Practices
- State funding secured for forest preservation and riparian easements, 20 easements completed
- Land use changes monitored, report developed
- Dock and boathouse ordinance provisions in compliance

Objective C: Reduce the loss of natural habitat

Action 1: Develop a soil loss ordinance for the county that includes the control of windbreak and forestry removal.
Lead: SWCD, Land Services Department

Action 2: Encourage and support the use of DNR's ecological classification system in native vegetation work. Support training of agency staff and conservation leaders on native plant communities appropriate to the County.
Lead: DNR-Forestry

Action 3: Support land ordinances that protect natural resources and encourage use of Mississippi Headwaters Board (MHB) Habitat Corridor Project – Easement and fee title acquisition program to prevent loss of habitat.
Lead: Land Services Department, MHB, SWCD, BOA, PC

Action 4: Require all developments to include green space and storm water management.
Lead: Land Services Department

Action 5: Preserve forested lands by identifying and mapping priority forested blocks in the county. Work with Minnesota Forest Resource Council (MFRC) to develop funding to support forest protection and restoration efforts in the County.
Lead: Morrison and Crow Wing County SWCD, MFRC, Sentinel Landscape Committee

Action 6: Encourage private forest stewardship plans. Utilize DNR Spatial Analysis to prioritize high priority areas.
Lead: Morrison and Crow Wing County SWCDs

Action 7: Encourage native grass plantings in right of ways on county and township roads.
Lead: SWCD

Action 8: Support the coordination/implementation of MN Forest Resource Council (MFRC) regional forest management plans/landscape plans.
Lead: Morrison and Crow Wing SWCDs

Action 9: Encourage protection and restoration of grasslands.
Lead: SWCD

Action 10: Complete and continue to monitor public water and public ditch buffers.
Lead: SWCD

Objective Partners: SWCD, Land Services Department., NRCS, County Board, Cities, DNR-Forestry, Consulting foresters, BWSR, Water Plan Taskforce, MFRC, USFWS, TNC, PC, Lake Associations, LID's, MHB, CRSL
Financial: $45,000/yr.
Timeframe: Duration of plan
Measurable Results:

- Soil loss ordinance drafted and presented to County Board
- 2 training sessions held on DNR ecological classification system
- Actively support ordinance amendments that better protect natural resources, preserve green space in developments, and require storm water management
- High priority forestlands in the County identified and mapped. A forest protection and restoration funding proposal drafted in cooperation with MFRC
- Information on forest stewardship plans distributed to all private forest landowners in the County. 15 forest stewardship plans completed
- A grassland protection and restoration strategy drafted and presented to agencies and County Board
- CRSL and MFRC Landscape Stewardship Plans are implemented

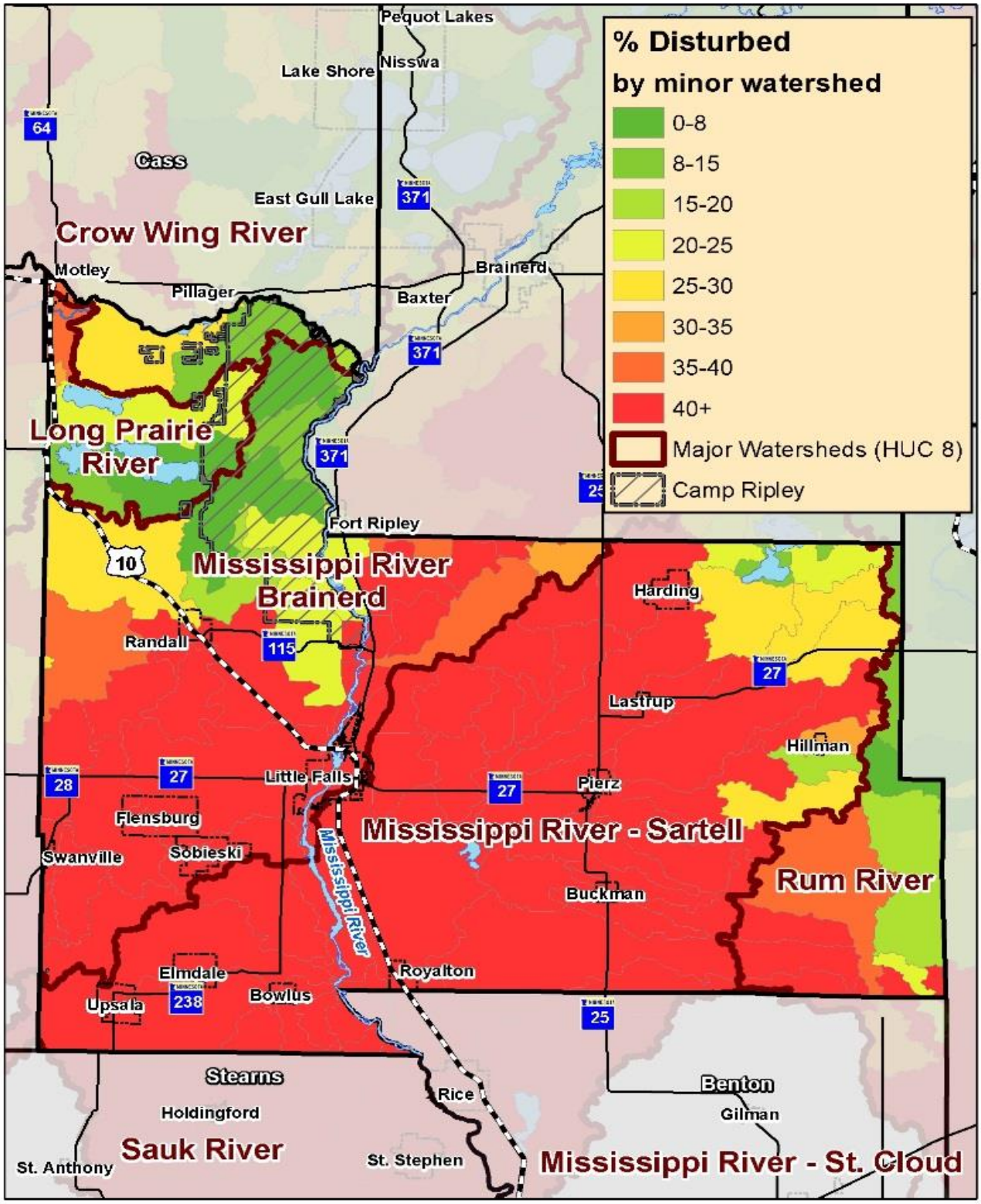


Figure 17 – Disturbed Land Cover Map—Morrison County

WATER PLANNING ON A WATERSHED BASIS

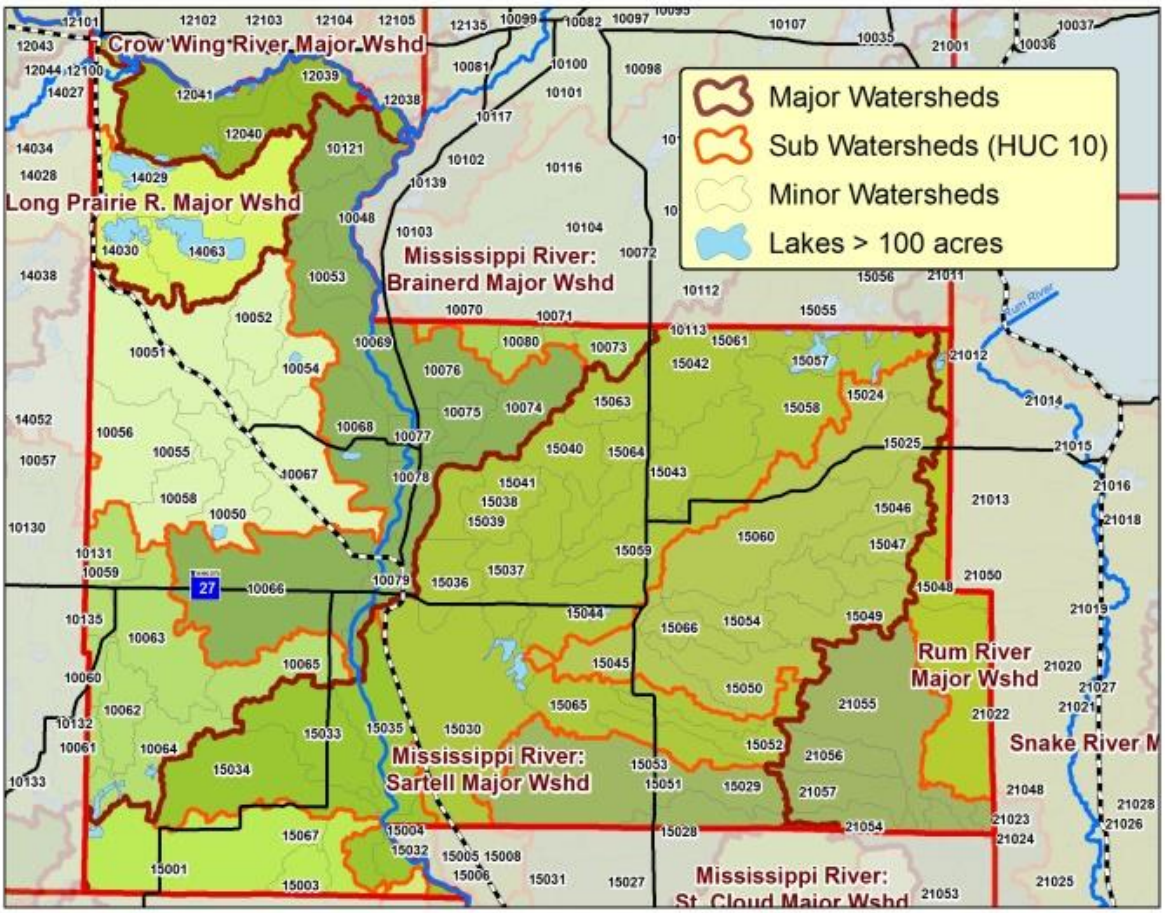


Figure 18 - Morrison County Major Watersheds Map

Introduction

The information in this section is derived from one of two sources:

- **Watershed Protection and Restoration Strategy (WRAPS) project reports**—The studies, where available, have been undertaken in several watersheds that intersect with Morrison County. Strategies listed are those specifically impacting Morrison County and not necessarily all those developed to protect the entire watershed. The State of Minnesota has adopted a "watershed approach" to address the state's 80 "major" watersheds (denoted by 8-digit hydrologic unit code or HUC). This watershed approach incorporates **water quality assessment, watershed analysis, civic engagement, planning**, **implementation**, and **measurement of results** into a 10-year cycle that addresses both restoration and protection.

Purpose:

- Support local working groups and jointly develop scientifically-supported restoration and protection strategies to be used for subsequent implementation planning
- Summarize watershed approach work done to date.

Scope:

- Impacts to aquatic recreation and impacts to aquatic life in streams
- Impacts to aquatic recreation in lakes

Audiences:

- Local working groups (local governments, SWCDs, watershed management groups, etc.)
- State agencies (MPCA, DNR, BWSR, etc.)

As part of the watershed approach, waters not meeting state standards are still listed as impaired and Total Maximum Daily Load (TMDL) studies are performed, as they have been in the past, but in addition the watershed approach process facilitates a more cost-effective and comprehensive characterization of multiple water bodies and overall watershed health. A key aspect of this effort is to develop and utilize watershed-scale models and other tools to identify strategies and actions for point and nonpoint source pollution that will cumulatively achieve water quality targets. For nonpoint source pollution this report informs local planning efforts, but ultimately the local partners decide what work will be included in their local plans. These reports also serve as watershed plans addressing EPA's nine minimum elements to qualify applicants for eligibility for section 319 implementation funds. More information on these studies is available at:

https://www.pca.state.mn.us/water/watersheds/mississippi-river-brainerd
https://www.pca.state.mn.us/water/watersheds/mississippi-river-sartell
https://www.pca.state.mn.us/water/watersheds/long-prairie-river
https://www.pca.state.mn.us/water/watersheds/crow-wing-river
https://www.pca.state.mn.us/water/watersheds/rum-river
https://www.pca.state.mn.us/water/sentinel-lakes
https://www.pca.state.mn.us/water/large-river-monitoring
https://www.pca.state.mn.us/water/statewide-mercury-reduction-plan

- **Total Maximum Daily Loading (TMDL) Studies**--The Clean Water Act, Section 303(d), requires that every two years states publish a list of waters that do not meet water quality standards and do not support their designated uses. These waters are then considered to be "impaired". Once a waterbody is placed on the impaired waters list, a Total Maximum Daily Load (TMDL) must be developed. The TMDL provides a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. It is the sum of the individual waste-load allocations (WLAs) for point or permitted sources, load allocations (LAs) for nonpoint or non-permitted sources and natural background, plus a margin of safety (MOS).

Little Rock Creek Sub-watershed

Little Rock Creek TMDL Study Excerpts

The Little Rock Creek Watershed is 44,229 acres and is divided between Benton (12,590 acres) and Morrison (31,639 acres) counties. The main stream segment of Little Rock Creek is perennial, whereas, a majority of the tributaries to the creek are intermittent or have been converted to drainage ditches. Little Rock Creek flows south through Little Rock Lake and ultimately discharges to the Mississippi River via the Harris Channel. The drainage area for Little Rock Creek has been further defined by linked surface water and groundwater modeling developed for the TMDL study. The groundwater model domain area for the Little Rock Creek Watershed is 215,701 acres, and was selected because groundwater perturbations outside of the surface watershed area will affect the groundwater drainage area, along with climatic variations and variations in groundwater pumping. Groundwater flows west through the Little Rock Creek watershed, discharging both to the creek and to the Mississippi River (south and west of the watershed).

Little Rock Creek Stressor Identification report (Benton SWCD, 2009) cites lower groundwater levels as a possible contributor to the impairments for dissolved oxygen and temperature. The data show that the dry weather and associated low flow conditions from the TMDL monitoring period (2006 through 2008) were not as severe at the 1988 drought, but the persistence of dry conditions resulted in above average pumping rates for agricultural irrigation (normalized to the drought index) for six consecutive years that may have exacerbated the flow conditions for Little Rock Creek.

Recommendations for the restoration of Little Rock Creek and the water plan implementation actions to address them include:

- Overall, a 52% reduction in total oxygen demand is necessary to ensure that the DO standard is met throughout Little Rock Creek under the critical flow conditions. Reductions in nitrate load of 47% and 29% are necessary to ensure that the standard is met in Little Rock Creek under the dry and low flow conditions, respectively. Reductions in nitrate load of 33% and 19% are necessary to ensure that the standard is met in Bunker Hill Creek under the moist and mid-range flow conditions, respectively. Overall, a 1% reduction in thermal loading across all thermal sources is needed in the Station 13 section of Little Rock Creek to meet the Maximum Weekly Average Temperature (MWAT) criteria.—**Groundwater, Goal 2, Objective A, Actions 1-8; Surface Water, Objective A, Actions 1, 2, and 5;**

- The calibrated water quality modeling was used to simulate three mitigation scenarios: 1) Removal of the man-made impoundment, 2) Doubling the groundwater flow into the system while maintaining the same chemical loads, and 3) a combination of the first two mitigation scenarios. The results of this modeling showed that a combination of both types of mitigation would be required to meet the dissolved oxygen standard and the temperature criteria, while an increase in groundwater flow would be necessary to meet the drinking water standard for nitrate in Little Rock Creek. – **Groundwater, Goal 2, Objective A, Actions 1-8**

- Reductions in groundwater use will be necessary to improve conditions in the stream. A variety of potential options to reduce groundwater use should be explored, including: limits on total appropriations, improved irrigation efficiency, scheduling and technologies, identifying

alternative sources, timing, proximity to the stream and other options not yet identified.— **Groundwater, Goal 2, Objective A, Actions 1-8**

- Nutrient and organic constituent reductions. -- **Surface Water, Objective A, Actions 1-10**

- Creating more of a free flowing system, while incorporating current Wildlife Management Area (WMA) management strategies, to improve connectivity and temperature issues during drought conditions -- **Surface Water, Objective A, Action 11.**

It is expected that groundwater and hydrology management will improve the loading capacity and water quality toward meeting the State water quality standards and temperature criteria over a long period, while helping to restore biological integrity in Little Rock Creek. Nonpoint contributions are not regulated and, therefore, reductions will need to proceed on a voluntary basis.

Rum River Watershed

Rum River Watershed WRAPS Study Excerpts

The Rum River Watershed covers 4,103 square miles, 101 of those in Morrison County, of the Upper Mississippi River Basin in central Minnesota stretching from Lake Mille Lacs in the north to the confluence with the Mississippi River in the City of Anoka. The watershed covers large portions of Aitkin, Mille Lacs, Isanti, and Anoka Counties and covers smaller areas of Crow Wing, Morrison, Benton, Kanabec, Chisago, and Sherburne County as well as portions of the Mille Lacs Band of Ojibwe Tribal land. The middle third of the watershed including Morrison County has wetland complexes and hardwood forest but cropland and rangeland make up the majority of the land use. Fenced cattle pastures and forage crops such as alfalfa and hay are more abundant than row crops like soybeans and corn.

Many of the lakes and streams in the Rum River Watershed already meet or exceed water quality goals. Research shows that protecting water quality from degrading is more cost effective than trying to restore degraded waters. The following list provides a short description of the major water quality concerns in the Rum River watershed that were developed based on input from local partners and the public:

- Riparian habitat – The Rum River is a State Wild, Scenic and Recreational River. Preservation and restoration of continuous natural vegetation within the riparian corridor and preservation of floodplains is critical to wildlife, water quality, flood abatement and the scenic nature of the river.
- Protecting watershed hydrology – Similar to land use changes, alterations from ditching and other forms of drainage can have multiple impacts to downstream water resources. Maintenance of long-neglected ditches is of particular concern, as this can increase rates and volumes of runoff in ways that impact water quality, erode streambanks and increase flood risks.
- Lakes – Cisco lakes, shallow wild rice lakes and recreational lakes near water quality thresholds are priorities for protection.
- Land use changes – Changes in land use including forested to agriculture or agriculture to developed are anticipated to occur in the future. Modeling scenarios have been performed to

estimate the impacts of these conversions and should be used by local governments to mitigate these impacts.

- Protecting groundwater – Portions of the watershed are important for recharge of regional aquifers, including those serving the Twin Cities metro. It is important to keep water on the land in these areas and certain areas sensitive to groundwater pollution should not host pollutant-generating facilities. Also, portions of this watershed are known to have high nitrates in the groundwater due to the combination of agricultural land use and sandy soils. The Minnesota Department of Agriculture 2013 Nitrogen Fertilizer Management Plan is the state's blueprint for prevention or minimization of the impacts of nitrogen fertilizer on groundwater.

Restoration and Protection Strategies

The Rum River WRAPS is near complete, but has not been formally approved. Strategies presented here are integrated into this plan to direct actions and obtain funding. The goal is waters that meet standards for aquatic life, recreation, drinking, industry, agriculture, and aesthetic enjoyment:

Upper Rum Sub-watershed

Water Body	Location	Water Quality Problem	Strategy Type	Water Plan Implementation Initiatives
Tibbetts Brook	07010207-676	Altered hydrology	Manage beaver dams	Surface Water, Obj. A, Action 11
Tibbetts Brook	07010207-677	Poor fish habitat	Rotational grazing and livestock exclusion	Surface Water, Obj. A, Action 11

West Branch Rum Sub-watershed

Water Body	Location	Water Quality Problem	Strategy Type	Water Plan Implementation Initiatives
Unnamed Trib. to West Branch	07010207-667	Altered hydrology	Treatment areas to control water release (retention ponds or buffers	Surface Water, Obj. A. Actions 1-3; Land Use and Dev, Obj. C, Action 4
Unnamed Trib. to West Branch	07010207-667	Poor fish habitat	Install minimum 25 foot buffer along channel	Surface Water, Obj. A. Actions 1-3

Long Prairie River Watershed

Long Prairie WRAPS Study Excerpts

The Long Prairie River Watershed covers 892 square miles of Douglas, Todd, Morrison, and Otter Tail Counties in west central Minnesota, 61.7 of which lie in Morrison County. Flowing from west to east the Long Prairie River is over 96 miles long and joins the Crow Wing River near its junction with the Mississippi River south of Brainerd, Minnesota. The watershed spans three ecological provinces: moving from the edges of the Prairie Parkland, through the Eastern Broadleaf Forest, and including portions of the Laurentian Mixed Forest. The dominant land use within the watershed is 54% agricultural, while grasslands and forests make up 24%, water 7.5%, and urban 6%. Land use varies along ecological provinces with the agricultural uses of the highly productive prairie soils in the headwaters contrasting with the recreational development focused around the lakes which are often in the steep and rolling woodlands of the glacial moraines.

In the eastern portion of the watershed which includes Morrison County lie the hills of the St. Croix Moraine of the Superior Lobe. Along this stretch the Turtle, Moran, and Fish Trap Creek sub-watersheds join the Long Prairie River main stem from the east. Lakes in this area have significant development and provide quality recreational opportunities. Lake watersheds here generally have significant levels of disturbance but the sandy soils of the Superior lobe help protect water quality from direct runoff. Some very high quality minimally impacted lakes are found in this portion of the watershed. Lakes Alexander and Lake Shamineau in particular have mainly forested watersheds and excellent water quality. The following strategies to maintain this generally good water quality:

Fish Trap Lake Sub-watershed

Water Body	Location	Water Quality Issue	Strategy Type	Water Plan Implementation Initiatives
Lake Alexander	49-0079	Secchi depth	Monitor in-lake TP, acquire ACUB easements	Surface Water, Obj. F. Action 8; Land Use and Dev., Obj. B, Action 2
Lake Alexander	49-0079	Phosphorus reduction	Shore land ordinances, shoreline BMP's, storm water controls, acquire conservation easements	Land Use and Dev, Obj. B, Actions 1 and 2; Land Use and Dev., Obj. C, Action 4
Lake Alexander	49-0079	Reduce upstream phosphorus loads	Acquire conservation easements on high priority forestlands	Land Use and Dev, Obj. B, Action 3
Fish Trap Lake	49-0137	In-lake TP	Monitor TP monthly for trends	Surface Water, Obj. F. Action 8
Fish Trap Lake	49-0137	Phosphorus reduction	Shore land ordinances, shoreline BMP's, storm water controls, acquire conservation easements	Land Use and Dev, Obj. B, Actions 1 and 2; Land Use and Dev., Obj. C, Action 4
Fish Trap Lake	49-0137	Invasive species	Monitor impacts of curly leaf pondweed endothall	Surface Water, Obj. D, Action 1

			applications on water quality	
Ham Lake	49-0136	Reduce upstream phosphorus loads	Acquire conservation easements on high priority forestlands	Land Use and Dev, Obj. B, Action 3
Ham Lake	49-0136	In-lake TP	Monitor TP monthly for trends	Surface Water, Obj. F. Action 8

Fish Trap Creek Sub-watershed

Water Body	Location	Water Quality Issue	Strategy Type	Water Plan Implementation Initiatives
Fish Trap Creek	70101080603	Dissolved Oxygen	Restore natural stream meander and flow to areas impacted by ditching, damming, and culverts.	Surface Water, Obj. A, Action 11

Shamineau Lake Sub-watershed

Water Body	Location	Water Quality Issue	Strategy Type	Water Plan Implementation Initiatives
Round Lake	49-0131	Reduce upstream phosphorus loads	Acquire conservation easements on high priority forestlands	Land Use and Dev, Obj. B, Action 3
Crook Neck Lake	49-0133	Shore land Protection	Maintain native vegetation by ordinances, restricting development	Land Use and Dev, Obj. B, Actions 1 and 2
Crook Neck Lake	49-0133	Phosphorus	Collect monthly TP samples for trend analysis	Surface Water, Obj. F. Action 8
Shamineau Lake	49-0127	Phosphorus	Natural plantings, buffers, bank stabilization, shore land ordinance enforcement, conservation easements or acquisitions.	Surface Water, Obj. A. Actions 1-3; Land Use and Dev, Obj. B, Actions 1 and 2; Land Use and Dev., Obj. C, Action 4
Shamineau Lake	49-0127	Phosphorus	Collect monthly TP samples for trend analysis	Surface Water, Obj. F. Action 8
Shamineau Lake	49-0127	Phosphorus	Shore land ordinances, shoreline BMP's, storm water controls, acquire conservation easements	Land Use and Dev, Obj. B, Actions 1 and 2; Land Use and Dev., Obj. C, Action 4

Crow Wing River Watershed

Crow Wing River WRAPS Study Excerpts

The Crow Wing River Watershed (CWRW) is located in northcentral Minnesota and covers approximately 1,946 square miles within Becker, Cass, Clearwater, Crow Wing, Hubbard, Morrison, Otter Tail, Todd, and Wadena Counties, 38 of which lie in Morrison County. The watershed is located in the Upper Mississippi River Basin and is comprised of two ecoregions: the Northern Lakes and Forests, and North Central Hardwood Forests. Land use within the watershed is primarily forested/shrub lands, followed by agricultural lands, wetlands, open water, and developed lands. There are a large number of pristine, high-value recreational lakes in the CWRW and several cold water streams that support trout are located in the watershed.

Lake Placid-Crow Wing River Sub-watershed

Water Body	Location	Water Quality Issue	Strategy Type	Water Plan Implementation Initiatives
Crow Wing River	07010106-506	Turbidity, maintain or improve existing water quality	Reduce storm water discharge by 10%, increase buffers by 25%	Surface Water, Obj. A. Actions 1-3
Lake Placid	49-0133	Shore land Protection	Maintain native vegetation by ordinances, restricting development	Land Use and Dev, Obj. B, Action 1
Sylvan Lake	49-0036	Phosphorus	Maintain upstream quality, conservation easements, shoreline buffers	Land Use and Dev, Obj. B, Actions 1 and 2; Land Use and Dev., Obj C, Action 4

Mississippi River--Sartell Watershed

Mississippi River--Sartell TMDL Study Excerpts

The Mississippi River - Sartell watershed covers approximately 1,020 square miles, of which 568 lie in Morrison County, in the central part of the Upper Mississippi River Basin. The watershed is also known locally as the Platte-Spunk Rivers watershed. The watershed includes parts of Benton, Crow Wing, Mille Lacs, Morrison, Stearns, and Todd counties. Major communities located in the watershed include Lastrup, Pierz, Buckman, Royalton, Upsala, Bowlus, Rice, Holdingford, Avon, St. Joseph, and Sartell. The Mississippi River - Sartell watershed has 879 total river miles and contains 232 lakes with a total acreage of 13,319.

The Mississippi River - Sartell watershed is located in the North Central Hardwood Forest ecoregion of Minnesota. This watershed is primarily agricultural, with approximately 96% of the land in this watershed under private ownership. The predominant land uses are grass/pasture/hay (35%), row crops (29%), forest (19%), and wetlands (9%).

The Mississippi River experiences one of its greatest drops in elevation within the Upper Mississippi River Basin within this watershed. From the community of Little Falls (just outside the watershed to the north) to Royalton, the river drops 6½ feet for every mile of river.

The Mississippi River flows through the central portion of this watershed and its confluence with several small creeks and streams is one of the significant natural features in this watershed. The lakes are primarily situated in the northeastern and southwestern corners of the watershed with a diverse network of tributaries located throughout the central region of the watershed. The excessively drained sand plain regions are some of the most intensively used lands within the watershed, and much of these areas are situated along the Mississippi River. These areas are sensitive to groundwater pollution and thus the implementation of best management practices is emphasized. Currently, there are two lakes and several streams within this watershed that do not meet Minnesota's surface water quality standards for conventional parameter (not including mercury) pollutants. The shorelines of the lakes within this watershed tend to be developed and the tributary streams primarily flow through areas of agricultural land use.

The diverse surface water resources within this watershed provide important recreational opportunities and economic benefits to the citizens and visitors to the watershed. Working cooperatively to restore and protect these resources is vital in the sustainability of these essential assets.

The major threats to the watershed and the water plan implementation actions to address them include:

- Loss of shoreline buffers and habitat due to development-- **Land Use and Dev, Objective. B, Actions 1 and 2**

- Introduction of large amounts of phosphorus, sediment, and bacteria to surface waters-- **Surface Water, Objective A. Actions 1-3**

- Increased nutrient, contaminant, and sedimentation loading from storm water runoff from development and other non-point sources—**Land Use, Objective B, Actions 1 and 4**

- Loss of biodiversity due to competition from invasive species-- **Surface Water, Objective D, Actions 1-4**

- Relatively high percentage of agricultural and urban/residential land uses within the riparian or sensitive areas of the watershed—**Land Use, Objective A, Actions 1, 2, 4, 5, 6; Objective B, Actions 1, 3, 4**

- Protecting drinking water supplies from bacteria impairments—**Groundwater, Objective H, Action 5**

Mississippi River--Brainerd Watershed

Mississippi River--Brainerd TMDL Study Excerpts

The Upper Mississippi River - Brainerd watershed covers 1,687 square miles in the north central part of the Upper Mississippi River Basin in central Minnesota, 382 of which lie in Morrison County. The watershed boundary begins in Aitkin County where the river flows through the cities of Aitkin, Brainerd/Baxter, and Little Falls. The watershed encompasses all or parts of Aitkin, Cass, Crow Wing, Morrison and Todd counties.

Almost half of the watershed is forested (42%), while grasslands and shrub wetlands make up 38%, row crops 10%, water 6%, and 4% is urban. The majority of the watershed is within the North Central Hardwood Forest with small sections in the Northern Lakes and Forests ecoregion.

The watershed has approximately 2,149 total river miles and contains 212 lakes greater than 10 acres in size. There are several impaired lakes and streams in this watershed.

Monitoring crews from the Minnesota Pollution Control Agency (MPCA) began focusing on the Mississippi River--Brainerd Watershed in May, 2016 in an effort to assess the condition of rivers, streams and lakes throughout the watershed. The work is being funded by the Clean Water Fund from the constitutional amendment passed by voters in 2008. The biological monitoring on streams is being performed by the North Biological Monitoring Unit located in the MPCA Brainerd Regional Office. Water chemistry monitoring on lakes and streams is led by staff out of the central MPCA office in St. Paul, with a large portion of the stream water chemistry monitoring being collected by the Soil and Water Conservation District's (SWCD) of Aitkin and Crow Wing Counties.

Of interest to Morrison County is the Swan River sub-watershed, which was delisted after MPCA's preliminary water monitoring and found to meet acceptable standards. Continued efforts were made following the delisting with a 319 grant to perform nutrient management and pasture management in the area to reduce the phosphorus since there are numerous poultry and hog facilities in the area. Phosphorus levels are on the rise once again which shows that continued work is yet to be done and that total sustainability has not been achieved.

ON-GOING ACTIVITIES ACTION PLAN

Local Water Plan: Continue a quarterly meeting schedule of the Morrison County Water Planning task force to stay on task with plan implementation, and coordinate funding needs and activities. Develop an annual plan of work which will include targeted actions, (number and location) and funding resources. The Task Force will also develop a method for all agencies to report accomplishments, current projects, and upcoming projects.

MN Wetland Conservation Act: Administered by the Morrison SWCD since adoption in 1992, with resolutions from all municipalities for blanket coverage of the entire county with one LGU. The Technical Evaluation Panel meets monthly on the third Wednesday of each month to review all applications requiring replacement plans or special problematic situations. The TEP is made up of SWCD Administration and technical staff, BWSR Wetland Specialist, Army Corps of Engineers, and DNR Ecological Services or Division of Waters, and DNR Enforcement.

Army Compatible Use Buffer Program: Morrison SWCD is the local agency for landowners wishing to participate in the program through BWSR. It is administered using the same format as Reinvest in Minnesota but allows the landowner to continue to farm and use the land as they have been, if funded with federal dollars.. The program pays 50% of the assessed value of an agricultural acre by township to place an easement on the property, preventing further residential or commercial development or mining. 72% of the ACUB zone is in Morrison County. Morrison SWCD also administers the program for Cass County and Crow Wing County residents within the zone. Lessard-Sams Outdoor Heritage Council funding has been awarded numerous times that has enhanced the ability to work with higher value lands adjacent to the Mississippi River (18 mile corridor) and the Crow Wing River, along with high value forests within the zone. That formula is 60% of the assessed value for vacant land by township rates. There is no agriculture allowed on easement acres if purchased with state funding.

State Cost Share Program: A BWSR funded program, these grant funds can be used for conservation practices on private lands as well as public lands. SWCD's provide financial and technical assistance for a docket of practices established by BWSR. Priorities and approval are set by the Morrison SWCD Board of Supervisors.

Minnesota Agricultural Water Quality Certification Program (MAWQCP): The MAWQCP is a voluntary program designed to accelerate adoption of on-farm conservation practices that protect Minnesota's lakes and rivers. Producers who implement and maintain approved farm management practices will be certified and in turn be assured that their operation meets the state's water quality goals and standards for a period of 10 years.

Rain Gauge Network: Morrison SWCD has collected rain gauge data sheets from 12 volunteers throughout the county and submits them to the MN Climatology Office. More volunteers are probably needed but it's difficult to find people to make the commitment.

EQIP/CSP/CRP: On-going Federal Farm Program opportunities, these programs are administered by NRCS and FSA. They bring millions of dollars into the county while promoting a variety of conservation practices.

RCPP Funding: A $2.8 million dollar award was approved by NRCS to the SWCD which will further the easement and conservation work within the Sentinel Landscape.

Buffer Law Compliance Monitoring: The SWCD is legislatively mandated to complete the buffer law compliance checks and then conduct ongoing monitoring.

DNR Well Monitoring: Gives the Dept. of Climatology as well as the local agencies an ability to analyze drought/rainfall conditions of the county.

Monitoring of wells around County Landfill: Public Works continues to monitor the wells for normal standards and testing for pharmaceuticals.

Morrison County 6th Grade Water Festival: Annually held at Camp Ripley for two days in September for all county 6th grade students. All agencies participate in holding learning stations on a wide variety of water, wildlife, and natural resource protection.

Lake and River Day: An opportunity to all shore land owners in the county to learn of new opportunities or rules concerning best management of their property.

Camp Ripley Sentinel Landscape Project: Will provide funding incentives and bring more partners to the effort of protecting the landscape in a nearly 10 mile radius of Camp Ripley, protecting habitat and ensuring agricultural lands are utilizing Best Management Practices.

Clean Water Funded Projects: As funded, will provide incentive payments for landowners to address anything from native buffers to feedlot management and/or a wide range of innovative conservation measures. The funds are highly competitive.

U.S. Fish and Wildlife Wetland Restorations: Assists private landowners with wildlife impoundments and wetland restorations for wildlife benefit. The landowner is expected to pay for 25% of the cost of the project. USFW does approximately 20 restorations per year.

Grassland Restoration: Provides habitat for wildlife, reduces erosion and nutrient losses.

Citizen Lake Monitoring: To be continued until there is a good trend analysis for all lakes and then in a schedule for maintenance and or funded implementation plans.

Nitrate Testing Clinic: Held twice annually at the SWCD office for a full week to allow citizens a free testing opportunity for household wells.

Irrigation Water Management: Regulated and permitted through DNR-EWR, the SWCD writes conservation management plans and the landowner are expected to report to the DNR on an annual basis.

Tree Sales: SWCD sells trees for field windbreaks and shelterbelts, as well as forestry projects. DNR also sells trees for reforestation projects. The distribution of both agencies trees are managed by the SWCD in late April.

Geologic Atlas: The SWCD identified and located the private wells in 2011 and the MN Geologic Atlas began the process of mapping the groundwater information in a format that will be used by all agencies and the county in making water and land use decisions. The first phase (Part A) has been fulfilled and the final atlas is likely to be completed sometime in 2018.

Environmental Reviews for Feedlots: A partnership of the SWCD and Morrison County Land Service Dept., the reviews provide the Planning Commission, Board of Adjustment, and the County Board a review of the natural resource implications of the project application.

DNR Wildlife Activities:

- Technical assistance in identification and control of aquatic and terrestrial invasive species.
- Management and restoration of prairie to improve wildlife habitat on public land (400 ac/yr.) and assistance on private land (24 sites per year)
- Annual monitoring of water levels and wild rice conditions at Rice-Skunk lakes.
- Annual management and monitoring of water levels in Little Elk WMA, Ted Brook and south bridge of the Little Elk River.

MN Forest Resource Council Landscape Stewardship Plan: Will provide additional funding sources to cooperate with all SWCD, CSLR, and MHB Forest protection and management initiatives.

APPENDIX A
COMP PLAN/WATER PALN COORDINATION

Excerpts from the 2016 Morrison County Comp Plan

Natural Resources and Open Space

Goal C1: Recognize the Mississippi River as a crucial natural resource within Morrison County and work to preserve and improve the long-term water quality of the River.

Objectives:
1. Implement the goals, objectives, policies and programs of the Mississippi Headwaters Board when required by law or otherwise deemed appropriate and consistent with the County's Comprehensive Plan.

Goal C2: Preserve natural resources identified as critical and sensitive including wildlife habitats, wetlands, forest lands, etc., within Morrison County.
Objectives:
1. Identify and map all critical and sensitive natural resources within Morrison County.
2. Continually identify, study and monitor strategies intended to preserve and manage natural resources.

Ground and surface water

Goal C3: Preserve and protect the quality of the County's groundwater and surface water resources to ensure its suitability for drinking water and/or recreational purposes.

Objectives:
1. Implement the goals, objectives, policies and programs of the Morrison County Water Plan when deemed appropriate and consistent with the County's Comprehensive Plan.
2. Continue to support the efforts of public and private organizations such as the Minnesota DNR and state and local lakes associations working to enhance surface water quality when deemed appropriate and consistent with the County's Comprehensive Plan.
3. Continue to study and understand the dynamics of the County's groundwater resources and how various users of those resources affect its quantity and quality.
4. Identify areas of the County that have significant risks for groundwater and surface water pollution or which have already been polluted and study ways in which to protect or restore these resources. Consider soil types, depth to groundwater, demand for drinking water and other relevant factors in identifying the most susceptible areas.
5. Make use of the Geologic Atlas of Morrison County (2014) so as to amend or create land use policies that take into account the unique aspects of each aquifer.
6. Consider amendments, where necessary, to the County's Emergency Management Plan and additional training for emergency responders regarding potential spills or other disasters involving toxic or other significant pollutants. Such planning should focus in particular on areas near railroad tracks, airports and major transportation corridors.

Shoreland

3.4 Shoreland Management--Purpose and Overview

Morrison County has an abundance of high quality lakes and rivers that are a significant part of the County's economy and attractiveness. As the desire of people to live on or near these water resources has increased over the past several decades, the need for increased management and monitoring has increased. The purpose of the Morrison County Shore land Management plan is to provide guidance for the future development in Shore land Management areas within Morrison County so that future generations will be able to enjoy and make use of these resources well into the future.

Shoreland Development Goals, Objectives, and Policies

Goal D1: Work to ensure that development occurring within the County's watersheds is done in a thoughtful and deliberate manner so as to balance environmental, social and economic goals to the greatest extent possible.

Goal D2: Seek opportunities to educate county staff, shore land property owners and the general public as to the impacts on water quality from development and the various land uses in a watershed.

Goal E3: Ensure that the County's lakes and rivers remain a resource that are available for use and enjoyment by the general public.

Goal D4: Recognize the character of established neighborhoods in the County's river and lakeshore areas so as to maintain and enhance the attractiveness of these neighborhoods. Consider adopting policies or regulations tailored to each unique type of neighborhood so as to preserve their individual character.

Goal D5: Explore with the DNR, other state and local agencies and shore land property owners the concept of regulations that are performance-based and tailored to the individual area rather than prescriptive "one size fits all" regulations wherever possible. Require implementation of mitigation practices during new development (whether by administrative permit, conditional use, variance or other approval process) to address the impacts of existing development and promote overall improvements to water quality as an integral part of the effort.

Goal D6: Seek to amend and create shore land use regulations so that they can be easily understood and consistently enforced.

Goal D7: Develop an inventory and/or assemble a series of existing or new maps to identify factors relevant to making informed decisions in shore land areas. Such information may include lake depths and types of aquatic vegetation along each section of shoreline, fish spawning areas, near-shore drainage patterns including the location of defined drainage-ways entering the waterbody, location of lots with nonconforming lake or river setbacks, contiguous nonconforming lots under common ownership which must be considered combined by state or local law, areas of natural shoreline, or other information deemed useful.

Goal D8: Work with Lake Associations, state and local government agencies, and tourism organizations to help prevent the spread of Aquatic Invasive Species (AIS). Study and understand

which lakes and rivers are most and least susceptible to this spreading so that prevention efforts can be developed and prioritized accordingly.

Goal D9: Recognize the importance of storm-water management to the preservation and enhancement of the County's lakes and rivers and implement policies and regulations that effectively manage storm-water runoff.

Goal D10: Work to better coordinate with federal, state and local government agencies and non-profits, lake associations and others with an interest in shore land development to effectively balance the benefits that arise from development of shore land areas with the need to protect, preserve and restore valuable natural resources.

Objectives:
1. Continue to maintain and develop relationships with local, state and federal agencies so as to avoid duplication of efforts.
2. Work with lake associations, Lake Improvement Districts, SWCD and others to identify existing non-compliant subsurface sewage treatment systems (SSTS) and identify both voluntary and regulatory methods for ensuring they are inspected and updated as necessary.
3. In areas with small lots or other limitations to effective long-term sewage treatment, seek to encourage the acquisition or preservation of nearby land suitable for community sewage treatment systems.
4. Work with Lake Associations, Lake Improvement Districts, local farm operators, SWCD, the Mississippi Headwaters Board, the MN Department of Natural Resources, the MN Pollution Control Agency and other interested parties to promote the installation and enhancement of vegetative buffers and other Best Management Practices (BMPs) for surface water protection along residential and commercial shore land properties. Prioritize these efforts in areas particularly susceptible to erosion or surface water pollution.
5. Continue to enforce state shore land regulations limiting new feedlots in shore land areas.
6. Work with pasture farm operators and existing feedlot operators in shore land areas to ensure proper manure management and prevent pollution of surface and ground-waters.
7. Develop educational materials or programs for Board of Adjustment and Planning Commission members, as well as applicants for variances, conditional use permits and other similar approvals regarding the legal requirements, limitations and other factors involved in rendering decisions on such applications. Such decisions should be based on the clear presence of a practice difficulty based on the property itself rather than the individual needs or desires of the applicant.
8. Assemble, develop and distribute clear and informative materials to educate the public regarding shore land best management practices, the County's shore land regulations, and the necessary procedures for ensuring compliance with these regulations.
9. Review the impact of back lot development and access lots on surface water use, and quality and make ordinance revisions necessary to minimize these impacts.
10. Study and consider the development of clear policies relating to existing and new issues relating to shore land areas, including vacation rental of homes in residential settings, the creation or expansion of resorts and campgrounds, the conversion, expansion or replacement of seasonal lakeshore cabins into year-round homes and the spread of invasive species.
11. Support the Objectives and Implementation Methods outlined in the Mississippi Headwaters Board's Comprehensive Management Plan and ensure that their "Standards for Land Use" are properly incorporated into the County's Land Use Ordinances when deemed appropriate and consistent with the County's Comprehensive Plan.
12. Ensure that efforts to protect surface waters consider activities and land uses throughout the entire watershed.

13. Work with the MPCA, DNR, SWCD, Mississippi Headwaters Board, Lake Associations, Lake Improvement Districts, agricultural producers and others to develop educational materials and regulations, when appropriate, to address impacts to water quality coming from areas not regulated under DNR shore land rules. Consider the adoption of regulations to address these concerns when and where deemed appropriate.
14. Review existing floodplain regulations to ensure consistency with state and federal requirements as well as to address the potential for expanded flood risks from more frequent and intense storm events.
15. Implement the action items identified within the Aquatic Invasive Species Prevention Plan for Morrison County, originally adopted in 2014.
16. Update the Aquatic Invasive Species Prevention Plan for Morrison County on an annual basis to assess the effectiveness of the action items and determine the need for amendments.
17. Recognize efforts by local and regional organizations to protect and enhance water quality in the County and take action to implement their recommendations when deemed appropriate and consistent with the County's Comprehensive Plan.

APPENDIX B
MINOR WATERSHED PRIORITIZATION

Minor Watershed Risk Classification Maps and Flow-Chart

Protection Analysis:

North-central MN is blessed with abundant water resources. Because of this sheer quantity, sorting these resources and prioritizing implementation strategies as well as funding are some of the biggest water planning challenges. Often, very few of each County's water resources are impaired and need to be restored, a new approach was developed to focus on which resources could benefit from water protection strategies, rather than restoration strategies. For these counties with an abundance of natural resources and relatively low land values, a well-designed protection approach is much more efficient and cost-effective than a restoration approach. Crow Wing County and the Mississippi Headwaters Board developed a protection model that assesses minor watersheds/catchments to determine which watersheds are already in good condition (class: vigilance), which could use more protection (classes: protection, enhance-protection), and which would likely need restoration strategies (enhancement). This method was simplified (called the 'basic model') and now expanding to the rest of north-central MN, including Morrison County. When prioritizing which watersheds to focus implementation strategies on, the distinction between public and private lands is important. From a planning perspective, watersheds with a high percentage of public land are not as at-risk for future water qualify impacts and do not require the same level of focus as watersheds with a smaller percentage of public land. For purposes of this plan, public land is considered to be already in a "protected" state. Public water bodies, such as lakes and streams, are also "protected" in that they cannot generally be filled or drained. Wetlands on private lands are also protected by the Minnesota Wetland Conservation Act (WCA), which also generally prohibits draining or filling of wetland areas. Many counties also have land with perpetual conservation easements, which are also considered to be protected. These areas added together forms one of the critical foundations of this plan's watershed classification. Another potential addition to the protection model is land enrolled in the Sustainable Forest Incentives Act (SFIA) program.

In addition to the amount of these protected lands/waters, each minor watershed was classified and mapped by the amount of land use disturbance, water quality trends, and various risk factors. Sandy Verry (US Forest Service Hydrologist, retired) and others have determined that the amount of mature forest cover on the landscape is a driving factor in sediment and nutrient delivery to downstream water bodies. Minimizing these changes in land use is important to maintaining high water quality. For this plan, land use disturbance includes land cover classes that are converted from a natural, forested state to man-induced classes such as: developed, cultivated, pasture, or grassland.

In addition to protected areas and land use disturbance, watershed health is also influenced by the water quality of the lands / streams that they contain. For this plan, watersheds with a declining trend in water quality (or impaired) were classified lower simply because of the declining trend.

The risk classification system is explained on the next page.

Risk Classification:

Vigilance

These watersheds have a high percentage of protected lands (> 50%), low amount of disturbed land cover classes (<8 %) and have no other potential threats to water quality, such as development, agriculture, drainage, or extractive uses. While all watersheds have some risk for negative impacts, "vigilance" watersheds have the least amount of risk and thus warrant the least amount of implementation focus.

Protection

These watersheds generally have a percentage of protected lands that is > 40% but also have some potential risk factors that could negatively impact the surface water (and / or groundwater) systems of the watershed. Low to moderate amounts of impervious surfaces, agriculture, and development pressure result in disturbed land cover classes of 8 – 25 %. These watersheds are generally in good condition and have no lakes with a declining trend in water quality. However, these watersheds have the potential to be better protected with strategies such as private forest stewardship, stormwater management, shoreline buffers, and conservation easements.

Enhance-Protection

These watersheds generally have a percentage of protected lands that is generally less than 40% but also have many potential risk factors that could negatively impact the surface water (and / or groundwater) systems of the watershed. Moderate amounts of impervious surfaces, development pressures (existing or potential), disturbed land cover classes, animal units, extractive uses, and/ or drainage systems are likely within the watershed. In addition, lakes or streams that are impaired or have declining trends in water quality may also be present in these watersheds. These watersheds are in fair condition but have many opportunities for project implementation and further protection efforts.

Enhance

These watersheds generally have a percentage of protected lands that is < 40 % but also have numerous potential risk factors that could negatively impact the surface water (and / or groundwater) systems of the watershed. High amounts of impervious surfaces, agriculture, development pressures lead to disturbed land cover classes of >50%. In addition, lakes or streams with declining trends in water quality or that are impaired for nutrients are also typically present in these watersheds. These watersheds are in fair to poor condition and while there are limited opportunities for protection or restoration strategies, many projects would likely be required to make a meaningful difference.

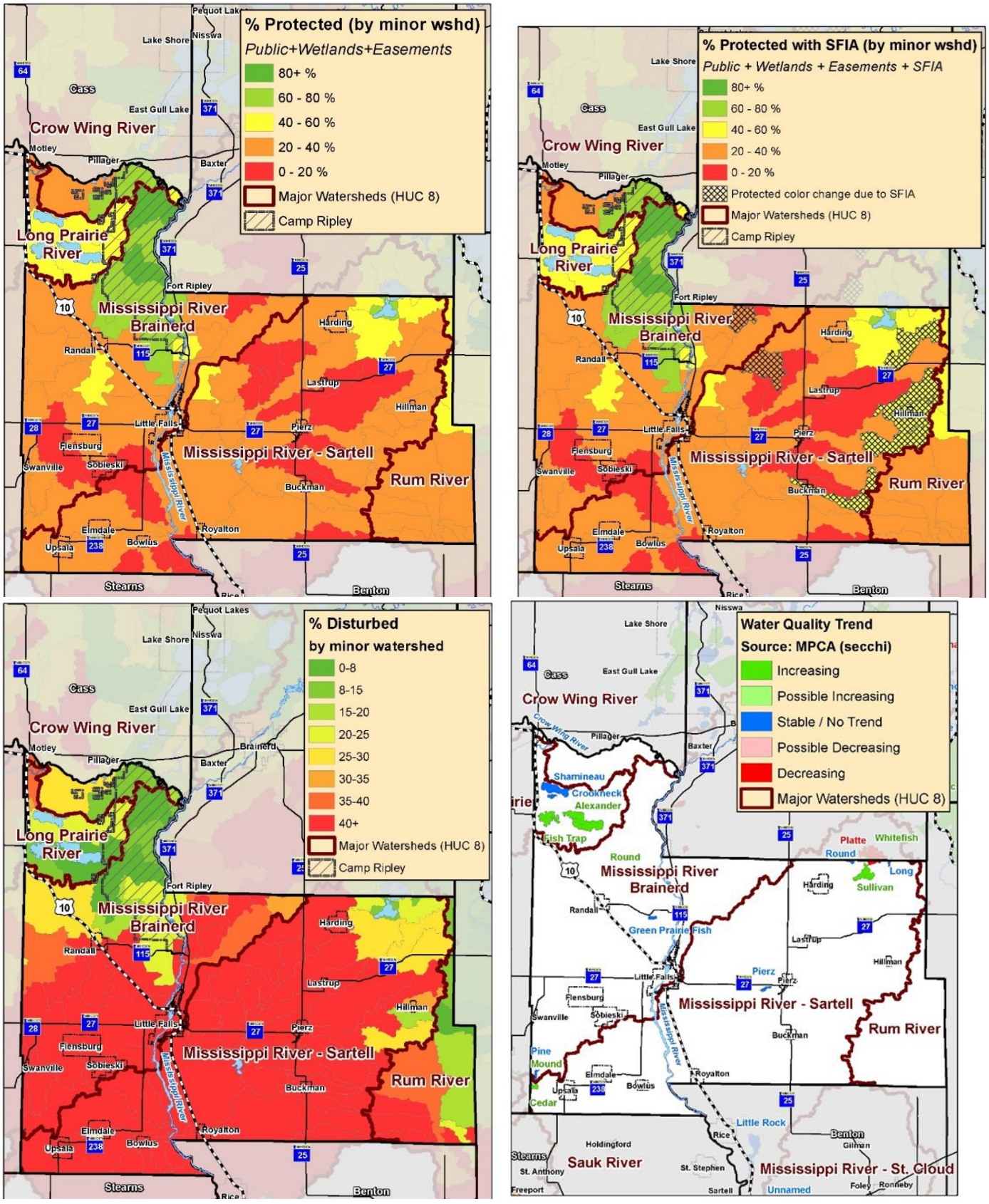


Figure 19 - Protection + Land Use Disturbance + Water Quality = RISK

Adding the Protection and Land Use Disturbance Maps as well as any available water quality information yield the following composite risk map below:

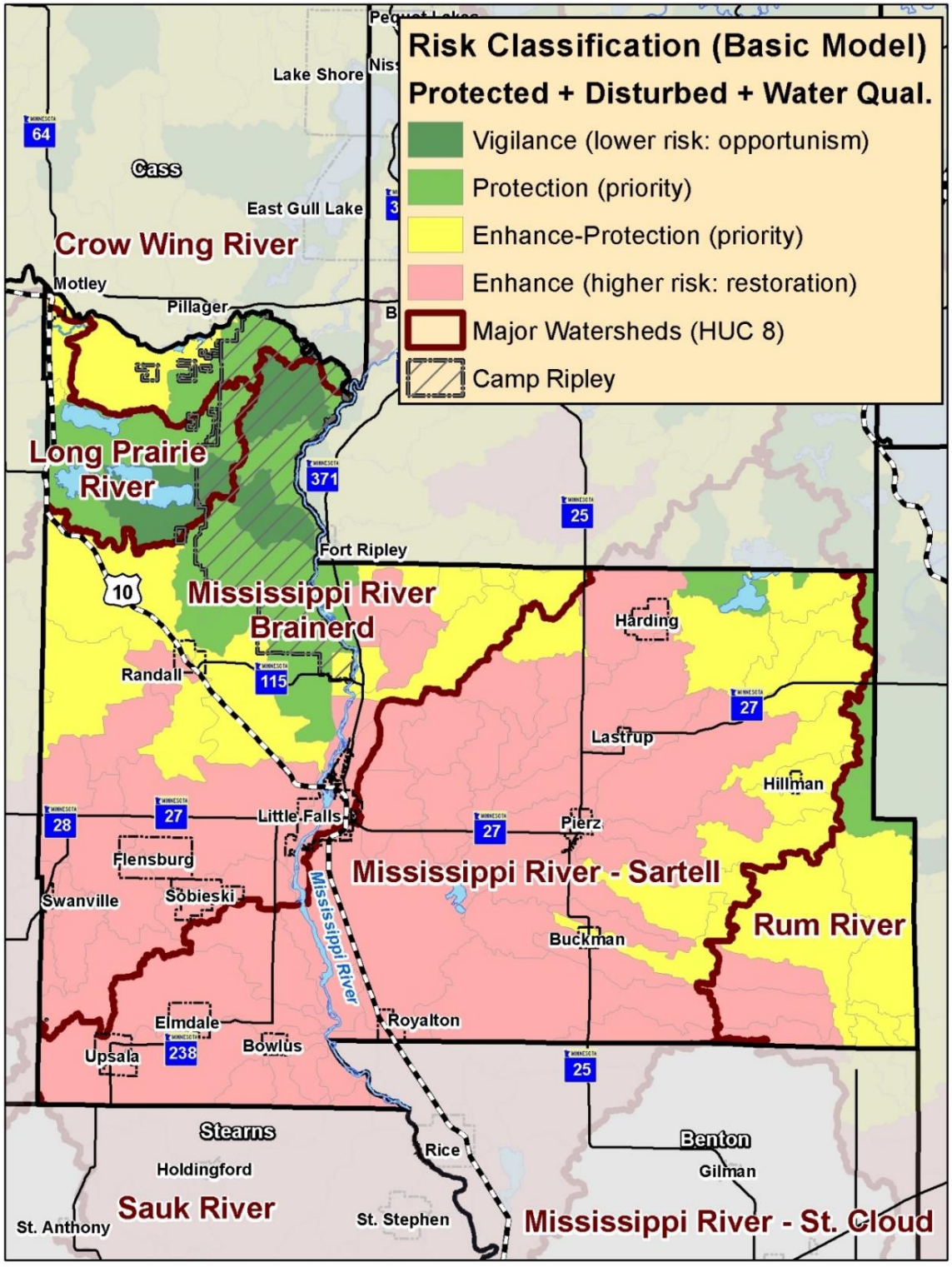
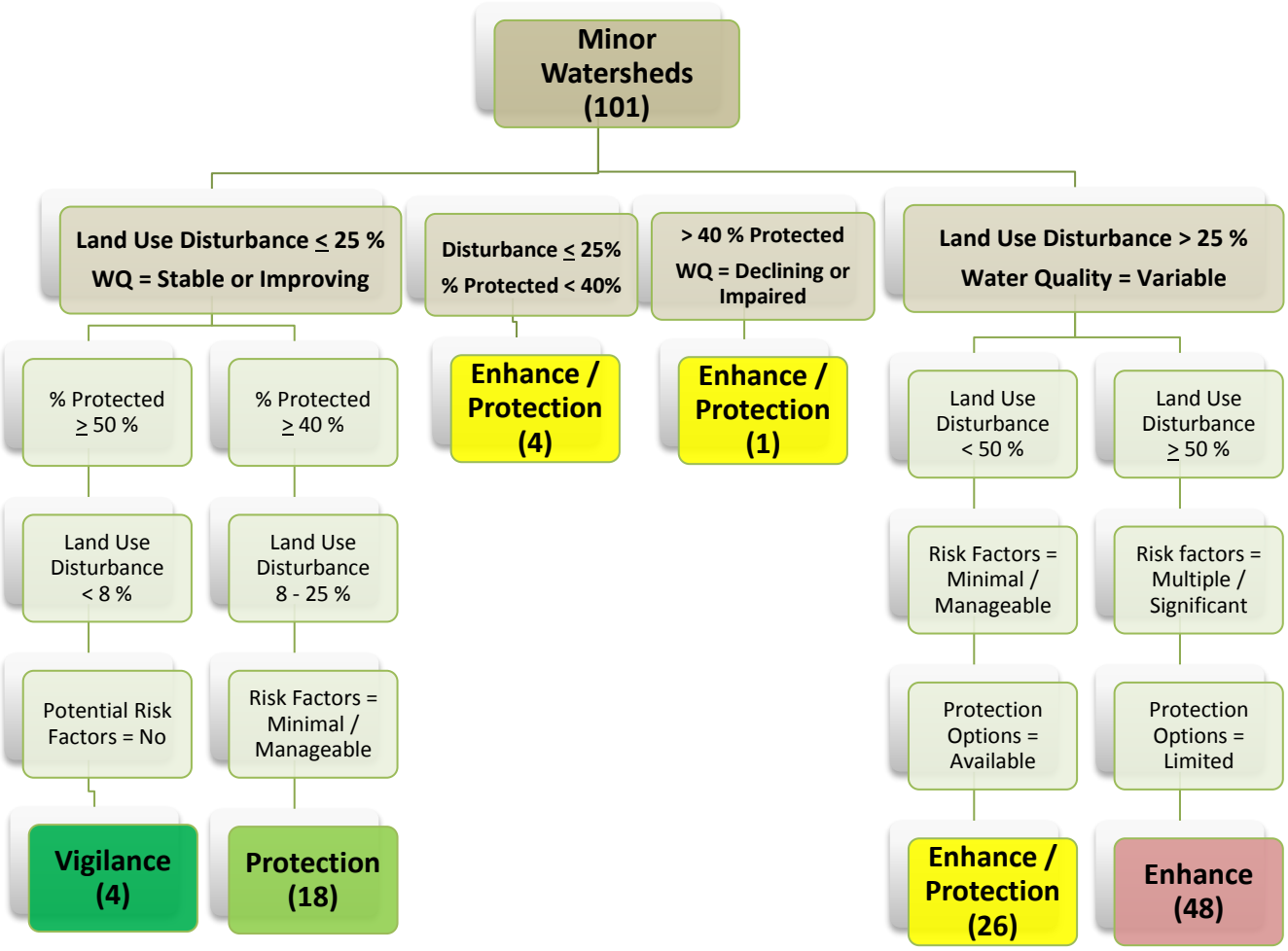


Figure 20 - Minor Watershed Risk Classification Map

The decision tree shows the classification of each minor watershed/catchment based on the amount of protection, land use disturbance, and water quality trend is shown below:



Protected = Total % of public ownership, permanent conservation easements, lakes, rivers, wetlands (private property)

Land Use Disturbance = Source 2011 National Land Cover Dataset (includes: *developed, cultivated, pasture, grassland*)

Possible Risk Factors Include = Agriculture (measured by # of animal units), development, ditching / drainage, extractive uses

Note: Enhance watersheds do not necessarily mean that the resources within are in poor condition, it just indicates that there is little protected lands and more lands that might be at risk for future water quality degredation.

APPENDIX C
ACRONYMS LIST

ACUB – Army Compatible Use Buffer

AIS – Aquatic Invasive Species

AgBMP – Agricultural Best Management Practices

BMPs – Best Management Practices

BOA – Board of Adjustments

BWSR – Board of Soil and Water Resources

Comp Plan – Morrison County Comprehensive Plan

CRP – Conservation Reserve Program

CRSL – Camp Ripley Sentinel Landscape

CSP – Conservation Security Program

CWF – Clean Water Fund

DNR – Department of Natural Resources

DWSMA – Drinking Water Supply Management Area

EQIP – Environmental Quality Incentive Program

FEMA – Federal Emergency Management Act

FSA – Farm Service Agency

FWQ – Feedlot Water Quality

GIS – Geographic Information System

GPS – Global Positioning System

HUC – Hydrologic Unit Code

LA – Lake Association

LCCMR – Legislative-Citizen Commission of Minnesota Resources

LGU – Local Governmental Unit

LID – Lake Improvement District

LSOHC – Lessard/Sams Outdoor Heritage Council

LWP – Local Water Plan

MDH – Minnesota Department of Health

MDA – Minnesota Department of Agricultural

MHB –Mississippi Headwaters Board

MnDOT – Minnesota Department of Transportation

MPCA – Minnesota Pollution Control Agency

NRBG –Natural Resources Block Grant

NRCS –Natural Resources Conservation Service

MFRC – Minnesota Forest Resources Council

MPCA –Minnesota Pollution Control Agency

MRWA – Minnesota Rural Waters Association

NPDES – National Pollution Discharge Elimination System

PAT – Project Advisory Team

PC – Planning Commission

PWI – Public Water Inventory

PWS – Public Water Supply

RCPP – Regional Conservation Partnership Program

RIM – Re-Invest in Minnesota

SSTS – Sub-Surface Treatment System

SWAG – Surface Water Assessment Grant

SWCD – Soil and Water Conservation District

TEP – Technical Evaluation Panel

TNC – The Nature Conservancy

TMDL – Total Maximum Daily Load

USDA – United States Department of Agriculture

USACOE – United States Army Corp of Engineers

USFWS – United States Fish and Wildlife Service

USGS – United States Geological Survey

WCA – Wetland Conservation Act

WCTSA – West Central Technical Service Agency

WHPA – Wellhead Protection Area

WHPP –wellhead Protection Plan

WRAPS – Watershed Restoration and Protection Strategy

APPENDIX D
GLOSSARY OF TERMS

AgBMP Loan program – low interest loan program administered by the Department of Ag. Morrison SWCD is the applicant and the funding revolves, allowing landowner an opportunity to borrow funds for conservation practices that have a water quality benefit.

aquifers - a body of permeable rock that is capable of storing significant quantities of water, that is underlain by impermeable material, and through which groundwater moves.

best management practices - methods, measures, or practices designed to prevent or reduce water pollution. Usually, BMPs are applied as a system of practices rather than a single practice.

Chapter 7080 rules – MN rules on septic design and standards.

cost-share - programs that partially reimburse landowners for implementing best management practices.

erosion - the wearing away of the land surface by rain, running water, wind, ice, gravity, or other natural or man-made agents.

groundwater - the water that moves down into the soil and underlying geological strata from the upper soil layers following rainfall. Groundwater is stored in aquifers and may move underground by streams or seepage.

impervious surfaces - surface that prevents or significantly reduces the entry of water into the underlying soil, resulting in runoff from the surface in greater quantities and/or at an increased rate when compared to natural conditions prior to development. Examples of places that commonly exhibit impervious surfaces include parking lots, driveways, roadways, storage areas, and rooftops.

intermittent - ceases to flow in very dry periods.

invasive - tending to spread.

land use - any building, facility, activity, development or operation that exists or operates on, in or around the earth.

native - those species that occur naturally in an area and have not been introduced, accidentally or otherwise, by humans.

nutrient - any element or compound that an organism must take in from its environment either because it cannot produce it at all or fast enough to meet its needs. In aquatic systems, nutrients can also be pollutants especially when they are excessive and contain phosphorus or nitrogen that permits high organic growth.

nutrient management – careful management of soil fertility so that crop needs are met while minimizing losses to surface or ground water.

open lot agreements – an agreement between the county and feedlot producers that allowed landowners a timeframe to address any pollution problems that might be present.

riparian - anything connected with or immediately adjacent to the banks of a stream or other body of water.

sediment - fragmented material that originated from the weathering of rocks and decomposition of organic material that is transported in suspension by water, air, or ice, to be subsequently deposited at a new location.

stormwater – the nature of stormwater is such that the amount of pollutants entering receiving waters (lakes, rivers, streams, etc.) will vary in accordance to the frequency, intensity, local drainage patterns and the duration of rain or snowfall or snowmelt events.

sub-watershed - a hydrologically defined geographic area located within a secondary or larger watershed.

surface water – Water in lakes, rivers, ponds, creeks, etc.

tributary - a stream feeding, joining, or flowing into a larger stream.

watershed - a region or land area which contributes water run-off and/or drainage to a specific water course or water body.

wellhead protection area - the area surrounding a well or well field that supplies a public water system through which contaminants are likely to pass and eventually reach the water well or well field.

wetlands - an area inundated by surface or groundwater at a frequency sufficient to support, and under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soils.

See approved Scoping Document for land formation, land use percentages, and historical Morrison County information.

APPENDIX E
INTERNET RESOURCES

The following is list of useful internet sites that contain information on variety of water resource management topics.

A. Water Resources

Minnesota Board of Water and Soil Resources http://www.bwsr.state.mn.us	Minnesota Shoreland Management Resource Guide http://www.shorelandmanagement.org
Morrison Soil and Water Conservation District http://www.morrisonswcd.org/	U.S. Environmental Protection Agency http://www.epa.gov/
Minnesota Department of Natural Resources http://www.dnr.state.mn.us	U.S. Department of Energy http://www.energy.gov/
US Fish & Wildlife http://www.fws.gov/	USGS Minnesota Water Science Center http://mn.water.usgs.gov/
Minnesota Pollution Control Agency http://www.pca.state.mn.us	River Watch Mississippi Basin www.riverwatch.noaa.gov
Minnesota Department of Health http://www.health.state.mn.us/	US Army Corps of Engineers www.usace.army.mil
Minnesota Lakes and Rivers Advocates www.mnlakesandrivers.org	Climate Change Trends and Action Report http://www.bwsr.state.mn.us/native_vegetation/BWSR_Climate_Change.pdf

B. Land Resources

The Nature Conservancy http://www.nature.org/	Minnesota Department of Transportation http://www.dot.state.mn.us/
Minnesota Natural Resources Conservation Service http://www.mn.nrcs.usda.gov/	National Center for Ecological Analysis and Synthesis http://www.nceas.ucsb.edu
Minnesota Department of Agriculture http://www.mda.state.mn.us/	U of M Dept of Soil, Water, and Climate http://www.soils.umn.edu/research/
Minnesota Geological Survey http://talc.geo.umn.edu/mgs/	U.S. Department of Agriculture Statistics http://www.nass.usda.gov/index.asp
University of Minnesota Extension Service http://www.extension.umn.edu	Natural Lands Trust http://www.natlands.org

C. Government Associations

Minnesota Association of SWCDs http://www.maswcd.org/	League of Minnesota Cities http://www.lmc.org
Minnesota Association of Watershed Districts http://www.mnwatershed.org	Minnesota Association of Township http://www.mntownships.org
Association of Minnesota Counties http://www.mncounties.org	National Rural Development Partnership http://www.rurdev.usda.gov/nrdp

D. State/County Government Resources

Northstar – MN Government http://www.state.mn.us/	Morrison County http://www.co.morrison.mn.us/
Minnesota State Legislature http://www.revisor.leg.state.mn.us	Department of Military Affairs http://www.dma.state.mn.us/

APPENDIX F
WATER PLAN / CONSERVATION PLANNING
MAP AVAILABILITY AND SUMMARY

Below is a list of some (certainly not all) of the available water/conservation planning maps and GIS data layers that are available. Some are included in the water plan and some are not.

Ownership:

- *Public/Private*

  The amount of public land is typically mapped by minor watershed and is based on this current parcel information from each County which is simply extracted by name to ensure all local, state, and federal entities are included.

- *Easements*

  Conservation easements are an interest in real property where landowners voluntarily place certain restrictions on the use of their property for conservation purposes. These easements are also an agreement between the landowner and the easement holder. Conservation easements provide flexibility to accommodate a landowner's interest in protecting the land while still retaining ownership. Conservation easements in Minnesota can be acquired and held by (1) governmental entities otherwise authorized to hold real property or (2) charitable organizations whose purpose meets the statutory definition of a conservation easement. Grants can provide the funding resources needed to help provide financial incentives that encourage landowners to sell development rights and place a conservation easement on their land. Grants can also be obtained to help cover the closing costs associated with a landowner donating an easement. These easements are mapped individually by holder as well as summarized by minor watershed.

  Most easements in Morrison County are part of the Army Compatible Use Buffer (ACUB) program.

- *SFIA enrolled lands*

  The Sustainable Forest Incentive Act provides incentive payments to encourage sustainable use of forest lands. Property owners with qualifying lands are eligible to enroll in this program. Sustainable Forest Incentive Act (SFIA) Property owners can receive a certain amount of money for each acre of qualifying forest land they enroll in SFIA. In return, they agree not to develop the land and to follow a forest management plan while they are in the program. All enrolled land must remain in SFIA for at least eight years. To qualify the landowner must be current on property taxes, have 20 or more contiguous acres, be at least 50 percent forest land as defined in Minnesota Statutes 88.01, subd. 7, have a forest management plan in place, and have an agreement ('covenant') in place limiting the property's use to forest management activities. Because of each County's parcel data, the SFIA enrolled parcels can be mapped by minor watershed.

Vegetation / Land Cover:

- *MN DNR Ecological Classification System*

  Ecological land classifications are used to identify, describe, and map progressively smaller areas of land with increasingly uniform ecological features. The system uses associations of biotic and environmental factors, including climate, geology, topography, soils, hydrology, and vegetation. ECS mapping enables resource managers to consider ecological patterns for areas as large as North America or as small as a single timber stand and identify areas with similar management opportunities or constraints relative to that scale. There are eight levels of ECS units in the United States. Map units for six of these levels occur in Minnesota: Provinces, Sections, Subsections, Land Type Associations, Land Types, and Land Type Phases. Provinces are units of land defined using major climate zones, native vegetation, and biomes such as prairies, deciduous forests, or boreal forests. There are 4 Provinces in Minnesota. Sections are units within Provinces that are defined by origin of glacial deposits, regional elevation, distribution of plants, and regional climate. Minnesota has 10 sections. Subsections are units within Sections that are defined using glacial deposition processes, surface bedrock formations, local climate, topographic relief, and the distribution of plants, especially trees. Minnesota has 26 subsections. Land Type Associations are units within Subsections that are defined using glacial landforms, bedrock types, topographic roughness, lake and stream distributions, wetland patterns, depth to ground water table, soil parent material, and pre-European settlement vegetation PDF. Minnesota has 291 land type associations.

- *Land Cover (2011)*

  The National Land Cover Database products are created through a cooperative project conducted by the Multi-Resolution Land Characteristics (MRLC) Consortium. The MRLC Consortium is a partnership of federal agencies (www.mrlc.gov), consisting of the U.S. Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA), the U.S. Forest Service (USFS), the National Park Service (NPS), the U.S. Fish and Wildlife Service (FWS), the Bureau of Land Management (BLM) and the USDA Natural Resources Conservation Service (NRCS). The success of NLCD over nearly two decades is credited to the continuing collaborative spirit of the agencies that make up the MRLC. NLCD 2011 is the most up-to-date iteration of the National Land Cover Database, the definitive Landsat-based, 30-meter resolution land cover database for the Nation. The legend and more info can be found at: http://www.mrlc.gov/nlcd11_leg.php

- *Cropland Data Layer (2006-2015)*

  The United States Department of Agriculture (USDA), National Agricultural Statistics Service (NASS) Cropland Data Layer (CDL) is a raster, geo-referenced, crop-specific land cover data layer. This is the 2006-2015 NASS USDA CDL dataset for Minnesota. The dataset was clipped and downloaded using the USDA NASS CropScape online web application: http://nassgeodata.gmu.edu/CropScape/

  The Minnesota Department of Agriculture (MDA) did minimal processing on this dataset to make more useful for Minnesota-specific work. The lineage section describes these

steps taken, but the full description of the Cropland Data Layer can be found in the NASS USDA Metadata.

- *Marschner Pre-settlement Vegetation*
  Pre-settlement vegetation of Minnesota based on Marschner's original analysis of Public Land Survey notes and landscape patterns. Marschner compiled his results in map format, which was subsequently captured in digital format.

- *MCBS Sites of Biodiversity Significance (DNR)*
  This data layer represents areas with varying levels of native biodiversity that may contain high quality native plant communities, rare plants, rare animals, and/or animal aggregations. Initially, boundaries of sites are determined by review of aerial photography in order to identify potential areas of native biodiversity based on native vegetation. In subsequent field investigations, the Minnesota County Biological Survey assesses the ecological characteristics of the site and the presence of rare species. A biodiversity significance rank (moderate, high, or outstanding) is assigned on the basis of the number of rare species, the quality of the native plant communities, size of the site, and context within the landscape.

- *Forest Cover*
  Although many watersheds in North-central MN have vast amounts of public forests, which are effectively managed by local, state, and federal government, it is the forested lands on private property that provide one of the largest opportunities to maintain high water quality in the watershed. Landowners have a number of educational resources, tax incentives, and other economic opportunities available to them that work to promote long-term forest health and productivity along with benefits to wildlife and water quality. The forest maps produced pull out all upland forest types from the 2011 National Land Cover Data Set (NLCD) and are shown in various maps at the minor watershed level.

- *Potential Native Plant Communities*
  This is a layer developed by the Natural Resources Research Institute (Duluth) and the Minnesota Forest Resources Council to predict the type of native plant community for a given location in the forested region of Minnesota.

- *Priority Open Landscapes (DNR)*
  DNR Priority Open Landscapes include all or portions of ECS land type associations designated during Subsection Forest Resource Management Planning. Maintenance and enhancement (and in some locations, restoration and protection) of open land and brush land habitat within these identified areas are a high priority. This management will help sustain populations of open landscape wildlife species in greatest conservation need, by encouraging practices such as prescribed burning, prescribed grazing, mowing, shearing, delaying haying, biomass harvest, avoidance of tree planting in open vistas, and forest management that uses shorter harvest rotations, clear cutting and large patch sizes.

Water Resources

- *Watersheds (U.S. Geological Survey)*

  Watersheds in the United States were delineated by the USGS using a national standard hierarchical system based on surface hydrologic features and are classified into 6 levels of hydrologic units:
  - 2-digit HUC first-level (region)
  - 4-digit HUC second-level (subregion)
  - 6-digit HUC third-level (accounting unit)
  - 8-digit HUC fourth-level (cataloguing unit)
  - 10-digit HUC fifth-level (watershed)
  - 12-digit HUC sixth-level (subwatershed)

  For most counties, there is a watershed basin map, based on the 4-digit (HUC 4). However, most of the watershed maps highlight features at the major watershed level (8-digit - HUC 8) as well as the minor watershed level (which is a subset of the 12-digit HUC level). A summary table is below:

Counties	# of Major Watersheds	# of Minor Watersheds	Border Watersheds (Minors)
Aitkin	7	176	73
Beltrami	8	141	68
Cass	6	194	78
Clearwater	7	90	50
Crow Wing	5	125	55
Hubbard	4	90	44
Itasca	6	201	69
Koochiching	7	157	48
Lake of the Woods	5	75	20
Morrison	7	101	48
Wadena	3	70	41

- *Lakes & Rivers (Public Waters)*

  Lakes included in these maps were based on the list of regulated lakes in each County's Zoning/Land Use Ordinance. Lake boundaries were taken from the DNR's Public Waters GIS layer. The DNR's Public Watercourse layer was used as the primary rivers layer.

- *Wetlands*

  Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Minnesota has 8-12 different types of wetlands (depending on the classification system). Wetland maps are based on the National Wetlands Inventory (NWI). The National Wetlands Inventory is a national program sponsored by the US Fish and Wildlife Service (USFWS). The NWI database was funded jointly between the USFWS

and the State. The base data was developed through interpretation of National Aerial Photography Program (NAPP) imagery (approx. 1:50,000 scale, typically color-infrared) in conjunction with limited field verification studies. Ancillary data sources, particularly USGS Quadrangle Maps and soil surveys, were also used in the interpretation process. After interpreting the aerial photographs, delineations were transferred to a 1:24,000 scale orthogonal base, digitized, and coded in conformance to the USFWS classification scheme. For North-central MN, NWI data is current from the 1980s, but the DNR plans to update this data in the next few years.

- *Impairments*

  Water is sampled for a variety of things (transparency, chemistry, turbidity, bacteria, etc.). These measurements are summarized and reported to the Minnesota Pollution Control Agency (MPCA), who is mandated by the federal Environmental Protection Agency to maintain water quality standards for Minnesota's lakes and streams. Those water bodies that do not meet standards are deemed to be impaired and require total maximum daily load (TMDL) studies in order to set pollutant reduction goals needed to restore these waters. Impairments are mapped by parameter (especially streams, where more variability exists) as most impaired lakes are just for nutrients (and Mercury, which were not mapped). This information is current through the proposed 2016 list.

- *Phosphorus Sensitivity (DNR)*

  This layer was created by DNR to identify Lakes of Phosphorus Sensitivity Significance (LPSS) within Minnesota. Available lake data were analyzed to classify lakes based on sensitivity to nutrient pollution. Phosphorus sensitivity was estimated for each lake by predicting how much water clarity would be reduced with additional phosphorus loading to the lake. A phosphorus sensitivity significance index was formulated to prioritize lakes as they relate to MPCA's policy objective of focusing on high quality, unimpaired lakes at greatest risk of becoming impaired. The phosphorus sensitivity significance index is a function of phosphorus sensitivity, lake size, lake total phosphorus concentration, proximity to MPCA's phosphorus impairment thresholds, and watershed disturbance. The goal of the LPSS list was to objectively prioritize lakes based on their sensitivity to phosphorus pollution. These results are not appropriate for those lakes listed by MPCA as impaired. For more info on this DNR layer, go to:

  ftp://ftp.gisdata.mn.gov/pub/gdrs/data/pub/us_mn_state_dnr/env_lakes_phosphorus_sensitivity/metadata/lakes_of_phosphorus_sensitivity_significance_20150820.pdf

- *Lakes of biodiversity significance (DNR)*

  This layer shows lakes meeting criteria for Lakes of Biological Significance (LBS). Lakes were identified and classified by DNR subject matter experts on objective criteria for four community types (aquatic plants, fish, amphibians, birds). Unique plant or animal presence was the primary measure of a lake's biological significance. Lakes were rated and grouped for each of the following communities: aquatic plants, fish, birds, and amphibians. Lakes were assigned one of three biological significance classes (outstanding, high, or moderate). Many Minnesota lakes have not been sampled for plants and/or animals, so this list of lakes will be periodically revised as additional biological data become available. The goal of this list was to identify lakes that exhibit the highest quality features within any of the four assessed biological communities (as

opposed to identification of lakes that exhibit diversity across communities). Therefore, a lake needed to meet criteria for only one of the community types (aquatic plants, fish, birds, amphibians) to be identified as a Lake of Biological Significance. Occurrences of high-quality features within the community types determined the biological significance rank. For more:
ftp://ftp.gisdata.mn.gov/pub/gdrs/data/pub/us_mn_state_dnr/env_lakes_of_biological_signific/metadata/lakes_of_biological_significance_criteria_20150423.pdf

- *Lakes with Fish-based IBI Scores (Most Recent IBI Survey – source: DNR)*
  This layer shows the Fish IBI (Index of Biotic Integrity) Scores for MN lakes as calculated by DNR Fisheries. Scores range from 0-100, with higher scores indicating higher biotic integrity. Attributes correspond to the most recent IBI survey for each lake. An IBI (Index of Biotic Integrity) is a biologically-based, multi-metric method for measuring the integrity of aquatic systems. Minnesota DNR Fisheries Research has developed a fish-based lake IBI that incorporates fish data collected by various methods (trap nets, gill nets, shoreline seines, and backpack electrofishing units) into 8-15 metrics in three categories: species richness, community assemblage, and trophic. Each metric represents an aspect of the biological assemblage structure, function, or other measurable characteristic that changes in some predictable way with increased human-induced stress. Fish IBI scores respond to differences in land use patterns, trophic state, and aquatic vegetation. Validation studies indicate that the fish-based lake IBI scores function as a measure of fish community response to human disturbance across a gradient of lakes. Continuing work by DNR Fisheries will expand the application of this IBI to more lake types and will validate this tool as a viable method for assessing lake impairment as part of Minnesota's 303(d) Impaired Waters assessments. These scores should be considered as 'preliminary' and are subject to change as the IBI tools are further developed and refined. This dataset only includes lakes over 100 acres and within lake classes 20-43, with few exceptions for lakes very close to 100 acres. Additional scores will be added to this dataset annually.

- *Trout Lakes/Streams*
  The lakes layer shows legally designated trout lakes as identified in Minnesota Rules Chapter 6264.0050. These are inland lakes managed by DNR Fisheries for trout species. In order to protect and foster the propagation of trout species, several restrictions on fishing in these lakes apply. Lake Trout information was taken from:
  http://www.dnr.state.mn.us/fishing/trout_lakes/list.html

  The streams layer shows legally designated trout streams and trout stream tributaries as identified in Minnesota Rules Chapter 6264. See
  http://www.revisor.leg.state.mn.us/arule/6264/0050.html
  for legal descriptions and restrictions associated with designated trout waters. This data set includes designated trout streams and their protected tributaries only.

- *Wild Rice/Shallow Lakes*
  Several wild rice lake lists/layers exist. The DNR has a layer of all lakes/streams with wild rice. They also have a list of their top 350 wild rice lakes/streams. They also have worked with local SWCDs to determine low, medium, and high priority wild rice

lakes/streams for protection using LSOCH funding: http://www.lsohc.leg.mn/FY2016/draft_accomp_plan/WA03.pdf
The DNR also has several other related layers, which include: designated shallow lakes & designated wildlife lakes (migratory and non-migratory).

- *Cisco/Tullibee*
  The best way to explain the importance of Cisco/Tullibee might be this article by Jim Umhoefer in the Star Tribune: http://www.startribune.com/saving-the-tullibee-a-fish-at-the-bottom-of-minnesota-s-food-chain/290248041/ The maps show the Tier I and Tier II Cisco/Tullibee lakes (the most important), which was received from Pete Jacobson (DNR – Grand Rapids).

- *Muskie Lakes (DNR)*
  This layer shows Minnesota's muskie lakes. Criteria for identification includes lakes having an active muskie management plan, lake plan, muskie long-range plan, and/or where muskie is cited as a primary or secondary species. Muskie lakes are classified as Native, Introduced, and Introduced-Hybrid waters on this layer. Note that muskie rivers (e.g., Mississippi, Big Fork, Little Fork, St. Croix, Kettle, Snake, Prairie, Rainy - International Falls to Baudette) are not included in this layer.

- *Outstanding WQ/ Other Surface Water Resources*
  Many counties have a number of surface water resources that have outstanding characteristics and implementation focuses that are often independent of the watershed in which they reside. In addition to the ones above, this list can include lakes with outstanding water quality or other unique resources (i.e. mine pit lakes, stream confluences, etc.).

Soils, Geomorphology, and Groundwater

Geomorphology and surficial geology are critical drivers of watershed health for a number of reasons. Outwash areas (sand & gravel) allow better infiltration for both groundwater recharge and stormwater management than till. However, these areas can be more erodible and can also be more difficult to stabilize. The heavier till soils shed more water and when eroded can contribute sediment further downstream. Outwash areas with a surficial geology of sands or gravels are the most critical areas to focus on in terms of both groundwater recharge and potential contamination. Many Minnesotans rely on this surficial aquifer for their source of drinking water. Since there is a direct connection from the surface to this aquifer, any contamination from human uses at the surface could have a direct effect. In addition, any disruptions to the recharge capacity of this aquifer could affect water levels in the groundwater and lakes / streams. Agricultural withdrawals in these surficial aquifers are often significant in many areas. The DNR maintains a layer of these annual appropriations with the annual amount of usage (a permit is required for over 10,000 GPD or 1 Million GPY). The associated irrigated areas data is available in some areas. There are basic statewide groundwater province information and geomorphic layers that show the glacial phases, sedimentary (surficial), and topographic information. There are also other layers available depending on the location. These are summarized below:

Soil layers (for counties with a modern soil survey):

- Map Unit Description (basic soil type)
- Drainage Class (well drained?)
- Farmland Classification (prime farmland?)
- Flooding & Ponding Frequency
- Gravel/Sand Source
- Hydric Rating (wet soil?)
- K/T Factor (erodibility - used in RUSLE analysis)
- Capability Class (1 to 4 are the least restrictive for agriculture)
- Surface Texture
- Wind Erodibility Index
- Average Slope
- Primary Hydrologic Group

Geologic Atlas Layers:

County Geological Atlases contain a number of detailed maps and charts showing not only the surface and bedrock geology of the area, but also the location and depth of aquifers and the sensitivity of these aquifers to contamination. For more information, including a status map:
http://www.mngs.umn.edu/county_atlas/countyatlas.htm

- Surficial (Surface) Geology
- Bedrock Geology
- Pollution Sensitivity
- Surface and Buried Aquifers
- Gravel/Mineral Endowment

Morrison County has a completed Geologic Atlas that is available from the SWCD upon request.

Surficial Sands

This dataset estimates the distribution of surficial sand units in Minnesota, from previously published surficial geology maps by the Minnesota Geological Survey, for use with Department of Natural Resources water table maps.

Groundwater Management Areas

A Groundwater Management Area (GWMA) is the surface and subsurface area within which a GWMA Plan, approved by the commissioner of the Department of Natural Resources, is implemented in accordance with Minnesota Statute 103G.287, Subd. 4. The boundaries of a GWMA are delineated by identifiable physical features, Minnesota Department of Natural Resources Catchments, and/or political or administrative boundaries.

Water Table Aquifer Vulnerability

This dataset provides a rating of Minnesota water table aquifer vulnerability. The data, methodology and ratings are based on similar work done previously by Porcher [Porcher, E. (1989), Ground water contamination susceptibility in Minnesota, Minnesota Pollution Control Agency, St. Paul, Minn., 29 p.]. In 1989, Porcher prepared a statewide assessment of groundwater contamination susceptibility, using the statewide Quaternary geology map that was prepared by the Minnesota Geological Survey (Hobbs, 1982). In 2011, an interagency group (MDH, MDA, and DNR) worked to find a map that would be an update to the map used by Porcher in 1989. The interagency work group decided that the statewide geomorphology layer that was produced by the Minnesota Geological Survey and the University of Minnesota at Duluth (DNR, UMD, MGS 1997) provided an updated interpretation of Quaternary materials and at higher level of resolution than the 1982 map with the addition of a Quaternary sand and gravel layer file to capture the "Beach Sands" in the northeast. The geomorphology layer includes generalized categories of the sediments or bedrock types that are associated with landforms and can be used to assign geologic sensitivity ratings. The ratings are based upon guidance from the Geologic Sensitivity Project Workgroup (DNR, 1991). MDA developed this dataset based on the guidance from the 2011 interagency workgroup.

Mean Groundwater Recharge 1996-2010

These data represent mean annual potential recharge rates from 1996-2010 to surficial materials for Minnesota using the Soil-Water-Balance model (Westenbroek and others, 2010). They can be used wherever regional estimates of recharge are needed, for example, preliminary estimates for watershed planners and groundwater modelers to obtain potential recharge estimates for an area of interest. The methodology is documented in: Smith, E.A., and Westenbroek, S.M., 2015, Potential groundwater recharge for the state of Minnesota using the Soil-Water-Balance model, 1996-2010: U.S. Geological Survey Scientific Investigations Report 2015-5038 (project report). The original SWB model is documented in: Westenbroek, S.M., Kelson, V.A., Dripps, W.R., Hunt, R.J., and Bradbury, K.R., 2010, SWB - A modified Thornthwaite-Mather Soil-Water-Balance code for estimating groundwater recharge: U.S. Geological Survey Techniques and Methods, book 6, chap. A31, 60 p. Also available at http://pubs.usgs.gov/tm/tm6-a31/

Water-Table Elevation and Depth to Water Table, Minnesota Hydrogeology Atlas series HG-03

This dataset estimates the water-table elevation from three primary sources: depth to water table in saturated soils from Natural Resources Conservation Service data (which are converted to elevation), elevation of surface water bodies, and the static water elevation in water table wells with verified locations. With the use of a 30-meter DEM derived using LiDAR data, depth to water table is derived from the water-table elevation. Data were obtained in 2015 and re-evaluated in January 2016. NRCS soil survey, DNR Water Features, and Minnesota County Well Index data were complete and accurate in 2015. Stream Routes with Stream Types were regenerated in 2013.

Minnesota Groundwater Provinces

Minnesota is generally considered to have abundant groundwater. But that resource is not evenly distributed across the state. That uneven distribution can limit the amount of groundwater available to industry and development in some areas. The Minnesota Groundwater Provinces map summarizes aquifer and groundwater resource differences at the regional level. The occurrence of groundwater in Minnesota is related primarily to local geologic conditions that determine the type and properties of aquifers. The map shows the six groundwater provinces of the state based on bedrock and glacial geology. Within each province, groundwater sources and the availability of groundwater for drinking water, industrial, and agricultural uses are similar. The aquifers within these provinces occur in two general geologic settings: bedrock comprising a wide range of rock types and ages, and unconsolidated sediments deposited by glaciers, streams, and lakes. The combination of physical aquifer attributes (thickness, lateral extent, permeability, and porosity type) of the two settings distinguishes the six groundwater provinces within the state.

Wellhead Protection:

These sets of data include the drinking water supply management area (DWSMA) boundaries and the vulnerability levels within each management area in Minnesota for public water supplies. DWSMAs are the boundaries (based on political infrastructure - i.e. parcels, streets) that surround a wellhead protection area (which is also an available dataset). Smaller community systems are also available to show on maps and are known as Source Water Assessment areas.

Nitrate/Arsenic:

Any arsenic contamination in MN is from natural causes. Since 2008, the Minnesota Department of Health measures the amount of arsenic in new wells drilled. This information is able statewide and can be summarized by the minor watershed or township. This well data also has nitrate results. Nitrate contamination is generally only an issue in agricultural areas. The Minnesota Department of Agriculture has also worked with affected counties to conduct more in-depth monitoring. This monitoring information is available in many counties with a fair amount of agriculture.

Nitrate Risk to the Water Table Aquifer (source: MDH):

Nitrate loading to the subsurface is estimated by reclassification of land use data (ranging from 1 point for relatively low to 5 points for relatively high estimated nitrate loading). Hydrogeologic sensitivity for the water table aquifer is ranked from low (1 point) to very high (4 points) based upon the permeability of geologic materials (surficial geology, soil parent material type and bedrock type), land slope, and the relationship between depth to water and depth to bedrock. Adding the estimated nitrate loading raster to the hydrogeologic sensitivity raster simulates nitrate release to the water table, and produces the nitrate risk map for the water aquifer. The final point score can fall within nitrate risk ranges classed on the final map as low (up to 4 points), moderate (5 to 6 points), or high (7 to 9 points). The results are checked by comparison to available nitrate chemical data collected from wells within the county being mapped.

Hydrogeologic Sensitivity of the Water Table Aquifer:

Hydrogeologic sensitivity mapping was done as part of the nitrate risk mapping effort. Hydrogeologic sensitivity of the water table aquifer was generated using guidelines provided in Minnesota DNR (1991). Areas were ranked as low, moderate, high, or very high hydrogeologic sensitivity based on permeability of near-surface bedrock or unconsolidated geologic materials, estimated depth to water, and land slope. LOW (1 point) was assigned to areas 1) covered by geologic materials primarily composed of clay or shale close to the surface, or 2) where land slopes were greater than 12% (regardless of underlying geologic materials).MODERATE (2 points) was assigned to areas not already assigned LOW, and underlain by modified clay till (clay plus a significant sand or gravel fraction). MODERATE was also assigned where land slopes were at least 6% and at most 12% (regardless of the rank of underlying geologic materials, except that material already ranked LOW remained LOW).HIGH (3 points) was assigned to areas not already assigned LOW or MODERATE, and underlain by unconsolidated sands and gravels. HIGH was also assigned to areas where limestone, dolomite, or sandstone were close to the surface and covered by loess. VERY HIGH (4 points) was assigned to areas not already assigned LOW, MODERATE or HIGH, where loess was absent, and shallow bedrock was limestone, dolomite, or sandstone.

Other

- *Feedlots*

  This dataset contains point representations of the locations of animal feedlot facilities in Minnesota based on information from the Minnesota Pollution Control Agency. The attribute table includes information about the number of animals for each location, including the type of primary animal and the number of animal units. This information can be shown in multiple ways, but the most common is aggregating the number of animal units by minor watershed.

- *Land Conversion Risk*

  The land conversion risk model was developed to look at the risk for private forest lands to be converted to agriculture. Private lands, all forest classes from the NLCD, and soil exhibiting a land capability classification of 1-4 (explanation below) were selected. The end result was mapped by minor watershed, with the higher percentage of these qualifying lands having a higher risk for conversion.
  Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops:
  - Class 1 soils have few limitations that restrict their use
  - Class 2 soils have moderate limitations that reduce the choice of plants or that require special conservation practices
  - Class 3 soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both
  - Class 4 soils have very severe limitations that reduce the choice of plans or that require very careful management, or both

- *Slopes*

Slopes can be represented a few ways…using LiDAR, the soil survey, or as a grid that shows areas with steeper slopes. If desired, slopes can be aggregated by minor watershed.

- *Development/Population Growth Patterns*

  There are a couple ways to represent growth and development. One common way is to map population changes over time (1990-2000, 2000-2010), typically at a township/city level. Another way is to track changes in E911 Address Pt density (i.e. look at the number of address pts present in 2015 vs. 2006 (or earlier). This often gives a more accurate picture of development as many counties require an E911 number be assigned for a structure placed on a previously undeveloped parcel of land. Counties that GPS the location of these new E911 pts can allow us to get a geographic view of the nature of this development in their county over time by comparing the density of these pts (per sq. mile) to other areas of the county. Either of these methods can be aggregated and mapped at the minor watershed level.

- *Elevation (Shaded Relief) & LiDAR*

  A statewide elevation layer exists that represents elevation using a base grid of 30 meters x 30 meters. This can be represented in a number of ways depending on the amount of elevation difference (from high to low) in the county and local preferences in terms of color and shading. LiDAR data is available that can be used to conduct more fine scale analysis. LiDAR ("**Li**ght **D**etection **a**nd **R**anging") is an active remote sensing technology that uses laser light to detect and measure surface features on the earth. LiDAR-derived high-resolution elevation data products are available for all of Minnesota. LiDAR datasets have been used for: erosion analysis, water storage and flow analysis, siting and design of BMPs, wetland mapping, and flood control mapping. One specific application of the data set is to delineate small catchments or contributing areas.

- *Zonation (DNR)*

  Zonation was developed by Paul Radomski, DNR Research Scientist, as a framework for large-scale spatial conservation prioritization; it is a decision support tool for conservation planning and is often included in WRAPs documents developed by the MNPCA. This values-based model can be used to identify areas important for protection and restoration based on local input.

- *Aquatic Invasive Species (AIS)*

  Infested lakes and streams can be mapped by type of invasive species using the frequently updated DNR infested waters list.

- *Altered Watercourses*

  The Altered Watercourse Project was a joint effort between the Minnesota Pollution Control Agency (MPCA) and Minnesota Geospatial Information Office (MnGeo) to create a statewide inventory of streams that have been hydrologically altered (e.g.

channelized, ditched or impounded). The dataset was created to support MPCA's water quality monitoring and assessment program and provides information about stream habitats that have been compromised through such alteration. The project entailed digitization of Geographic Information System (GIS) 'events' on to the United States Geological Survey's National Hydrography Dataset (NHD) stream linework. The events were then categorized as one of four types: Altered, Natural, Impounded or No definable channel, based upon a standardized methodology and criteria. These categorizations were performed manually by GIS technicians using visible interpretation of multiple years of aerial photography, LiDAR (Light Detection And Ranging)-based elevation data, and various other reference data in ArcGIS 10.0.

- *Watershed Health Assessment Framework Scores (DNR)*
  The Watershed Health Index approach identifies and analyzes data that characterizes the principal components of watershed health at the Major Watershed and Catchment scales. For each of the principal components (Geomorphology, Connectivity, Hydrology, Biology, and Water Quality) indices and underlying metrics have been developed that describe the relative health of the system. The generated values are scaled from 0 to 100 to provide a statewide comparable index of relative health risk. For more info: http://www.dnr.state.mn.us/whaf/index.html

- *Potential Pine Woodland Areas (DNR)*
  This map identifies where FDc12, FDc23, FDc24, FDn12, and FDn33 Woodland Native Plant Communities (NPC) are likely to occur based on soils and land cover data. These five communities are generally dominated by jack pine but also contain significant components of red pine, aspen, bur oak, birch, and/or white pine. Identifying Potential Pine Woodland Areas was prompted by concern and interest in jack pine because it is a unique and declining habitat/community, it is difficult to regenerate in much of the CP and PMOP, and the CP-PMOP SFRMP establishes aggressive goals to increase jack pine cover type acres during the life of the Plan.

- *Environmental Benefits Index (EBI)…older (2011)*
  The statewide ecological ranking tool makes it possible to identify areas on the landscape that are at risk for soil erosion, at risk for contributing sediment to surface waters, or are of high habitat quality. When used in combination with other tools and resources, local conservation staff can develop and establish conservation practices that address the site's specific needs and in turn achieve the greatest environmental benefits. Identifying potential costs and benefits of conservation practices requires accurate information about a site's soils, terrain, and proximity to water bodies. The tool consists of three spatial data layers: Erosion potential of soils, Terrain analysis and surface water proximity to determine critical overland flow areas, and Habitat quality. This Environmental Benefits Index (EBI) is a composite score of multiple ecological benefits. The score is based on a 0-300 scale, where a score of 300 is most valuable from a conservation perspective. The EBI is the sum of these 3 independent layers.

  This layer was created with the intention to rank CRP and other critical lands on multiple ecological benefits simultaneously. This approach is similar to the EBI used by the Farm Service Agency to rank farmers requests to enroll land in the Conservation Reserve Program. Our approach differs in that it offers flexibility in the weighting scheme, and allows users to explore both the spatial distribution of the data and the consequences of

using alternative weighting systems. For example if, identifying lands of high soil erosion risk is important, the habitat quality and water quality risk maps can be down-weighted (e.g. scaled from 0-50). This would produce a different map than when all attributes are weighted equally.

- *Stream Stability Risk (Sandy VeRry model for open lands)*
  Land Use/land cover changes in a watershed can affect stream stability, which is the ability of a stream to maintain (over time) its dimension, pattern, and profile so that it neither aggrades or degrades and is able to transport the flows and detritus of its watershed without adverse effect. According to retired U.S. Forest Service Hydrologist Sandy Verry, when more than 60% of a watershed is permanently converted to open areas or young forests, it will have 2-3 times the amount of bankful volume, which will have a dramatic effect on the stream stability. Sandy's model looks at watershed size, slope, open areas, and storage areas (lakes and wetlands) to determine the potential for stream stability risk.

- *Individual Minor Watershed Maps*
  Several minor-watersheds & HUC12 watersheds surrounding Camp Ripley have been mapped individually to show all the relevant features of that minor, specifically the amount of protected land, surface water resources, ownership (parcel outlines), etc. The examples completed so far also include the Implementation Toolbox and thermometer showing the amount of protected lands.