Comprehensive Watershed Management Plan 2023-2032

Prepared through the One Watershed, One Plan Program

April 2023

Prepared for the Lower Minnesota River West Partnership

Comprehensive Watershed Management Plan: 2023-2032

Prepared for the
Lower Minnesota River West Partnership

Prepared through the
One Watershed, One Plan Program

April 2023

4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
952.832.2600
www.barr.com

List of Tables

List of Figures

List of Appendices, Attachments, or Exhibits

Certifications

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the Laws of the State of Minnesota.

Sterling Greg Williams Jr.

April 6, 2023
Date

PE #: 47642

Abbreviations

1W1P	One Watershed, One Plan
AG	Advisory Group
AFO	Animal Feedlot Operations
AHPS	Advanced Hydrologic Prediction Service
AUID	Assessment Unit Identifier
BMPs	Best Management Practices
BWSR	Board of Water and Soil Resources
CIG	Conservation Innovation Grants
CIP	Capital Improvement Plan or Capital Improvement Program
CLMP	Citizen Lake Monitoring Program
CPI	Crop Productivity Index
CRP	Conservation Reserve Program
CSMP	Citizen Stream Monitoring Program
CWA	Clean Water Act
DWSMA	Drinking Water Supply Management Area
E. coli	*Escherichia coli*
EDA	Environmental Data Access
EQIP	Environmental Quality Incentives Program
FEMA	Federal Emergency Management Agency
FIBI	Fish Index of Biological Integrity
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FISRWG	Federal Interagency Stream Restoration Working Group
FSA	Farm Service Agency
GRAPS	Groundwater Restoration and Protection Strategies
HICWD	High Island Creek Watershed District
HSPF	Hydrological Simulation Program-FORTRAN
HUC	Hydrologic Unit Code
IBI	Index of Biological Integrity
JPA	Joint Powers Agreement
LA	Load Allocation
LGU	Local Governmental Unit
LIWG	Local Implementation Work Group
MBS	Minnesota Biological Survey
MDA	Minnesota Department of Agriculture
MDEED	Minnesota Department of Employment and Economic Development
MDH	Minnesota Department of Health
MDNR	Minnesota Department of Natural Resources
MGS	Minnesota Geological Survey

MIBI	Macroinvertebrate Index of Biological Integrity
MLCCD	Minnesota Land Cover Classification Dataset
MnDOT	Minnesota Department of transportation
MOS	Margin of Safety
MPCA	Minnesota Pollution Control Agency
MS4	Municipal Separate Storm Sewer System
MSL	Mean Sea Level
MWLMP	Major Watershed Load Monitoring Program
NED	National Elevation Dataset
NAPP	National Aerial Photography Program
NGO	Non-governmental organization
NHIS	Natural Heritage Information System
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
NWS	National Weather Services
OHWL	Ordinary High-Water Level
PAC	Policy Advisory Committee
PC	Policy Committee
PCBs	Polychlorinated Biphenyls
PFCs	Perfluorinated Chemicals
PWI	Public Waters Inventory
RCPP	Regional Conservation Partnership Program
SAM	Scenario Application Manager
SDS	State Disposal System
SSTS	Subsurface sewage treatment systems
ST	Steering Team
SWAG	Surface Water Assessment Grant
SWPPP	Stormwater Pollution Prevention Plan
SWCD	Soil and Water Conservation District
TAC	Technical Advisory Committee
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total suspended solids
USACE	U.S. Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Services
USGS	United States Geological Survey
WASCB	Water and Sediment Control Basin

WBIF	Watershed-based implementation funding
WCA	Wetland Conservation Act
WD	Watershed District
WHPP	Wellhead Protection Program
WLA	Wasteload Allocation
WMO	Watershed Management Organization
WPLMN	Watershed Pollutant Load Monitoring Network
WRAPS	Watershed Restoration Protection Strategies
WWTP	Wastewater Treatment Plant

Acknowledgements for the Lower Minnesota River West Comprehensive Watershed Management Plan

Approved by the Minnesota Board of Water and Soil Resources (BWSR) on March 22, 2023.

Moved for Adoption by the Lower Minnesota River West Partnership Policy Committee on April 6, 2023.

This Comprehensive Watershed Management Plan (Plan) was prepared with the dedicated assistance of its Steering Team, Advisory Group, and Policy Committee.

Policy Committee

Jim Mueller - High Island Creek Watershed District
Doug Krueger – McLeod County
Charles Mathews – McLeod SWCD
Marie Dranttel – Nicollet County
Eric Annexstad – Nicollet SWCD
Steve Saxton – Sibley County
Paul Wiemann – Sibley SWCD

Steering Team

Allen Kerber - High Island Creek Watershed District
Sarah Young – McLeod County
Marc Telecky – McLeod County
Ryan Freitag – McLeod SWCD
Coleton Draeger – McLeod SWCD
Ben Rosburg – Nicollet County
Kevin Ostermann – Nicollet SWCD
Blake Honetschlager – Nicollet SWCD
John Wenninger – Sibley County
Marilee Peterson – Sibley County
Joel Wurscher – Sibley SWCD
Jack Bushman – Sibley SWCD
Mark Hiles – (BWSR)
Shaina Keseley – BWSR
Jeremy Maul – BWSR
Jenny Mocol-Johnson – BWSR

Advisory Group

Paul Moline – Carver County
Mike Wanous – Carver SWCD
Linda Loomis – Lower MN River Watershed District
Faye Healy – Minnesota Valley Trust
Jennifer Ronnenberg – MN Dept. of Health
Garry Bennett – MN Dept. of Natural Resources
Bryan Spindler – MN Pollution Control Agency
Deanna Biehn – Nicollet County
Jesse Harmon – Nicollet County
Geoff Beranek – Sibley County
Tim Becker – Sibley County
Jeremy Buckentin – Sibley SWCD
Emma Severns – University of Minnesota Extension

…and all members of the Steering Team

The Policy Committee would also like to thank all members of the public who contributed to this Plan by completing the survey, providing comments, or otherwise providing input during Plan development.

Executive Summary

The Lower Minnesota River West Partnership (Partnership) is a group of the Counties and Soil and Water Conservation Districts (SWCDs) of McLeod, Nicollet, and Sibley, and High Island Creek Watershed District. The Partnership covers an area north and west of the Minnesota River herein referred to as the "Lower Minnesota River West watershed" or "planning area." The Partnership was formed to develop a Comprehensive Watershed Management Plan (Plan) through the One Watershed, One Plan (1W1P) program detailed in Minnesota Statutes 103B.801. Through the 1W1P program, the local governments (Partners) prepared this document to guide cooperative water and natural resource management actions over the next 10 years.

Introduction

This Plan outlines a cooperative and coordinated strategy by which the Partners will work together to protect, maintain, and restore the water and natural resources within the planning area. Through prioritized and targeted actions, the Partners will make progress towards measurable, common goals. This Plan provides a framework for the Partners to operate as a local, coordinated partnership while effectively leveraging the resources of local governments (i.e., the Partners) and supporting organizations (e.g., State and Federal agencies). The Plan is a local plan emphasizing the interests of local water managers, policy makers, and affected stakeholders consulted during Plan development (see Section 1.5). The Plan was developed through the efforts of:

- Steering Team – comprised of technical staff of the Partner organizations
- Advisory Group – including staff from state and local cooperators and invited stakeholders
- Policy Committee – comprised of elected officials representing the Partner organizations

This Plan will be executed through a Joint Powers Agreement (JPA) between the Partners (see Appendix D). The JPA recognizes the importance of partnerships to implement watershed protection and restoration efforts for the planning area on a cooperative and collaborative basis pursuant to the authority contained in Minnesota Statutes Section 471.59.

Planning Boundary and Subwatersheds

The Lower Minnesota River West planning area includes the portion of the Lower Minnesota River 8-digit HUC watershed (07020012) west of the Minnesota River. Initial 1W1P conversations included the entire Lower Minnesota River 8-digit HUC watershed as a single planning area. Ultimately, the planning area was split into an east and west portion divided by the Minnesota River and along the Sibley County-Carver County line in the northeast portion of the planning area.

The Lower Minnesota River West planning area covers 498,000 acres (778 square miles) and includes portions of four counties (see inset figure). A small portion of Renville County is included in the planning area although Renville County and SWCD are not members of the Partnership. The planning area was subdivided into six major subwatersheds at approximately the 10-digit HUC level for planning purposes (see Section A.1 and Figure A-1). The Lower Minnesota River West planning area is shown in Figure 1-1.

The planning area includes primarily agricultural land use as well as areas of pastureland, and forested areas near the Minnesota River. While development of the planning area has altered the natural landscape, it has also made possible the significant agricultural productivity that supports the local and regional economy. Urban development within the watershed is very limited, with smaller towns located throughout the planning area (see Table ES-1). The terrain of the Lower Minnesota River West watershed includes gently rolling terrain in the western and central portions of the watershed transitioning to hills, bluffs, and ravines in the far eastern portion of the watershed adjacent to the Minnesota River. The Minnesota River flows from south to north along the eastern boundary of the planning area. Major hydrologic features include High Island Creek and Rush River (including its North Branch, Middle Branch, and South Branch), which generally flow from west to east across the planning area before discharging to the Minnesota River. In the northeast, Silver Creek and Bevens Creek flow north out of the planning area into Carver County.

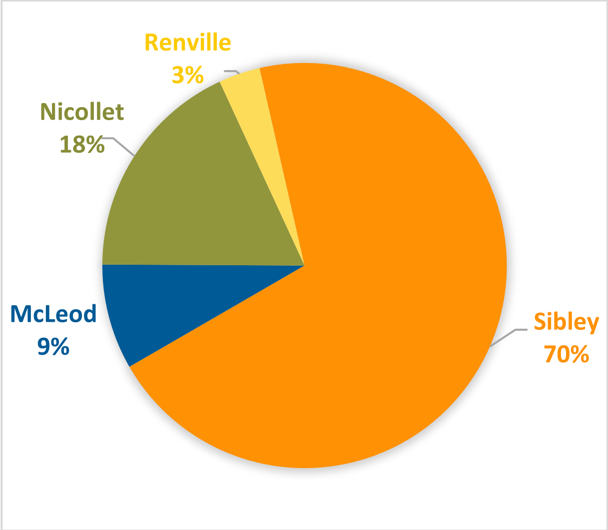


Figure ES-1 Planning Area by County

Additional information about the physical and environmental characteristics of the planning area are presented in Appendix A.

Table ES-1 Summary of Land Use/Land Cover within the Planning Area

Land Cover	Square Miles	% of Total Area
Barren Land	0.74	0.09%
Cultivated Crops	657.30	84.40%
Deciduous Forest	33.72	4.33%
Developed, High Intensity	0.54	0.07%
Developed, Low Intensity	8.29	1.06%
Developed, Medium Intensity	2.32	0.30%
Developed, Open Space	21.30	2.74%
Emergent Herbaceous Wetlands	22.57	2.90%
Evergreen Forest	0.04	0.01%
Hay/Pasture	11.43	1.47%
Herbaceous (grassland)	0.73	0.09%
Mixed Forest	0.79	0.10%
Open Water	12.49	1.60%
Shrub/Scrub	0.42	0.05%
Woody Wetlands	6.06	0.78%
Total	**778.75**	**100%**

Source: Minnesota Land Cover Classification Dataset (MLCCD)

Issue and Resource Prioritization

Section 2 of the Plan summarizes the issue identification and prioritization process used by the Partners and documents the resulting issue priorities. The Partnership implemented an iterative process to identify and prioritize watershed issues with consideration of existing data and input from the Advisory Group, Steering Team, Policy Committee, and public (via stakeholder engagement efforts).

The Partners ultimately established a three-tiered issue prioritization, with four major issues categorized as Level 1 (top priority), two major issues categorized as Level 2 (medium priority), and two major issues categorized as Level 3 (lower priority) (see inset figure). The partners placed emphasis for implementation on Level 1 issues, although many of these activities have direct or indirect benefits for Level 2 and Level 3 issues. Measurable goals (see Section 3) were established for all levels of priority issues.

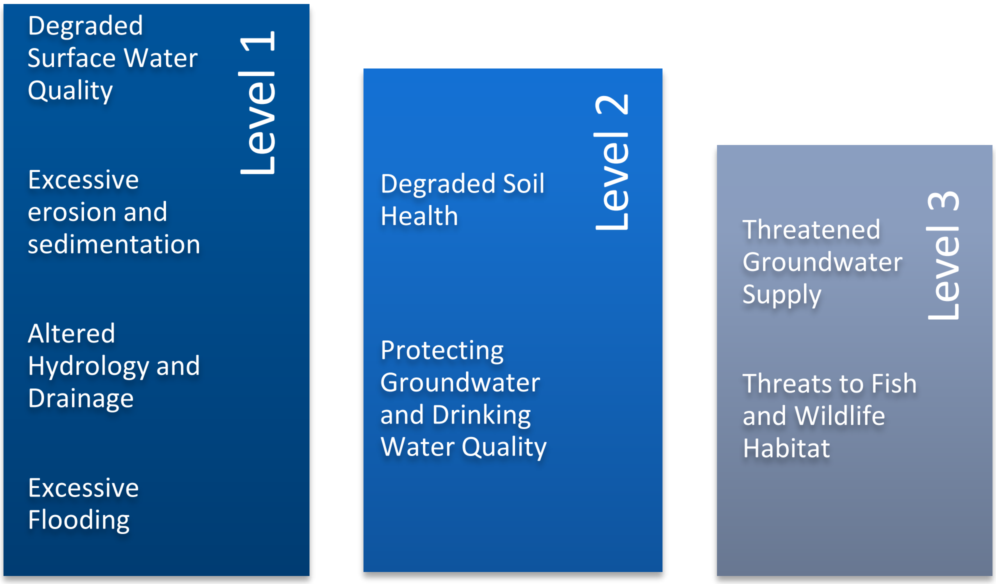


Figure ES- 2 Issue Priority Levels

Section 2 also details the delineation of priority areas for focusing implementation activities related to priority issues of degraded surface water and altered hydrology and drainage. This process used existing geospatial data, modeling results, and watershed assessments. Priority implementation areas for addressing degraded surface water quality and altered hydrology and drainage are presented in Figure 2-8 and Figure 2-9.

Measurable Goals

Section 3 describes the development of measurable goals. The Partners considered a range of available information, including:

- Existing management plans, studies, reports, data and information, including:
    - County Water Management Plans
    - Lower Minnesota River Watershed Restoration and Protection Strategy (WRAPS) report and associated scenario modeling
    - Lower Minnesota River Total Maximum Daily Load (Part I)
    - Lower Minnesota River Groundwater Restoration and Protection Strategy (GRAPS) report
- Input received from stakeholder engagement (see Section 2.1 and Appendix C)
- Input from the Steering Team
- Input from Advisory Group members
- Input from Policy Committee members

Generally, goals were developed first at a qualitative level ("what types of things would we like to achieve?") and refined to include quantifiable elements ("how much can we achieve?") where supported by available data and tools. In situations where existing data is not sufficient to develop a quantitative goal, the goals focus on collecting and interpreting information to support developing more quantitative future goals. Measurable outputs for each goal were selected appropriate to the level of quantification. Emphasis was given to goals that address Level 1 priority issues, although goals were developed to address all eight priority issue areas.

The Plan goals are divided into long-term (i.e., desired future condition) and short-term (i.e., 10-year, or Plan goals) goals. Long-term goals may not be achievable within the 10-year life of the Plan. 10-year goals are presented as reasonable progression towards the desired future condition. Specific 10-year pollutant reduction goals were estimated using HSPF-SAM.

A complete list of measurable goals developed by the Partners are presented in Table 3-2 and Table 3-3.

Targeting of Projects and Practices

The Partners used digital terrain analysis to identify potential locations to implement best management practices (BMPs) to address excessive erosion and sedimentation and surface water quality degradation issues. Potential BMPs include grade stabilization, increased runoff/flood storage, cover crops, and others. Potential project locations were identified throughout the planning area, regardless of subwatershed priority level. Sites identified via terrain analysis were supplemented with existing databases of drainage and/or erosion issues (see Figure 4-1). The Partners used existing HSPF-SAM models to estimate pollutant reductions anticipated from implementing projects at these locations in addition to other implementation activities (see Section 4.2).

Priority areas for addressing degraded surface water quality and altered hydrology and drainage issues (presented in Figure 2-8 and Figure 2-9), will be used to target projects, studies, and education efforts to achieve applicable goals and evaluate multi-benefit practices. Some activities are targeted to more specific geographies applicable to the specific need or outcome (e.g., groundwater-related activities targeting drinking water supply management areas, or DWSMAs).

Implementation

The Plan includes a targeted and measurable implementation schedule that outlines the projects, programs, and other activities the Partners will implement over the next 10 years (see Section 5 and Table 5-4). The Partners established the implementation schedule with input from the Advisory Group (which represents many of the entities identified as cooperators in Table 5-4).

The implementation schedule provides sufficient direction and measurable outcomes while maintaining flexibility to adapt to developing opportunities. The targeted implementation schedule includes a range of strategies and tools, including cost-share projects, education programs, and new and expanded programs necessary to achieve the goals of the Plan.

The Plan implementation schedule is presented in Table 5-4. The activities included in the implementation program are intended to leverage the existing roles, capacities, and expertise of the Partners while providing a framework for the Partners to perform expanded roles. The activities and projects described in this Plan will be implemented through existing, new, and expanded programs of the Partners. Programs and activities may be adjusted based on the associated funding source.

Activities included in Table 5-4 are assigned to the following categories:

- Administration of the Partnership
- Projects and project support
- Monitoring and studies
- Education and public involvement
- Regulatory oversight

The proposed timeframe, estimated cost (local and non-local contributions), measurable outputs, and lead and cooperating entities are identified for each implementation activity. Estimates of costs, measurable outputs, and timeframes were developed based on a combination of HSPF-SAM model runs and documentation, Partner estimates of local capacity, and consideration of future BWSR Watershed Based Implementation Funding (WBIF). The current implementation schedule (Table 5-4) was derived from iteration with the Partners. The Partners may revise the implementation schedule, if needed, following the amendment procedure described in Section 5.5.

Implementation Costs

The implementation schedule includes planning level cost estimates for individual activities. Planning level costs are split between local funding sources and external funding sources. Local funding sources include funding borne by the Partners, while external funding sources include all other funding sources (e.g., cost-share with non-Partner entities, State grants). Costs are subtotaled by category and funding source as presented in Table ES-2 and Figure ES- 3.

This Plan includes an ambitious implementation schedule. Total estimated annual costs (approximately $1.7M) exceed current local funding allocated to existing and similar programs within the planning area. Thus, additional funding provided from WBIF, other State funds, Federal funding, and/or private funding sources will be necessary to accomplish Plan goals.

Table ES-2 Summary of Estimated Plan Funding

Type of Activity	Partner Local Funds	Estimated Landowner Contribution	Watershed Based Implementation Funds (WBIF)	Other state/ federal funding sources	Total
Partnership Administration	$350,000	--	$300,000	--	$650,000
Project and Project Support	$6,096,000	$677,000	$2,591,000	$5,881,000	$15,245,000
Studies and Monitoring	$825,000	--	--	$150,000	$975,000
Education and Outreach	$354,000	--	$109,000	$109,000	$572,000
Regulatory Review/ Oversight	$30,000	--	--	--	$30,000
Total	$7,655,000	$677,000	$3,000,000	$6,140,000	$17,472,000

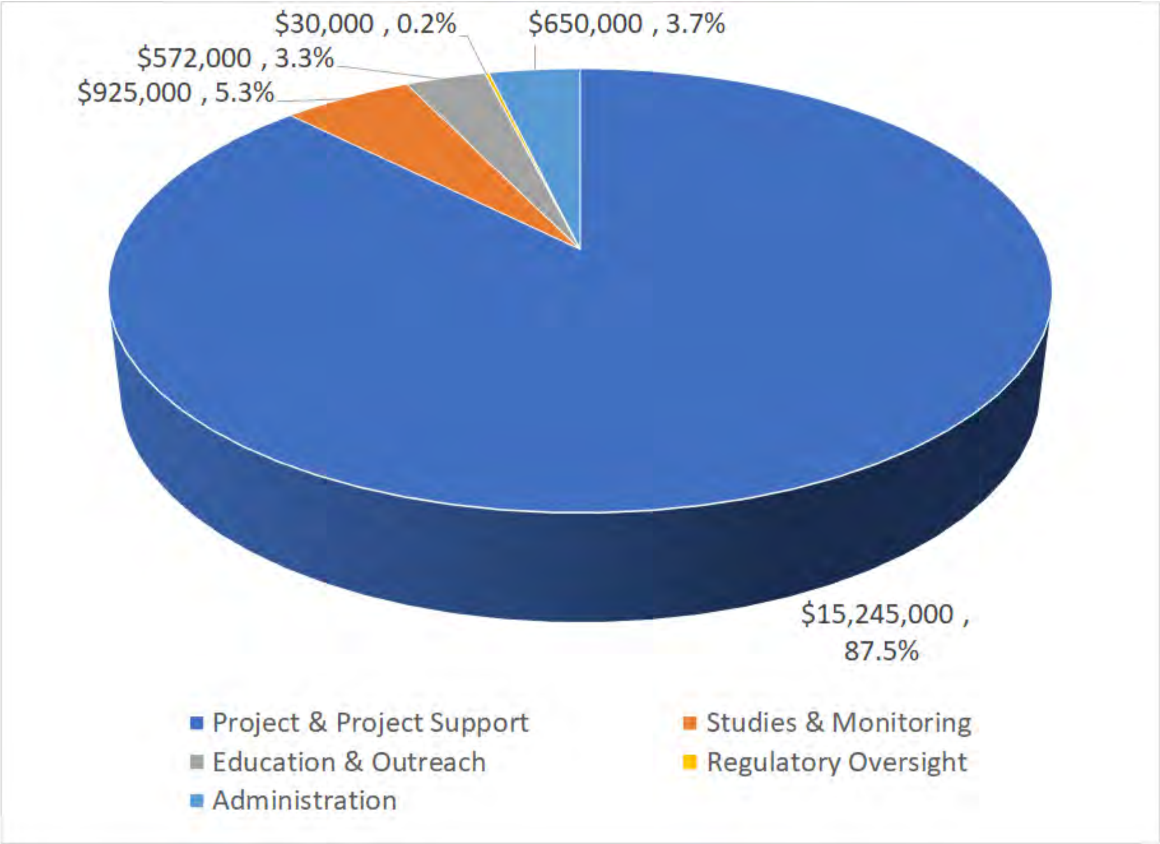


Figure ES- 3 Estimated Plan Implementation Costs

Additional non-governmental funding sources may be used to fund Plan implementation. The Partners will coordinate with non-governmental organizations to explore potential cost-share opportunities surrounding shared goals. The Partners will seek additional partnerships with private sector businesses as such opportunities arise. Future opportunities may include working with agri-business on incentives that provide opportunity for water resources improvements. Incentives may not be implemented through the Partnership but are instigated through Partnership actions.

Additional information about Plan costs and funding sources is included in Section 5.3.

Implementation Roles and Responsibilities

The Partners will implement this Plan according to the governance structure established in the implementation Joint Powers Agreement (JPA, see Appendix D). The JPA does not create a new entity. Instead, the JPA is a formal and outward commitment to work together as a partnership and specifies mutually accepted expectations and guidelines between partners. Per the JPA, the Partners will establish committees to carry out the coordinated implementation of this Plan. During implementation, the Plan will be executed through the coordinated effort of the following committees:

- Policy Advisory Committee
- Technical Advisory Committee
- Local Implementation Work Group

These groups are described in greater detail in Section 5.4. The Local Implementation Work Group will perform the annual work planning, which will be based on prioritized implementation activities, the availability of funds, and the roles and responsibilities for implementation. Coordination and communication are critical for a partnership operating under a JPA. The Partners will continue to coordinate with BWSR, MDA, MDH, MDNR, and MPCA as required through State-legislated programs and to accomplish the many Plan activities that identify State agencies as cooperating entities. The Partners will also coordinate with Federal partners where appropriate, including NRCS, FSA, USACE, EPA, and USFWS. Similarly, continued coordination and communication with local governmental units, such as cities, township boards, joint powers boards, drainage authorities, and other water management authorities is necessary to facilitate watershed wide activities. The Partners will also collaborate with non-governmental organizations where mutual benefit may be achieved.

1 Introduction

The Lower Minnesota River West Partnership (Partnership) is a partnership of the Counties and Soil and Water Conservation Districts (SWCDs) of McLeod, Nicollet, and Sibley, and the High Island Creek Watershed District (HICWD) (i.e., the Partners) located upstream of the Minnesota River. The Partnership was formed as part of the One Watershed, One Plan (1W1P) program detailed in Minnesota Statutes 103B.101. Through the 1W1P program, the Partners prepared this document – the **Lower Minnesota River West Comprehensive Watershed Management Plan** (Plan).

1.1 Purpose and Scope

The purpose of this Plan is to document coordinated, prioritized, and targeted practices and programs to achieve the water and natural resource management goals established by the Partnership (see Section 3). This Plan provides a framework for the different entities comprising the Partnership to operate in a coordinated manner while effectively leveraging the resources and authorities of each entity and supporting organizations (e.g., State and Federal agencies).

The Plan includes a prioritized, targeted, and measurable implementation program (see Section 5) that outlines the projects, programs, and strategies the Partnership will implement over the next 10 years. The implementation program provides direction and milestones while maintaining flexibility to adapt to developing opportunities and/or immediate concerns. Plan development is based on a watershed-wide, science-based approach to resource management informed by the expertise of Partner staff. The targeted implementation program includes a range of strategies and tools, including capital improvements, local controls, and new and expanded programs necessary to achieve the Plan goals.

This is a local plan emphasizing the interests of local water managers, policy makers, and stakeholders (see Section 2.1). This Plan was developed under and through a memorandum of agreement (MOA) between the Partners and will be executed through an implementation joint powers agreement (JPA, see Appendix D). The partners will operate as a joint powers collaboration, pursuant to the authority contained in Minnesota Statutes Section 471.59.

Much of the information contained within this Plan is compiled from existing water and natural resource management plans, studies, reports, modeling, and other sources. A list of documents referenced in the development of this Plan is included in Section 6.

1.2 One Watershed, One Plan Program

The One Watershed, One Plan (1W1P) program is an evolution of Minnesota’s watershed management strategy that emphasizes management of water resources according to hydrologic boundaries instead of political boundaries. Legislation passed by the State in 2012 (Minnesota Statutes §103B.101, subd.14), led to the establishment of the 1W1P program at the Board of Water and Soil Resources (BWSR). Additional legislation was passed in 2015 (Minnesota Statutes §103B.801) that outlines the purpose of and requirements for comprehensive watershed management plans developed through the 1W1P program.

The 1W1P vision is to align local planning and implementation with state strategies at a watershed level over a ten-year transition period. The BWSR *One Watershed, One Plan Operating Procedures* is a policy document that outlines processes to achieve this vision. Additional information about the 1W1P program can be found on the BWSR website: http://www.bwsr.state.mn.us/planning/1W1P/index.html

As part of the 2012 legislation, BWSR was granted funding to initiate the 1W1P program. This Plan was developed through a grant provided by BWSR.

1.3 Watershed Characteristics

The area addressed by this plan (i.e., planning area) includes primarily agricultural land use as well as areas of pastureland, and forested areas near the Minnesota River. While development of the planning area has altered the natural landscape, it has also made possible the significant agricultural productivity that supports the local and regional economy. Urban development within the watershed is very limited, with smaller towns located throughout the planning area. The terrain of the Lower Minnesota River West watershed includes gently rolling terrain in the western and central portions of the watershed transitioning to hills, bluffs, and ravines in the far eastern portion of the watershed, adjacent to the Minnesota River. The Minnesota River flows from south to north along the eastern boundary of the planning area. Major hydrologic features include High Island Creek and Rush River (including its North Branch, Middle Branch, and South Branch) which generally flow from west to east across the planning area before discharging to the Minnesota River. In the northeast, Silver Creek and Bevens Creek flow north out of the planning area into Carver County. Additional information about the physical and environmental characteristics of the planning area are presented in Appendix A.

1.4 Plan Boundary

The Lower Minnesota River West planning area is presented in Figure 1-1. The planning area includes the portion of the Lower Minnesota River 8-digit HUC watershed (07020012) west of the Minnesota River. Initial 1W1P conversations included the entire Lower Minnesota River 8-digit HUC watershed as a single planning area. Ultimately, the planning area was split into an east and west portion divided by the Minnesota River and along the Sibley County-Carver County line in the northeast portion of the planning area. The Lower Minnesota River West planning area covers 498,000 acres (778 square miles) and includes portions of four counties (see Figure 1-1); the planning area includes a small portion of Renville County although the County and SWCD are not members of the Partnership. The planning area was subdivided into six major subwatersheds at approximately the 10-digit HUC level for planning purposes (see Section A.1 and Figure A-1).

1.5 Planning Partners and Plan Development

The Lower Minnesota River West Partnership includes the following 7 entities who committed to the implementation of this Plan through execution of the JPA included in Appendix D:

- The Counties of McLeod, Nicollet, and Sibley (i.e., the Counties) by and through their respective County Board of Commissioners.

- The McLeod, Nicollet, and Sibley Soil and Water Conservation Districts (i.e., SWCDs) by and through their respective SWCD Board of Supervisors.
- The High Island Creek Watershed District (HICWD) by and through their Board of Managers.

The above entities collectively form the Lower Minnesota River West Partnership and are referred to within this Plan collectively as the "Partnership" or individually as "Partners." Renville County and Renville SWCD opted out of the plan development process and development of the implementation JPA due to the limited portion of the planning area in Renville County.

In addition to the primary implementation responsibilities of the Partners, implementation of this Plan will rely on the involvement and cooperation of other federal, state, and local entities. Several of these cooperators were involved in the development of this Plan through the establishment and participation of the following committees:

- The **Policy Committee (PC)** served as the decision-making authority for the planning process. The committee was composed of one County Commissioner and one SWCD Supervisor appointed from each of the Partner counties in the planning area, and one manager from HICWD.
- The **Advisory Group (AG)** served to provide input to the Policy Committee regarding the planning process and Plan content, including supplying technical information throughout Plan development. The committee was composed of local, State, and Federal agency staff, and other stakeholders. A complete list of participating organizations is included on the Acknowledgements page at the beginning of this document.
- The **Steering Team (ST)** guided the logistics of the planning process and drafted the Plan. The Steering Team was composed of local governmental staff from the counties and SWCDs in the planning area, as well as BWSR staff. A complete list of participating organizations is included on the Acknowledgements page at the beginning of this document.

Individuals who participated in these committees during Plan development are noted on the "Acknowledgements" page located at the beginning of the Plan.

Input from the Partners, cooperators, and public served a critical role during Plan development and contributed to a Plan that prioritizes local interests in coordination with broader goals. The Partnership performed the following stakeholder engagement activities during the planning process:

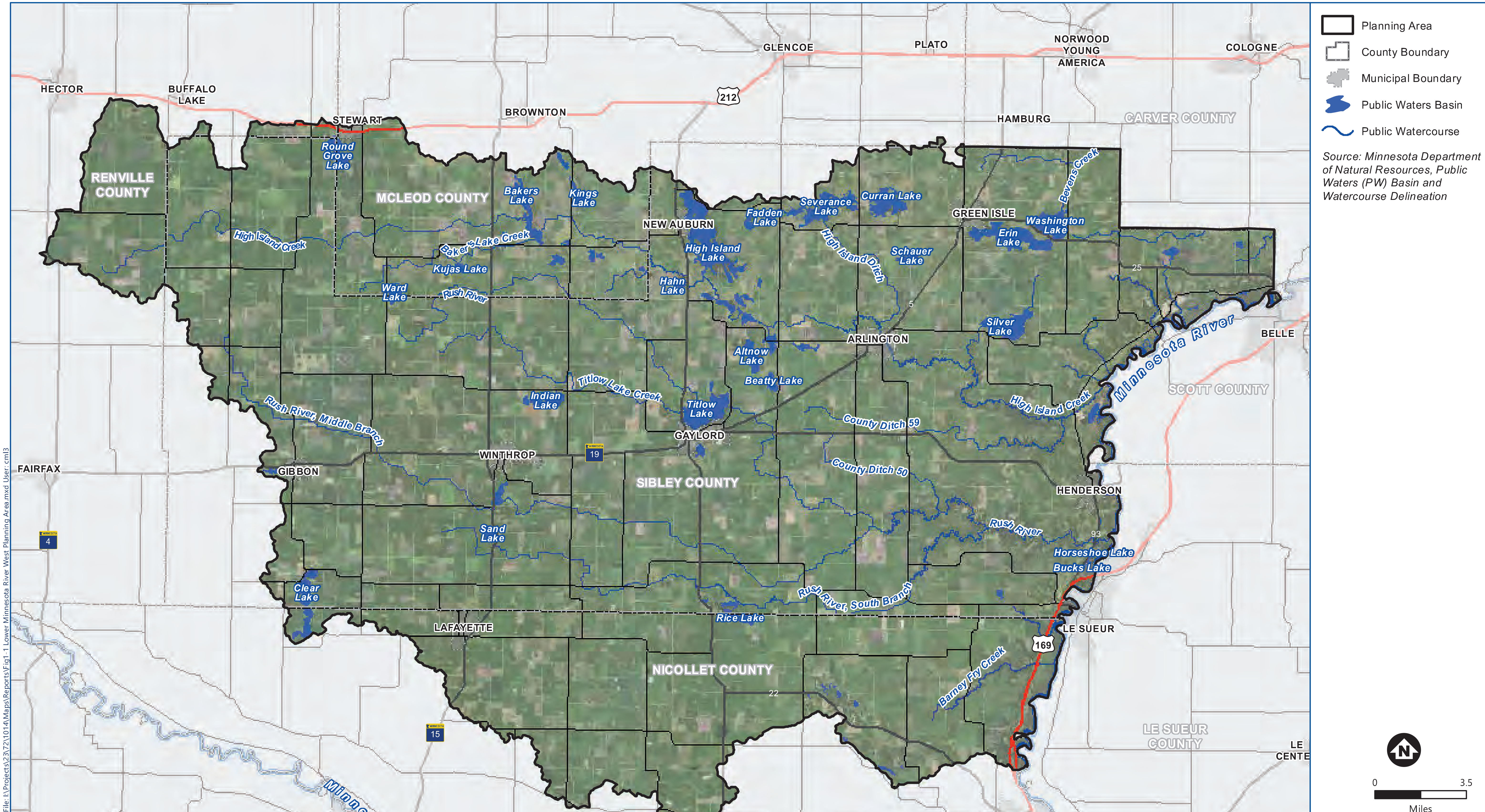
- **Notification of Plan Update** – September, 2020 – The Partnership solicited input from state agencies regarding issues to be addressed by the Plan and data relevant to Plan development. The Partnership received input from the following agencies:
    - Minnesota Board of Water and Soil Resources (BWSR)
    - Minnesota Department of Agriculture (MDA)
    - Minnesota Department of Health (MDH)
    - Minnesota Department of Natural Resources (MDNR)
    - Minnesota Pollution Control Agency (MPCA)

- **Online and mailed survey** – December, 2020–February, 2020 – The Partners developed a detailed survey to obtain input from residents about how they use and view the water and natural resources within the planning area. The survey was hosted online and mailed to approximately 2,500 residents within the planning area and advertised via social media posts and flyers at post offices and other high traffic locations. Results of the survey are summarized in Section 2.1.2 and Appendix C.

Throughout the planning process, stakeholder input was shared, received, and considered through meetings of the Steering Team, Advisory Group, and Policy Committee. Table 1-1 presents a timeline of key committee meetings held during the Plan development process.

Table 1-1 Key Plan development meetings held during Plan development

Date	Committee	Major agenda items
6/4/2020	Policy Committee	First Policy Committee meeting, adopt bylaws, approve process for consultant selection and request for proposals. Approve structure and membership of the Advisory Committee.
7/2/2020	Policy Committee	Review and approve the 60-day notice; Initiate 60-day review process; Review and approve the Request for Qualifications; Initiate RFQ process
8/6/2020	Policy Committee	Select consultant
9/3/2020	Policy Committee	Review and approve contract with Barr Engineering Co.
11/17/2020	Steering Team	Review public kick off survey
12/3/2020	Policy Committee	Review and approve public kick off survey
03/04/2021	Policy Committee	Approve public engagement survey memo; Review and approve issue statements
3/18/2021	Advisory Committee/Policy Committee Workshop	Issue Prioritization Workshop
6/3/2021	Policy Committee	Discuss and approve priority resource concern tiers
8/5/2021	Policy Committee	Discuss and approve spatial priority maps
9/2/2021	Advisory Committee	Review goals table
10/14/2021	Policy Committee	Review goals table
12/2/2021	Policy Committee	Discuss draft implementation schedule
12/16/2021	Advisory Committee	Review terrain analysis; Review implementation schedule
1/4/2022	Policy Committee	Review implementation schedule
1/16/2022	Policy Committee	Review implementation schedule
2/3/2022	Policy Committee	Discuss governance structure for implementation
4/7/2022	Policy Committee	Discuss targeting practices and pollutant reduction estimates
5/3/2022	Steering Team	Review hydrologic analyses and implementation schedule
6/9/2022	Policy Committee	Review draft Plan document; authorize draft Plan submittal
6/23/2022	Steering Team	Review draft Plan document
7/24/2022	Local Lead Staff	Review minor changes to draft Plan document
8/4/2022	Policy Committee	Review Plan development schedule, set Public Hearing
10/3/2022	Steering Team	Review 60-day review comments and draft responses
10/14/2022	Policy Committee	Discuss, revise, and approve response to 60-day review comments
11/10/2022	Policy Committee	Host Public Hearing on the draft Plan
12/8/2022	Policy Committee	Authorize draft Plan for 90-day review submittal
1/31/2023	Steering Team	Develop process for project ranking, approval and funding
2/9/2023	Policy Committee	Review WBIF project funding process and Joint Powers Agreement for plan implementation



LOWER MINNESOTA RIVER WEST PLANNING AREA

Lower Minnesota River West Comprehensive Watershed Management Plan

FIGURE 1-1

BARR SEH

2 Issue and Resource Prioritization

This section summarizes the issue identification and issue and resource prioritization process used by the Partners and memorializes the prioritized issue statements used as input to develop measurable goals (see Section 3) and the targeted implementation plan (see Section 5). The Partners considered several types of data in identifying and prioritizing resources and issues, including:

- Existing plans, studies, and geospatial data (see Land and Water Resources Inventory included as Appendix A)
- State agency presentations and responses to the Plan notification letter
- Public survey results
- Input from Steering Team, Policy Committee, and Advisory Group at several meetings
- Paired analysis ranking by the Steering Team, Advisory Group, and Policy Committee

The issue statements presented in Table 2-1 were developed and refined with consideration of each of the above sources. Note that due to public health guidelines resulting from the COVID-19 pandemic, the public survey replaced the planned public kickoff meeting.

2.1 Issue Identification and Prioritization Process

Figure 2-1 generally illustrates the process led by the Steering Committee ultimately resulting in the issue and resource prioritizations adopted by the Policy Committee.

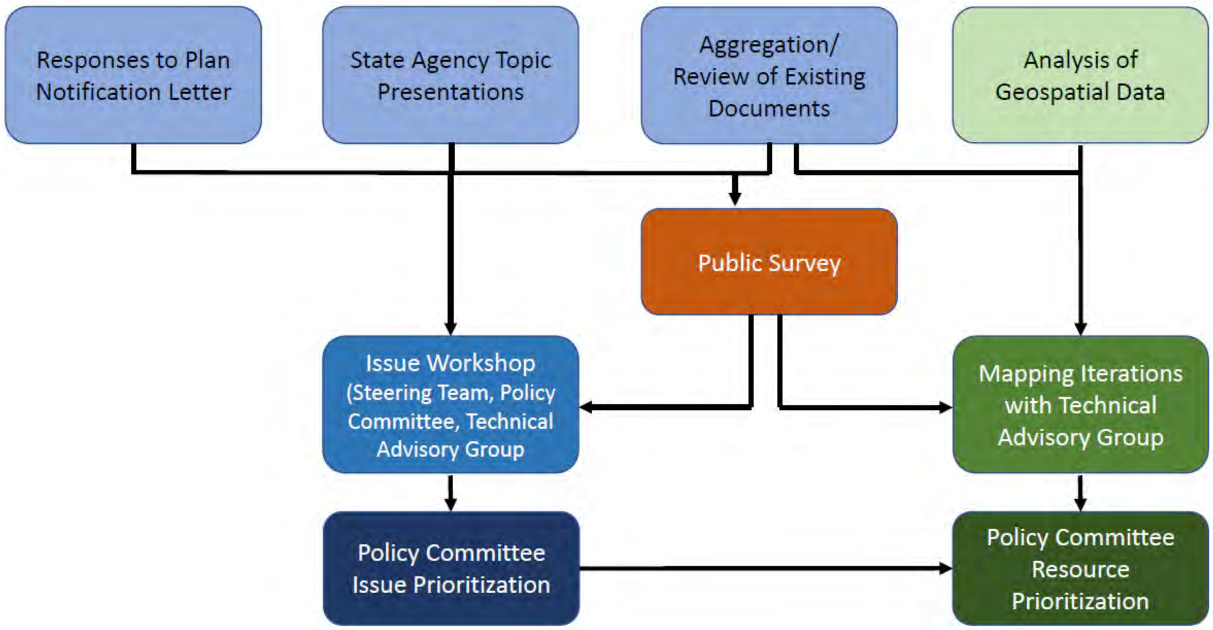


Figure 2-1 Issue and Resource Identification and Prioritization Process

2.1.1 Requests for Input and Initial Data Aggregation

The Steering Team solicited information from State watershed plan review authorities and other stakeholders via a Plan development notification letter (see BWSR 1W1P Operating Procedures v.2, Section IV.A). The following entities responded to the Plan notification letter:

- Minnesota Board of Water and Soil Resources (BWSR)
- Minnesota Department of Agriculture (MDA, input received via BWSR)
- Minnesota Department of Health (MDH)
- Minnesota Department of Natural Resources (MDNR)
- Minnesota Pollution Control Agency (MPCA)

Information provided in the responses to the notification letter identified priority issues such as degraded surface water quality, altered hydrology and drainage issues, and potential for groundwater contamination. Input also emphasized the use of a "prioritized, targeted, and measurable" framework for developing the Comprehensive Watershed Management Plan (i.e., this document). Responses also provided or referenced potential data sources to be used in Plan development. The responses to the notification letter are summarized in a memo to the Steering Team dated November 10, 2020 (see Appendix C).

Following the Plan notification letter, the following State agencies attended Policy Committee meetings to present additional information to members of the Policy Committee and Steering Team:

- Minnesota Board of Water and Soil Resources (BWSR)
- Minnesota Pollution Control Agency (MPCA)
- Minnesota Department of Health (MDH)
- Minnesota Department of Natural Resources (MDNR)

The Partnership's Plan development consultant also reviewed existing studies and management plans relevant to natural resources management in the planning area to identify priority issues and resources. The documents reviewed included, generally:

- Watershed Restoration and Protection Strategies (WRAPS) reports
- Total Maximum Daily Load (TMDL) studies
- Groundwater Restoration and Protection Strategies (GRAPS) report
- County local water plans
- Municipal comprehensive plans
- Water quality monitoring and assessment reports
- Groundwater monitoring data and studies
- Land and natural resource assessments

A complete list of the documents referenced in the development of this Plan is included in Section 6 (References). A summary of the document review is provided in a table included in the November 10, 2020 memo to the Steering Team (see Appendix C).

2.1.2 Resident Survey

The Steering Team developed a resident survey to characterize public opinions regarding the condition and management of water and natural resources in the planning area. In developing survey questions, the Steering Team considered input from State plan review authorities (provided in responses to the Plan notification letter and presentations) as well as information compiled from the initial data aggregation effort.

The survey was hosted online from December 2020 through mid-February 2021 and mailed to approximately 2,500 residents within the planning area. A total of 273 surveys were completed; complete survey results are summarized in a February 22, 2021 memorandum to the Steering Team (see Appendix C). Survey respondents generally provided a representative cross-section of the planning area, with approximately 70% of responses coming from Sibley County residents, 14% from Nicollet County residents, and 6% from McLeod County residents. Figure 2-2 presents survey results regarding respondent membership in select demographic groups. Approximately 60% of survey respondents identified as rural residents while 25% identified as city/town residents. Over 50% of survey respondents identified as farmers (landowner, tenant, or both).

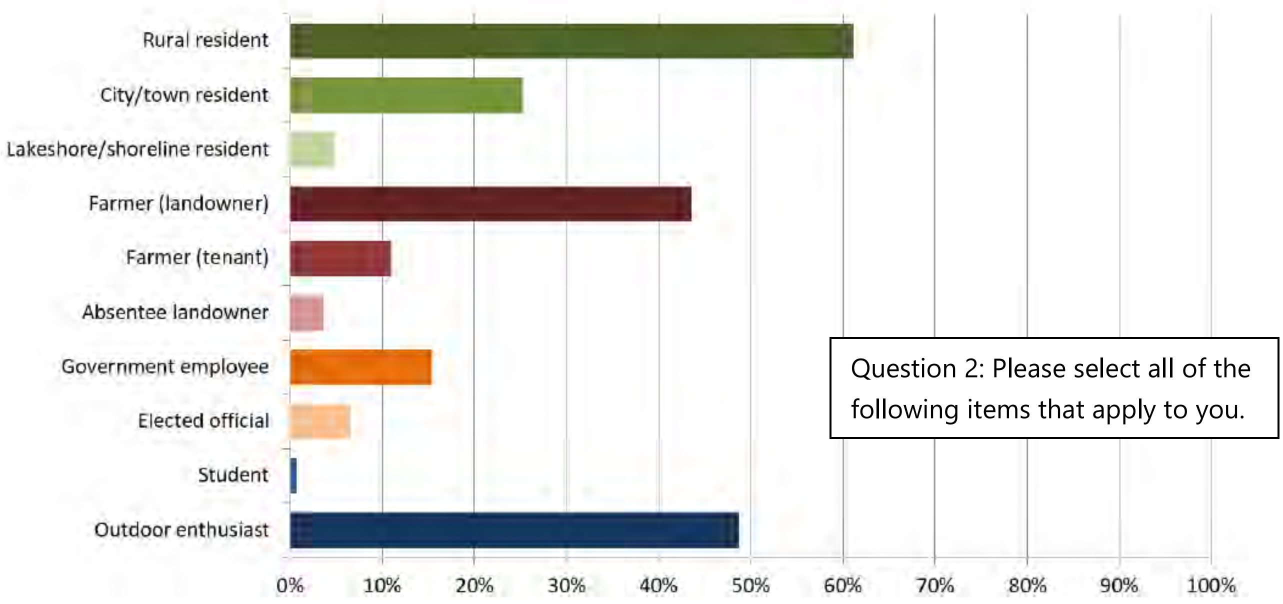


Figure 2-2 Results of survey question 2: respondent demographics

Over 50% of survey respondents indicated that they were concerned about the condition of specific water and natural resources. Resources most frequently identified included:

- Minnesota River (41 responses)
- High Island Creek (16 responses)
- Rush River (17 responses)
- Wetlands (9 responses)
- High Island Lake (6 responses)
- Buffalo Creek (4 responses)
- Silver Lake (4 responses)
- Lake Titlow (3 responses)

Concerns identified among the survey responses varied, but most frequently included:

- Water quality degradation and/or pollutant loading (29 responses)
- Too much agricultural tiling (26 responses)
- Excessive erosion (23 responses)
- Flooding (23 responses)

Survey question 8 asked respondents to classify the importance of 15 specific water and natural resource issues according to their level of importance (see Figure 2-3). Results identified drinking water quality, water quality of lakes, rivers, and streams, pollutant loading, loss of habitat, and flooding as top issues. The survey also included an open-ended question (question 9) allowing respondents to provide additional comments. Common themes among the responses included:

- Regulating, limiting, or otherwise dis-incentivizing agricultural tiling within the watershed
- Maintenance of degraded dams and ditches
- Balancing protection and restoration with management and utilization (e.g., "Don't hug the tree so tight as to kill the tree")
- Need for more runoff/flood storage and slower conveyance of water from upstream areas in the watershed
- Protection of remaining natural areas and high-quality resources
- Increases in flood frequency and severity observed in recent history

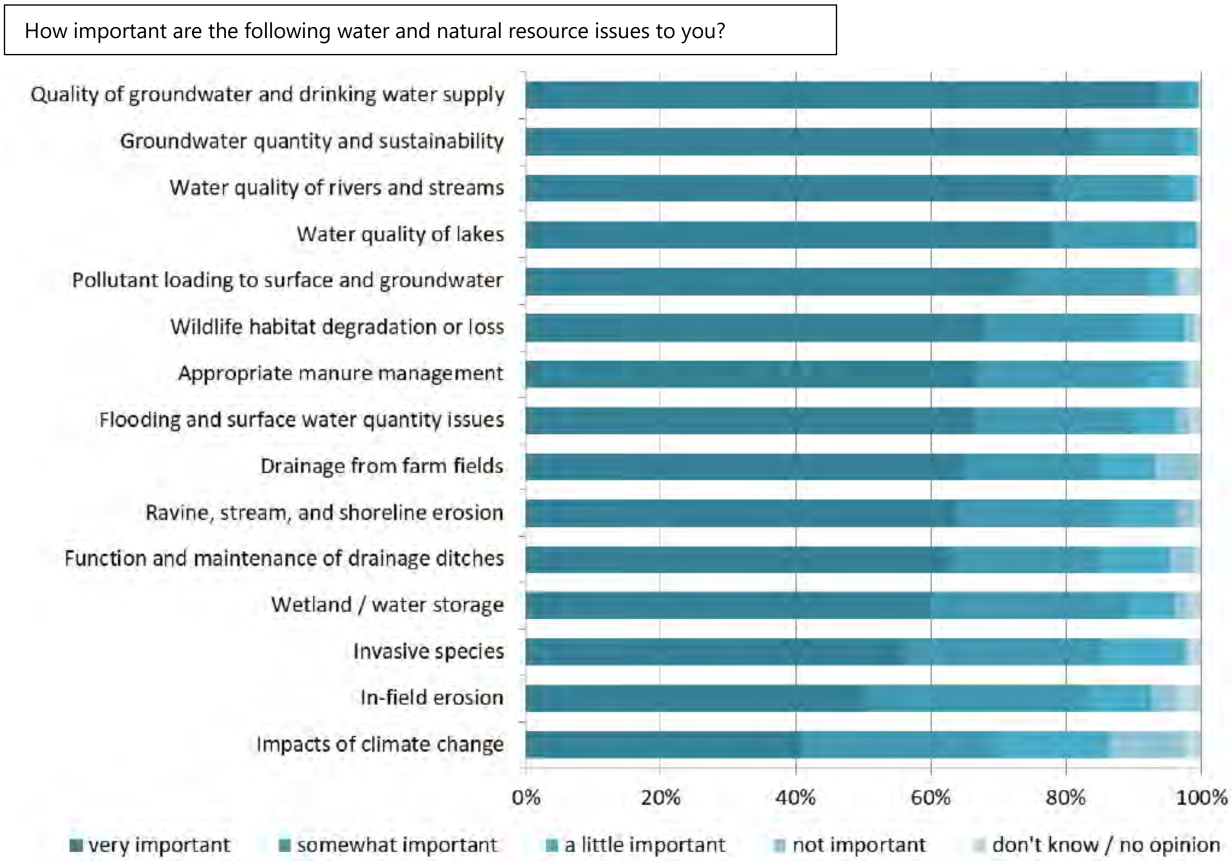


Figure 2-3 Results of survey question 8: How important are the following issues to you?

2.1.3 Development of Issue Statements

The Steering Team grouped specific issues identified through data aggregation and stakeholder input into eight broad issue categories and drafted brief issue statements to characterize each category. The draft issue statements were later revised by the Steering Team based on input from the Advisory Group and Policy Committee.

The final issue statements are presented in Table 2-1. The issue statements are, because of their brevity, broad in scope. Each issue category is described in greater detail in Section 2.2. Specific problems, risks, and opportunities within each issue category area are included in Table 2-3 and provide additional context for the issue statements.

Table 2-1 Priority Issue Statements

Issue Group	Issue Statement
Surface Water Quality Degradation	Surface water quality is threatened or impaired by pollutant loading and other stressors.
Excessive Erosion & Sedimentation	Excessive in-field, ravine, shoreline, and in-channel erosion diminishes agricultural productivity, damages riparian areas, and degrades surface water quality and stream habitats.
Altered hydrology and Drainage	Changes to natural hydrologic systems, tiling of fields, and loss of flood storage increase runoff and negatively impact water quality, flood risk, and ecology.
Excessive Runoff and Flooding	Increased runoff and frequent flooding threaten public safety, property, and infrastructure and carry significant financial and environmental costs.
Degraded Soil Health	Degraded soil health diminishes agricultural productivity, landscape resilience, and the associated benefits to the environment.
Protection of Groundwater/ Drinking Water Quality	The high quality of groundwater and drinking water must be protected from potential threats.
Threatened Groundwater Supply	Groundwater sustainability is at risk from consumptive use and loss of recharge.
Threats to Fish, Wildlife, and Habitat	Human activity threatens natural areas, prairies, bluffs, and wetlands providing habitat and other ecological benefits, and the species that inhabit them.

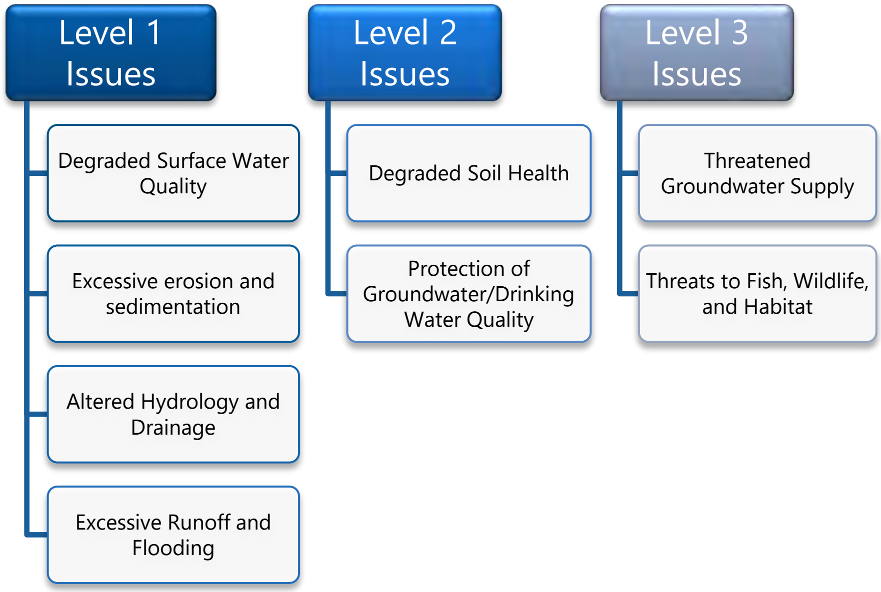
2.1.4 Issue Prioritization using Paired Analysis

Following the development of issue statements (see Table 2-1), members of the Policy Committee, Advisory Group, and Steering Team used a paired comparison matrix to rank the eight issue categories. Seven members of the Policy Committee, seven Advisory Group members, and eight members of the Steering Team completed the sample matrix shown in Figure 2-4. Possible scores for each issue range from 0 to 7, with higher numbers indicating a higher relative priority.

Overall scores for each issue were calculated giving equal weight to the average Policy Committee score, average TAG score, and average Steering Team score. The results are presented in Figure 2-5. Some similarities and discrepancies in issue priority scoring between the Policy Committee, TAG, and Steering Team are apparent in Figure 2-5 and include:

- Excessive erosion and sedimentation and altered hydrology were ranked highly by all groups
- Soil health was scored similarly by each group
- Flooding was ranked notably higher by the Policy Committee and Steering Team
- Groundwater quality and quantity were ranked higher by the Policy Committee than by other groups
- The TAG ranked threats to fish, wildlife, and habitat higher than the other groups

Discussion of the issues and consideration of the weighted average scoring ultimately led the Policy Committee to adopt a three-level issue prioritization including Level 1 (high priority), Level 2 (moderate priority), and Level 3 (low priority) issue categories as follows:



Discussion of priority issues considered both the current and potential future condition of resources. For example, the relative ranking of "threats to groundwater/drinking water" considers that groundwater quality affects the health of all residents in the planning area, but also considers that current groundwater quality is good and that local aquifers have a relatively low risk of contamination (see Section A.6).

Discussion of the priority issues by the Policy Committee, Advisory Group, and Steering Team also noted that many of the issue categories are interrelated. For example, increased runoff resulting from altered hydrology has the potential to contribute to excessive near-/in-channel erosion, resulting in degraded surface water quality. Likewise, degraded soil health negatively contributes to increased erosion and degraded surface water quality. Actions to address one issue category may have secondary benefits to other issues. These benefits are noted in the Partnership's targeted implementation schedule (see Section 5.1 and Table 5-4).

Figure 2-4. Sample matrix for paired comparison of issues statements

Instructions:

1. Work your way through each open square in the matrix one at a time.

2. For each open square:

 2A. Consider only the **TWO** issue statement corresponding to its Row and Column.

 2B. Decide which of the two issues statements (the row, and the column) is a higher priority, in your opinion, to address.

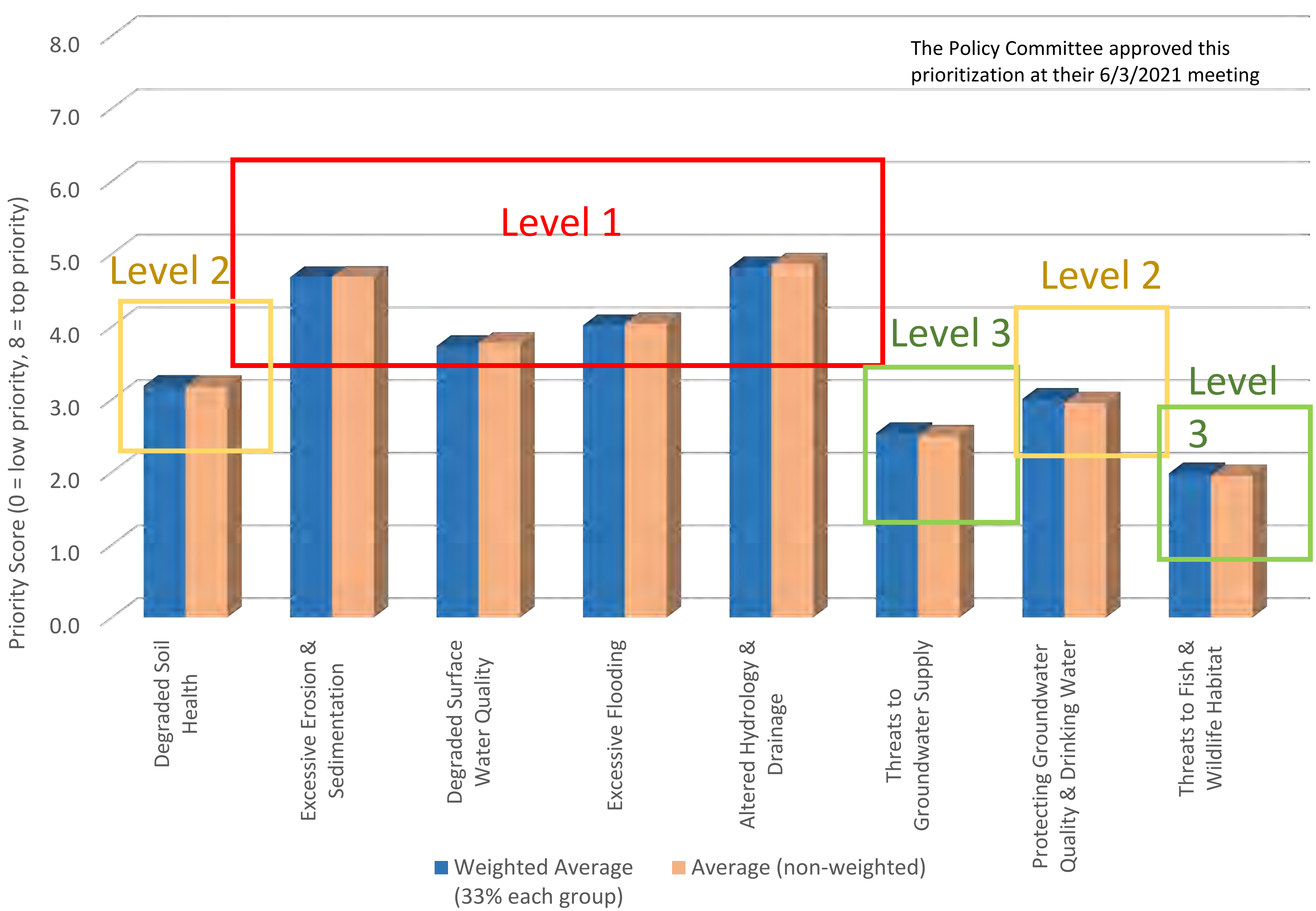
 2C. Indicate the higher priority issue in the square using the abbreviation (e.g., "SH" for the issue of degraded soil health).

3. In the "Total Occurrences" column, record the total number of times your selected that issue in a blank square (they should sum to 28).

	Issue Statement	Degraded **soil health** diminishes agricultural productivity, landscape resilience, and the associated benefits to the environment	Excessive in-field, ravine, shoreline, and in-channel **erosion** diminishes agricultural productivity, damages riparian areas, and degrades surface water quality and stream habitats.	**Surface water quality** is threatened or impaired by pollutant loading and other stressors.	Increased runoff and frequent **flooding** threaten public safety, property, and infrastructure and carry significant financial and environmental costs.	**Changes to natural hydrologic systems**, tiling of fields, and loss of storage increase runoff and negatively impact water quality, flood risk, and ecology.	**Groundwater sustainability** is at risk from consumptive use and loss of recharge.	The high **quality of groundwater** and drinking water must be protected from potential threats.	Human activity threatens **natural areas, prairies, bluffs, and wetlands** providing habitat and other ecological benefits, and the species that inhabit them
Issue Statement	**Code**	SH	ER	SWQ	FL	AH	GWQ	GWS	NA
Degraded **soil health** diminishes agricultural productivity, landscape resilience, and the associated benefits to the environment	SH								
Excessive in-field, ravine, shoreline, and in-channel **erosion** diminishes agricultural productivity, damages riparian areas, and degrades surface water quality and stream habitats.	ER								
Surface water quality is threatened or impaired by pollutant loading and other stressors.	SWQ								
Increased runoff and frequent **flooding** threaten public safety, property, and infrastructure and carry significant financial and environmental costs.	FL								
Changes to natural hydrologic systems, tiling of fields, and loss of storage increase runoff and negatively impact water quality, flood risk, and ecology.	AH								
Groundwater sustainability is at risk from consumptive use and loss of recharge.	GWQ								
The high **quality of groundwater** and drinking water must be protected from potential threats.	GWS								
Human activity threatens **natural areas, prairies, bluffs, and wetlands** providing habitat and other ecological benefits, and the species that inhabit them	NA								

Total Occurrences	
SH =	
ER =	
SWQ =	
FL =	
AH =	
GWQ =	
GWS =	
NA =	

Figure 2-5. Issue prioritization scoring by the Policy Committee, Advisory Group, and Steering Team



2.2 Priority Issues

Through the process described in Section 2.1, the Partnership identified eight priority issues. The following subsections describe each priority issue, with the issue priority level noted in the subsection heading (i.e., Level 1, Level 2, or Level 3).

2.2.1 Surface Water Quality Degradation (Level 1)

Issue Statement: Surface water quality is threatened or impaired by pollutant loading and other stressors.

Pollutants are discharged into surface waters as either point sources or non-point sources. Point source pollutants discharge to receiving surface waters at a specific point from a specific identifiable source. Examples of point source pollution include feedlots and wastewater treatment plants. Unlike point sources, non-point source pollution cannot be traced to a single source or pipe. Pollutants that are carried from land to water in stormwater or snowmelt runoff, in seepage through the soil (e.g., from non-functioning subsurface sewage treatment systems, or SSTS), and in atmospheric transport make up non-point source pollution. Both point sources and non-point sources can contribute to nutrient, sediment, bacterial, and other pollutant loadings to lakes, streams, and other resources.

For lakes, ponds, and wetlands, phosphorus is often a pollutant of primary concern. Point sources of phosphorus typically come from municipal and industrial discharge to surface waters, whereas non-point sources of phosphorus come from urban and agricultural runoff, construction sites, and SSTS. Excess phosphorus can lead to increased algal production and eutrophication, decreasing water clarity and impairing recreational uses.

Nitrates, fecal coliform bacteria, and sediment (see Section 2.2.2) cause additional issues, especially in areas of agricultural land use. Nitrates and sediment are commonly found in agricultural runoff and urban stormwater in concentrations elevated relative to pre-developed or “background” conditions. Excessive nitrogen can be toxic to fish and insects and even at small concentrations can limit sensitive species. Nitrogen is also a major human health concern when present in high concentrations in drinking water (MPCA, 2020).

Fecal coliform bacteria are usually associated with SSTS, feedlot operations, and concentrated wildlife, such as flocks of waterfowl. Bacteria present in waters can limit their recreational uses and pose human health risks in drinking water. Fertilizer and pesticide applications also contribute to pollutant loading in lakes and streams and may pose health risks at elevated concentrations. Sources of pollutants like nitrates, phosphorus, and bacteria in the planning area are summarized in Section 2.3 of the *Lower Minnesota River Watershed Restoration and Protection Strategies* (WRAPS) report (MPCA, 2020).

HSPF model results presented in the Lower Minnesota River WRAPS were used to estimate pollutant loading in the planning area (see Section A.9.6). Unit-area loading of total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS) are presented in Figure A-20, Figure A-21, and Figure A-22, respectively.

The addition of pollutants into surface waters and altered hydrology can pose significant stress to aquatic biota. These stressors can impair the ability of waterbodies to support beneficial uses such as aquatic life, recreation, and consumption. Many of the waterbodies in the planning area are listed as impaired by the MPCA because beneficial uses are impaired by one or more stressors. Several stream reaches are impaired due to the following stressors: turbidity/TSS, bacteria, excess nutrients, mercury and polychlorinated biphenyls (PCBs) in fish tissue, and/or low fish or macroinvertebrate indices of biological integrity. Additionally, High Island Lake, Clear Lake, Titlow Lake, and Silver Lake are impaired due to excess nutrients.

Impaired waters are presented in Figure A-14 and summarized in Section A.9.2. Total maximum daily loads (TMDLs) are required to be developed for all impaired waters to determine the amount of a pollutant that the water may receive and still meet water quality standards. TMDLs may require actions by local governments to limit pollutant loading from point and non-point sources. Information from the *Lower Minnesota River TMDL – Part I* (MPCA, 2020) was referenced during the development of this Plan.

2.2.2 Excessive Erosion and Sedimentation (Level 1)

Issue Statement: Excessive in-field, ravine, shoreline, and in-channel erosion diminishes agricultural productivity, damages riparian areas, and degrades surface water quality and stream habitats.

Although erosion and sedimentation are natural processes, they can be accelerated by human activities such as development, agricultural production, and livestock grazing. Excessive erosion and sedimentation can lead to a variety of negative economic and environmental consequences. Erosion of topsoil from farm and pasture lands can reduce soil health and productivity, increasing costs to landowners. Streambank erosion and sediment deposition (both linked to altered hydrology, see Section 2.2.3) can alter channels in ways that pose risks to infrastructure; streambank failure in critical areas can undermine roadways and utilities and can result in loss of valuable land. Sediment deposition can wholly or partially block ditches and culverts, requiring more frequent maintenance and/or increasing flood risk to nearby properties.

Sediment is a major contributor to surface water pollution in the planning area, and excessive amounts of suspended sediment are carried by stormwater runoff when erosion occurs. Sediment deposition decreases water depth and degrades water quality, riparian fish and wildlife habitat, and aesthetics. Sediment often carries nutrients and other pollutants bound to sediment particles, and increases turbidity, which reduces light penetration and affects aquatic life. Several reaches of High Island Creek, some of its tributaries, and the Middle Branch Rush River are identified as impaired for aquatic life due to high turbidity/TSS (see Table A-12). The Lower Minnesota River WRAPS study (MPCA, 2020) identified in-channel and near-channel erosion as significant sources of sediment. Soil erosion risk in the planning area is presented in Figure A-5 and illustrates higher erosion risk in ravine and bluff areas adjacent to the Minnesota River.

Reducing in- and near-channel sources of sediment can mitigate negative impacts to downstream channel areas, aquatic habitats, and aquatic biota. Section 3.3 of the Lower Minnesota River WRAPS (MPCA, 2020) includes strategies to mitigate accelerated erosion of ditches and streams in the planning area.

2.2.3 Altered Hydrology and Drainage (Level 1)

Issue Statement: Changes to natural hydrologic systems, tiling of fields, and loss of flood storage increase runoff and negatively impact water quality, flood risk, and ecology.

In an unaltered condition (i.e., prior to development for residential, agricultural, or other land uses), the natural landscape retains and infiltrates significant amounts of precipitation. In forested or rural areas, runoff can be as low as 10 percent of the water budget (Federal Interagency Stream Restoration Working Group, 1998). Development and land use changes lead to loss of permanent vegetation, increased impervious area, and altered drainage networks (e.g., drain tile). Approximately 63% of watercourses in the Lower Minnesota River watershed are considered altered and less than 20% are classified as natural, with 1% classified as impounded and the remainder having no defined channel (MPCA, 2020). The prevalence of agricultural drain tile systems throughout the planning area is a contributor to the widespread hydrologic alterations. Urban development and transportation infrastructure are also contributors to hydrologic alteration in the planning area.

Alteration of the landscape and hydrology disrupts the natural water cycle and compromises the ability of the land to provide water quality, water quantity, and ecological benefits. These changes typically increase both the volume and rate of runoff. Flow alteration can lead to increased variability and altered baseflow in streams. Flow alteration is cited as a significant stressor for biological impairments in the *Lower Minnesota River Watershed Streams Stressor Identification Study* (MPCA, 2018) and was present in 65% of assessed stream reaches (see Figure A-15). Altered hydrology contributes to increased peak flows, erosion, and flooding. Altered hydrology and landscape changes (e.g., loss of wetlands, forest, and riparian floodplain) also reduce opportunities for infiltration, retention, and water storage.

Altered hydrology and land use changes further limit the ability of the landscape to mitigate negative impacts stemming from climate trends, including increased winter temperatures, precipitation volume, and precipitation intensity (i.e., landscape resiliency). Conversely, by restoring hydrologic function and retaining runoff, the Partnership can minimize negative local and downstream impacts while maintaining beneficial land use.

2.2.4 Excessive Runoff and Flooding (Level 1)

Issue Statement: Increased runoff and frequent flooding threaten public safety, property, and infrastructure and carry significant financial and environmental costs.

Impacts from flooding can include physical damage to structures (such as homes), property, utilities and transportation infrastructure. Flooding can also limit productivity of agricultural land and threaten public health by flooding wells and septic systems and causing unexpected discharges of waste into surface waters. Excessive flooding carries a high cost for affected communities and individuals, including: flood fighting costs; post-flood cleanup costs; business and agricultural losses; increased expenses for normal operating and living during a flood situation; and benefits paid to property owners from flood insurance. Flooding and high flows can erode and destabilize streambanks, negatively impacting water quality.

Increases in development/urbanization, artificial drainage, and alteration of natural hydrology can exacerbate flooding concerns by increasing runoff volume and peak flow rates. Conversion of wetlands and other natural areas to other land uses throughout the watershed can diminish watershed storage, contributing to local and downstream flooding issues.

The amount, rate, and type of precipitation received are important in estimating stormwater runoff rates and associated flood implications. Changing regional precipitation patterns are resulting in more frequent, intense precipitation events. Existing drainage systems may be undersized for evolving precipitation patterns, further exacerbating flooding. Existing or historical floodplain mapping/modeling may not accurately reflect current or future flood risk.

Over time, a combination of factors has led to increased peak flows and watershed yield in the planning areas (see Section A.10). Resulting issues include flooding around Baker's Lake, and flooding issues on the Rush River affecting Highway 93. Excessive runoff also contributes to major regional flooding along the Minnesota River adjacent to and downstream of the planning area. Mapped floodplains within the planning area are presented in Figure A-26 but are not comprehensive for all waters within the planning area (i.e., the absence of mapped floodplain should not be interpreted as the absence of flood risk).

2.2.5 Degraded Soil Health (Level 2)

Issue Statement: Degraded soil health diminishes agricultural productivity, landscape resilience, and the associated benefits to the environment.

Much of the land in the Lower Minnesota River West planning area is farmed or used for pasture. Agricultural and animal production are major components of the local economy. Good soil health is very important as healthy soils are necessary to achieve sustainable agricultural and livestock production; crop productivity data is presented in Figure A-4. Healthy soils require less fertilizer and promote several environmental benefits, including allowing for increased infiltration following precipitation events, resulting in lower levels of overland runoff and limiting the potential for soil erosion and flood risk. Healthy soils are better able to filter and break down nutrients and other pollutants from the landscape.

Conversely, degraded soils may require higher than normal fertilizer applications to create/maintain productive farmland, increasing costs to the producer and the potential for excess nutrient loading from the landscape to surface waters and groundwater. After farmland has been tilled, it is often left bare from fall to spring, leaving no plants to intercept rainfall to hold it on the surface for later evaporation, or to reduce the erosive impact as raindrops strike the ground. In addition to increased runoff, erosion is more likely to occur due to the lack of roots holding the soil in place. The upper soil layers are the most fertile and the most likely to be eroded. Erosion of these topsoil layers contributes to high levels of turbidity and total suspended solids in streams and rivers (see Section 2.2.2). Soil erosion risk in the planning area watershed is presented in Figure A-5.

Improving soil health can be accomplished through increased use of land management practices including no-till/strip-till rotations, cover crops, perennial crops, crop diversity, and others. These practices promote infiltration and limit the amount of runoff and erosion from croplands when not in active production. Some landowners within the planning area have started implementing soil health best management practices (BMPs) that are intended to limit erosion and soil loss and improve soil productivity. However, there are opportunities to increase the widespread use of soil health BMPs and promote the associated agricultural and environmental benefits of healthier soils.

2.2.6 Threats to Groundwater/Drinking Water Quality (Level 2)

Issue Statement: The high quality of groundwater and drinking water must be protected from potential threats.

Groundwater is the primary source of water for drinking water, industrial, and agricultural use within the watershed. Contaminants in groundwater, including arsenic, nitrates and bacteria, can pose a risk to human health. Data collected through MDH programs indicate that nitrate concentrations in groundwater are similar to background levels (i.e., <3 mg/L) throughout most of the planning area (see Section A.6.2) although datasets are limited and do not represent the majority of private wells. However, a limited number of wells in the eastern portion of the watershed near the Minnesota River exhibit higher nitrate levels. Elevated nitrate levels are influenced by human activities (MDH, 2018). Land use within the planning area creates high potential for nitrogen loading from fertilizer use.

High concentrations of arsenic are a specific groundwater quality concern within the planning area. Arsenic occurs naturally in rocks and soil across Minnesota and can dissolve into groundwater. Long-term (chronic) exposure to low levels of arsenic in drinking water is associated with diabetes and increased risk of cancers of the bladder, lungs, liver and other organs.

Over 20% of 320 arsenic samples taken from wells within the planning area had arsenic concentrations in excess of 10 ug/L (i.e., above the EPA recommended value for drinking water) as noted in the *Lower Minnesota River West Groundwater Restoration and Protection Strategies* (GRAPS) report (MDH, 2021). The occurrence of arsenic is difficult to predict as it is a naturally occurring element. A complete assessment of groundwater quality and associated potential health risks is limited by the large spatial extent of aquifers and limited monitoring data. In addition, the vulnerability of non-community public water supplies (e.g., campgrounds) within the planning area is not well defined.

In the planning area, drinking water quality is threatened by activities occurring below the land surface as well as activities on the land surface that may infiltrate contaminants to the subsurface. Infiltration of pollutant-laden runoff can reach groundwater, potentially impacting drinking water sources in areas with vulnerable wells and aquifers. Additionally, unused or unsealed wells provide a conduit for surface contaminants to reach drinking water sources. Hydrologic sensitivity to contamination is highly variable over short distances and is exacerbated in areas with porous soils. Nitrate concentrations in the planning area may be affected by both well construction and overlying geologic protection (MDH, 2012). Pollution sensitivity of near-surface materials and wells are presented in Figure A-8 and Figure A-9, respectively. Table 2-2 lists the potential sources of groundwater contamination that may negatively impact the quality of drinking water. More information about sources of groundwater contamination within the planning area is included in the Lower Minnesota River West GRAPS report (MDH, 2021).

Table 2-2 Potential anthropogenic sources of groundwater contamination

Location	Source	Contaminants of concern[1]		
		Nitrate	Bacteria	Chemicals[2]
Subsurface	Improperly functioning subsurface sewage treatment systems (SSTS)	X	X	
	Leaking underground storage tanks			X
	Buried waste			X
Surface	Improperly functioning wastewater facilities	X	X	
	Nonconforming feedlot operations	X	X	
	Manure application	X	X	
	Landfills			X
	Fertilizer and chemical application to crops	X		X

(1) Arsenic is not included because it is a naturally occurring contaminant of concern
(2) e.g., petroleum, pesticides

2.2.7 Threatened Groundwater Supply (Level 3)

Issue Statement: Groundwater sustainability is at risk from consumptive use and loss of recharge.

Groundwater serves many consumptive uses in the Lower Minnesota River West planning area. It is the primary source of water for agriculture, industrial uses, and drinking water. Drinking water supply management areas (DWSMAs) and wells within the planning area are presented in Figure A-7. Competing demands from agriculture, domestic, and industrial uses can strain municipal water supply systems. Permitted groundwater use within the planning area increased from approximately 475 million gallons per year in 1990 to a peak of about 970 million gallons per year in 2009. Permitted water use in 2018 was about 820 million gallons per year (MDH, 2021). The MDNR operates several groundwater monitoring wells in the planning area, although the period of record (less than 20 years) is insufficient to estimate water level trends.

Changes in groundwater levels can affect lake levels and alter baseflow in local streams, impacting stream temperature and habitat quality. Twenty-five lakes within the planning area are identified as groundwater dominated lakes based on a drainage area-to-lake area ratio of less than 10 (MDH, 2021). In addition, the GRAPS report identified several plant communities and rare plant and animal species that may be at risk due to groundwater impacts.

Conservation and management of groundwater is necessary to promote the sustainability of groundwater as a resource for future use as well as the ecological health of the natural systems that depend on it. Strategies to address groundwater sustainability in the planning area include conservation and promotion of recharge.

2.2.8 Threats to Fish, Wildlife, and Habitat (Level 3)

Issue Statement: Human activity threatens natural areas, prairies, bluffs, and wetlands providing habitat and other ecological benefits, and the species that inhabit them.

Natural, undeveloped landscapes including forests, wetlands, and stream corridors serve many ecological functions, including habitat for fish and wildlife. Within the planning area, many of these areas have been converted to other land uses (e.g., wetlands drained, streams rerouted). The loss or alteration of habitat negatively impacts wildlife populations, including rare and endangered species; these impacts may be amplified when the remaining habitat areas are no longer connected. Much of the remaining habitats in the watershed are imperiled (e.g., stream adjacent corridors, Le Sueur calcareous fen). Loss of habitat is cited as a stressor for biological impairments in the Lower Minnesota River WRAPS (MPCA, 2020). Climate change further threatens native species and their habitats directly and through related impacts to hydrology.

The cumulative loss of wetlands and riparian buffer areas over time may increase sediment runoff, stream bank erosion, and nutrient loading. Diminished flood storage provided by these areas may increase flood risk in downstream areas. The loss of forested areas diminishes soil stability, further contributing to erosion and downstream water quality impacts. Altered landscapes are more susceptible to aquatic and terrestrial invasive species that can threaten native vegetation, alter habitats, and negatively impact agricultural production. Benefits provided by forests, wetlands, and other natural features, including ecological, habitat, and others, must be recognized and considered as part of land use decisions.

Inclusion in conservation programs can provide natural areas protection from development; however, many programs are not permanent. In addition, restoration of previously drained wetland areas for increased water storage and flow attenuation (see Section 2.2.4) provides an opportunity to achieve secondary benefits to fish and wildlife. Areas of biodiversity significance in the planning area are presented in Figure A-27. Wetland areas identified in the National Wetland Inventory (NWI) are presented in Figure A-12.

Table 2-3. Priority issues categories and supporting specific issues

General Issue Area	General Issue Statement	**Specific issues (or opportunities) provided as examples of this category** (Green text indicates issue statement from agency response to notification letter - agency in parentheses) (Blue text indicates issues identified in public survey responses) (Black text indicates additional issues identified by the Steering Team
Degraded Soil Health	Degraded soil health diminishes agricultural productivity, landscape resilience, and the associated benefits to the environment	- poor soil health may limit the soil's ability to filter nutrients and other pollutants and contribute to increased runoff (BWSR) - practices of soil health have the potential to positively change the interaction of agriculture and the natural system at the soil level (BWSR) - poor soil health may require additional fertilizer applications and man-made products, increasing pollutant loading (public) - losing top soil due to poor farming practice (public) - need to improve soil health to retain water where the rain falls (public) - conservation practices to enhance/preserve soil health are not consistently used (public) - the landscape has become less resilient to change because of degraded soil health - economic incentives to use soil health practices (i.e., improved productivity vs. cost) is not realized - infiltration and groundwater recharge is reduced by degraded soil health
Excessive Erosion & Sedimentation	Excessive in-field, ravine, shoreline, and in-channel erosion diminishes agricultural productivity, damages riparian areas, and degrades surface water quality and stream habitats.	- accelerated soil erosion, leading to turbidity and water quality issues, is a priority within this planning area (BWSR) - Lower MN River WRAPS identified total suspended solids (TSS) as a stressor for impaired waters (MPCA) - near-channel erosion (e.g., streambank, bluff and ravine erosion) is the dominant loading source for TSS in the Lower Minnesota River Watershed (BWSR, MPCA, public) - eroding valleys, rivers, ravines, and tributaries, especially in the western part of the watershed, contribute sediment and nutrients to the Rush River and High Island Creek (MDNR, public) - erosion has resulted in infrastructure damage, loss of cropland, diminished drainage, and eutrophication (MDNR, public) - unstable bluff areas (e.g., along County Road 6 and State Highway 93) pose a serious threat to public safety (MDNR) - protection and restoration of shoreland and riparian zones is needed for ecological and water quality benefit (MDNR) - erosion from county ditches is filling lakes with sediment (public) - native plant buffers are needed along shorelines (public) - erosion results in loss of organic matter and productive topsoil - sedimentation in floodplain areas reduces capacity and increases flood risk - sedimentation increases the frequency of regular maintain for public infrastructure - sedimentation decreases the ecological and habitat value of wetlands
Degraded Surface Water Quality	Surface water quality is threatened or impaired by pollutant loading and other stressors.	- degraded water quality is a significant issue in the watershed (BWSR) - several lakes are listed as impaired for eutrophication: Clear, Silver, Titlow, High Island, and Bakers Lake (MPCA, BWSR) - stream reaches are impaired for sediment, bacteria, nutrients, and fish and macroinvertebrate indices of biological integrity due to various stressors (MPCA) - recreational uses are impaired due to bacteria and nutrient loading from feedlots, land application of manure, and leaking subsurface sewage treatment systems (SSTS) (MPCA) - urban stormwater runoff contains pollutants such as pesticides, fertilizers, sediment, salt, and other debris (BWSR) - poor water quality leads to loss/reduction of recreational opportunities (e.g., swimming in Lake Titlow) (public) - local lakes have bad water quality (e.g., Washington Lake, Clear Lake, High Island Lake) (public) - nutrient loading to High Island Creek (public) - chemicals applied in towns/cities and residential use is affecting water quality (public) - agricultural/field runoff carries chemicals and nutrients to lakes, streams, and wetlands (public) - runoff containing road salt, detergents, pesticides contaminate lakes and streams (public) - bird and animal waste washing into lakes and streams (public) - lack of adequate stormwater treatment is widespread - high quality resources require protection (e.g., Sand Lake, Ward Lake, Plaman Lake)

Table 2-3. Priority issues categories and supporting specific issues

General Issue Area	General Issue Statement	**Specific issues (or opportunities) provided as examples of this category** (Green text indicates issue statement from agency response to notification letter - agency in parentheses) (Blue text indicates issues identified in public survey responses) (Black text indicates additional issues identified by the Steering Team
Excessive Flooding	Increased runoff and frequent flooding threaten public safety, property, and infrastructure and carry significant financial and environmental costs.	- flooding on Minnesota's highways is a particular problem in this watershed (MDNR) - weather record for the planning area shows increased frequency and severity of extreme weather events (BWSR) - water storage is needed due to increased precipitation, runoff rates, and volumes (MDNR) - altered hydrology contributes to more extensive flooding (MDNR; MPCA) - municipal and rural stormwater systems may be undersized for current/future precipitation patterns - existing floodplain mapping/modeling likely does not accurately reflect current (or future) flood risk - ongoing Rush River flooding at HWY 93 (public) - flooding along the Minnesota River, including CO RD 6 (public) - excessive flooding of Rush River park in recent years (public) - flooding around Bakers Lake (public) - floodplain around Buffalo Creek much larger than before (public)
Altered Hydrology and Drainage	Changes to natural hydrologic systems, tiling of fields, and loss of storage increase runoff and negatively impact water quality, flood risk, and ecology.	- altered hydrology is a cause of water quality impairment affecting recreational use and biological health (MDNR) - restoring hydrologic function can reduce flooding, improve water quality, stabilize channels, and improve habitat (MDNR) - altered hydrology contributes to accelerated erosion and increased flooding (MDNR, MPCA) - dams have negative impacts, including altered stream flow, habitat degradation, reduced fish passage, and lowered dissolved oxygen (MDNR) - multipurpose drainage management projects provide an opportunity for targeting best management practices (BWSR) - altered hydrology can impact timing of peak flows and lead to a lack of baseflow (MDNR) - altered hydrology contributes to increased peak flows and flooding, reduced infiltration, loss of water storage capacity (MDNR, public) - water storage is needed in the watershed (MDNR, public) - agricultural drainage is overloading drainage systems (public) - draining of the Lake Erin system (public) - there is too much drain tile, overwhelming streams and rivers (e.g., western part of High Island Creek watershed) (public) - tiling is driving force for other issues (e.g. water quality, flooding, and erosions) (public) - development (e.g., Green Isle, Saxon Township) increases impervious area and associated runoff - stream channelization in the upper watershed increases flow rates in lower reaches - stream channelization leads to lack of access to natural floodplains
Threats to Groundwater Supply	Groundwater sustainability is at risk from consumptive use and loss of recharge.	- groundwater level monitoring is needed to assess trends caused by drought and flooding or by water use (MDNR) - Plan should address protection of recharge areas, particularly in proximity to wellhead protection areas (MDNR) - the planning area includes areas with deep wells with limited groundwater resources and aquifer availability (MDH) - concern that tiling may lower water table over long term (public) - future actions may impact wells/aquifer in future (public) - increasing industrial use may impact local water levels - infiltration and groundwater recharge may be decreased by development, tiling, and other human activity

Table 2-3. Priority issues categories and supporting specific issues

General Issue Area	General Issue Statement	**Specific issues (or opportunities) provided as examples of this category** (Green text indicates issue statement from agency response to notification letter - agency in parentheses) (Blue text indicates issues identified in public survey responses) (Black text indicates additional issues identified by the Steering Team
Protection of Groundwater/ Drinking Water Quality	The high quality of groundwater and drinking water must be protected from potential threats.	- degraded groundwater quality is a significant issue in the watershed (BWSR) - unused, unsealed wells can provide a conduit for contaminants from the surface to drinking water (MDH) - private well owners may lack water quality information/testing (MDH) - over 20% of arsenic samples taken from wells in the planning area have arsenic levels above the Safe Drinking Water Act (SDWA) standard of 10 µg/L (MDH) - the Plan should consider impacts to non-community public water supplies (e.g., schools, campgrounds) (MDH) - agricultural runoff impacts wells and drinking water (public) - infiltration of runoff containing pollutants can impact drinking water in areas with vulnerable wells and aquifers - there is a lack of education and outreach regarding groundwater quality issues (specifically arsenic) - there is a lack of cost-share opportunities to address arsenic in groundwater
Threats to Fish, Wildlife, and Habitat	Human activity threatens natural areas, prairies, bluffs, and wetlands providing habitat and other ecological benefits, and the species that inhabit them	- Lower MN River WRAPS identifies lack of habitat as a stressor for biological impairments (fish and macroinvertebrates) (BWSR, MPCA) - protection and restoration of wetlands provides benefits for water quality, flood damage reduction, and wildlife habitat (BWSR) - 3,400 acres of Conservation Reserve Program (CRP) practices are scheduled to expire within the partnership's counties by 2022 (BWSR) - Plan should focus on protection and enhancement of stream-adjacent habitat corridors (MDNR) - Plan should focus on protection and enhancement of remaining areas of biodiversity, springs, and Le Sueur Calcareous Fen (MDNR) - invasive species are a risk to ecosystems, agriculture, recreation, and human health (BWSR) - emerging weed threats such as Palmer amaranth pose a significant risk to agricultural production (BWSR) - wetlands are being drained/lost (public) - loss of wildlife habitat areas (public) - removal of tree lines and wetland drainage reduces habitat (public) - there are opportunities to improve fishing in Silver Lake (public) - poor water quality affecting fish population (e.g., Buffalo Creek) (public) - declining biodiversity provides opportunities for proliferation of invasive species - lack of natural disturbance (e.g., fire) and/or maintenance leads to woody species encroachment of prairie habitats - preservation of high quality natural resources is necessary to sustain recreational activities (e.g., hunting, fishing)

2.3 Spatial Prioritization of Issue Areas

The spatial extent and severity of issues like degraded water quality, altered hydrology, and others vary across the planning area. This spatial variability prevents a one-size-fits-all approach to implementing practices and programs addressing priority issues. Therefore, the Partners prioritized areas in which to target implementation activities to utilize financial and staff capacity effectively and efficiently. The Partnership used available geospatial data, modeling and monitoring results, and existing technical knowledge of the planning area to prioritize areas for practices and program implementation.

The Partners may perform prioritization and/or targeting at various levels of geographic specificity according to available information. One level of prioritization is subwatershed scale targeting, defined as follows:

- **Subwatershed scale prioritization** – subwatersheds (at approximately the HUC 12 level) or portions of subwatersheds (e.g., HSPF model subwatersheds) are identified as priority areas for project or program implementation, although the specific location of proposed projects is not specified.

In addition to subwatershed prioritization, the Partners used various tools and datasets for field scale targeting, described in Section 4, and summarized as:

- **Field scale targeting** – the location of potential field practices (e.g., grade stabilization, streambank restoration) within a subwatershed are identified or based on the results of available surveys, inventories, terrain analysis, and other datasets/analysis.

The following sections describe the subwatershed prioritization methods. The methods described in this section rely on the land and water resources data presented in Appendix A.

2.3.1 Priority Areas to Address Degraded Surface Water Quality

The Partners identified degraded surface water quality as a Level 1 priority issue. Several streams and lakes within the planning area are listed on the State of Minnesota's impaired waters list due to a variety of pollutants and stressors (see Section A.9). This issue is closely linked to the Level 1 priority issue of excessive erosion and sedimentation; sediment negatively impacts water quality and is a vector for nutrients and other pollutants.

The Partners initially considered the following geospatial datasets in prioritizing areas for actions to address degraded surface water quality degradation and excessive erosion and sedimentation. These include:

- Total nitrogen (TN) loading as estimated by HSPF modeling (see Figure A-20)
- Total phosphorus (TP) loading as estimated by HSPF modeling (see Figure A-21)
- Total suspended solids (TSS) loading as estimated by HSPF modeling (see Figure A-22)
- Streams and lakes listed as impaired (see Figure A-14)
- Lakes identified by the MPCA as having high sensitivity to phosphorus
- Subwatershed location in areas identified as "headwaters" or "bluffs" (see Figure 2-7)

- Priority lakes as identified through stakeholder engagement (see Figure 2-6), including:
    - Bakers Lake
    - Clear Lake
    - High Island Lake
    - Indian Lake
    - Round Grove Lake
    - Sand Lake
    - Titlow Lake
    - Washington Lake

2.3.1.1 Scoring of Priority Areas Inputs – Degraded Surface Water Quality

The inputs listed above were considered in multiple iterations to develop composite watershed scores. Subwatersheds were then divided into "low", "medium", and "high" priorities based on the composite subwatershed score. Several iterations were presented to the Steering Team and Advisory Group; draft prioritization options were revised based on feedback and presented to the Policy Committee. The Policy Committee adopted the prioritization presented in Figure 2-8.

The priority areas reflected in Figure 2-8 are based on the following consideration of inputs:

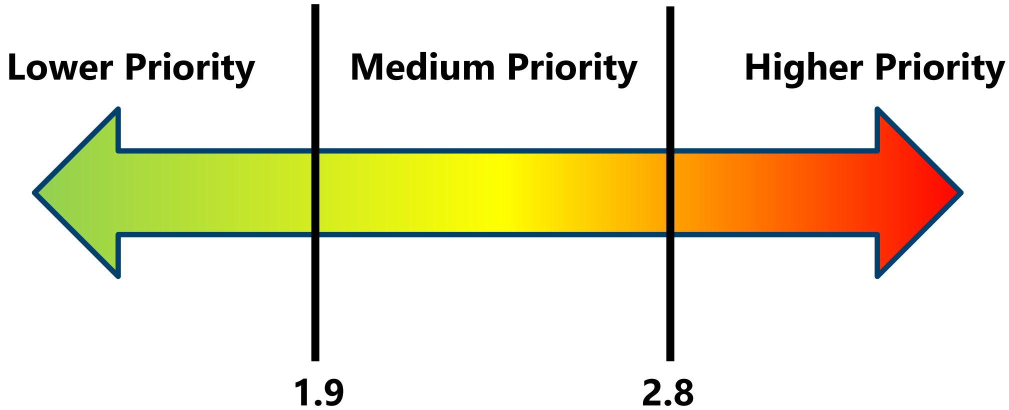
Pollutant Loading Score/4.5 + Headwater Score + Bluff score + Impairment Score = Priority Score

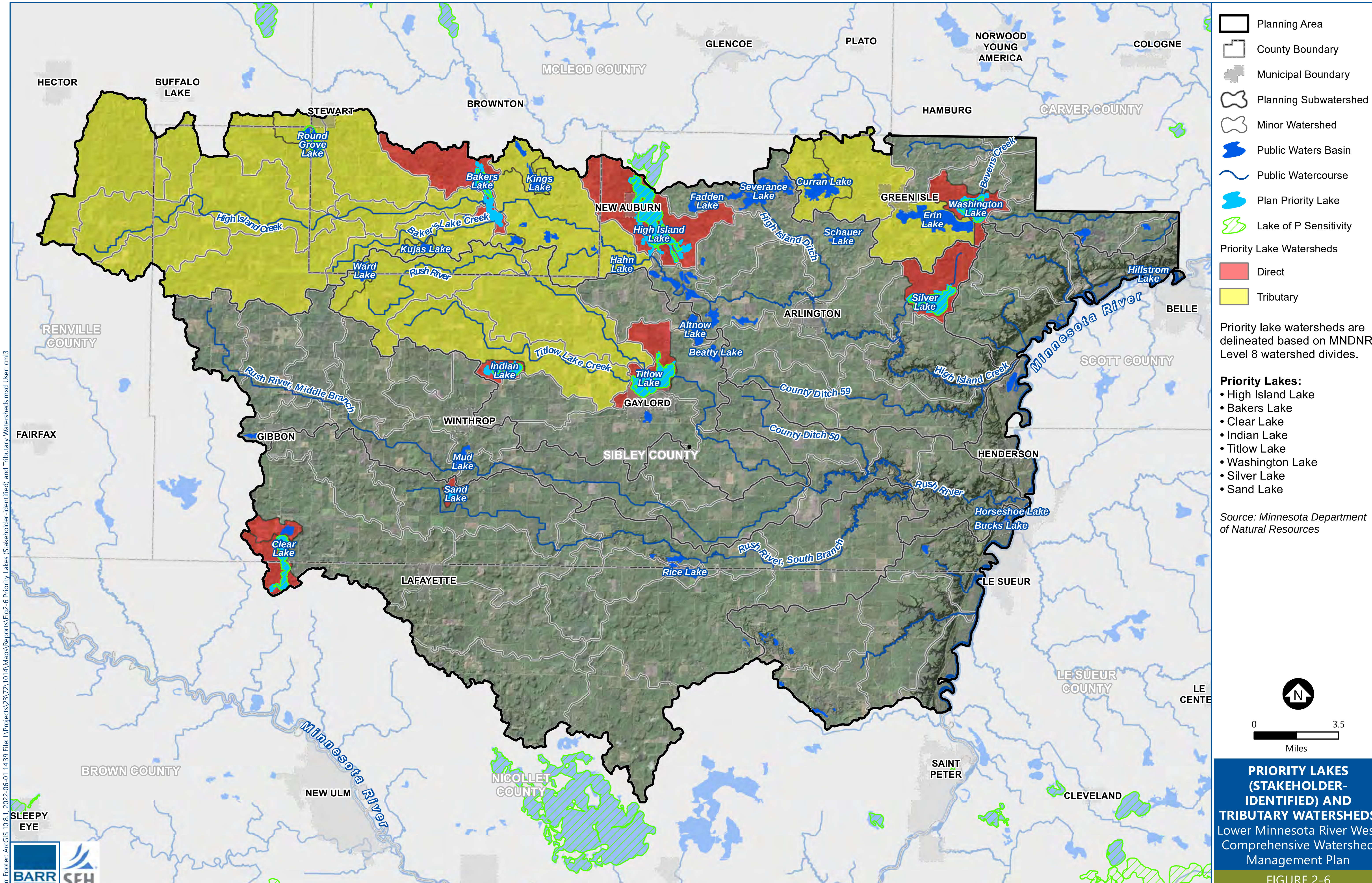
- **Pollutant loading score** – each HSPF subwatershed was assigned a score of 1, 2, or 3 points based on whether the modeled subwatershed pollutant loading fell within the lowest (the 0-33 percentile), middle (34-66 percentile), or highest (67-100 percentile) third of modeled pollutant loading rates, respectively. Each subwatershed received a separate score for each pollutant. The sum of the scores for TN, TP, and TSS is the "pollutant loading score" for that subwatershed. *For example, a subwatershed with a sediment loading rate in 80^{th} percentile, TP loading rate in the 50^{th} percentile, and TN loading rate in the 50^{th} percentile would individual pollutant loading scores of 3, 2, and 2, and a total pollutant score of 7.*
- **Headwater score** – each HSPF subwatershed located with the "headwater" area as determined by the Steering Team and Advisory Group received a score of 1. HSPF subwatersheds outside of the headwaters area received a score of 0.
- **Bluff score** – each HSPF subwatershed located with the "bluff" area as determined by the Steering Team and Advisory Group received a score of 1. HSPF subwatersheds outside of the bluff area received a score of 0.
- **Impairment score** – HSPF subwatersheds that are directly tributary to a non-bacterial impairment received a score of 1; other HSPF subwatersheds received a score of 0. Bacterial impairments were omitted from the scoring because practices commonly implemented to address watershed TN, TP, and TSS loading often do not reduce bacterial loading. Activities in the implementation schedule intended to specifically address bacterial loading are targeted using other means.

Priority subwatershed scores for each subwatershed were classified such that:

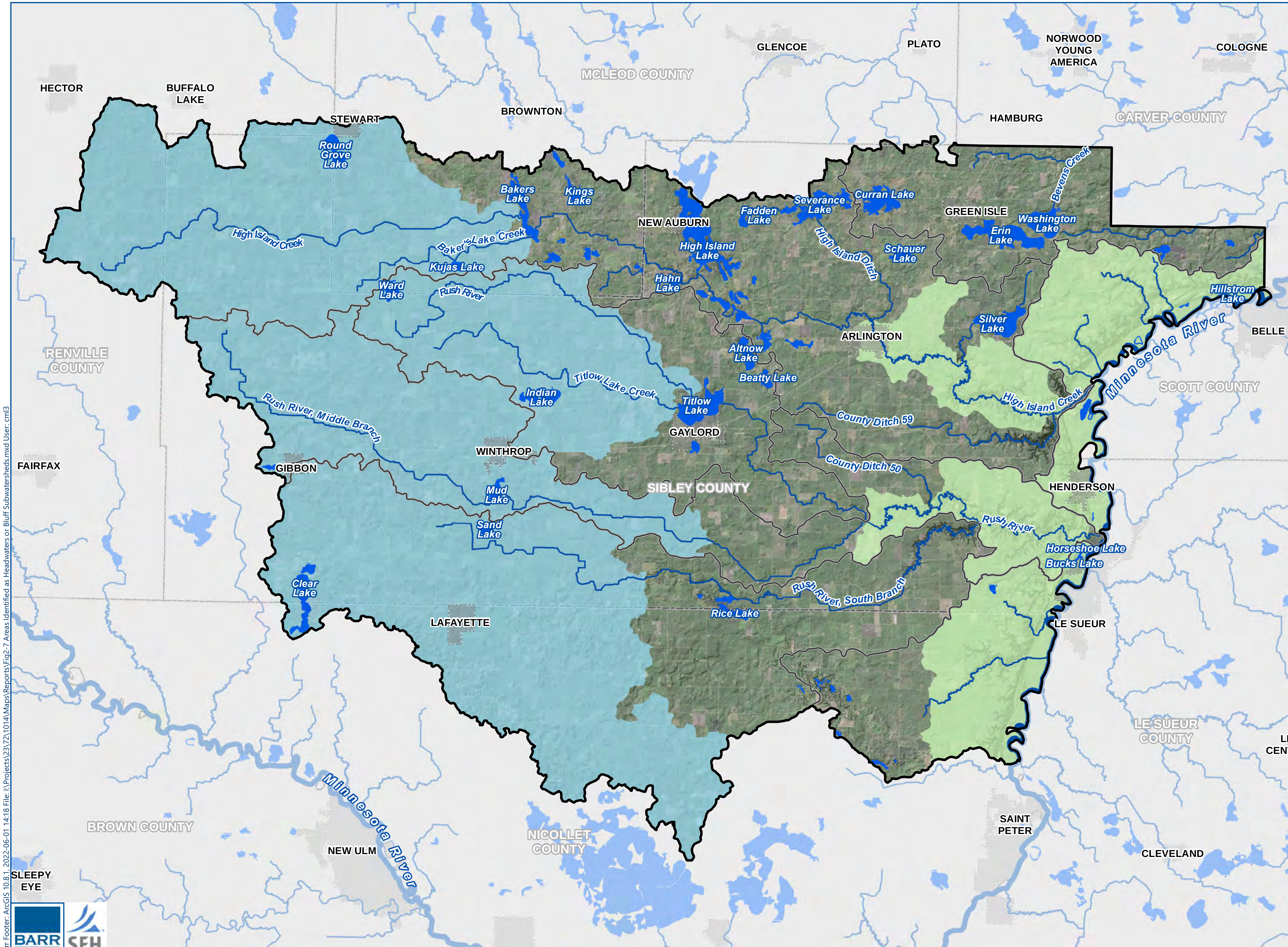
- **High priority** = priority scores >2.8
- **Medium priority** = priority scores 1.9 to 2.8
- **Low priority** = priority scores <1.9

The numeric values of the breakpoints were selected to result in an approximate equal distribution between low, medium, and high priority areas; these values do not represent any real unit.





PRIORITY LAKES (STAKEHOLDER-IDENTIFIED) AND TRIBUTARY WATERSHEDS
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE 2-6



Planning Area

County Boundary

Municipal Boundary

Planning Subwatershed

Public Waters Basin

Public Watercourse

Bluff Areas

Headwater Areas

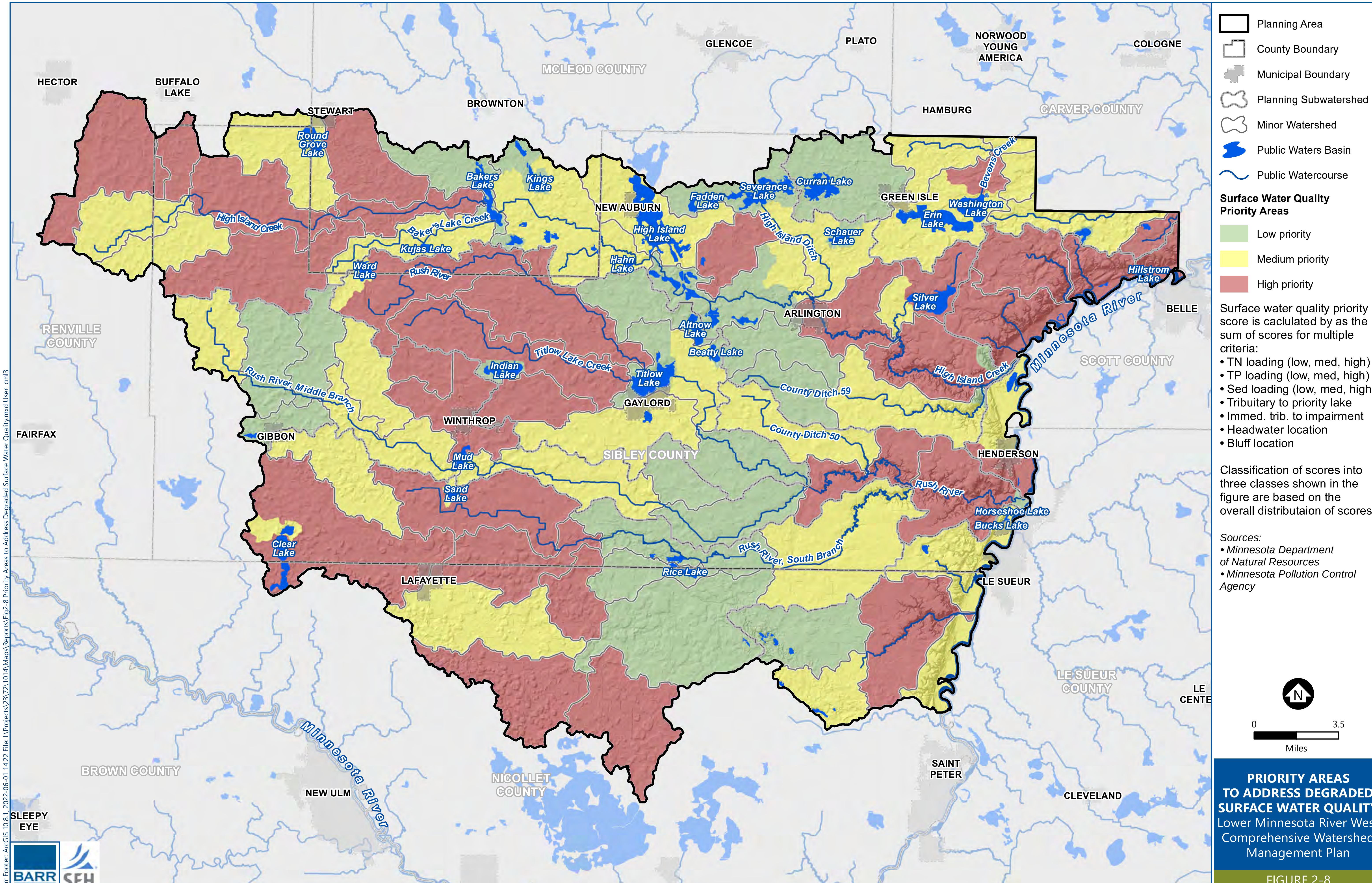
* Bluff watersheds include those tributary to the Minnesota River and the downstream reaches of High Island Creek and the Rush River .

Sources:
- *Minnesota Department of Natural Resources*
- *Minnesota Pollution Control Agency*

0 3.5
Miles

AREAS IDENTIFIED AS HEADWATERS OR BLUFF SUBWATERSHEDS
Lower Minnesota River West Comprehensive Watershed Management Plan

FIGURE 2-7



PRIORITY AREAS TO ADDRESS DEGRADED SURFACE WATER QUALITY
Lower Minnesota River West Comprehensive Watershed Management Plan

FIGURE 2-8

2.3.2 Priority Areas to Address Altered Hydrology and Drainage

The Partners identified altered hydrology and drainage as a Level 1 priority issue. Altered hydrology and drainage is a contributor to these other Level 1 issues: excessive flooding, degraded surface water quality, and excessive erosion and sedimentation. The Partners initially considered the following geospatial datasets to prioritize areas for actions primarily intended to address the issue of altered hydrology and drainage. These include:

- Estimated unit area runoff as estimated by HSPF modeling (see Figure A-19)
- Streams listed as impaired for which altered hydrology is a stressor (see Figure A-14)
- Subwatershed location in areas identified as “headwaters” or “bluffs” (see Figure 2-7)
- Priority lakes as identified through stakeholder engagement (see Figure 2-6), including:
    - Bakers Lake
    - Clear Lake
    - High Island Lake
    - Indian Lake
    - Round Grove Lake
    - Sand Lake
    - Titlow Lake
    - Washington Lake

2.3.2.1 Scoring of Priority Areas Inputs – Altered Hydrology and Drainage

The inputs listed above were considered in multiple iterations to develop composite watershed scores. Subwatersheds were then divided into “low”, “medium”, and “high” priorities based on the composite subwatershed score. Several iterations were presented to the Steering Team and Advisory Group; draft prioritization options were revised based on feedback and presented to the Policy Committee. The Policy Committee adopted the prioritization presented in Figure 2-9.

The priority areas reflected in Figure 2-9 are based on the following consideration of inputs:

Estimated Runoff Score/1.5 + Headwater Score + Bluff score + Priority Lake Score = Priority Score

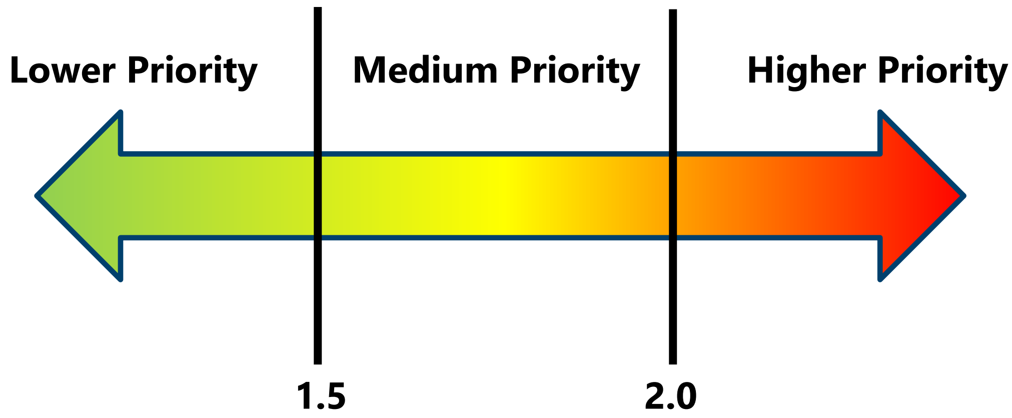
- **Estimated runoff score** – each HSPF subwatershed was assigned a score of 1, 2, or 3 points based on whether the modeled subwatershed runoff rate (inches/year) fell within the lowest (the 0-33 percentile), middle (34-66 percentile), or highest (67-100 percentile) third of modeled runoff rates, respectively.
- **Headwater score** – each HSPF subwatershed located with the “headwater” area as determined by the Steering Team and Advisory Group received a score of 1. HSPF subwatersheds outside of the headwaters area received a score of 0.
- **Bluff score** – each HSPF subwatershed located with the “bluff” area as determined by the Steering Team and Advisory Group received a score of 1. HSPF subwatersheds outside of the bluff area received a score of 0.

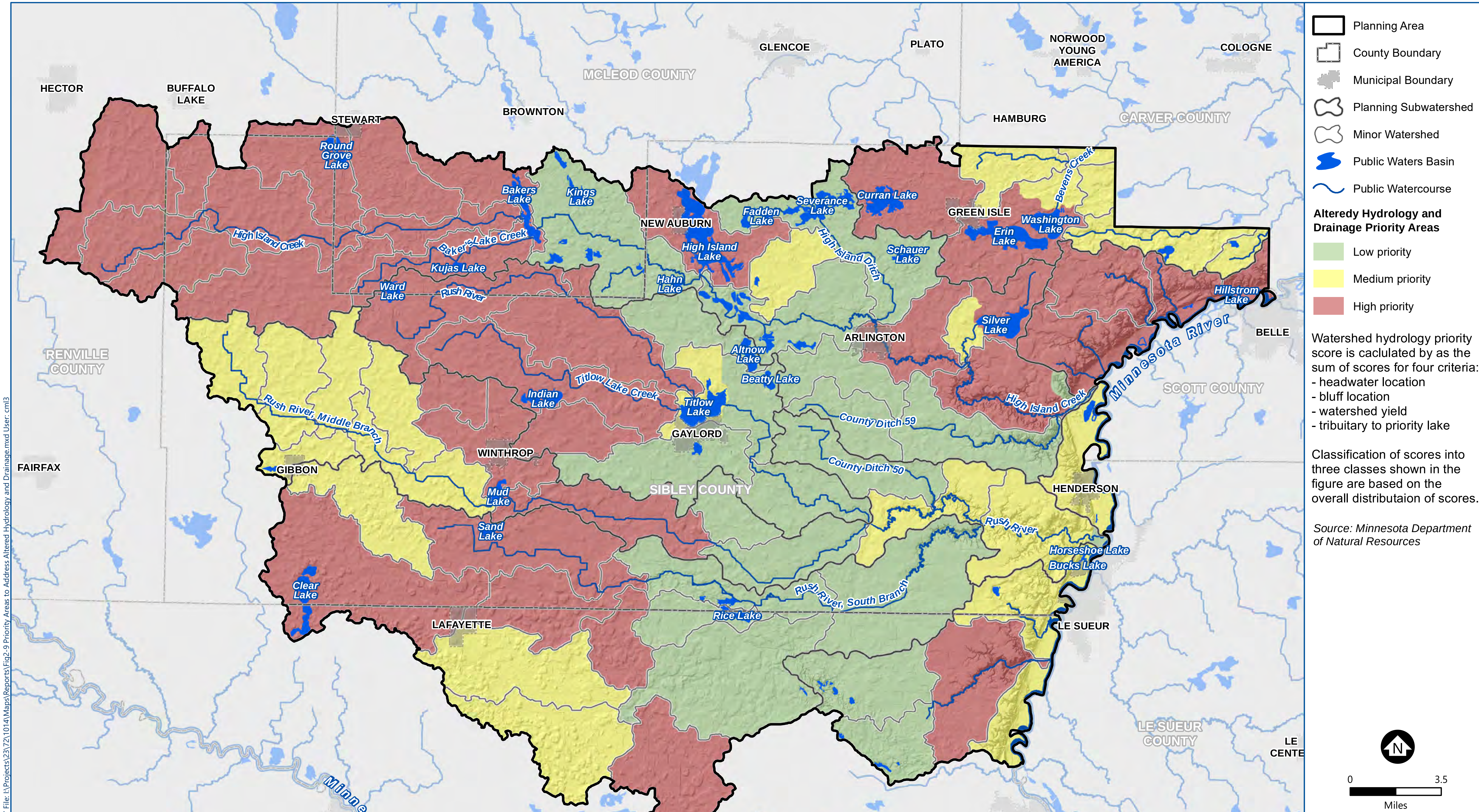
- **Priority lake score** – HSPF subwatersheds that are directly or indirectly tributary to a priority lake (see Figure 2-6) received a score of 1; other HSPF subwatersheds received a score of 0.

Priority subwatershed scores for each subwatershed were classified such that:

- **High priority** = priority scores >2
- **Medium priority** = priority scores >1.5 to 2
- **Low priority** = priority scores up to 1.5

The numeric values of the breakpoints were selected to result in an approximate equal distribution between low, medium, and high priority areas; these values do not represent any real unit.





PRIORITY AREAS TO ADDRESS ALTERED HYDROLOGY AND DRAINAGE
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE 2-9

Barr Footer: ArcGIS 10.8.1, 2022-06-01 14:17 File: I:\Projects\23\72\1014\Maps\Reports\Fig2-9 Priority Areas to Address Altered Hydrology and Drainage.mxd User: cml3

3 Establishing Measurable Goals

This section summarizes the development of measurable goals to address the issues prioritized by the Partners (see Section 2.22). Goals may be applicable watershed-wide or focused on specific spatial areas, natural resources, or target audiences. Goals address existing issues and seek to prevent or mitigate future water and natural resource management issues.

The measurable goals developed for this Plan are presented in Table 3-2 and Table 3-3.

3.1 Goal Development Process

The Partners developed measurable goals through an iterative process performed over several meetings involving the Steering Team, Advisory Group, and Policy Committee (see Table 1-1).

In developing measurable goals, the Partners considered a range of available information, including:

- Existing management plans, studies, reports, data and information, including:
    - County Water Management Plans
    - Lower Minnesota River Watershed Restoration and Protection Strategy (WRAPS) report and associated scenario modeling
    - Lower Minnesota River Total Maximum Daily Load (Part I)
    - Lower Minnesota River Groundwater Restoration and Protection Strategy (GRAPS) report
- Input received from stakeholder engagement (see Section 2.1 and Appendix C)
- Input from the Steering Team
- Input from Advisory Group members
- Input from Policy Committee members

Generally, goals were first developed at a qualitative level ("what types of things would we like to achieve?") and refined to include quantifiable elements ("how much can we achieve?") where supported by available data and tools. In situations where existing data is not sufficient to develop a quantitative goal, the goals focus on collecting and interpreting information to support developing more quantitative future goals. Measurable outputs for each goal were selected appropriate to the level of quantification.

Emphasis was given to goals that address Level 1 priority issues, although goals were developed to address all eight priority issue areas. Pollutant reduction goals associated with the "degraded surface water quality" issue are subdivided by pollutant of concern and according to major planning watershed and presented separately in Table 3-3.

The Plan goals are divided into long-term and short-term (i.e., 10-year) goals. **Long-term goals** describe desired future conditions (e.g., achieve applicable water quality standards) that may not be achievable within the 10-year life of the Plan. **10-year goals** are presented as reasonable progression towards the desired future condition. The Partners may refine long-term and 10-year goals as they evaluate progress during Plan implementation (though changes to goals may require a Plan amendment, see Section 5.5).

3.2 Measurable Goals and Associated Details

The measurable goals developed for this Plan are presented in Table 3-2 and Table 3-3. Table 3-2 includes goals to address all priority issues. Table 3-3 presents a subset of goals to address the "degraded surface water quality" issue area specific to the eight planning subwatersheds.

Table 3-2 and Table 3-3 include the following information:

Priority Issue – Goals are grouped according to priority issues. Level 1 issues appear first in Table 3-2, followed by Level 2 and Level 3 issues. Table 3-3 includes goals addressing the Level 1 issue area of degraded surface water quality.

Subwatershed (Table 3-3 only)– This field identifies the spatial area (e.g., subwatershed) or natural resource (e.g., wetlands) where the goal applies.

Specific Issue, Pollutant, or Stressor – This field groups or subdivides goals at a more specific issue level. For example, degraded surface water quality is subdivided into goals applicable to specific stressors that contribute to water quality impairments (e.g., phosphorus, total suspended solids).

Long-term Goal – This field presents the desired future condition for a resource or area that is likely to be achieved beyond the 10-year life of this Plan.

Long-term Goal Rationale (Table 3-2 only) – This field presents the origin or basis for the long-term goals that extend beyond the life of this Plan. This field may reference existing documents (e.g., State water quality standards) or input from the Steering Team, Advisory Group, and/or Policy Committee

10-year Goal – This field presents goals estimated to be achieved within 10 years through the implementation of this Plan.

10-year Goal ID – This field presents an identifier unique to each goal such that implementation tasks presented in Table 5-4 may be cross-referenced to applicable goals.

10-year Goal Rationale or Source– This field presents the origin or basis for the 10-year goal. This field may reference existing documents (e.g., Lower MN River WRAPS report) or input from the Steering Team, Advisory Group, and/or Policy Committee.

10-year Goal Measures (Table 3-3 only) – This field includes quantitative measures or outputs that will be used to assess progress towards the 10-year goal and long-term goal. Measures may include number of implemented practices, inventory/study results, modeling results (see Section 4.3), reports or other measures tailored to the individual goal.

Related Implementation Items (Table 3-2 only) – This field includes the "Item ID(s)" of items included in the implementation schedule (Table 5-4) that are related to the 10-year goal. In many cases, multiple implementation items are associated with the goal.

Throughout the implementation of this Plan, the Partners intend to leverage their existing relationships and expertise to continue to provide technical services for a range of applicable activities. Such assistance is not specifically listed within the individual issue goals but remains a priority and focus for the Partners during implementation.

3.2.1 Level 1 Goals – Excessive Erosion and Sedimentation

Long-term goals related to excessive erosion and sedimentation include, briefly (see Table 3-2):

- Reducing the occurrence and severity of eroded streambanks
- Reducing sediment loading to downstream resources through expanded use of conservation practices
- Reducing TSS concentrations in streams and rivers to achieve water quality standards

10-year goals include increasing runoff retention and storage within the watershed, achieving compliance with the Minnesota state buffer law, stabilizing degraded and eroded ditches, increasing the use of cover crops, and reducing sediment loading via field BMPs. Excessive erosion and sedimentation issues are closely linked to degraded surface water quality. As such, additional 10-year goals include a quantifiable reduction in sediment loading for each major planning subwatershed (see Section 3.2.1 and Table 3-3).

3.2.2 Level 1 Goals – Degraded Surface Water Quality

Long-term surface water quality goals presented in Table 3-2 applicable watershed-wide are based on applicable water quality standards (MN Rules 7050) and the Minnesota Nutrient Reduction Strategy (MPCA, 2014). Goals are defined for individual pollutants/stressors, including:

- Total phosphorus (TP)
- Total nitrogen (TN)
- Total suspended solids (TSS)
- *Escherichia coli (E. coli)*
- Fish Index of Biological Integrity (FIBI)
- Macroinvertebrate Index of Biological Integrity (MIBI)

Long-term goals specific to individual planning subwatersheds (see Table 3-3) are similar but also incorporate target load reductions based on the TMDL(s), where available.

Plan (i.e., 10-year) surface water quality goals are specific to the six planning subwatersheds and are presented in Table 3-3. 10-year goals include cumulative load reductions for phosphorus, nitrogen, and sediment for each subwatershed based on existing pollutant loading and estimated area to be treated via project implementation. These goals were developed using established water quality tools and following the methodology described in Section 4.2 and Section 4.3. Pollutant reduction goals are estimated both at edge of field (i.e., field scale, see Section 4.2) and at planning subwatershed outlets (i.e., in-resource, see Section 4.3).

The applicability of existing tools to directly estimate benefits relative to *E. coli* loading, FIBI, and MIBI is limited; thus, quantitative goals related to these parameters are not defined in this iteration of the Plan. Instead, 10-year goals for these pollutants/stressors focus on the implementation of strategies/practices specifically identified to address these issues, including those identified in the Lower Minnesota River WRAPS report.

3.2.3 Level 1 Goals – Altered Hydrology and Drainage

Altered hydrology is a driver for many of the water and natural resource issues present in the planning area. Long-term goals related to altered hydrology and drainage include:

- Limit the adverse impacts to water quality, flooding, and ecology resulting from hydrologic alteration of the watershed
- Protect and restore the ability of the landscape to mitigate adverse effects of climate change, increased precipitation, and development

Increasing water storage and runoff retention is a key element in limiting the impacts of altered hydrology (see Section 3.2.4). 10-year goals focus on reducing runoff from areas with drain tile via multipurpose drainage management projects, soil health practices, education, and outreach. 10-year goals also focus on enrolling lands in conservation programs, restoring floodplain and wetland areas to restore hydrologic functions, and maintaining existing vegetative cover.

The Partners recognize the impact of tiled drainage of planning area hydrology. Generally, the goals of the Partners are to offset these impacts to the extent possible while recognizing that the amount of drain tile within the planning area is likely to increase.

3.2.4 Level 1 Goals – Excessive Flooding

Long-term goals related to excessive flooding include increasing watershed storage, reducing runoff, and reducing flood risk to structures and major infrastructure. These long-term goals are consistent with the Lower Minnesota River WRAPS, and local resource management plans. 10-year goals are focused on steps needed to achieve long-term goals, including the following (see Table 3-2):

- Increasing watershed storage (i.e., retention) by 20,000 acre-feet (equivalent to approximately 0.5 inches of runoff over the watershed)
- Characterizing flood risk and identifying priority flood risk mitigation areas
- Managing and restoring floodplain areas to achieve multiple benefits
- Reducing flood risk to 20 property owners through technical assistance and/or cost share

Increased stormwater retention (i.e., the long-term storage of stormwater on-site) and detention (the short-term storage and delayed discharge of stormwater) are essential to reducing flood risk and mitigating the impacts of altered hydrology and degraded water quality in the planning area. Increased storage may be achieved in any place on the landscape that provides temporary or permanent water storage, including surface depression storage, floodplain storage, wetlands, and soil storage (via increased use of conservation practices). Increased stormwater retention also reduces pollutant loading and erosion, leading to water quality benefits.

The 10-year watershed storage goal is based on planning level hydrologic analysis performed for 18 locations in the planning area (three sites in each planning subwatershed). This analysis looked at potential flood storage achieved through restriction or elimination of constructed outlets (see Appendix B). This analysis estimated potential increases in watershed storage of approximately 200 acre-feet per location. The area necessary to increase watershed storage by approximately 0.5 inches (approximately 20,000 acre-feet) is about 4% of the planning area at an average depth of 1 foot, or about 1% of the planning area with an average depth of 4 feet (see Table 3-1). A 20,000 acre-feet watershed storage goal is aggressive but may be achievable through a combination of wetland and floodplain restoration, soil health practices, and drainage projects.

Table 3-1 Potential watershed storage depths, volumes, and equivalent runoff

Inches of Runoff	Storage Volume (acre-ft)	Storage area (acres and % of planning area) based on average depth (feet)							
		0.5 ft		1 ft		2 ft		4 ft	
		acres	% area	acres	% area	acres	% area	acres	% area
0.25	10,400	20,750	4.2%	10,375	2.1%	5,188	1.0%	2,594	0.5%
0.5	20,800	41,500	8.3%	20,750	4.2%	10,375	2.1%	5,188	1.0%
0.75	31,100	62,250	12.5%	31,125	6.3%	15,563	3.1%	7,781	1.6%
1.0	41,500	83,000	16.7%	41,500	8.3%	20,750	4.2%	10,375	2.1%

Increased watershed storage will reduce peak water levels and streamflows. The hydrologic analysis presented in Appendix B demonstrates that flow reduction associated with additional flood storage is highly variable depending on factors, such as the location of storage areas within the watershed. The Partners have not established peak flow reduction goals as part of this Plan, due in part to the continued installation of agricultural drain tile throughout the planning area which can impact the timing of runoff and make it difficult to assess impacts of Plan implementation.

3.2.5 Level 2 Goals – Degraded Soil Health and Protection of Groundwater and Drinking Water Quality,

Table 3-2 includes long-term and 10-year goals addressing the Level 2 priority issues of degraded soil health, and protection of groundwater/drinking water quality. The Partners acknowledge the relationship between soil health, water quality, and economic sustainability of the planning area. 10-year Plan goals related to degraded soil health support a single long-term goal:

- Maintain and improve soil health to increase productivity while protecting and improving the environment

Goals related to the protection of groundwater/drinking water focus on public health risks associated with nitrate, bacteria, and arsenic in drinking water. 10-year Plan goals are generally associated with on-going programs to reduce risk of groundwater contamination.

3.2.6 Level 3 Goals – Threatened Groundwater Supply and Threats to Fish and Wildlife Habitat

Table 3-2 presents long-term and 10-year goals addressing the Level 3 issues of threatened groundwater supply and threats to fish and wildlife habitat. Goals addressing these issues are generally focused on education, outreach, technical support, and cooperative action to support other entities that are acting in a primary role. The implementation schedule identifies the specific activities to achieve these goals (see Table 5-4).

Table 3-2. Measurable Goals for the Lower Minnesota River West Comprehensive Watershed Management Plan

Issue Level	Priority Issue	Specific Issue, Pollutant, or Stressor	Long-term Goal	Long-term Goal Rationale	10-year Goal	10-year Goal ID	Related items from Implementation Schedule and associated measures/outputs (see Table 5-4)
Level 1	Excessive Erosion and Sedimentation	Near channel and in-channel erosion	Reduce the occurrence and severity of eroded streambanks and associated sediment loss	Advisory Committee; Analysis of sediment sources from Lower MN River WRAPS	Increase average runoff retention by increasing watershed storage by 20,000 acre-feet (~0.5 inches of annual runoff)	ESC-A	- Estimated increase in watershed storage (20,000 acre-feet) resulting from implemented projects (FLD-1); - Number of implemented storage projects (FLD-1); - Storage projects focused on High Island Creek (10 projects) (ESC-7)
					Achieve and maintain ongoing full compliance with MN Buffer Law with emphasis on diverse, high quality buffers	ESC-B	-Site visits to critical areas to promote buffer implementation and maintenance (ESC-1)
					Stabilize degraded and eroded ditches through at least 10 multipurpose drainage projects over 10 years prioritizing efforts in public ditch systems and 10 streambank restoration projects (or 5,000 feet of channel)	ESC-C	- Inventory of highly degraded streambank as identified by streambank evaluation (ESC-6) - Inventory of drainage systems for MDM project opportunities (AHD-3) - Number of multipurpose drainage projects (10 projects) (AHD-4) - Number of stream channel stabilization/restoration projects degraded streambanks/ditches (10 projects, or 5,000 feet) (ESC-2) - Number of projects supported via technical support (10 projects, or 5,000 feet) (ESC-3)
		Upland erosion	Reduce the sediment loading to downstream water resources through the expanded us of conservation practices	Lower MN WRAPS; Advisory Committee	Reduce upland erosion by increasing the use of cover crops, perennial vegetation, and conservation till strategies relative to baseline by 4,000 acres (see also degraded soil health goals)	ESC-D	- Increased acreage of soil health practices (4,000 acres) (ESC-4) - Estimated/modeled reduction in sediment loading (see Table 3-3 for values, SWQ-1); - Outreach events (10 over 10 years) with agra-business (ESC-5); - Demonstration projects (10 over 10 years) to promote soil health BMPs (SLH-5)
		Instream TSS	Reduce TSS concentrations in watershed streams to <10% of samples exceeding 65 mg/L (April 1 – September 30)	MN Water Quality Standard (MN Rules 7050.0222 Subp. 3, Subp. 4)	Reduce sediment loading through the implementation of field practices (see surface water quality goals); See **Table 3-3** for goals specific to planning subwatersheds	ESC-E	- Implemented projects (number and/or estimated benefit, see surface WQ goals) (SWQ-1) - Number of projects supported via technical support (10 projects) (ESC-3) - Monitoring data for TSS in streams (SWQ-6)
Level 1	Degraded Surface Water Quality	Phosphorus (Lakes)	Meet applicable Western Corn Belt Plains water quality standards (TP$\leq$90 ug/L, chl a$\leq$30 ug/L, SD$\geq$0.7 m) and North Central Hardwood Forest water quality standards (TP<60 ug/L, chl a<20 ug/L, SD>1.0 m) in impaired lakes by reducing total phosphorus loading	MN Water Quality Standard (MN Rules 7050.0222 Subp.3); Lower Minnesota River TMDL Part 1 (MPCA, 2020)	Reduce phosphorus loading through implementation of practices identified in the Lower Minnesota River TMDL and WRAPS studies - see **Table 3-3** for goals specific to planning subwatersheds	SWQ-A	- Number of implemented projects; see **Table 3-3** for values (SWQ-1) - Estimated benefit from projects; see **Table 3-3** for values (SWQ-1); - Feasibility studies addressing in-lake TP loading (SWQ-2); - Projects to address in-lake TP loading (SWQ-3)
		Phosphorus (Streams)	Reduce phosphorus loading by 45% by 2040	MN Nutrient Reduction Strategy (MPCA, 2014)	See **Table 3-3** for phosphorus reduction goals specific to planning subwatersheds	SWQ-B	- Number of implemented projects; see **Table 3-3** for values (SWQ-1) - Estimated benefit from projects; see **Table 3-3** for values (SWQ-1) - Residential cost share projecs (30 projects) to reduce TP loading (SWQ-4)
		Total Suspended Solids	Reduce TSS concentrations in watershed streams and the Minnesota River to <10% of samples exceeding 65 mg/L (April 1 – September 30)	MN Water Quality Standard (MN Rules 7050.0222 Subp. 3, Subp. 4)	See **Table 3-3** for sediment reduction goals specific to planning subwatersheds	SWQ-C	- Number of implemented projects; see **Table 3-3** for values (SWQ-1) - Estimated benefit from projects; see **Table 3-3** for values (SWQ-1) - Residential cost share projecs (30 projects) to reduce TSS loading (SWQ-4)
		Nitrate	Reduce total nitrogen loading by 45% by 2040	MN Nutrient Reduction Strategy (MPCA, 2014)	See **Table 3-3** for nitrogen reduction goals specific to planning subwatersheds	SWQ-D	- Number of implemented projects; see **Table 3-3** for values (SWQ-1) - Estimated benefit from projects; see **Table 3-3** for values (SWQ-1)
		E. coli	Reduce *E. coli* concentrations in watershed streams and the Minnesota River to monthly geometric means <126 CFU/100 mL (April 1 - October 31)	MN Water Quality Standard (MN Rules 7050.0220 Subp. 3a.D, Subp. 4a.D, and Subp. 5a.D); Lower Minnesota River TMDL (MPCA, 2020)	Reduce E. coli loading through management of SSTS, un-sewered discharges, and feedlots	SWQ-E	- Assistance to address non-functioning SSTS (250 over 10 years) (GWQ-5); - Assistance to improve animal waste management systems (20 over 10 years) (SWQ-7); - Number of nutrient, fertilizer, and/or manure management plans (50 plans) (GWQ-4);

Table 3-2. Measurable Goals for the Lower Minnesota River West Comprehensive Watershed Management Plan

Issue Level	Priority Issue	Specific Issue, Pollutant, or Stressor	Long-term Goal	Long-term Goal Rationale	10-year Goal	10-year Goal ID	Related items from Implementation Schedule and associated measures/outputs (see Table 5-4)
Level 1	Degraded Surface Water Quality	Fish Index of Biological Integrity	Achieve applicable Fish Indices of Biological Integrity for streams (see Figure A-17): - Low gradient streams, modified use (Fish IBI = 15) - Low gradient streams, general use (Fish IBI = 42) - Southern headwaters, modified use (Fish IBI = 33) - Southern headwaters, general use (Fish IBI = 55) - Southern streams, modified use (Fish IBI = 35) - Southern streams, general use (Fish IBI = 50) - Southern Rivers, general use (Fish IBI = 49)	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Lower Minnesota River Monitoring and Assessment Report - Appendix 3.2 (MPCA, 2017)	Implement structural and non-structural practices to mitigate the negative impact of stressors (e.g., nutrients, sediment, altered hydrology) to improve FIBI.	SWQ-F	- Number of implemented projects; see **Table 3-3** for values (SWQ-1) - Monitoring of water quality/IBI in streams (SWQ-6)
		Macroinvertebrate Index of Biological Integrity	Achieve the following Macroinvertebrate Indices of Biological Integrity for streams (see Figure A-16): - Prairie streams, modified use (MIBI = 22) - Prairie streams, general use (MIBI = 41) - Southern streams, modified use (MIBI = 24) - Southern streams, general use (MIBI = 37) - Southern forest streams, modified use (MIBI = 30) - Southern forest streams, general use (MIBI = 41)	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Lower Minnesota River Monitoring and Assessment Report - Appendix 3.3 (MPCA, 2017)	Implement structural and non-structural practices to mitigate the negative impact of stressors (e.g., nutrients, sediment, altered hydrology) to improve MIBI.	SWQ-G	- Number of implemented projects; see **Table 3-3** for values (SWQ-1) - Monitoring of water quality/IBI in streams (SWQ-6)
Level 1	Altered Hydrology and Drainage	Altered Hydrology	Limit the adverse impacts to water quality, flooding, and ecology resulting from hydrologic alteration of the watershed	Steering Team and Advisory Committee; Stakeholder engagement Lower Minnesota River WRAPS	Increase runoff retention by increasing watershed storage by 20,000 acre-feet (corresponding to ~0.5 inches of annual runoff)	AHD-A	- Estimated increase in watershed storage (20,000 acre-feet) resulting from implemented projects (FLD-1) - Number of implemented storage projects (FLD-1) - Education distributions promoting the use of BMPs focused on soil health (SLH-4)
					Reconnect/restore floodplains upstream of the Minnesota River to increase flood risk mitigation, water storage, and ecological functions	AHD-B	- Inventory of priority floodplain reconnection/restoration opportunities (FLD-6); - Projects to reconnect/restore riparian floodplain (6 projects over 10 years) (FLD-7); - Floodplain acreas added to conservation programs (FLD-7); - Recommendations for updates to floodplain and related ordinances (FLD-5)
					Implement tile system BMPs to reduce discharge rates from tiled watersheds (emphasizing altered hydrology priority areas)	AHD-C	- Number of tile system BMPs implemented/supported (AHD-4, AHD-5); - Inventory/assessment of tile drainage/multipurpose drainage project opportunities (AHD-1, AHD-3); - Events to promote interest in tile BMPs/multipurposes drainage projects (AHD-2)
					Mitigate the adverse impacts resulting from drainage alteration through promotion of drainage water management practice by landowners via education, outreach, and cost-share.	AHD-D	- Number of tile system BMPs implemented/supported (AHD-4, AHD-5); - Inventory/assessment of tile drainage/multipurpose drainage project opportunities (AHD-1, AHD-3); - Events to promote interest in tile BMPs/multipurposes drainage projects (AHD-2); - Meetings (annual) with drainage authorities to coordinate activities (AHD-6); - Inventory of feasible locations for 2-stage ditches (AHD-12)
					Mitigate the impacts of drainage alterations through the promotion of multipurpose drainage management projects and implementation of at least 10 multipurpose drainage projects over 10 years	AHD-E	- Number of tile system BMPs implemented/supported (AHD-4, AHD-5); - Inventory/assessment of tile drainage/multipurpose drainage project opportunities (AHD-1, AHD-3); - Events to promote interest in tile BMPs/multipurposes drainage projects (AHD-2); - Meetings (annual) with drainage authorities to coordinate activities (AHD-6); - Inventory of feasible locations for 2-stage ditches (AHD-12)

Table 3-2. Measurable Goals for the Lower Minnesota River West Comprehensive Watershed Management Plan

Issue Level	Priority Issue	Specific Issue, Pollutant, or Stressor	Long-term Goal	Long-term Goal Rationale	10-year Goal	10-year Goal ID	Related items from Implementation Schedule and associated measures/outputs (see Table 5-4)
Level 1	Altered Hydrology and Drainage	Landscape Resiliency and Hydrologic Functions	Protect and restore the ability of the landscape to mitigate adverse effects of climate change, increased precipitation, and development	Lower MN WRAPS; Advisory Committee; public;	Protect and maintain natural vegetative cover in Rush River, High Island Creek, Bevens Creek, and Minnesota River valleys	AHD-F	- Inventory of priority conservation opportinities (AHD-7); - Outreach to 100 landowners regarding conservaion opportunities (AHD-8); - Total acres enrolled in conservation programs (AHD-9); - Recommendations for ordinance revisions/updates (FWH-2);
					Protect and increase wetland areas to promote soil health, water quality, and water quantity benefits	AHD-G	- Outreach to 100 landowners regarding wetland protection (AHD-10); - Wetland restoration projects (5 projects) (AHD-11); - Recommendations for ordinance revisions/updates (FWH-2);
					Increase and maintain enrollment of lands in easement and/or conservation programs (e.g., CRP); target 2,000 acres	AHD-H	- Number of acres enrolled in conservation programs (2,000 acres) (AHD-9); - Inventory of priority conservation opportinities (AHD-7); - Outreach to 100 landowners regarding conservaion opportunities (AHD-8);
Level 1	Excessive Runoff and Flooding	Storage	Increase storage and reduce runoff throughout the Lower Minnesota River West watershed	Lower MN WRAPS; Advisory Committee	Increase storage in the watershed by 20,000 acre-feet (corresponding to ~0.5 inches of runoff)	FLD-A	- Estimated increase in watershed storage (20,000 acre-feet) resulting from implemented projects (FLD-1) - Number of implemented storage projects (FLD-1) - Education distributions promoting the use of BMPs focused on soil health (SLH-4)
		Flood Risk Mitigation	Reduce flood risk to structures and major infrastructure	Advisory Committee, Steering Team, public	Characterize current flood risk within the planning area and identify priority flood risk mitigation areas throughout planning area	FLD-B	- Prioritized inventory of flood risk (FLD-2); - Revised hydrologic models, as needed (FLD-3); - Subwatershed storage goals based on analysis (FLD-4); - Database of culverts with flooding issues (FLD-10);
					Reconnect/restore floodplains upstream of the Minnesota River to increase flood risk mitigation, water storage, and ecological functions	FLD-C	- Inventory of priority floodplain reconnection/restoration opportunities (FLD-7); - Projects to reconnect/restore riparian floodplain (6 projects over 10 years) (FLD-8); - Floodplain acreas added to conservation programs (FLD-8); - Recommendations for updates to floodplain and related ordinances (FLD-6)
					Reduce flood risk to 20 property owners through technical assistance, cost-share funding for localized flood risk minimization practices, and/or capital projects	FLD-D	- Technical assistance/cost-share provided to property owners (20 owners) (FLD-9); - Prioritized inventory of flood risk (FLD-2); - Database of culverts with flooding issues (FLD-10); - Reconstruction of Baker's Lake Outlet (FLD-5)
Level 2	Degraded Soil Health	Cover crops, perennial vegetation, and till strategies	Maintain and improve soil health to increase productivity while protecting and improving the environment	Steering Team and Advisory Committee; public	Quantify the use and benefit (e.g., water storage, reduced runoff, increased organic matter) of cover crops, perennial vegetation, till strategies, and residue management throughout the watershed	SLH-A	- Inventory of soil health practices (SLH-1); - Estimates of soil health benefits from partners (SLH-2);
					Implement educational programs and demonstration projects to increase awareness of soil health best practices and community capacity to implement BMPs	SLH-B	- Convene group of local implementers to champion/demonstrate practices (SLH-3); - Educational distributions related to soil health practices (annually) (SLH-4); - Demonstration projects to support soil health practices (5 projects) (SLH-5); - Host 20 field day events (SLH-6); - Outreach events with agra-business (annually) (SLH-7);
					Increase the use of cover crops, perennial vegetation, and conservation till strategies by 4,000 acres (see also Goal ESC-4)	SLH-C	- Inventory of soil health practices (SLH-1); - Increased acres of cover crops/perennial vegetation (4,000 acres) (ESC-4); - Educational distributions related to soil health practices (annually) (SLH-4); - Host 20 field day events (SLH-6); - Outreach events with agra-business (annually) (SLH-7);

Table 3-2. Measurable Goals for the Lower Minnesota River West Comprehensive Watershed Management Plan

Issue Level	Priority Issue	Specific Issue, Pollutant, or Stressor	Long-term Goal	Long-term Goal Rationale	10-year Goal	10-year Goal ID	Related items from Implementation Schedule and associated measures/outputs (see Table 5-4)
Level 2	Protection of Groundwater/Drinking Water Quality	Nitrate	Achieve nitrate concentrations below the MCL of 10 mg/L in monitored private drinking water supplies	US EPA Drinking Water Standards and Health Advisory Tables (2018); MDH Drinking Water Standards and Guidance	Provide all private well owners access to well testing programs and education about drinking water quality and proper well management	GWQ-A	- Number of tested wells (500 wells over 10 years) (GWQ-7); - Educational distributions regarding groundwater contamination (20 items) (GWQ-10) - Educational communications regarding wells (10 items) (GWQ-12); - Meeting (mid-Plan cycle) of public water suppliers (GWQ-11);
					Establish a local database of monitored private wells with elevated levels of nitrate (concentrations ≥3ppm); identify wells/areas with chronically high nitrate concentrations relative to the MCL	GWQ-B.1	- Monitoring plan (GWQ-8); - Groundwater quality monitoring database (GWQ-9); - Trend analysis/identification of priority areas (GWQ-8); - Updates to well inventory (GWQ-14);
					Reduce nitrogen loading to groundwater through the implementation of field practices and reduction of fertilization rates/increased nitrogen use efficiency (see goal SWQ-1 and SLH-3)	GWQ-C	- Implementation of applicable BMPs (e.g., cover crop, reduced fertilizer application) - number of projects and estimated nitrogen load reduction (GWQ-3); - Number of nutrient, fertilizer, and/or manure management plans (50 plans) (GWQ-4); - Increased acres of cover crops/perennial vegetation (4,000 acres) (ESC-4);
		E. coli	Reduce the occurrence of *E. coli* contamination of groundwater supplies	US EPA Drinking Water Standards and Health Advisory Tables (2018); MDH Drinking Water Standards and Guidance	Reduce *E. coli* loading through management of SSTS, un-sewered discharges, and feedlots	GWQ-D	- Assistance to address non-functioning SSTS (250 over 10 years) (GWQ-5); - Assistance to apply for SSTS loans (ongoing) (GWQ-6); - Assistance to improve animal waste management systems (20 over 10 years) (SWQ-7); - Number of nutrient, fertilizer, and/or manure management plans (50 plans) (GWQ-4); - Educational distributions regarding groundwater contamination (20 items) (GWQ-10)
		Well Management	Reduce the risk of groundwater contamination through proper well management	Steering team; Advisory Committee	Minimize groundwater contamination by sealing and/or providing cost sharing to seal 100 private wells.	GWQ-E	- Projects to seal abandoned private wells (100 projects) (GWQ-1); - Projects to seal abandoned high capacity wells (2 projects) (GWQ-2); - Educational communications regarding wells (10 items) (GWQ-12);
		Arsenic	Achieve arsenic concentrations below the MCL of 10 mg/L in private (finished) drinking water	US EPA Drinking Water Standards and Health Advisory Tables (2018); MDH Drinking Water Standards and Guidance	See also Goal GWQ-1		
					Establish a local database of monitored private wells with elevated levels of arsenic (>10 ug/L); identify wells/areas with chronically high arsenic concentrations relative to the MCL	GWQ-B.2	- Monitoring plan (GWQ-8); - Groundwater quality monitoring database (GWQ-9); - Trend analysis/identification of priority areas (GWQ-8); - Updates to well inventory (GWQ-14);
					Provide technical assistance and/or cost-share funding for treatment of 25 wells with high arsenic concentrations	GWQ-F	- Inventory of priority areas to address arsenic (GWQ-8); - Technical assistance and cost-share assistance for arsenic issues (25 projects) (GWQ-13); - Educational distributions regarding groundwater contamination (20 items)
Level 3	Threatened Groundwater Supply	Groundwater sustainability	Maintain sustainable groundwater supply for future use	Conservation goal based on MDNR Draft Groundwater Strategic Plan (2013)	Promote the implementation of groundwater conservation and sustainability practices (e.g., recharge)	GWS-A	- Convene group of local implementers to champion/demonstrate practices (SLH-3); - Educational distributions related to soil health practices (annually) (SLH-4); - Demonstration projects to support soil health practices (5 projects) (SLH-5);
					Characterize the state and trend of groundwater supplies and use in the watershed	GWS-B	- Groundwater monitoring Plan (GWS-1); - Groundwater monitoring report (GWS-2)

Table 3-2. Measurable Goals for the Lower Minnesota River West Comprehensive Watershed Management Plan

Issue Level	Priority Issue	Specific Issue, Pollutant, or Stressor	Long-term Goal	Long-term Goal Rationale	10-year Goal	10-year Goal ID	Related items from Implementation Schedule and associated measures/outputs (see Table 5-4)
Level 3	Threats to Fish, Wildlife, and Habitat	Wetlands	Preserve the quality and quantity of natural areas	Steering Team and Advisory Committee; Wetland Conservation Act; MDNR Aquatic Invasive Species Program	Preserve the quality and quantity of wetlands (existing area 58,800 acres per NWI)	FWH-A	- Outreach to 100 landowners regarding wetland protection (AHD-10); - Wetland restoration projects (5 projects) (AHD-11); - Technical support for restoration projects (5 projects) (FWH-1); - Recommendations for ordinance revisions/updates (FWH-2); - Continued implementation of Wetland Conservation Act;
		Sites of biological significance		Steering Team and Advisory Committee; Wetland Conservation Act; MDNR Aquatic Invasive Species Program	Preserve sites of biological significance	FWH-B	- Technical assistance for invasive species and natural conservation projects (5 projects) (FWH-3); - Recommendations for ordinance revisions/updates (FWH-2); - Outreach events for lake associations or others (10 events) (FWH-6);
		Stream corridors	Preserve the quality of natural areas adjacent to stream and river corridors	Steering Team and Advisory Committee; Wetland Conservation Act; MDNR Aquatic Invasive Species Program	Protect and preserve natural areas adjacent to stream corridors through easements and enrollment of 2,000 acres in conservation programs and targeted outreach	FWH-C	- Number of acres enrolled in conservation programs (2,000 acres) (AHD-9); - Inventory of priority conservation opportinities (AHD-7); - Outreach to 100 landowners regarding conservaion opportunities (AHD-8);
		Invasive species	Limit the presence and impact of invasive species	Steering Team and Advisory Committee; Wetland Conservation Act; MDNR Aquatic Invasive Species Program	Characterize the presence and impact of invasive species, and cooperate with partners to mitigate impacts	FWH-D	- Technical assistance for invasive species and natural conservation projects (5 projects) (FWH-3); - Invasive species management plans (10 plans) (FWH-5); - Meetings (annual) of partner AIS management staff (FWH-4); - Outreach events for lake associations or others (10 events) (FWH-6);
		Fish and Macroinvertebrates	See fish and macroinvertebrate IBI goals above under degraded surface water quality of lakes and streams	see surface water quality goals	see surface water quality goals	FWH-E	- see surface water quality goals - Outreach events for lake associations or others (10 events) (FWH-6);

Table 3-3 Measurable Goals for the Lower Minnesota River West Comprehensive Watershed Management Plan

Issue Area	Subwatershed	Specific Issue, Pollutant, or Stressor	Long-term Goal	10-year Goal	10-year Goal ID	10-year Goal Measures
Degraded Surface Water Quality	Bevens Creek/ Silver Creek/ NE Sibley County	Phosphorus (Washington Lake)	Continue to meet North Central Hardwood Forest water quality standards in Washington Lake (TP<60 ug/L, chl a<20 ug/L, SD>1.0 m)	Implement structural and non-structural projects and practices to reduce watershed TP loading to Washington Lake by 6.6 lbs/year (as estimated at field scale)	SWQ-A.1	4 implemented projects; Washington Lake watershed TP load reduction 6.6 lbs/year (as estimated at field scale)
		Phosphorus	Reduce phosphorus loading by 45% (from average 1980-1996 conditions) by 2040; (45% reduction equals 79,000 lbs/year TP based on HSPF watershed loading estimates)	Implement structural and non-structural projects and practices to reduce watershed TP loading by 110 lbs/year (as estimated at field scale), 47 lbs/year in Bevens Creek and 33 lbs/year in Silver Creek	SWQ-B.1	40 implemented projects; watershed TP load reduction of 110 lbs/year (as estimated at field scale) and 47 lbs/year in Bevens Creek and 33 lbs/year in Silver Creek
		Total Suspended Solids	Reduce TSS concentrations to <10% of samples exceeding 65 mg/L (April 1 – September 30) by reducing TSS loading in the watershed	Implement structural and non-structural projects and practices to reduce watershed sediment loading by 11 tons/year (as estimated at field scale), 9.1 tons/year in Bevens Creek and 4.8 tons/year in Silver Creek	SWQ-C.1	40 implemented projects; watershed sediment load reduction of 11 tons/year (as estimated at field scale) and 9.1 tons/year in Bevens Creek and 4.8 lbs/year in Silver Creek
		Nitrate	Reduce total nitrogen loading by 45% (from average 1980-1996 conditions) by 2040; (45% reduction equals 1,527,000 lbs/year TN based on HSPF watershed loading estimates)	Implement structural and non-structural projects and practices to reduce watershed TN loading by 3800 lbs/year (as estimated at field scale), 2400 lbs/year in Bevens Creek and 1300 lbs/year in Silver Creek	SWQ-D.1	40 implemented projects; watershed TN load reduction of 3800 lbs/year (as estimated at field scale) and 2400 lbs/year in Bevens Creek and 1300 lbs/year in Silver Creek
		E. coli	Reduce *E. coli* concentrations in Bevens Creek/Silver Creek watershed streams to monthly geometric means <126 CFU/100 mL (April 1 - October 31)	Reduce *E. coli* loading through management of SSTS, un-sewered discharges, and feedlots	SWQ-E.1	Implementation of projects and practices to address non-functioning SSTS (250 over 10 years watershed-wide), and animal waste management facilities (20 over 10 years watershed-wide); see Implementation Schedule
		Fish Index of Biological Integrity	Achieve applicable Fish Indices of Biological Integrity for streams (see Figure A-17): - Southern headwaters, modified use (FIBI = 33) - Southern headwaters, general use (FIBI = 55) - Southern streams, modified use (FIBI = 35) - Southern streams, general use (FIBI = 50)	Implement structural and non-structural practices to mitigate the negative impact of stressors (e.g., nutrients, sediment, altered hydrology) to improve FIBI.	SWQ-F.1	Implementation of 40 projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)
		Macroinvertebrate Index of Biological Integrity	Achieve applicable Macroinvertebrate Indices of Biological Integrity for streams (see Figure A-16): - Southern streams, general use (MIBI = 37) - Southern forest streams, modified use (MIBI = 30) - Southern forest streams, general use (MIBI = 41)	Implement structural and non-structural practices to mitigate the negative impact of stressors (e.g., nutrients, sediment, altered hydrology) to improve MIBI.	SWQ-G.1	Implementation of 40 projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)

Table 3-3 Measurable Goals for the Lower Minnesota River West Comprehensive Watershed Management Plan

Issue Area	Subwatershed	Specific Issue, Pollutant, or Stressor	Long-term Goal	10-year Goal	10-year Goal ID	10-year Goal Measures
Degraded Surface Water Quality	High Island Creek	Phosphorus (High Island Lake)	Meet Western Corn Belt Plains water quality standards in High Island Lake (TP<90 ug/L, chl a<30 ug/L, SD>0.7 m) by reducing total phosphorus loading by 85% (see TMDL)	Implement structural and non-structural projects and practices to reduce watershed TP loading to High Island Lake by 11.8 lbs/year (as estimated at field scale)	SWQ-A.2a	4 implemented projects; High Island Lake watershed TP load reduction of 11.8 lbs/year (as estimated at field scale)
		Phosphorus (Silver Lake)	Meet North Central Hardwood Forest water quality standards in Silver Lake (TP<60 ug/L, chl a<20 ug/L, SD>1.0 m) by reducing total phosphorus loading by 89% (see TMDL)	Implement structural and non-structural projects and practices to reduce watershed TP loading to Silver Lake by 8.9 lbs/year (as estimated at field scale)	SWQ-A.2b	3 implemented projects; Silver Lake watershed TP load reduction of 8.9 lbs/year (as estimated at field scale)
		Phosphorus (Bakers Lake)	Continue to meet Western Corn Belt Plains water quality standards in Bakers Lake (TP<90 ug/L, chl a<30 ug/L, SD>0.7 m)	Implement structural and non-structural projects and practices to reduce watershed TP loading to Bakers Lake by 5.9 lbs/year (as estimated at field scale)	SWQ-A.2c	2 implemented projects; Bakers Lake watershed TP load reduction of 5.9 lbs/year (as estimated at field scale)
		Phosphorus (Round Grove Lake)	Continue to meet Western Corn Belt Plains water quality standards in Round Grove Lake (TP<90 ug/L, chl a<30 ug/L, SD>0.7 m)	Implement structural and non-structural projects and practices to reduce watershed TP loading to Round Grove Lake by 5.9 lbs/year (as estimated at field scale)	SWQ-A.2d	2 implemented projects; Round Grove Lake watershed TP load reduction of 5.9 lbs/year (as estimated at field scale)
		Phosphorus	Reduce phosphorus loading by 45% (from average 1980-1996 conditions) by 2040; (45% reduction equals 54,600 lbs/year TP based on HSPF watershed loading estimates)	Implement structural and non-structural projects and practices to reduce watershed TP loading by 1272 lbs/year (as estimated at field scale) and 924 lbs/year in High Island Creek	SWQ-B.2	40 implemented projects; watershed TP load reduction of 1272 lbs/year (as estimated at field scale) and 924 lbs/year in High Island Creek
		Total Suspended Solids	Reduce TSS concentrations to <10% of samples exceeding 65 mg/L (April 1 – September 30) by reducing TSS loading in the watershed	Implement structural and non-structural projects and practices to reduce watershed sediment loading by 219 tons/year (as estimated at field scale) and 153 tons/year in High Island Creek	SWQ-C.2	40 implemented projects; watershed sediment load reduction of 219 tons/year (as estimated at field scale) and 153 tons/year in High Island Creek
		Nitrate	Reduce total nitrogen loading by 45% (from average 1980-1996 conditions) by 2040; (45% reduction equals 1,102,000 lbs/year TN based on HSPF watershed loading estimates)	Implement structural and non-structural projects and practices to reduce watershed TN loading by 48000 lbs/year (as estimated at field scale) and 51800 lbs/year in High Island Creek	SWQ-D.2	40 implemented projects; watershed TN load reduction of 48000 lbs/year (as estimated at field scale) and 51800 lbs/year in High Island Creek
		E. coli	Reduce *E. coli* concentrations in High Island Creek and tributary streams to monthly geometric means <126 CFU/100 mL (April 1 - October 31)	Reduce *E. coli* loading through management of SSTS, un-sewered discharges, and feedlots	SWQ-E.2	Implementation of projects and practices to address non-functioning SSTS (250 over 10 years watershed-wide), and animal waste management facilities (20 over 10 years watershed-wide); see Implementation Schedule
		Fish Index of Biological Integrity	Achieve applicable Fish Indices of Biological Integrity for streams (see Figure A-17): - Low gradient streams, modified use (FIBI = 15) - Southern headwaters, modified use (FIBI = 33) - Southern headwaters, general use (FIBI = 55) - Southern streams, modified use (FIBI = 35) - Southern streams, general use (FIBI = 50)	Implement structural and non-structural practices to mitigate the negative impact of stressors (e.g., nutrients, sediment, altered hydrology) to improve FIBI.	SWQ-F.2	Implementation of 40 projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)
		Macroinvertebrate Index of Biological Integrity	Achieve applicable Macroinvertebrate Indices of Biological Integrity for streams (see Figure A-16): - Prairie streams, modified use (MIBI = 22) - Prairie streams, general use (MIBI = 41) - Southern streams, general use (MIBI = 37) - Southern forest streams, general use (MIBI = 43)	Implement structural and non-structural practices to mitigate the negative impact of stressors (e.g., nutrients, sediment, altered hydrology) to improve MIBI.	SWQ-G.2	Implementation of 40 projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)

Table 3-3 Measurable Goals for the Lower Minnesota River West Comprehensive Watershed Management Plan

Issue Area	Subwatershed	Specific Issue, Pollutant, or Stressor	Long-term Goal	10-year Goal	10-year Goal ID	10-year Goal Measures
Degraded Surface Water Quality	North Branch Rush River	Phosphorus (Titlow Lake)	Meet Western Corn Belt Plains water quality standards in Titlow Lake (TP<90 ug/L, chl a<30 ug/L, SD>0.7 m) by reducing total phosphorus loading by 82% (see TMDL)	Implement structural and non-structural projects and practices to reduce watershed TP loading to Titlow Lake by 7.2 lbs/year (as estimated at field scale)	SWQ-A.3a	3 implemented projects; Titlow Lake watershed TP load reduction of 7.2 lbs/year (as estimated at field scale)
Degraded Surface Water Quality	North Branch Rush River	Phosphorus (Indian Lake)	Continue to meet Western Corn Belt Plains water quality standards in Indian Lake (TP<90 ug/L, chl a<30 ug/L, SD>0.7 m)	Implement structural and non-structural projects and practices to reduce watershed TP loading to Indian Lake by 2.4 lbs/year (as estimated at field scale)	SWQ-A.3b	1 implemented projects; Indian Lake watershed TP load reduction of 2.4 lbs/year (as estimated at field scale)
Degraded Surface Water Quality	North Branch Rush River	Phosphorus	Reduce phosphorus loading by 45% (from average 1980-1996 conditions) by 2040; (45% reduction equals 51,300 lbs/year TP based on HSPF watershed loading estimates)	Implement structural and non-structural projects and practices to reduce watershed TP loading by 179 lbs/year (as estimated at field scale) and 163 lbs/year in the North Branch Rush River	SWQ-B.3	40 implemented projects; watershed TP load reduction of 179 lbs/year (as estimated at field scale) and 163 lbs/year in the North Branch Rush River
Degraded Surface Water Quality	North Branch Rush River	Total Suspended Solids	Reduce TSS concentrations to <10% of samples exceeding 65 mg/L (April 1 – September 30) by achieving loading capacity identified in the Lower Minnesota River TMDL (see TMDL)	Implement structural and non-structural projects and practices to reduce watershed sediment loading by 22 tons/year (as estimated at field scale) and 23 tons/year in the North Branch Rush River	SWQ-C.3	40 implemented projects; watershed sediment load reduction of 22 tons/year (as estimated at field scale) and 23 tons/year in the North Branch Rush River
Degraded Surface Water Quality	North Branch Rush River	Nitrate	Reduce total nitrogen loading by 45% (from average 1980-1996 conditions) by 2040; (45% reduction equals 1,190,000 lbs/year TN based on HSPF watershed loading estimates)	Implement structural and non-structural projects and practices to reduce watershed TN loading by 6800 lbs/year (as estimated at field scale) and 9300 lbs/year in the North Branch Rush River	SWQ-D.3	40 implemented projects; watershed TN load reduction of 6800 lbs/year (as estimated at field scale) and 9300 lbs/year in the North Branch Rush River
Degraded Surface Water Quality	North Branch Rush River	*E. coli*	Reduce *E. coli* concentrations in the North Branch Rush River and tributary streams to monthly geometric means <126 CFU/100 mL (April 1 - October 31)	Reduce *E. coli* loading through management of SSTS, un-sewered discharges, and feedlots	SWQ-E.3	Implementation of projects and practices to address non-functioning SSTS (250 over 10 years watershed-wide), and animal waste management facilities (20 over 10 years watershed-wide); see Implementation Schedule
Degraded Surface Water Quality	North Branch Rush River	Fish Index of Biological Integrity	Achieve applicable Fish Indices of Biological Integrity for streams (see Figure A-17): - Low gradient streams, modified use (FIBI = 15) - Southern headwaters, modified use (FIBI = 33) - Southern headwaters, general use (FIBI = 55) - Southern streams, modified use (FIBI = 35)	Implement structural and non-structural practices to mitigate the negative impact of stressors (e.g., nutrients, sediment, altered hydrology) to improve FIBI.	SWQ-F.3	Implementation of 40 projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)
Degraded Surface Water Quality	North Branch Rush River	Macroinvertebrate Index of Biological Integrity	Achieve applicable Macroinvertebrate Indices of Biological Integrity for streams (see Figure A-16): - Prairie streams, modified use (MIBI = 22) - Southern streams, general use (MIBI = 37)	Implement structural and non-structural practices to mitigate the negative impact of stressors (e.g., nutrients, sediment, altered hydrology) to improve MIBI.	SWQ-G.3	Implementation of 40 projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)

Table 3-3 Measurable Goals for the Lower Minnesota River West Comprehensive Watershed Management Plan

Issue Area	Subwatershed	Specific Issue, Pollutant, or Stressor	Long-term Goal	10-year Goal	10-year Goal ID	10-year Goal Measures
Degraded Surface Water Quality	Middle Branch Rush River (prior to confluence with other branches)	Phosphorus	Reduce phosphorus loading by 45% (from average 1980-1996 conditions) by 2040; (45% reduction equals 51,700 lbs TP/year based on HSPF watershed loading estimates)	Implement structural and non-structural projects and practices to reduce watershed TP loading by 312 lbs/year (as estimated at field scale) and 260 lbs/year in the Middle Branch Rush River	SWQ-B.4	40 implemented projects; watershed TP load reduction of 312 lbs/year (as estimated at field scale) and 260 lbs/year in the Middle Branch Rush River
		Total Suspended Solids	Reduce TSS concentrations to <10% of samples exceeding 65 mg/L (April 1 – September 30) by achieving loading capacity identified in the Zumbro River TMDL (see TMDL)	Implement structural and non-structural projects and practices to reduce watershed sediment loading by 53 tons/year (as estimated at field scale) and 23 tons/year in the Middle Branch Rush River	SWQ-C.4	40 implemented projects; watershed sediment load reduction of 53 tons/year (as estimated at field scale) and 23 tons/year in the Middle Branch Rush River
		Nitrate	Reduce total nitrogen loading by 45% (from average 1980-1996 conditions) by 2040; (45% reduction equals 1,236,000 lbs/year TN based on HSPF watershed loading estimates)	Implement structural and non-structural projects and practices to reduce watershed TN loading by 12000 lbs/year (as estimated at field scale) and 12400 lbs/year in the Middle Branch Rush River	SWQ-D.4	40 implemented projects; watershed TN load reduction of 12000 lbs/year (as estimated at field scale) and 12400 lbs/year in the Middle Branch Rush River
		E. coli	Reduce *E. coli* concentrations in the Middle Branch Rush River and tributary streams to monthly geometric means <126 CFU/100 mL (April 1 - October 31)	Reduce *E. coli* loading through management of SSTS, un-sewered discharges, and feedlots	SWQ-E.4	Implementation of projects and practices to address non-functioning SSTS (250 over 10 years watershed-wide), and animal waste management facilities (20 over 10 years watershed-wide); see Implementation Schedule
		Fish Index of Biological Integrity	Achieve applicable Fish Indices of Biological Integrity for streams (see Figure A-17): - Low gradient streams, modified use (FIBI = 15) - Low gradient streams, general use (FIBI = 42) - Southern headwaters, modified use (FIBI = 33) - Southern headwaters, general use (FIBI = 55) - Southern streams, modified use (FIBI = 35) - Southern streams, general use (FIBI = 50) - Southern Rivers, general use (FIBI = 49)	Implement structural and non-structural practices to mitigate the negative impact of stressors (e.g., nutrients, sediment, altered hydrology) to improve FIBI.	SWQ-F.4	Implementation of 40 projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)
		Macroinvertebrate Index of Biological Integrity	Achieve applicable Macroinvertebrate Indices of Biological Integrity for streams (see Figure A-16): - Prairie streams, modified use (MIBI = 22) - Southern streams, modified use (MIBI = 24) - Southern streams, general use (MIBI = 37)	Implement structural and non-structural practices to mitigate the negative impact of stressors (e.g., nutrients, sediment, altered hydrology) to improve MIBI.	SWQ-G.4	Implementation of 40 projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)

Table 3-3 Measurable Goals for the Lower Minnesota River West Comprehensive Watershed Management Plan

Issue Area	Subwatershed	Specific Issue, Pollutant, or Stressor	Long-term Goal	10-year Goal	10-year Goal ID	10-year Goal Measures
Degraded Surface Water Quality	South Branch Rush River	Phosphorus (Clear Lake)	Meet Western Corn Belt Plains water quality standards in Clear Lake (TP<90 ug/L, chl a<30 ug/L, SD>0.7 m) by reducing total phosphorus loading by 50% (see TMDL)	Implement structural and non-structural projects and practices to reduce watershed TP loading to Clear Lake by 8.9 lbs/year (as estimated at field scale)	SWQ-A.5	3 implemented projects; Clear Lake watershed TP load reduction of 8.9 lbs/year (as estimated at field scale)
		Phosphorus	Reduce phosphorus loading by 45% (from average 1980-1996 conditions) by 2040; (45% reduction equals 61,700 lbs/year TP based on HSPF watershed loading estimates)	Implement structural and non-structural projects and practices to reduce watershed TP loading by 378 lbs/year (as estimated at field scale) and 314 lbs/year in the South Branch Rush River	SWQ-B.5	40 implemented projects; watershed TP load reduction of 378 lbs/year (as estimated at field scale) and 314 lbs/year in the South Branch Rush River
		Total Suspended Solids	Reduce TSS concentrations to <10% of samples exceeding 65 mg/L (April 1 – September 30) by reducing TSS loading in the watershed	Implement structural and non-structural projects and practices to reduce watershed sediment loading by 65 tons/year (as estimated at field scale) and 46 tons/year in the South Branch Rush River	SWQ-C.5	40 implemented projects; watershed sediment load reduction of 65 tons/year (as estimated at field scale) and 46 tons/year in the South Branch Rush River
		Nitrate	Reduce total nitrogen loading by 45% (from average 1980-1996 conditions) by 2040; (45% reduction equals 1,304,000 lbs/year TN based on HSPF watershed loading estimates)	Implement structural and non-structural projects and practices to reduce watershed TN loading by 14300 lbs/year (as estimated at field scale) and 14700 lbs/year in the South Branch Rush River	SWQ-D.5	40 implemented projects; watershed TN load reduction of 14300 lbs/year (as estimated at field scale) and 14700 lbs/year in the South Branch Rush River
		E. coli	Reduce *E. coli* concentrations in the South Branch Rush River and tributary streams to monthly geometric means <126 CFU/100 mL (April 1 - October 31)	Reduce *E. coli* loading through management of SSTS, un-sewered discharges, and feedlots	SWQ-E.5	Implementation of projects and practices to address non-functioning SSTS (250 over 10 years watershed-wide), and animal waste management facilities (20 over 10 years watershed-wide); see Implementation Schedule
		Fish Index of Biological Integrity	Achieve applicable Fish Indices of Biological Integrity for streams (see Figure A-17): - Low gradient streams, modified use (FIBI = 15) - Low gradient streams, general use (FIBI = 42) - Southern headwaters, modified use (FIBI = 33) - Southern headwaters, general use (FIBI = 55) - Southern streams, modified use (FIBI = 35) - Southern streams, general use (FIBI = 50)	Implement structural and non-structural practices to mitigate the negative impact of stressors (e.g., nutrients, sediment, altered hydrology) to improve FIBI.	SWQ-F.5	Implementation of 40 projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)
		Macroinvertebrate Index of Biological Integrity	Achieve applicable Macroinvertebrate Indices of Biological Integrity for streams (see Figure A-16): - Prairie streams, modified use (MIBI = 22) - Prairie streams, general use (MIBI = 41) - Southern streams, modified use (MIBI = 24) - Southern streams, general use (MIBI = 37)	Implement structural and non-structural practices to mitigate the negative impact of stressors (e.g., nutrients, sediment, altered hydrology) to improve MIBI.	SWQ-G.5	Implementation of 40 projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)

Table 3-3 Measurable Goals for the Lower Minnesota River West Comprehensive Watershed Management Plan

Issue Area	Subwatershed	Specific Issue, Pollutant, or Stressor	Long-term Goal	10-year Goal	10-year Goal ID	10-year Goal Measures
Degraded Surface Water Quality	Minnesota River (Le Sueur and Belle Plaine subwatersheds)	Phosphorus	Reduce phosphorus loading by 45% (from average 1980-1996 conditions) by 2040; (45% reduction equals 8,100 lbs/year TP based on HSPF watershed loading estimates)	Implement structural and non-structural projects and practices to reduce watershed TP loading to the Minnesota River by 503 lbs/year (as estimated at field scale) from the Le Sueur and Belle Plaine subwatersheds	SWQ-B.6	40 implemented projects; watershed TP load reduction of 503 lbs/year to the Minnesota River from the Le Sueur and Belle Plaine watersheds
		Total Suspended Solids	Reduce TSS concentrations to <10% of samples exceeding 65 mg/L (April 1 – September 30) by reducing TSS loading in the watershed	Implement structural and non-structural projects and practices to reduce watershed sediment loading to Lake Pepin by 123 tons/year (as estimated at field scale) from the Le Sueur and Belle Plaine subwatershed	SWQ-C.6	40 implemented projects; watershed sediment load reduction of 123 tons/year to the Minnesota River from the Le Sueur and Belle Plaine watersheds
		Nitrate	Reduce total nitrogen loading by 45% (from average 1980-1996 conditions) by 2040; (45% reduction equals 186,000 lbs/year TN based on HSPF watershed loading estimates)	Implement structural and non-structural projects and practices to reduce watershed TN loading to Lake Pepin by 17700 lbs/year (as estimated at field scale) from the Le Sueur and Belle Plaine subwatershed	SWQ-D.6	40 implemented projects; watershed TN load reduction of 17700 lbs/year to the Minnesota River from the Le Sueur and Belle Plaine watersheds
		E. coli	Reduce *E. coli* concentrations in the Minnesota River and tributary streams to monthly geometric means <126 CFU/100 mL (April 1 - October 31)	Reduce *E. coli* loading through management of SSTS, un-sewered discharges, and feedlots	SWQ-E.6	Implementation of projects and practices to address non-functioning SSTS (250 over 10 years watershed-wide), and animal waste management facilities (20 over 10 years watershed-wide); see Implementation Schedule
		Fish Index of Biological Integrity	Achieve applicable Fish Indices of Biological Integrity for streams (see Figure A-17): - Southern headwaters, modified use (FIBI = 33) - Southern headwaters, general use (FIBI = 55)	Implement structural and non-structural practices to mitigate the negative impact of stressors (e.g., nutrients, sediment, altered hydrology) to improve FIBI.	SWQ-F.6	Implementation of 40 projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)
		Macroinvertebrate Index of Biological Integrity	Achieve applicable Macroinvertebrate Indices of Biological Integrity for streams (see Figure A-16): - Prairie streams, modified use (MIBI = 22) - Southern streams, general use (MIBI = 37)	Implement structural and non-structural practices to mitigate the negative impact of stressors (e.g., nutrients, sediment, altered hydrology) to improve MIBI.	SWQ-G.6	Implementation of 40 projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)

4 Targeting Practices and Pollutant Reductions

The Partnership prioritized geographic areas at the subwatershed scale (see Section 0) to focus its actions. Within prioritized spatial areas, additional analyses are needed to identify, ground-truth, and prioritize individual project opportunities at a finer scale (i.e., project targeting). During Plan development, the Steering Team and Advisory Committee used a GIS-based terrain analysis to identify priority project opportunities. These priority project locations are presented in Figure 4-1. The Partnership also used the HSPF-SAM tool to estimate pollutant reductions achievable by implementing water quality best management practices (BMPs) at these locations and potential pollutant reductions achievable with more widespread adoption of BMPs throughout the planning area.

4.1 Digital Terrain Analysis and Project Siting

Digital terrain analysis was performed throughout the planning area to identify potential project locations. This analysis includes the development and application of a hydro-conditioned digital elevation model (i.e., topography data adjusted to accurately reflect drainage direction), used in conjunction with soils and existing infrastructure and BMP data. The analysis identifies catchment outlet locations where erosion is likely and beneficial field practices (e.g., filter strips, water and sediment control basins) may be implemented, as well as the area tributary to each location. Because the terrain analysis focuses on areas of concentrated drainage, locations identified by terrain analysis also include possible flood storage locations within the watershed.

Digital terrain analysis identified approximately 800 potential project locations within the planning area. Potential project locations are presented watershed wide in Figure 4-1; Figure 4-2 presents a higher resolution example of this data. Desktop analysis using GIS datasets provides a useful screening tool. However, field verification of potential project locations is ultimately necessary to determine feasibility and project design, as well as verify that existing, un-mapped BMPs are not already present. Because the terrain analysis is based on topography and drainage patterns, it may not identify potential issues within tiled systems where the drainage routes are not visible to a desktop analysis. Local knowledge of drainage systems from the planning Partners is necessary to maintain an inventory of potential problems and opportunities.

The partnership may not address all potential project locations within the next 10 years. Some locations may not offer feasible construction options, while other priority locations may be discovered following Plan adoption. The implementation schedule (see Table 5-4) lays out an estimated schedule for executing projects within priority watersheds. The estimated number, benefit, and cost of projects anticipated to be implemented at these locations are included in Table 4-1. The project locations in Figure 4-1 represent potential opportunities that the Partners may draw on as opportunities dictate. Future progress assessments and resource assessments may alter priorities or identify additional project locations.

4.2 Estimating Benefits and Costs of Water Quality Practices – Field Scale

HSPF modeling of the Lower Minnesota River watershed, including the Lower Minnesota River West planning area, was performed in support of the *Lower Minnesota River Watershed Restoration and Protection Strategy* (WRAPS) study (MPCA, February 2020). HSPF modeling provides estimates of pollutant loading from the landscape (see Section A.9.6). The HSPF modeling considers the presence of existing BMPs, land use, and other factors affecting pollutant loading. Additional information about the HSPF modeling is available in the Lower Minnesota River WRAPS report.

HSPF water quality modeling output and digital terrain analysis were combined to estimate the potential benefit and cost of projects implemented at the locations shown in Figure 4-1, as described in the following sections.

4.2.1 Estimated Pollutant Loading to Proposed BMP Locations

The HSPF modeling performed for the planning area provides unit area (i.e., per acre) estimates of total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS) loading rates as presented in Figure A-20, Figure A-21, and Figure A-22, respectively. Watersheds used in the HSPF model were aggregated to the six planning subwatersheds to estimate an area-weighted average pollutant loading for each planning subwatershed as presented in Table 4-1. The numbers of potential project, as estimated from digital terrain analysis, are also included in Table 4-1.

Table 4-1 Estimated pollutant loading aggregated to planning subwatersheds

Planning Subwatershed	Total Area (acres)	Sediment loading[1] (tons/acre/yr)	TP loading[1] (lbs/acre/yr)	TN loading[1] (lbs/acre/yr)	Potential BMP Locations[3]	Treated Area (acres)
High Island Creek	154,200	0.043	0.50	18.7	368	7,360
Minnesota River Direct	54,770	0.050	0.41	14.4	186	3,720
NE Sibley/Bevens Creek	31,670	0.032	0.51	17.6	15	300
North Branch Rush River	63,350	0.024	0.40	15.3	50	1,000
Middle Branch Rush River	76,470	0.039	0.46	17.5	132	2,640
South Branch Rush River	117,940	0.043	0.50	18.7	77	1,540
Total	**498,400**	**0.040**	**0.47**	**17.6**	**828**	**16,560**

(1) Unit area pollutant loading is based on HSPF model results for TN, TP, and TSS and aggregated to planning subwatershed level using an area weighted average.
(2) Potential project locations identified in Figure 4-1.

The data presented in Table 4-1 is aggregated to six planning subwatersheds. The HSPF model includes 85 subwatersheds wholly or partially within the planning area, each with unique estimates of sediment, total nitrogen, and total phosphorus loading from the landscape. Subwatershed-specific estimates of sediment, total nitrogen, and total phosphorus loading to each potential project location are useful for tracking the estimated benefit of constructed projects (see Section 4.4) but are not presented in this report. When planned and/or constructed practices are incorporated into the HSPF model in future analyses, subwatershed-specific pollutant loading rates and associated pollutant removals will be applied within the model (see Section 4.4).

The terrain analysis initially performed using GIS identified an uncharacteristically low tributary area to potential project locations (1,540 acres – or approximately 2 acres of drainage to each project). This may be due to the presence of upstream drain tile that does not appear within the GIS-based drainage network. First-hand experience from Steering Team members suggests that typical project drainage areas range between 5 and 40 acres. Therefore, an average drainage area of 20 acres per project was assumed for this analysis (see Table 4-1).

Site visits and field verification is necessary to verify the drainage area to potential projects to ensure proper sizing of any BMPs. Under- or over-estimation of the drainage area tributary to potential BMPs may result in inaccurate estimates of pollutant reduction as well as estimated project cost (as the size of the BMP is proportional to the drainage area) (see Section 4.2.2).

4.2.2 Potential Pollutant Reduction (estimated at field scale) and Associated Costs – Targeted BMPs

Estimated reductions in pollutant loading that may be achieved by implementing BMPs at locations shown in Figure 4-1 was estimated using values from the *Documentation of the BMP Database Available in the Scenario Application Manager* (RESPEC, 2017). The Scenario Application Manager (SAM) is a publicly available tool to estimate and aggregate pollutant reduction from various BMPs. A subset of the BMPs included in SAM applicable to the planning area were selected and grouped by type as presented in Table 4-2.

The terrain analysis identifies potential project locations but does not specify the type of project to be implemented (see Section 4.1). A range of applicable BMP types may be implemented at many of the individual proposed BMP locations identified in Figure 4-1 or additional sites yet to be identified. At the planning stage, the site-specific BMPs are not yet identified.

Therefore, an approximate average pollutant removal efficiency was assumed for each pollutant based on the six BMP groups presented in Table 4-2. The pollutant reductions achieved will ultimately depend on the specific BMPs implemented and the subwatershed-specific pollutant loading characteristics. During Plan implementation, the Partners will consider local pollutant loading characteristics in promoting specific BMP types to cooperating landowners to maximize project benefit (e.g., focusing on saturated buffers or other BMPs effective at removing nitrate in subwatersheds with high nitrogen loading).

The Partners understand that many treatment-oriented BMPs (e.g., WASCBs) have limited nitrogen/nitrate reduction potential. To address this, additional source control and pollution prevention activities are included in the implementation schedule (e.g., development of fertilizer management plans, see Table 5-4.

The estimated total pollutant load reduction for each pollutant in a given catchment (i.e., area tributary to a BMP) is estimated as:

$$\Delta W_j = \sum_{n}^{i} A_i * W_{i,j} * \%_{reduction\ j}$$

Where:	ΔW_j	=	total change in load of pollutant *j*
	A_i	=	area tributary to BMP i
	$W_{i,j}$	=	unit area load of pollutant *j* tributary to BMP i
	%reduction j	=	approximate average removal efficiency for pollutant j
	n	=	*number of BMPs located within the catchment*

Table 4-3 presents an example of this analysis applied in the High Island Creek planning subwatershed, which includes 368 potential BMP locations. The analysis presented herein assumes an average project drainage area of 20 acres, resulting in a cumulative treated area of 7,360 acres.

Average costs associated with potential BMPs are derived from the SAM documentation and summarized in Table 4-2. An additional 50% is added to account for engineering and design, permitting, maintenance, and other associated costs that are excluded from the cost values included in the SAM documentation (RESPEC, 2017). The average BMP costs included in Table 4-2 may be suitable for estimating the costs of larger projects but may underestimate the cost of smaller projects. For planning purposes, an estimated project cost of $1,000 per treated acre was assumed for the potential project locations identified in Figure 4-1 – this is greater than the average presented in Table 4-2 and is intended to include costs for design, engineering, and increases in costs since the SAM documentation was developed.

Table 4-2 Summary of BMP pollutant removal efficiencies and unit costs

BMP Group	Specific BMP	Average TN Reduction (%)			Average TP Reduction (%)			Average Sediment Reduction (%)	Approx. cost per treated acre[4] (excluding engineer., design, etc.)
		Surface[1]	Tile Drainage[1]	Groundwater[1]	Surface[1]	Tile Drainage[1]	Groundwater[2]	Surface Runoff[1]	
Nutrient Management	Nutrient Management	0	12	12	4	0	3	0	$90
	Nutrient Management and Manure Incorporation	10	14	14	13	0	8	0	
Tile Management	Controlled Tile Drainage	0	43	0	0	43	16	0	$220
	Alternative Tile Intakes	66	0	0	66	0	25	90	
Buffers & Filter Strips	Riparian Buffers, 16 ft wide (replacing row crops)	43	0	35	50	0	28	74	$20
	Riparian Buffers, 50 ft wide (replacing row crops)	66	0	35	67	0	38	84	
	Riparian Buffers, 100 ft wide (replacing row crops)	79	0	35	80	0	46	90	
	Filter Strips, 50 ft wide (cropland field edge)	66	0	35	67	0	38	84	
	Riparian Buffers, 50 ft wide (replacing pasture)	44	0	23	45	0	28	50	
Crop Management	Conservation Crop Rotation	42	42	42	44	0	17	75	$600
	Conservation Cover Perennials	91	93	93	84	0	48	96	
	Corn & Soybeans with Cover Crop	28	28	28	29	0	16	74	
	Short-Season Crops to Cover Crop	43	43	43	29	0	16	74	
	Corn & Soybeans to Rotational Grazing	75	75	75	59	0	16	75	
Till Practices	Reduced Tillage (30% + residue cover)	33	0	0	33	0	19	50	$130
	Reduced Tillage (no till)	79	0	0	68	0	38	80	
WASCB	Water and Sediment Control Basin (cropland)	82	0	0	85	0[3]	0[3]	90	$50
Average		**~30%**			**~30%**			**~60%**	**$180**

Notes:

(1) Pollutant removal efficiencies are based on Table A1 of SAM BMP Reference Manual (RESPEC, 2017);

(2) Pollutant removal efficiencies not included in Table A1 of SAM BMP Reference Manual (RESPEC, 2017) and are based on Table 6-2 of the same document;

(3) WASCB total phosphorus removal efficiencies for tile drainage and groundwater are based on MPCA communications;

(4) Estimated costs are present value assuming 10-year lift extrapolated based on Table 5-1 of SAM BMP Reference Manual (RESPEC, 2017). Costs derived from this source are not intended to represent 100% of the total costs of implementing a practice and do not include operation and maintenance costs or design and construction oversight expenses.

Table 4-3 Summary of estimated pollutant removal in the High Island Creek planning subwatershed

Pollutant	Watershed Area (acres)	Treated Area (acres)	Total Pollutant Load[1]	Total Load to all potential BMPs[1]	Total Reduction from BMPs	Reduction per BMP location[2]
Total Nitrate	154,200	7,360	2,889,706 lbs/yr 18.7 lbs/ac/yr	137,900	41,400 lbs/yr 5.6 lbs/ac/yr	112 lbs/yr
Total Phosphorus	154,200	7,360	76,404 lbs/yr 0.50 lbs/ac/yr	3,650 lbs/yr	1,090 lbs/yr 0.15 lbs/ac/yr	3.0 lbs/yr
Sediment	154,200	7,360	6,586 tons/yr 0.043 tons/ac/yr	314 tons/yr	189 tons/yr 0.026 tons/ac/yr	0.51 tons/yr

(1) Sediment, TN, and TP loading based on HSPF model results
(2) Assumes an average of 20 acres of treated area per BMP location

4.2.3 Establishing Field Scale Pollutant Load Reduction Goals for Subwatersheds

The methods described in Section 4.2.2 provide estimates of pollutant loading, pollutant reduction, and associated cost averaged over a range of possible BMP types implemented at the locations identified in Figure 4-1. The locations identified in Figure 4-1 and their respective drainage areas, however, represent only part of the watershed improvement actions planned by the Partners over the next 10 years. In practice, water quality improvement practices may not be implemented at all locations identified in Figure 4-1, while additional projects may be identified at other locations with different pollutant loading and spatial characteristics.

In addition to these targeted projects, the Partners' implementation schedule (see Table 5-4) includes activities seeking to expand the use of cover crops, perennial vegetation, and other soil health practices with pollutant reduction potential (see Item ESC-4 in Table 5-4). The method described in Section 4.2.2 was applied to estimate cumulative field scale pollutant reductions resulting from multiple implementation actions using estimated total treatment area in each of the six planning subwatersheds (including those areas tributary to the project locations shown in Figure 4-1). The resulting pollutant load reductions are presented in Table 4-4. Results for the Middle Branch Rush River correspond to the drainage area upstream of the confluence with the South Branch Rush River

Table 4-4 Estimated cumulative field scale pollutant reductions by planning subwatershed

Planning Subwatershed	Total Area (acres)	Estimated treated area (acres)	Sediment load reduction[1] (tons/yr)	TP load reduction[1] (lbs/yr)	TN load reduction[1] (lbs/yr)
High Island Creek	154,200	8,560	219	1,272	48,124
Minnesota River Direct	54,770	4,120	123	503	17,743
NE Sibley/Bevens Creek	31,670	600	11	110	3,755
North Branch Rush River	63,350	1,500	22	179	6,875
Middle Branch Rush River[2]	55,744[2]	2,400[2]	53	312	12,009
South Branch Rush River	117,940	2,540	65	378	14,280
Rush River (at outlet)[3]	257,760	7,280	162	1,000	38,179
Total	**498,400**	**20,560**	**516**	**2,885**	**107,800**

(1) Unit area pollutant loading is based on HSPF model results for TN, TP, and TSS and aggregated to planning subwatershed level using an area weighted average.
(2) Reflects drainage area and treated area located upstream of confluence with other Rush River branches
(3) Includes area downstream of branch confluence not otherwise accounted for in North, Middle, or South branch rows.

The estimated pollutant load reductions presented in Table 4-4 represent the estimated reduction from implementation activities identified in Table 5-4. These values are also the basis for the pollutant load reduction goals presented according to planning subwatershed in Table 3-3.

4.3 Estimating Resource-specific Pollutant Load Reductions

The method described in Sections 4.2.2 and utilized in Section 4.2.3 allow the Partners to estimate the potential pollutant reduction achieved by a BMP at the point of implementation (i.e., field scale). These reductions may be summed to estimate the total pollutant load reduction at field scale. However, this method does not accurately reflect the cumulative pollutant reduction achieved at a location downstream in (or beyond) the catchment or planning subwatershed. Modeling tools that consider the spatial location of BMPs and flow routing are necessary to realistically estimate cumulative pollutant load reductions (and corresponding pollutant concentrations) in streams, lakes, and other resources located downstream of the implemented BMP(s).

4.3.1 In-resource Pollutant Reduction Points of Analysis

The Partnership used the HSPF-SAM watershed assessment tool to estimate the cumulative in-stream pollutant load reduction at the outlets of:

- High Island Creek
- Rush River
    - North Branch Rush River (before the confluence with Middle Branch Rush River)
    - Middle Branch Rush River (before the confluence with North Branch Rush River)
    - South Branch Rush River (before the confluence with the Middle Branch Rush River

And in the following streams at the approximate planning area boundary (the outlet of the HSPF subwatershed located at the planning area boundary):

- Bevens Creek
- Silver Creek

These locations are presented in Figure 4-1. The nature of the Minnesota River direct drainage planning subwatershed (see Figure 4-1) and construction of the HSPF-SAM model prevent the direct calculation of an in-stream pollutant reduction from this planning subwatershed or the Minnesota River as a whole. However, the sum of the pollutant reductions from the above watershed outlet points provides an approximation of the cumulative pollutant reduction within the planning area.

4.3.2 Estimating In-resource pollutant reductions using HSPF

The HSPF-SAM tool allows the user to select the type of BMP and extent of implementation (e.g., acres, stream reach length) applied to each planning subwatershed to evaluate potential future implementation scenarios. Multiple BMPs may be applied to each planning subwatershed, and the user may adjust BMP treatment effectiveness if so desired.

At the planning level, the specific type and number of BMPs to be implemented is unknown. It is assumed that many of the practices implemented will be some combination of the following practices:

- Nutrient management
- Controlled tile drainage
- Alternative tile intakes
- Cover crops
- Reduced tillage
- Grade stabilization (approximated as Water and sediment control basins (WASCBs) in HSPF-SAM)
- Wetland restoration (not included as BMP in HSPF-SAM)

For each of the above BMPs (excluding wetland restoration), two HSPF-SAM scenarios were run assuming 1) 40% of the applicable area was treated with the BMP, and 2) 60% of the applicable area was treated with the BMP.

The pollutant removal efficiencies used in each HSPF-SAM model run were set to the values presented in Table 4-2 – note that these removal efficiencies are based on Table A.1 of the HSPF-SAM BMP Reference Manual (RESPEC, 2017) and represents lower nitrogen removal efficiencies for tiled areas than the default values of the HSPF-SAM model for similar BMPs. The treated area and pollutant loading output from these model runs were used to determine a "per treated acre" pollutant reduction for each BMP type as estimated at each of the analysis points listed in Section 4.3.1. The results are presented in Table 4-5.

Table 4-5 Estimated sediment reduction per upstream treated acre (in-resource)

Point of Analysis	Total Area[1] (acres)	TSS load reduction (tons/year) per treated upstream acre					
		Nutrient management	Controlled tile drainage	Alternative tile intakes	Cover Crops (corn/soybean)	Reduced tillage (30%)	WASCB
High Island Creek	154,200	--	--	0.031	0.027	0.018	0.032
North Branch Rush River	63,350	--	--	0.028	0.023	0.015	0.027
Middle Branch Rush River	55,744	--	--	0.017	0.014	0.009	0.017
South Branch Rush River	117,940	--	--	0.030	0.026	0.019	0.034
Rush River Outlet	257,802	--	--	0.026	0.023	0.016	0.029
Bevens Creek	28,460	--	--	0.036	0.029	0.020	0.036
Silver Creek	7,890	--	--	0.057	0.047	0.031	0.057

(1) Drainage area to the point of analysis (see Figure 4-1)

Table 4-6 Estimated total phosphorus reduction per upstream treated acre (in-resource)

Point of Analysis	Total Area[1] (acres)	TP load reduction (lbs/year) per treated upstream acre					
		Nutrient management	Controlled tile drainage	Alternative tile intakes	Cover Crops (corn/soybean)	Reduced tillage (30%)	WASCB
High Island Creek	154,200	0.013	0.095	0.142	0.077	0.091	0.229
North Branch Rush River	63,350	0.013	0.102	0.152	0.080	0.082	0.223
Middle Branch Rush River	55,744	0.013	0.100	0.157	0.075	0.085	0.221
South Branch Rush River	117,940	0.015	0.112	0.171	0.087	0.101	0.256
Rush River Outlet	257,802	0.014	0.106	0.160	0.082	0.092	0.241
Bevens Creek	28,460	0.013	0.092	0.145	0.079	0.083	0.226
Silver Creek	7,890	0.026	0.206	0.299	0.158	0.183	0.466

(1) Drainage area to the point of analysis (see Figure 4-1)

Table 4-7 Estimated total nitrogen reduction per upstream treated acre (in-resource)

Point of Analysis	Total Area[1] (acres)	TN load reduction (lbs/year) per treated upstream acre					
		Nutrient management	Controlled tile drainage	Alternative tile intakes	Cover Crops (corn/soybean)	Reduced tillage (30%)	WASCB
High Island Creek	154,200	1.9	5.9	8.9	3.8	4.6	11.3
North Branch Rush River	63,350	2.0	6.3	9.4	4.0	4.5	11.1
Middle Branch Rush River	55,744	1.6	5.1	7.8	3.2	3.9	9.5
South Branch Rush River	117,940	1.8	5.7	8.7	3.6	4.3	10.6
Rush River Outlet	257,802	1.8	5.7	8.6	3.6	4.2	10.4
Bevens Creek	28,460	1.7	5.2	8.1	3.4	4.1	10.2
Silver Creek	7,890	2.7	8.3	12.8	5.5	6.7	16.4

(1) Drainage area to the point of analysis (see Figure 4-1)

An average of the BMP unit-area pollutant reduction within each planning area was multiplied by the estimated acres treated during the 10-year Plan implementation (according to the implementation schedule, see Table 5-4) in order to calculate the cumulative, in-resource pollutant reduction at the points of analysis listed in Section 4.3.1. The estimated pollutant reductions for total phosphorus, total suspended solids, and total nitrogen for each planning subwatershed, are presented in Table 4-8 and in Table 3-3 as "10-year Plan Goals."

Table 4-8 Estimated pollutant reductions at analysis points (in-resource)

Point of Analysis	Total Area[1] (acres)	Treated Area[1] (acres)	Average pollutant reduction per treated acre			Cumulative pollutant reduction (mass/year)		
			TSS (tons/yr)	TP (lbs/yr)	TN (lbs/yr)	TSS (tons/yr)	TP (lbs/yr)	TN (lbs/yr)
High Island Creek	154,200	8,560	0.018	0.108	6.06	153.0	924	51,880
North Branch Rush River	63,350	1,500	0.015	0.108	6.21	23.1	163	9,310
Middle Branch Rush River	55,744	2,400	0.009	0.109	5.18	22.7	260	12,420
South Branch Rush River	117,940	2,540	0.018	0.124	5.79	45.8	314	14,690
Rush River Outlet	257,802	7,280	0.016	0.116	5.73	114.2	844	41,730
Bevens Creek	28,460	450	0.020	0.106	5.46	9.1	47.8	2,460
Silver Creek	7,890	150	0.032	0.223	8.73	4.8	33.5	1,310

(1) Area are those located upstream of points of analyses – thus total area and treated area may be less than the planning area or total treated area, respectively.

4.4 Tracking Pollutant Reduction Benefits through Implementation

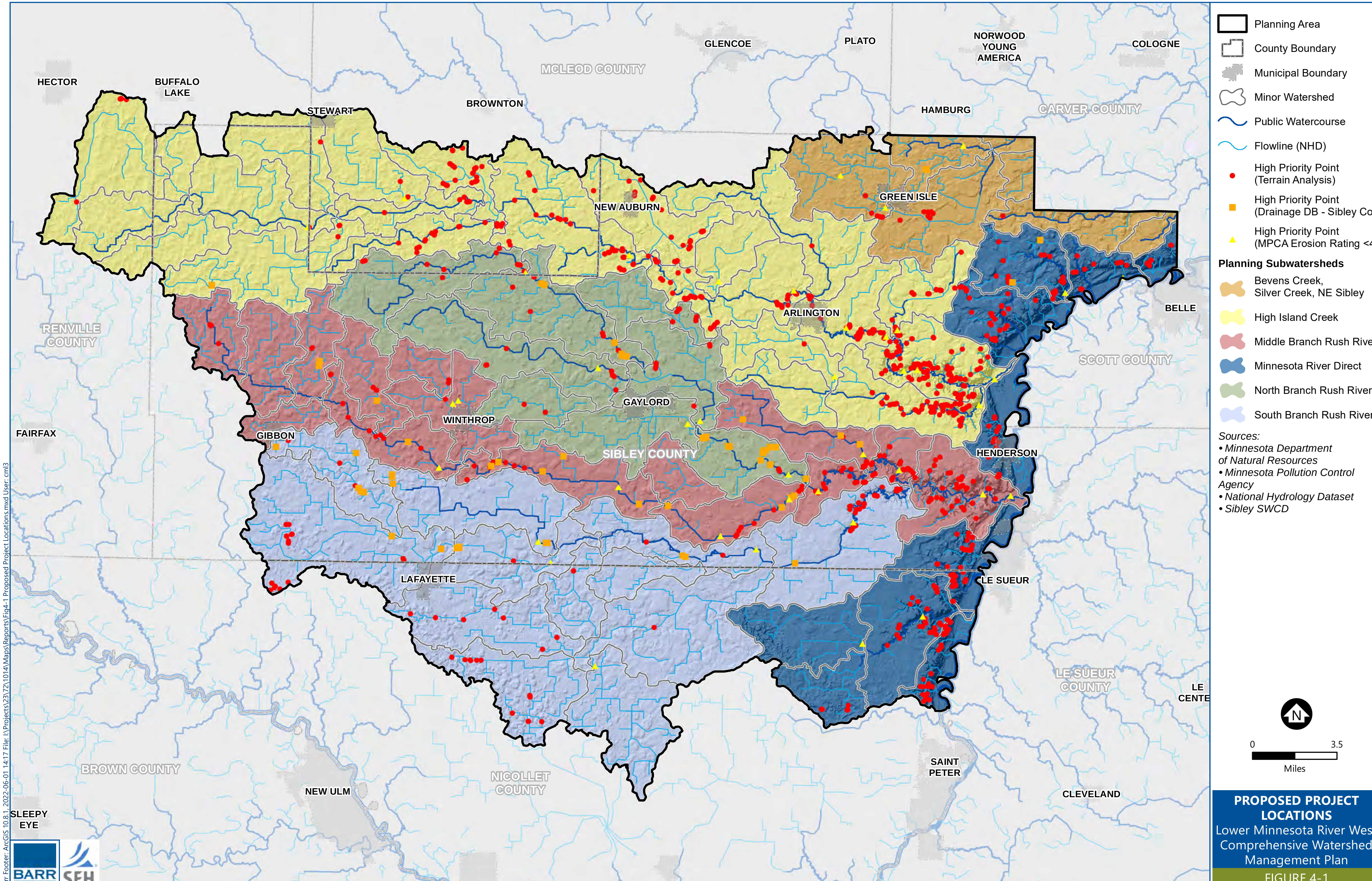
Sections 4.2 and 4.3 describe methods for estimating pollutant reductions at a planning level prior to implementation. During Plan implementation, it will be useful for the Partners to track estimated pollutant reductions from constructed projects and practices. A simple method to do so may include a summary spreadsheet that includes data such as:

- Subwatershed location
- Drainage area/treated area
- Basin pollutant loading rate (estimated by HSPF, other modeling, or monitoring data)
- BMP type implemented
- BMP pollutant reduction efficiency

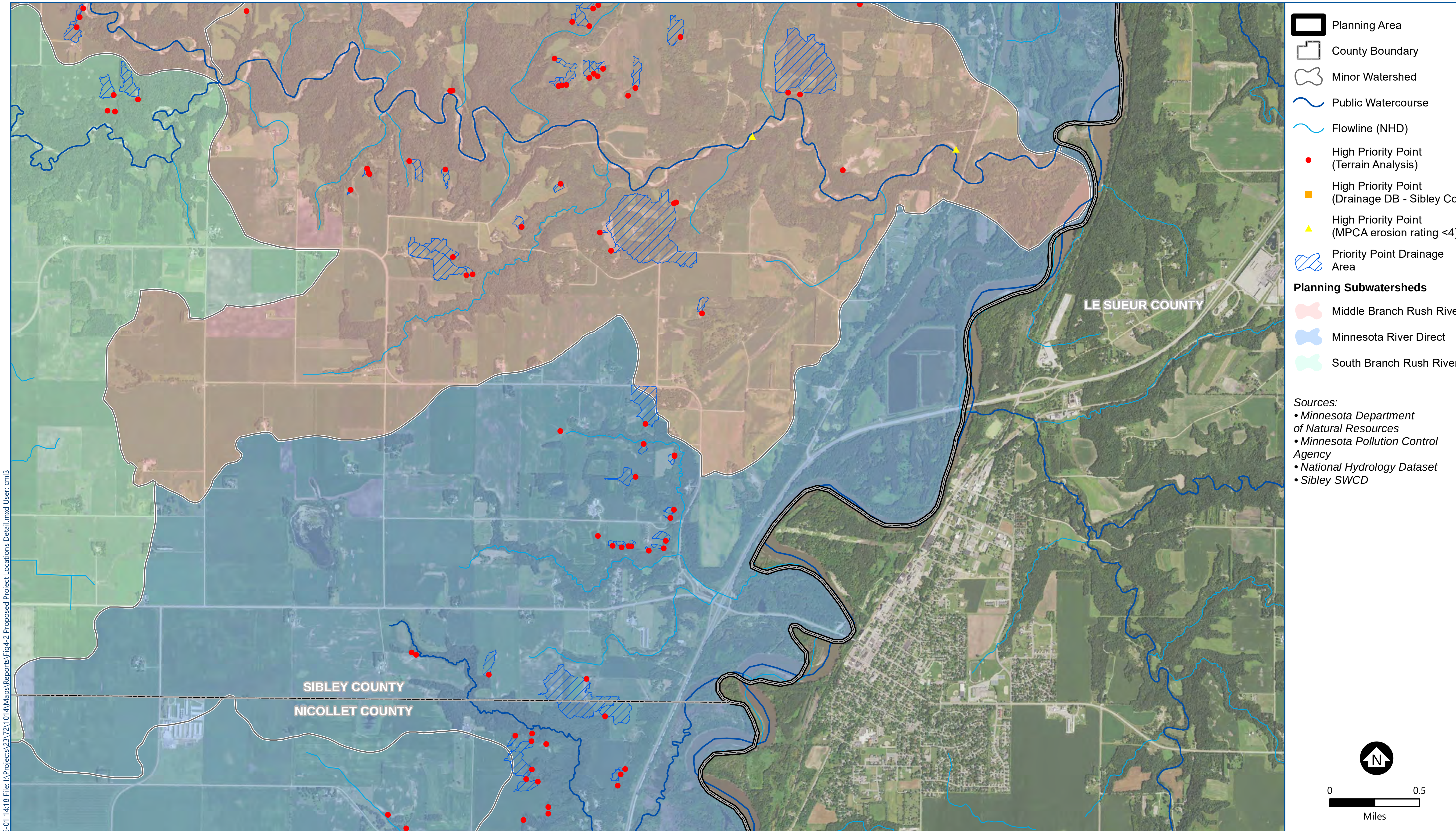
When a BMP is implemented, the user may select the specific BMP and associated pollutant reduction estimates (i.e., percent reduction relative to existing load) based on SAM documentation (i.e., Tables 6-1 through 6-3 in the Documentation of the BMP Database Available in the Scenario Application Manager (RESPEC, 2017), and summarized in Table 4-2 of this Plan) or enter user-defined pollutant reduction estimates based on case-specific considerations. The user may also enter the treated area directly or as a percentage of land suitable to the BMP type.

The tracking spreadsheet may calculate the corresponding load reduction (i.e., mass/time) estimated for the BMP based on the information listed above. The spreadsheet may be setup to sum cumulative benefit of BMPs implemented at multiple locations throughout the planning subwatershed. The Partners may use this tool to track BMP implementation over time and compare the cumulative benefits to the field-scale pollutant reduction goals presented in Table 3-3.

State agencies may have interest in overall pollutant load reductions achieved by BMPs and pace of progress relative to surface water quality goals established for individual resources. The Partnership will track project implementation (location, practice, estimated field-scale pollutant reduction) as projects are implemented. This data will be compiled approximately 5 years into Plan implementation to allow HSPF (or similar) water quality modeling to be performed to estimate cumulative in-resource pollutant reduction (and corresponding pace of progress towards meeting in-resource water quality goals). Cumulative pollutant reduction relative to TMDL goals will be assessed at the in-resource level.



PROPOSED PROJECT LOCATIONS
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE 4-1



PROPOSED PROJECT LOCATIONS DETAIL
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE 4-2

Barr Footer: ArcGIS 10.8.1, 2022-06-01 14:18 File: I:\Projects\23\72\1014\Maps\Reports\Fig4-2 Proposed Project Locations Detail.mxd User: cml3

5 Targeted Implementation Program

This section describes the Partners' implementation program. The implementation program is a combination of projects, studies, programs and practices intended to achieve the measurable goals described in Section 3. Recognizing that financial and staff resources limit the ability of the Partnership to completely address priority issues in the watershed (see Section 2), the Partnership prioritized and targeted (see Section 4) the implementation program described herein to achieve benefits consistent with the Partnership's locally driven priorities and goals.

The activities and projects described in this Plan will be implemented primarily through existing staff, funding, and operations of the Partners. Programs and activities may be adjusted based on the associated funding source (see Section 5.2.2). Some funding sources (e.g., watershed-based implementation funding) may have specific requirements that affect program design.

5.1 Implementation Schedule

The Plan implementation schedule is presented in Table 5-4. The activities included in the implementation program are intended to leverage the existing roles, capacities, and expertise of the Partners and provide a framework for the Partners to perform expanded roles to achieve Plan goals. Each activity in the implementation program is cross-referenced to one or more goals (see Table 3-2) that the activity is designed to support.

Activities included in Table 5-4 are organized by primary issue area and are assigned to the following four categories:

- Projects and project support
- Monitoring and studies
- Education and public involvement
- Regulation and administration

These categories are described in greater detail in the following sections. Information included in Table 5-4 includes:

Item ID – Each activity in the implementation schedule is assigned a unique alphanumeric identifier. The letters identify the primary priority issue (see Section 4.0) that the activity is intended to address.

Implementation Action Description – This field provides a brief description of the planned implementation activity.

Applicable Goals – Each activity is cross-referenced to one or more applicable Plan goals (see Table 3-2). Many activities address multiple Plan goals.

Priority Issues Addressed – These fields indicate whether the implementation activity directly (as indicated by "●") or indirectly (as indicated by "o") addresses each of the eight priority issues identified in Section 2.1. Many activities are intended to address multiple issue areas.

Target or Focus Area – This field identifies the physical area or resource for each implementation activity. Some activities are applicable watershed wide. This field may reference targeting maps that identify priority project areas (Figure 2-8 and Figure 2-9).

Measurable Output – This field identifies how performance of the implementation activity will be measured. The unit may be based on a spatial measurement (e.g., feet of stream restoration) or actions performed (e.g., number of educational workshops).

Timeframe – These fields indicate when the implementation activity will be performed. The 10-year planning window is subdivided into 2-year periods. Where applicable, numbers corresponding to activity measurable outputs are included in each two-year window (e.g., "20 projects in 2025-2026").

Estimated Total Cost – This field represents the total estimated cost (in 2022 dollars) to implement the activity over the 10-year planning window. This cost includes:

> **Estimated Local Contribution** – This field represents the portion of the total estimated cost (in 2022 dollars) borne by members of the Partnership.
>
> **Estimated External Contribution** – This field represents the portion of the total estimated cost (in 2022 dollars) estimated to come from external sources, including but not limited to: State funding, Federal funding, cost-share, and private partners.

Lead Local Governmental Unit (LGU) – This field designates the entity responsible for leading each activity. The lead LGU is limited to members of the Partnership. The lead LGU assumes responsibility to move the activity forward with assistance from cooperating entities, as needed. Note that all members of the Partnership may undertake activities in Table 5-4 regardless of identification as lead LGU.

Supporting Entities – This field identifies members of the Partnership and any State, Federal, or private entities that are anticipated to cooperate with the lead LGU in the completion of an activity. Supporting entities identified for an activity may not be limited to those included in Table 5-4.

5.1.1 Projects and Project Support

Activities in Table 5-4 categorized as "projects" include projects and project support activities and represent approximately 90% of the overall Plan implementation costs (see Section 5.2.2). This category includes capital improvement projects and cost-share field practices designed primarily to address issues related to surface water quality, excessive erosion and sedimentation, altered hydrology, and flooding. This category also includes feasibility studies, planning, engineering, and design work necessary to design and construct these projects. Projects and project support activities will be funded through a combination of local and external funds (see Section 5.2.2).

5.1.1.1 Cost-Share Field Practices

A significant portion of the implementation program is tied to activity SWQ-1:

> *Implement BMPs at priority level 1 and 2 sites identified through terrain analyses (see Figure 4-1) or other assessments to reduce erosion, filter pollutants, and/or retain runoff; specific BMPs to be determined based on site-specific feasibility, with target implementation by subwatershed as follows:*

Table 5-4 outlines the number of surface water quality improvement projects planned for each of the major planning subwatersheds within the planning area. Information regarding the prioritization and estimation of costs and benefits for projects related to implementation item SWQ-1 is provided in Section 4.

The Partners intend to incentivize these projects through cost-share programs, where the costs of implementing BMPs are shared with the landowner (as most of the proposed project are located on private lands). The Partners seek to use existing cost-share programs that are available at the local, state, and federal level that assist landowners in paying for BMPs. These practices include traditional conservation practices, structural and non-structural, that retain and control runoff to improve water quality. Structural practices that may be eligible include sediment control structures or controlled drainage practices. Nonstructural practices that may be eligible include implementing cover crops or nutrient management practices.

The individual practices implemented at proposed project locations presented in Figure 4-1 will depend on local landscape considerations, landowner willingness, and potential for multiple benefits (e.g., a project that increases watershed storage and improve water quality). The Partners anticipate that many of the projects implemented as part of activity SWQ-1 will provide multiple benefits related to altered hydrology and drainage, accelerated erosion, and other concerns, in addition to directly prioritizing the issue of degraded surface water quality.

The implementation structure selected by the Partnership promotes the implementation of these practices by efficiently leveraging the existing skills and programs of the Partner entity to sponsor projects at locations within their jurisdictions. The Partners will utilize an application process to score and rank cost-share opportunities from landowners or applicants, as described in Section 5.4.4.1. The project scoring criteria will promote projects in higher priority areas (see Figure 2-8) and multi-benefit projects, while also considering other factors.

5.1.1.2 Capital Improvements

For the purposes of this Plan, capital improvement projects are those projects that are larger scaled, higher cost, and have a longer effective life than the projects typically funded through agricultural incentive and cost-share programs (see Section 5.1.1.1). Capital projects are intended to provide significant benefits, often on a regional scale, rather than on a field scale, and will require preparation of feasibility studies before design and construction.

Capital projects can often exceed $100,000 in cost and have an expected life greater than 25 years.

The Counties of McLeod, Nicollet, and Sibley maintain and update capital improvement plans (CIPs) that may include projects impacting or benefiting water resources. These projects may be specifically or generally aligned with the goals of this Plan and may have regional benefit depending upon the project's location in the watershed. No specific capital projects from these CIPs were identified for inclusion in this Plan during Plan development. Presently, the High Island Creek Watershed District does not have an adopted CIP. Capital projects identified by the HICWD for inclusion in this plan include:

- Reconstruct Baker's Lake Outlet (Option 8 of feasibility study) - including mid-elevation weir (1014.91 ft), embankment raise to 1019 feet, and channel cleanout (see item FLD-NEW in Table 5-4).

The Partners will review possible capital improvement projects of Partner entities annually as part of the regular review and work planning process and consider incorporation of county CIP projects into this Plan, as applicable. If the HICWD develops a more comprehensive CIP, the Partnership will consider including all or part of the CIP as part of this Plan via the Plan amendment process (see Section 5.5).

Capital projects implemented as part of this Plan will require preparation of an operations and maintenance plan that details inspection and maintenance schedules and responsibilities over the expected life of the project. Permanent easements may be required to provide access necessary for inspection and maintenance. Generally, maintenance responsibilities are assigned to the property owner. Capital projects are often completed in partnership with multiple entities (including state agencies) and are good candidates for state or federal grant funding. The Partners will pursue early coordination with permitting and review agencies, as applicable, to ensure proposed projects are aligned with grant funding.

5.1.1.3 Permanent Land Protections

Protecting natural land from development or land disturbance provides opportunities to achieve many of the goals identified in this Plan. Protected areas provide flood water storage and runoff retention, water quality filtration, wildlife habitat, and other benefits. Local governments can work with private landowners, state, federal, and non-governmental partners to protect lands using a combination of temporary tax incentives, permanent easements, and fee title acquisition.

As part of Plan implementation, the Partners have identified activities to establish land protections to address the priority issue of altered hydrology and drainage, including:

- Identify priority opportunities for enrollment in conservation programs (item AHD-7 in Table 5-4)
- Targeted outreach to landowners in priority areas regarding conservation programs (item AHD-8 in Table 5-4)
- Promote enrollment in conservation programs through distribution of educational materials, hosting workshops, and/or targeted field visits, and cost share support (item AHD-9 in Table 5-4)

5.1.1.4 Operations and Maintenance Considerations

Projects implemented through this Plan will require documented operations and maintenance agreements to ensure that the project functions as intended throughout its planned design life. Maintenance agreements will detail inspection and maintenance schedules and responsibilities over the expected life of the project. Permanent easements and/or access agreements may be required to provide access necessary for inspection and maintenance.

Generally, maintenance responsibilities are assigned to the property owner. For cost-share projects, maintenance will be performed by the property owner unless otherwise specified via agreement. For public capital projects, operation and maintenance shall generally be the responsibility of the Partner in whose jurisdiction the project is located and under whose jurisdiction the project is constructed (e.g., local drainage authority), as specified by written agreement. During Plan implementation, the Partners will consider whether coordinating inspection and maintenance activities as a shared service is appropriate to promote efficiency.

5.1.2 Studies, Analyses, and Monitoring

Table 5-4 includes several implementation activities categorized as "studies." This category generally includes studies, technical analyses, and monitoring activities. This also includes those activities necessary to evaluate Plan progress and address data gaps related primarily to the priority level 1 issues of degraded surface water quality, excessive erosion and sedimentation, altered hydrology and drainage, and increased flooding. Additionally, several activities address the priority level 2 issue of degraded soil health and protection of groundwater and drinking water quality.

The Partnership may use information collected through monitoring and studies to identify future (or modify current) Plan implementation activities and priorities. For example, working with state agencies to track arsenic and nitrate concentrations in groundwater (activity GWQ-9) may affect the implementation of activity GWQ-14 to provide technical assistance or cost-share to address high arsenic concentrations. Monitoring and study activities included in Table 5-4 will leverage past and present programs operated in the watershed. These include, but are not limited to:

- MPCA water quality monitoring and analyses:
    - Lower Minnesota River Total Maximum Daily Load (TMDL) – Part I study (2020)
    - Lower Minnesota River Restoration and Protection Strategies (WRAPS) study (2020)
    - Lower Minnesota River Watershed Streams Stressor Identification Report (2018)
    - Lower Minnesota River Watershed Lakes Stressor Identification Report (2017)
    - Lower Minnesota River Watershed Monitoring and Assessment Report (2017)
    - Fecal Coliform TMDL Implementation Plan for the High Island Creek and Rush River (2009)
    - Carver, Bevens, and Silver Creeks Bacterial TMDL Implementation Plan (2007)
    - Data collected/used in MPCA analyses, including:
        - Water chemistry (chloride, DO, E. coli, nitrate + nitrite, TKN, temperature, TP, TSS)
        - Aquatic biological monitoring (fish and macroinvertebrate)
        - Fish contaminants (e.g., mercury and polychlorinated biphenyls (PCBs))
        - Cooperative stream gaging (MPCA, MDNR)
- MDH groundwater monitoring and analyses:
    - Groundwater Restoration and Protection Strategies (GRAPS) (2021)

- MDA/SWCD township private well water quality testing
- USGS/MDNR stream gaging
- County septic/SSTS monitoring
- County well inspection/monitoring

The Partnership will use the data collected as part of existing, new, and expanded monitoring in support of other implementation tasks, where applicable. Additional information about existing monitoring programs is presented in Section A.8. Existing monitoring locations are presented in Figure A-13. Monitoring data collected within the watershed includes, generally:

- Surface water chemistry: nitrogen, phosphorus, TSS/turbidity, *E. coli*, fecal coliform
- Groundwater quality: nitrates, fecal coliform, arsenic, septic and well inspections
- Biological: invertebrate population data (MIBI), fish population data (FIBI), threatened species data
- Hydrologic: water surface elevations, discharge, precipitation

Available monitoring data is available from the MPCA's Environmental Data Access (EDA). This data is derived from the MPCA, with input from some other entities, and is not a comprehensive database of all monitoring activity. The EDA database is available online at: https://www.pca.state.mn.us/quick-links/eda-surface-water-data

Monitoring and study activities are generally scheduled early in Plan implementation to maximize the benefit over the 10-year planning window. Monitoring and studies are anticipated to be funded primarily through local funds, due in part to limited State grant eligibility (see Section 5.2.2). The Partners see opportunities for further coordination and alignment of state monitoring programs with local implementation priorities through the implementation of this Plan. The Partners may perform or request additional monitoring more closely aligned with Plan implementation. Additional groundwater monitoring may also be needed to demonstrate trends and better understand local issues and implementation effectiveness.

Ongoing monitoring activities are also necessary for the Partners to assess progress relative to Plan measurable goals. It is anticipated that ongoing MPCA and Partner monitoring programs will be sufficient to address progress towards surface water quality goals. The Partners may implement performance monitoring of capital improvements or other individual projects on a project-by-project basis, to be detailed as part of project scoping. Partners will incorporate local and state-led monitoring results into a 5-year assessment to evaluate Plan progress and determine whether programmatic changes are needed. This may include comparison of monitoring results to modeled conditions, trend analyses, and/or comparison to applicable standards and goals. Throughout Plan implementation, the Partners will share locally collected data with appropriate state agencies for inclusion in public databases, as appropriate.

5.1.3 Education and Public Involvement

Table 5-4 includes implementation activities categorized as "education" – this category includes education, public involvement, and outreach activities. The Partners recognize that public awareness and support is necessary to successfully implement this Plan and achieve meaningful progress towards Plan goals. Public input was solicited at the beginning of Plan development through a detailed survey (see Section 1.5 and Appendix C). Additional stakeholder input received via the Advisory Group was considered throughout Plan development.

The education and landowner outreach activities in Table 5-4 are primarily focused towards promoting soil, water, and natural resource stewardship through increased public understanding of priority issues, promoting voluntary landowner practices, and providing varying levels of technical assistance. Education and outreach related to protecting groundwater quality and drinking water additionally focus on issues of public health and safety. Planned engagement activities, generally, include:

- Site visits and site-specific technical assistance to support:
  - Buffer implementation and maintenance
  - Soil health practices
  - Wetland protection and restoration opportunities
  - Land conservation programs
  - SSTS management actions
  - Nutrient and manure management plans
- Outreach events to support:
  - Multipurpose drainage projects
  - Resource protection for lake associations or other groups
  - Well testing and well sealing
- Workshops (e.g., conservation programs, soil health practices)
- Demonstration projects/field days (e.g., soil health practices)
- Targeted mailings
- News articles/press releases/digital media (project- or initiative-specific)

Plan implementation presents an opportunity to increase and optimize the existing education and outreach roles of the Partners. The Partners will leverage existing relationships and public outreach methods as a foundation to implement the activities in Table 5-4, further developing capacity and methods through the assistance of cooperating entities. Existing education and public involvement programs include:

- County fair booths
- Field days
- Presentations to community groups (e.g., Friends of High Island)
- Elementary school programs (e.g., pollinator planting)
- Photo contest/social media engagement
- Newsletters
- Annual reports

Template education and outreach materials will be developed for use within each County and hosted online (see activity ADM-1 in Table 5-4). Activities will be locally administered and implemented, with individual Partners tailoring administration to the particular needs of their jurisdictions.

5.1.4 Regulation

The priority concerns identified by the Partners and discussed in Section 2 are addressed in part through Federal, State, and local regulations. Table 5-4 includes implementation activities categorized as "regulation." These activities include those actions related to the review and recommended revision of local official controls (e.g., ordinances). The Partnership is, in itself, not a regulatory entity. As a joint powers collaboration, each of the Partners retain their individual regulatory authorities.

The activities in Table 5-4 include those administered by the Partners and do not include State and Federal regulatory programs administered by others (e.g., MDNR administration of public waters rules). The Partners will continue to locally administer existing State, Federal, or local regulatory programs, as appropriate or required. These programs are summarized in Section 5.2.

5.2 Regulatory Roles and Responsibilities

State, Federal, and local entities implement regulatory programs, permit programs, and other official controls (e.g., ordinances) to manage select activities that may impact water and natural resources. In some cases, regulatory programs are designed at the State or Federal level but administered by local governmental units (e.g., Wetland Conservation Act). Programs applicable to the resources and issues addressed by this Plan are summarized in the following sections. Note that this Plan does not include the authority to increase the regulatory responsibilities of any of the Partners – each Partner shall maintain their existing regulatory authority. Local controls are described in Section 5.2.1.

5.2.1 Local Administration of Official Controls

The Partners locally administer several programs to regulate activities impacting water and natural resources. These programs include, but are not limited to, those described in the following subsections. Within their respective jurisdictions, the Partners implement and enforce various project reviews, permits, and approvals to ensure that development, redevelopment, and other land-disturbing activities are performed consistent with locally implemented controls. The regulatory roles of the Partners are summarized in Table 5-1. Note that other local entities (in addition to the Partners) also adopt and enforce local controls within the planning area (e.g., city ordinances).

Table 5-1 Summary of local regulatory authorities

Jurisdiction	Resource Regulation or Ordinance									
	Wetland Conservation Act	Stormwater Management	Shoreland Management	Floodplain Management	Subsurface Sewage Treatment Systems	Feedlots	State Buffer Law	Land Use /Zoning	Drainage Authority	Bluffland Ordinance
High Island Creek Watershed District		X		X					X	
McLeod County			X	X	X	X	X	X	X[4]	X[3]
McLeod SWCD	X						--[1]		X[4]	
Nicollet County	X		X	X	X	X	X	X	X	X[3]
Nicollet SWCD	X						--[1]			
Sibley County			X	X	X	--[2]	X	X	X	X[3]
Sibley SWCD	X						--[1]			

(1) SWCDs have a technical role in buffer law, but no enforcement authority
(2) Sibley County has delegated feedlot regulatory authority to MPCA
(3) Land use controls specific to bluff areas are implemented through county zoning ordinances
(4) McLeod County drainage inspector is housed within the SWCD office

5.2.1.1 Wetland Conservation Act

Wetlands in Minnesota are regulated under the Wetland Conservation Act (WCA) of 1991, which is intended to result in "no net loss" of wetlands. Anyone proposing to drain, fill, or excavate a wetland must first try to avoid disturbing the wetland; second, try to minimize any impact on the wetland; and, finally, replace any lost wetland acres, functions, and values. Certain wetland activities are exempt from the act, allowing projects with minimal impact or projects located on land where certain pre-established land uses are present to proceed without regulation.

Within the planning area, McLeod SWCD and Sibley SWCD serve as the local government units (LGUs) that implement the WCA locally. In Nicollet County, both the county and the SWCD serve as LGUs depending upon land use. The Minnesota Board of Water and Soil Resources (BWSR) provides oversight of the WCA statewide, and the MDNR enforces the WCA.

5.2.1.2 Buffers and Soil Loss

The State of Minnesota passed the Buffer and Soil Loss Legislation (Minnesota Statute 103F.48) in 2015; this legislation is commonly referred to as the Minnesota Buffer Law. The statute requires a continuous buffer of perennial vegetation with a 50-foot average width and 30-foot minimum width around all public waters and a 16.5-foot minimum width continuous buffer of perennial vegetation along all public drainage systems (see also Section 5.2.1.9).

Within the planning area, the SWCDs are tasked with implementing and assessing compliance with the buffer legislation. SWCDs provide technical assistance, along with financial assistance options, for landowners to implement buffers. While SWCDs determine compliance with the buffer law, that information is provided to the Counties who are responsible for buffer law enforcement. Landowners also have the option of working with their local SWCD to determine if alternative practices aimed at protecting water quality can be used, rather than a buffer.

5.2.1.3 Shoreland Management

The State of Minnesota established shoreland rules (MN Rules 6120.2500 - 6120.3900) to regulate land use and development of shoreland areas. These rules establish minimum standards to protect habitat and water quality and preserve property values. The rules include zoning provisions that require a 50-foot (or greater depending on waterbody classification) setback around public waters and include structure height limits, impervious surface limits, lot requirements, and vegetation removal guidance. Permits are required from the local unit of government for intensive vegetation removal and excavations occurring in shoreland overlay areas.

These standards are implemented through local shoreland ordinances. Within the planning area, shoreland regulation is implemented through county zoning ordinances. The MDNR's role is to ensure that local shoreland ordinances comply with the state shoreland rules and to provide technical assistance and oversight to these local governments.

5.2.1.4 Floodplain Management

The State of Minnesota established floodplain rules (MN Rules 6120.5000 – 6120.6200) to manage flood-prone areas. Within the planning area, local governmental units regulate development and land disturbing activities within the floodplain to minimize risk to infrastructure, property, and health and safety resulting from flood events. Floodplain regulations are generally included as part of City and County zoning ordinances or watershed district rules and may apply to FEMA-designated floodplains (see Section A.10.1) or floodplain areas designated by local entities, where applicable.

Floodplain ordinances require, at a minimum, that minimum building elevations (i.e., lowest floor) be at least 1 foot above the 100-year water surface elevations (this elevation is known as the regulatory flood protection elevation). Floodplain ordinances also prohibit or limit allowable land use and development within the floodplain. Some local units of government implement higher standards than the minimums required.

5.2.1.5 Subsurface Sewage Treatment Systems (SSTS)

At the State level, the Minnesota Pollution Control Agency administers programs regulating the design, construction, and maintenance of subsurface sewage treatment systems (SSTS) through MN Rules 7080 – 7083 (see Section 7.2.2.5). Locally, the Counties administer SSTS programs consistent with MN Rules 7080 – 7083, including an inspection program. County programs provide technical assistance, education, plan review, and SSTS inspections to protect water quality, prevent and control water-borne diseases, and prevent or eliminate nuisance conditions.

The Partners will prioritize activities to address SSTS systems classified as imminent threats to public health and safety above activities to respond to non-compliant systems not classified as imminent health threats. An SSTS may be classified as an imminent health threat if there is (1) sewage discharge to surface water; (2) sewage discharge to ground surface; (3) sewage backup; or (4) any other situation with the potential to immediately and adversely affect or threaten public health or safety. The Partners will continue to work towards compliance of all systems, as resources allow.

5.2.1.6 Well Management and Wellhead Protection

Through its Well Management Program, the MDH administers and enforces the Minnesota Water Well Code, which regulates activities such as well abandonment and installation of new wells. The MDH also administers the Wellhead Protection Program, which is aimed at preventing contaminants from entering public water supply wells. Cities within the planning area have completed or will be completing wellhead protection plans consistent with MDH guidance (see Table A-9).

Well maintenance is an important aspect of protecting wells from contamination. Examples of well maintenance and protection include proper installation, well caps, and inventory and location of private wells. Sealing wells that are unused or vulnerable is also an important part of protecting groundwater and managing a well network.

5.2.1.7 Feedlots

Minnesota Rules 7020 establishes rules, regulations, and programs applicable to feedlots. At the State level, feedlot regulations and programs are administered by the MPCA. Within the planning area, McLeod County and Nicollet County serve as delegated partners to the MPCA to provide feedlot regulatory oversight, implement technical assistance programs, and maintain a feedlot inventory within their respective jurisdictions. Within Sibley County, the MPCA administers Minnesota Rules 7020.

5.2.1.8 Stormwater Runoff and Erosion Control

Stormwater management and erosion control for land disturbing activities of an area one acre or more are regulated at the State level by the MPCA's construction stormwater permit (see Section 7.2.2.4). Additionally, land disturbing activity above or below the MPCA threshold may be subject to local stormwater management and erosion control requirements enforced via County (and/or City) ordinance. The High Island Creek Watershed District also implements a project review and permit program that addresses drainage systems, flooding, and erosion and sedimentation issues (see Section 5.2.1.11).

5.2.1.9 Drainage Management

Activities affecting public drainage systems (i.e., public ditches) are subject to Minnesota Statutes 103E and fall under the jurisdiction of a local drainage authority (e.g., county, watershed district). Generally, the counties maintain jurisdiction over the ditches. Within the planning area, drainage authorities include:

- High Island Creek Watershed District
- McLeod County
- Nicollet County

- Renville County (not a member of the Partnership)
- Sibley County

The Partnership includes all drainage authorities within the planning area with the exception of Renville County. As part of their respective roles in overseeing the public drainage system, each drainage authority will seek to identify opportunities for hydrologic restoration and promote modifications and improvements to public drainage systems are consistent with the goals of this Plan, including opportunities for increased watershed storage.

Through the drainage authorities, the Partnership will consider opportunities to coordinate Plan implementation activities with drainage projects, leveraging programs like BWSR's multipurpose drainage management grants. This non-local source of public funding could enhance a project with on-system BMPs (e.g., alternative side inlets) with off-system BMPs (cover crops, tillage), wetland treatment/storage systems, or modified channel design. Projects that affect drainage systems can be implemented in such a way to promote benefits for flooding, landscape resilience, and wildlife ecology. When working on projects affecting public drainage system projects, the drainage authorities know it is important to consider project timing, especially for synching-up effort with the multi-purpose drainage grant program. The Partnership will offer technical and financial assistance for drainage management practices consistent with the goals of this Plan.

For ditch projects, the MDNR requires the land adjacent to public ditches to include a buffer strip of permanent vegetation that is usually 1 rod (16.5 feet) wide on each side (Minnesota Statutes, Section 103E.021). Additional information regarding public drainage systems is included in Section A.7.3.

5.2.1.10 Land Use Planning

Counties and cities within the planning area regulate the development and redevelopment of land through land use planning and zoning. Land use planning is necessary to balance economic development with appropriate management of natural resources. Land use regulations are typically implemented through zoning ordinances. Long-term land use and planning considerations for each Partner are detailed in Partner Comprehensive Plans (see Table 5-2).

Table 5-2 Partner Comprehensive Plan Adoption

Partner	Plan	Date Adopted
High Island Creek Watershed District	Rules and Regulations	April 26, 2021
McLeod County	McLeod County Comprehensive Land Use Plan	1995
McLeod SWCD	The McLeod County Comprehensive Local Water Plan 2013-2023	June 18, 2013
Nicollet County	Nicollet County Comprehensive Plan	January 5, 2021
Nicollet SWCD	Nicollet County Local Water Management Plan 2018 Extension	2018
Sibley County	Sibley County Comprehensive Plan	October 27, 2009

Among the Partners, each County maintains zoning ordinances to regulate land use and development with consideration for natural resources (see Table 5-1). Each Partner's zoning ordinance includes additional development and land disturbance requirements applicable to shoreland and floodplain areas, including:

- Restrictions on permitted land uses
- Requirements for permanent vegetation
- Minimum setbacks from the ordinary high-water level (OHWL) of lakes and rivers for structures
- Restrictions on SSTS to protect groundwater and surface waters
- Minimum building elevations relative to flood elevations
- Maximum allowable percent impervious surface
- Requirements for stormwater management

In addition to the counties, some cities and townships within the planning area regulate land use and development through their own zoning ordinances and other official controls. City and township land use planning and zoning requirements must be at least as restrictive as County ordinances. Cities without land use planning guidance may rely on County ordinances for guidance.

Goals and issues identified in Partner comprehensive and local water plans were considered during Plan development. Land use planning and development present opportunities for the Partners to implement activities in pursuit of Plan goals, both within their jurisdiction and in coordination with the cities that have adopted their own land use planning requirements. As rural portions of the planning area are converted to less pervious residential, commercial, and suburban land uses, application of ordinances with appropriate protections for water and natural resources is critical to prevent or mitigate future problems.

As part of Plan implementation, the Partners will review relevant ordinances and identify possible revisions to minimize impacts to water and natural resources (see Table 5-4). The Partners will continue to offer technical assistance related to land use planning and development project review, as requested by local jurisdictions. The Partners will seek opportunities to collaborate with local jurisdictions as they amend, update, or adopt local land use controls.

5.2.1.11 Watershed District Rules and Permit Programs

Per the authority given to watershed districts in Minnesota Statutes 103D, the High Island Creek Watershed District (HICWD) adopted rules applicable within its jurisdiction. The HICWD enforces its rules through project review and permit programs. This section summarizes the current HICWD Rules, but HICWD will maintain and update their rules as a separate document outside of this Plan.

HICWD Rules

The HICWD Rules (2021, as amended) require a permit for the following types of work:

- Flood control and drainage work
- Bridges, culvert, drain, and stream crossing work
- Drainage channel work
- Work that may cause erosion and sedimentation

Briefly, the HICWD Rules address:

Flood control and drainage (Section 6) – This section allows that every person shall use their land reasonably in disposing of surface water and may deliver into a natural drainageway all the surface water that would naturally drain there but may not burden a lower landowner with more water than is reasonable under the circumstances. This rule requires that surface water shall not be artificially removed from upper land to and across lower land without adequate provision being made on the lower land for its passage, nor shall the natural flow of surface water be obstructed so as to cause an overflow onto the property of others.

Bridges, culverts, drains, and stream crossings (Section 8) – Construction or reconstruction of bridges, culverts, or drains into or across any natural, legal, or private drainageway requires a permit. These structures shall be suitably located, have adequate waterway opening and shall have adequate shoulder and bank protection. A permit is similarly required for pipe, wire, or cable crossings. Section 8 prohibits livestock within any drainage system and requires that livestock crossings prevent access to drainage systems.

Drainage channels (Section 9) – Work performed in public or private drainage channels shall be performed to prevent erosion of the bank and siltation of channels. Required measures may include: control or avoidance of overland flow into ditches, seeding of channel slopes, maintenance of channel depth and slopes, and avoidance of flat bottom ditches.

Alteration of natural drainageways, lakes and marshes (Section 10) – Management of natural drainageways, lakes, wetlands and their abutting lands should be done in such a way so as to reduce their deterioration and to maximize their value for the general welfare of the District. To this end, the managers require a permit for changes to the bed, bank, or shores of these resources, or any excavation, grading, or filling near these resources (excluding roadway maintenance).

Erosion and sedimentation (Section 11) – Construction projects requiring the movement of earth (e.g., subdivision improvements, road construction, ditch maintenance and improvements) shall provide for the prevention of erosion during and after construction. The managers require submittal of a plan and/or description of the practices to be used to avoid erosion and sedimentation. Activities excluded from this requirement include construction of single family homes, agricultural buildings, or construction disturbing less than 0.25 acres provided these activities are more than 500 feet from a natural lake, stream, or wetland.

Environmental assessments (Section 12) – Improvement projects which will affect the quality or quantity of waters discharged into the watercourses of the District must submit statements regarding the effect of the work with a permit application. Statements must address public benefits, adverse impacts, possible alternatives (and their impacts to the environment), and the relationship of the project to increases in productivity and/or conservation of natural resources.

Floodplain management (Section 13) – The HIWCD serve as advisors to the counties and municipalities regarding floodplain management. Those making improvements to property adjacent to permanent watercourses, lakes, and marshes (and tributary to these resources) must submit engineering data and such other information to determine the effects of such activities on the lands, marshes, lakes and watercourses of the District. Improvements on lands within designated shoreline and floodplain areas shall conform to applicable floodplain and shoreland management standards and criteria.

Additional information is available from the HICWD at: www.highislandcreekwd.com

5.2.2 Adequacy of Regulatory Controls

Review of local controls and ordinances indicates that local regulatory roles and official controls are generally sufficient to protect the resources prioritized in this Plan consistent with state requirements (e.g., MDNR shoreland rules, MS4 permits). Through implementation, opportunities for the Partners to improve coordination and consistency across the planning area may present themselves; the Partners will consider these opportunities as part of annual planning.

The implementation schedule includes actions related to review and update of local controls to address specific priority issues:

- Meet with drainage authorities at least annually to review permitting processes, performance standards, and coordinate messaging (ADH-7)
- Review and recommend revisions for floodplain ordinances to ensure adequate protection of floodplain functions, infrastructure, and bluff protection (FLD-5)
- Review and recommend updates, as needed, to zoning and land use regulations to promote the protection of sites of biological significance, wetlands, and habitat areas (FWH-2)

There may be additional opportunities to extend guidance or requirements implemented by some Partners to other portions of the planning area with existing materials serving as templates.

5.3 Plan Implementation Costs and Funding

The implementation schedule (Table 5-4) includes planning level cost estimates for individual activities. Planning level costs are split between local funding sources and external funding sources. Local funding sources include funding borne by the Partners, while external funding sources include all other funding sources (e.g., cost-share with non-Partner entities, State grants). Costs are presented in 2022 dollars for planning purposes. More detailed cost estimates may be required for individual activities prior to execution. Costs presented in Table 5-4 are subtotaled by category and summarized in Figure 5-1 (total cost) and Figure 5-2 (local costs) and presented in tabular format in Table 5-3.

This Plan includes an ambitious implementation schedule carrying a total estimated cost of approximately **$17.5M**. Total estimated annual costs (approximately $1.7M) exceed current local funding allocated to existing and similar programs within the planning area. Organizational capacity of the Partners (i.e., staff time and expenses currently expended to address the issues addressed by this Plan) was estimated during Plan development at approximately $800,000 per year (or approximately $8M over the 10-year planning period). The current level of Partner funding to address Plan issues is similar to the anticipated local contribution. However, significant additional funding through State, Federal, and private grant or cost-share dollars will be necessary to accomplish Plan goals.

Table 5-3 summarizes the estimated implementation costs broken down by type of activity and funding amounts coming from Partner local funds, watershed-based implementation funding (WBIF), local landowner contributions, and other state and federal funding sources.

Table 5-3 Summary of Estimated Plan Funding

Type of Activity	Partner Local Funds	Estimated Landowner Contribution	Watershed Based Implementation Funds (WBIF)	Other state/ federal funding sources	Total
Partnership Administration	$350,000	--	$300,000	--	$650,000
Project and Project Support	$6,096,000	$677,000	$2,591,000	$5,881,000	$15,245,000
Studies and Monitoring	$825,000	--	--	$150,000	$975,000
Education and Outreach	$354,000	--	$109,000	$109,000	$572,000
Regulatory Review/ Oversight	$30,000	--	--	--	$30,000
Total	$7,655,000	$677,000	$3,000,000	$6,140,000	$17,472,000

The Partners understand that there is some uncertainty in the amount of external funding (e.g., state funding, federal grants) that will be received during implementation. The implementation schedule presented in Table 5-4 is based on expected funding values. If additional funding (especially external sources) is available, some implementation activities may be expanded – those activities are identified with red activity item ID numbers in Table 5-4.

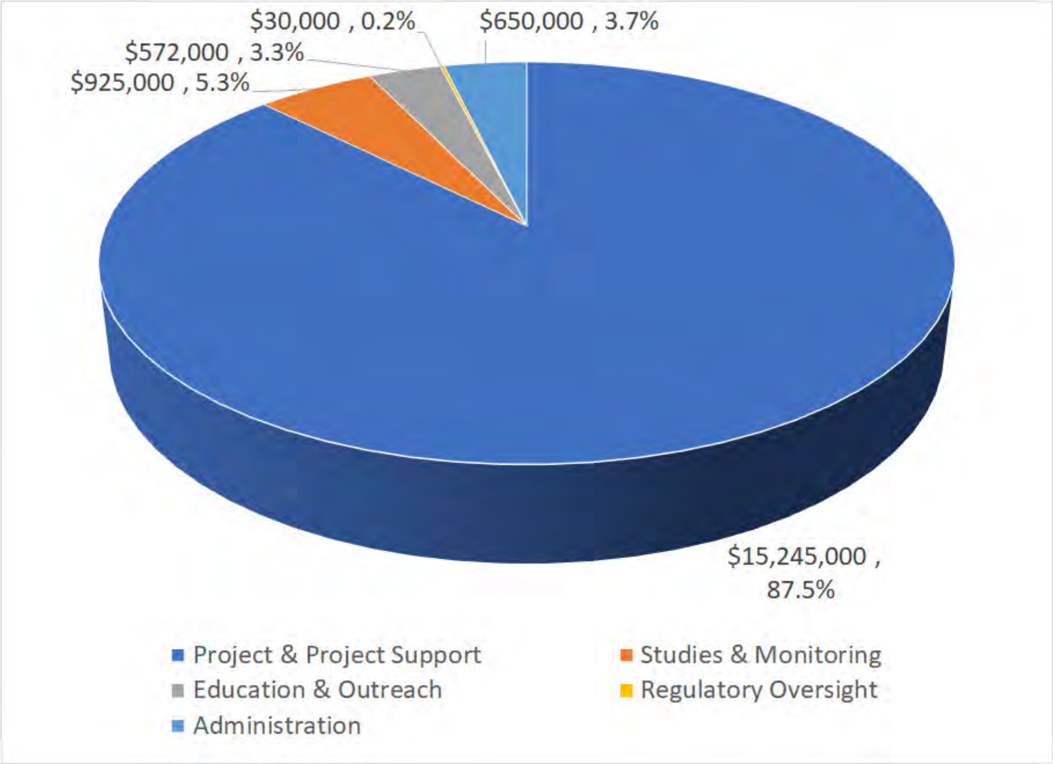


Figure 5-1 Summary of Implementation Schedule Total Costs

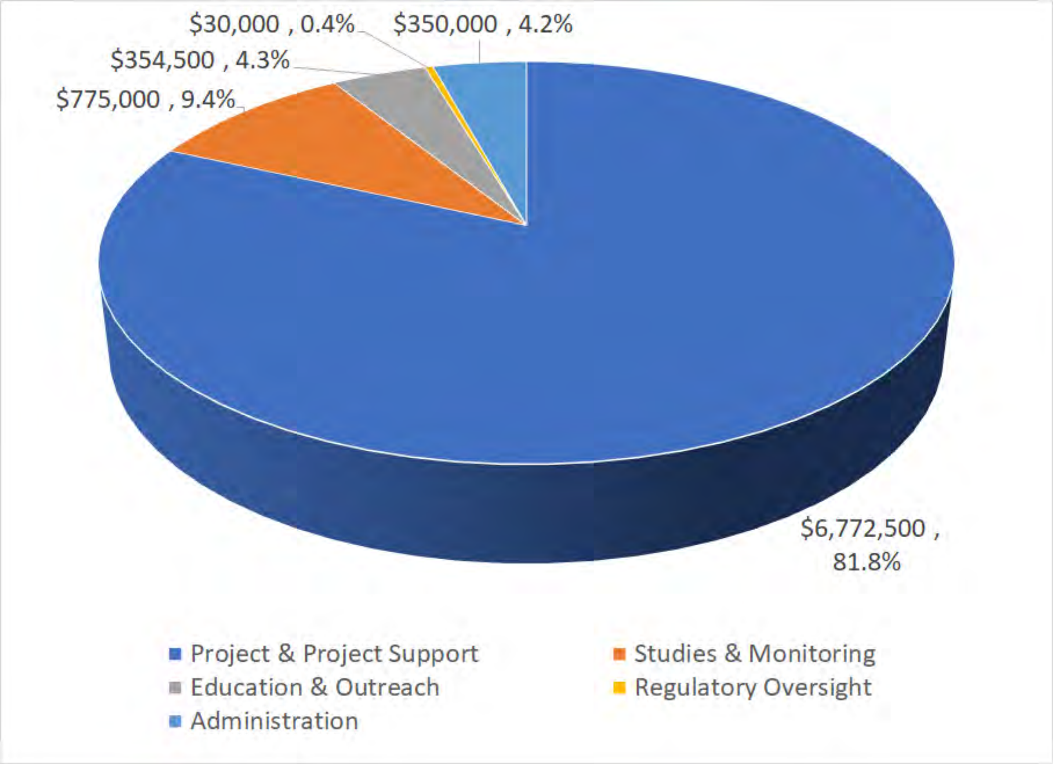


Figure 5-2 Summary of Implementation Schedule Local Costs

5.3.1 Federal Funding Sources

Federal funding includes all funds derived from the Federal tax base. For example, this includes programs such as the Environmental Quality Incentives Program (EQIP), Conservation Reserve Program (CRP), Regional Conservation Partnership Program (RCPP), Conservation Innovation Grants (CIG), and Fish and Wildlife Service (FWS) funding for habitat projects. Federal funding excludes general operating funds obtained from BWSR, counties, fees for service and grants or partnership agreements with state government or other conservation organizations.

The Partners have experience with utilizing federal funding to support work within the planning area. Local funding is commonly leveraged with EQIP to funding increase practice adoption. In 2016, Sibley County was awarded a Federal Section 319 grant for the High Island Creek and Rush River watersheds. This grant was implemented by a partnership that included Sibley, Nicollet, McLeod and Renville counites and SWCDs.

The Partners anticipate continued use and expanded pursuit of federal funding sources to achieve their Plan implementation goals. The Partners anticipate that the NRCS Regional Conservation Partnership Program (RCPP) may be a funding source that can be targeted during implementation. Note that cost support provided by Federal programs like EQIP are considered in the breakdown of activity costs between local Partners and other sources for activity SWQ-1, see Section 4.2 and Table 5-4.

5.3.2 State Funding

The amount of funding needed for Plan implementation from non-local sources is approximately $800K annually and $8M over the 10-year planning period. This includes State funding (i.e., funds derived from the State tax base). State funds include money derived from all State-implemented grant programs (e.g., Clean Water Fund Projects & Practices program, etc.). The Partners anticipate that this will include State-funded watershed-based implementation funds (WBIF). WBIF are anticipated to be approximately $600K awarded every two years or approximately $3M over the life of the Plan.

State funding excludes general operating funds obtained from counties, fees for service, and grants or partnership agreements with the Federal government or other conservation organizations.

5.3.3 Local Funding

This Plan does not create any additional taxing authority among the Partners. The annual amount of funding needed from local sources to perform the activities included in the implementation schedule is approximately $8M over the 10-year planning period, or approximately $800,000 annually. Local revenue includes money derived from the local property tax base, and in-kind services of any personnel funded from the local tax base. Locally generated money for water management activities may include:

- County or watershed district (WD) support of Soil and Water Conservation Districts (SWCDs)
- Funds generated through the sale of services and products such as SWCD tree sales
- Fees for services performed by local SWCDs

- Local costs to administer ordinances including state rules and programs (e.g., shoreland, feedlots, SSTS, Wetland Conservation Act)
- Landowner contributions toward conservation implementation, including cash and in-kind services used as matching funds for state and federal cost-share programs
- Funds from locally based partnerships with non-governmental organizations (NGOs), corporations, local businesses, etc. that contribute to Plan activities
- Local funds for capital improvement projects that are initiated by local governments and that benefit water resources as described in the Plan (e.g., stormwater improvements, water quality treatment, flood risk reduction)
- Donated easements that have a primary or secondary purpose of water quality improvements
- County, City, Township, and Watershed District funding generated through levy authority

Local funds will be used for activities where opportunities for State and Federal funding are limited (e.g., monitoring and studies) or where local funds are required for grant-matching.

5.3.4 Other Funding Sources

Additional non-governmental funding sources may be used to fund Plan implementation. The Partners will coordinate with such NGOs to explore potential partnerships and cost-share opportunities surrounding shared goals. Partners may include Pheasants Forever, Fishers and Farmers Partnership, The Nature Conservancy, and others.

Private sector companies, including those specifically engaged in agri-business, may also be a potential source of funding for implementation. The Partners will seek partnerships with private sector businesses as such opportunities arise. Opportunities may include working with agri-business (e.g., seed companies, tool manufacturers) on incentives that provide opportunity for water resources improvements. Incentives may not be implemented through the Partnership but instigated through Partnership actions.

5.3.5 Collaborative Grants

The Partners recognize the importance of securing grant funding in completing the implementation activities identified in this Plan (see Table 5-4). The Partners will leverage this Plan in applying for competitive state and federal grants, as part of annual work planning (see Section 5.4.4).

5.4 Plan Administration and Coordination

The Partners, collectively known as the Lower Minnesota River West Partnership, will implement this Plan according to the governance structure established in the Joint Powers Agreement for implementation (JPA, see Appendix D). The JPA does not create a new entity. Instead, the JPA is a formal and outward commitment to work together as a partnership and it specifies mutually accepted expectations and guidelines between partners.

Per the JPA, the Parties will establish committees to carry out the coordinated implementation of this Plan. These committees will include:

Policy Advisory Committee (PAC) – The Policy Advisory Committee (PAC) will operate cooperatively and collaboratively, but not as a separate entity. Each governing entity agrees to appoint one representative who must be an elected or appointed member of each governing entity to the PAC. Each governing entity may choose to appoint one alternate to serve on the PAC, as needed, in the absence of the appointed member. PAC members agree to keep their respective governing entities regularly informed on the implementation of the Lower Minnesota River West Comprehensive Watershed Management Plan. Each representative shall have one vote, subject to the authority delegated by their respective governing entity. The PAC will establish bylaws to describe the functions and operations of all committee(s). Once established, the PAC will follow the adopted bylaws, and have the power to modify the bylaws. The PAC will meet as needed, but no less than twice per year to advise implementation of the Lower Minnesota River West Watershed Management work plan. Each member of the PAC, subject to the authority delegated by their respective governing body, shall have the authority to act on behalf of the party they represent in all matters relevant to the implementation of the Lower Minnesota River West Comprehensive Watershed Management Plan, including but not limited to, the recommendation to approve grant applications, grant agreements, interim reports, payment of invoices, and entering into professional contracts. The PAC shall also approve an annual work plan and annual budget consisting of an itemized statement of the Lower Minnesota River West Comprehensive Watershed Management Plan implementation revenues and expenses for the ensuing calendar years, and shall be presented to the respective governing entities that are represented on the PAC.

Technical Advisory Committee (TAC) – The PAC may appoint technical representatives to a Technical Advisory Committee (TAC) to provide support and make recommendations on implementation of the Lower Minnesota River West Comprehensive Watershed Management Plan. The TAC may consist of the Local Implementation Work Group (LIWG) members, staff from the state's main water agencies and/or plan review agencies (e.g., BWSR, MPCA, MDNR, MDH), and area stakeholders. The TAC will meet as needed.

Local Implementation Work Group (LIWG) – The parties agree to establish a Local Implementation Work Group (LIWG), which shall consist of, but not be limited to, local staff, including local county water planners, local watershed district staff, and local SWCD staff, for the purposes of logistical and day-to-day decision-making in the implementation of the Lower Minnesota River West Comprehensive Watershed Management Plan. The LIWG shall prepare a draft annual work plan and budget consisting of an itemized statement of the Lower Minnesota River West Comprehensive Watershed Management Plan implementation revenues and expenses for the ensuing calendar year which shall be presented to the PAC for review. The LIWG will meet as needed.

5.4.1 Fiscal Agent and Administration

A partnership established with a JPA (that does not create an entity) cannot receive funds directly or hold funds or agreements that have a financial connection. One member of the Partnership must be designated as a fiscal agent for each grant or project to hold funds and agreements. The PAC shall appoint one of the parties to the JPA to be the Fiscal Agent for each source of funding received. Roles and responsibilities of the fiscal agent are specified in the implementation JPA (see Appendix D). Grants obtained outside of the Partnership will be administered by the local governmental unit, as is current practice.

The PAC shall appoint one of the parties to the JPA to be the Day-to-Day Contact, to be the point of contact for, and handle, the day-to-day administrative work of Plan implementation. The Day-to-Day Contact will handle this function and continue thereafter until and unless the PAC appoints an alternate Day-to-Day Contact. Roles and responsibilities of the Day-to-Day Contact are specified in the implementation JPA (see Appendix D).

5.4.2 Watershed District Plan Adoption

The HICWD is a watershed district subject to Minnesota Statutes 103D, which requires the HICWD to adopt a watershed management plan. In adopting the Lower Minnesota River West Comprehensive Watershed Management Plan (this Plan), the HICWD intends for this document to serve as the organization's watershed management plan, with the understanding that this Plan, once approved by BWSR, shall meet the requirements of Minnesota Statutes 103D.405.

The HICWD shall maintain its rules (see Section 5.2.1.11) as a separate document outside of this Plan and independent of the Partnership. The HICWD may also maintain a separate capital improvement program (CIP) informed by the implementation schedule included in this Plan. Through the annual work planning process, the LIWG may integrate the HICWD CIP into this Plan's implementation schedule, as appropriate.

5.4.3 Coordination and Shared Services

Coordination and communication are critical for a partnership operating under a JPA. The Partners will coordinate and collaborate with local, State, and Federal governments throughout the implementation of this Plan. The Partners seek to develop and maintain relationships that will promote effective coordination to accomplish Plan goals. As part of this coordination, the Partners have and will continue to consider opportunities for shared services (e.g., shared staff positions) to provide mutually beneficial and efficient service to multiple Partners in pursuit of Plan goals.

Future opportunities for shared services (e.g., outreach coordination, monitoring) will be considered by the LIWG as additional needs are identified during annual work planning and progress assessment.

The Partners will coordinate the use and distribution of WBIF to implement field practices according to the procedures described in Section 5.1.1.1 and following the priority area implementation sequence outlined in the implementation schedule (see Table 5-4).

Many governmental units have roles and responsibilities related to water and natural resource management within the planning area and have established plans, goals, and actions to manage these resources. Input from State and local governmental agencies was considered and incorporated in the development of this Plan, including information submitted to the Partners in response to Plan notification (see Section 1.5).

Many of the priority issues and associated goals included in this Plan directly or indirectly support the goals, objectives, and responsibilities of other governmental units. The Partners will continue to coordinate with BWSR, MDA, MDH, MDNR, and MPCA as required through State-legislated programs and to accomplish the many Plan activities that identify State agencies as cooperating entities. Similarly, continued coordination and communication with local governmental units, such as cities, townships, counties, joint powers organizations, drainage authorities, and other water management authorities is necessary to facilitate watershed wide activities. The Partners will also collaborate with non-governmental organizations where mutual benefit may be achieved. Many of these collaborations are intended to improve habitat, recreational opportunities, and water quality within the Plan area, while providing education and outreach opportunities.

For those activities identified in the implementation schedule (Table 5-4), one or more Partners will serve as the lead for implementation. Specific opportunities for coordination with other units of government that are not part of the Partnership are identified in the implementation schedule (Table 5-4). The "supporting entities" field in Table 5-4 notes those other governmental units or parties that the Partners will coordinate with in performing each activity.

5.4.4 Work Planning

Implementation of this Plan is based on coordinated action by the members of the Partnership. Therefore, annual work planning will be based on priority of implementation activities planned, the availability of funds, and the roles and responsibilities for implementation.

The LIWG will develop an annual work plan following the generalized process presented in Figure 5-3. The annual work plan will be based on the targeted implementation schedule (see Table 5-4), updated to reflect the current status of each activity. Factors the LIWG will use to develop and prioritize the annual work plan may include:

- Annual commitments from previous years
- Implementation of planned activities previously delayed
- Funding availability and/or partnering/cost-share opportunities
- Degree of benefit (e.g., water quality, flood relief) relative to other activities
- Consistency with Plan goals
- Distribution of activities to address Level 1, Level 2, and Level 3 goals
- Feasibility (e.g., can the activity be implemented?)

In prioritizing field practices planned as part of implementation activity SWQ-1, the LIWG will consider the process and considerations described in Section 5.4.4.1. Analysis of the degree of benefit may include estimates of pollutant load reduction based on HSPF, or similar model results, and project location within priority Level 1, 2, or 3 watersheds (see Figure 2-8 and Figure 2-9).

The LIWG will present the draft annual work plan to the PAC and TAC for review. Members of the TAC may use this review to promote the inclusion of planned activities that may be a high priority to local, state, or other partnering entities. The LIWG may revise the annual work plan prior to final approval by the PAC. The intent of the annual work plans will be to maintain coordinated and collaborative progress toward completing the targeted implementation schedule. The work plan and budget request will promote local water management priorities for state funding requests.

Biennially, the LIWG will also develop and submit (following PAC approval) a work plan and budget request for Watershed Based Implementation Funding (WBIF) to BWSR covering a 3-year period and based on this Plan. The Partners also intend to pursue competitive grants and other funding based on the work plan to accomplish the Plan implementation schedule. As a part of work planning, the LIWG will identify planned activities suited to available grant opportunities and make recommendations for pursuit of grants to the PAC.

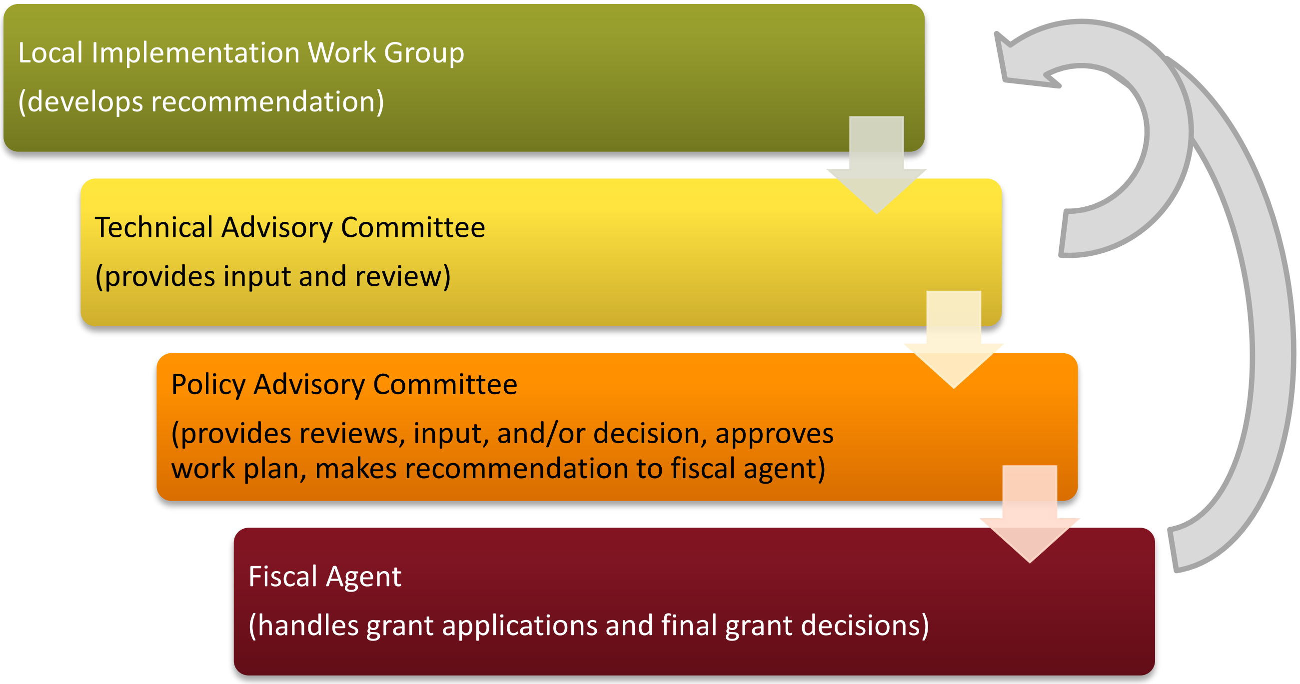


Figure 5-3 Generalized workflow for Plan implementation

5.4.4.1 Work Planning – Cost-share Grant Projects

The Partners intend to incentivize BMP projects through a cost-share program (see Section 5.1.1.1). The LIWG will utilize the application process to score and rank cost-share opportunities from landowners or other applicants. The scoring and ranking will consider:

- location of the project as it relates to the priority implementation areas (see Figure 2-8 and Figure 2-9)
- pollutants of concern/priority issues
- runoff retention/storage

- flood risk reduction
- pollution reduction
- preliminary costs
- installation timing
- funds being requested

Other items that could be considered in the ranking process include potential for multiple benefits, landowner willingness, local landscape considerations etc. It is anticipated that funding will be available for projects identified in this Plan (i.e., points shown in Figure 4-1). For projects not identified in this Plan, the Partners will use the individual project scoring and ranking criteria (as developed and maintained by the Partners) to determine eligibility and priority.

The LIWG will work under the direction of the PAC to develop the cost-share program policies and processes and will guide project implementation and project selection using the following outline:

1. Local Implementation Policy development – creation and adoption of cost share policies or subagreements to direct how funds will be encumbered and distributed. The PAC will adopt cost-sharing policies on an annual basis to direct fund distribution.

2. Cost-Share Rates – setting cost-share percentage, incentive payments, or flat rates in targeted priority areas.

3. Application Processing – creating a workflow of processing an application through local Partner boards based upon the adopted policy.

Many of the cost-share implementation contracts to plan, develop, and install practices on the land will be held between the private landowners and the local entity. This method assures continuity with landowners and the traditional SWCD service model. These funds will be spent locally by individual Partners and reimbursed by the funding source fiscal agent per adopted policies.

5.4.5 Evaluation and Reporting

5.4.5.1 Annual Reporting and Biennial Evaluation

The LIWG will annually provide the PAC with an update on progress of Plan implementation. As part of this process, the LIWG will request input and feedback on progress from the PAC and TAC. The LIWG will take this feedback into consideration when developing the annual work plan for the following year, including reevaluating priorities for implementation schedule activities and pursuit of grants. The annual review process will also include an assessment of Partnership operations. This will include self-assessment of LIWG, TAC, and PAC functions, adequacy of the current governance structure, and delivery of implementation. This may also include solicited input from external parties (e.g., SWCD service recipients).

Local governmental units have several annual reporting requirements; their reporting responsibilities will be conducted per state agency requirements. The LIWG will prepare reports related to grants and programs developed collaboratively and administered under this Plan. The LIWG will also develop an annual report documenting progress toward completing the implementation schedule and achieving Plan goals and any changes in Plan priorities. The information to be included in the annual report will be developed through the annual evaluation process described above.

The LIWG will track projects and practice locations through a collaborative, shared spreadsheet tracking system. The Partners, State agencies, and many stakeholders will have interest in overall pollutant load reductions and increased watershed storage achieved by BMPs and pace of progress relative to level 1 priority goals. The project sponsor will provide BMP location and estimated pollution reduction, runoff reduction, and/or flood storage increase of each practice installed. The Partnership will use that data to inform model runs (e.g., HSPF-SAM) or other analyses that provide cumulative results and pace of progress (see also Section 4.4). The LIWG may use resources to assist in this effort, at the discretion of the PAC.

Assessment of progress at least every two years will consider the achievement of "outputs" for individual implementation items identified in Table 5-4. Some items in the implementation schedule will provide additional data that may impact Plan priorities and help define future implementation. Results of planned studies and similarly relevant activities will be considered and incorporated into the annual evaluation process. The Partnership will consider the execution of monitoring efforts as part of its evaluation (i.e., what was planned and what was completed) to identify potential gaps.

5.4.5.2 Five Year Review

A more thorough evaluation of Plan progress is planned after five years (halfway through the 2023-2032 period covered by this Plan) to be performed by the LIWG. Over the 10-year life of the Plan, developments may arise that warrant revisions to the Plan. New priority issues may emerge. The relative importance of existing issues may change based on monitoring data, modeling results, or shifting priorities of the Partners. Progress towards Plan goals and the implementation schedule may deviate from that anticipated. Thus, a 5-year evaluation will be performed to assess whether revisions to priority issues, goals, activity targeting, and implementation schedule are needed. This evaluation may result in a Plan amendment (see Section 5.5) needed to update elements of the Plan, as needed.

5.5 Plan Updates and Amendments

The Partners understand that this Plan and its targeted implementation schedule are a guide. The Plan provides a roadmap for the next 10 years while maintaining flexibility for the Partners to use their local expertise to ensure that Plan resources are used efficiently and responsibly to address priority issues. The Partners will annually assess progress towards Plan implementation and adjust the implementation schedule through the development of its annual work plan (see Section 5.4.4).

Prior to a scheduled Plan update, the Partners may wish to make significant revisions to the Plan through a Plan amendment. A Plan amendment may be required to significantly change Plan priority issues, goals, targeted implementation schedule, or administrative processes.

Amendments to this Plan will follow the procedures described herein. This Plan will remain in full effect until an update is approved by BWSR and adopted by each Partner. The Plan amendment process shall be initiated only by the PAC. However, Plan amendments may be proposed by any agency, person, or local government, including the LIWG and TAC. The LIWG will intentionally consider potential changes that warrant a plan amendment ahead of annual work planning. Potential changes and a call for additional recommendations to be considered will be discussed as part of annual work planning. All recommended Plan amendments must be submitted to the PAC along with an explanation of why the Plan amendment is needed.

Draft Plan amendments presented to the PAC for consideration shall be prepared and formatted as described herein. Amendments must be provided (printed or digitally) in the form of replacement pages for the plan, each page of which must:

- Show deleted text as stricken and new text as underlined
- Be renumbered as appropriate (unless the entire Plan is reproduced)
- Include the effective date of the amendment (unless the entire Plan is reproduced)

If the PAC, in coordination with BWSR, determines that a Plan amendment is needed, the LIWG will complete the amendment according to BWSR policy and related statutes.

In recognizing the need to maintain flexibility during implementation, a Plan amendment is generally not required for the following situations (unless requested by the Partners):

- Revising the estimated cost for an individual project or program
- Adding or removing activities from the implementation schedule, provided that:
    - The activity is consistent with Plan goals, and
    - The action is performed through the annual work plan update
- Altering the timeline for planned activities within the implementation schedule
- Including new or updated monitoring data, model results, or other technical information

If it is unclear whether a proposed revision to the Plan requires an amendment, the PAC will coordinate with BWSR staff to determine the need for a Plan amendment. Examples of situations where a Plan amendment may be required include:

- Addition of capital improvement projects that are not described in the Plan
- Establishment of a water management district(s) to collect revenues and pay for projects initiated through, MS 103D.601, 605, 611 or 730 (only applicable within the HICWD). To use this funding method, MS 103D.729 requires a Plan amendment
- Addition of new projects or programs with significant financial impact relative to existing estimated costs

Partner entities maintaining individual CIPs outside of this Plan periodically update their CIPs. The Partnership requests that Partners updating separate, relevant CIPs provide a courtesy notification and opportunity for discussion with the PAC.

Table 5-4 Lower Minnesota River West Comprehensive Watershed Management Plan Implementation Schedule

Item ID	Implementation Action Description	Type A = Admin P = Project S = Study E = Educ. R = Reg.	Applicable Goals (see Table 3-3)	Applicability to Goal Areas: Tier 1 – Degraded Surface Water Quality	Tier 1 – Accelerated Erosion and Sedimentation	Tier 1 – Altered Hydrology	Tier 1 – Excessive Flooding	Tier 2 – Degraded Soil Health	Tier 2 – Groundwater Contamination	Tier 3 – Threatened Groundwater Supply	Tier 3 – Threats to Fish, Wildlife, and Habitat	Target or Focus Area	Measurable Output	Timeframe (Values are incremental for each 2-year period): 2023 to 2024	2025 to 2026	2027 to 2028	2029 to 2030	2031 to 2032	Estimated Total Cost	Estimated Local Contribution (landowner, SWCD/County locally budgeted/ assessed)	Estimated External Contribution (WBIF, competitive grants, federal)	Lead LGU	Supporting Entities
ADM-1	Develop template education materials and branding for consistent messaging between partners	E	All related to education	●	●	●	●	●	●	●	●	Planning Area	Templates, Branding	X					$ 5,000	$ 2,500	$ 2,500	All Partners	BWSR
ADM-2	Annual work planning, budgeting, and reporting	A	All (indirectly)	●	●	●	●	●	●	●	●	Planning Area	Work plans, Annual report (1 per year)	X	X	X	X	X	$ 600,000	$ 300,000	$ 300,000	All Partners	BWSR
ADM-3	Interim progress assessment and possible amendment	A	All (indirectly)	●	●	●	●	●	●	●	●	Planning Area	Interim assessment report			X			$ 50,000	$ 50,000	$ -	All Partners	BWSR
																	ADM SUBTOTAL:		$ 655,000	$ 352,500	$ 302,500		
ESC-1	Perform site visits to critical areas to engage landowners regarding buffer implementation (site visits to difficult, hard to maintain areas and also successful, exemplary sites to extrapolate to others.)	E	ESC-B	O	●	O					O	Riparian Areas	Site Visits	10	10	10	10	10	$ 25,000	$ 25,000	$ -	SWCD	BWSR
ESC-2	Stream restoration (e.g., stabilization, restoration, re-meandering formerly straightened reaches) to increase channel resiliency and reduce bank and bed erosion (in addition to project sites identified in item SWQ-1)	P	ESC-C	O	●	O	O				O	See ESC-8; Rush River, High Island Creek, tributaries	Number of projects; total restored feet	10 projects and/or 5,000 feet					$ 1,500,000	$ 750,000	$ 750,000	HICWD County	SWCD MDNR MPCA
ESC-3	Provide technical support for landowner projects to stabilize streambanks using natural design, in coordination with MDNR	P	ESC-C	O	●	O	O				O	See ESC-8; Rush River, High Island Creek, tributaries	Number of projects; total restored feet	10 projects and/or 5,000 feet					$ 100,000	$ 100,000	$ -	SWCD County	MDNR MPCA
ESC-4	Implement and/or expand cost share assistance programs to promote maintenance and increased use of BMPs focused on soil health (e.g., cover crops, conservation tillage - defined as no-till and strip-till)	P	ESC-A, ESC-D, ESC-E, SLH-C	O	●	O	O	O				Cropland in Level 1 and 2 Project Areas (see Figure 3-8, Figure 3-9)	Number of acres added to soil health practices (>4000 over 10 years)	400 ac added	600 ac added	800 ac added	1000 ac added	1200 ac added	$ 300,000	$ 150,000	$ 150,000	SWCD	NRCS MDA BWSR
ESC-5	Host outreach events for agri-business to promote soil health practices	E	ESC-D		●			O				Watershed-wide	1 Outreach event per year	2	2	2	2	2	$ 10,000	$ 10,000	$ -	SWCD	NRCS MDA BWSR
ESC-6	Watershed evaluation (including desktop and field components) of streambank areas to determine priority restoration areas (leveraging HSPF and other model results, MPCA/MDNR survey results, etc., in partnership with MDNR)	S	ESC-C	O	O	●	O				O	Level 1 and 2 priority areas (see Figure 3-9)	Inventory of priority restoration areas	X	X				$ 150,000	$ 75,000	$ 75,000	SWCD	MDNR MPCA
ESC-7	Implement water storage projects in the High Island Creek Watershed District to minimize sediment loss and flood risk	P	ESC-A	O	●	O	●					High Island Lake Watershed District	Projects and associated storage (1 per year)	2	2	2	2	2	$ 100,000	$ 100,000	$ -	HICWD	SWCD MDNR
																	ESC SUBTOTAL		$ 2,185,000	$ 1,210,000	$ 975,000		
SWQ-1	Implement BMPs at priority level 1 and 2 sites identified through terrain analyses (see Figure X) or other assessments to reduce erosion, filter pollutants, and/or retain runoff; specific BMPs to be determined based on site-specific feasibility, with target implementation by subwatershed as follows:	P	SWQ-A, SWQ-B, SWQ-C, SWQ-D, ESC-E, SWQ-E, SWQ-F	●	●	O	O	O	O	O	O	Level 1, 2, 3 Project Areas (see Figure 3-8)	Number of projects implemented and corresponding reduction in pollutant loading	Numbers below indicate planned number of projects per biennium, by watershed					See below	See below	See below	SWCD County	MDNR NRCS BWSR MDA
	High Island Creek Level 1-2 Areas	P		●	●	O	O	O	O	O	O	Level 1 and 2	30 projects over 10 years	6	6	6	6	6	$ 600,000	$ 180,000	$ 420,000		
	North Branch Rush River Level 1-2 Areas	P		●	●	O	O	O	O	O	O	Level 1 and 2	30 projects over 10 years	6	6	6	6	6	$ 600,000	$ 180,000	$ 420,000		
	Middle Branch Rush River Level 1-2 Areas	P		●	●	O	O	O	O	O	O	Level 1 and 2	30 projects over 10 years	6	6	6	6	6	$ 600,000	$ 180,000	$ 420,000		
	South Branch Rush River Level 1-2 Areas	P		●	●	O	O	O	O	O	O	Level 1 and 2	30 projects over 10 years	6	6	6	6	6	$ 600,000	$ 180,000	$ 420,000		
	NE Sibley/Bevens Creek Level 1-2 Areas	P		●	●	O	O	O	O	O	O	Level 1 and 2	30 projects over 10 years	6	6	6	6	6	$ 600,000	$ 180,000	$ 420,000		
	Minnesota River Level 1-2 Areas	P		●	●	O	O	O	O	O	O	Level 1 and 2	30 projects over 10 years	6	6	6	6	6	$ 600,000	$ 180,000	$ 420,000		
	High Island Creek Level 3 Areas	P		●	●	O	O	O	O	O	O	Level 3	10 projects over 10 years	2	2	2	2	2	$ 200,000	$ 100,000	$ 100,000		
	North Branch Rush River Level 3 Areas	P		●	●	O	O	O	O	O	O	Level 3	10 projects over 10 years	2	2	2	2	2	$ 200,000	$ 100,000	$ 100,000		
	Middle Branch Rush River Level 3 Areas	P		●	●	O	O	O	O	O	O	Level 3	10 projects over 10 years	2	2	2	2	2	$ 200,000	$ 100,000	$ 100,000		
	South Branch Rush River Level 3 Areas	P		●	●	O	O	O	O	O	O	Level 3	10 projects over 10 years	2	2	2	2	2	$ 200,000	$ 100,000	$ 100,000		
	NE Sibley/Bevens Creek Level 3 Areas	P		●	●	O	O	O	O	O	O	Level 3	10 projects over 10 years	2	2	2	2	2	$ 200,000	$ 100,000	$ 100,000		
	Minnesota River Level 3 Areas	P		●	●	O	O	O	O	O	O	Level 3	10 projects over 10 years	2	2	2	2	2	$ 200,000	$ 100,000	$ 100,000		
	Total	P											240 projects over 10 years	**48**	**48**	**48**	**48**	**48**	**$ 4,800,000**	**$ 1,680,000**	**$ 3,120,000**		
SWQ-2	Perform feasibility studies to design in-lake phosphorus reduction projects to address nutrient-impairments of Titlow, Silver, Clear, and High Island Lake	S	SWQ-A	●							O	Clear Lake, High Island Lake, Silver Lake, Titlow Lake	Feasibility studies	X					$ 100,000	$ 25,000	$ 75,000	Sibley SWCD Nicollet SWCD	MPCA MDNR

Table 5-4 Lower Minnesota River West Comprehensive Watershed Management Plan Implementation Schedule

Item ID	Implementation Action Description	Type A = Admin P = Project S = Study E = Educ. R = Reg.	Applicable Goals (see Table 3-3)	Applicability to Goal Areas								Target or Focus Area	Measurable Output	Timeframe (Values are incremental for each 2-year period)					Estimated Total Cost	Estimated Local Contribution (landowner, SWCD/County locally budgeted/ assessed)	Estimated External Contribution (WBIF, competitive grants, federal)	Lead LGU	Supporting Entities
				Tier 1				Tier 2		Tier 3													
				Degraded Surface Water Quality	Accelerated Erosion and Sedimentation	Altered Hydrology	Excessive Flooding	Degraded Soil Health	Groundwater Contamination	Threatened Groundwater Supply	Threats to Fish, Wildlife, and Habitat			2023 to 2024	2025 to 2026	2027 to 2028	2029 to 2030	2031 to 2032					
SWQ-3	Implement projects to reduce internal loading of phosphorus in Titlow, Silver, Clear, and High Island Lakes	P	SWQ-A	●							o	Clear Lake, High Island Lake, Silver Lake, Titlow Lake	4 projects over 10 years		1	1	1	1	$ 300,000	$ 100,000	$ 200,000	Sibley SWCD Nicollet SWCD	MPCA MDNR
SWQ-4	Support projects to reduce phosphorus and sediment loading in residential stormwater runoff via cost share	P	SWQ-A, SWQ-B, SWQ-C, ESC-E	●	●		o			●		Cities/townships	30 projects over 10 years	6	6	6	6	6	$ 30,000	$ 7,500	$ 22,500	SWCDs	MPCA Cities
SWQ-5	Perform field verification of proposed project sites identified through terrain analysis (see Figure 4-1) to verify problems and evaluate feasibility	S	SWQ-A, SWQ-B, SWQ-C, ESC-E	●	●		o	o		o	o	Level 1 and 2 Project Areas (see Figure 3-8)	Inventory of feasibility sites for future implementation	X	X				$ 50,000	$ 50,000	$ -	SWCD	MDNR MPCA
SWQ-6	Coordinate with MPCA and other state agencies to tailor agency monitoring plan(s) to focus on critical stressors for local priorities (e.g., nutrients, sediment, bacteria, biological impairments)	S	All SWQ Goals	●							●	Watershed-wide	Monitoring Plan	X					$ 10,000	$ 10,000	$ -	SWCD	MPCA
SWQ-7	Provide financial assistance to implement animal waste management systems to reduce waste loading to streams	P	SWQ-F	●					●			Subwatersheds with bacterial impairments	Number of assisted feedlots (20 over 10 years)	4	4	4	4	4	$ 2,000,000	$ 600,000	$ 1,400,000	County SWCD	NRCS MPCA MDA
SWQ-8	Re-analyze High Priority Areas/Terrain Analysis using updated LiDAR information once available to allow for more accurate priority targeting	P	SWQ-A, FLD-A	●	●	o	o		●			Watershed-wide	Updated terrain analysis	X	X				$ 20,000	$ 20,000	$ -	SWCD	MDNR
																	SWQ SUBTOTAL		$ 7,310,000	$ 2,492,500	$ 4,817,500		
AHD-1	Maintain an inventory of tile drainage within the watershed to apply for multipurpose drainage management (MDM) grants	S	AHD-E			●	o					Watershed-wide	Tile drainage inventory	X	X	X	X	X	$ 40,000	$ 40,000	$ -	County	BWSR MDNR
AHD-2	Host outreach events to promote application and interest in multipurpose drainage projects.	E	AHD-D, AHD-E	o	o	●	o	o				Watershed-wide	10 events over 10 years	2	2	2	2	2	$ 20,000	$ 20,000	$ -	County SWCD	BWSR MDNR
AHD-3	Inventory and asses drainage systems within the watershed for multipurpose drainage management (MDM) opportunities	S	AHD-D, AHD-E	o	o	●	o				o	Watershed-wide	Inventory and Priority Listing	X			X		$ 50,000	$ 50,000	$ -	County SWCD HICWD	NRCS MPCA MDA
AHD-4	Implement multipurpose drainage projects for public ditches in priority areas to mitigate adverse impacts to hydrology and water quality (coordinating with state agencies early in process, as applicable)	P	AHD-E	o	o	●	o				o	Level 1 and 2 priority areas (see Figure 3-9)	10 projects over 10 years	2	2	2	2	2	$ 1,000,000	$ 500,000	$ 500,000	County SWCD	NRCS MPCA MDA
AHD-5	Support (through cost-share) the implementation of tile system BMPs to mitigate hydrologic impacts of upstream tile systems	P	AHD-C, AHD-D	o	o	●	o				o	Level 1 and 2 priority areas (see Figure 3-9)	100 projects over 10 years	20	20	20	20	20	$ 2,500,000	$ 1,250,000	$ 1,250,000	County SWCD	NRCS MPCA MDA
AHD-6	Meet with drainage authorities at least annually to review permitting processes, performance standards, review Plan goals, and coordinate messaging	R	AHD-E			●	o					Watershed-wide	Meetings (at least 1 per year)	2	2	2	2	2	$ 10,000	$ 10,000	$ -	County	NRCS MPCA MDA
AHD-7	Identify priority opportunities for enrollment in conservation programs	S	AHD-G, AHD-H, FWH-C	o		●	o				●	Level 1 and 2 priority areas (see Figure 3-9)	Inventory of priority opportunities	X					$ 20,000	$ 20,000	$ -	SWCD	BWSR NRCS
AHD-8	Targeted outreach to landowners in priority areas regarding conservation programs	E	AHD-F, AHD-G, AHD-H, FWH-C									Level 1 and 2 priority areas (see Figure 3-9)	3 workshops/year; target 100 landowners over 10 years	20	20	20	20	20	$ 50,000	$ 50,000	$ -	SWCD	BWSR NRCS
AHD-9	Promote enrollment in conservation programs through distribution of educational materials, hosting workshops, and/or targeted field visits, and cost share support	E	AHD-B, AHD-F, AHD-G, AHD-H, FWH-C	o		●	o				o	See LR-9	2,000 acres enrolled over 10 years	150	350 acres	500 acres	500 acres	500 acres	$ 300,000	$ 150,000	$ 150,000	SWCD	MDNR NRCS
AHD-10	Targeted outreach to landowners with high priority wetland areas, including workshops and site visits	E	AHD-G, FWH-A	o		●	o				o	Level 1 and 2 priority areas (see Figure 3-9)	Target 100 landowners in 10 years	20	20	20	20	20	$ 50,000	$ 25,000	$ 25,000	SWCD	BWSR MDNR
AHD-11	Identify and implement high priority wetland restoration projects in coordination with willing landowners	P	AHD-G, FWH-A	o		●	o				o	Level 1 and 2 priority areas (see Figure 3-9)	Inventory of opportunities; 5 projects over 10 years		1	1	1	2	$ 400,000	$ 200,000	$ 200,000	SWCD	BWSR MDNR
AHD-12	Identify locations where two-stage ditches are feasible to maintain capacity while reducing velocity and/or erosion potential and provide technical support for implementation	P	AHD-D, AHD-E	o	o	●	o					High and Medium Priority Areas	Inventory of locations; technical assistance	X	X	X	X	X	$ 60,000	$ 60,000	$ -	SWCD County	MDNR BWSR
																	ADH SUBTOTAL		$ 4,500,000	$ 2,375,000	$ 2,125,000		
FLD-1	Implement projects to increase headwater storage and/or reduce peak flow rates at priority locations identified in below subwatersheds	P	FLD-A, ESC-A, AHD-A	o	o		●	o				Level 1 and 2 Areas (see Figure 3-9)	Number of projects implemented and corresponding increase in storage	Numbers below indicate storage anticipated per biennium, by watershed					See SWQ-1	See SWQ-1	See SWQ-1	SWCD County	MDNR MPCA
	High Island Creek Level 1-2 Areas	P		o	o		●	o					30 projects over 10 years										

Table 5-4 Lower Minnesota River West Comprehensive Watershed Management Plan Implementation Schedule

Item ID	Implementation Action Description	Type A = Admin P = Project S = Study E = Educ. R = Reg.	Applicable Goals (see Table 3-3)	Applicability to Goal Areas: Tier 1: Degraded Surface Water Quality	Tier 1: Accelerated Erosion and Sedimentation	Tier 1: Altered Hydrology	Tier 1: Excessive Flooding	Tier 2: Degraded Soil Health	Tier 2: Groundwater Contamination	Tier 3: Threatened Groundwater Supply	Tier 3: Threats to Fish, Wildlife, and Habitat	Target or Focus Area	Measurable Output	Timeframe (Values are incremental for each 2-year period): 2023 to 2024	2025 to 2026	2027 to 2028	2029 to 2030	2031 to 2032	Estimated Total Cost	Estimated Local Contribution (landowner, SWCD/County locally budgeted/ assessed)	Estimated External Contribution (WBIF, competitive grants, federal)	Lead LGU	Supporting Entities
	South Branch Rush River Level 1-2 Areas	P		O	O		●	O					30 projects over 10 years	Specific quantity and location of increased storage will be updated based on results of implementation item FLD-6 and SWQ-1 incorporating storage and/or runoff reduction					Costs included with SWQ-1 and other implementation items	Costs included with SWQ-1 and other implementation items	Costs included with SWQ-1 and other implementation items	SWCD County HICWD	MDNR MPCA
	Middle Branch Rush River Level 1-2 Areas	P		O	O		●	O					30 projects over 10 years										
	South Branch Rush River Level 1-2 Areas	P		O	O		●	O					30 projects over 10 years										
	NE Sibley/Bevens Creek Level 1-2 Areas	P		O	O		●	O					30 projects over 10 years										
	Minnesota River Level 1-2 Areas	P		O	O		●	O					30 projects over 10 years										
	High Island Creek Level 3 Areas	P		O	O		●	O					10 projects over 10 years										
	South Branch Rush River Level 3 Areas	P		O	O		●	O					10 projects over 10 years										
	Middle Branch Rush River Level 3 Areas	P		O	O		●	O					10 projects over 10 years										
	South Branch Rush River Level 3 Areas	P		O	O		●	O					10 projects over 10 years										
	NE Sibley/Bevens Creek Level 3 Areas	P		O	O		●	O					10 projects over 10 years										
	Minnesota River Level 3 Areas	P		O	O		●	O					10 projects over 10 years										
FLD-2	Use available information to prioritize areas within the planning area for more new/more detailed H&H modeling to assess flood risk	S	FLD-B				●					Watershed-wide	Prioritized inventory of flood risk areas		X				$ 25,000	$ 25,000	$ -	SWCD	MDNR
FLD-3	Develop/revise hydrologic and hydraulic models, if necessary, to characterize flood risk in priority areas and identify possible solutions	S	FLD-B				●					See FLD-2	Hydrologic and hydraulic model/analyses	X	X	X			$ 150,000	$ 150,000	$ -	SWCD	MDNR
FLD-4	Use results of hydrologic and hydraulic modeling/analyses to refine storage and flow rate reduction goals for subwatersheds and identify priority locations for storage practices (see FL-3)	S	FLD-B	O	O		●		O			Watershed-wide	Subwatershed storage and flow rate goals			X			$ 50,000	$ 50,000	$ -	SWCD County	MDNR
FLD-5	Reconstruct Baker's Lake Outlet (Option 8 of feasibility study) - including mid-elevation weir (1014.91 ft), embankment raise to 1019 feet, and clean channel cleanout	P	FLD-A, FLD-D	O	●		●					Baker's Lake	Reconstructed Outlet		X				$ 490,000	$ 245,000	$ 245,000	HICWD County	MDNR
FLD-6	Review and recommend revisions for floodplain ordinances to ensure adequate protection of floodplain functions, infrastructure, and bluff protection	R	FLD-C			O	●					Watershed-wide	Ordinance revision recommendations	X					$ 10,000	$ 10,000	$ -	County	MDNR
FLD-7	Develop an inventory of floodplain reconnection/ restoration opportunities and completed upstream projects	S	FLD-C			●	O				O	Watershed-wide	Inventory of opportunities	X					$ 20,000	$ 20,000	$ -	SWCD	BWSR MDNR
FLD-8	Implement projects to reconnect or restore disconnected floodplain areas to increase flood resilience (including cooperative efforts with MDNR)	P	FLD-C, FLD-D			●	●				O	Floodplains (emphasizing lower Rush River and High Island Creek)	6 projects over 10 years			2	2	2	$ 500,000	$ 250,000	$ 250,000	SWCD	MDNR
FLD-9	Support landowner flood risk mitigation projects through cost-share grant program and technical assistance.	P	FLD-D				●					Floodplains	20 projects over 10 years	4	4	4	4	4	$ 100,000	$ 20,000	$ 80,000	SWCD	MDNR
FLD-10	Compile and maintain data on problem culverts from counties and road authorities based on existing inventories; meet with Partner public works departments annually to coordinate multi-benefit (e.g., hydraulic and ecological) infrastructure improvements	S	FLD-B, FLD-D		O	●	●					Watershed-wide	Problem area database; meetings with PW depts	X	X	X	X	X	$ 20,000	$ 20,000	$ -	County	MnDOT
																	FLD SUBTOTAL		$ 1,365,000	$ 790,000	$ 575,000		
SLH-1	Develop an inventory of existing soil health practices (e.g., cover crops, perennial vegetation) within the planning area to assess extent and gaps	S	SLH-A	O	●	O	O	●	O	O		Watershed-wide	Inventory of soil health best practices	X	X	X	X	X	$ 50,000	$ 50,000	$ -	SWCD	BWSR NRCS MDA MOSH
SLH-2	Review existing work performed by others at state and regional level to asses/quantify the runoff reduction, water quality, water storage, and groundwater protection benefits of cover crops, perennial vegetation, and other soil health practices. Consider applicability of findings to this planning area and opportunities to communicate impacts to producers and other stakeholders.	S	SLH-A	O	●	O	O	●	O	O		Soil health focus areas (to be determined)	Study; numeric benefit estimates	X	X	X	X	X	$ 50,000	$ 50,000	$ -	SWCD	BWSR NRCS MDA MOSH
SLH-3	Convene and support a group of local producers to champion and demonstrate implementation of soil health practices in the planning area	E	SLH-B, GWS-A	O	●	O	O	●	O	O		Watershed-wide	Meetings; technical support	X	X	X	X	X	$ 10,000	$ 10,000	$ -	SWCD	BWSR MDA MOSH NRCS

Table 5-4 Lower Minnesota River West Comprehensive Watershed Management Plan Implementation Schedule

Item ID	Implementation Action Description	Type A = Admin P = Project S = Study E = Educ. R = Reg.	Applicable Goals (see Table 3-3)	Applicability to Goal Areas: Tier 1: Degraded Surface Water Quality	Tier 1: Accelerated Erosion and Sedimentation	Tier 1: Altered Hydrology	Tier 1: Excessive Flooding	Tier 2: Degraded Soil Health	Tier 2: Groundwater Contamination	Tier 3: Threatened Groundwater Supply	Tier 3: Threats to Fish, Wildlife, and Habitat	Target or Focus Area	Measurable Output	Timeframe (Values are incremental for each 2-year period): 2023 to 2024	2025 to 2026	2027 to 2028	2029 to 2030	2031 to 2032	Estimated Total Cost	Estimated Local Contribution (landowner, SWCD/County locally budgeted/ assessed)	Estimated External Contribution (WBIF, competitive grants, federal)	Lead LGU	Supporting Entities
SLH-4	Distribute education materials promoting the use of BMPs focused on soil health (e.g., cover crops, perennial vegetation, conservation tillage) and ag loans for equipment to support conservation till strategies	E	SLH-B, GWS-A	O	O		O	●	O	O		Watershed-wide	News Articles; digital communications (1 per year)	2	2	2	2	2	$ 5,000	$ 2,500	$ 2,500	SWCD	BWSR MDA MOSH NRCS
SLH-5	Implement demonstration projects to show impact and implementation of soil health practices	P	SLH-B, SLH-C, GWS-A	O	O		O	●	O	O		Watershed-wide	5 projects over 10 years	1	1	1	1	1	$ 100,000	$ 50,000	$ 50,000	SWCD	BWSR NRCS MDA MOSH
SLH-6	Host field days to demonstrate and promote soil health practices	E	SLH-B, SLH-C	O	O		O	●	O	O		Watershed-wide	20 field day events over 10 years	4	4	4	4	4	$ 40,000	$ 20,000	$ 20,000	SWCD	BWSR MDA MOSH NRCS
SLH-7	Host outreach events with agra-businesses to promote soil health	E	SLH-B, SLH-C	O	O		O	●	O	O		Watershed-wide	1 event per year	2	2	2	2	2	$ 20,000	$ 10,000	$ 10,000	SWCD	BWSR NRCS MDA MOSH
																	SLH SUBTOTAL		$ 275,000	$ 192,500	$ 82,500		
GWQ-1	Provide financial assistance to seal abandoned or unused **private wells**	P	GWQ-E						●			Watershed-wide (focus on DWSMAs)	Number of sealed wells (10 per year)	20	20	20	20	20	$ 100,000	$ 50,000	$ 50,000	County SWCD	MDH
GWQ-2	Seal abandoned or unused **high-capacity wells**	P	GWQ-E						●			Watershed-wide (focus on DWSMAs)	Number of sealed wells (2 over 10 years)	2 high capacity wells over 10 years					$ 60,000	$ 30,000	$ 30,000	County	Cities MDH
GWQ-3	Implement practices to reduce or limit nitrate movement into groundwater (e.g., nutrient management, cover crops, saturated buffers, two-stage ditches, wetland restoration)	P	GWQ-C	O	O	O	O	O	●			Watershed-wide	Number of projects incorporating nitrogen reduction	See SWQ-1 actions; ESC-6 actions					See SWQ-1, SWQ-2, SWQ-4	See SWQ-1, SWQ-2, SWQ-4	See SWQ-1, SWQ-2, SWQ-4	SWCD	County NRCS MDA
GWQ-4	Cooperate with agricultural producers to develop site-specific nutrient, fertilizer, and/or manure management plans	P	GWQ-C, GWQ-D	O				O	●			Watershed-wide	Nutrient management plans (50 over 10 years)	10	10	10	10	10	$ 100,000	$ 100,000	$ -	SWCD	MDA MPCA NRCS
GWQ-5	Provide financial assistance for repair or replacement of non-functioning SSTS	P	GWQ-D	●					●			Watershed-wide (focus on DWSMAs)	Number of addressed SSTS (25 per year)	50	50	50	50	50	$ 500,000	$ 350,000	$ 150,000	County	MPCA
GWQ-6	Provide assistance for landowners to apply for loans to address SSTS issues	P	GWQ-D	●					●			Watershed-wide (focus on DWSMAs)	Loan assistance	X	X	X	X	X	$ 10,000	$ 10,000	$ -	County	MDA
GWQ-7	Provide free and/or reduced cost well testing	S	GWQ-A						●			Watershed-wide	Number of wells sampled (500 over 10 years)	100	100	100	100	100	$ 50,000	$ 50,000	$ -	County	MDH MDA
GWQ-8	Coordinate every 3 years with MDH and other partners to review most current groundwater monitoring programs, management activities, and data, identify trends in nitrate concentrations in residential wells, and identify priority action areas	S	GWQ-B.1, GWQ-B.2, GWQ-F						●	●		Watershed-wide	Monitoring Plan, additions to database, priority areas	X		X	X		$ 25,000	$ 25,000	$ -	SWCD County	MPCA MDH MDA
GWQ-9	Compile and maintain a local database of groundwater quality data and track results of private groundwater well testing for nitrate, arsenic, and other contaminants	S	GWQ-B.1, GWQ-B.2						●			Watershed-wide	Additions to monitoring database	X	X	X	X	X	$ 50,000	$ 50,000	$ -	County	MDH MDA
GWQ-10	Distribute education materials increasing resident awareness of groundwater issues, groundwater conservation, testing, and pollutant loading best practices	E	GWQ-A, GWQ-D	O					●			Watershed-wide	News Article; digital communications (2 per year)	4	4	4	4	4	$ 10,000	$ 5,000	$ 5,000	County	MDH MDA
GWQ-11	Organize and/or facilitate meeting opportunity (mid-Plan cycle) for public water suppliers to coordinate groundwater protection efforts	E	All GWQ goals						●			Public water suppliers	Meetings (every 5 years)			X		X	$ 2,000	$ 2,000	$ -	County	MDH MDA
GWQ-12	Distribute education materials regarding private well maintenance, capping, and closure	E	GWQ-A, GWQ-E						●			Watershed-wide	News Article; digital communications (1 per year)	X	X	X	X	X	$ 5,000	$ 2,500	$ 2,500	County	MPCA MDH
GWQ-13	Provide technical assistance and cost-share assistance to address private wells with high arsenic levels	P	GWQ-F						●			Watershed-wide	Cost-share projects (25 over 10 years)	5	5	5	5	5	$ 50,000	$ 25,000	$ 25,000	County	MDH MDA
GWQ-14	Update county-based well inventory as part of other planning outreach efforts	S	GWQ-B.1, GWQ-B.2						●			Watershed-wide	Inventory updates (annual)	X	X	X	X	X	$ 10,000	$ 10,000	$ -	County	MDH MDA
																	GWQ SUBTOTAL:		$ 972,000	$ 709,500	$ 262,500		
GWS-1	Coordinate with MDNR and other partners to review groundwater level monitoring data, identify data gaps/needs, and identify potential programs or activities to fill gaps (e.g., community-based aquifer management partnership)	S	GWS-B							●		Watershed-wide (with focus on public water suppliers)	Monitoring Plan		X				$ 5,000	$ 5,000	$ -	County	MDNR MDH Cities

Table 5-4 Lower Minnesota River West Comprehensive Watershed Management Plan Implementation Schedule

Item ID	Implementation Action Description	Type A = Admin P = Project S = Study E = Educ. R = Reg.	Applicable Goals (see Table 3-3)	Applicability to Goal Areas: Tier 1 – Degraded Surface Water Quality	Tier 1 – Accelerated Erosion and Sedimentation	Tier 1 – Altered Hydrology	Tier 1 – Excessive Flooding	Tier 2 – Degraded Soil Health	Tier 2 – Groundwater Contamination	Tier 3 – Threatened Groundwater Supply	Tier 3 – Threats to Fish, Wildlife, and Habitat	Target or Focus Area	Measurable Output	Timeframe (Values are incremental for each 2-year period): 2023 to 2024	2025 to 2026	2027 to 2028	2029 to 2030	2031 to 2032	Estimated Total Cost	Estimated Local Contribution (landowner, SWCD/County locally budgeted/ assessed)	Estimated External Contribution (WBIF, competitive grants, federal)	Lead LGU	Supporting Entities
GWS-2	Work with MDNR to establish groundwater quantity trends in the watershed	S	GWS-B, GWQ-B.1, GWQ-B.2							●		Watershed-wide	Monitoring report			X			$ 50,000	$ 50,000	$ -	County	MDNR
																	GWS SUBTOTAL		$ 55,000	$ 55,000	$ -		
FWH-1	Provide local technical assistance in support of wetland restoration and other natural resource projects, as requested (private and public projects)	P	FWH-A, FWH-B, FWH-C			O					●	Watershed-wide	Number of projects for which assistance provided (1 every 2 years)	1	1	1	1	1	$ 50,000	$ 50,000	$ -	SWCD	MDNR
FWH-2	Review and recommend updates, as needed, to zoning and land use regulations to promote the protection of sites of biological significance, wetlands, and habitat areas	R	FWH-A, FWH-B, FWH-C			O					●	Areas of biological significance	Updated Ordinance(s)		X				$ 10,000	$ 10,000	$ -	SWCD County	MDNR
FWH-3	Work with MDNR and other partners to provide local technical assistance in support of invasive species management and other natural resource projects	P	FWH-B, FWH-D								●	Watershed-wide	Number of projects for which assistance provided (1 every 2 years)	1	1	1	1	1	$ 50,000	$ 50,000	$ -	SWCD	MDNR MDA
FWH-4	Coordinate efforts of county weed inspectors and facilitate sharing of information, as needed	P	FWH-D								●	Watershed-wide	Annual meeting; as needed communication	X	X	X	X	X	$ 10,000	$ 10,000	$ -	SWCD County	MDNR
FWH-5	Provide technical assistance and cost-share support for the development of invasive species management plans for private landowners or landowner groups (e.g., associations)	P	FWH-D								●	Watershed-wide	Invasive species mgmt. plans (5 over 10 years)	1	1	1	1	1	$ 15,000	$ 15,000	$ -	SWCD	MDNR
FWH-6	Host outreach and education events for lake associations or other interested stakeholder groups regarding natural resource protection	E	FWH-B, FWH-D, FWH-E	O							●	Priority lake watersheds	10 events over 10 years	2	2	2	2	2	$ 20,000	$ 20,000	$ -	SWCD HICWD	MDNR
																	FWH SUBTOTAL		$ 155,000	$ 155,000	$ -		
																	PLAN TOTAL:		$ 17,472,000	$ 8,332,000	$ 9,140,000		

Notes: Estimated costs for Regulatory and Administrative Activities include only the estimated incremental/additional cost relative to the implementation of current programs

Red Item IDs indicate activities/programs that may be expanded if additional grant/external funding becomes available

● = implementation activity directly benefits the priority issue

o = implementation activity may indirectly benefit the priority issue

ADM = Administration of Partnership

ESC = Accelerated Erosion and Sedimentation

SWQ = Degraded Surface Water Quality

AHD = Altered Hydrology and Drainage

FLD = Excessive Flooding

SLH = Degraded Soil Health

GWQ = Protection of groundwater and drinking water quality

GWS = Threatened Groundwater Supply

FWH = Threats to Fish, Wildlife, and Habitat

6 References

Baker, D.G., Nelson, W.W., and Kuehnast, E.L. 1979. *Climate of Minnesota Part XII – The Hydrologic Cycle and Soil Water*.

Baratta, V.M., and Petersen, T.A. 2017. Geologic atlas of Sibley County, Minnesota (Part B): Minnesota Department of Natural Resources, County Atlas Series C-24, report and pls. 7–8. http://www.dnr.state.mn.us/waters/programs/gw_section/mapping/platesum/siblcga.html

High Island Creek Watershed District (HICWD). 2021. *Rules and Regulations of High Island Creek Watershed District.*

Federal Interagency Stream Restoration Working Group (FISRWG), 1998. *Stream Corridor Restoration: Principles, Processes, and Practices*.

Lusardi, B.A.; Runkel, A.C.; Meyer, G.N. 2011. *C-24 Geologic Atlas of Sibley County, Minnesota [Part A]*. Minnesota Geological Survey. Retrieved from the University of Minnesota Digital Conservancy, https://hdl.handle.net/11299/116056

McLeod County. 1995. *McLeod County Comprehensive Land Use Plan*.

McLeod County and Mid-Minnesota Development Commission. 2013. *The McLeod County Comprehensive Local Water Plan 2013-2023.*

Minnesota Board of Water and Soil Resources. June 2016. *2016 Nonpoint Priority Funding Plan.*

Minnesota Climatology Working Group. State Climatology Office, Minnesota Department of Natural Resources Division of Ecological and Water Resources: www.climate.umn.edu

Minnesota Department of Administration. 2019. Population and demographics data. https://mn.gov/admin/demography/

Minnesota Department of Agriculture. March 2015. Minnesota Nitrogen Fertilizer Management Plan. Online available: https://www.mda.state.mn.us/pesticide-fertilizer/minnesota-nitrogen-fertilizer-management-plan,

Minnesota Department of Employment and Economic Development. County Profiles. Accessed 2022. Online Available: https://mn.gov/deed/data/data-tools/county-profiles/

Minnesota Department of Health (MDH). July 2021. *Lower Minnesota River West Groundwater Restoration and Protection Strategies (GRAPS).*

MDH. 2018. *Nitrate in Drinking Water*. Online available: https://www.health.state.mn.us/communities/environment/water/contaminants/nitrate.html

MDH. 2016. *Evaluating Proposed Stormwater Infiltration Projects in Drinking Water Supply Management Areas.*

Minnesota Department of Natural Resources (MDNR). 2020. Climate Normal Summary. https://www.dnr.state.mn.us/climate/summaries_and_publications/normalsportal.html

MDNR. 2020. LakeFinder website at: https://www.dnr.state.mn.us/lakefind/index.html

MDNR. 2020. Cooperative stream gaging. https://www.dnr.state.mn.us/waters/csg/index.html

MDNR. 2016. *Why are native plant communities important?*

MDNR. 2009. Conservation Status Ranks for Native plant Community Types and Subtypes. https://files.dnr.state.mn.us/natural_resources/npc/s_ranks_npc_types_&_subtypes.pdf

Minnesota Pollution Control Agency (MPCA). February 2020. *Lower Minnesota River Watershed Restoration and Protection Strategy Report* (WRAPS). Online available at: https://www.pca.state.mn.us/sites/default/files/wq-ws4-58a.pdf

MPCA. February 2020. *Lower Minnesota River Watershed Total Maximum Daily Load Report Part 1 – Southern and Western Watersheds* (TMDL). Online available at: https://www.pca.state.mn.us/sites/default/files/wq-iw7-49e.pdf

MPCA. December 2018. *Lower Minnesota River Watershed Streams Stressor Identification Report*. Online available at: https://www.pca.state.mn.us/sites/default/files/wq-ws5-07020012c.pdf

MPCA. 2018. *Lower Minnesota River Watershed Approach Civil Engagement Project Summary*. Online available at: https://www.pca.state.mn.us/sites/default/files/wq-ws4-55c.pdf

MPCA. 2018. *MPCA Standard Operating Procedure for Lake Water Quality.* *https://www.pca.state.mn.us/water/water-monitoring-standard-operating-procedures*

MPCA. June 2017. *Lower Minnesota River Watershed Monitoring and Assessment Report*. Online available at: https://www.pca.state.mn.us/sites/default/files/wq-ws3-07020012b.pdf

MPCA. November 2017. *Lower Minnesota River Watershed Lakes Stressor Identification Report*. Online available at: https://www.pca.state.mn.us/sites/default/files/wq-ws5-07020012d.pdf

MPCA. June 2016. *Development of Biological Criteria for Tiered Aquatic Life Uses: Fish and macroinvertebrate thresholds for attainment of aquatic life use goals in Minnesota streams and rivers.*

MPCA. 2016. Watershed Pollutant Load Monitoring Network Summary. https://www.pca.state.mn.us/sites/default/files/wq-cm1-03.pdf

MPCA, MDNR, MDA, MDH, BWSR, Minnesota Public Facilities Authority (MPFA), Metropolitan Council, University of Minnesota, Natural Resources Conservation Service (NRCS), Farm Service Agency (FSA), and United States Geological Survey (USGS). September 2014. *The Minnesota Nutrient Reduction Strategy.*

MPCA. 2013. *Nitrogen in Minnesota Surface Waters*. http://www.pca.state.mn.us/index.php/view-document.html?gid=19622

MPCA. July 2009. *Fecal Coliform TMDL Implementation Plan for the High Island Creek and Rush River*. Online available at: https://www.pca.state.mn.us/sites/default/files/wq-iw7-12c.pdf

MPCA. March 2007. *Carver, Bevens, and Silver Creeks Bacterial TMDL Implementation Plan.* Online available at: https://www.pca.state.mn.us/sites/default/files/wq-iw7-04c.pdf

Moore, Trisha L., John S. Gulliver, Latham Stack, and Michael H. Simpson. 2016. Stormwater management and climate change: vulnerability and capacity for adaptation in urban and suburban contexts. *Climate Change*. Volume 138, Issue 3-4, pages 491-504.

National Oceanic and Atmospheric Administration. 2013. *NOAA Atlas 14 Precipitation-Frequency Atlas of the United States, Volume 8 Version 2.0: Midwestern States (Colorado, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, Wisconsin).*

National Oceanic and Atmospheric Administration. 2020. Climate summary data available online at: https://www.ncdc.noaa.gov/cdo-web/datatools

National Weather Bureau--now National Weather Service (NWS). 1961 and 1964. *Technical Paper 40 (TP-40)* and *Technical Paper 49 (TP-49).*

NWS. 2020. Information about advanced hydrologic prediction service (AHPS) https://water.weather.gov/ahps/

Natural Resources Conservation Services (NRCS). Soil Survey webpage (continuing schedule) https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

NRCS (Previously the Soil Conservation Service). 1975. *National Engineering Handbook.*

Nicollet County. 2018. *Nicollet County Local Water Management Plan 2018 Extension.*

Nicollet County. 2021. *Nicollet County Comprehensive Plan.*

RESPEC. 2017. *Documentation of the BMP Database Available in the Scenario Application Manager.* Draft Topical Report RSI-2742. Prepared for the MPCA.

Sibley County. 2009. *Sibley County Comprehensive Plan.*

Sibley County. 2018. *Updated Sibley County Comprehensive Local Water Plan 2013-2023.*

United States Department of Agriculture (USDA). 2012. County Ag profiles https://www.nass.usda.gov/Publications/AgCensus/2012/Online_Resources/County_Profiles/Minnesota/index.php

USDA and Soil Conservation Service (now Natural Resources Conservation Services). 1975. *Minnesota Hydrology Guide.*

United States Geological Survey (USGS). 2016. National Land Cover Dataset (NLCD). https://www.usgs.gov/centers/eros/science/national-land-cover-database

United States Fish and Wildlife Services (USFW). *National Wetland Inventory (NWI)* https://www.fws.gov/wetlands/

Appendices

Appendix A

Land and Water Resources Inventory

A. Land and Water Resources Inventory

This section of the Lower Minnesota River West Comprehensive Watershed Management Plan (Plan) summarizes the physical land, water, and natural resources within the planning area. The planning area boundary follows the western boundary of the Lower Minnesota River watershed (HUC 07020012) but does not include the entirety of the HUC8 level watershed. The planning area, referred to as the Lower Minnesota River West watershed, terminates in the northeast at the boundary of Carver County, which is not a hydrologic boundary (see Figure A-1). The planning area drains 779 square miles and includes portions of McLeod, Nicollet, Renville, and Sibley Counties, as described in Table A-1.

Table A-1 Counties located within the planning area

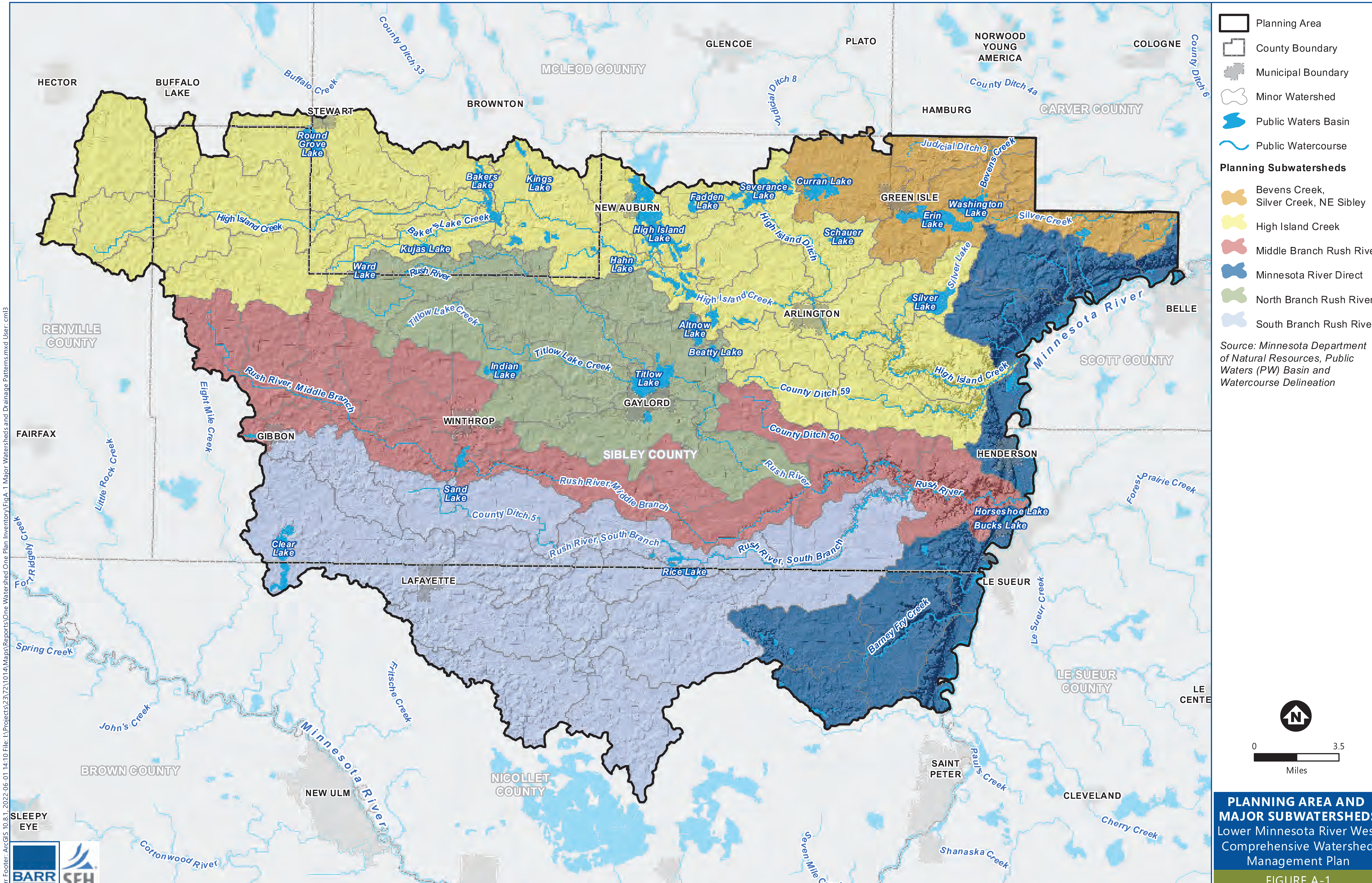
County	Area within Lower Minnesota River West Watershed (mi^2)	Percent of Planning Area within County (%)	Percent of County within Planning Area (%)
McLeod	65.5	8.4%	13.0%
Nicollet	140.4	18.0%	30.1%
Renville[1]	25.9	3.3%	2.6%
Sibley	547.0	70.2%	91.1%
Total	778.7	**100%**	--

(1) Renville County is included in the Advisory Group but is not a Partner

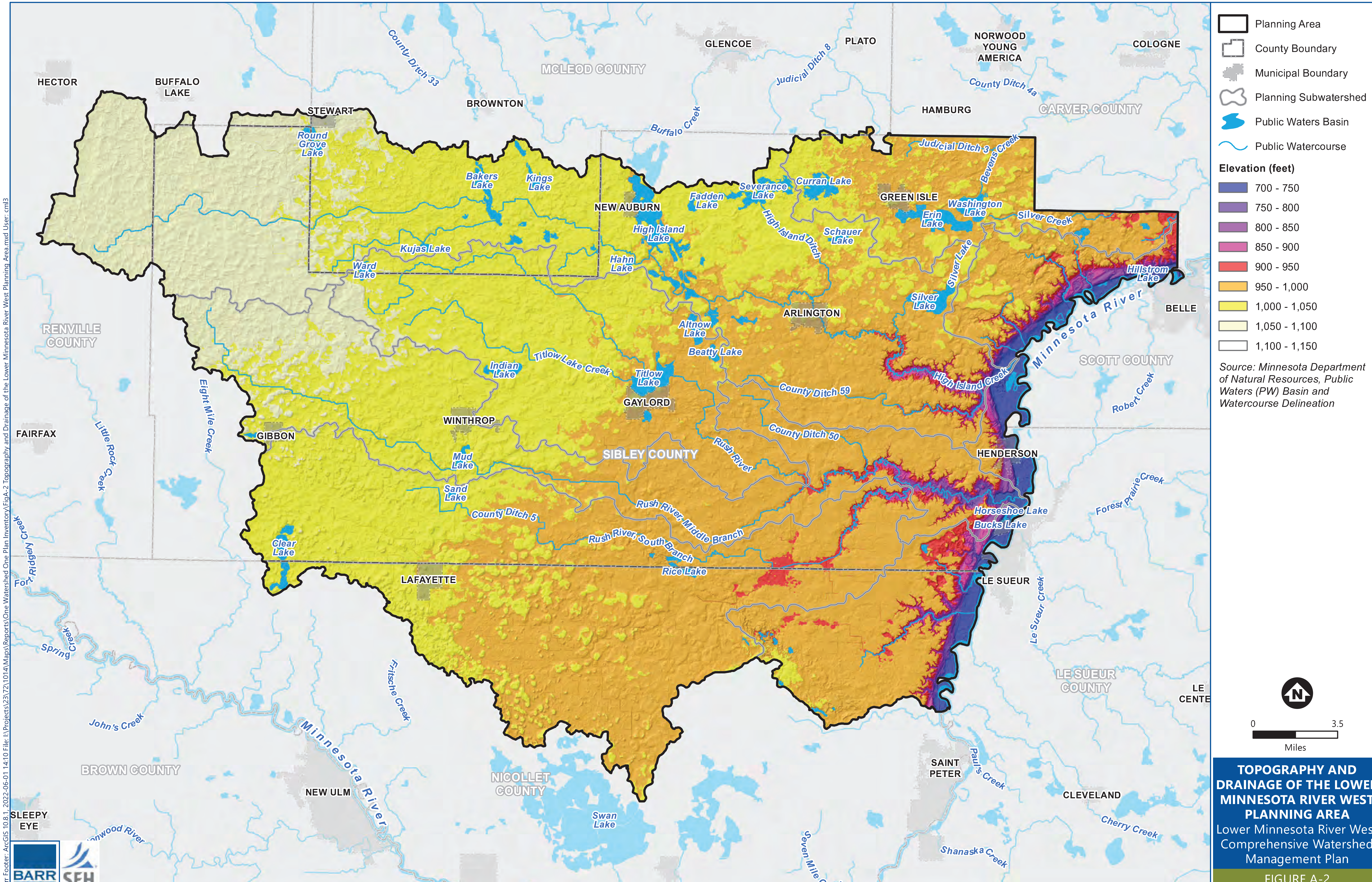
A.1 Topography and Drainage Patterns

The topography of the Lower Minnesota River West watershed includes gently rolling terrain in the western and central portions of the watershed transitioning to hills, bluffs, and ravines in the far eastern portion of the watershed adjacent to the Minnesota River.

Figure A-2 presents elevation information within the planning area based on the National Elevation Dataset (NED) in NAVD88 datum. Elevations in the Lower Minnesota River West watershed range from a maximum of about 1,100 feet above mean sea level (ft MSL) in the far western portion (Renville County) to approximately 720 ft MSL at the downstream limit of the Minnesota River in the northeast.



PLANNING AREA AND MAJOR SUBWATERSHEDS
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE A-1



TOPOGRAPHY AND DRAINAGE OF THE LOWER MINNESOTA RIVER WEST PLANNING AREA
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE A-2

A.1.1 Drainage Patterns

The planning area generally drains from west to east towards the Minnesota River, which forms the eastern boundary of the planning area. The entire planning area is ultimately tributary to the Minnesota River. Some of the planning area in northeastern Sibley County drains into Carver County (outside the planning area) before reaching the Minnesota River.

Within the planning area, the Minnesota Department of Natural Resources (MDNR) has further delineated subwatersheds at the HUC10 and HUC12 level for natural resource planning and management purposes. HUC10 and HUC12 watersheds within the planning area are summarized in Table A-2. HUC12 watersheds define the smallest federal drainage units. Watershed delineation data maintained by the MDNR is available from: https://www.mngeo.state.mn.us/chouse/water_watersheds.html

For the purposes of this Plan, the Partners also grouped the seven HUC10 watersheds within the planning area into six major watersheds as follows (see Figure 1-1 and Table A-2):

- North Branch Rush River Watershed
- Middle Branch Rush River Watershed
- South Branch Rush River Watershed
- High Island Creek Watershed
- Minnesota River (direct) Watershed
- Bevens Creek/Silver Creek/Northeast Sibley County Watershed

Table A-2 Major watersheds and subwatersheds within the planning area

Major Watershed	HUC10 Watershed Name	HUC10 Number	HUC10 Drainage Area (mi2)	HUC12 Subwatershed Name	HUC12 Number	HUC12 Drainage Area (mi^2)
Bevens Creek/ Silver Creek	Bevens Creek	0702001207	49.5	Upper Bevens Creek	070200120701	37.0
				Silver Creek	070200120703	12.4
High Island Creek	High Island Creek	0702001206	240.9	Judicial Ditch No 11	070200120601	60.7
				Judicial Ditch No 15	070200120602	17.2
				Bakers Lake-High Island Creek	070200120603	32.6
				Kings Lake-High Island Creek	070200120604	21.3
				High Island Lake	070200120605	12.9
				Judicial Ditch No 12-High Island Creek	070200120606	20.8
				Severance Lake	070200120607	17.1
				Buffalo Creek	070200120608	27.8
				High Island Creek	070200120609	30.5
Rush River	North Branch Rush River	0702001202	99.0	County Ditch No 18	070200120201	17.8
				Judicial Ditch No 18	070200120202	31.9
				County Ditch No 56	070200120203	20.3
				North Branch Rush River	070200120204	29.0
	Middle Branch Rush River	0702001204	119.5	County Ditch No 23	070200120401	45.1
				County Ditch No 54	070200120402	42.0
				Rush River	070200120403	32.4
	South Branch Rush River	0702001203	184.3	Judicial Ditch No 1	070200120301	38.5
				Judicial Ditch No 6	070200120302	29.7
				Judicial Ditch No 20	070200120303	16.8
				County Ditch No 40A	070200120304	30.9
				Judicial Ditch No 1A	070200120305	46.1
				South Branch Rush River	070200120306	22.3
Minnesota River (direct)	City of Belle Plaine – MN River	0702001209	28.4	Robert Creek-Minnesota River	070200120901	26.0
				City of Belle Plaine-MN River	070200120902	2.5
	City of Le Sueur – MN River	0702001205	57.1	Barney Fry Creek	070200120501	34.0
				City of Le Sueur-MN River	070200120502	15.1
				City of Henderson-MN River	070200120503	8.0

A.2 Climate and Precipitation

Because of its location near the center of the North American continent, the Lower Minnesota River West watershed has a continental climate characterized by moderate precipitation (normally sufficient for crops), wide daily temperature variations, and large seasonal variations in temperature (warm humid summers, and cold winters with moderate snowfall).

Climate data for the 1991-2020 climate normal period, as reported by the National Oceanic and Atmospheric Administration (NOAA), is summarized in Table A-3 for weather stations in Gaylord, St. Peter, and the Brownton Wastewater Treatment Plant (WWTP).

Table A-3 Summary of climate data for select locations in the planning area (1991-2020)

Statistic	Gaylord (Station 212076)	Brownton WWTP (Station 211065)	St. Peter (Station 217405)
Average Annual Temperature	44.9°F	43.7°F	43.9°F
Average Minimum Monthly Precipitation	0.9 inch (February)	0.7 inch (January)	1.0 inch (January, February)
Average Maximum Monthly Precipitation	5.3 inches (June)	5.2 inches (June)	5.1 inches (June)
Average Annual Precipitation	31.21 inches	31.70 inches	32.42 inches
May-September Precipitation	20.41 inches (65% of annual)	20.68 inches (67% of annual)	20.30 inches (63% of annual)
Average Snowfall	37.2 inches	50.0 inches	37.9 inches

Source: climate data for Brownton WWTP and St. Peter obtained from NOAA at: https://www.ncdc.noaa.gov/cdo-web/datatools; data for Gaylord obtained from the MN Climatology Office gridded precipitation data at: https://climateapps.dnr.state.mn.us/gridded_data/precip/monthly/monthly_gridded_precip.asp

The data in Table A-3 show similarities in precipitation among the three selected stations. Average annual precipitation (1991-2020) is approximately 32 inches. Average annual lake evaporation in the region is about 42 inches according to the Climate of Minnesota, Part XII (Baker, 1979).

Additional climate information can be obtained from a number of sources, such as the following:

- For a range of Minnesota climate information: http://climateapps.dnr.state.mn.us/index.htm
- For climate normal (1991-2020) data: https://www.ncdc.noaa.gov/cdo-web/datatools/normals

A.2.1 Precipitation-Frequency Data (Atlas 14)

While average weather poses little risk to human health and property, extreme precipitation events may result in flooding that threatens infrastructure and public safety. NOAA published Atlas 14, Volume 8, in 2013. Atlas 14 is the primary source of information regarding rainfall amounts and frequency in Minnesota. Atlas 14 provides estimates of precipitation depth (i.e., total rainfall in inches) and intensity (i.e., depth of rainfall over a specified period) for durations from 5 minutes up to 60 days. Atlas 14 supersedes publications Technical Paper 40 (TP-40) and Technical Paper 49 (TP-49) issued by the National Weather Bureau (now the National Weather Service) in 1961 and 1964, respectively. Atlas 14 improvements in precipitation estimates include denser data networks, longer (and more recent) periods of record, application of regional frequency analysis, and new techniques in spatial interpolation and mapping. Comparison of precipitation between TP-40 and Atlas 14 indicates increased precipitation depths for more extreme (i.e., less frequent) events and higher intensity for nearly all storm events.

Snowmelt and rainstorms occurring during snowmelt in early spring are significant in this region. The volumes of runoff generated, although they occur over a long period, can have significant impacts where the contributing drainage area is large. Runoff from spring snowmelt is not provided in Atlas 14. The USDA Soil Conservation Service (now the National Resource Conservation Service (NRCS)) *National Engineering Handbook,* Hydrology, Section4, presents maps of regional runoff volume. This information is summarized in the *Minnesota Hydrology Guide*, published by the USDA's Soil Conservation Service (now the NRCS) in 1975. Table A-4 lists the selected rainfall and snowmelt runoff events for the region.

Table A-4 Selected precipitation and runoff events used for design purposes

Type	Frequency	Duration	Gaylord (Station 212076) (inches)	Brownton WWTP (Station 211065) (inches)	St. Peter (Station 217405) (inches)
Rainfall[1]	2-year	24 hour	2.83	2.79	2.86
	5-year	24 hour	3.54	3.48	3.58
	10-year	24 hour	4.20	4.15	4.25
	25-year	24 hour	5.21	5.15	5.27
	50-year	24 hour	6.06	6.01	6.14
	100-year	24 hour	6.98	6.95	7.08
	10-year	10 day	6.52	6.50	6.59
	100-year	10 day	9.56	9.60	9.67
Snowmelt[2]	10-year	10 day	4.3		
	25-year	10 day	5.2		
	50-year	10 day	5.9		
	100-year	10 day	6.5		

(1) NOAA Atlas 14 – Volume 8. Stations noted in table heading
(2) Snowmelt depth reported as liquid water based on *Minnesota Hydrology Guide* (USDA Soil Conservation Service)

A.2.2 Climate Trends and Future Precipitation

Even with wide variations in climate conditions, climatologists have found four significant recent climate trends in the Upper Midwest (NOAA, 2013):

- Warmer winters – decline in severity and frequency of severe cold

- Higher minimum temperatures
- Higher dew points
- Changes in precipitation trends – more rainfall is coming from heavy thunderstorm events and increased snowfall

According to NOAA's 2013 assessment of climate trends for the Midwest, annual and summer precipitation amounts in the Midwest are trending upward, as is the frequency of high intensity storms. Higher intensity precipitation events typically produce more runoff than lower intensity events with similar total precipitation amounts; higher rainfall intensities are more likely to overwhelm the capacity of the land surface to infiltrate and attenuate runoff. NOAA climate normal data indicates the following local trends:

- Gaylord (station 212076) – the average annual precipitation has increased from 29.46 inches (1971-2000 average) to 31.21 inches (1991-2020 average), a 6 percent increase

- St. Peter (station 217405) – the average annual precipitation has increased from 29.09 inches (1971-2000 average) to 32.42 inches (1991-2020 average), an 11 percent increase

The study of long-term extreme weather trends found that precipitation amounts are predicted to increase significantly over what is historically used in floodplain assessments and infrastructure design. Recent work completed by the University of Minnesota (Moore et al., 2016) provides information useful to consider long-term extreme weather trends in the region. This work identified a range of estimates for the mid-21st century 100-year 24-hour rainfall event. The lower estimate for the mid-21st century 100-year 24-hour rainfall estimate was approximately 7.3 inches, which is similar to the current mean 100-year 24-hour rainfall depth published in Atlas 14 (7.8 inches). The middle estimate is 10.2 inches, which is similar to the upper limits of the Atlas 14 90-percent confidence limits for the 100-year 24-hour rainfall depth (10.4 inches). Upper estimates of mid-21st century 100-year 24-hour rainfall exceed the 90-percent confidence limits of Atlas 14.

The Partnership recognizes recent precipitation trends and expects that increases in precipitation amount and intensity may continue. The Partnership has developed this Plan, including goals and implementation activities, with consideration for these trends.

A.3 Land Cover and Land Use

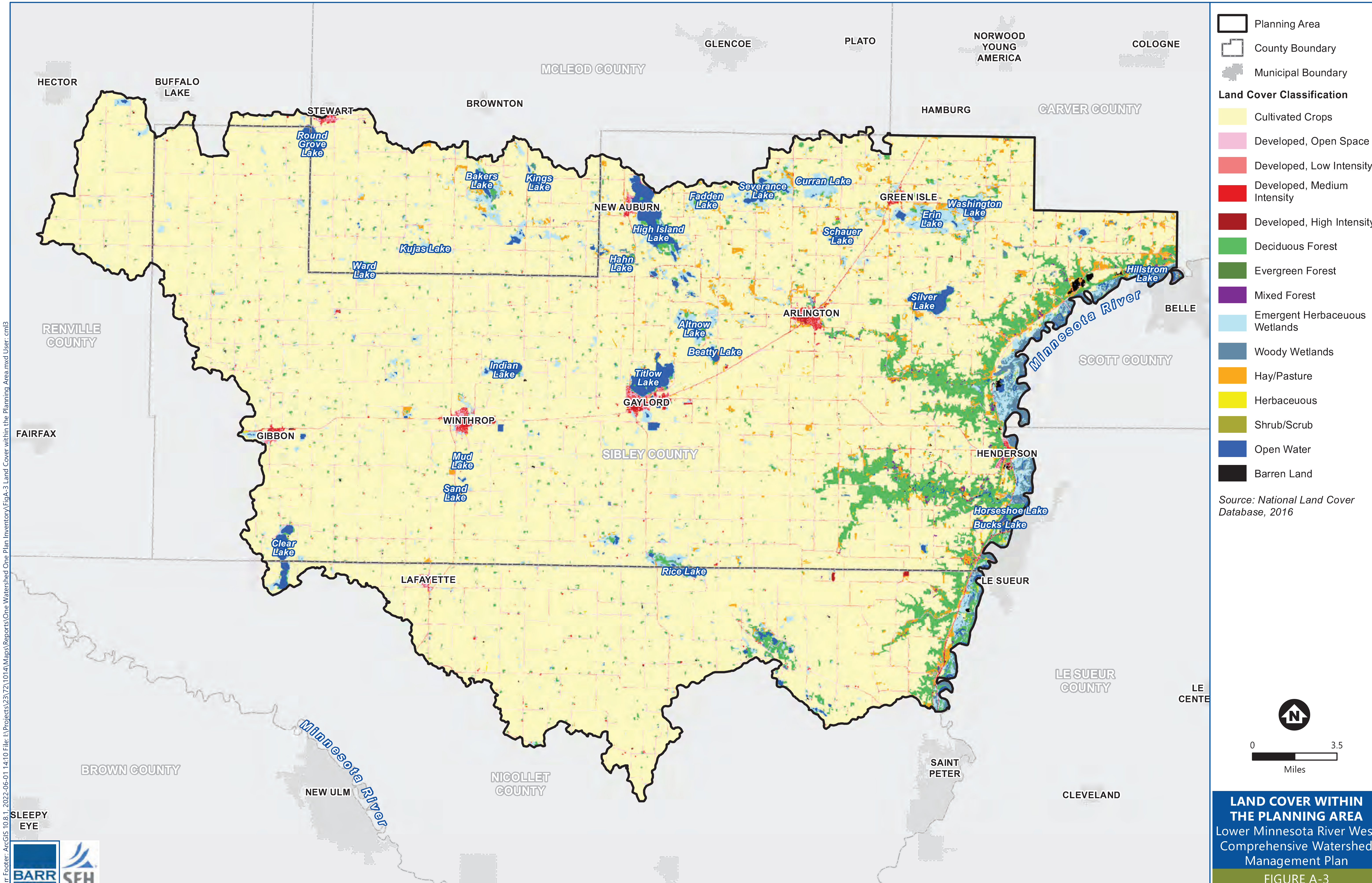
Historically, the land within the planning area was covered primarily by prairie. Pre-settlement vegetation data is available from the MDNR. Pre-settlement vegetation within the Lower Minnesota River West watershed consisted primarily of prairie and wet prairie. Areas of aspen and oak forest occupied lands adjacent to the downstream reaches of the Rush River and High Island Creek. River bottom forest were also present adjacent to the Minnesota River and its tributary branches – areas of pre-settlement vegetation remain along portions of the Minnesota River and its tributaries.

Much of the modern landscape in the planning area has been modified by agriculture and human development. Figure A-3 and Table A-5 present current land cover based on the National Land Cover Database (USGS, 2016).

Table A-5 Breakdown of land cover within the planning area

Land Cover	Square Miles	% of Total Area
Barren Land	0.74	0.09%
Cultivated Crops	657.30	84.40%
Deciduous Forest	33.72	4.33%
Developed, High Intensity	0.54	0.07%
Developed, Low Intensity	8.29	1.06%
Developed, Medium Intensity	2.32	0.30%
Developed, Open Space	21.30	2.74%
Emergent Herbaceous Wetlands	22.57	2.90%
Evergreen Forest	0.04	0.01%
Hay/Pasture	11.43	1.47%
Herbaceous (grassland)	0.73	0.09%
Mixed Forest	0.79	0.10%
Open Water	12.49	1.60%
Shrub/Scrub	0.42	0.05%
Woody Wetlands	6.06	0.78%
Total	**778.75**	**100%**

Source: National Land Cover Dataset (USGS, 2016)



LAND COVER WITHIN THE PLANNING AREA
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE A-3

A.3.1 Agricultural Land Use

Within the planning area, land use is overwhelmingly cropland (85% of the overall area), with hay and pasture occupying an additional 1.5%. Row crop agriculture and scattered livestock operations are the primary agricultural land use across the watershed. Cropland within the planning area is predominantly planted in corn and soybeans (MPCA, 2020).

The NRCS estimates that there are 2,652 farms in the Lower Minnesota River watershed; 9% are larger than 1,000 acres, 42% are less than 180 acres, and 48% are of medium size – 180 to 1,000 acres (NRCS, 2016).

There are approximately 1,100 registered Animal Feedlot Operations (AFO) in the planning area. AFOs in the planning area with the largest number of combined animal units (AUs) are primarily swine, beef cattle, and poultry.

A.3.2 Urban Land Use

Although much of the planning area is covered by cropland, pasture, and forest (closer to the Minnesota River), the planning area also includes several urbanized areas. The planning area includes the following small rural population centers (greater than 1,000):

- Arlington
- Belle Plaine
- Gaylord
- Le Sueur
- Winthrop

The following cities, with populations less than 1,000, are also located in the planning area:

- Gibbon
- Green Isle
- Henderson
- Lafayette
- New Auburn
- Stewart

Development and growth of urban and rural population centers within the planning area has been minimal over the past 10 years (Minnesota Department of Administration population data, 2019).

A.3.3 Land Use Considerations

Land use and land cover are important considerations for managing surface water, groundwater, and upland natural resources. The hard or impervious surface areas associated with each land use greatly affect the amount of runoff generated from an area. Significant changes in land use can increase runoff due to added impervious surfaces, soil compaction and changes to drainage patterns. Row crops, such as corn and soybeans, increase the risk of erosion and of elevated total suspended solids levels in streams because the land can be without vegetation cover for long periods of time due to the short Minnesota growing season. It is expected that the land use in the planning area will remain primarily agricultural during the life of this Plan.

A.4 Demographics and Economics

Demographic and economic factors are important considerations for understanding public priorities (see Section 2.1) and support for this Plan, as some implementation actions rely on the voluntary landowner participation (see Section 5.1.1). This section briefly summarizes demographic and economic data for the counties located within the planning area. County demographic profiles are available from the Minnesota Department of Employment and Economic Development (MDEED) at: County Profiles / Minnesota Department of Employment and Economic Development (mn.gov). More information is available from the State of Minnesota at: Minnesota State Demographic Center (SDC) / MN State Demographic Center

A.4.1 Population

Table A-6 presents the estimated 2021 population of the counties within the planning area in. Most of the residents in Sibley County reside within the planning area, while the majority of the residents in other counties reside outside the planning area. Population growth within the planning areas is generally less than Minnesota as a whole. Since 2010, the population of Nicollet County increased by approximately 5 percent, the population of McLeod County increased by less than 1 percent, and the populations of Sibley and Renville Counties declined by 2 percent and 7 percent, respectively. Much of the growth in Nicollet County over this period occurred outside the planning area. The populations of McLeod, Renville, and Sibley Counties are anticipated to decline over the life of this Plan (MDEED, 2022).

Table A-6 Estimated Population (2021) of Planning Area Counties

County	Total Population (2021 Estimate)	% of County Area in Planning Area
McLeod	36,958	13.0%
Nicollet	34,706	30.1%
Renville[1]	14,604	2.6%
Sibley	14,986	91.1%
Total	101,254	--

Source: Minnesota State Demographic Center - Data by Topic: Our Projections / MN State Demographic Center

(1) A portion of Renville County is located within the planning area but is not a Partner.
(2) Population is not evenly distributed by area – values are presented as an approximation for context.

The population of counties within the planning area has become more diverse over time, although white residents comprise approximately 90 percent of the population in each county. Residents identifying as Hispanic are the largest ethnic or racial minority in the planning area counties, including 4.8% of the population in Nicollet County, 6.7 percent in McLeod County, and approximately 9 percent in Sibley and Renville Counties (MDEED, 2022).

A.4.2 Education

Table A-7 presents the highest education level achieved by portions of the population in each of the counties within the planning area. The percentage of the population over 18 years old with at least a high school diploma (or equivalent) ranges from 90 percent in Renville County to 95 percent in Nicollet County. The percent of college educated adults ranges from about 53 percent in Renville and Sibley Counties to 58 percent in McLeod County and 70 percent in Nicollet County; the state-wide average is 68 percent.

Table A-7 Education Level in Planning Area Counties

County	Highest Level of Education Achieved (% of population)					
	Less than High School	High School Grad or equiv.	Some College, no degree	Associate's Degree	Bachelor's Degree	Advanced Degree
McLeod	7%	34%	25%	15%	13%	6%
Nicollet	5%	25%	26%	13%	21%	10%
Renville[1]	10%	37%	25%	13%	12%	3%
Sibley	8%	39%	24%	12%	13%	3%

Source: U.S. Census Bureau, 2017-2021 American Community Survey (summarized by MDEED)

(1) A portion of Renville County is located within the planning area but is not a Partner.

A.4.3 Employment and Economics

Table A-8 presents medium income data reported for the counties within the planning area and statewide. Median incomes within the planning area are generally highest for Nicollet County but all fall below statewide values. Nicollet County values may be elevated by economic growth in North Mankato, which is located outside the planning area. Cost of living within the planning area is below the statewide average (MDEED, 2022).

Table A-8 Median Incomes in Planning Area Counties

County	Median Annual Household Income	Median Annual Family Income	Per Capital Annual Income
McLeod	$67,067	$89,972	$36,575
Nicollet	$74,317	$94,377	$39,188
Renville[1]	$61,233	$75,786	$31,381
Sibley	$67,412	$84,659	$33,948
Minnesota State	$77,706	$98,356	$41,204

Source: Minnesota Department of Employment and Economic Development County Profiles

(1) A portion of Renville County is located within the planning area but is not a Partner.

In 2021, unemployment rates within the planning area counties ranged from a low of 2.8 percent in Nicollet County to a high of 3.9 percent in Renville County. Generally, unemployment values are similar to the 2021 statewide average of 3.4 percent. Unemployment rates within the planning area counties have declined from pandemic recession values ranging from 4.9 percent to 5.9 percent in 2020. From 2006-2021, the labor force in Nicollet County increased by 4.1 percent while the labor force in McLeod, Renville, and Sibley Counties declined by 8.3 percent, 1.6 percent, and 8.8 percent, respectively.

A.5 Soils

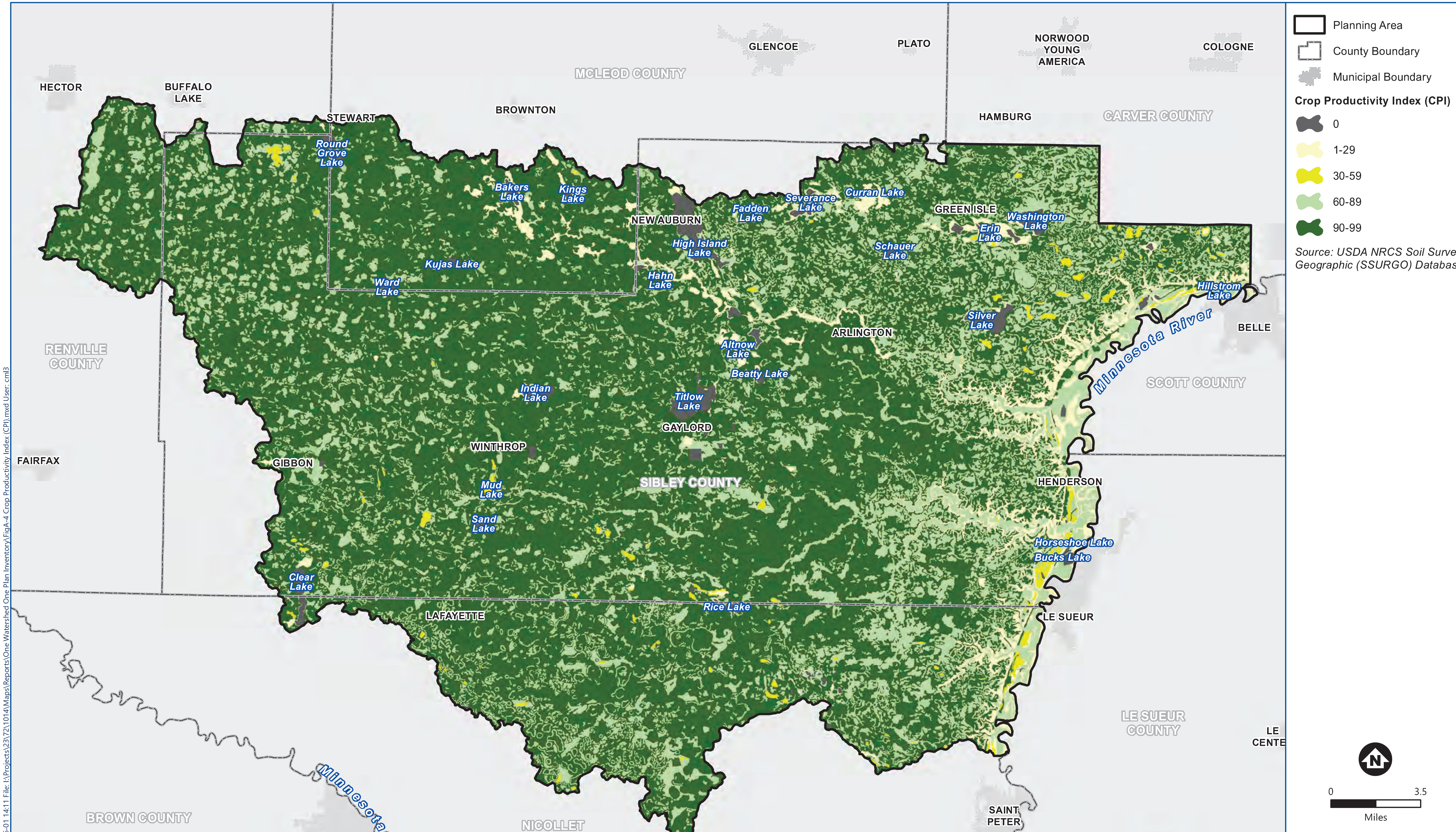
Most of the Lower Minnesota River West watershed falls within the northern boundaries of the Western Corn Belt Plains ecoregion. The remainder of the watershed lies within the North Central Hardwood Forest ecoregion (ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources). Soils in the watershed are mainly comprised of the Central Iowa and Minnesota Till Prairie complex, consisting of rich organic glacial prairie soils that provide a rich medium for cultivation. Soil types (grouped according to soil parent material) are presented in Figure A-6.

Soil parent material within the planning area consists primarily of fine-loamy till, with interspersed areas of organic matter in the north and south, and various types of alluvium in areas adjacent to streams and the Minnesota River. More detailed information about the soils present in the planning area are available from the NRCS soil survey dataset. The NRCS updates information presented in soil surveys on a continuing schedule. The most current information may be found on the NRCS soil survey webpage at: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

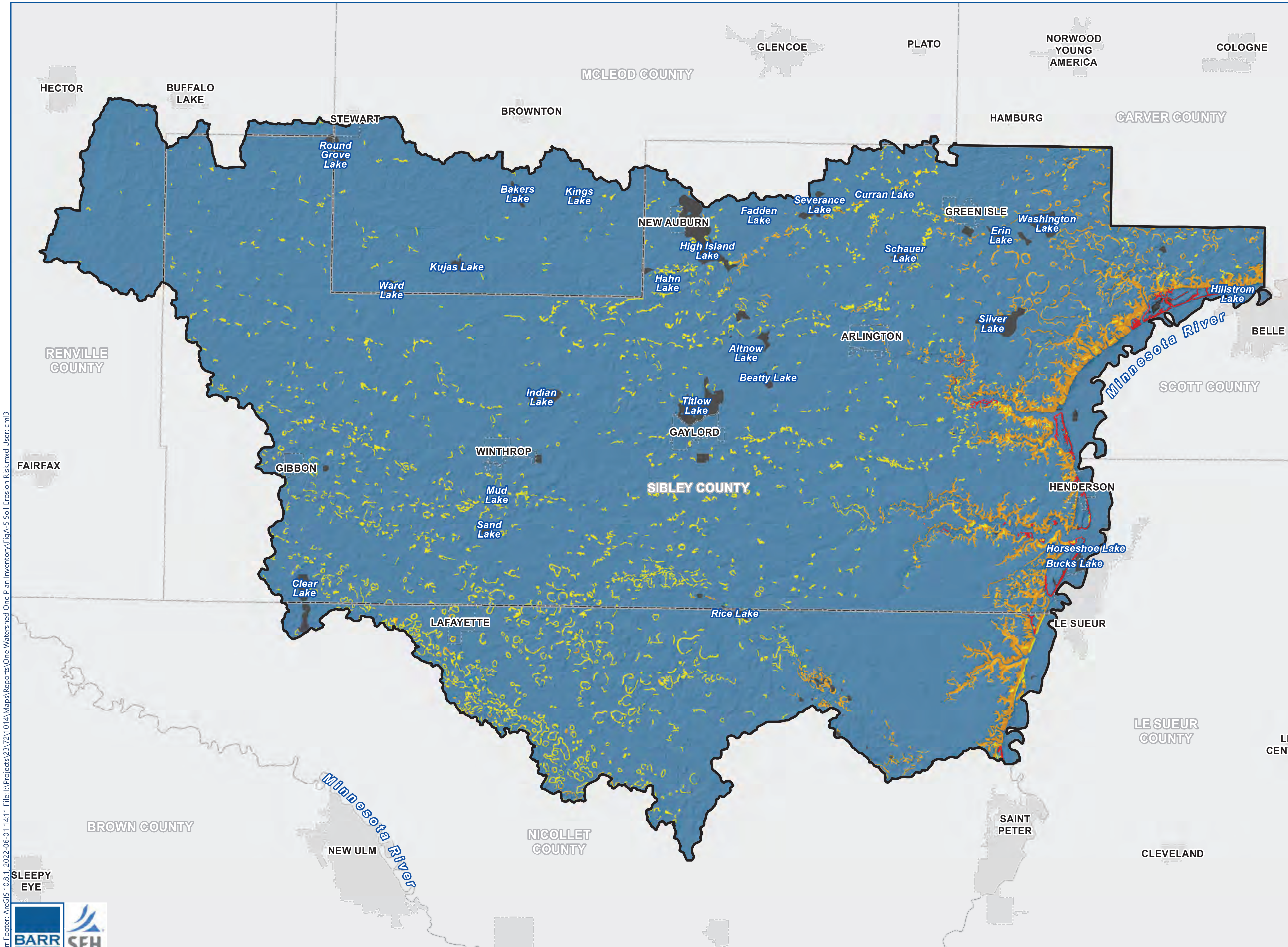
The surficial soils in the planning area are thick, with depths to bedrock generally greater than 200 feet, and as great as 500 feet in buried bedrock valleys near the Minnesota River (Lusardi et al., 2011). Layers of sand and gravel occur between finer surficial soils and the bedrock surface throughout much of the planning area.

Local surface soils greatly affect the suitability of the land for agricultural production. Figure A-4 presents the crop productivity index (CPI) for agricultural land use in the planning area. CPI ratings provide a relative ranking of soils based on their potential for intensive crop production and can be used to rate the potential yield of one soil against that of another soil over time. Ratings range from 0 to 100; higher numbers indicate higher production potential; much of the watershed has CPI values in excess of 90, indicating high productivity. Degraded soils may be subject to increased runoff and erosion. Soil erosion risk in the planning area is presented in Figure A-5.

Infiltration capacities of soils affect the amount of direct runoff resulting from rainfall. The higher the infiltration rate for a given soil, the lower the runoff potential. Conversely, soils with low infiltration rates produce high runoff volumes and high peak discharge rates. According to the NRCS soil surveys, most of the underlying soils in the planning area are classified as hydrologic soil group C/D, with moderately low infiltration rates. Some soils, primarily along the eastern border of the planning area are classified as group A with high infiltration rates. While hydrologic soil group mapping is useful for generally assessing infiltration capacity, field verification of infiltration rates is recommended to obtain reliable data.



CROP PRODUCTIVITY INDEX (CPI)
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE A-4



Planning Area
County Boundary
Municipal Boundary

Soil Erosion Risk

- Slight
- Moderate
- Severe
- Very Severe
- Not rated

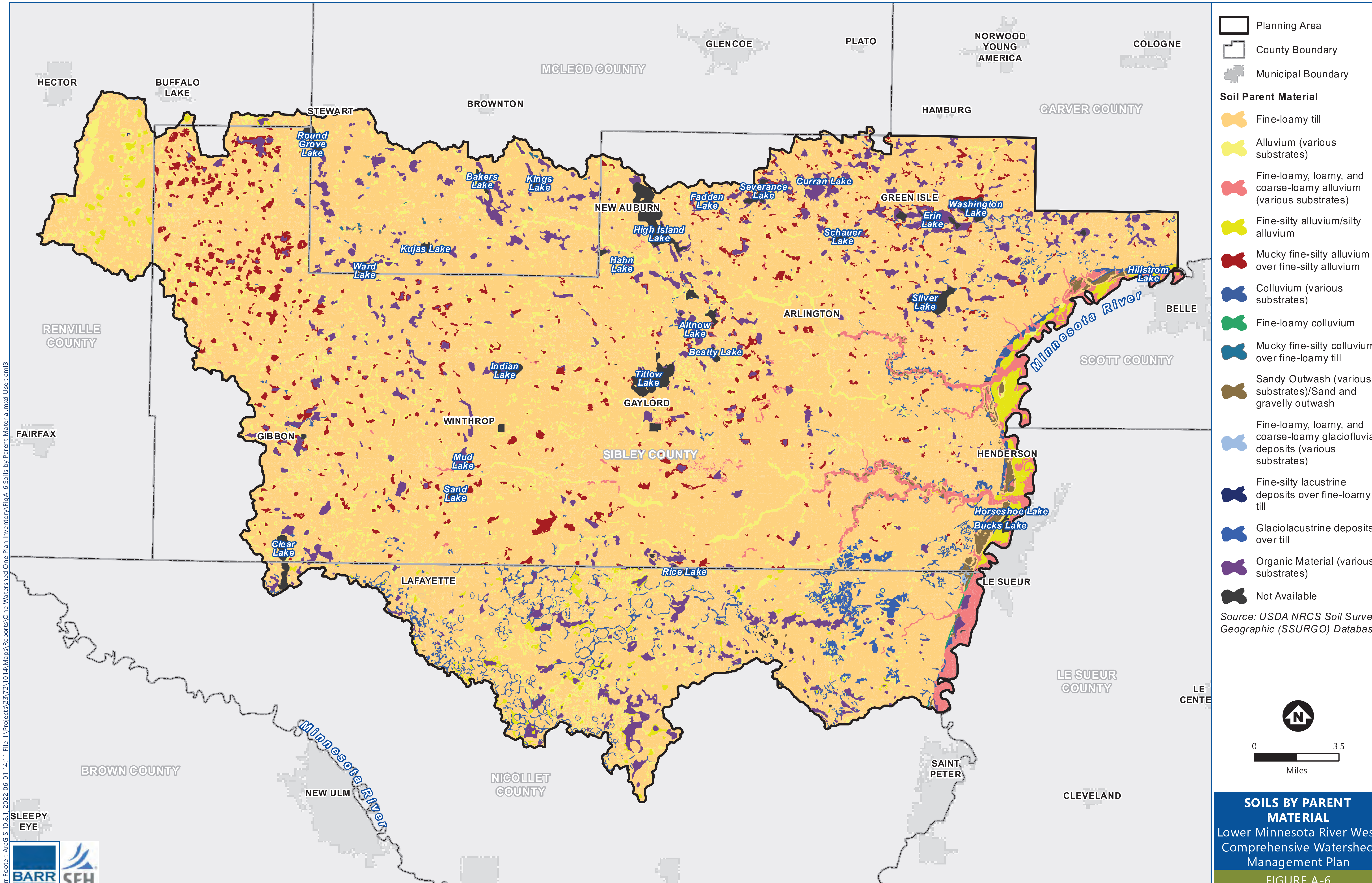
Source: USDA NRCS Soil Survey Geographic (SSURGO) Database.

0 3.5
Miles

SOIL EROSION RISK
Lower Minnesota River West Comprehensive Watershed Management Plan

FIGURE A-5

BARR SEH



SOILS BY PARENT MATERIAL

Lower Minnesota River West Comprehensive Watershed Management Plan

FIGURE A-6

A.6 Geology and Groundwater

Several bedrock units are present at the bedrock surface within the planning area (Lusardi et al., 2011). Paleozoic sedimentary units (e.g., Jordan sandstone, St. Lawrence formation) in the eastern part of the county dip gently towards the southeast. The oldest, stratigraphically lowest rock units of the sequence form the bedrock surface in the center of the county while the younger units form the bedrock surface to the east.

In the eastern part of the planning area, many of the Paleozoic sedimentary sandstone and carbonate units have a high enough permeability to be considered aquifers. In the western part, the Paleozoic sedimentary bedrock is not present and the principal bedrock units are Precambrian crystalline rock. These units have low permeability and are rarely used as aquifers.

More information about geology is available in the Geologic Atlas of McLeod, Nicollet, Renville, and Sibley Counties. County geologic atlases are available from the Minnesota Geological Survey (MGS) at: https://www.dnr.state.mn.us/waters/groundwater_section/mapping/index.html.

A.6.1 Hydrogeology

Groundwater is an important resource within the planning area because it is the source of drinking water for all watershed residents. The infiltration of water from the ground surface to the surficial and, ultimately, bedrock aquifers (i.e., groundwater recharge) is critical for sustaining groundwater resources. The potential for groundwater recharge varies across the watershed, based on local soils, geology, and land use characteristics.

The depth of the surficial aquifer (i.e., water table) varies within the planning area. The water table is estimated to be within 10 feet of the land surface across most of the planning area, with greater depths to the water table occurring near the upland valley edges and terraces within the Minnesota River valley.

Most residential wells in the planning area draw water from buried sand and gravel aquifers of varying depths above the bedrock surface. Municipal drinking water supply wells within the planning area rely on water from buried sand and gravel aquifers and the following bedrock aquifers:

- Jordan-Mt. Simon
- Eau Claire-Mt. Simon
- Mt. Simon

Several municipalities have developed wellhead protection plans (WHPPs) under the guidance of the Minnesota Department of Health (MDH). WHPPs are intended to limit the potential for groundwater contamination of public water supply wells and include the delineation and vulnerability assessment of Drinking Water Supply Management Areas (DWSMAs). Figure A-7 presents DWSMA extents and vulnerability within the planning area.

Table A-9 Municipal and non-municipal community well depths and WHPP status for select communities

Municipality/ Entity	County	HUC12 Watershed	WHPP Status	DWSMA Vulnerability
Arlington	Sibley	High Island Creek	Yes	Low
Gaylord	Sibley	Co Ditch 18, Co Ditch 56, North Branch Rush River	Yes	Low
Gibbon	Sibley	Co Ditch 23	Yes	Low
Green Isle	Sibley	Upper Bevens Creek	Yes	Low
Henderson	Sibley	City of Henderson	No	Anticipate Low
Lafayette	Nicollet	JD 1, JD 6	Yes	Low
New Auburn	Sibley	High Island Lake	No	Anticipate Low
Stewart	McLeod	Bakers Lake, High Island Lake	No	Anticipate Low
Winthrop	Sibley	Co Ditch 54	Yes	Low

Source: Data from MDH initial comment letter

A.6.2 Groundwater Quality

The quality of groundwater resources within the planning area is important to protecting public health and preserving quality of life. Groundwater quality data is collected by several entities within the watershed, including, but not limited to:

- Minnesota Department of Agriculture (MDA)
- Minnesota Department of Health (MDH)
- Minnesota Department of Natural Resources (MDNR)
- Minnesota Pollution Control Agency (MPCA)
- United States Geological Survey (USGS)

Groundwater monitoring locations and data are available from the MPCA's Environmental Data Access (EDA) website at: https://pca-gis02.pca.state.mn.us/eda_groundwater/index.html

Public water suppliers are required to perform periodic water quality monitoring. Owners of private wells are not required to monitor well water quality. The MDH, MDA and other organizations promote the sampling of private wells through education and subsidized sampling programs. The MDH maintains a database of water quality results from sampling of private and public wells. Contaminants of primary concern in groundwater include arsenic, nitrates, and bacteria.

The MDA, in coordination with counties and SWCDs, also implements a township well-testing program. Through this program, nitrate testing is offered to townships that are vulnerable to groundwater contamination and have significant row crop production. Several townships within the planning area participate in the program. Results from township testing for nitrate may be used by private homeowners for information on their wells. Additional information regarding the MDA's township well testing is available at: https://www.mda.state.mn.us/township-testing-program

Groundwater quality is a concern within the planning area (see Section 2.2.6). Data collected through MDH programs and presented in the MDH initial comment letter to the Partners indicate that wells throughout much of the planning area exhibit nitrate concentrations similar to background levels (i.e., <3 mg/L) although the dataset is limited and does not represent the full extent of wells with higher than background nitrate levels. A limited number of wells in the far eastern portion of the watershed, near the Minnesota River, exhibit higher nitrate levels relative to other areas.

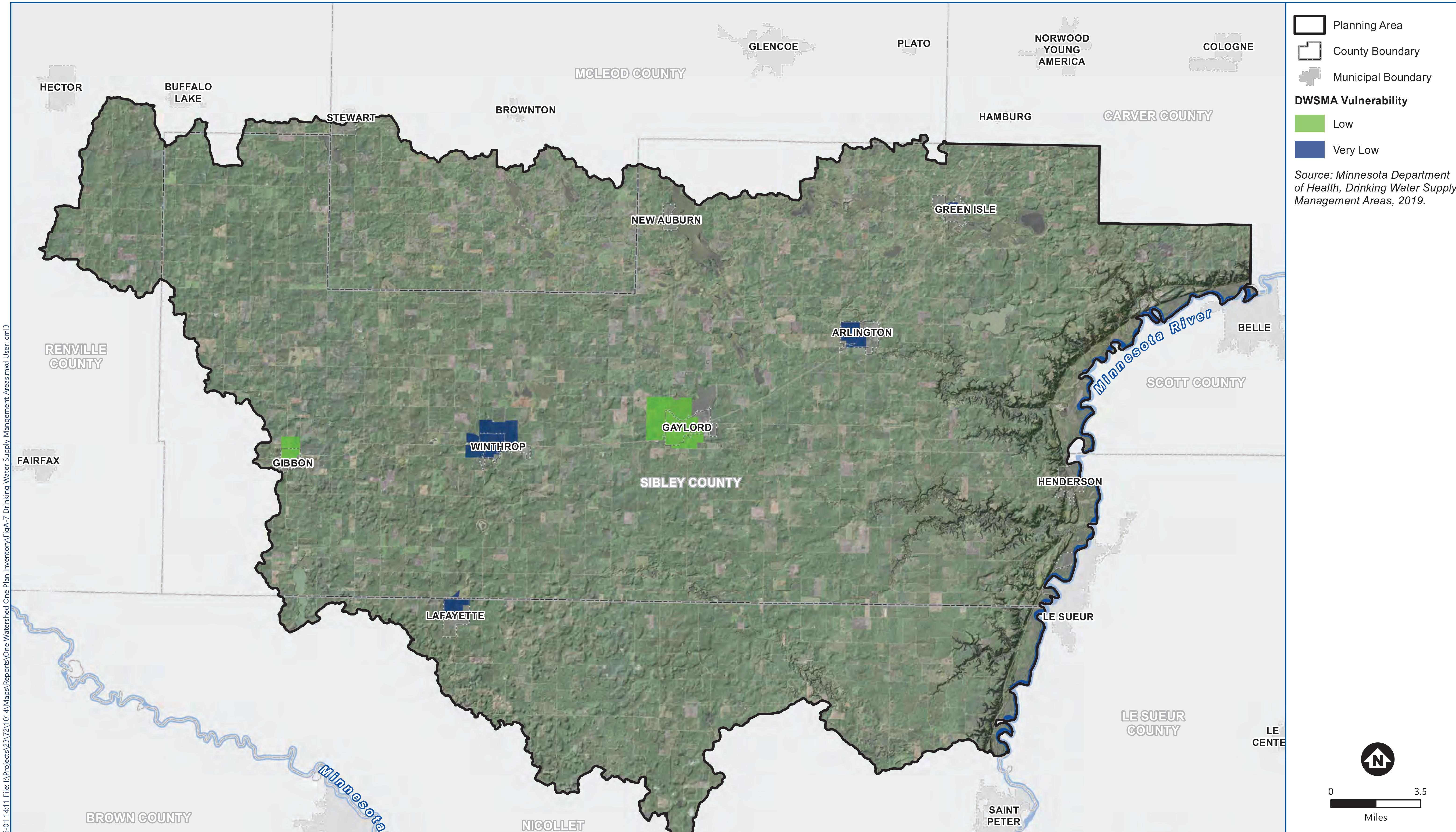
High concentrations of arsenic are a specific groundwater quality concern in the planning area. MDH data shows that over 20% of wells sampled for arsenic in the Lower Minnesota River West planning area had arsenic concentrations in excess of 10 ug/L (i.e., above the EPA recommended value for drinking water) (MDH, 2021). Arsenic is a naturally occurring element in Minnesota groundwater. Its occurrence is difficult to predict; therefore newly-constructed wells are tested for arsenic if they are used as a potable water supply (Baratta and Peterson, 2017),

A.6.3 Groundwater Sensitivity to Pollution

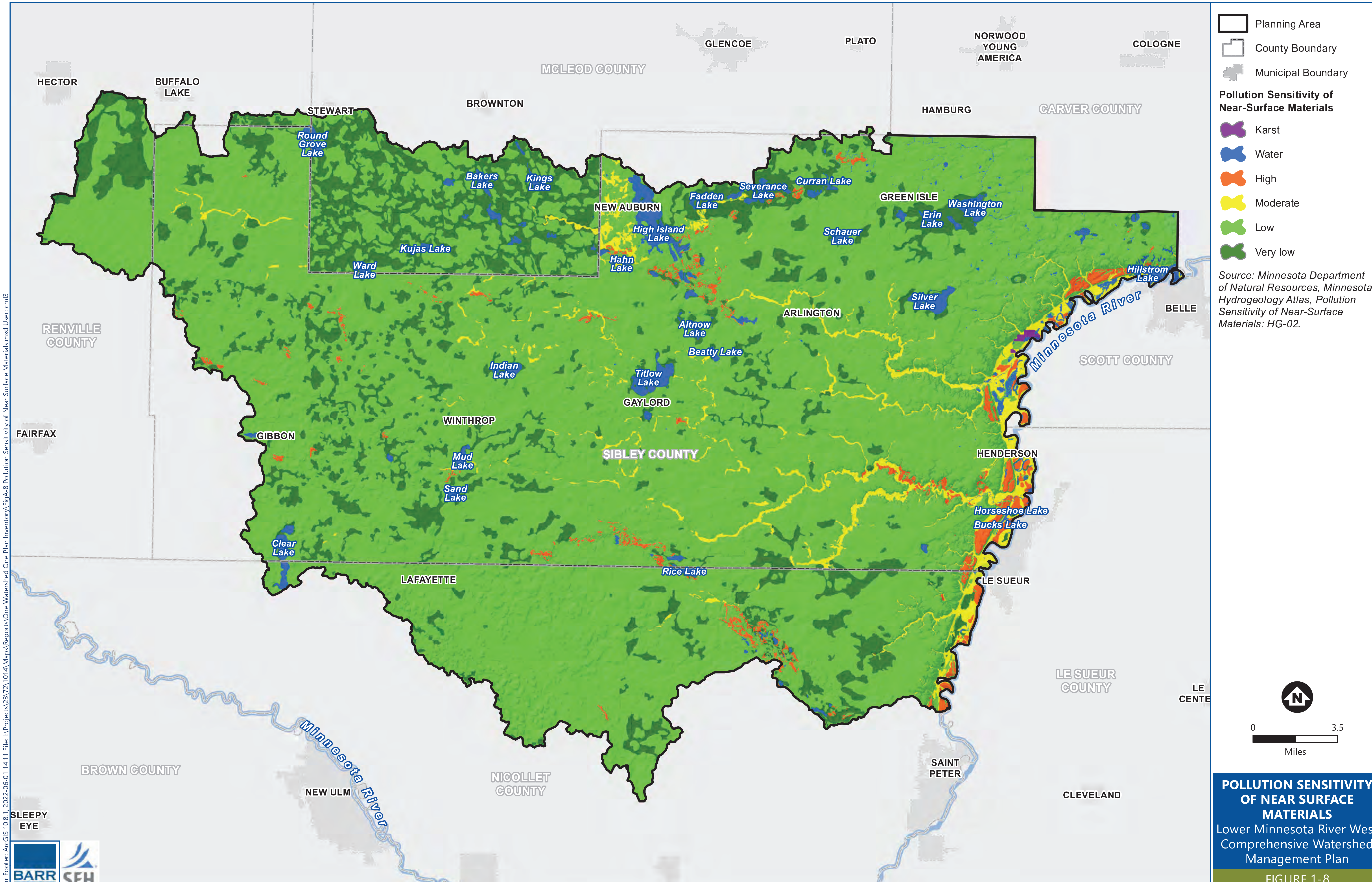
The MDNR defines a sensitive area as a geologic area characterized by natural features where there is significant risk of groundwater degradation from activities conducted at or near the land surface. The MDNR designated five classes of sensitivity for the bedrock surface (very high, high, moderate, low, and very low). The MDNR has designated five classes of surface material sensitivity based on vertical travel times (high: hours to a week, moderate: a week to weeks, low: weeks to months, very low: months to a year, and ultra low: more than a year); these classes are superseded by special conditions including karst, surface bedrock, disturbed lands, and peatlands. The sensitivity of the bedrock surface to pollution is very low with the exception of isolated areas within the Minnesota River valley. This information is documented in the Minnesota Hydrogeology Atlas and is available from the MDNR at: https://www.dnr.state.mn.us/waters/groundwater_section/mapping/status_mha.html

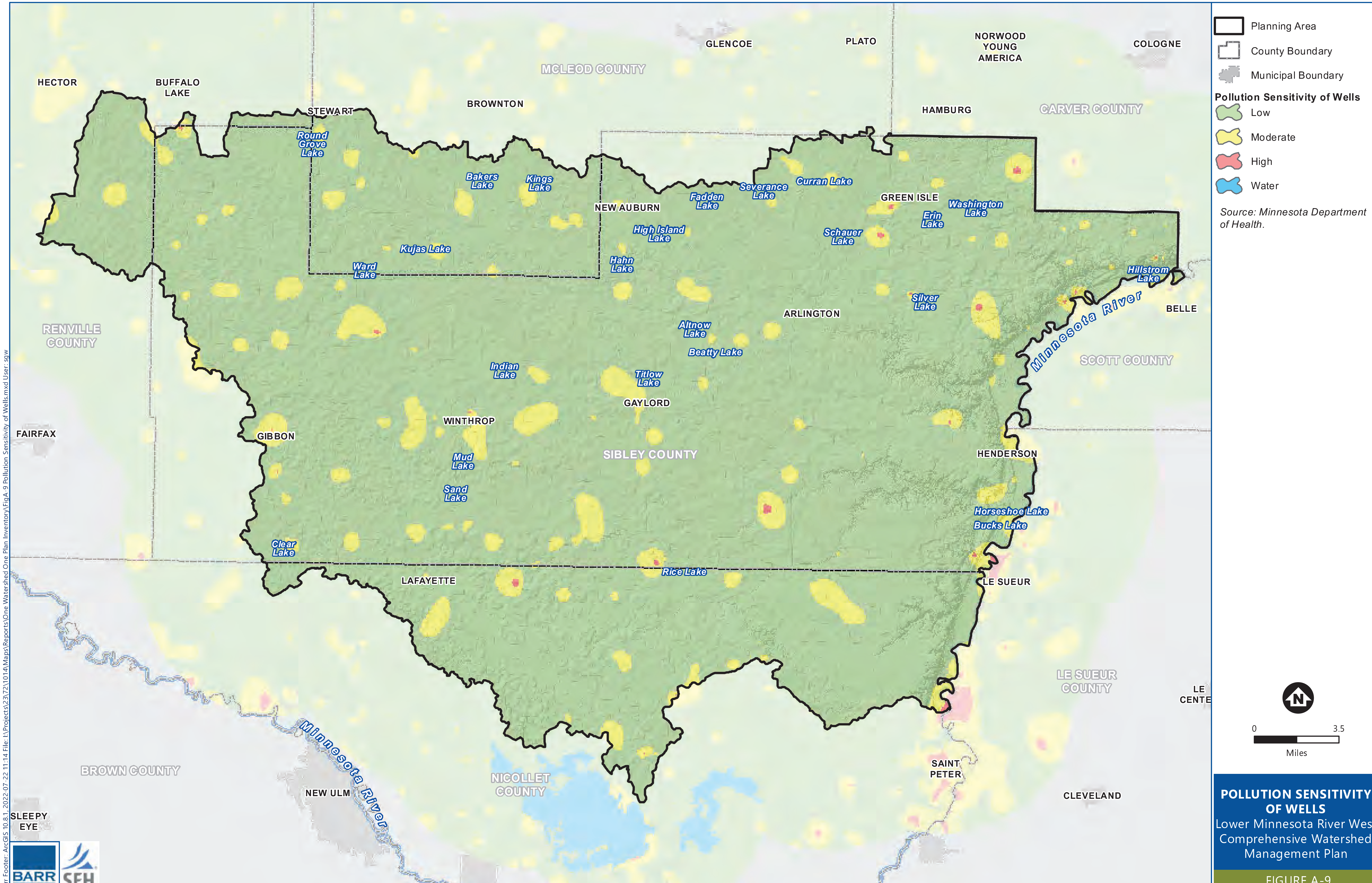
The pollution sensitivity of near surface materials is presented in Figure A-8. The sensitivity of near surface materials is affected by the composition of surface soils and geology, as well as factors that increase groundwater conductivity (e.g., gravel beds, karst features). Karst features are rare within the planning area.

The MDNR and MDH have further estimated the pollution sensitivity of wells based on the sensitivity of near surface materials and well characteristics. The pollution sensitivity of wells is classified by MDNR/MDH as low, medium, or high. The pollution sensitivity of wells is low throughout most of the planning area (see Figure A-9).



DRINKING WATER SUPPLY MANGEMENT AREAS
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE A-7


HECTOR
BUFFALO LAKE
STEWART
BROWNTON
GLENCOE
PLATO
NORWOOD YOUNG AMERICA
COLOGNE
HAMBURG
MCLEOD COUNTY
CARVER COUNTY
RENVILLE COUNTY
SCOTT COUNTY
FAIRFAX
GIBBON
WINTHROP
GAYLORD
ARLINGTON
NEW AUBURN
GREEN ISLE
BELLE
HENDERSON
LE SUEUR
LAFAYETTE
SIBLEY COUNTY
LE SUEUR COUNTY
LE CENTE
SAINT PETER
CLEVELAND
NICOLLET COUNTY
BROWN COUNTY
NEW ULM
SLEEPY EYE
Minnesota River
Round Grove Lake
Bakers Lake
Kings Lake
Kujas Lake
Ward Lake
Fadden Lake
Severance Lake
Curran Lake
Washington Lake
Erin Lake
Schauer Lake
High Island Lake
Hahn Lake
Silver Lake
Hillstrom Lake
Altnow Lake
Beatty Lake
Titlow Lake
Indian Lake
Mud Lake
Sand Lake
Clear Lake
Rice Lake
Horseshoe Lake
Bucks Lake
Planning Area
County Boundary
Municipal Boundary
Pollution Sensitivity of Near-Surface Materials
Karst
Water
High
Moderate
Low
Very low
Source: Minnesota Department of Natural Resources, Minnesota Hydrogeology Atlas, Pollution Sensitivity of Near-Surface Materials: HG-02.
0
3.5
Miles
POLLUTION SENSITIVITY OF NEAR SURFACE MATERIALS
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE 1-8
BARR
SEH



Barr Footer: ArcGIS 10.8.1, 2022-07-22 11:14 File: I:\Projects\23\72\1014\Maps\Reports\One Watershed One Plan Inventory\FigA-9 Pollution Sensitivity of Wells.mxd User: sgw

A.7 Surface Waters

The panning area is characterized by the Minnesota River and its tributaries, numerous streams, wetlands, ponds, and other surface waters. Figure A-10 presents MDNR Public Waters within the planning area.

A.7.1 MDNR Public Waters

The MDNR designated many of the streams, rivers, lakes, basins, and wetlands within the watershed as "public waters" to indicate those lakes, wetlands, and watercourses that fall under MDNR regulatory jurisdiction. MDNR public waters are all water basins and watercourses, natural or altered, that meet the criteria set forth in Minnesota Statutes, Section 103G.005, subd. 15, as identified on public water inventory (PWI) maps and lists authorized by Minnesota Statutes, Section 103G.201. In addition to public water lakes, this includes:

- Public water wetlands – MDNR public waters wetlands include all type 3, type 4, and type 5 wetlands (as defined in U.S. Fish and Wildlife Service Circular No. 39, 1971 edition) that are 10 acres or more in size in unincorporated areas or 2 ½ acres or more in size in incorporated areas (see Minnesota Statutes Section 103G.005, subd. 15a and 17b).

- Public water watercourses – MDNR public waters include natural and altered watercourses with a total drainage area greater than two square miles (see Minnesota Statutes Section 103G.005, subd. 15a9). This definition can include ditches that are privately held and not under the jurisdiction of the county drainage system.

The MDNR uses county-scale maps to show the general location of the public waters (lakes, wetlands, and watercourses) under its regulatory jurisdiction. The regulatory "boundary" of public waters is called the ordinary high water level (OHWL). Public waters within the planning area are presented in Figure A-10. PWI maps are available from the MDNR website at:
https://www.dnr.state.mn.us/waters/watermgmt_section/pwi/maps.html

A.7.2 Rivers and Streams

The Minnesota River forms the eastern boundary of the planning area and ultimately receives all drainage from the planning area's 779 square miles. While the Minnesota River is the most significant local water resource, the Lower Minnesota River West planning area comprises only 6% of the upstream drainage area. Thus, conditions within the planning area may have little impact on the Minnesota River. Within the planning area, there are several named streams tributary to the Minnesota River. Table A-10 lists the significant named streams in the watershed, divided among the HUC10 level subwatersheds.

The MDNR classified streams in the Lower Minnesota River West watershed as primarily warm water streams. The bluffs of the Minnesota River valley give rise to groundwater springs which affect stream hydrology (e.g., more base flow) and ecology (e.g., lower temperatures). There are no MDNR-designated trout streams in the planning area.

Table A-10 Summary of streams in the planning area

Major Subwatershed (HUC10)	Streams
Bevens Creek	• Bevens Creek • Silver Creek
Minnesota River (City of Le Sueur)	• Barney Fry Creek • Minnesota River
Minnesota River (City of Belle Plaine)	• Minnesota River
High Island Creek	• Buffalo Creek • High Island Creek
North Branch Rush River	• Rush River, north branch
Middle Branch Rush River	• Rush River, middle branch
South Branch Rush River	• Rush River, south branch

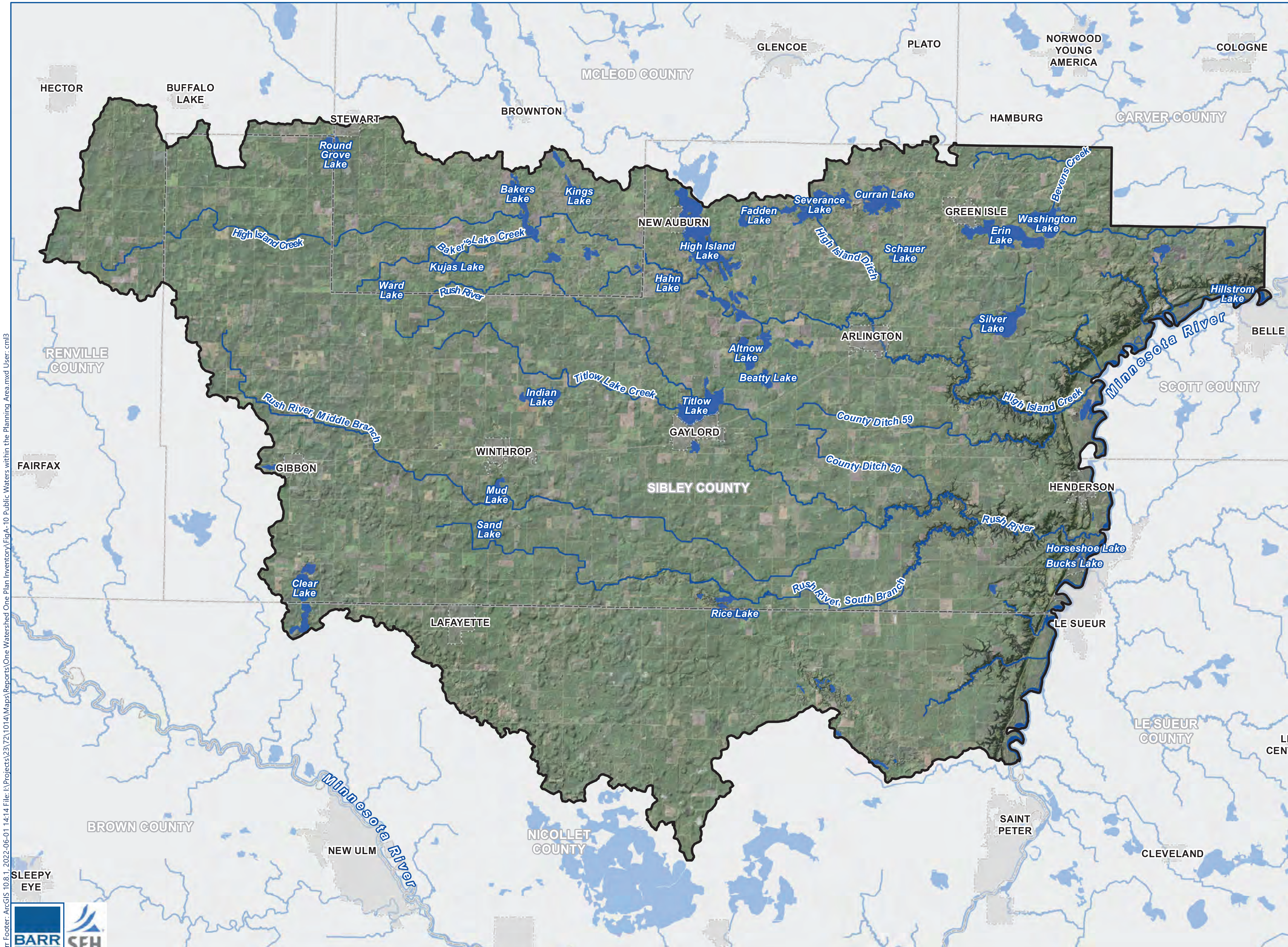
A.7.3 Drainage Systems

In addition to the natural streams and rivers, there are many altered watercourses and ditches within the planning area. Many ditches were constructed in the early 1900s to aid in land development for agriculture. The goal of these ditches is to remove water from agricultural lands. In more recent years, subsurface drainage systems have been installed in most of the agricultural fields within the planning area to further promote drainage. Many of the drainage ditches within the watershed are identified as MDNR public waters, as shown on Figure A-10.

Ditches identified as public waters may be part of private drainage systems or public drainage systems (also known as judicial or county ditches). Public drainage systems administered under Chapter 103E of Minnesota Statutes are under the jurisdiction of a drainage authority (e.g., county, watershed district). The land associated with an open ditch that is part of a public drainage system remains privately held. Some ditches identified by the MDNR as public waters due to their drainage area are part of private drainage systems and are not under the jurisdiction of the county drainage system. Many (but not all) drainages and tile systems present in the planning area are presented in Placeholder for figure A-11

Figure A-11.

Generally, the counties maintain jurisdiction over the ditches. For any new ditches or ditch improvements, the land adjacent to public ditches is required by the MNDR to include a buffer strip of permanent vegetation that is usually 1-rod (16.5 feet) wide on each side (Minnesota Statutes, Section 103E.021). Additional requirements for public drainage systems are included in Minnesota Statutes 103E.015, 103E.215, 103E.411, and 103E.701 Subdivision 6.



Planning Area
County Boundary
Municipal Boundary
Public Waters Basin
Public Watercourse

Source: Minnesota Department of Natural Resources, Public Waters (PW) Basin and Watercourse Delineation

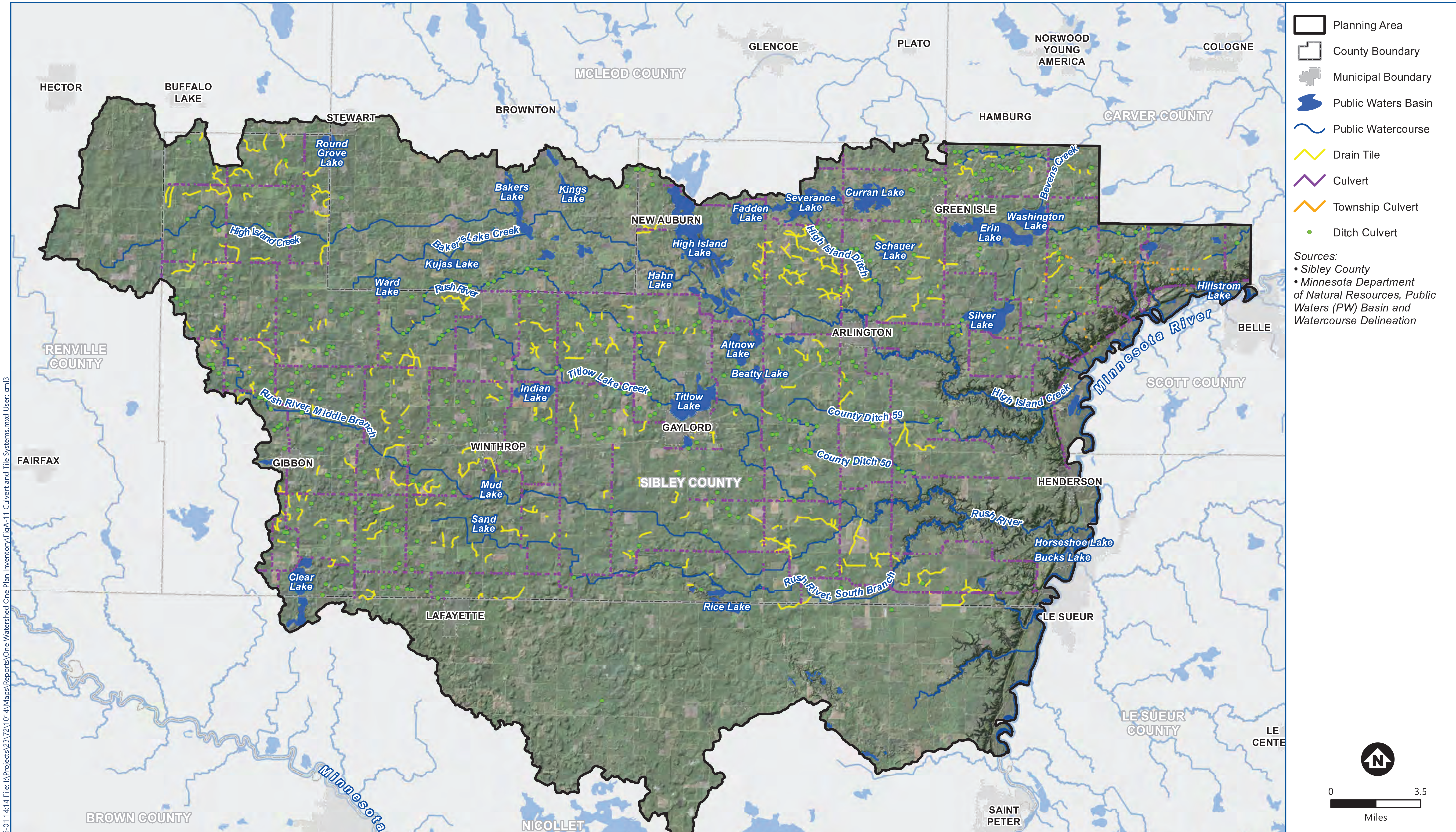
0 3.5
Miles

PUBLIC WATERS WITHIN THE PLANNING AREA

Lower Minnesota River West Comprehensive Watershed Management Plan

FIGURE A-10

BARR SEH



CULVERT AND TILE SYSTEMS

Lower Minnesota River West Comprehensive Watershed Management Plan

FIGURE A-11

A.7.4 Lakes

Figure A-10 presents the public waters lakes located the planning area. Significant named lakes within the planning area with surface area greater than 500 acres include:

- Clear
- Curran
- Erin
- High Island
- Severance
- Silver
- Titlow
- Washington

During Plan development, the Partners identified several lakes within the planning area as priority lakes (i.e., focus areas for implementation). Priority lakes are described in Section 0.

A.7.5 Wetlands

Wetlands in the planning area are important community and ecological assets. These resources provide significant wildlife habitat and refuge, along with recreational, runoff retention, and water quality treatment benefits. Many wetlands within the Lower Minnesota River West watershed have been drained for agricultural development prior to the establishment of regulations protecting wetlands (MPCA, 2016). Many of these areas are identified as restorable wetlands (MPCA, 2021). In addition, many wetland areas remain throughout the watershed, concentrated in riparian areas adjacent to river and stream channels.

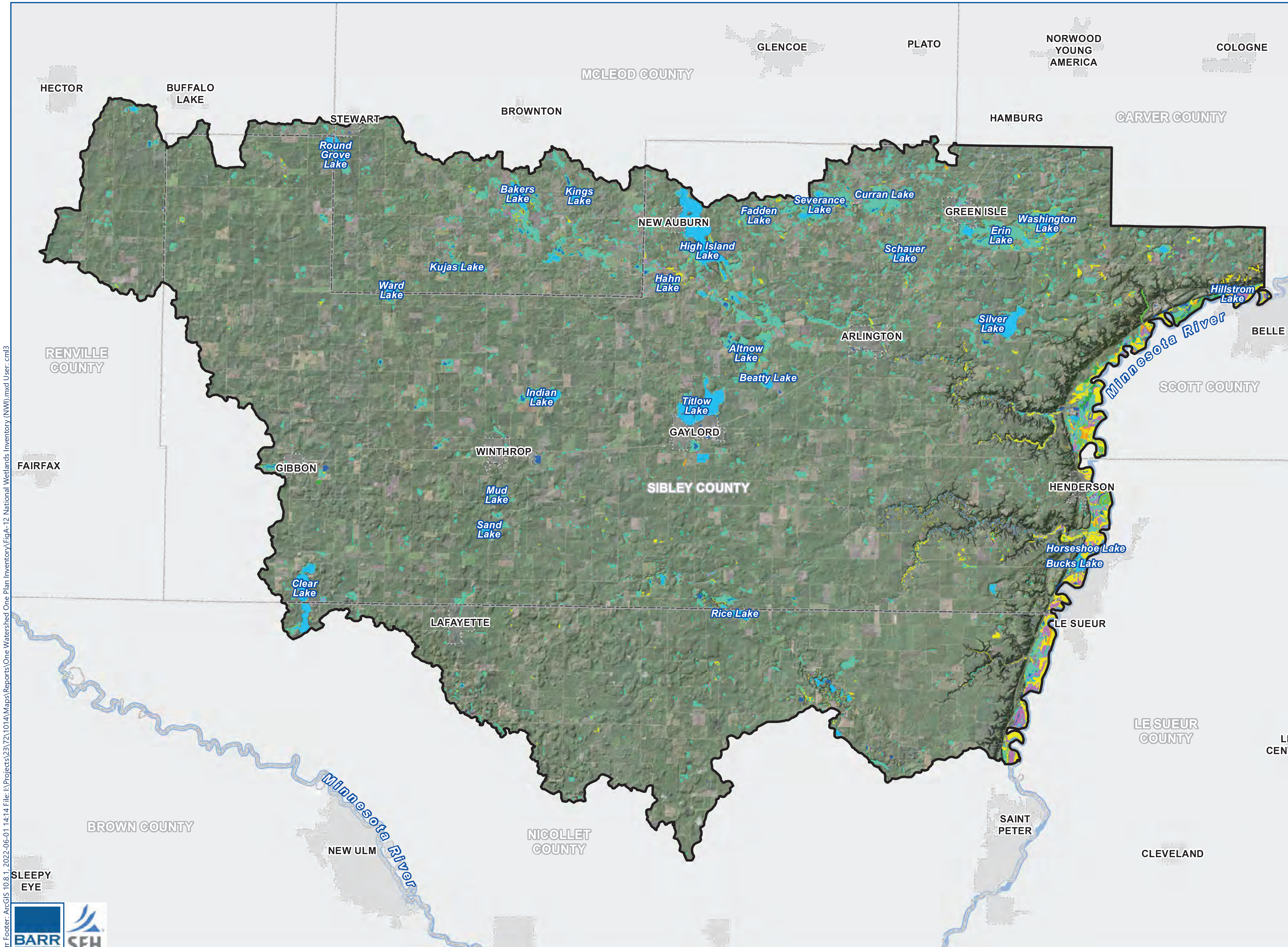
Nationally, the U.S. Fish and Wildlife Service (USFWS) is responsible for mapping wetlands across the country, including those in Minnesota. Using the National Aerial Photography Program (NAPP), in conjunction with limited field verification, the USFWS identifies and delineates wetlands, produces detailed maps on the characteristics and extent of wetlands, and maintains a national wetlands database as part of the National Wetlands Inventory (NWI). The NWI may be referenced for regulatory purposes in administering the Wetland Conservation Act (WCA). The NWI is periodically updated based on available imagery.

Figure A-12 shows the location of NWI wetlands within the planning area. Wetlands in the planning area are concentrated in the northeast portion of the watershed and along the Minnesota River in the bottomlands. There are approximately 59,000 acres of NWI wetlands in the watershed, including over 20,000 acres adjacent to the Minnesota River.

The NWI classifies wetlands in the planning area as emergent wetlands, forested or shrub wetlands, or pond, lake, or riverine wetlands. Freshwater forested/shrub wetland occur throughout the planning area adjacent to streams and rivers (see Figure A-12). There may be additional wetlands (especially those smaller than 0.5 acre) in the watershed that are not included in the NWI.

More information about the NWI is available from the USFWS at: https://www.fws.gov/wetlands/

Additional information about updates to the NWI in Minnesota is available from the MDNR at: https://www.dnr.state.mn.us/eco/wetlands/nwi_proj.html



Planning Area

County Boundary

Municipal Boundary

Wetlands

- Freshwater Emergent Wetland
- Freshwater Forested Wetland
- Freshwater Forested/Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Freshwater Shrub Wetland
- Freshwater Shrub/Emergent Wetland
- Lake
- Riverine

Source: U.S. Fish and Wildlife Service, National Wetlands Inventory.

0 3.5
Miles

NATIONAL WETLANDS INVENTORY (NWI)
Lower Minnesota River West Comprehensive Watershed Management Plan

FIGURE A-12

A.8 Watershed Monitoring

Several agencies, LGUs, and other stakeholders have focused monitoring efforts within the Lower Minnesota River West watershed. Several types of monitoring are taking place, including stage, flow, continuous and discrete water chemistry, pollutant load monitoring, fish IBI, and macroinvertebrate IBI monitoring. Below is a summary of monitoring efforts that are being carried out in the planning area. Monitoring locations are shown in Figure A-13.

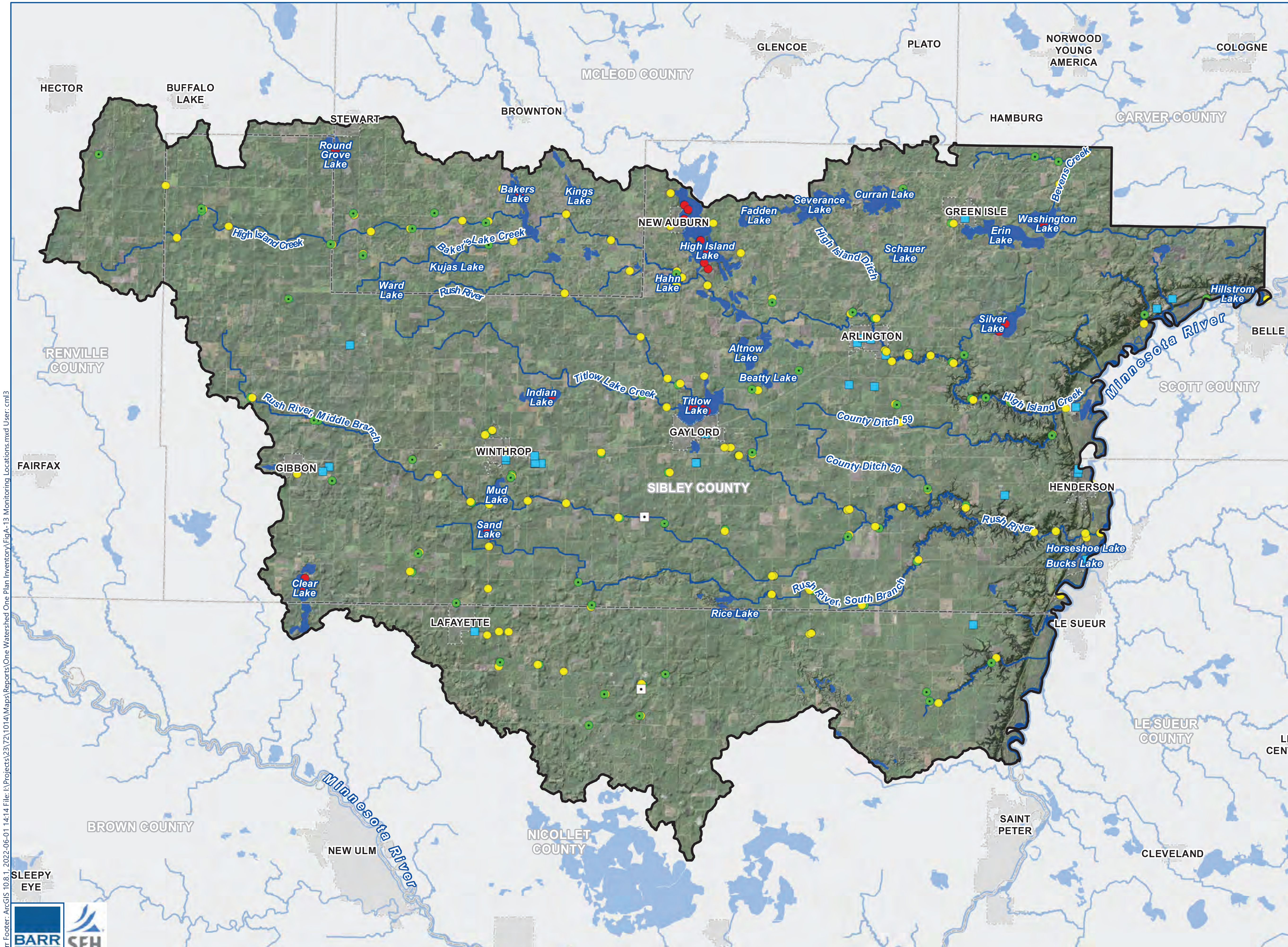
A.8.1 Hydrologic Monitoring

There are several continuous stage and flow monitoring sites in the planning area (see Figure A-13). Three of these sites are currently active. These stream gages are summarized in Table A-11. Stream gages within the watershed are operated in cooperative partnerships of the MPCA, MDNR, and/or United States Geologic Survey (USGS). Live and historical data can be found for these gages online at https://www.dnr.state.mn.us/waters/csg/index.html

Besides monitoring stream flow, stream gages are very critical in assisting with pollutant load monitoring and flood prediction. Several of the stream gages located within the planning area are linked to the National Weather Service (NWS) Advanced Hydrologic Prediction Service (AHPS) to assist in predicting peak flood stage resulting from storm events. More information about AHPS is available from the NWS at: https://water.weather.gov/ahps/

Table A-11 Summary of stream gages within the planning area

Stream/River	Site Description	MDNR ID	USGS ID	Period of Record	Drainage Area (square miles)
High Island Creek	High Island Creek near Arlington, CR9	33075001	5326700	2000-current	164
	High Island Creek near Henderson, CSAH6	33091001	5327000	1973-current	238
Minnesota River	Minnesota River at Henderson, MN19	33032001	5326450	1998-2019	638
Judicial Ditch 1A	Judicial Ditch 1A near New Sweden	--	5326200	1967	47
Rush River	South Branch Rush River at CR 8 near Bernadotte	--	5326180	2007-2008	82
	Middle Branch Rush River near Gaylord	--	5326100	1979-2000	67



Planning Area

County Boundary

Municipal Boundary

Public Waters Basin

Public Watercourse

Surface Water Monitoring Station

Biological

Discharge

Lake

Stream

USGS Gauge

Sources:
• Minnesota Pollution Control Agency, Surface Water Stations - MPCA Environmental Data Access.
• Minnesota Department of Natural Resources, Public Waters (PW) Basin and Watercourse Delineation

0 3.5
Miles

BARR SEH

MONITORING LOCATIONS
Lower Minnesota River West Comprehensive Watershed Management Plan

FIGURE A-13

Barr Footer: ArcGIS 10.8.1, 2022-06-01 14:14 File: I:\Projects\23\72\1014\Maps\Reports\One Watershed One Plan Inventory\FigA-13 Monitoring Locations.mxd User: cml3

A.8.2 Water Quality and Biological Monitoring

Several different agencies also conduct water chemistry and biological monitoring in the planning area. Through its Watershed Pollutant Load Monitoring Network (WPLMN), the MPCA conducts (or coordinates with partners to conduct) annual pollutant load monitoring at select continuous flow gaging locations. The MPCA (or its partners) sample for total suspended solids (TSS), total phosphorus (TP), dissolved ortho-phosphorus, nitrate and nitrite, and total Kjeldahl nitrogen. Approximately 30-35 samples per year are collected at each site over a wide variety of flow conditions and rain events. The MPCA (or its partners) compiles and analyzes all of the streamflow and pollutant concentration data using FLUX32 software. The final products are annual load concentrations for each parameter at each site that can be compared from year to year and analyzed for long term trends (MPCA, 2017; MPCA, 2016).

The MPCA's on-going monitoring performed through MWLMP is designed to measure and compare regional differences and long-term trends in water quality. In the case of impaired waters, the data collected through these efforts will be used to aid in the development of TMDL studies, WRAPS studies, and implementation of plans, assist watershed modeling efforts, and provide information to watershed research projects.

Water quality and biological monitoring data are available from the MPCA's Environmental Data Access (EDA) website at: https://www.pca.state.mn.us/quick-links/eda-surface-water-data

A.8.2.1 Citizen and Local Monitoring

Citizen monitoring is an important component of the watershed monitoring approach. The MPCA coordinates two programs aimed at encouraging citizen surface water monitoring: the Citizen Lake Monitoring Program (CLMP) and the Citizen Stream Monitoring Program (CSMP). Sustained citizen monitoring can provide the long-term picture needed to help evaluate current status and trends. Citizen-collected data helps agency staff interpret the results from intensive monitoring efforts, which occur less frequently. It also allows interested parties to track any water quality changes that occur in the years between the intensive monitoring events. Coordinating with volunteers to focus monitoring efforts where it will be most effective for planning and tracking purposes will help local citizens/governments see how their efforts are being used to inform water quality management decisions and affect change. The MPCA used citizen monitoring data for assessment in Lower Minnesota River watershed (MPCA, 2017; MPCA, 2016).

The MPCA also passes through funding via Surface Water Assessment Grants (SWAGs) to local groups such as counties, soil and water conservation districts (SWCDs), watershed districts, nonprofits, and educational institutions to monitor lake and stream water quality.

A.8.2.2 Stream Water Chemistry Monitoring

During the MPCA's most recent intensive monitoring efforts within the planning area, 22 stream locations were monitored for water chemistry in the Lower Minnesota River watershed, including four sites within the planning area: three sites on the Minnesota River and a site on High Island Creek (MPCA, 2017). Monitoring was performed primarily from 2014 to 2015. Three additional stream locations in the High

Island Creek watershed were sampled by MPCA citizen volunteers. Citizen volunteers enrolled in the CSMP observed physical water characteristics at the stream stations and submitted data to MPCA in 2015. Stream water chemistry monitoring locations are presented in Figure A-13.

Additional details regarding monitoring locations, parameters, and results are included in the *Lower Minnesota River Watershed Monitoring and Assessment Report* (MPCA, 2017).

In addition to MPCA monitoring, the USGS has been collecting water quality samples at the High island Creek gage (05327000) since 1969. Information is available from the USGS at: https://nwis.waterdata.usgs.gov/mn/nwis/qwdata/?site_no=05327000&agency_cd=USGS

A.8.2.3 Stream Biological Monitoring

The MPCA completed the biological monitoring component of the intensive watershed monitoring in 2014. Ninety new locations in the Lower Minnesota River watershed were monitored for biological parameters in the watershed (MPCA, 2017). In addition, 42 existing biological monitoring stations within the Lower Minnesota River watershed were revisited in 2014 and 2015 (see Figure A-13). To measure the health of aquatic life at each biological monitoring station, the MPCA calculates indices of biological integrity (IBIs), specifically fish and invertebrate IBIs, based on monitoring data collected for each of these communities. The MPCA developed a fish and macroinvertebrate classification framework to account for natural variation in community structure, which is attributed to geographic region, watershed drainage area, water temperature, and stream gradient.

As part of the MPCA's intensive watershed monitoring, mercury was analyzed in fish tissue samples collected from High Island Creek and Rush River, as well as 46 lakes in the watershed. Polychlorinated biphenyls (PCBs) were measured in fish from the same waterbodies. In addition, fish from 13 lakes were tested for perfluorochemicals (PFCs). A total of 2,284 fish were collected for contaminant analysis between 1983 and 2015.

Additional detail regarding biological monitoring locations, parameters, and results are included in the *Lower Minnesota River Watershed Monitoring and Assessment Report* (MPCA, 2017).

A.8.2.4 Lake Water Quality Monitoring

The planning area has 40 lakes at least 10 acres in size. Clear Lake, Titlow Lake, Round Grove Lake, Silver Lake, and High Island Lake were sampled and assessed for water quality and/or biological integrity as part of the MPCA's intensive watershed monitoring (see Figure A-13), The MPCA also supports the Citizen Lake Monitoring Program (CLMP) in which volunteers collect and report water clarity data.

Monitoring methods were consistent among monitoring groups and are described in the document entitled *MPCA Standard Operating Procedure for Lake Water Quality* (MPCA, 2018). The lake water quality assessment typically includes:

- Samples collected over a minimum of 2 years (in the 10-year assessment period)

- Samples collected from June to September. Typically, a minimum of 8 individual data points (over the 2 years) required for TP, corrected chlorophyll-a (chl-*a* corrected for pheophytin), Secchi disc.

- Samples collected from upper most 3 meters of water column

Additional detail regarding lake monitoring locations, parameters, and results are included in the *Lower Minnesota River Watershed Monitoring and Assessment Report* (MPCA, 2017).

A.8.2.5 Groundwater Monitoring

Through the Ambient Groundwater Monitoring Program, the MPCA monitors trends in statewide groundwater quality by sampling for a comprehensive suite of chemicals including nutrients, metals and volatile organic compounds. These ambient wells represent a mix of deeper domestic wells and shallow monitoring wells.

The MDA also coordinates groundwater quality monitoring through its township testing program, although such testing has not been performed recently within the planning area. More information is available at: https://www.mda.state.mn.us/township-testing-program. The MDA also monitors pesticides in groundwater through a network of monitoring wells.

The MDH also coordinates voluntary well testing programs to monitor groundwater for nitrate and other contaminants. Results of MDH groundwater monitoring of nitrate and arsenic concentrations are summarized in Section A.6.2.

A.9 Surface Water Quality

The water quality of surface water resources within the planning area is important to the recreational, economic, and ecological functions of those resources. Historically, surface water quality data in the planning area has been collected by entities including, but not limited to:

- Minnesota Pollution Control Agency (MPCA)
- United States Geological Survey
- Counties and Soil and Water Conservation Districts (SWCDs)

Water quality monitoring programs within the planning area are summarized in Section A.8. Surface water monitoring locations are presented in Figure A-13. Monitoring locations and data are also available from the MPCA's Environmental Data Access (EDA) website at: https://www.pca.state.mn.us/quick-links/eda-surface-water-data

Much of the surface water quality information summarized in this section is based on the *Lower Minnesota River Watershed Restoration and Protection Strategy Report* (WRAPS) (MPCA, 2020) and its supporting documents, including:

- *Lower Minnesota River Watershed Monitoring and Assessment Report* (MPCA, 2017)
- *Lower Minnesota River Watershed Stream Stressor Identification Report* (MPCA, December 2018)
- *Lower Minnesota River Watershed Lake Stressor Identification Report* (MPCA, November 2017)

A.9.1 Watershed Restoration and Protection Strategies (WRAPS)

The MPCA completed Watershed Restoration and Protection Strategies (WRAPS) studies for the Lower Minnesota River watershed in 2020. The WRAPS studies consider available data and assessments to identify water resources not meeting applicable water quality standards (i.e., impaired waters) and outline strategies to restore impaired waters and protect waters that are not impaired.

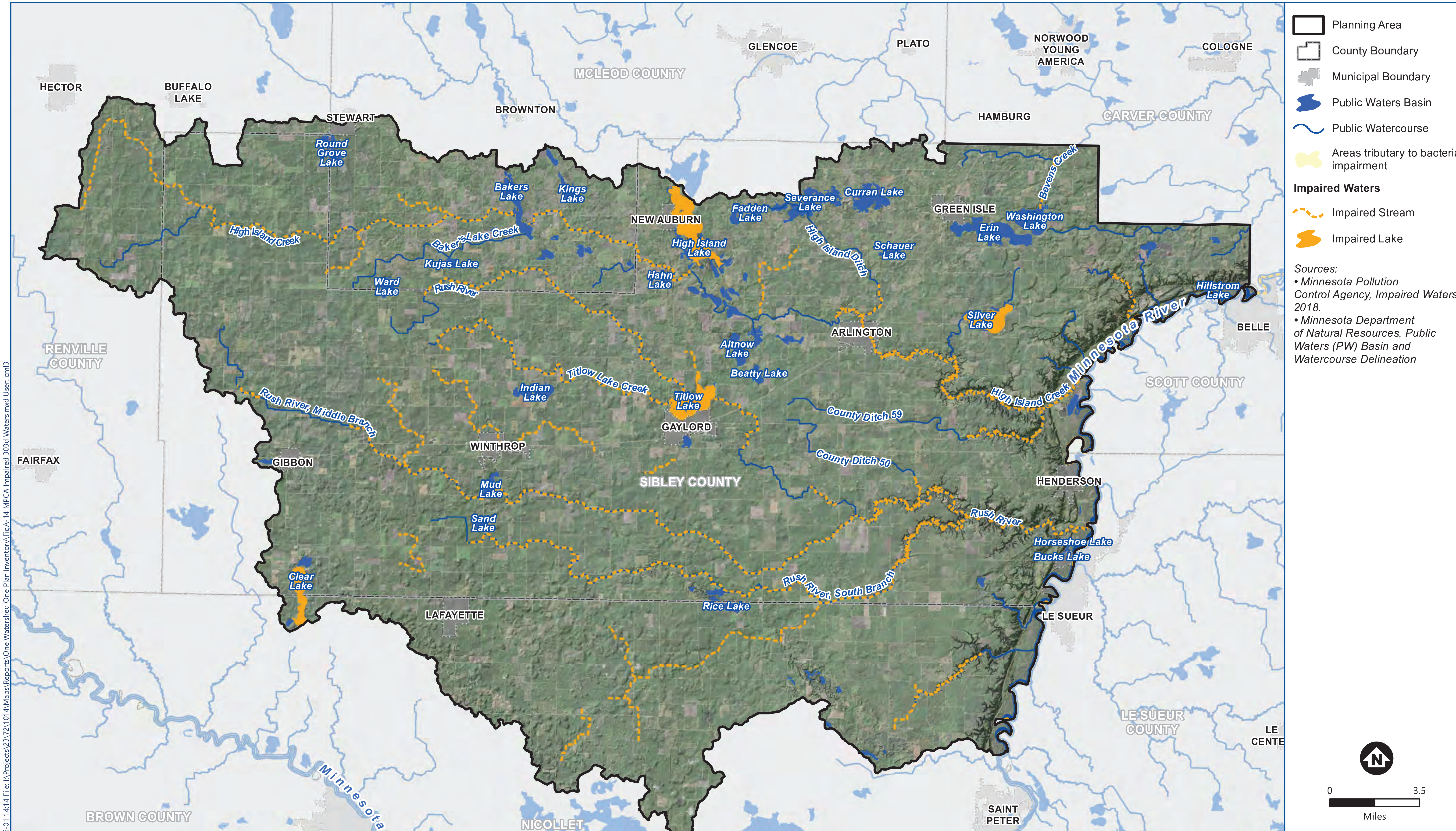
The MPCA performed intensive watershed monitoring for the planning area prior to completing the WRAPS studies (see Section A.8). The MPCA use this data to assess surface waters in the planning area for support of aquatic life, aquatic recreation, and fish consumption, where sufficient data was available. Not all lakes and stream reaches (identified by unique "assessment unit identifiers," or AUIDs) could be assessed due to insufficient data, modified channel condition, or their status as limited resource value waters.

Information from the WRAPS is summarized in this document. Additional information may be obtained from the MPCA website at: https://www.pca.state.mn.us/water/watersheds/lower-minnesota-river

A.9.2 Surface Water Quality Assessments

The Lower Minnesota River WRAPS includes assessments of stream and lake water quality to evaluate if those resources are achieving designated uses. Designated uses include a waterbody's ability to support aquatic life, aquatic recreation, and aquatic consumption. The state of Minnesota, consistent with the Clean Water Act, adopted water quality standards corresponding to a waterbody's designated uses. Minnesota water quality standards are published in Minnesota Rules 7050, available at: https://www.revisor.mn.gov/rules/7050/

Minnesota water quality standards applicable to the waterbodies assessed as part of the WRAPS, as well as the methodology for comparing data to those standards, are described in the *Lower Minnesota River Watershed Monitoring and Assessment Report* (MPCA, 2017). Waterbodies that fail to meet water quality standards applicable to its designated uses are identified by the MPCA as "impaired" for that use and placed on the MPCA's impaired waters 303(d) list. Individual waterbodies may be impaired for multiple uses or may be impaired for a single designated use due to multiple stressors (see Section A.9.3). Impaired waterbodies within the planning area are presented in Figure A-14.



MPCA IMPAIRED (303(d)) WATERS

Lower Minnesota River West Comprehensive Watershed Management Plan

FIGURE A-14

A.9.2.1 Stream Assessments

The WRAPS studies assessed streams for aquatic life, aquatic recreation, and fish consumption designated uses. Aquatic life use impairments include:

- Low fish index of biotic integrity (FIBI) – which means an unhealthy fish community is present
- Low macroinvertebrate (i.e., aquatic bugs) index of biotic integrity (MIBI) – which means an unhealthy macroinvertebrate community is present
- Turbidity/total suspended solids (T, TSS) levels too high to support fish or macroinvertebrate life

Aquatic recreation use impairments include:

- Fecal coliform (FC) – a type of bacteria, found in the intestinal tracts of warm-blooded animals
- *Escherichia coli (E. coli)* – a bacteria, found in the intestinal tracts of warm-blooded animals; E. coli is a specific type of fecal coliform
- Nutrients/eutrophication/biological indicators (Nutrients) – water clarity is reduced due to excessive growth of algae resulting from, typically, excessive phosphorus concentrations

Fish consumption impairments include:

- Mercury in fish tissue (Hg-F) – fish tissue contains concentrations of mercury that pose a health risk if eaten
- Polychlorinated biphenyls in fish tissue (PCB-F) – fish tissue contains concentrations of polychlorinated biphenyls (PCBs) that pose a risk to health if eaten

The results of the stream assessments relative to aquatic life and aquatic recreation are presented in Table A-12 according to stream reach (AUID number) and are based on information published in the WRAPS. FIBI and MIBI impairments are assessed relative to a threshold IBI values based on stream classification. Threshold IBI values for MIBI and FIBI are presented in Figure A-16 and Figure A-17, respectively. Note that not all reaches in Table A-12 have been assess for all impairments, and several reaches have multiple impairments.

A.9.2.2 Lake Assessments

Lakes are assessed for aquatic recreation uses based on ecoregion specific water quality standards for total phosphorus (TP), chlorophyll-a (chl-*a*) (i.e., the green pigment found in algae), and Secchi transparency depth. To be listed as impaired, a lake must not meet water quality standards for TP and either chl-*a* or Secchi depth. Lakes are also assessed for aquatic life based on water quality standards for fish index of biological integrity (FIBI) and chloride. Six lakes in the planning area are assessed in the WRAPS; the results are summarized in Table A-13 and include four impairments for eutrophication.

Table A-12 Stream aquatic life and aquatic recreation impairments from LMR WRAPS

HUC 10 Watershed	Name	Stream AUID	Fish IBI	Macro-invertebrate IBI	Dissolved Oxygen	Turbidity/TSS	River eutrophication	Chloride	*E. coli*
Bevens Creek	Bevens Creek	07020012-843	Mts	Imp		Mts	Imp		Imp
High Island Creek	Buffalo Creek	07020012-832	Imp	Imp		Imp			Imp
High Island Creek	Buffalo Creek	07020012-831	Mts	Mts					
High Island Creek	County Ditch 39	07020012-683	Mts	Imp					
High Island Creek	High Island Creek	07020012-653	Imp	Imp		Imp			Imp *
High Island Creek	High Island Creek	07020012-834	Imp	Imp		Imp		Mts	Imp *
High Island Creek	High Island Creek	07020012-837							Imp *
High Island Creek	High Island Creek	07020012-838	Imp	Imp		Imp		Mts	Imp *
High Island Creek	High Island Ditch 2	07020012-588	Mts			Imp			Imp *
High Island Creek	Judicial Ditch 11	07020012-590	Imp						
High Island Creek	Judicial Ditch 11	07020012-593	Imp	Imp					
High Island Creek	Judicial Ditch 12	07020012-794	Imp						
High Island Creek	Judicial Ditch 15	07020012-682	Imp	Imp					
High Island Creek	Judicial Ditch 24	07020012-591	Mts						
High Island Creek	Unnamed Creek	07020012-594	Mts						
Rush River, North	County Ditch 18	07020012-714				Mts			Imp
Rush River, North	County Ditch 18	07020012-791	Imp						
Rush River, North	Rush River, N. Branch	07020012-556	Imp	Imp					
Rush River, North	Rush River, N. Branch	07020012-558			Mts				Imp
Rush River, North	Rush River, N. Branch	07020012-555	Imp	Imp					Imp
Rush River, North	Unnamed Ditch	07020012-713							Imp
Rush River, North	Unnamed Ditch	07020012-610	Mts						
Rush River, Middle	County Ditch 11	07020012-674	Mts						
Rush River, Middle	County Ditch 22	07020012-675	Mts	Mts					

Table A-12 Stream aquatic life and aquatic recreation impairments from LMR WRAPS

HUC 10 Watershed	Name	Stream AUID	Fish IBI	Macro-invertebrate IBI	Dissolved Oxygen	Turbidity/TSS	River eutrophication	Chloride	*E. coli*
Rush River, Middle	County Ditch 42	07020012-551	Mts	Imp					
Rush River, Middle	County Ditch 44	07020012-786	Imp	Imp					
Rush River, Middle	County Ditch 49	07020012-677	Imp	Imp					
Rush River, Middle	County Ditch 50	07020012-796	Imp	Imp					
Rush River, Middle	County Ditch 56	07020012-790	Mts	Imp					
Rush River, Middle	Rush River	07020012-521	Imp	Mts		Imp		Mts	Imp*
Rush River, Middle	Rush River	07020012-548	Imp	Imp		Imp			
Rush River, Middle	Rush River, M. Branch	07020012-550							Imp
Rush River, Middle	Rush River, M. Branch	07020012-586	Imp	Imp					
Rush River, Middle	Unnamed Ditch	07020012-788	Mts	Imp					
Rush River, South	County Ditch 30A	07020012-801	Imp	Imp					
Rush River, South	County Ditch 32A	07020012-783	Imp	Imp					
Rush River, South	County Ditch 9	07020012-784	Imp						
Rush River, South	Judicial Ditch 1A	07020012-509			Mts				Imp
Rush River, South	County Ditch 13	07020012-636	Mts	Imp					
Rush River, South	Judicial Ditch 1	07020012-785	Mts	Imp					
Rush River, South	Judicial Ditch 6	07020012-574	Mts						
Rush River, South	Rush River, S. Branch	07020012-825	Imp	Imp					Imp*
Rush River, South	Rush River, S. Branch	07020012-826	Imp	Imp				Mts	Imp*
MN River - Belle Plaine	Unnamed creek	07020012-798	Imp	Imp					
MN River - Le Sueur	Barney Fry Creek	07020012-602	Imp	Imp					Imp
MN River - Le Sueur	County Ditch 47A	07020012-792	Imp	Mts					
MN River - Le Sueur	County Ditch 75	07020012-793	Imp	Mts					
		Total Impairments	**26**	**26**	**0**	**7**	**1**	**0**	**17**

Source: Lower Minnesota River WRAPS (MPCA, 2020)

Imp = impaired; Imp* = impaired, TMDL completed; Mts = meets standards;

Table A-13 Lake impairments from Lower Minnesota River WRAPS

HUC 10 Watershed	Lake Name	Lake ID	Fish IBI	Chloride	Eutrophication	Water Clarity Trend
High Island Creek	High Island (Main Basin)	72-0050-01		Mts	Imp	Increasing
High Island Creek	Round Grove	43-0116-00		Mts	Mts*	
High Island Creek	Silver	72-0013-00		Mts	Imp	
Rush River, North	Titlow	72-0042-00			Imp	
Rush River, South	Clear	72-0089-00		Mts	Imp	Steady
	Total Impairments		**NA**	**0**	**4**	

Source: Lower Minnesota River WRAPS (MPCA, 2020)

Imp = impaired; Mts = meets standards; Mts* = meets standards, but close to phosphorus standard

A.9.3 Stressor Identification

A **stressor** is something that adversely impacts or causes fish and macroinvertebrate communities in streams to become unhealthy. Biological stressor identification is performed for streams with either fish or macroinvertebrate biota impairments and encompasses both evaluation of pollutants (such as phosphorus, bacteria or sediment) and non-pollutant-related factors as potential stressors (e.g., altered hydrology, fish passage, habitat).

Stressor identification studies have been completed for the Lower Minnesota River watershed (MPCA, 2018). This study identified the factors (i.e., stressors) that are causing the biotic (i.e., fish and macroinvertebrate) community impairments within the planning area, including both pollutants and non-pollutants. Table 3 of the LMR WRAPS document summarizes the primary stressors identified in streams with aquatic life impairments in the planning area. Common stressors include:

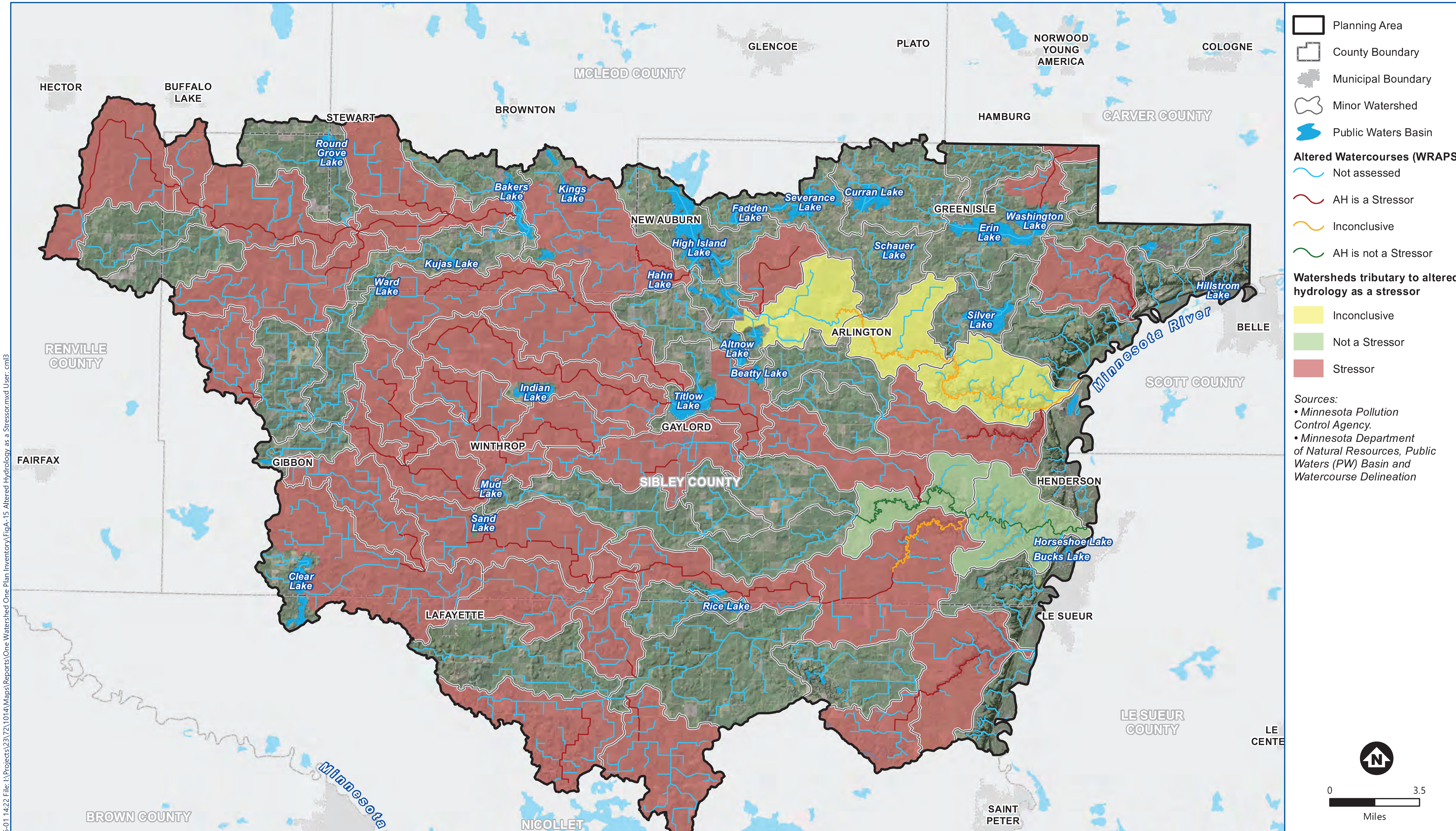
- **Low Dissolved Oxygen (DO)**: when dissolved oxygen drops below optimal levels, desirable aquatic organisms, such as fish, may suffer stress or die off.
- **Elevated Nitrate:** elevated levels of nitrate in streams can be toxic to fish and macroinvertebrates, especially for certain species of caddisflies, amphipods, and salmonid fishes.
- **Sediment/turbidity**: increased turbidity of water harms fish and macroinvertebrates through gill abrasion, loss of visibility, and reduced sunlight penetration needed for plants.
- **Loss of Habitat:** excess fine sediment that deposits on the bottom of stream beds negatively impacts fish and macroinvertebrates that depend on clean, coarse stream bottoms for feeding, shelter, and reproduction.
- **Altered Hydrology:** flow alteration is the change of a stream's flow volume and/or flow pattern typically caused by anthropogenic activities, which can include channel alteration, water

withdrawals, land cover alteration, wetland drainage, agricultural tile drainage, urban stormwater runoff, and impoundment (see Figure A-15).

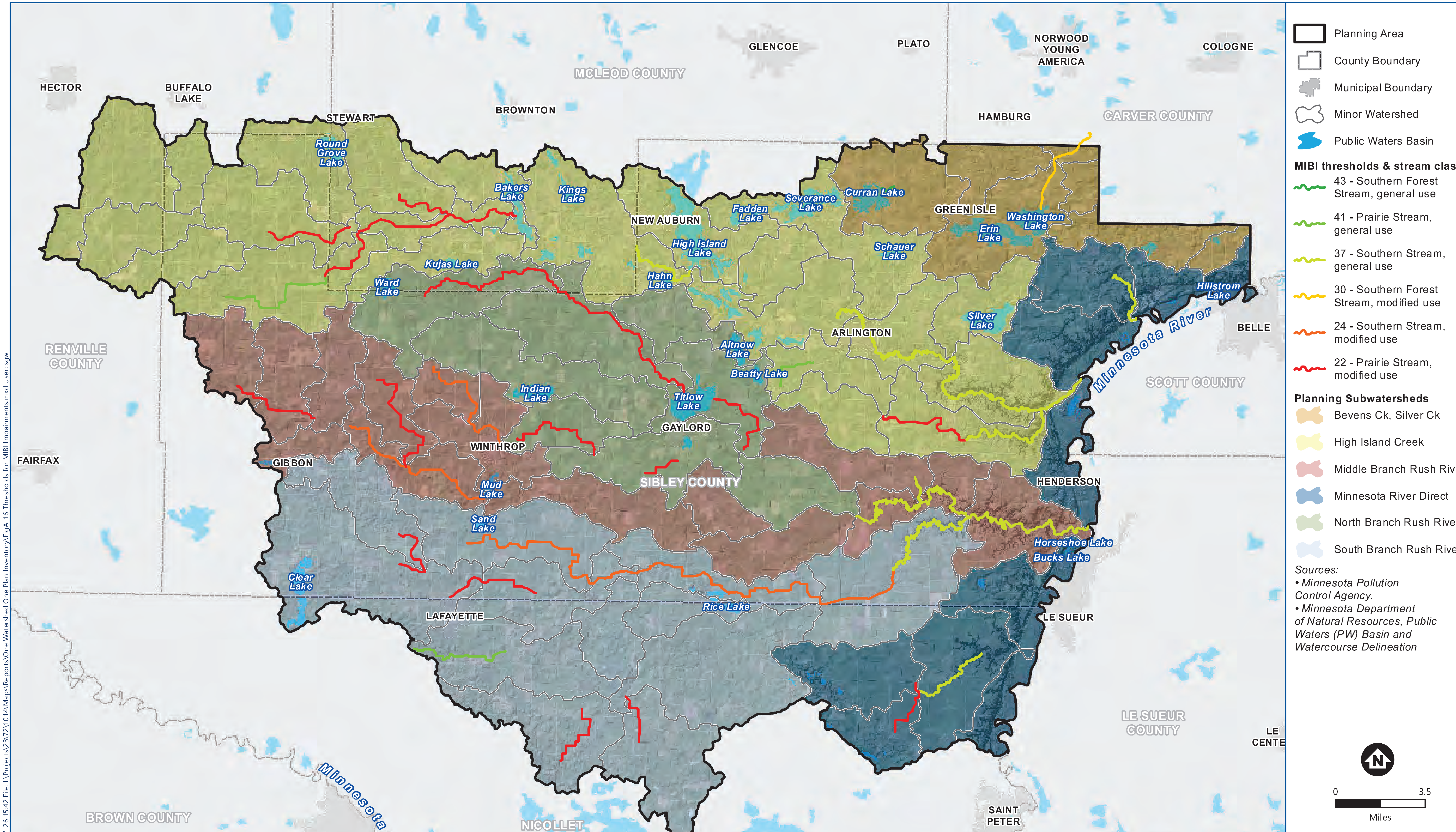
- **Eutrophication (elevated nutrients):** very low or highly fluctuating dissolved oxygen levels due to excess nutrients (phosphorus) fertilizing stream algae growth.

The Lower Minnesota River watershed stream and lake stressor identification studies (MPCA, 2017; MPCA, 2018) also found the following:

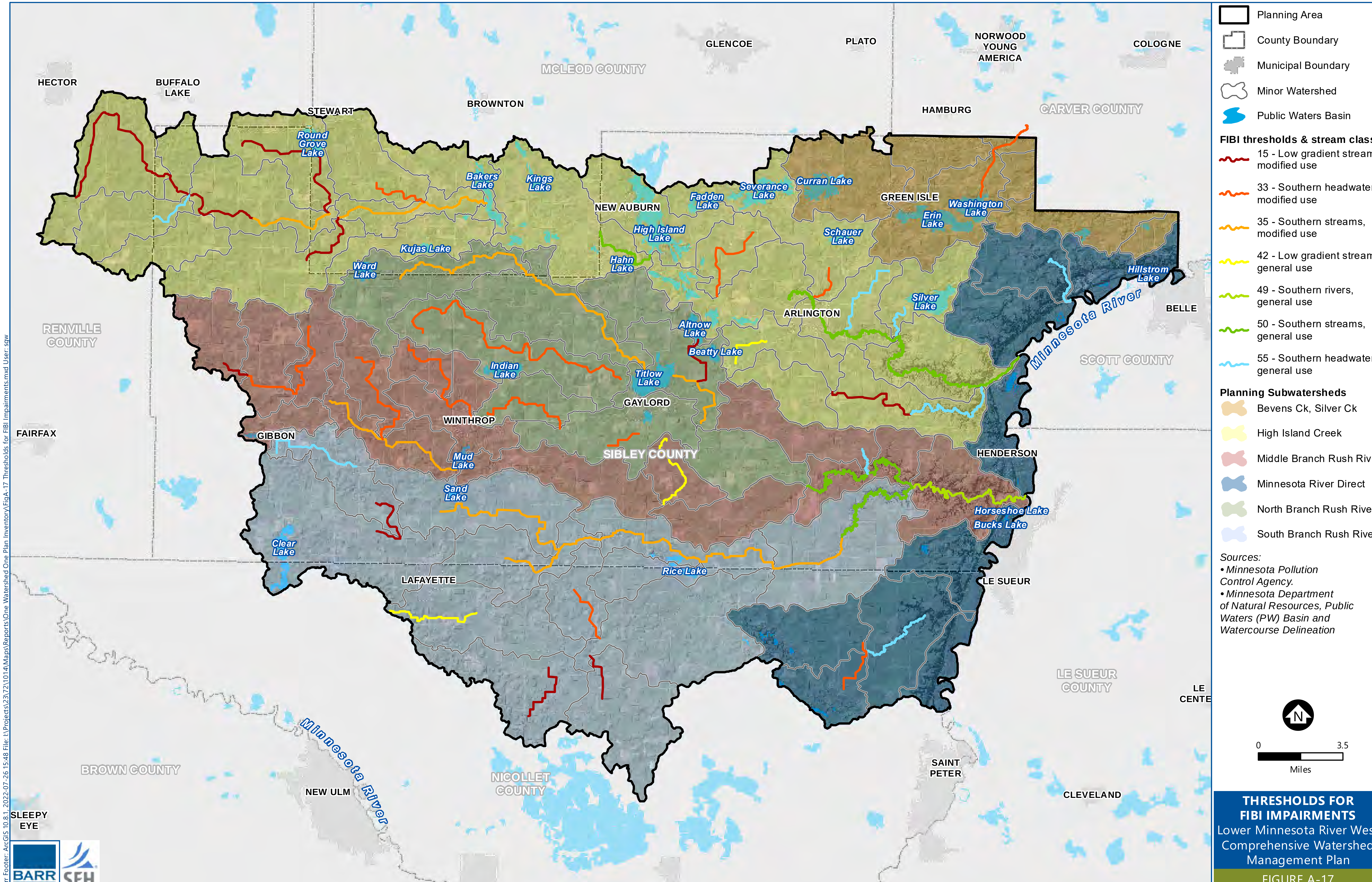
- Nearly all reaches have multiple stressors
- Insufficient/degraded habitat is the most prevalent stressor, occurring in 76% of assessed reaches
- Altered hydrology is a significant stressor, occurring in 65% of assessed reaches – this is not surprising given the large extent of stream alteration that has occurred in this watershed; Figure A-15 identifies watersheds in which altered hydrology was identified as a stressor
- Pollutant-related stressors were also significant with eutrophication (phosphorus) affecting 62% of the reaches and nitrate and TSS affecting 54%
- Nitrate is most prevalent as a stressor in streams of intensely agricultural areas



ALTERED HYDROLOGY AS A STRESSOR
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE A-15



THRESHOLDS FOR MIBI IMPAIRMENTS
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE A-16



THRESHOLDS FOR FIBI IMPAIRMENTS
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE A-17

A.9.4 Pollutant Sources

The Lower Minnesota River WRAPS and TMDL identify pollutant sources to impaired waters. These sources include point sources and non-point sources of pollutants.

Point sources are defined as facilities that discharge stormwater or wastewater to a lake or stream and have a National Pollutant Discharge Elimination System or State Disposal System (NPDES/SDS) permit. Point sources in the planning area include industrial facilities and numerous wastewater treatment facilities. Point sources in the planning area are described in Section 2.3 of the WRAPS documents.

Nonpoint sources of pollution, unlike pollution from industrial and wastewater treatment facilities come from many diffuse sources. Nonpoint source pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes and streams. Common non-point pollutant sources in the planning area include:

Feedlots – Manure contains high concentrations of phosphorus, nitrogen, and bacteria that can run off into lakes and streams when not properly managed. While feedlot sites, themselves, are not generally a significant source of pollution in the LMRW, local impacts to water resources in the LMRW could in some cases be significant. Data indicate that there are 57 feedlots located in shoreland (within 1,000 feet of a lake or 300 feet of a river/stream) within the Lower Minnesota River watershed. Of the 57 feedlots in shoreland, 48 have open lots as part of the facility. Feedlots in shoreland with an open lot should be a priority for feedlot inspections, and feedlot fixes, if necessary, as they present the highest potential for runoff pollution. Feedlots located within the planning area are presented in Figure A-18.

Subsurface Sewage Treatment Systems (SSTS) – SSTS (septic systems) that are not maintained or failing can contribute excess phosphorus, nitrogen, and bacteria into the ground. The MPCA collects data yearly from local government units on subsurface sewage treatment systems (SSTS). In the planning area, failing SSTS are unlikely to contribute substantial amounts of pollutants and stressors, when compared to other sources. However, the impacts of failing SSTS on water quality may be pronounced in areas with high concentrations of failing SSTS or at times of low precipitation and/or flow.

Undersewered/Unsewered Community – These are defined as a cluster of five or more houses or business that are within a half-mile radius that have inadequate wastewater treatment or unknown method of treatment. This may include a community having failing individual systems or inadequate collection and treatment infrastructure. The MPCA has identified 41 communities in the Lower Minnesota River watershed which were considered undersewered/unsewered in the planning area.

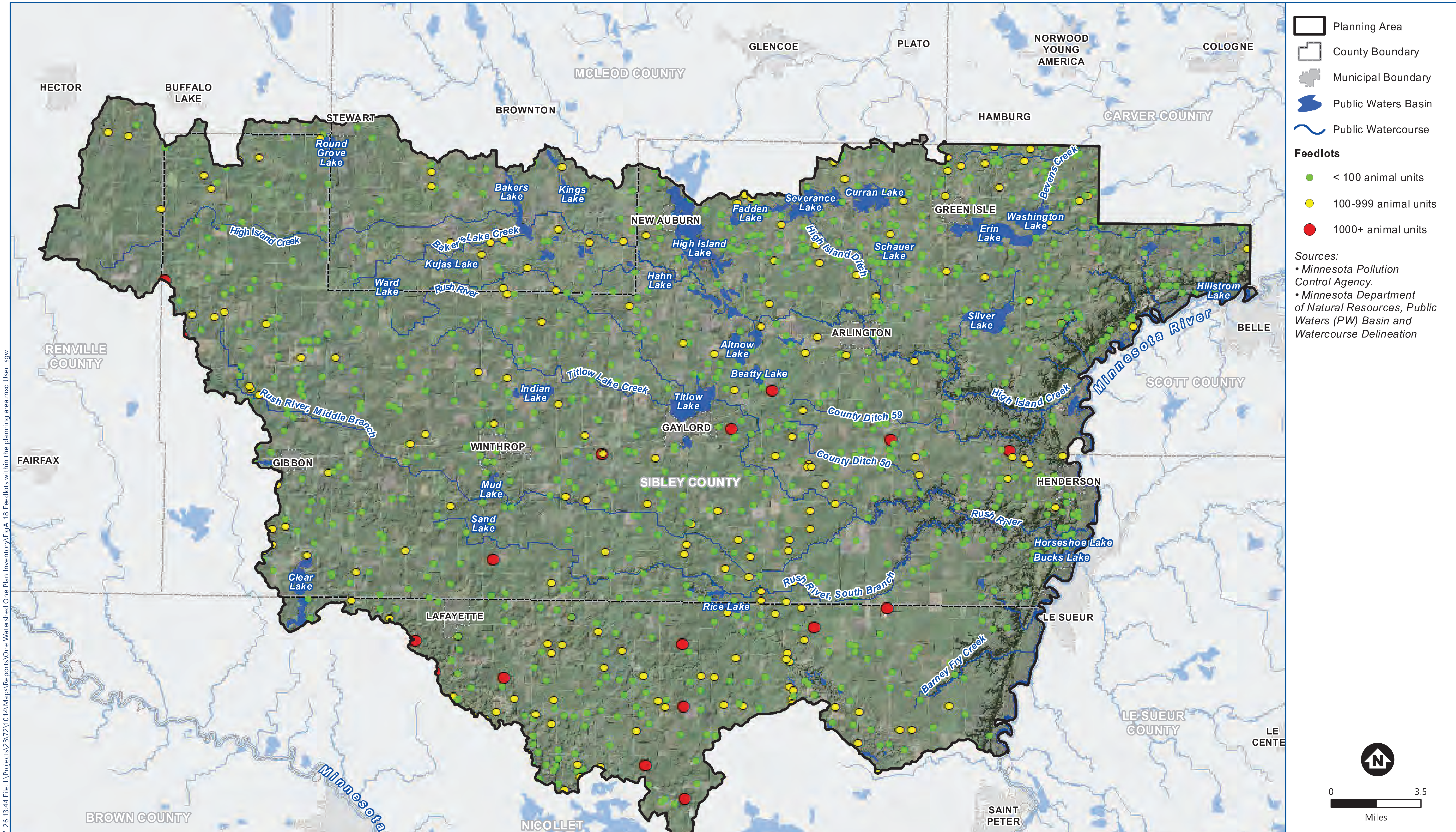
Near-stream/ditch erosion – Near-stream/ditch erosion can deliver excess sediment and nutrients from destabilized banks or transport deposited sediment in the stream during very high flows. Near-channel erosion (e.g., streambank, bluff and ravine erosion) is the dominant loading source for TSS in the planning area. While bank erosion is a natural process, altered hydrology has significantly increase the rate of near-channel erosion relative to historic natural rates. Data collected by the MPCA indicates that a significant percentage of TSS loading can be traced to “knickpoints” where sharp changes in channel slope occur.

Agricultural runoff – Cropland runoff can deliver sediment, nitrogen and phosphorus when soil is disturbed or exposed to wind and rain. Cropland is the second leading source of sediment in the planning area (MPCA, 2020). In flat areas, wind erosion is a common sediment contributor to drainage ditches and local stream, exacerbated by lack of residue during winter and spring months. Cropland drainage and cropland groundwater are also dominant pathways of nitrogen in the Minnesota River Basin. Nitrogen from cropland groundwater, drainage, and runoff comes from a variety of sources, including commercial fertilizer, manure, legumes, and atmospheric deposition. The increase in tile drainage has resulted in an increased transport of nitrogen to surface waters.

Internal loading – Lake sediments contain large amounts of phosphorus that can be released into the lake water through physical mixing or under certain chemical/oxygen conditions.

Urban and rural stormwater – Runoff from impervious surfaces common to developed areas may collect phosphorus, sediment, bacteria, and other pollutants prior to discharging to downstream waters.

The MPCA maintains a database which includes the locations of potential pollutant sources (e.g., underground storage tanks). This data is available from the MPCA at:
https://www.pca.state.mn.us/data/whats-my-neighborhood



FEEDLOTS WITHIN THE PLANNING AREA
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE A-18

BARR SEH

A.9.5 TMDL Analyses

Figure A-14 presents the impaired waters in the planning area. Waterbodies on the impaired waters list are required to have an assessment completed that addresses the causes and sources of the impairment. This process is known as a total maximum daily load (TMDL) analysis. The TMDL analysis includes target goals for water quality improvement. The MPCA has completed a comprehensive TMDL for the Lower Minnesota River watershed. This included TMDLs for High Island Creek, Rush River, High Island Lake, Silver Lake, Lake Titlow, Clear Lake, Buffalo Creek, and the Lower Minnesota River.

Information from these TMDL documents is summarized in this document. Additional information may be obtained from the MPCA website at:
https://www.pca.state.mn.us/water/watersheds/lower-minnesota-river

Generally, the TMDL methodology relies on water quality monitoring data and water quality modeling to estimate a TMDL, defined as the maximum amount of pollutant that a waterbody can receive and still meet water quality standards and/or designated uses. A TMDL is comprised of three components:

- Wasteload Allocation (WLA) – the portion of the TMDL allocated to existing or future point sources of the relevant pollutant
- Load Allocation (LA) – the portion of the TMDL allocated to existing or future nonpoint sources of the relevant pollutant. The LA may also encompass "natural background" contributions, internal loading and atmospheric deposition;
- Margin of Safety (MOS) – accounting of uncertainty about the relationship between pollutant loads and receiving water quality

The Lower Minnesota River watershed TMDLs address several of the impairments identified in Table A-12.

A.9.5.1 Total Suspended Solids Impairments

The Lower Minnesota River TMDL includes detailed analysis of TSS loading to impaired reaches (see Section 4.4 of the TMDL). Considerations and conclusions from that analysis include:

- Permitted sources of TSS include industrial and municipal wastewater treatment facility effluent and municipal stormwater. Wastewater facilities within the watershed are required to treat TSS to below the water quality standard.

- Minimal evidence exists that suggests that natural background sources are a major driver of the waterbody impairments and/or affect their ability to meet state water quality standards.

- The load reductions needed to meet the stream TSS TMDLs range from 2% to 89%

A.9.5.2 Bacteria Impairments

The Lower Minnesota River TMDL includes detailed analysis of bacteria loading to impaired reaches (see Section 4.5 of the TMDL). Considerations and conclusions from that analysis include:

- Permitted sources of bacteria include industrial and municipal wastewater treatment facility effluent, and municipal stormwater. Wastewater facilities in the watershed are required via permit to treat below the bacteria water quality standard.

- Prior studies suggest the presence of background *E. coli* and a fraction of *E. coli* may be present regardless of the control measures taken by traditional implementation strategies. *E. coli* load allocations in the TMDL include natural background.

- Nineteen of the 34 reaches included in the TMDL analysis demonstrated bacteria loading exceedances during all flow regimes during which data was collected.

A.9.5.3 Eutrophication Impairment

Phosphorus TMDLs were developed for 19 lakes with eutrophication impairments in the Lower Minnesota River TMDL. Four of these lakes are located within the planning area: High Island Lake, Silver Lake, Lake Titlow, and Clear Lake. The loading capacities and allocations for the lake phosphorus TMDLs were developed with the lake response model, BATHTUB (Walker, 1999). Considerations and conclusions from the TMDL analysis of Rice Lake include:

- Load allocations suggest significant internal phosphorus loading from lake sediments may be present (High Island Lake 95% of total load, Silver Lake 99% of total load, Lake Titlow 95% of total load).

- Background sources of phosphorus include atmospheric deposition and low levels of soil erosion from stream channels and upland areas occurring under natural conditions. The fraction of atmospheric deposition is very minimal compared to other load sources.

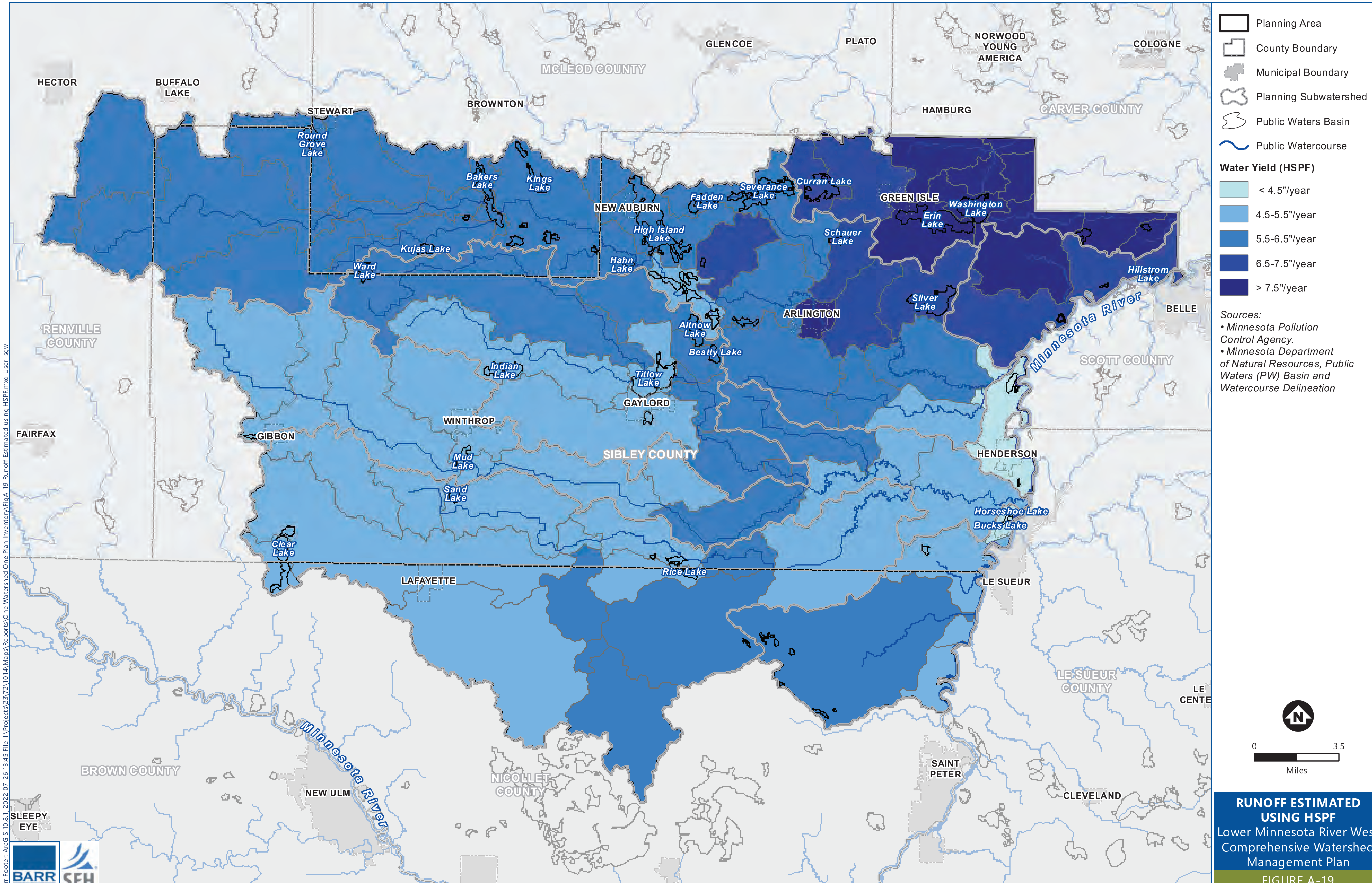
- Necessary total load reductions for the lakes in the planning area range from 50%-89% to achieve the total phosphorus water quality standard in each lake.

A.9.6 Water Quality Modeling

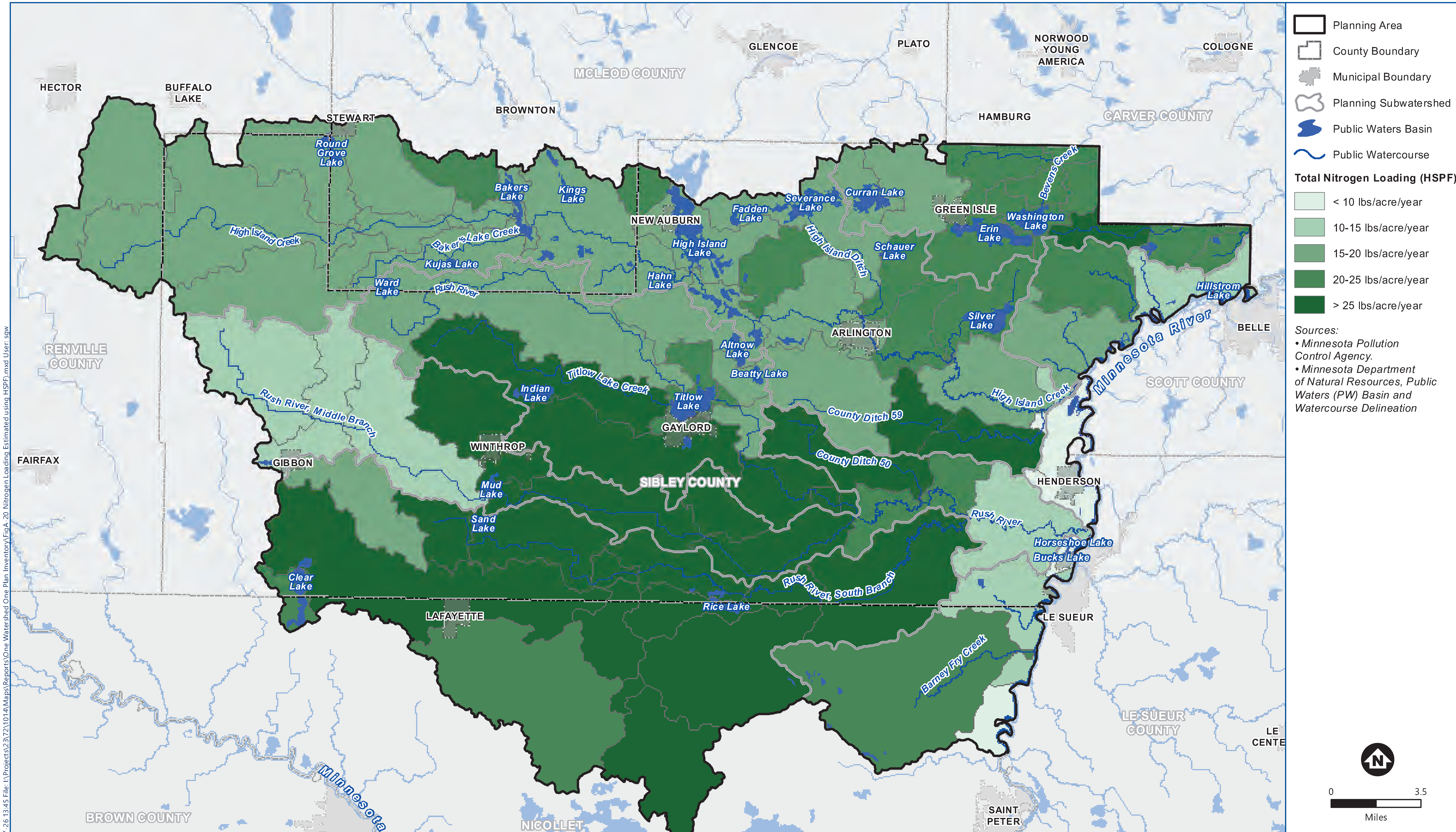
Monitoring for pollutants and stressors is generally extensive with the watershed approach, but not every stream or lake can be monitored due to financial and logistical constraints. Water quality modeling has been used to estimate pollutant loading within the planning area. The type, extent, and level of detail vary among different modeling efforts.

In support of the LMR WRAPS and TMDL studies, HSPF modeling was performed for the entirety of the planning area. HSPF is a large-basin, watershed model that simulates runoff and water quality in urban and rural landscapes. HSPF focuses on a generalized, larger scale perspective of watershed processes. HSPF incorporates data including stream pollutant monitoring, land use, weather, soil type, etc. to estimate flow, sediment, and nutrient conditions within the watershed. The HSPF model is calibrated to collected data and provides estimation of river flows and water quality in areas where limited or no observed data has been collected. The HSPF model also provides estimations of the locations and proportions of watershed sources -- specific combinations of land use, slopes and soils -- comprising pollutant loading at downstream locations where more substantial observed data are available.

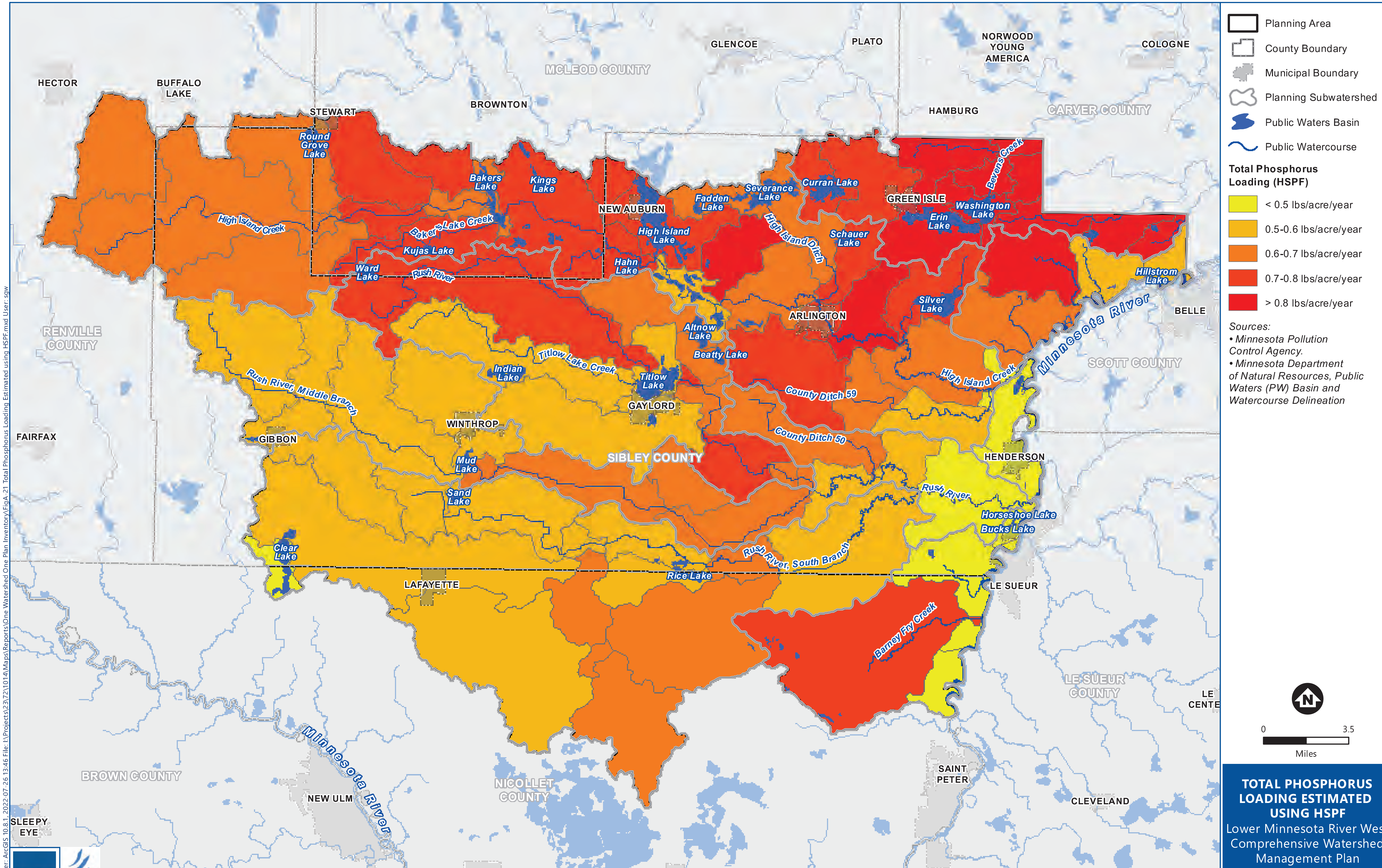
Estimated runoff, TN loading, TP loading, and TSS loading using HSPF are presented in, Figure A-19, Figure A-20, Figure A-21, Figure A-22, respectively.



HECTOR
BUFFALO LAKE
STEWART
BROWNTON
MCLEOD COUNTY
GLENCOE
PLATO
NORWOOD YOUNG AMERICA
COLOGNE
HAMBURG
CARVER COUNTY
Round Grove Lake
Bakers Lake
Kings Lake
NEW AUBURN
Fadden Lake
Severance Lake
Curran Lake
GREEN ISLE
Washington Lake
Erin Lake
High Island Lake
Schauer Lake
Kujas Lake
Ward Lake
Hahn Lake
Hillstrom Lake
Silver Lake
ARLINGTON
BELLE
Altnow Lake
Beatty Lake
Minnesota River
RENVILLE COUNTY
SCOTT COUNTY
Indian Lake
Titlow Lake
GAYLORD
WINTHROP
FAIRFAX
GIBBON
SIBLEY COUNTY
HENDERSON
Mud Lake
Sand Lake
Horseshoe Lake
Bucks Lake
Clear Lake
Rice Lake
LAFAYETTE
LE SUEUR
LE SUEUR COUNTY
LE CENTE
BROWN COUNTY
NICOLLET COUNTY
SAINT PETER
NEW ULM
CLEVELAND
SLEEPY EYE
Planning Area
County Boundary
Municipal Boundary
Planning Subwatershed
Public Waters Basin
Public Watercourse
Water Yield (HSPF)
< 4.5"/year
4.5-5.5"/year
5.5-6.5"/year
6.5-7.5"/year
> 7.5"/year
Sources:
• Minnesota Pollution Control Agency.
• Minnesota Department of Natural Resources, Public Waters (PW) Basin and Watercourse Delineation
N
0 3.5
Miles
BARR
SEH
RUNOFF ESTIMATED USING HSPF
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE A-19



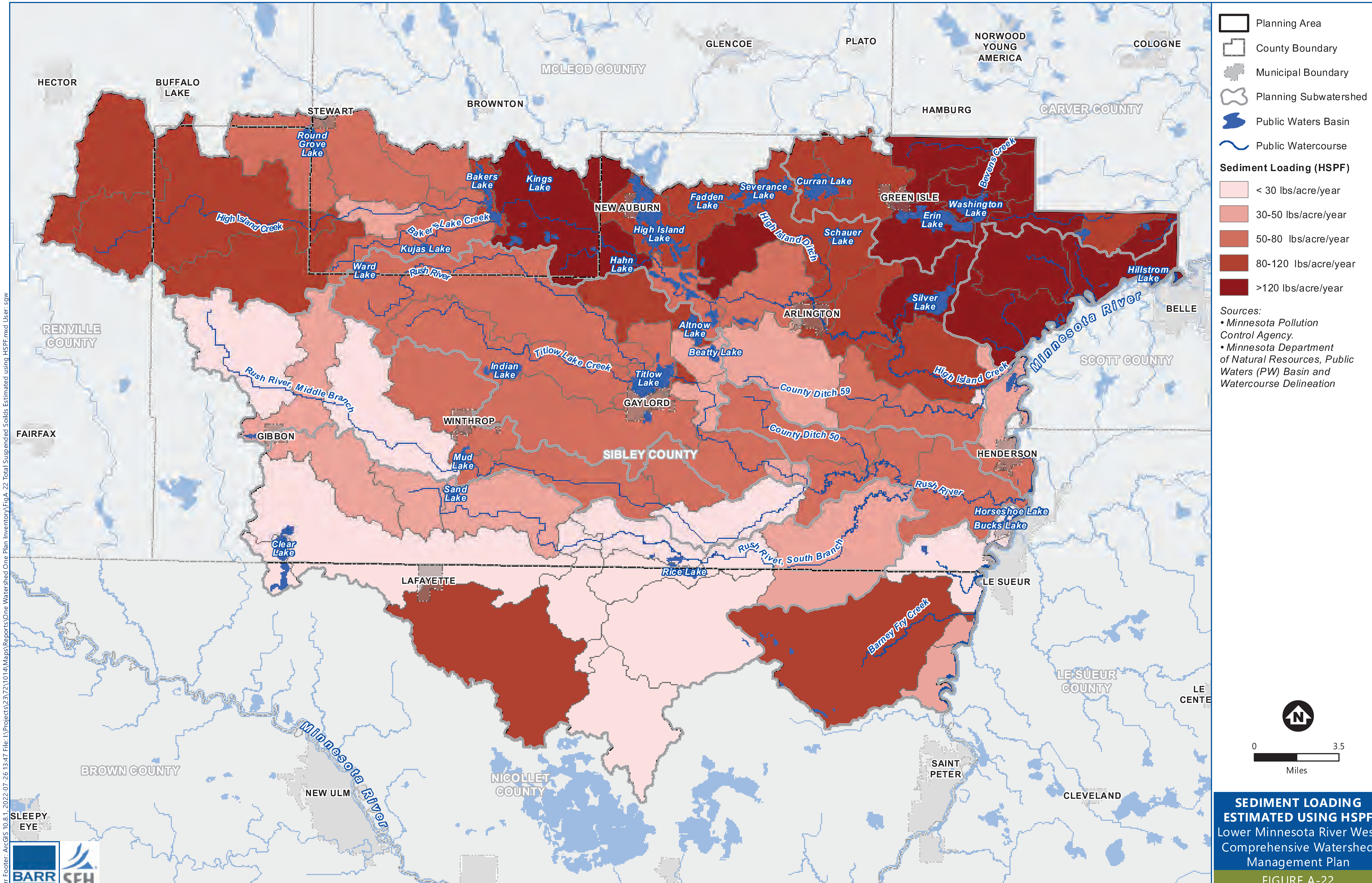
NITROGEN LOADING ESTIMATED USING HSPF
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE A-20



TOTAL PHOSPHORUS LOADING ESTIMATED USING HSPF

Lower Minnesota River West Comprehensive Watershed Management Plan

FIGURE A-21



SEDIMENT LOADING ESTIMATED USING HSPF
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE A-22

A.10 Water Quantity and Flooding

The Minnesota River is the most significant hydrologic feature in the planning area and ultimately receives all runoff from the Lower Minnesota River West planning area. The Minnesota River drains a total area of approximately 17,000 square miles before discharging to the Mississippi River, of which the 780 square miles of the planning area makes up approximately 4.5 percent of the total tributary area, and approximately 6 % of the drainage area upstream of the Henderson (approximately 13,000 square miles).

The MDNR, in partnership with the USGS, maintains flow gages at several locations within the watershed. These gages are summarized in Table A-11 and shown in Figure A-13. Flow data is available from the MDNR cooperative stream gaging website at: https://www.dnr.state.mn.us/waters/csg/index.html

The longest continuous flow record on the Minnesota River near the planning area is located the Minnesota River at Jordan (USGS 0533000). The flow record at Jordan runs from 1935 to the present. Flow data is available for the Minnesota River at Mankato (USGS 05325000). Average annual flow and peak annual flow are presented in Figure A-23. The data exhibit increasing trends in both average annual flow and peak flows; four of the ten highest peak flows on record have been observed since 2010. The Jordan gage is located downstream of the planning area and represents an incrementally larger drainage area. While conditions during individual flood events may differ significantly between Jordan and Henderson, the Jordan flow record is indicative of regional trends.

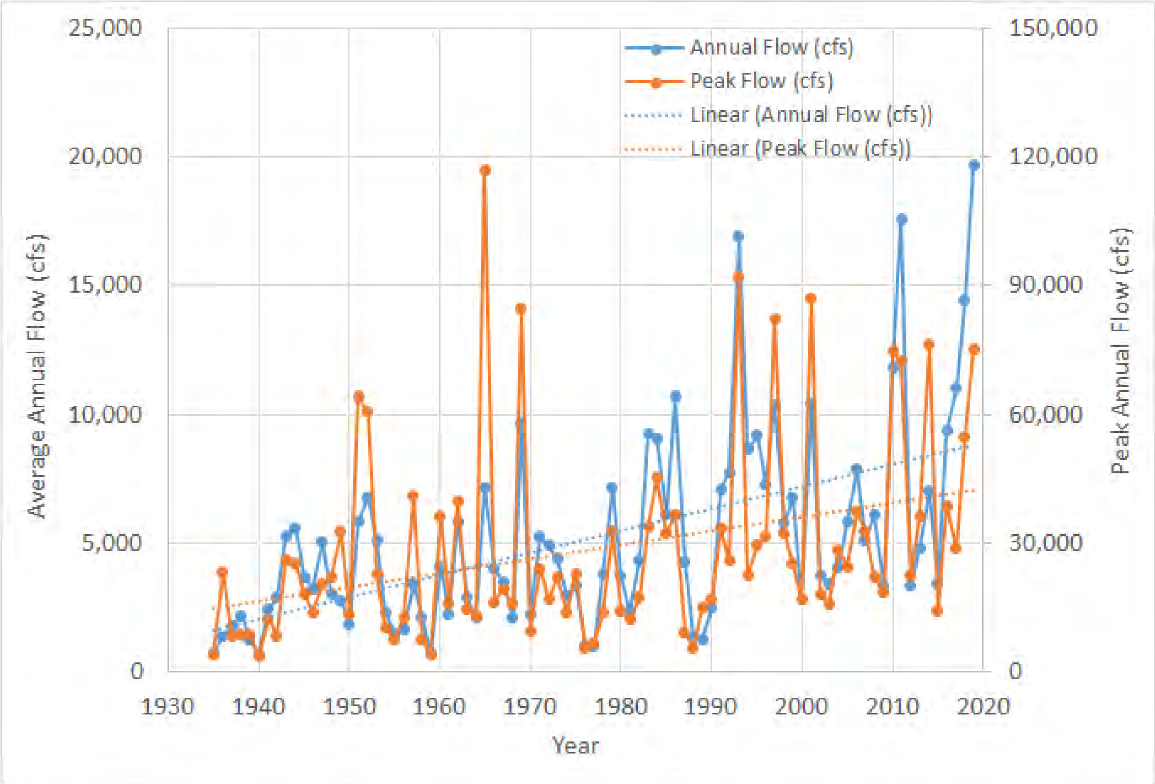


Figure A-23 Flow Record for the Minnesota River at Jordan (USGS 0533000)

Peak discharge data is also not always indicative of the worst flooding events. For example, the 2010 flood resulted in higher river stage in Henderson than the 1965 flood, despite a peak discharge approximately 20,000 cubic feet per second (cfs) less. Peak river stage data available at Henderson dating back to 1935 (see Figure A-25), however, shows a sharp increase in peak river stage occurring over the past 20 years.

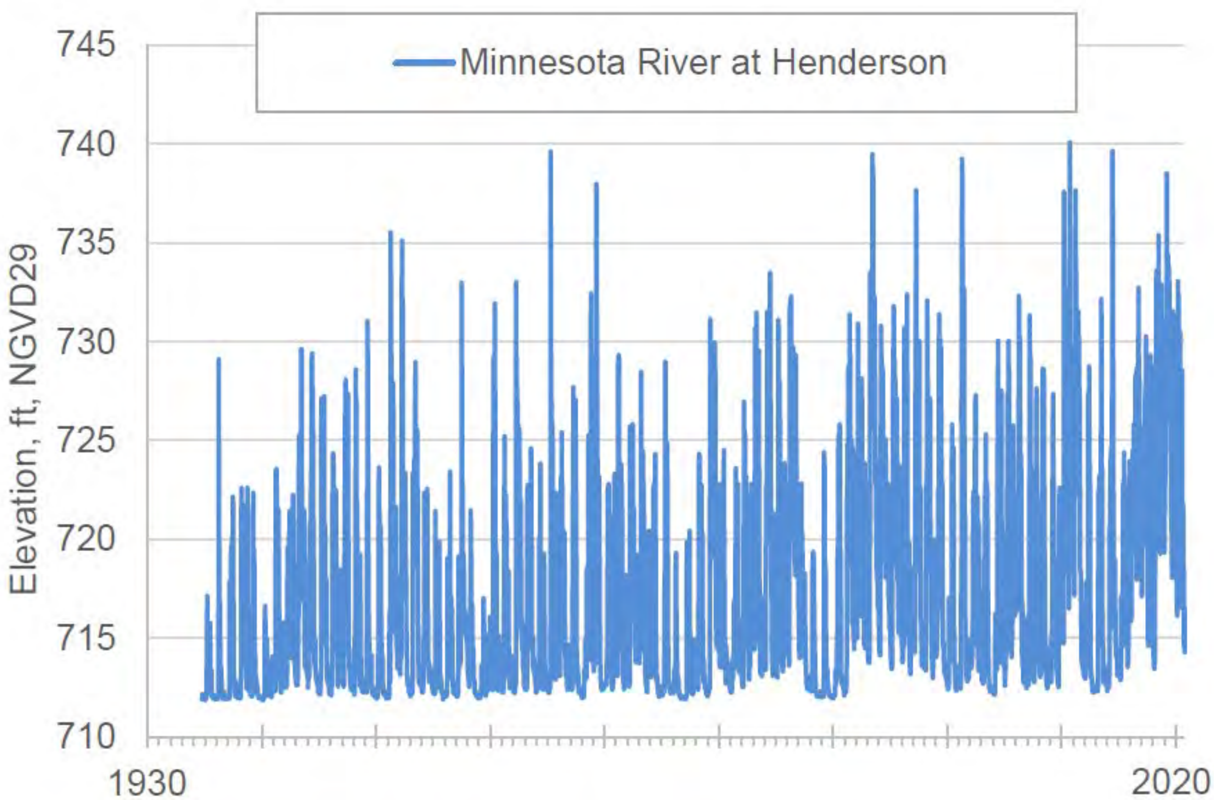


Figure A-24 Peak River Stage at Henderson

The planning area represents only 5% of the area tributary to USGS gage 0533000; trends observed in the Minnesota River are not necessarily proportional to trends within the planning area. Data collected within the planning area from High Island Creek near Henderson (USGS gage 0532700), however, shows similarly increasing trends in annual and peak flows, albeit from a shorter period of record (1974-present, see Figure A-25).

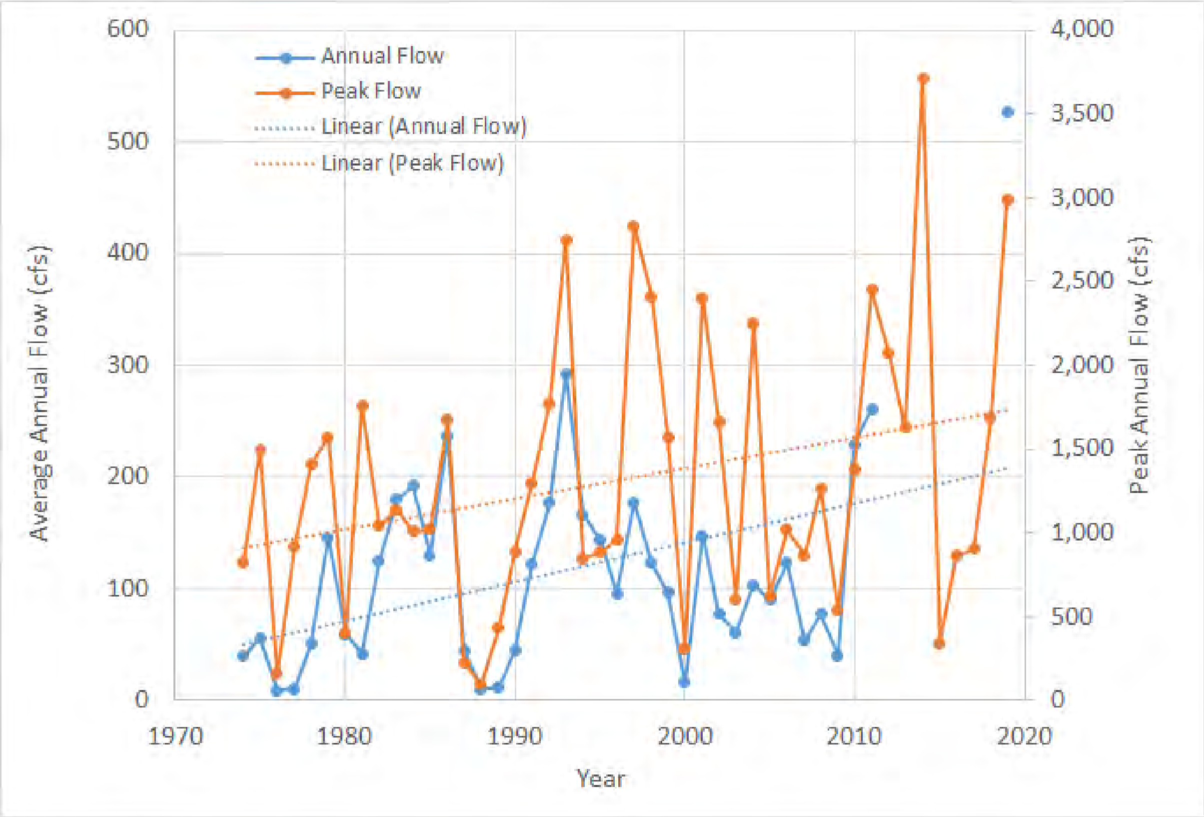


Figure A-25 Flow Record for the High Island Creek near Henderson (USGS 0532700)

A.10.1Floodplains and Flooding

High flows (or flood flows) are typically of greater concern than average flow conditions due to the potential risk to public safety and infrastructure. Flood Insurance Studies (FIS) have been performed for areas located within the planning area at the county and/or city level. An FIS contains information regarding flooding in a community, including flood history of the community and information on engineering methods used to develop Flood Insurance Rate Maps (FIRM) for a community. Homeowners within Federal Emergency Management Agency (FEMA) designated floodplains are required to purchase flood insurance. Homeowner and renters outside of the official floodplain can also qualify for flood insurance.

The FIS identifies areas that are expected to be inundated in a flood event having a 1 percent chance of occurring each year (also commonly referred to as the 100-year event). In some areas, the estimated water level is identified (e.g., FEMA zones AE, AH, AO). In some cases, no estimated flood depths or flood elevations are shown because detailed analysis has not been performed (e.g., FEMA zone A). Figure A-26 presents the mapped 100-year (1 percent) floodplain within the planning area watershed.

FIRMs are available from FEMA online at: https://msc.fema.gov/portal/advanceSearch

Within the planning area, each county has adopted a floodplain ordinance that regulates land disturbing activity within the floodplain.

Historically, significant flooding has occurred along the Minnesota River. Flooding occurring along the Minnesota River often occurs for extended periods of time due to the large area of the watershed. The Minnesota River flood of 1965 produced an estimated peak discharge of 113,000 cfs and was caused by a combination of snowmelt and rainfall. The 1965 flood had a rate of rise from bank-full (about elevation 728) to peak stage (elevation 740) in a period of 5 days. The 1965 flood forced the evacuation of 95 families for an average period of about 2 weeks. Business losses were substantial as three of the four principal highways leading into Henderson were closed by flooding. Damages at Henderson from the 1965 flood were estimated at $601,000 at the time.

In 1969, a similar flood in magnitude to the 1965 flood was predicted to occur. In preparation for the 1969 flood, the Corps of Engineers constructed approximately 9,000 feet of emergency levee at Henderson, and the levee served to minimize flood damages at Henderson in 1969. A permanent levee system was constructed in 1996 to minimize flood risk for the community. The levees are designed to protect the city from a Minnesota River flood having an estimated peak discharge of 113,000 cfs plus an additional freeboard allowance of 3 feet.

Flooding in the Minnesota River valley has created traffic and mobility challenges for MnDOT and local communities for decades. The roadways leading into and out of the City of Henderson (Highways 19 and 93 and County Road 6) have been hit especially hard in recent years, with closures due to flooding reaching an all-time high. During seasonal flooding events, residents, commuters and commercial vehicles traveling through the area have had to resort to detours that take them miles out of their way, costing them both time and money. The lengthy detours and restricted access to the Henderson area can substantially impact local businesses and regional traffic patterns. MnDOT is currently leading the design of a flood mitigation project for Highway 93 which is intended to raise the roadway above the September 2010 flood elevations.

Frequent flooding has also impacted crop production within the Minnesota River floodplain, leading to a gradual conversion of the predominant land use from agricultural land to woodland and recreational lands. The U.S. Fish and Wildlife Service manages the Minnesota Valley National Wildlife Refuge, which includes portions of the Minnesota River floodplain within the planning area.

In addition to flooding along the Minnesota River, more localized flooding issues frequently occur adjacent to the Rush River and High Island Creek in area with high runoff potential and limited watershed storage opportunities. Flooding on Rush River has resulted in overtopping of Highway 93 approximately 1.5 miles south of Henderson several times in the past 10 years. MnDOT monitors water levels on Rush River and implements roadway closures as needed to ensure public safety. The Highway 93 flood mitigation project that is currently being designed is intended to significantly reduce the Highway 93 closure frequency due to flooding of Rush River.

A.10.2 Hydrologic and Hydraulic Modeling

Hydrologic and hydraulic models have been developed for portions of the planning area; these models vary in extent and level of detail.

The HSPF modeling performed in support of the Lower Minnesota River WRAPS study (see Section A.9.1) estimated watershed runoff (or yield) for the entire planning area (see Figure A-19). While these results do not explicitly represent flood risk, they may be referenced by the Partner to prioritize areas for additional flood storage practices.

A hydrologic model of the Rush River watershed was developed as part of the Highway 93 flood mitigation project that is currently being designed. This model was developed using HEC-HMS and calibrated to flooding events that occurred on Rush River in 2019. This model was used to estimate peak flows for Rush River for various recurrence interval events to use in the sizing of a replacement bridge at Highway 93.

Hydraulic models of Rush River near its confluence with the Minnesota River was also developed as part of the Highway 93 flood mitigation project. This modeling was conducted to evaluate the peak water surface impacts associated with the proposed grade raise and to size the replacement bridge at Highway 93. This model was developed using SRH-2D software.

A geomorphic analysis of Rush River was also completed as part of the Highway 93 flood mitigation project to estimate the rate of sediment accumulation within the delta of Rush River. This analysis was also used to select an appropriate elevation for bridge low member elevation and roadway elevations.

FEMA FLOODPLAINS
Lower Minnesota River West Comprehensive Watershed Management Plan
FIGURE A-26

Barr Footer: ArcGIS 10.8.1, 2022-07-26 13:47 File: I:\Projects\23\72\1014\Maps\Reports\One Watershed One Plan Inventory\FigA-26 FEMA Floodplain.mxd User: sgw

A.11 Wildlife Habitat and Rare Features

The planning area includes significant amounts of natural wildlife habitat and ecological features of significance. The MDNR maintains a database of rare plants, animals, native plant communities and other rare features in its Natural Heritage Information System (NHIS). The NHIS database contains historical records from museum collections, published information, and field work observations, especially from the MDNR Minnesota Biological Survey (MBS). More information about the NHIS can be found on the MDNR website at: https://www.dnr.state.mn.us/nhnrp/nhis.html

A.11.1 Native Plant Communities

There are several native plant communities recognized within the planning area (see Figure A-27). These communities provide a variety of functions including filtration, flood attenuation, carbon storage, erosion control, and habitat for thousands wildlife and plant species (MDNR 2016). The native plant communities identified within the planning area are concentrated in riparian areas adjacent to the downstream reaches of the Rush River, High Island Creek, and the Minnesota River bluff area. Classes of native vegetation common in the planning area include:

- Southern floodplain forest
- Southern mesic and wet-mesic forests (including maple, basswood, oak)
- Southern mesic prairie
- Wet meadow
- Wet prairie
- Various marshes

Native plant communities are assigned a conservation status (S-rank) by the MDNR that reflects its risk of elimination (MDNR 2009). Approximately 60% of the native plant area in the planning area are identified as “Vulnerable to Extirpation” (S3) and 37% are identified as “Imperiled” (S2).

A.11.2 Sites of Biodiversity Significance

The MBS has identified some areas as having “outstanding,” “high,” “moderate,” or “below” biodiversity significance according to the assemblage of rare species and natural features. Figure A-27 presents areas of biodiversity significance within the planning area. With the planning area there are a significant number of such sites, including several areas along the Minnesota River bluffs that are classified as areas of “moderate” biodiversity. Additionally, areas around High Island Lake, Indian Lake, and Titlow Lake are classified as having “moderate” biodiversity. Areas of “high” biodiversity occur adjacent to the downstream reaches of High Island Creek, the Rush River, and Barney Fry Creek.

Additional information about the MBS sites of biodiversity significance is available from the MDNR website at: https://www.dnr.state.mn.us/eco/mcbs/biodiversity_guidelines.html

A.11.3 Rare Species

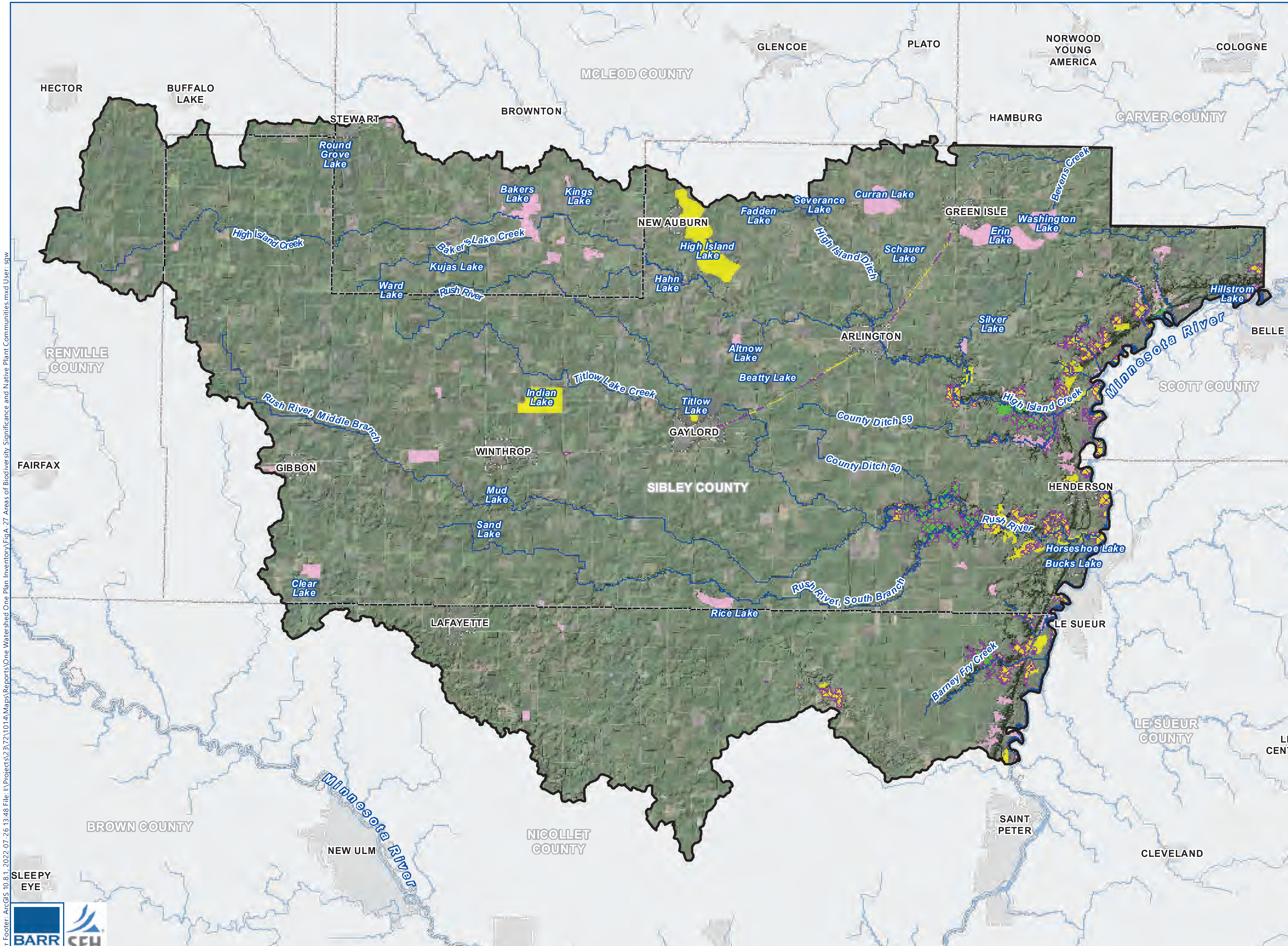
There are many rare plant, animal, and native plant communities present within the planning area. The location of specific species is not presented in this Plan for conservation purposes. Data about rare species is maintained in the NHIS database. More information about the NHIS can be found on the MDNR website at: https://www.dnr.state.mn.us/nhnrp/nhis.html

More information regarding threatened or endangered plant species in the region is available from the USFWS at: https://www.fws.gov/midwest/endangered/plants/

A.11.4 Fisheries

The rivers, streams, and lakes within the planning area are home to many species of fish. The MDNR has performed fish surveys on select lakes and within the planning area (e.g., Clear Lake); this information is available from the MDNR LakeFinder website at: https://www.dnr.state.mn.us/lakefind/index.html

There are no MDNR-designated trout streams in the planning area.



Planning Area

County Boundary

Municipal Boundary

Public Watercourse

Native Plant Community

Sites of Biodiversity Significance

High

Moderate

Below

Sources:

- *Minnesota Department of Natural Resources- Division of Ecological and Water Resources-Biological Survey.*
- *Minnesota Department of Natural Resources, Public Waters (PW) Basin and Watercourse Delineation*

0 3.5
Miles

AREAS OF BIODIVERSITY SIGNIFICANCE AND NATIVE PLANT COMMUNITIES

Lower Minnesota River West Comprehensive Watershed Management Plan

FIGURE A-27

BARR SEH

Appendix B

Hydrologic Analysis of Potential Storage Areas

MEMORANDUM

TO: Greg Williams (Barr Engineering)

FROM: Riley Mondloch, PE, CFM (Lic. MN, WI)
Rachel Pichelmann, PE, CFM (Lic. IA, IN, MN, SD)

DATE: May 10, 2022

RE: Lower Minnesota River West Comprehensive Watershed Management Plan - Wetland Restoration Hydrologic Modeling
SEH No. 158029

Background

The Sibley Soil and Water Conservation District is currently leading the development of the Lower Minnesota River West Comprehensive Watershed Management Plan. As part of this ongoing watershed planning effort, project stakeholders have developed goals and corresponding implementation actions. These goals focus on several areas of watershed management including surface water quality, erosion and sedimentation, altered hydrology, flooding, soil health, groundwater quality and supply, and fish, wildlife and habitat. A draft implementation schedule has been developed that includes several goals involving wetland restoration throughout the planning area. SEH, working as a subconsultant to Barr Engineering, was tasked with identifying and modeling 18 potential wetland restoration areas: 3 in each of the 6 major subwatersheds. The purpose was to develop a hydrologic model of the wetland restorations and estimate the resulting peak flows reductions in the local vicinity of the wetland restoration area and in the greater watershed.

The Lower Minnesota River West Comprehensive Watershed Management Plan area is broken down into 6 major subwatersheds as shown in **Figure 1.** The north and south branch of Rush River join with the middle branch to have one outlet location into the Minnesota River. Bevens Creek flows out of Sibley County to the north, there appear to be two main locations where channelized flow would leave the county. The Minnesota River watersheds are several smaller watersheds encompassing bluff areas that flow directly into the Minnesota River via numerous smaller ravines.

Hydrology

A HEC-HMS model of the entire Rush River watershed was created by SEH in 2020 as part of the Highway 93 Reconstruction Project for MnDOT. This model subdivided the Rush River watershed into 17 subwatersheds. SCS methodology with Atlas 14 rainfall depths was used. Numerous rainfall durations and distributions were modeled, but the 24-hour MSE3 event was the primary distribution used in this previous modeling. The model was calibrated to three recent storm events that caused Rush River to overtop Highway 93. Calibration was primarily done by increasing the time of concentration (lag time) of subwatersheds; this approximates the attenuation provided by the significant number of low areas, road crossings, and other impediments to flow in the upper watershed as adding all of those to the model as physical features would not have been practical. The 17 subwatersheds are routed to the bottom of Rush River using reaches with lag routing methodology. The modeling report created for this project titled “Rush River Floodplain Analysis Report” and dated October 20, 2021 explains the previous hydrologic analysis in greater detail.

This previous Rush River model was used as the starting point for this wetland restoration hydrologic modeling project. High Island Creek, Bevens Creek, and the Minnesota River watersheds were added to the model to represent the entire planning area. Lag time for these new watersheds was set manually based on the calibration done to the Rush River portion. Curve Number (CN) was also set based on the previous Rush River modeling as the land use is consistent in the nearby watersheds.

The existing peak flow out of High Island Creek in this model was compared to StreamStats and was well within the confidence interval. The HMS 100-year, 24-hour peak flow is 5310 cfs. As a check two other flow data sources were referenced. The StreamStats flow for the 100-year event is 4720 cfs, and the 100-year flow based on a Bulletin 17B analysis of USGS gage data for station 05327000 is 4300 cfs.

Potential wetland restoration areas were identified by looking at the LiDAR-based topographic surface and selecting areas where a significant amount of storage could be added by simply eliminating the primary outlet, which in most cases was a jurisdictional ditch or drain tile system. Areas were chosen where it appeared that an increase in ponded water would not be likely to impact a nearby structure or road, however this would need to be confirmed during later stages of design.

The images provided in **Figure 2** below provide an example of an area that was selected for this analysis. On the left, the LiDAR-based topographic surface is displayed, showing a large low-lying area with drainage ditches upstream and downstream. In the middle, the same area is shown with a current aerial background and 10-ft contours showing that the low-lying area is currently used for agricultural production. On the right, the same area is shown with a historical aerial photograph from 1938 (obtained from the Minnesota Historical Aerial Photographs Online) which shows the presence of a wetland. This comparison shows that a wetland restoration at this location appears to be feasible, and it could therefore be considered in the hydrologic analysis. It is understood that the feasibility of each potential wetland restoration project will need to be determined with consideration of landowner willingness, impacts to the jurisdictional ditch system, and other factors.

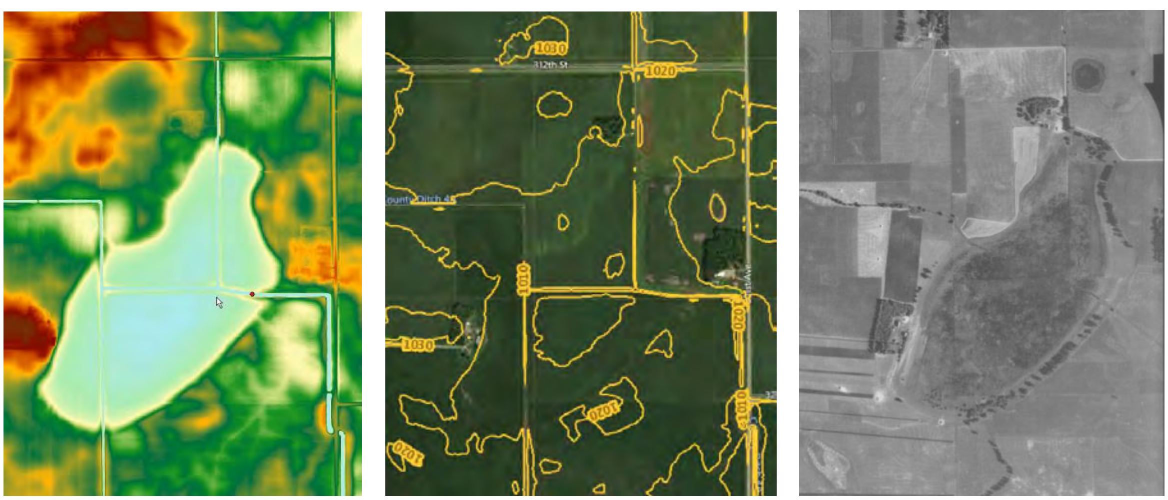


Figure 2. Comparison of LiDAR-based surface (left) to current (middle) and historical (right) images.

18 total potential wetland restoration areas were modeled, 3 in each of the 6 larger planning watersheds, as shown on **Figure 1**. Subwatersheds to the wetland restoration storage areas were delineated using the MnTOPO LiDAR data. CN values were set matching the larger watershed that the wetland restoration area subwatershed was part of.

Time of concentration (Tc) (Input to HMS as Lag = 0.6*Tc) for the 18 wetland restoration area subwatersheds were calculated using TR-55 in GeoHMS. It should be noted that these calculations were done based on surface elevations and may ignore tile drainage, and there are numerous low areas and terrain features that can cause high variability in Tc values depending how the calculation is done. However, the purpose is to compare existing to proposed conditions with storage added, so provided the time of concentration is the same for both conditions the benefit of restoring storage can be demonstrated.

The subwatershed draining to each wetland restoration area was removed from the larger subwatershed they were part of. Then, the storage area was connected to the outlet of the larger subwatershed using a reach element with normal depth type routing to represent travel time to the larger watershed outlet.

Stage-storage relationships for the wetland restoration areas were calculated using CivilGeo's GeoHMS software and the MnTOPO LiDAR data. The storage areas added to HMS needed to have outlet structures defined. The existing storage conditions were represented by adding a box culvert with the width approximating the ditch draining the low area because a channel option was not available. Manning's n and slope of the box culvert outlet were set to approximate the open channel ditch. An additional spillway defined as a broad crested weir outlet structure was added to each storage area, the overtopping elevation of these structures were set to the lowest natural elevation that water would flow out of the storage area if no ditch were present.

A proposed wetland restoration would likely consist of removal of drain tile or drainage ditch, and construction of a controlled outlet to manage wetland levels and promote storage. To create the proposed conditions model and simulate removal and filling of the ditch, the culvert (ditch) outlet structures were simply removed, leaving the spillway outlet structures as the only outlet. This simplified representation of a proposed conditions was used for modeling purposes.

Results

Table 1 shows the results for the 100-year, 24-hour MSE3 event. This table includes the location coordinates of each wetland restoration area. These coordinates reference the approximate location where the ditch fill/removal was assumed to take place. The results table compares the subwatershed area to the wetland restoration location to that of the larger subwatershed it is located within. The wetland restoration subwatersheds vary between 0.21 and 5.64 percent of the total watershed, providing a wide range of relative drainage area sizes.

The peak flow to each wetland restoration area is shown next in Table 1, this will be assumed to be consistent between existing and proposed. The peak outflow of each storage area under existing conditions is shown along with the peak volume stored. The peak volume stored and peak outflow of the wetland restoration areas under proposed conditions is then compared. The increase in volume stored is due to filling the outlet channel up to match natural overtopping elevations, no excavation was assumed. The peak flow percent reduction out of the wetland restoration areas varies between 32 percent and 100 percent, with roughly half being a complete elimination of outflow. Additionally, the peak outflow of the larger planning watersheds was compared between existing and proposed conditions. The proposed changes reduce total peak flows between 0.5 and 4.8 percent. However, this percent change can vary depending on how well the peak outflow of the local wetland restoration area subwatersheds line up with the peak outflow timing of the larger planning watershed in the model. Other factors such as the location of the wetland restoration within the subwatershed, and the relative size of the wetland restoration to the contributing watershed area, are expected to impact the results.

The peak flow reduction depends on the amount of storage added relative to the contributing drainage area. **Figure 3** plots the Ratio of Drainage Area to Peak Storage vs Peak Flow Reduction. This demonstrates there is not a perfectly consistent trend with the limited number of samples, however it shows the wetland restoration areas where local peak outflows are eliminated have larger storage relative to the contributing drainage area. The watersheds where peak flow is reduced by less than 100%

generally have drainage area to peak storage volume ratios of 250 or less. Ground cover and the associated runoff curve numbers and other hydrologic factors also are expected to impact these results..

Comparing the runoff volume to available storage provides a better relationship to estimate peak discharge reduction, however, requires additional hydrologic calculations. Chapter 6 of the USDA NRCS Urban Hydrology for Small Watersheds TR-55 provides charts and equations that can also be used to estimate peak discharge based on runoff volume.

The modeling completed for this analysis is theoretical and intended only to provide guidance on the amount of peak flow reduction that could result from wetland restoration projects of various sizes in various locations. Some of the locations modeled may not be feasible due to landowner willingness or may discover other limitations making them less desirable for wetland restoration.

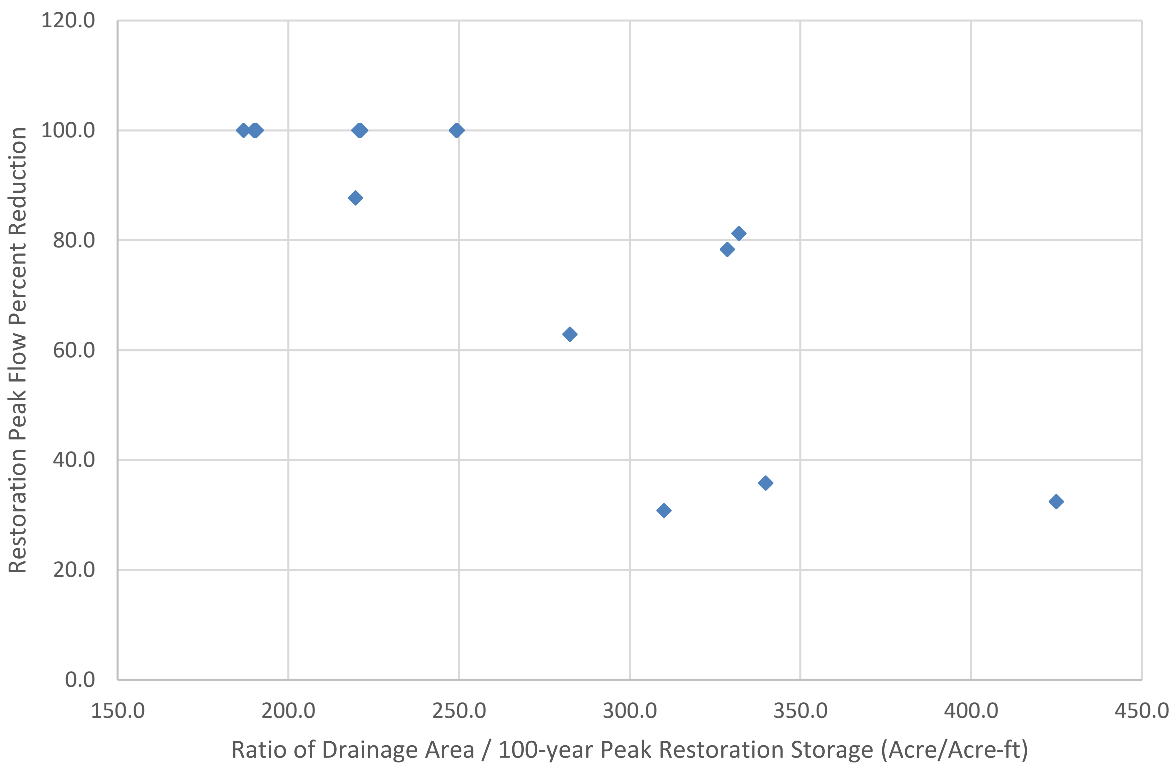


Figure 3 – Ratio of Drainage Area to Peak Storage vs Peak Flow Reduction

R.M.
c: Karen Chandler, Barr Engineering

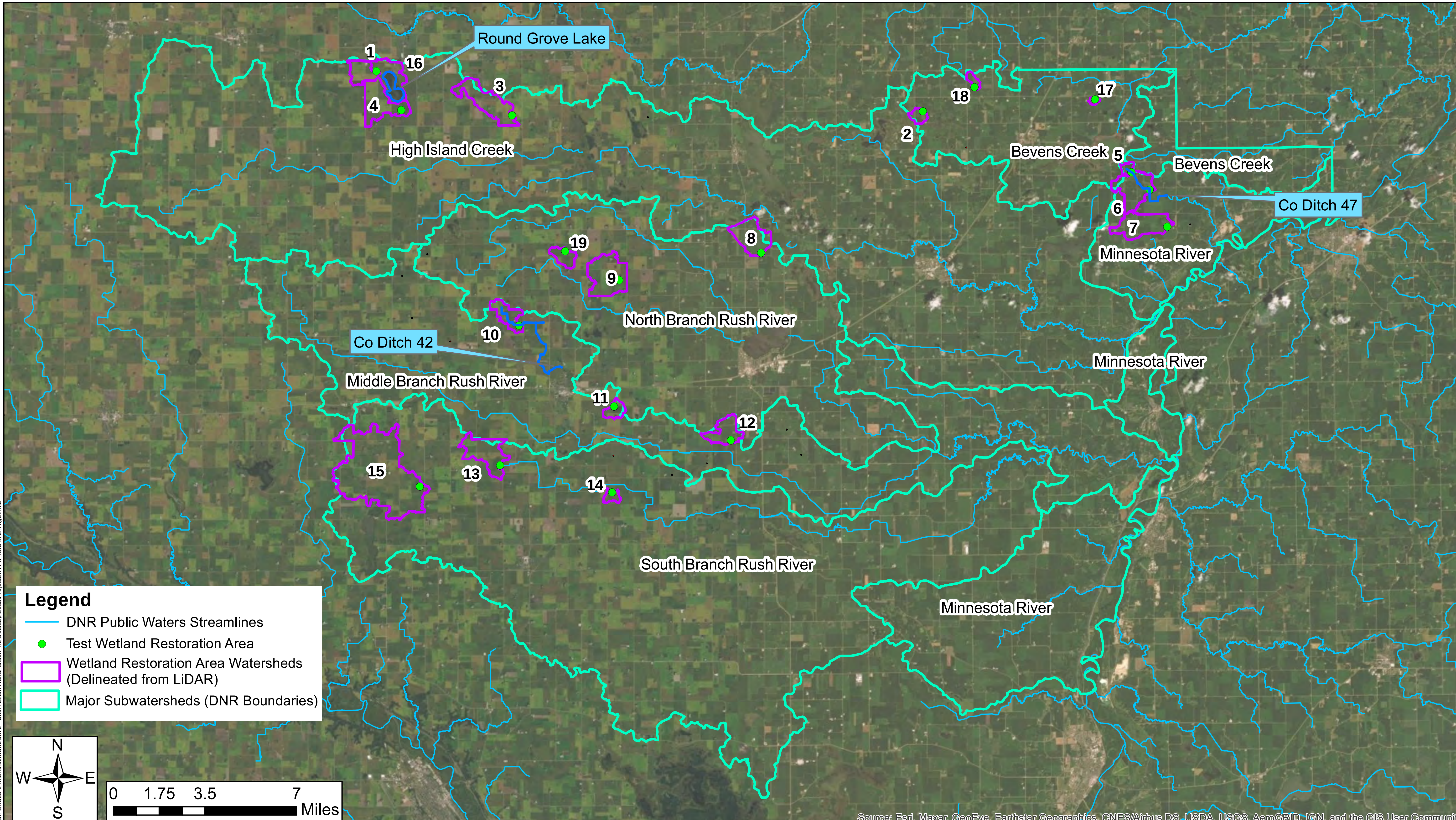
Storage Area/Wetland Restoration Analysis Results

Lower Minnesota River West Watershed Plan

May 2, 2022

	Coordinates (ft Sibley County) x	Coordinates (ft Sibley County) y	Local Watershed Number in Model	Planning Watershed Total Area Sq-Mi	Local Watershed Area Sq-Mi	Local Watershed Percent of Total Area (%)	Local watershed Peak Flow (cfs)	Existing: Max Volume Stored (ac-ft) at	Existing: Max Volume Stored (ft NAVD)	Existing: Storage Peak Outflow (cfs)	Proposed: Max Volume Stored (ac-ft) at	Proposed: Max Volume Stored (ft NAVD)	Proposed: Surface Area at Overflow Elevation ac	Proposed: Storage Peak Outflow (cfs)	Local Peak Flow Percent Reduction (%)	Total Watershed Peak Flow - Existing (cfs)	Total Watershed Peak Flow - Proposed (cfs)	Total Watershed Flowrate Reduction (%)
High Island Cr	532233	195666	1	241	0.76	0.32	327.6	54.1	1052	192.9	97.4	1053.0	44	123.9	35.8	5313.0	5239.4	1.4
	537266	187822	4 & 16 (Round Lake)		3.07	1.27	321.0	4.6	1039.2	320.1	402.3	1046.4	85	60.1	81.2			
	559617	186752	3		1.76	0.73	227.9	14.5	1033.2	214.2	347.2	1036.6	220	0.0	100.0			
South Br Rush	579785	110732	14	184	0.24	0.13	113.6	1.1	992.6	113.2	55.4	996.2	53	0.0	100.0	9891.3	9414.3	4.8
	557170	116154	13		1.70	0.92	381.2	35.3	1011.6	346.4	388.7	1014.9	304	0.0	100.0			
	540977	111951	15		8.07	4.39	1171.4	204.6	1013.1	1056.8	1133.7	1018.8	226	731.6	30.8			
Middle Br Rush	580191	128049	11	120	0.41	0.34	206.9	1.3	1008.3	205.2	93.7	1011.5	99	0.0	100.0	16569.6	16460	0.7
	561011	144415	10		0.79	0.66	359.2	2.4	1029.2	357.5	182.25	1033.5	156	0.0	100.0			
	603748	121208	12		0.95	0.79	472.3	5.1	982.7	465.3	187.4	986.9	83	57.1	87.7			
North Br Rush	570294	159365	19	99	0.50	0.51	342.7	1.3	1029.5	343.4	115	1033.3	130	0.0	100.0	3658.5	3613.4	1.2
	581204	153565	9		1.88	1.89	617.3	8.5	1015.3	606.4	289.2	1019.5	100	224.9	62.9			
	609841	159041	8		1.42	1.43	552.0	12.3	999.3	534.2	330.5	1004.5	150	0.0	100.0			
Bevens Cr	677289	189976	17	37	0.08	0.21	76.2	0.3	978.8	75.9	15.5	981.5	23	0.0	100.0	1578.5	1570.1	0.5
	652896	192408	18		0.20	0.54	122.2	10.4	995.0	93.1	20.5	996.0	9	62.9	32.4			
	642534	187553	2		0.30	0.81	109.6	5.2	1000.9	104.3	59.4	1002.7	86	0.0	100.0			
Mn River (North Area)	684591	175321	5	28	0.19	0.69	121.6	1.1	976.9	120.7	33.7	980.5	19	0.0	100.0	2569.1	2543.3	1.0
	688270	171740	6		1.52	5.43	590.3	27.2	974.6	519.8	201.6	977.3	78	112.8	78.3			
	691805	164262	7		1.58	5.63	553.7	72	968.5	375.9	275.3	971.4	143	0.0	100.0			

*Middle branch Rush River total includes north and south branch and is taken at bottom of Rush River and includes all 9 restoration areas within Rush River watershed



Path: C:\Users\rmondloch\OneDrive - Short Elliott Hendrickson Inc\Desktop\LocalProjects\1W1P\GIS\Working2.mxd

3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110
PHONE: (651) 490-2000
FAX: (888) 908-8166
TF: (800) 325-2055
www.sehinc.com

Project: BARRE 158029
Print Date: 5/10/2022

User Name: rmondloch
Projection: NAD 1983 HARN Adj MN Sibley Feet
Source:SEH, Barr Engineering, MnDNR, ESRI

Test Wetland Restoration Area Watersheds

One Watershed One Plan
Sibley County, MN

Figure 1

Appendix C

Summary of Stakeholder Engagement Activities

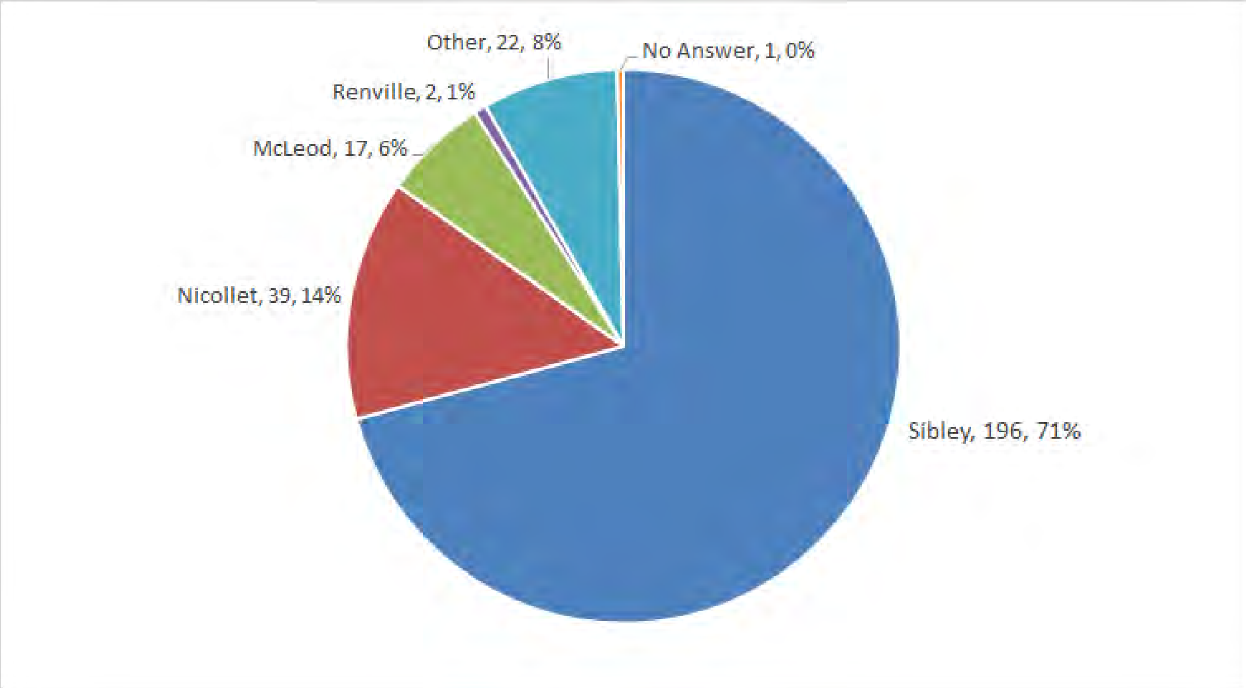
resourceful. naturally.
engineering and environmental consultants

Memorandum

To: Lower Minnesota River West – Comprehensive Watershed Management Partnership Steering Team
From: Greg Williams, PE, Barr Engineering Co.
Subject: Results of the Lower Minnesota River West Comprehensive Watershed Management Plan public engagement survey
Date: February 22, 2021
Project: 23721014
c:

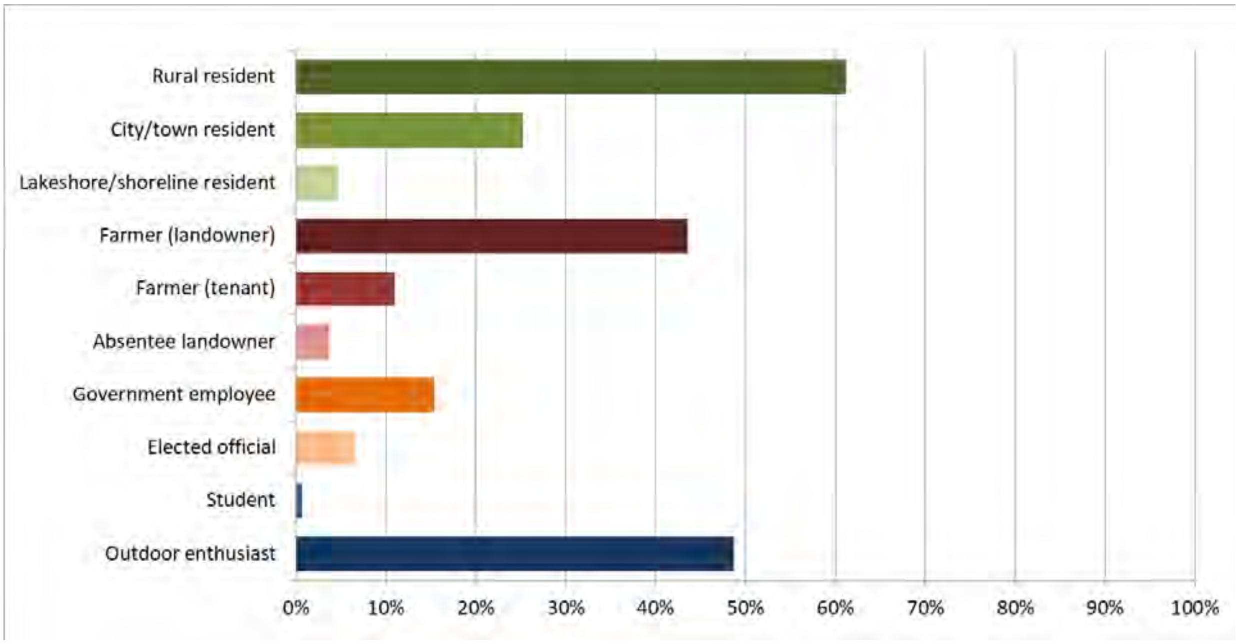
The Lower Minnesota River West Comprehensive Watershed Management Partnership (LMRWCRWMP) Steering Team developed and distributed a public engagement survey to understand the water and natural resource concerns of the people who live and work within the planning area. The survey included 10 questions. The survey was hosted online from mid-December, 2020 through February, 2021 and digitally advertised by the Partner organizations. Local lead staff also mailed the survey to approximately 2,500 residents. As of February 17, 2021, a total of 273 surveys (212 online, 61 mail) had been completed. This memorandum summarizes the results of the surveys submitted to date.

Question 1 – What is your County of residence?



Sibley, Nicollet, and McLeod counties are represented in proportion similar to their respective percentages of the overall planning area (70%, 18%, and 8% respectively). About 8% of survey respondents identified a county outside the planning area. Other counties identified by multiple respondents included Le Sueur (5 responses), Scott (4 responses), and Blue Earth (3 responses).

Question 2 – Please select all of the following items (e.g., occupation, location of residence) that apply to you.



Question 2 asked survey respondents to identify themselves with respect to occupation, location, and other factors. The majority of survey respondents (60%) are rural residents while about 25% identified as city/town residents. Over 40% of survey respondents are landowner farmers and 10% are tenant farmers. Several respondents identified as both landowner and tenant farmers. About 15% of respondents identified as government employees. Very few students (2) responded to the survey. Nearly half (47%) of respondents identified as being outdoor enthusiasts. Sixteen survey respondents listed additional unique "identifiers" (e.g., business owner, drainage contractor, beekeeper).

Question 3 – Do you identify with any special interest groups in the area (e.g., farm organizations, church groups, fish/wildlife groups)?

Question 3 asked survey respondents to identify special interest groups with which they are involved. Such groups may provide potential connections for engaging residents in future actions. Approximately 40% of respondents (108) belong to a special interest group. Special interest groups most commonly cited included:

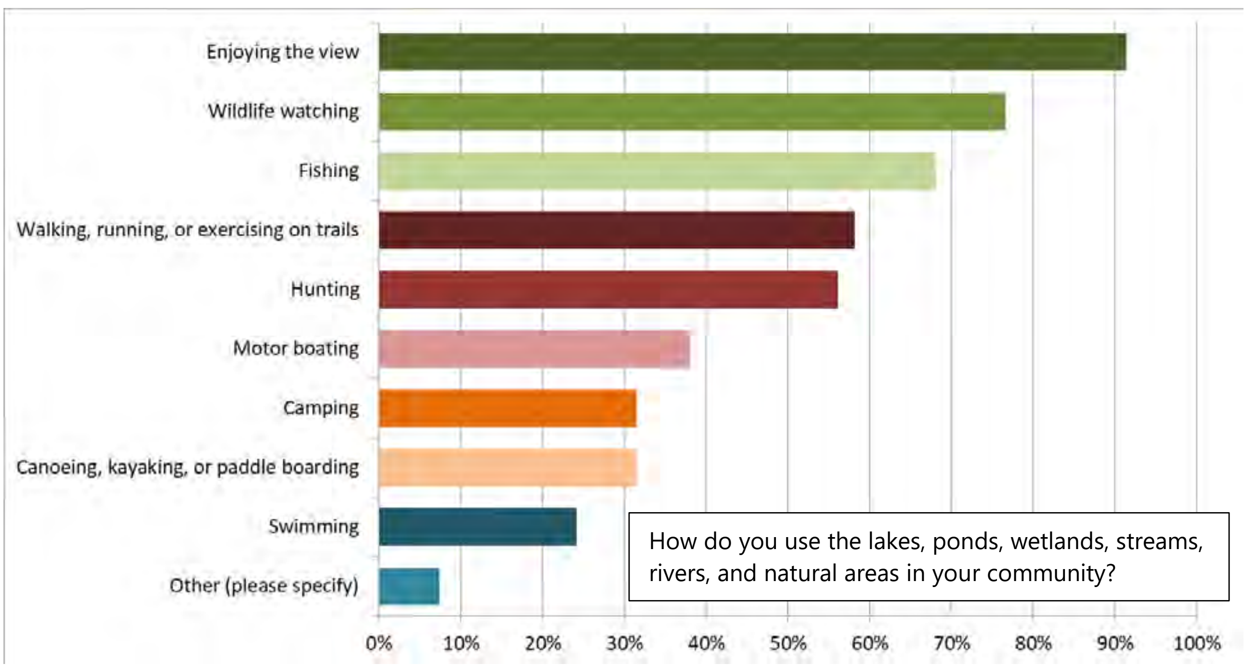
- Conservation/sporting groups (e.g., Ducks Unlimited, Friends of Rush River) – 51 respondents
- Church groups – 33 respondents
- Agricultural groups (e.g., Farm Bureau, Corn/Soybean Growers) – 20 respondents

Question 4 – How do you use the lakes, ponds, wetlands, streams, rivers, and natural areas in your community?

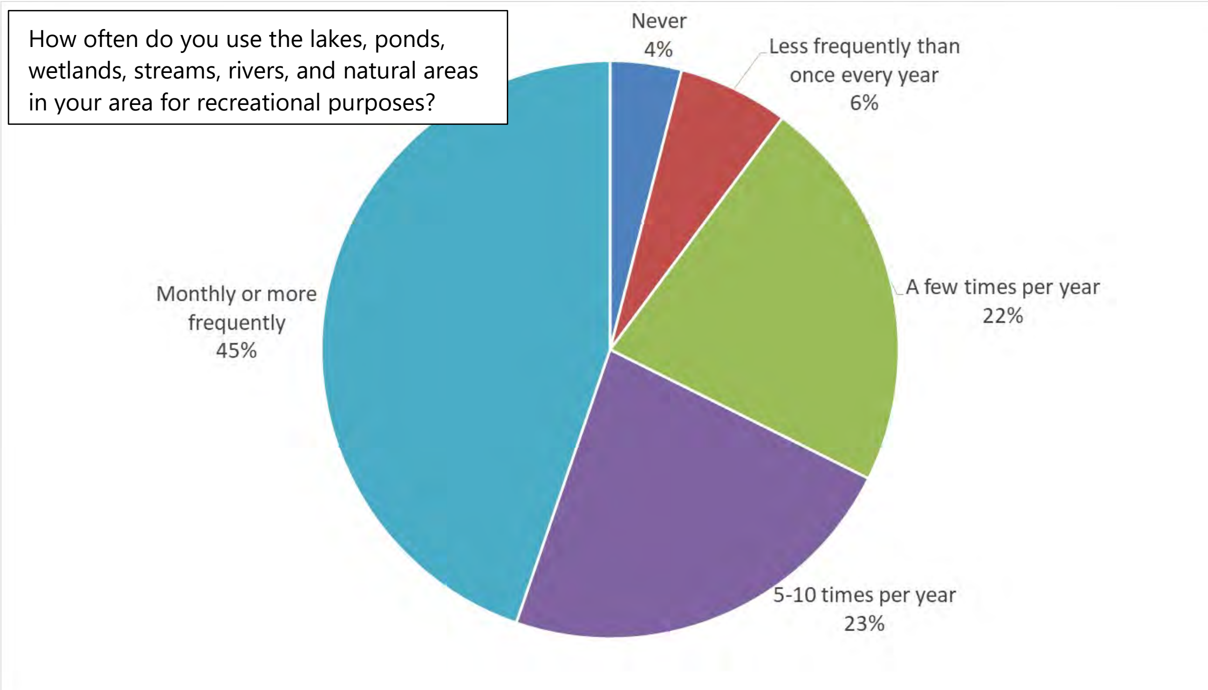
Question 5 – How often do you use the lakes, ponds, wetlands, streams, rivers, and natural areas in your area for recreational purposes?

Questions 4 and 5 are related to public use of the water and natural resources within the planning area. Responses to question 4 indicate that residents use the water resources and natural areas in the planning area for a range of activities. Enjoying the view (90% of respondents), wildlife watching (75% of respondents) and fishing (67% of respondents) were the most popular responses. Other uses identified by respondents included:

- Ice skating
- Horseback riding
- Trapping
- Pet recreation

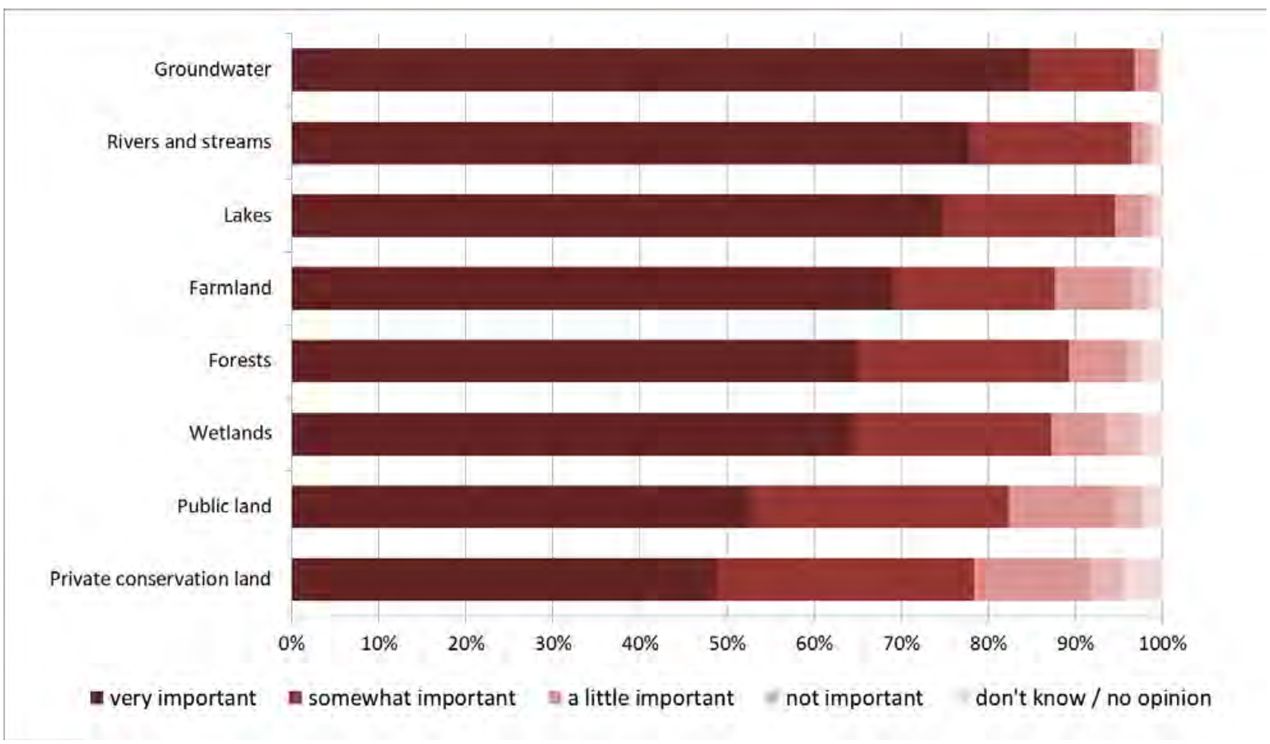


Responses to question 5 indicate frequent (monthly or more frequently) recreational use of resources in the planning area by nearly half of survey respondents. Few survey respondents (10%) indicated that they use the watershed's water and natural resources for recreation less than once per year or never.



Question 6 – How Important are each of the following natural resources in your area?

Question 6 asked respondents to select how important each of eight natural resources are from a list of five choices.



Survey responses suggest that most residents consider *all* of the identified resources to be at least "somewhat important." Many individual responses identified all of the resources as "very important," limiting the ability for relative differentiation. Few survey respondents selected the "don't know/no opinion" option (selected less than 10% of the time for any resource).

About 95% of survey respondents identified the following resources as very important or somewhat important:

- Groundwater
- Rivers and streams
- Lakes

Question 7 – Are there specific waterbodies or natural resources you are worried about?

Over half (153, or 54%) of the survey respondents answered "Yes" to the question asking if there were specific resources they are concerned about. Some responses were general (e.g., wetlands) while others identified specific waterbodies or areas (e.g., High Island Lake). Resources referenced most frequently in the responses to question 7 include:

- Minnesota River (41 responses)
- High Island Creek (16 responses)
- Rush River (17 responses)
- Wetlands (9 responses)
- High Island Lake (6 responses)
- Buffalo Creek (4 responses)
- Silver Lake (4 responses)
- Lake Titlow (3 responses)

A follow-up to question 7 asked survey respondents to identify their specific concerns. Responses were varied. The most frequently cited concerns included issues related to:

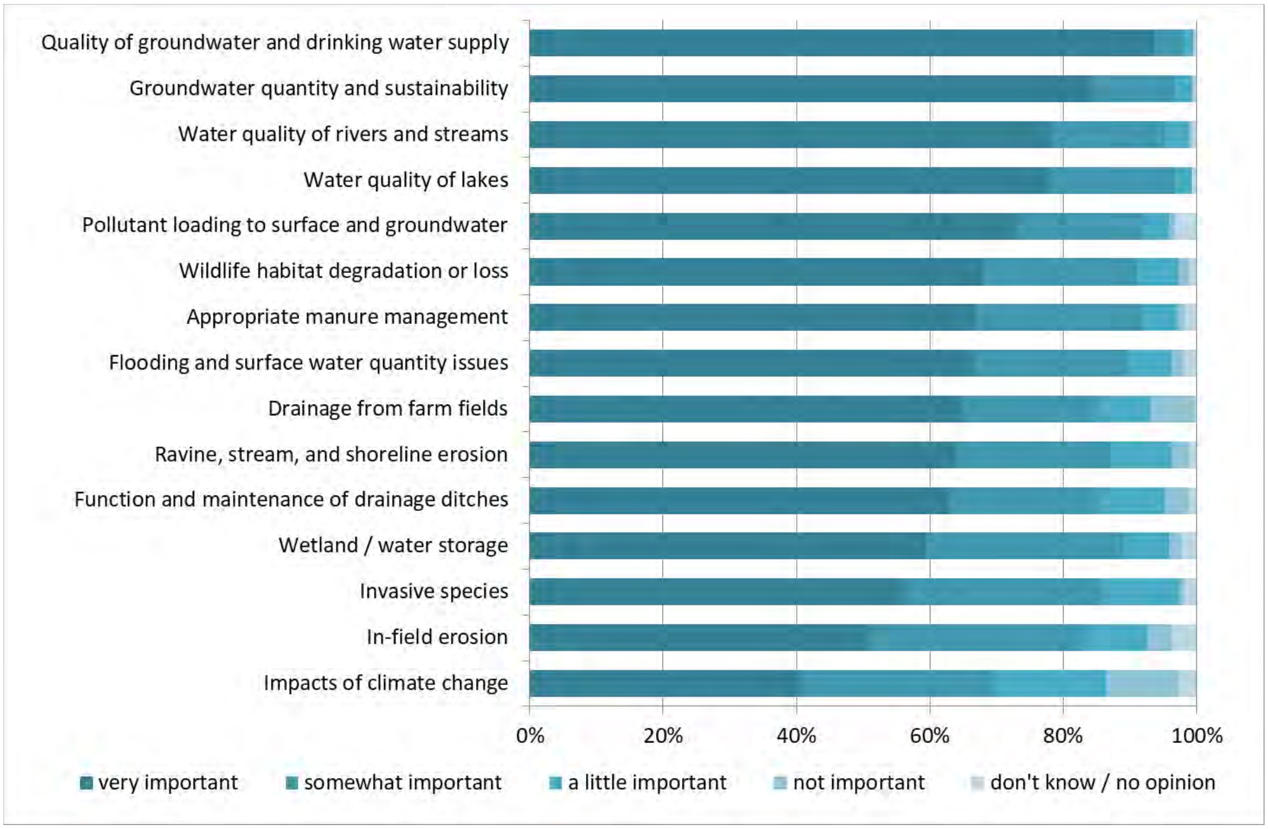
- Water quality degradation and/or pollutant loading (29 responses)
- Too much tiling (26 responses)
- Excessive erosion (23 responses)
- Flooding (23 responses)

Other issues cited less frequently included:

- Groundwater/drinking water quality
- Habitat loss and/or degradation
- Maintenance and repair of dams/ditches

Question 8 – How important are each of the following water- and natural resource-related issues to you?

Question 8 asked survey respondents to judge the importance of 15 specific water and natural resource issues:



All of the 15 issues listed in question 8 were considered very or somewhat important by at least 70% of survey respondents. Issues related to groundwater/drinking water quality and supply were considered the most important by survey respondents. Water quality of rivers and streams, water quality of lakes, and pollutant loading were also identified as highly important. This is noteworthy because groundwater quality within the planning area is very good, while many of the lakes and streams are impaired. Thus, surface water quality issues may warrant greater emphasis in the Plan, despite the perceived importance of groundwater issues. In additions, efforts to address surface water issues may focus on restoration, versus protection-focused efforts to address groundwater issues.

Excessive erosion was frequently cited as a specific concern in responses to question 7. Results of question 8 suggest that ravine, streambank, and shoreline erosion is generally perceived as a more significant issue than in-field erosion (note: this is consistent with sediment loading source data presented in the Lower Minnesota River Watershed Restoration and Protection Strategies (WRAPS) report (MPCA, 2020).

Impacts of climate change was the only issue identified as "very important" by less than 50% of survey respondents; this issue was the only issue considered "not important" by more than 10% of survey respondents.

Question 9 – Please share any additional comments you have regarding water and natural resource management in your area

Question 9 provided an opportunity for survey respondents to submit comments and/or suggestions in an open-ended response format. One hundred twelve respondents (41%) responded to question 9. Responses included more detailed discussion of specific issues as well as suggestions for implementation actions and strategies to address problems.

Some common themes included:

- Regulating, limiting, or otherwise dis-incentivizing tiling within the watershed
- Maintenance of degraded dams and ditches
- Balancing protection and restoration with management and utilization (e.g., "Don't hug the tree so tight as to kill the tree")
- Need for more storage and slower conveyance of water from upstream areas in the watershed
- Protection of remaining natural areas and high quality resources
- Increases in flood frequency and severity observed in recent history

Question 10 – Please indicate your interest in being contacted regarding BMP implementation opportunities and future Plan development meetings

Question 9 asked respondents to provide their contact information if they would like to be contacted regarding best management practice (BMP) implementation opportunities and future meetings related to the development of the Comprehensive Watershed Management Plan (Plan). Sixty-eight (25%) of respondents said they would be interested in BMP implementation opportunities. Seventy-eight (29%) of respondents said they would like to be contacted regarding future meetings. Fifty-one (19%) of survey respondents were interested in both.

Conclusions

The responses to the survey indicate strong public interest in the quality and management of water and natural resources in the planning area. Survey respondents are generally representative of the planning area and represent opinions of farmers and non-farmers, as well as rural and town/city residents. Open-ended responses indicate that many residents are well-informed about issues in the watershed as well as the factors driving these issues. The survey also indicates that there is interest in continued participation in the Plan process, either as part of Plan development or practice implementation.

The results of the survey, including open-ended comments, will be used as input in the issue and resource prioritization decisions of the Policy Committee.

Appendix D

Joint Powers Agreement (JPA)

LOWER MINNESOTA RIVER WEST COMPREHENSIVE WATERSHED MANAGEMENT PLAN JOINT POWERS AGREEMENT

This Joint Powers Agreement (Agreement) is made and entered into by and between the following parties (sometimes referred to as members):
The Counties of McLeod, Nicollet, and Sibley by and through their respective County Board of Commissioners, and
The McLeod, Nicollet, and Sibley Soil and Water Conservation Districts, by and through their respective Soil and Water Conservation District Board of Supervisors, and
The High Island Creek Watershed District, by and through their respective Board of Managers.

WHEREAS, the Counties of this Agreement are political subdivisions of the State of Minnesota, with authority to carry out environmental programs and land use controls, pursuant to Minnesota Statutes Chapter 375 and as otherwise provided by law; and

WHEREAS, the Soil and Water Conservation Districts (SWCDs) of this Agreement are political subdivisions of the State of Minnesota, with statutory authority to provide technical assistance to landowners and carry out erosion control and other soil and water conservation programs, pursuant to Minnesota Statutes Chapter 103C and as otherwise provided by law; and

WHEREAS, the Watershed District of this Agreement is a political subdivision of the State of Minnesota, with statutory authority to carry out conservation of the natural resources of the state by land use controls, flood control, and other conservation projects for the protection of the public health and welfare and the provident use of the natural resources, pursuant to Minnesota Statutes Chapters 103B, 103D and as otherwise provided by law; and

WHEREAS, the parties to this Agreement have a common interest and/or statutory authority to implement the Lower Minnesota River West Comprehensive Watershed Management Plan to conserve soil and water resources through the implementation of practices, programs, and regulatory controls that effectively control or prevent erosion, sedimentation, siltation and related pollution in order to preserve natural resources, ensure continued soil health and productivity, protect water quality, reduce flood risk and associated damages, preserve wildlife, protect the tax base, and protect public lands and waters; and

WHEREAS, with matters that relate to coordination of water management authorities pursuant to Minnesota Statutes Chapters 103B, 103C, and 103D with public drainage systems pursuant to Minnesota Statutes Chapter 103E, this Agreement does not change the rights or obligations of the public drainage system authorities.

WHEREAS, pursuant to Minn. Stat. Section 103B.101 Subd. 14, the Minnesota Board of Water and Soil Resources (BWSR) "may adopt resolutions, policies, or orders that allow a comprehensive plan, local water management plan, or watershed management plan, developed or amended, approved and adopted, according to chapter 103B, 103C, or 103D, to serve as substitutes for one another or be replaced with a comprehensive watershed management plan."

WHEREAS, it is understood by all the parties to this Agreement that the Lower Minnesota River West Comprehensive Watershed Management Plan does not replace or supplant local land use, planning, or zoning authority, but, instead, provides a framework to provide increased opportunities for cooperation and consistency on a watershed basis, and to allow local governments to cooperatively work together to implement projects with the highest return on investment for improving water quality/quantity issues on a watershed basis.

WHEREAS, the Parties have formed this Agreement for the specific goal of implementing the Lower Minnesota River West Comprehensive Watershed Management Plan pursuant to Minnesota Statutes § 103B.801.

NOW, THEREFORE, the Parties hereto agree as follows:

1. **Purpose of the Agreement:** The Parties to this Agreement recognize the importance of partnerships to implement protection and restoration efforts for the Lower Minnesota River West Watershed Planning area *(see Attachment A with a map of the planning area)* on a cooperative and collaborative basis together under this Agreement pursuant of the authority contained in Minn. Stat. Section 471.59. The purpose of this Agreement is to collectively implement, as local government units, the Lower Minnesota River West Comprehensive Watershed Management Plan while providing assurances that decision-making spanning political boundaries is supported by an in-writing commitment from participants.

This Agreement does not establish a Joint Powers Entity but sets the terms and provisions by which the parties "may jointly or cooperatively exercise any power common to the contracting parties or any similar powers, including those which are the same except for the territorial limits within which they may be exercised." Minnesota Statutes § 471.59. This Agreement does not include a financial obligation, but rather an ability to share resources.

Parties signing this agreement will be collectively referred to as the Lower Minnesota River West Watershed Partnership (Partnership).

2. **Term:** This Agreement is effective upon signature of all Parties, in consideration of the Minnesota Board of Water and Soil Resources (BWSR) operating procedures; and will remain in effect until canceled according to the provisions of this Agreement or earlier terminated by law.

3. **Adding Additional Parties:** A qualifying party within the Lower Minnesota River West Watershed Planning area desiring to become a member of this Agreement shall indicate its intent by adoption of a governing board resolution that includes a request to the Policy Advisory Committee to

join the Lower Minnesota River West Watershed Partnership. The party agrees to abide by the terms and conditions of the Agreement; including but not limited to the bylaws, policies and procedures adopted by the Policy Advisory Committee.

4. **Withdrawal of Parties:** A party desiring to leave the membership of this Agreement shall indicate its intent, in writing, to the Policy Advisory Committee in the form of an official board resolution adopted by its governing body. Notice must be made at least 60 days in advance of leaving the Agreement. Any party that leaves the membership of the Agreement remains obligated to comply with the terms of any grants the Lower Minnesota River West Watershed Partnership has at the time of the party's notice to leave membership, and is obligated until the grant has expired or has been closed out.

5. **General Provisions**:

a. **Compliance with Laws/Standards:** The Parties agree to abide by all federal, state, and local laws; statutes, ordinances, rules, and regulations now in effect, or hereafter adopted, pertaining to this Agreement, or to the facilities, programs, and staff for which the Agreement is responsible.

b. **Indemnification:** Each party to this Agreement shall be liable for the acts of its officers, employees or agents and the results thereof to the extent authorized or limited by law and shall not be responsible for the acts of any other party, its officers, employees or agents. The provisions of the Municipal Tort Claims Act, Minnesota Statutes Chapter 466 and other applicable laws govern liability of the Parties. To the full extent permitted by law, actions by the Parties, their respective officers, employees, and agents pursuant to this Agreement are intended to be and shall be construed as a "cooperative activity." It is the intent of the Parties that they shall be deemed a "single governmental unit" for the purpose of liability, as set forth in Minnesota Statutes § 471.59, subd. 1a(a), and this is not intended to create any liability or exposure of one party for the acts or omissions of any other party.

c. **Employee Status:** The parties agree that respective employees or agents of each party shall remain the employees or agents of each individual respective party and shall not be considered employees of any other part or of the collaborative, and shall not be entitled to any compensation, rights or benefits of any kind from any other party or from the collaborative.

d. **Records Retention and Data Practices:** The parties agree that each respective party will be responsible for complying with the Minnesota Government Data Practices Act (Minnesota Statutes Chapter 13), and the Official Records Act (Minnesota Statutes Section 15.17) for the data collected, created, received, maintained, disseminated or stored by each respective part pursuant to the terms of this Agreement.

e. **Timeliness:** The Parties agree to perform obligations under this Agreement in a timely manner and keep each other informed about any delays that may occur.

f. **Termination:** This Agreement will remain in full force and effect until canceled by all parties, unless otherwise terminated in accordance with other provisions of this Agreement. The parties acknowledge their respective and applicable obligations, if any, under Minn. Stat. Section 471.59, Subd. 5 after the purpose of the Agreement has been Terminated.

g. **Amendment:** Policy Advisory Committee may modify this Agreement upon approval by a majority vote of all of the Parties to the Agreement. Any amendment to this Agreement shall be in writing, adopted by each Party in the same manner as the original Agreement.

6. Administration:

a. **Establishment of Committees for Implementation of the Lower Minnesota River West Comprehensive Watershed Management Plan:** Committees will be established to carry out the coordinated implementation of the Lower Minnesota River West Comprehensive Watershed Management Plan. The parties agree to establish, under this Agreement, a Policy Advisory Committee, a Technical Advisory Committee, and a Local Implementation Work Group.

i. **The Policy Advisory Committee:** The parties agree to establish a Policy Advisory Committee for the purpose of implementing the Lower Minnesota River West Comprehensive Watershed Management Plan. The Policy Advisory Committee will operate cooperatively and collaboratively, but not as a separate entity. Each governing entity agrees to appoint one representative, who must be an elected or appointed member of each governing entity to the Policy Advisory Committee. Each governing entity may choose to appoint one alternate to serve on the Policy Advisory Committee in the absence of the appointed member. Policy Advisory Committee members agree to keep their respective governing entities regularly informed on the implementation of the Lower Minnesota River West Comprehensive Watershed Management Plan. Each representative shall have one vote, subject to the authority delegated by their respective governing entity. The Policy Advisory Committee will establish bylaws to describe the functions and operations of all committee(s). Once established, the Policy Advisory Committee will follow the bylaws adopted, and have the power to modify the bylaws. The Policy Advisory Committee will meet as needed, but no less than bi-annually, to advise implementation of the Lower Minnesota River West Watershed Management workplan. Each member of the Policy Advisory Committee, subject to the authority delegated by their respective governing body, shall have the authority to act on behalf of the party they represent in all matters relevant to the implementation of the Lower Minnesota River West Comprehensive Watershed Management Plan, including but not limited to, the recommendation to approve grant applications, grant agreements, interim reports, payment of invoices, and entering into professional contracts. The Policy Advisory Committee shall also approve an annual work plan and annual budget consisting of an itemized statement of the Lower Minnesota River West Comprehensive Watershed Management Plan, revenues and expenses for the ensuing calendar years, and shall be presented to the respective governing entities that are represented on the Policy Advisory Committee.

ii. **The Local Implementation Work Group:** The parties agree to establish a Local Implementation Work Group, which shall consist of, but not limited to, local staff, including local county water planners, local watershed district staff, and local SWCD staff, for the purposes of logistical, and day-to-day decision-making in the implementation of the Lower Minnesota River West Comprehensive Watershed Management Plan. The Local Implementation Work Group shall prepare a draft annual work plan and budget consisting of an itemized statement of the Lower Minnesota River West Comprehensive Watershed Management Plan revenues and expenses for the ensuing calendar year which shall be presented to the Policy Advisory Committee for review. The Local Implementation Work Group will meet as needed.

iii. **The Technical Advisory Committee:** The Policy Advisory Committee may appoint technical representatives to a Technical Advisory Committee to provide support and make recommendations on implementation of the Lower Minnesota River West Comprehensive Watershed Management Plan. The Technical Advisory Committee may consist of the Local Implementation Work Group, contacts for the state's main water agencies (Board of Water and Soil Resources, Minnesota Department of Agriculture, Minnesota Department of Health, Minnesota Department of Natural Resources, Minnesota Pollution Control Agency, and Environmental Quality Board), and/or plan review agencies, and area stakeholders. The Technical Advisory Committee will meet, as needed.

7. **Implementation of the Plan.** The Parties agree to adopt and begin implementation of the Lower Minnesota River West Comprehensive Watershed Management Plan within 120 days of state approval, and provide notice of plan adoption pursuant to Minnesota Statutes Chapters 103B and 103D.

8. **Fiscal Agent:** The Policy Advisory Committee shall appoint one of the parties to the Agreement to be the Fiscal Agent for each source of funding received. The appointed Fiscal Agent agrees to:

a. Accept all responsibilities associated with any grant agreements executed by the party for the implementation of the Lower Minnesota River West Comprehensive Watershed Management Plan.

b. Perform financial transactions as part of any executed grant agreements, and contract implementation.

c. Provide for strict accountability of all funds, report all receipts and disbursements, and annually provide a full and complete audit report of the grant.

d. Provide the Policy Advisory Committee with the records necessary to describe the financial condition of the grant agreement.

e. Include the grant information on the Fiscal Agent's website.

f. Retain fiscal records consistent with the Fiscal Agent's records retention schedule (See 5. d.).

9**.** **Plan Administration**: The Policy Advisory Committee shall appoint, annually, one of the parties to the Agreement to be the Day-to-Day Contact, being the point of contact for, and handling of the day-to-day administrative work of the Lower Minnesota River West Comprehensive Watershed Management Plan. The appointed day-to-day contact agrees to:

a. Accept all day-to-day responsibilities associated with the implementation of grants received for implementing the Lower Minnesota River West Comprehensive Watershed Management Plan, including being the primary contact for any grant agreements, and any reporting requirements associated with any grant agreements not otherwise stated.

b. Provide the Policy Advisory Committee with the records necessary to describe the implementation of the Lower Minnesota River West Comprehensive Watershed Management Plan.

c. Provide for proper public notice of all meetings.

d. Ensure that minutes of all Policy Advisory Committee meetings are recorded and made available in a timely manner to the Policy Advisory Committee and maintain a file of all approved minutes including corrections and changes.

e. Retain records consistent with the fiscal agent's records retention schedule until termination of the agreement (at that time, records will be turned over to the Fiscal Agent) (See 5. c.).

f. Perform any other duties to keep the Policy Advisory Committee, the Technical Advisory Committee, and the Local Implementation Work Group informed about the implementation of the Lower Minnesota River West Comprehensive Watershed Management Plan.

10. **Authorized Representatives:** The following persons will be the primary contacts for all matters concerning this Agreement:

McLeod County
Marc Telecky or successor
Director of Environmental Services
1065 5th Avenue SE
Hutchinson, MN 55350
Telephone: 320.484.4342

McLeod County Soil and Water Conservation District
Ryan Freitag or successor
District Manager
520 Chandler Avenue North
Glencoe, MN 55336
Telephone: 320.864.1214

Nicollet County
Ben Rosburg or successor
Environmental Specialist
501 S. Minnesota Avenue
St. Peter, MN 56082
Telephone: 507.934.7072

Nicollet Soil and Water Conservation District
Kevin Ostermann or successor
District Manager
501 7th Street, P.O. Box 457
Nicollet, MN 56074
Telephone: 507.232.2550

<u>Sibley County</u>
Marilee Peterson or successor
County Auditor – Treasurer
400 Court Avenue, P.O. Box 51
Gaylord, MN 55334
Telephone: 507.237.4070

<u>Sibley Soil and Water Conservation District</u>
Joel Wurscher or successor
District Manager
112 5th Street, P.O. Box 161
Gaylord, MN 55334
Telephone: 507.702.7077

<u>High Island Creek Watershed District</u>
Kevin Miller or successor
Board President
18376 30th Street
Brownton, MN 55312
Telephone: 320.510.1039

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

Partner: **McLeod County**

Approved:

By: ____

Board Chair   Date

By: ____

County Administrator   Date

Approved as to form:

By: ____

County Attorney   Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

Partner: **McLeod County Soil and Water Conservation District**

Approved:

By: ____

Board Chair Date

By: ____

District Manager Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

Partner: **Nicollet County**

Approved:

By: ____

Board Chair Date

By: ____

County Administrator Date

Approved as to form:

By: ____

County Attorney Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

Partner: **Nicollet Soil and Water Conservation District**

Approved:

By: ____

Board Chair   Date

By: ____

District Manager   Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

Partner: **Sibley County**

Approved:

By: ____

Board Chair Date

By: ____

County Administrator Date

Approved as to form:

By: ____

County Attorney Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

Partner: **Sibley Soil and Water Conservation District**

Approved:

By: ____

Board Chair Date

By: ____

District Manager Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

Partner: **High Island Creek Watershed District**

Approved:

By: ____

Board President Date

Attest: ____

Board Secretary Date

Approved as to form:

By: ____

Dean Zimmerli, Attorney for District

Attachment A – figure of planning area