Comprehensive Watershed Management Plan: 2022–2031

Prepared for the
Watershed Alliance for the Greater Zumbro

Prepared through the
One Watershed, One Plan Program

November 2021

CLEAN WATER LAND & LEGACY AMENDMENT

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November 2021

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Comprehensive Watershed Management Plan

November 2021

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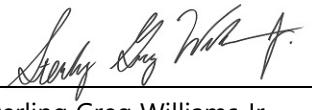
Certifications

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
PE #: 47642

November 24, 2021
Date

Abbreviations

1W1P	One Watershed, One Plan
ACEP	Agricultural Conservation Easement Program
AFO	Animal Feedlot Operations
AHPS	Advanced Hydrologic Prediction Service
AUAR	Alternative Urban Area-wide Reviews
BMPs	Best Management Practices
BVWD	Bear Valley Watershed District
BWSR	Board of Water and Soil Resources
CGM	Cooperative groundwater monitoring
CIG	Conservation Innovation Grants
CIP	Capital Improvement Plan
CRP	Conservation Reserve Program
CTA	Conservation Technical Assistance Program
CWA	Clean Water Act
CWMP	Comprehensive Water Management Plan (Plan)
DEOZ	Decorah Edge Overlay Zone
DWSMA	Drinking water supply management area
E. coli	*Escherichia coli*
EDA	Environmental Data Access
EIS	Environmental Impact Statement
EQB	Environmental Quality Board
EQIP	Environmental Quality Incentives Program (EQIP)
FIBI	Fish Index of Biological Integrity
FISRWG	Federal Interagency Stream Restoration Working Group
FSA	Farm Service Agency
FWS	Fish and Wildlife Service
GRAPS	Groundwater Restoration and Protection Strategies
HFRP	Healthy Forests Reserve Program
HSPF	Hydrological Simulation Program-FORTRAN
JPA	Joint Powers Agreement
LA	Load Allocation
LGU	Local Governmental Unit
LIWG	Local Implementation Work Group
LSP	Land stewardship plan
MAWQCP	Minnesota Agricultural Water Quality Certification Program
MBS	Minnesota Biological Survey
MDA	Minnesota Department of Agriculture
MDH	Minnesota Department of Health
MDNR	Minnesota Department of Natural Resources

MFRC	Minnesota Forest Resources Council
MGS	Minnesota Geological Survey
MHA	Minnesota Hydrogeology Atlas
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
MPFA	Minnesota Public Facilities Authority
MRLP	Mississippi River-Lake Pepin
MS4	Municipal Separate Storm Sewer System
MSL	Mean Sea Level
NED	National Elevation Dataset
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
PCBs	Polychlorinated biphenyls
Plan	Comprehensive Water Management Plan
PWI	Public Waters Inventory
PWPS	Private well pesticide sample
RCPP	Regional Conservation Partnership Program
SAM	Scenario Application Manager
SDS	State Discharge System
SHPO	State Historic Preservation Office
SSTS	Subsurface sewage treatment systems
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
TTP	township testing program
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
WASCBs	Water and Sediment Control Basin
WAGZ	Watershed Alliance for the Greater Zumbro
WBIF	Watershed-based implementation funding
WCA	Wetland Conservation Act
WHPP	Wellhead Protection Program
WLA	Wasteload Allocation
WRAPS	Watershed Restoration Protection Strategies
ZRW	Zumbro River Watershed

Acknowledgements for the Watershed Alliance for the Greater Zumbro Comprehensive Watershed Management Plan

Approved by the Minnesota Board of Water and Soil Resources (BWSR) October 27, 2021.

Approved by the Watershed Alliance for the Greater Zumbro Policy Committee on November 4, 2021.

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

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…and all members of the Planning Work Group

The Policy Committee would also like to thank all members of the stakeholder advisory committee and members of the public who contributed to this Plan by completing the survey, attending the public kickoff or waterside chats, or otherwise providing input during Plan development.

1 Executive Summary

The Watershed Alliance for the Greater Zumbro (WAGZ) Partnership (Partnership) is a group of Counties, Soil and Water Conservation Districts (SWCDs), Bear Valley Watershed District, and the City of Rochester (Partners) located in southeastern Minnesota. The Partnership covers an area including the Zumbro River watershed and a portion of the Mississippi River-Lake Pepin watershed herein referred to as the "Greater Zumbro 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.101. 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.

1.1 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 2.5). The Plan was developed through the efforts of:

- Planning Work Group – comprised of technical staff of the Partners organizations
- Advisory Committee – 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 A). The JPA recognizes the importance of partnerships to implement protection and restoration efforts for the Greater Zumbro planning area on a cooperative and collaborative basis pursuant to the authority contained in Minnesota Statutes Section 471.59.

1.2 Planning Boundary and Subwatersheds

The "Greater Zumbro" planning area includes the Zumbro River 8-digit HUC watershed (07040004) and a portion of the Mississippi River-Lake Pepin 8-digit HUC watershed (07040001). Approximately 86% of the planning area (1,421 square miles) drains to the Zumbro River, while the remaining 14% (233 square miles) is tributary to the Mississippi River-Lake Pepin. The planning area has been subdivided into eight subwatersheds as approximately the 10-digit HUC level for planning purposes.

Six counties are located within the planning area (see inset figure). The area includes agricultural land, pasture land, and natural forest. Growing urban areas are centered around the City of Rochester, as well as the Cities of Red Wing and Lake City. the terrain of the planning area is gently rolling in the western and central portions, transitioning to hills, bluffs, and ravines in the north and east where karst geology is more prevalent. A major hydrologic feature in the planning area is the Zumbro River, which collects inflow from four major forks and numerous smaller tributaries as it flows from west to east to the Mississippi River. In the Mississippi River-Lake Pepin watershed, the land general drains from south to north via several smaller streams.

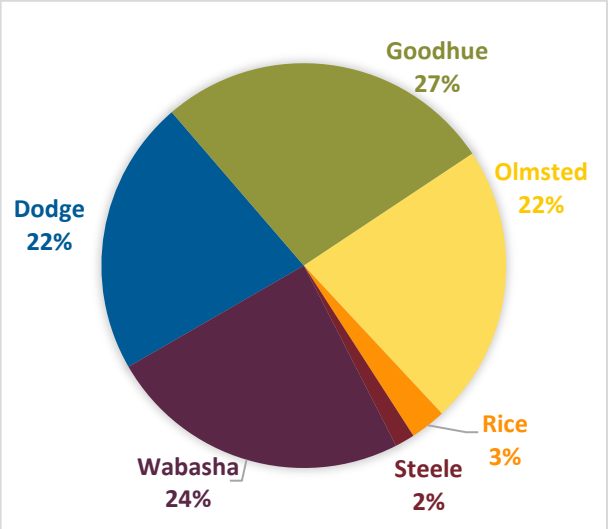


Table 1-1 Summary of Land Use/Land Cover within the Planning Area

Land Cover	Zumbro River Watershed	Mississippi River Lake Pepin Watershed
Barren Land	0.1%	0.1%
Cultivated Crops	56.2%	33.2%
Deciduous Forest	9.6%	25.4%
Developed, High Intensity	0.3%	0.2%
Developed, Low Intensity	2.5%	2.1%
Developed, Medium Intensity	0.9%	0.6%
Developed, Open Space	5.3%	4.5%
Emergent Herbaceous Wetlands	0.3%	0.2%
Evergreen Forest	0.1%	0.2%
Hay/Pasture	11.6%	12.7%
Herbaceous (grassland)	11.5%	10.9%
Mixed Forest	0.0%	0.0%
Open Water	0.5%	8.9%[1]
Shrub/Scrub	0.0%	0.1%
Woody Wetlands	1.1%	0.8%

Source: Minnesota Land Cover Classification Dataset (MLCCD)

(1) Includes a portion of the Lake Pepin water surface within Minnesota

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

1.3 Issue and Resource Prioritization

Section 3 of the Plan summarizes the issue identification and prioritization process used by the Partners and documents the resulting issue priorities. Section 3 also details the delineation of priority areas for focusing implementation activities related to surface water quality and groundwater quality issues. The Partnership implemented an iterative process to identify and prioritize watershed issues with consideration of existing data and input from the Technical Advisory Group and other stakeholders.

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

The Partners used existing geospatial data, modeling results, and watershed assessments to identify areas that are a higher priority for the implementation of surface water quality and groundwater quality protection and restoration efforts. Priority implementation areas for surface water quality and groundwater quality are presented in Figure 3-6, Figure 3-7, and Figure 3-8.

1.4 Targeting of Projects and Practices

The Partners used digital terrain analysis to identify likely locations to implement best management practices (BMPs) to address accelerated erosion and sedimentation and surface water quality degradation issues. Potential BMPs include vegetated buffers, water and sediment control basins, cover crops, and others. Potential project locations were identified throughout the planning area, regardless of

subwatershed priority level including over 200 sites in the Zumbro River watershed and approximately 80 sites in the Mississippi River-Lake Pepin watershed (see Figure 4-1). The Partners used existing HSPF-SAM models to estimate pollutant reductions anticipated from implementing projects at these locations (see Section 4.2).

Groundwater priority areas presented in Figure 3-7 and Figure 3-8, are used to target projects, studies, and education efforts to achieve groundwater goals, as well as evaluate multi-benefit practices. Some activities are targeted to more specific geographics applicable to the specific need or outcome (e.g., educational materials targeting DWSMAs, stormwater reuse targeted in urban areas).

1.5 Measurable Goals

Section 5 describes the development of measurable goals. The Partners considered a range of available information, including:

- Goals from existing management plans, studies, reports, data, and information, including:
    - County Water Management Plans
    - Mississippi River-Lake Pepin WRAPS report
    - Mississippi River-Lake Pepin TMDL report
    - Rochester Comprehensive Plan and Surface Water Management Plan
    - Zumbro River WRAPS report
    - Zumbro River TMDL report
    - Zumbro River Watershed Landscape Stewardship Plan
    - Zumbro River GRAPS report
- Results from previous modeling/analysis efforts:
    - Zumbro River priority project identification
    - Mississippi River-Lake Pepin Scenarios Report
- Existing implementation programs and schedules
- Input received during Waterside Chats (see Section 2.5 and Appendix B)
- Input from the Planning Work Group
- Input from Technical Advisory Group members
- Input from Policy Committee members

Generally, goals were developed first at a qualitative level and refined to include quantifiable elements where supported by data availability. 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 nine priority issues.

Goals are established both for long-term (i.e., desired future condition) and for short-term (i.e., 10-year, or Plan goals). Long-term goals consider state and regional planning efforts (e.g., WRAPS and TMDL goals, Minnesota Nutrient Reduction Strategy). Plan goals represent achievable steps towards long-term goals

vetted by the Planning Work Group, Advisory Group. Specific pollutant reduction goals were estimated using HSPF-SAM.

A complete list of measurable goals developed by the Partners are presented in Table 5-2 and Table 5-3.

1.6 Implementation

The Plan includes a targeted and measurable implementation schedule that outlines the projects, programs, and strategies the Partners will implement over the next 10 years (see Section 6 and Table 6-4). The implementation schedule was established by the Partners with input from the Advisory Group (which represents many of the entities identified as cooperators in Table 6-4).

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

The Plan implementation schedule is presented in Table 6-4. 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 6-4 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 in HSPF-SAM documentation, Partner estimates of local capacity, consideration of future WBIF. The current implementation schedule (Table 6-4) was derived from iteration with the Partners and will be revised, as needed, during Plan implementation.

1.6.1 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 1-2 and Figure 1-1.

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 watershed-based implementation funding (WBIF), other State funds, Federal funding, and/or private funding sources will be necessary to accomplish Plan goals.

Table 1-2 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	$452,500 $452,500	-- --	$402,500 $402,500	-- --	$855,000 $855,000
Project and Project Support	$6,235,000 $7,111,000	$750,000 $900,000	$5,600,000 $5,600,000	$3,835,000 $8,592,000	$16,420,000 $22,203,000
Studies and Monitoring	$910,000 $910,000	-- --	-- --	$260,000 $310,000	$1,170,000 $1,220,000
Education and Outreach	$375,000 $375,000	--	$110,000 $110,000	$150,000 $225,000	$635,000 $710,000
Regulatory Review/ Oversight	$59,000 $59,000	--	--	--	$59,000 $59,000
Total (base funding) **Total (additional funding)**	$8,031,500 $8,907,500	$750,000 $900,000	$6,112,500 $6,112,500	$4,245,000 $9,127,000	$19,139,000 $25,047,000

Notes: black text indicates base funding scenario; red text indicates additional funding scenario

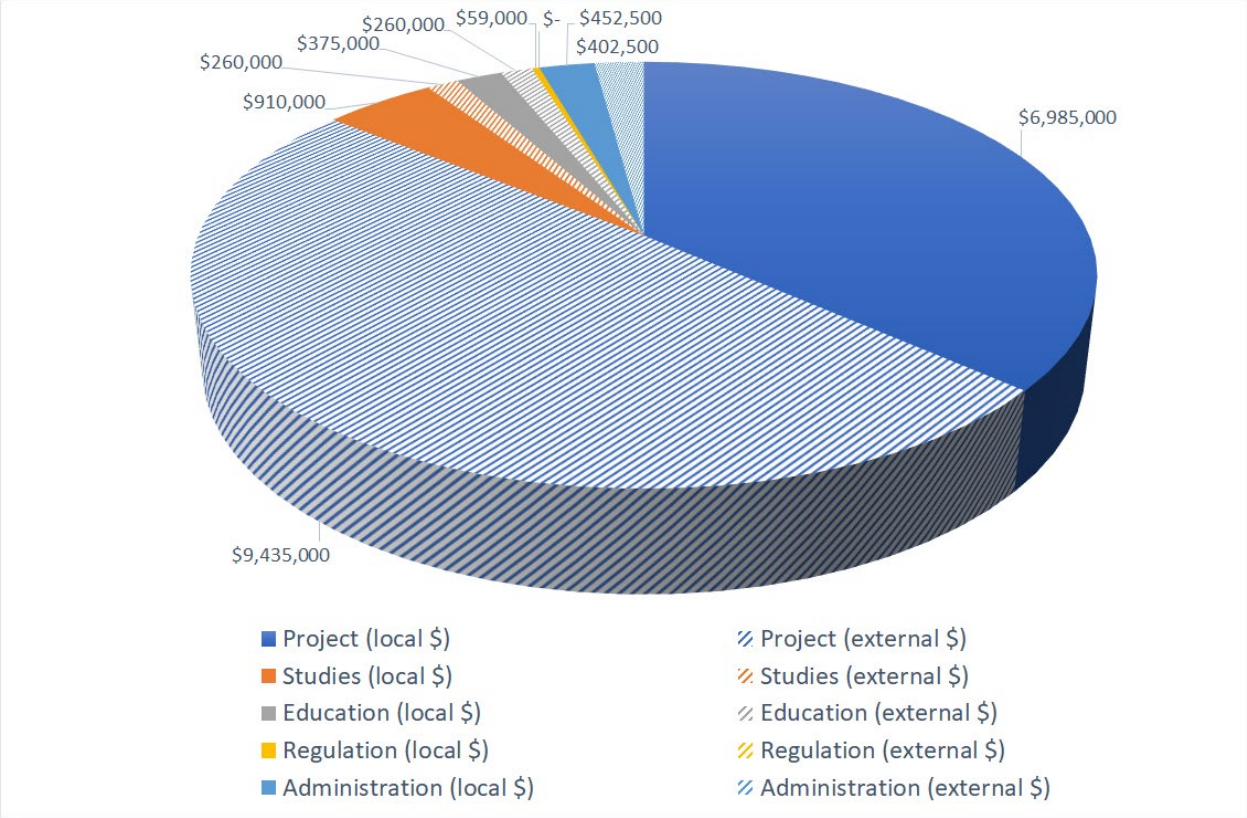


Figure 1-1 Estimated Plan Implementation Costs (Local and External Funds)

Additional non-governmental funding sources may be used to fund Plan implementation. The Partners will coordinate with NGOs 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 6.3.

1.6.2 Implementation Roles and Responsibilities

The Parties will implement this Plan according to the governance structure established in the implementation Joint Powers Agreement (JPA, see Appendix A). 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 6.4. Annual work planning will be performed by the Local Implementation Work Group. Planning 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, county 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.

2 Introduction

The Watershed Alliance for the Greater Zumbro (WAGZ or Partnership) is a partnership of Counties, Soil and Water Conservation Districts (SWCDs), the Bear Valley Watershed District (BVWD), and the City of Rochester located within the Zumbro River and Mississippi River-Lake Pepin watersheds. 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 **Greater Zumbro Comprehensive Watershed Management Plan** (Plan).

2.1 Purpose and Scope

The purpose of this Plan is to develop and document coordinated, prioritized, and targeted practices and programs to achieve the water and natural resource management goals established by the Partnership (see Section 5). 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 includes a prioritized, targeted, and measurable implementation program (see Section 6) 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 and watershed management that leverages the technical 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 goals of the Plan.

This is a local plan emphasizing the interests of local water managers, policy makers, and affected stakeholders (see Section 3.1). 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 A). 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 complete list of documents referenced in the development of this Plan is included in Section 7.

2.2 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 the1W1P 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 over a ten-year transition period into plans built largely around the state's major watersheds. 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 has been developed through a grant provided by BWSR.

2.3 Watershed Characteristics

The area addressed by this plan (i.e., planning area) includes areas of agricultural land, pasture land, and natural forests. The planning area also includes growing urban areas centered around the City of Rochester, as well as the Cities of Red Wing and Lake City. The terrain of the Zumbro River watershed includes gently rolling terrain in the western and central portions of the watershed transitioning to hills, bluffs, and ravines in the eastern portion of the watershed. The topography of the Mississippi River Lake Pepin portion of the planning area is characterized by rolling hills, ravines, and bluffs similar to the downstream part of the Zumbro River watershed. A major hydrologic feature in the planning area is the Zumbro River, which collects inflow from four major forks and numerous smaller tributaries as it flows from west to east to the Mississippi River. In the Mississippi River-Lake Pepin watershed, the land general drains from south to north via several smaller streams. Additional information about the physical and environmental characteristics of the planning area are presented in Section C.

2.4 Plan Boundary

The "Greater Zumbro" planning area is presented in Figure 2-1. The area includes the Zumbro River 8-digit HUC watershed (07040004) and a portion of the Mississippi River-Lake Pepin 8-digit HUC watershed (07040001). Portions of six counties comprise the planning area (see Table C-1). Approximately 86% of the planning area (1,421 square miles) drains to the Zumbro River, while the remaining 14% (233 square miles) is tributary to the Mississippi River-Lake Pepin. Tributary watersheds delineated at approximately the 10-digit HUC level (for planning purposes) are presented in Section C.1.1 and Figure C-3.

2.5 Planning Partners and Plan Development

The WAGZ Partnership includes the following 13 entities who committed to the implementation of this Plan through execution of the JPA included in Appendix A:

- The Counties of Dodge, Goodhue, Olmsted, Rice, and Wabasha (i.e., the Counties) by and through their respective County Board of Commissioners.
- The Dodge, Goodhue, Olmsted, Rice, Steele, and Wabasha Soil and Water Conservation Districts (i.e., SWCDs) by and through their respective SWCD Board of Supervisors.
- The Bear Valley Watershed District (BVWD) by and through their Board of Managers.
- The City of Rochester (i.e., the City) by and though their City Council Members.

The above entities collectively form the WAGZ Partnership and are referred to within this Plan as the "Partners." Steele County also participated in Plan development, but has not, to date, signed the implementation JPA due to the limited portion of the planning area in Steele 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** 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 counties in the planning area, one manager from BVWD, and a City administrator or deputy city administrator from the City of Rochester.
- The **Technical Advisory Group (TAG)** 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, representatives from agricultural and conservation groups, and other stakeholders. A complete list of participating organizations is included in the Acknowledgements section.
- The **Planning Work Group (PWG)** guided the logistics of the planning process and drafted the Plan. The Planning Work Group 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 in the Acknowledgements section.

Individuals who participated in these committees during Plan development are noted in the "Acknowledgements" section 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** – April 2019 – 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)
    - Bear Valley Watershed District (BVWD)
    - City of Oronoco

- **Public Kickoff Meeting** – June 13, 2019 – The Partnership advertised and hosted an open house at the 125 Live event center in Rochester, Minnesota. Members of the Planning Work Group,

Policy Committee, Technical Advisory Group, and the public were invited to attend. BWSR staff, state agencies and the Partnership's planning consultant, Barr Engineering Co. (Barr), presented relevant data in poster format. The Partnership solicited input from attendees regarding priority concerns and resource use.

- **Online and mailed survey** – Summer 2019 – The Partners developed a brief survey to obtain input about how residents use and view the water and natural resources within the planning area. The survey was hosted online and mailed to approximately 1,000 residents within the planning area. Results of the survey are summarized in Section 3.1.4 and Appendix B.

- **Waterside Chats** – Fall 2019 – The Greater Zumbro River Watershed Partnership hosted "Waterside Chats" in three communities:
    - October 24th, 2019 at the Zumbro Valley Recreation Club in Mantorville
    - November 7th, 2019 at the Community Center in Mazeppa
    - November 14th, 2019 at the Sportsman's Club in Lake City.

  The Chats were facilitated by the local County or SWCD staff expert in each area. Waterside chat participants represented an assortment of local citizens, landowners, producers, and representatives from local and state government entities. At each waterside chat, facilitators summarized the priority resources and issues that had been identified in local and state plans, studies, reports, state agency feedback, and resident surveys. Following the presentation, attendees discussed a series of questions to provide their input and feedback on the list of priority issues to be addressed in the 10-year scope of the plan. Comments were captured by a facilitator from the planning partnership, summarized, and reported out to the large group. The waterside chats are described in greater detail in Appendix B.

- **Story Map –** February 2021 – The planning workgroup developed an ArcGIS story map collection to introduce the various stages of the planning process, present the primary list of watershed issues and resource concerns, and discuss the actions the Partnership plans to implement to improve them. Included in the storymap was a public input survey. The survey was developed to seek feedback from watershed residents on the activities and projects they would like to see accomplished in the watershed. Responses from the survey will advise the local implementation workgroup as they develop the workplan.

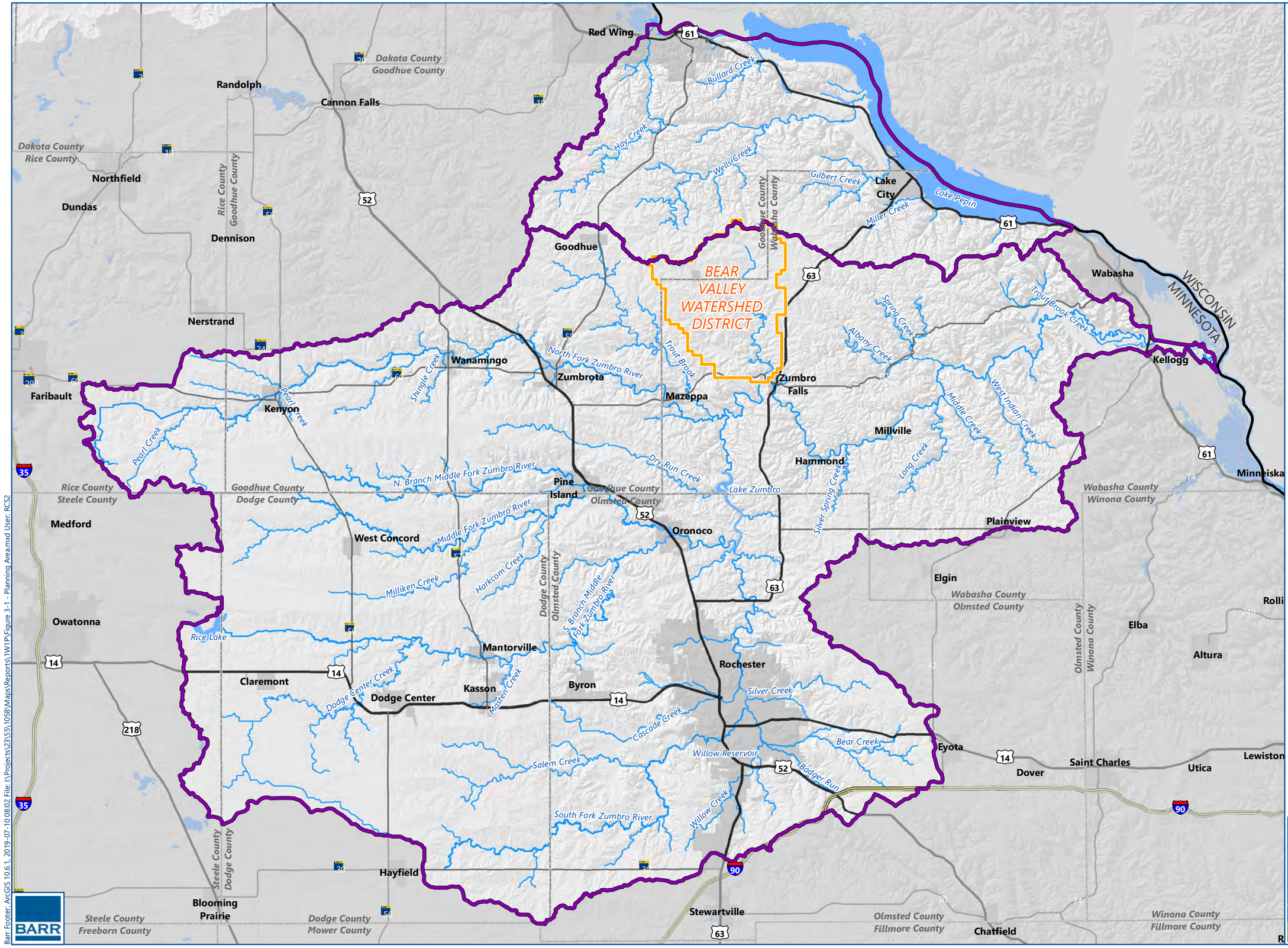
Throughout the planning process, stakeholder input was shared, received, and considered through frequent meetings of the Planning Work Group, Advisory Committee, and Policy Committee. Table 2-1 presents a timeline of key committee meetings held during the Plan development process.

Table 2-1 Key Plan development meetings held during Plan development

Date	Committee	Major agenda items
February 14, 2019	Policy Committee	First Policy Committee meeting, bylaws adopted, process approved for consultant selection and request for proposals.
April 4, 2019	Policy Committee	Approve structure and membership of the TAG; consultant selection;
June 13, 2019	Public	Public Kickoff Meeting
July 17, 2019	Planning Work Group	Watershed data aggregation; inventory narrative
August 8, 2019	Policy Committee	Approve logo and Waterside Chats structure
September 9, 2019	Technical Advisory Group	Summary of TAG priority concerns and responses to notification
September 26, 2019	Planning Work Group	Development of issue statements; planning for waterside chats
October 10, 2029	Planning Work Group & Technical Advisory Group	Joint issue identification and prioritization workshop
October 24, 2019	Public	Waterside Chat – Mantorville
November 7, 2019	Public	Waterside Chat – Mazeppa
November 14, 2019	Public	Waterside Chat – Lake City
December 13, 2019	Policy Committee	Summarize Waterside Chats, discuss organizational structure
January 9, 2020	Planning Work Group	Determine issue priority tiers and begin spatial prioritization
February 5, 2020	Planning Work Group & Technical Advisory Group	Spatial prioritization workshop
February 13, 2020	Technical Advisory Group	Review and discussion of priority concerns, spatial prioritization, targeting maps, and draft goals
February 25, 2020	Planning Work Group	Spatial prioritization
March 26, 2020	Planning Work Group	Spatial prioritization and draft goal development
May 6, 2020	Planning Work Group	Spatial prioritization and draft goal development
May 29, 2020	Technical Advisory Group	Spatial prioritization and goal development
June 11, 2020	Policy Committee	Discussion of governance structures; authorize terrain analysis of Mississippi River-Lake Pepin watershed
June 11, 2020	Technical Advisory Group	Spatial prioritization and goal development
June 23, 2020	Groundwater Advisory Group	Special meeting of TAG and other groundwater experts to review and revise the groundwater spatial prioritization, targeting maps
August 3, 2020	Planning Work Group	Hydrology and watershed storage; draft Plan section review
August 13, 2020	Policy Committee	Discuss Plan implementation organizational structure
September 10, 2020	Planning Work Group	Mississippi River-Lake Pepin terrain analysis
October 8, 2020	Policy Committee	Mississippi River-Lake Pepin terrain analysis
October 15, 2020	Planning Work Group	Implementation schedule
October 30, 2020	Technical Advisory Group	Discuss groundwater and surface water priority area targeting maps, terrain analysis for MRLP and the draft implementation table.
December 2, 2020	Planning Work Group	Implementation schedule; draft Plan section review
December 10, 2020	Policy Committee	Governance structure; implementation schedule

Table 2-1 Key Plan development meetings held during Plan development

Date	Committee	Major agenda items
February 11, 2020	Planning Work Group	Implementation schedule; Draft Plan review
March 11, 2021	Planning Work Group	Draft Plan review
April 8, 2021	Policy Committee	Review internal draft comments; approve Joint Powers Agreement for Plan implementation; authorize 60-day draft submittal
May 24, 2021	Planning Work Group	Project ranking system; draft implementation structure
June 10, 2021	Policy Committee	Establish schedule for public hearing; Project ranking system
July 8, 2021	Planning Work Group	Review comments from 60-day review and draft responses; executive summary document; local implementation policy
August 12, 2021	Planning Work Group	Local implementation policy; WBIF grant funding allocation
August 12, 2021	Policy Committee	Public hearing on the draft Plan; authorize 90-day draft submittal
October 7, 2021	BWSR Southern Regional Committee	Presentation on the WAGZ Plan by local lead staff
October 23, 2021	BWSR Board	Approve the WAGZ Plan
November 4, 2021	Policy Committee	Adopt the Plan; direct partners to seek Plan adoption by their respective boards



PLANNING AREA OF THE WAGZ COMPREHENSIVE WATERSHED MANAGAMENT PLAN

WAGZ Comprehensive Watershed Management Plan

FIGURE 2-1

Barr Footer: ArcGIS 10.6.1, 2019-07-10 08:02 File: I:\Projects\23\55\1058\Maps\Reports\1W1P\Figure 3-1 - Planning Area.mxd User: RCS2

3 Identification and Prioritization of Issues and Resources

This section summarizes the issue identification and prioritization process used by the Partners and memorializes the prioritized issue statements used as input to develop measurable goals (see Section 5) and the targeted implementation plan (see Section 6). 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 C)
- Input from plan review authorities
- Public survey results
- Discussion at three watershed chats and the public kickoff meeting
- Paired analysis ranking by the PWG, TAG, and Policy Committee

The issue statements presented in Table 3-1 were developed and refined with consideration of each of the above sources.

3.1 Issue Identification and Prioritization Process

The PWG led the identification and prioritization of issues and resources as an iterative process, with each step incorporating outcomes from prior steps. This process is illustrated in Figure 3-1.

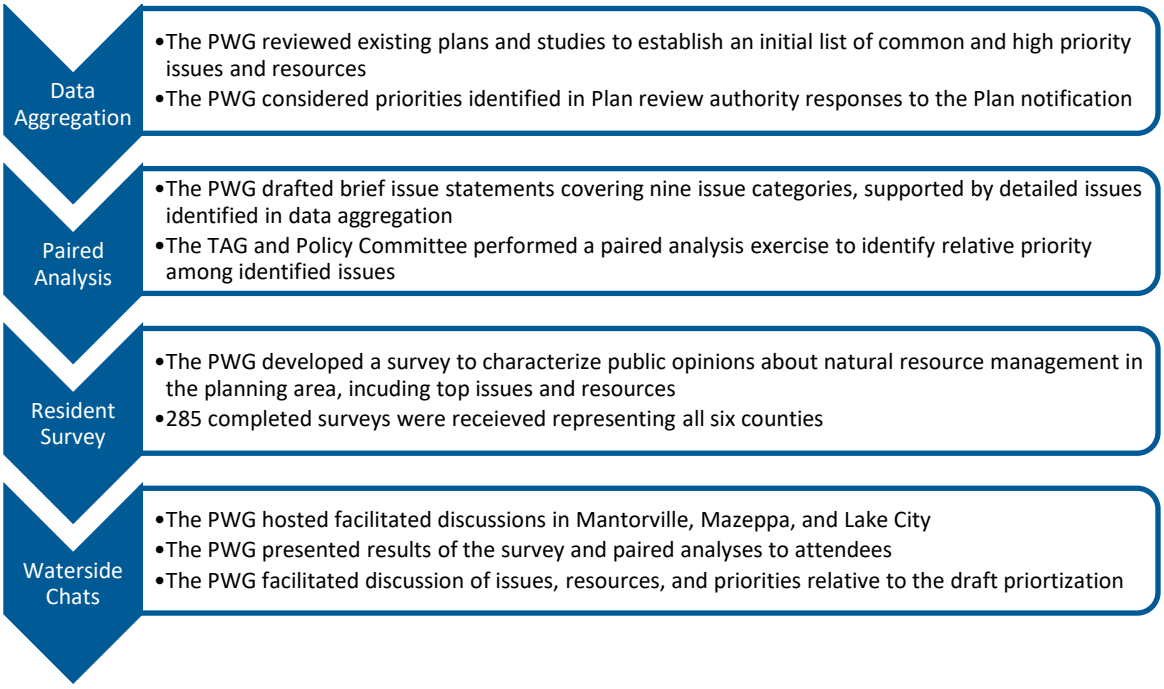


Figure 3-1 Issue and Resource Identification and Prioritization Process

3.1.1 Data Aggregation

Early in Plan development, the PWG reviewed existing studies and management plans relevant to natural resources management in the planning area. These include, generally:

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

A complete list of the documents referenced in the development of this Plan is included in Section 7. The PWG also reviewed priority issues identified in responses to the Plan notification letter (see BWSR 1W1P Operating Procedures v.2, Section IV.A) from the following Plan review authorities:

- Bear Valley Watershed District (BVWD)
- City of Oronoco
- 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)

The PWG identified approximately 90 unique issues, many of which were identified in multiple existing documents and/or by multiple stakeholders.

3.1.2 Development of Issue Statements

The specific issues identified through data review (see Section 3.1.1) were iteratively grouped into nine issue categories in cooperation with the PWG and TAG. Based on these categories and specific issues, the PWG drafted brief issue statements to characterize each category. The draft issue statements were later revised by the PWG based on discussion with the TAG and Policy Committee (see Section 3.1.3), results of the resident survey (see Section 3.1.4), and discussion at the waterside chats (see Section 3.1.5).

The final issue statements are presented in Table 3-1. The issue statements are, because of their brevity, broad in scope. Each issue category is described in greater detail in Section 3.2. Specific problems, risks, and opportunities within each issue category area are included in Table 3-3 and provide additional context for the issue statements.

Table 3-1 Priority Issue Statements

Issue Group	Issue Statement
Degraded Soil Health	Degraded soil health diminishes agricultural productivity and limits the beneficial ecological functions of soil.
Accelerated Erosion & Sedimentation	Excessive erosion and sedimentation diminish agricultural productivity, damages riparian areas, and degrades surface water quality and stream habitats.
Surface Water Quality Degradation	Surface water quality is threatened or impaired by pollutant loading and altered hydrology.
Water Quantity and Excessive Flooding	Excessive flooding threatens public safety, property, and riparian ecology.
Landscape Resiliency and Altered Hydrology	Landscape resiliency and the associated ecological functions are threatened by climate change, land use changes, and altered hydrology.
Groundwater/Drinking Water Contamination	Groundwater quality and drinking water safety is threatened by pollutant loading.
Threatened Groundwater Supply	Groundwater sustainability is at risk from consumptive use and loss of recharge.
Threats to Fish, Wildlife, and Habitat	Natural areas, forests, prairies, and wetlands providing habitat and other ecological benefits, and the species that inhabit them, are threatened by human activity.
Reduced Livability & Recreation	Outdoor recreation and overall quality of life are affected by the degradation of, and lack of access to, natural resources.

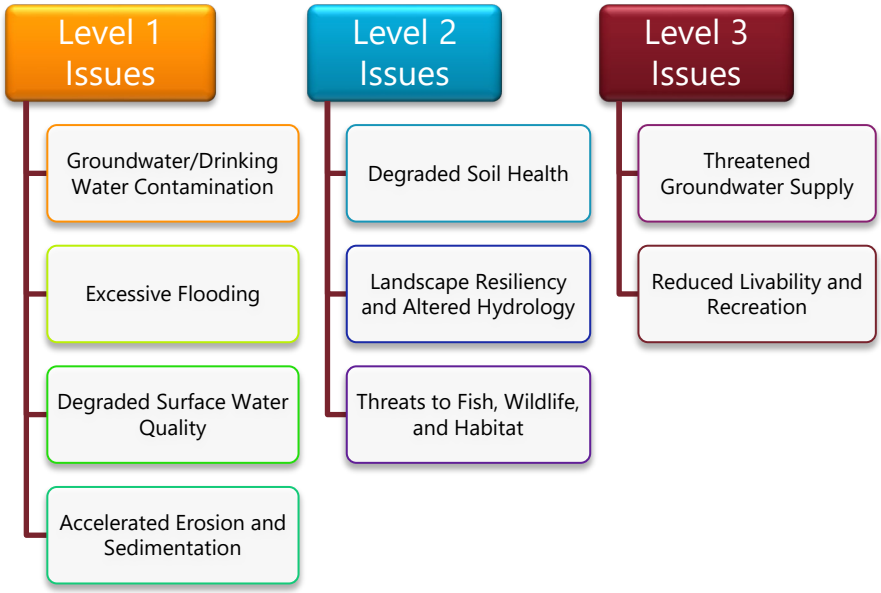
3.1.3 Issue Prioritization using Paired Analysis

Following the development of issue statements (see 3.1.2 and Table 3-1), the Policy Committee, TAG, and PWG used a paired comparison matrix to rank the nine issue categories. Eight members of the Policy Committee, eight members of the TAG, and nine members of the PWG completed the sample matrix shown in Figure 3-2. Possible scores for each issue range from 0 to 8, with higher numbers indicating a higher relative priority. Scores for each issue were calculated giving equal weight to the average Policy Committee score, average TAG score, and average PWG score. The results are presented in Figure 3-3.

In general, there is consistency between the scores assigned to each issue group by the Policy Committee versus those assigned by the TAG. Some notable discrepancies in issue priority scoring are apparent in Figure 3-3 and include:

- Issues related to flooding and groundwater supply were given a higher priority by the Policy Committee than the TAG or PWG
- Threats to fish, wildlife, and habitat issue was ranked higher by the TAG than both the PWG and, especially, the Policy Committee
- Landscape resiliency and altered hydrology issue was scored higher by the TAG and PWG than the Policy Committee

Additional discussion with Policy Committee, TAG, and PWG, in combination with the weighted average scoring, ultimately led to a consensus determination of Level 1 (high priority), Level 2 (moderate priority), and Level 3 (low priority) issue categories as follows:



Discussion of the priority issues by the Policy Committee, TAG, and PWG noted that many of the nine issue categories are interrelated. For example, the presence of Karst geology in the planning area results in a strong connection between degraded surface water quality and groundwater contamination. Degraded soil health negatively contributes to increased erosion, which can degrade surface water quality. Actions to address one issue category may have secondary benefits to other issues.

Table 3-2. Greater Zumbro 1W1P - Issue Area Paired Analysis

Instructions:

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

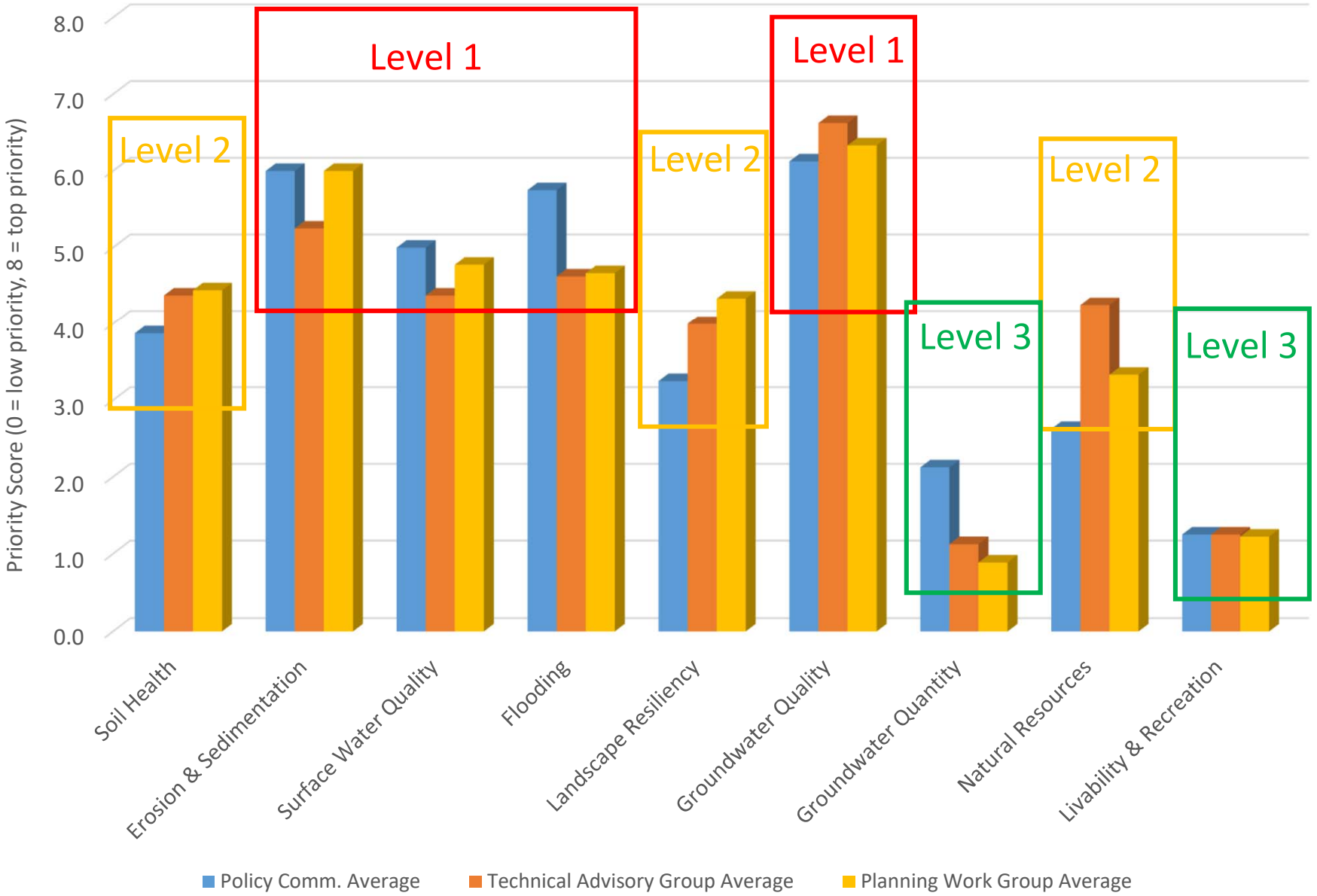
2. For each open square:
   2A. Consider only the **TWO** issue statement corresponding to its Row and Column.
   2B. Decide which of the two issues statements (the row, and the column) is a higher priority, in your opinion, to address in this 1W1P.
   2C. Indicate the higher priority issue in the square using the abbreviation (e.g., "E&S" for the issue of excessive erosion and sedimentation).

3. In the "Total Occurrences" column, record the total number of times your selected that issue in a blank square (they should sum to 36).

Issue Statement	**Code**	SH	E&S	SWQ	FL	LR	GWQ	GWS	NAT	REC
Degraded **soil health** diminishes agricultural productivity and limits the beneficial ecological functions of soil.	SH									
Excessive **erosion and sedimentation** diminishes agricultural productivity, damages riparian areas, and degrades surface water quality and stream habitats.	E&S									
Surface water quality is threatened or impaired by pollutant loading and altered hydrology.	SWQ									
Excessive **flooding** threatens public safety, property, and riparian ecology.	FL									
Landscape resiliency and the associated ecological functions are threatened by climate change, land use changes, and **altered hydrology**.	LR									
Groundwater quality and drinking water safety is threatened by pollutant loading.	GWQ									
Groundwater sustainability is at risk from consumptive use and loss of recharge.	GWS									
Natural areas, forests, prairies, and wetlands providing habitat and other ecological benefits, and the species that inhabit them, are threatened by human activity.	NAT									
Outdoor recreation and overall quality of life are affected by the degradation of, and lack of access to, natural resources.	REC									

Total Occurrences	
SH =	
E&S =	
SWQ =	
FL =	
LR =	
GWQ =	
GWS =	
NAT =	
REC =	

Figure 3-3: Issue Prioritization Scoring by Policy Commmitte, TAG, and PWG



3.1.4 Resident Survey

As part of an extensive stakeholder engagement effort, the PWG developed a brief survey to characterize public opinions regarding natural resource management in the planning area. The survey was made available at the project public kickoff meeting hosted in Rochester on June 13, 2019, county fairs, online via the project webpage, and mailed to approximately 900 residents in the planning area.

A total of 285 surveys were completed; complete survey results are summarized in Appendix B. Surveys were available and completed concurrent with other issue identification and prioritization efforts (see Sections 3.1.1 through 3.1.3) to maximize participation while maintaining project schedule. Results of the resident survey were used to validate the draft issue prioritization performed by the Policy Committee, TAG, and PWG (see Section 3.1.3).

Survey question 7 asked respondents to identify their top 5 water issues from a provided list in order of importance (see Figure 3-4). Responses to question 7 generally corroborate the issue prioritization performed by the Policy Committee, TAG, and PWG (see Figure 3-3). Survey question 9 provided an opportunity for survey respondents to submit general comments and/or suggestions in an open-ended response. Responses to question 9 address a wide range of issues. Some common themes included:

- Emphasis on soil health practices to achieve direct (i.e., in-field) and downstream benefits (e.g., improved water quality, reduced flooding)
- Frequent flooding in the watershed (exacerbated by altered hydrology) leads to erosion, water quality, and public health issues
- The importance of groundwater quality and groundwater protection
- A desire for more public education and engagement regarding water quality issues
- The need for enforcement of existing standards and/or appropriate land use management to limit non-point source pollution (nutrients and sediment)

The responses to the survey indicate strong public interest in the quality and management of water and natural resources in the planning area. Results identify several issues of importance, but generally identify groundwater quality, pollutant loading, erosion, and flooding as top priorities.

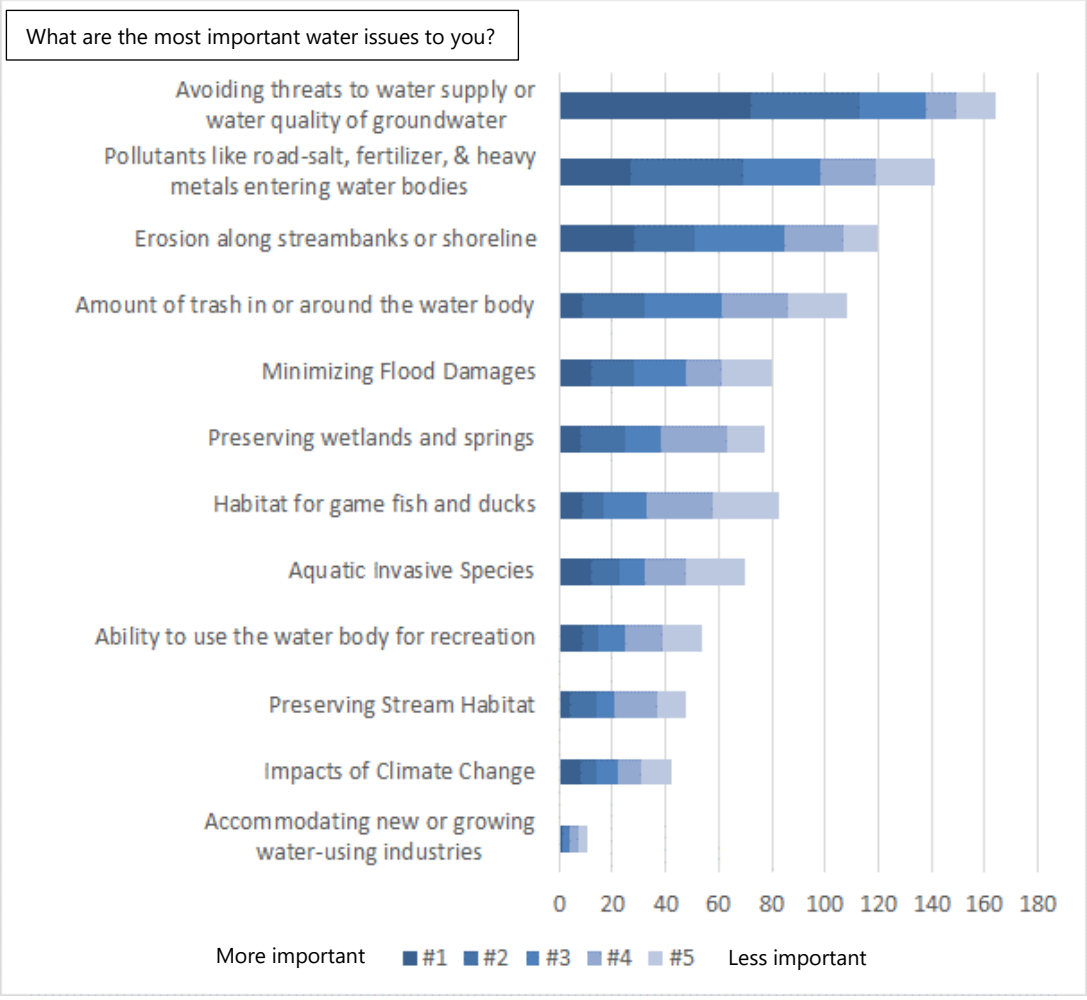


Figure 3-4 Results of survey question 7: What are the most important water issues to you?

3.1.5 Waterside Chats

In fall 2019, the Partnership hosted "Waterside Chats" in three communities across the watershed. These events were intended to present information to the public and obtain input informed by the public's local knowledge of the watershed. The three waterside chats were held:

- October 24th, 2019 at the Zumbro Valley Recreation Club in Mantorville
- November 7th, 2019 at the Community Center in Mazeppa
- November 14th, 2019 at the Sportsman's Club in Lake City

Each waterside chat began with a presentation by the local SWCD or County Staff which included a summary of the Plan development process, a summary of what has been accomplished, and information on how the public can participate. Staff summarized the priority resources and issues that had been identified in local and state plans, studies, reports, state agency feedback, and resident surveys. Initial results of the prioritization of these issues identified by a survey of watershed residents and ranked by the

policy committee, planning workgroup and technical advisory group were also shared to aid in the table conversations.

Following the presentation, attendees were broken into small groups. Each small group discussed a series of questions to provide their input and feedback on the list of priority issues to be addressed in the 10-year scope of the plan. Comments were captured by a facilitator from the planning partnership, summarized, and reported out to the large group.

The waterside chats were attended by over 60 participants who provided meaningful input on priority issues and implementation strategies. Discussion of priorities corroborated the draft prioritization performed by the Policy Committee, TAG, and PWG (see Section 3.1.3). The waterside chats identified many specific issues that were incorporated into Table 3-3 and potential implementation strategies carried forward in Plan development (see Section 6).

A complete summary of the waterside chats is provided in Appendix B.

3.2 Priority Issues

Through the process described in Section 3.1, the Partnership identified nine priority issues described in this section.

3.2.1 Groundwater/Drinking Water Contamination (Level 1)

Issue Statement: Groundwater quality and drinking water safety is threatened by pollutant loading.

Groundwater is the primary source of drinking water, industrial, and agricultural use within the watershed. Pollutants in groundwater, including nitrates and bacteria, pose a risk to human health. Private and public drinking water wells have shown high levels of nitrate contamination across the planning area. Nitrate in groundwater may be naturally occurring at low levels; data collected by USGS and others indicates background nitrate concentrations less than 1 mg/L in portions of the planning area (see Section C.5.2)Elevated nitrate levels are influenced by human activities (MDH, 2018). Land use within the planning area creates high potential for nitrogen and pesticide loading. Emerging and naturally occurring contaminants (e.g., arsenic, manganese) are also of concern. A complete assessment of groundwater quality and associated potential health risks is limited by the large spatial extent of aquifers and limited monitoring data. The vulnerability of non-community public water supplies (e.g., schools, campgrounds), in particular, 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. Hydrologic sensitivity to contamination is highly variable over short distances. This sensitivity is exacerbated in areas with porous soils and the Karst geology present throughout much of the eastern portion of the planning area. Additionally, unused or unsealed wells provide a conduit for surface contaminants to reach drinking water sources. Nitrate concentrations in the planning area are affected by both well construction and overlying geologic protection (MDH, 2012).

Pollution sensitivity of near-surface materials and wells are presented in Figure C-10 and Figure C-12, respectively. Table 3-2 lists the potential sources of groundwater contamination that may negatively impact the quality of drinking water.

Table 3-2 Potential sources of groundwater contamination

Location	Source	Contaminants of concern		
		Nitrate	Bacteria	Chemicals[1]
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) e.g., petroleum, pesticides

3.2.2 Excessive Flooding (Level 1)

Issue Statement: Excessive flooding threatens public safety, property, and riparian ecology.

Impacts from flooding can include damages to structures (such as homes), property, utilities and transportation infrastructure. Flooding can also 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 elevating peak flows and runoff 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 stormwater management systems may be undersized for evolving precipitation patterns, further exacerbating flooding. In light of changing precipitation patterns, existing 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 C.9). Floodplains within the planning area are presented in Figure C-25.

3.2.3 Surface Water Quality Degradation (Level 1)

Issue Statement: Surface water quality is threatened or impaired by pollutant loading and altered hydrology.

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 (i.e., geographically targeted) or pipe. Instead, pollutants that are carried from land to water in stormwater or snowmelt runoff, in seepage through the soil (non-functioning subsurface sewage treatment systems), 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 loading to lakes and streams.

For lakes, ponds, and wetlands, phosphorus is often a pollutant of major 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 subsurface sewage treatment systems (SSTS). Nitrates, fecal coliform bacteria, and sediment (see Section 3.2.4) cause additional issues, especially in agricultural areas. Nitrates and sediment are commonly found in agricultural runoff and urban stormwater. Fecal coliform bacteria are usually associated with SSTS, feedlot operations, and concentrated wildlife, such as flocks of waterfowl. Fertilizer and pesticide applications also contribute to pollutant loading in lakes and streams. Sources of pollutants like nitrates, phosphorus, and bacteria in the planning area are summarized in Section C.8.5 and in Section 2.3 of the Mississippi River-Lake Pepin (MRLP) Watershed Restoration Protection Strategies (WRAPS) (MPCA, 2015) and Zumbro River WRAPS (MPCA, 2017). HSPF model results presented in the WRAPSs were used to estimate pollutant loading in the planning area (see Section C.8.7.1). Estimated watershed loadings of total nitrogen, total sediment, and total phosphorus are presented in Figure C-18, Figure C-19, and Figure C-20, respectively.

The addition of pollutants into surface waters and altered hydrologic patterns 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, including: several stream reaches impaired due to turbidity, total suspended solids (TSS), bacteria, aquatic life (fishes bioassessments and macroinvertebrate bioassessments), PCB in fish tissue, and mercury in fish tissue; Lake Zumbro and Rice Lake are impaired due to excess nutrients/eutrophication.

Impaired waters are presented in Figure C-16 and summarized in Section C.8.6. 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 Zumbro River Watershed TMDL (MPCA, 2017) and Mississippi River-Lake Pepin Tributaries TMDL (MPCA, 2015) were referenced during the development of this Plan.

3.2.4 Accelerated Erosion and Sedimentation (Level 1)

Issue Statement: Excessive erosion and sedimentation 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 or accelerated 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) 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 culverts, manholes, and storm sewers, 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 the Zumbro River and its tributaries are identified as impaired for aquatic life due to high turbidity (see Figure C-16). Reducing near-channel sources of sediment, especially, can mitigate negative impacts to downstream channel areas, aquatic habitats, and aquatic biota.

Section 3.3 of the MRLP WRAPS (MPCA, 2015) and Zumbro River WRAPS (MPCA, 2017) includes strategies to mitigate accelerated erosion of ditches and streams. Soil erosion risk in the planning area is presented in Figure C-7.

3.2.5 Degraded Soil Health (Level 2)

Issue Statement: Degraded soil health diminishes agricultural productivity and limits the beneficial ecological functions of soil.

Most of the land in the Zumbro River watershed and some of the land in the MRLP watershed is farmed or used for pasture. Agricultural and animal production are major components of the regional 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 C-6). Healthy soils require less fertilizer and promote a number of environmental benefits, including allowing for increased infiltration following precipitation events, resulting in lower levels of overland runoff and associated soil erosion. 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 potential nutrient loading in the watershed while increasing costs to the producer. After farmland has been tilled, it is often left bare from fall to spring. This means there are no plants available 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 top soil layers contributes to high levels of turbidity and total suspended solids in streams and rivers (see Section 3.2.4). Soil erosion risk in the planning area watershed is presented in Figure C-7.

Improving soil health can be accomplished through increased commitment to using other land management practices, including no-till/strip-till rotations, cover crops, perennial crops, crop diversity, etc. 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. In the planning area, there are opportunities to further realize the agricultural and environmental benefits of healthier soils through broader use of such practices.

3.2.6 Landscape Resiliency and Altered Hydrology (Level 2)

Issue Statement: Landscape resiliency and the associated ecological functions are threatened by climate change, land use changes, and altered hydrology.

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 (FISRWG, 1998). Development and land use changes lead to loss of permanent vegetation, increased impervious area, and altered drainage networks (e.g., drain tile, storm sewer). Approximately 43% of streams in the Zumbro River watershed have been altered by channelization (MPCA, 2017).

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. 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 Zumbro River WRAPS (MPCA, 2017) and MRLP WRAPS (MPCA, 2015). 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

keeping precipitation and runoff on the landscape, the Partnership can minimize negative local and downstream impacts.

3.2.7 Threats to Fish, Wildlife, and Habitat (Level 2)

Issue Statement: Natural areas, forests, prairies, and wetlands providing habitat and other ecological benefits, and the species that inhabit them, are threatened by human activity.

Natural, undeveloped landscapes, such as forests, wetlands, and stream corridors, serve many ecological functions, including habitat for fish and wildlife. Over time, many of these natural areas have been converted to other land uses. The loss of habitat negatively impacts wildlife populations, including rare and endangered species; these impacts may be exaggerated when the remaining habitat areas are no longer connected. Much of the remaining habitats in the watershed are imperiled (e.g., calcareous fens, bottom land hardwood forests). Climate change further threatens native species and their habitats directly and through associated hydrologic changes. Loss of habitat is cited as a stressor for biological impairments in the Zumbro River WRAPS (MPCA, 2017) and MRLP WRAPS (MPCA, 2015).

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.

Areas of biodiversity significance in the planning area are presented in Figure C-27. Wetland areas identified in the National Wetland Inventory (NWI) are presented in Figure C-14.

3.2.8 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 Zumbro River and MRLP watersheds. It is the primary source of water for agriculture and irrigation, industrial uses, and drinking water. Drinking water supply management areas (DWSMAs) and wells within the planning area are presented in Figure C-9. Competing demands from domestic, agriculture, and industrial uses can strain municipal water supply systems. The urbanization of Rochester and other areas and associated future increase in population is also driving increases in municipal water supply withdrawals. Data published by the MDNR shows a moderate decline in water level in the Jordan aquifer within the planning area (MDNR, 2010), suggesting that current and projected consumptive use of groundwater may not be sustainable. Well-specific local data from the MDNR's cooperative groundwater monitoring (CGM) program is mixed. In addition, naturally occurring infiltration and groundwater recharge is limited by development, agricultural drainage, and other land use activities.

In addition to consumptive uses, groundwater inflow contributes to baseflow in local streams and impacts stream temperature, impacting the habitat quality of trout streams. These impacts may be magnified in areas of karst geology. Conservation and management of groundwater is necessary to promote the sustainability of the resource for future use and ecological benefits.

3.2.9 Reduced Livability and Recreation (Level 3)

Issue Statement: Outdoor recreation and overall quality of life are affected by the degradation of, and lack of access to, natural resources.

Natural resources, including lakes, streams, forests, and prairies, are an important part of life in the Zumbro River and MRLP watersheds. Many residents and visitors interact with nature through recreational activities like hunting, fishing, hiking, boating and other activities. Others find stress-relief and sanctuary by simply being in nature. The loss or degradation of these resources (and access to these resources) limits recreational opportunities and diminishes the public health benefits these areas provide. Degraded resources can negatively impact property values and sense of community pride.

Table 3-3 Priority issues categories and supporting specific issues

General Issue Area	Specific issues provided as examples of this category (Blue text indicates issue statement from agency response to notification letter - agency in parentheses)
Groundwater/Drinking Water Contamination	- some private wells in the watershed show high levels of nitrate (MDA, MDH) - nitrate in groundwater (drinking water source for the entire watershed) is a health concern for residents (MDNR, MDH, MDA, MPCA) - pesticides in groundwater is a public health concern (MDA) - several drinking water supply management areas (DWSMAs) are highly vulnerable to contamination (MDH) - abandoned, unsealed wells can provide conduit for groundwater contamination (MDH) - private well owners may lack water quality information/testing (MDH) - vulnerability of non-community public water supplies (e.g., schools, campgrounds) is not well defined (MDH) - large portions of the watershed show high pollution sensitivity of wells (MDH) (due in part to Karst geology) - non-functioning subsurface sewage treatment systems (SSTS) and wastewater treatment facilities (WWTF) may leach excessive nutrients and pathogens - hazardous waste generators, landfills, or other point sources have the potential to leach pollutants - feedlot sites and manure application sites may contribute to nutrient and pathogen contamination of groundwater - infiltration of runoff containing pollutants can impact drinking water in areas with vulnerable wells and aquifers - mining land uses may increase groundwater/surface water interaction and pollutant pathways between resources - emerging and naturally-occurring contaminants (e.g., manganese, arsenic) threaten drinking water safety
Excessive Flooding	- river flooding threatens to damage homes, property, and public infrastructure (cited in Rochester Comp Plan, 1999 SWMP) - local flooding from stormwater runoff threatens homes, property, and public infrastructure, especially in urbanized areas (cited in Rochester Comp Plan, 1999 SWMP) - urbanization/development increases rate and volume of runoff (~BWSR) - municipal stormwater systems may be undersized for current/future precipitation patterns - existing floodplain mapping/modeling may not accurately reflect current (or future) flood risk - high water levels, especially for longer durations, contribute to streambank instability/erosion (~BWSR) - increased precipitation/extreme weather events place increased risk and demand on infrastructure (MDNR, BWSR); trends show increased frequency/severity of events (BWSR) - maintain/add impounding structures in the watershed to cut down on flooding and sediment loss (BVWD) - artificial drainage that has occurred in the watershed may impact peak flows and flooding (BWSR) - altered hydrology contributes to more extensive flooding (MDNR; MPCA)

Table 3-3 Priority issues categories and supporting specific issues

Surface Water Quality Degradation	- several waterbodies are listed as impaired for aquatic life and/or aquatic recreation due to one or more stressors, including 5 stream reaches in the Mississippi River-Lake Pepin watershed, and 28 stream reaches and 2 lakes in the Zumbro watershed (MPCA) - Rice Lake water quality is degraded from internal loading of nutrients (MPCA) - Lake Zumbro water quality is degraded from phosphorus and sediment loading (MPCA) - recreational uses are impaired due to bacteria loading from feedlots, land application of manure, cattle in riparian areas, and leaking subsurface sewage treatment systems (SSTS) (MDNR) - there are many resources that are not degraded that should be a priority for protection (BWSR) - total maximum daily load studies may result in required corrective actions - pesticide and fertilizer application (e.g., nutrient management on crop and pasture lands) may contribute to nutrient loading to lakes and streams - nitrate-nitrogen in surface waters is a threat to human health and aquatic life (MPCA) - best practices to improve the water quality of runoff from agricultural lands are not consistently implemented - non-point sources contribute to nutrient, bacteria, and other pollutant loadings to lakes and streams (e.g., non-functioning SSTS, stormwater runoff); pollutant loadings vary across the watershed (BWSR) - high pollutant loading from developed portions of the watershed (from S. Zumbro Stormwater & Capital Improvement Plan) - point sources contribute to nutrient, bacteria, and other pollutant loadings to lakes and streams (e.g., feedlots, WWTPs) - dredge spoil disposal can lead to erosion and pollutant loading from deposited sediment - improper disposal of hazardous waste can result in pollutant loading to surface waters (e.g., burning of agricultural plastics)
Accelerated Erosion & Sedimentation	- accelerated soil erosion contributes to turbidity, total suspended solids (TSS), and other water quality issues; Zumbro WRAPS identifies TSS as a stressor; Mississippi River-Lake Pepin WRAPS identifies bedded sediment as a stressor (BWSR) - development activity increases stormwater runoff and erosion - erosion of streambank areas may pose risk to property and infrastructure - erosion of streambank areas eliminates or degrades riparian wildlife and fisheries habitat (~MDNR) - poorly managed urban stormwater can result in excessive erosion (BWSR) - help farmers maintain/add waterways to filter and reduce amount of sediment that moves downstream (BVWD) - gully erosion issues cited in BVWD Plan
Degraded Soil Health	- poor soil health may limit the soil's ability to filter nutrients and other pollutants (~BWSR) - poor soil health may require additional fertilizer applications, increasing nutrient loading - agricultural productivity is less than may be achieved with improved soil health - best practices to enhance/preserve soil health (e.g., no till, cover crops) are underutilized - degraded soil health can reduce infiltration and permeability, resulting in increased runoff and accelerated soil erosion (~BWSR)

Table 3-3 Priority issues categories and supporting specific issues

Landscape Resiliency and Altered Hydrology	- artificial drainage that has occurred in the watershed may impact peak flows and flooding (BWSR) - more frequent periods of low flow in some watercourses (BWSR) - hydrologic changes contribute to instability in natural and artificial watercourses (BWSR) - altered hydrology contributes to increased peak flows and flooding, reduced infiltration, loss of water storage capacity (MDNR) - restoring hydrologic function can reduce flooding, improve water quality, stabilize channels, and improve habitat (MDNR) - altered hydrology contributes to accelerated erosion (MDNR) - altered hydrology is a significant stressor to aquatic biology (MDNR, MDNR) - climate change threatens native species directly and via habitat impacts resulting from associated hydrologic changes (MDNR) - water storage is of heightened importance due to increased precipitation, runoff rates, and volumes resulting from climate change (MDNR) - impacts of altered hydrology and increased flow may be exaggerated by climate trends (e.g., extended periods of saturated streambanks) - forest resources (e.g., bottomland and hillside) are threatened by climate and land use changes
Threats to Fish, Wildlife, and Habitat	- Zumbro Stressor Identification Study identifies lack of habitat as a stressor for biological impairments (fish and macroinvertebrates) (BWSR, MPCA) - Mississippi River-Lake Pepin WRAPS identifies physical habitat as a stressor for Gilbert Creek (BWSR, MPCA) - quality and quantity of wetland habitats are reduced by altered hydrology (BWSR), conversion to other land uses - The Zumbro watershed and larger "bank service area 8" (BSA 8) have a low supply of wetland bank credits, leading to wetland mitigation moving outside the watershed (BWSR) - altered hydrology threatens fish and wildlife habitat - dams and limited aquatic connectivity affect recreation, fish passage (MDNR) - many rare habitats/species in the watershed are critically imperiled (e.g., calcareous fens, bottom land hardwood forests) (MDNR) - preserving baseflow in streams is critical to maintaining trout and other habitat (MPCA) - approximately 6,000 acres of conservation reserve program lands are set to expire soon (BWSR) - aquatic invasive species (AIS) threaten recreation and native ecosystems (cited in Wabasha AIS Prevention Plan) - emerging invasive weed threats pose risk to agricultural production - terrestrial invasive species threaten existing ecosystems
Threatened Groundwater Supply	- groundwater levels show decline over time in watershed (MDNR 2010 Water Availability Report) - infiltration recharge may be decreased by development, tiling, and other human activity - increasing groundwater withdrawals may result in well interference and affect water availability (i.e., sustainability) (MDNR) - preserving baseflow in streams is critical to maintaining trout habitat (MPCA)
Reduced Livability & Recreation	- preservation of quality natural resources is necessary to sustain recreational activities (e.g., hunting, fishing, bird watching) - degraded natural resources negatively affect property values, community vibrancy, and public health - expansion and management of trails enhances recreational enjoyment and improves wildlife habitat (MDNR) - maintenance/reconstruction of public canoe launches is needed; many are damaged from flooding (MDNR) - boat ramps are often crowded from high recreational use (MDNR) - dams and limited aquatic connectivity affect recreation and fish passage (MDNR) - recreational uses of waterbodies are impaired due to water quality issues (e.g., bacteria) (MDNR) - preserving baseflow is important to maintaining aquatic recreation

3.3 Spatial Prioritization of Issue Areas

The spatial extent and severity of resource issues vary across the watershed and prevent a one-size-fits-all approach to implementing practices and programs addressing priority issues. Therefore, the Partners prioritized areas for targeting planned actions to most effectively and efficiently utilize its financial and staff capacity to address these issues. The Partnership used available geospatial data, modeling and monitoring results, and existing technical knowledge of the Planning area to identify spatial areas for prioritized implementation.

Prioritization and/or targeting may be performed at various levels of geographic specificity according to available information. This section describes 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.

Subwatershed scale prioritization is differentiated from field scale targeting, described in Section 4, and summarized as:

- **Field scale targeting** – the location of potential field practices (e.g., vegetated buffers, WASCBs, stormwater practices) within a subwatershed are identified or estimated based on the results of available surveys, terrain analysis, modeling results, or other technical analysis (see Section 1).

The following sections describe the methodology used to target practices to address specific issue areas. The methods described in this section rely on the land and water resources data presented in Appendix C.

3.3.1 Priority Areas for Surface Water Quality

The Partnership identified surface water quality degradation as a Level 1 priority issue, as many waterbodies 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 C.8). This issue is closely linked to the Level 1 priority issue of accelerated erosion and sedimentation; sediment negatively impacts water quality and is a vector for nutrients and other pollutants.

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

- Sediment loading as estimated by HSPF modeling (see Figure C-20)
- Total phosphorus (TP) loading as estimated by HSPF modeling (see Figure C-19)
- Total nitrogen (TN) loading as estimated by HSPF modeling (see Figure C-18)
- Watershed yield (runoff) as estimated by HSPF modeling (see Figure C-26)
- Streams and lakes listed as impaired (see Figure C-16)
- Streams identified by the MPCA as "nearly impaired," "barely impaired," or "nearly exceptional" (see Figure 3-5)
- Priority conservation areas identified by the MDNR Zonation analysis (see Figure 3-5)

The above-listed inputs were used to develop a three-level priority ranking (Level 1 = highest priority) for each HSPF subwatershed as follows:

1. HSPF subwatersheds were assigned a score of 0, 1, or 2 for each of four pollutants (sediment, TP, TN, runoff) 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. *For example, a subwatershed with a sediment loading rate in 80th percentile, TP loading rate in the 50th percentile, TN loading rate in the 50th percentile, and runoff in the 30th percentile would receive pollutant loading scores of 2, 1, 1, and 0, respectively.*

2. Pollutant loading "scores" of 0, 1, or 2 were summed for the four pollutants to create a combined pollutant loading score ranging from 0 to 8.

3. Subwatersheds were split into the following categories based on combined pollutant load score:
    a. Priority 1 = pollutant load score 7-8 (higher priority)
    b. Priority 2 = pollutant load score 4-6
    c. Priority 3 = pollutant load score 0-3 (lower priority)

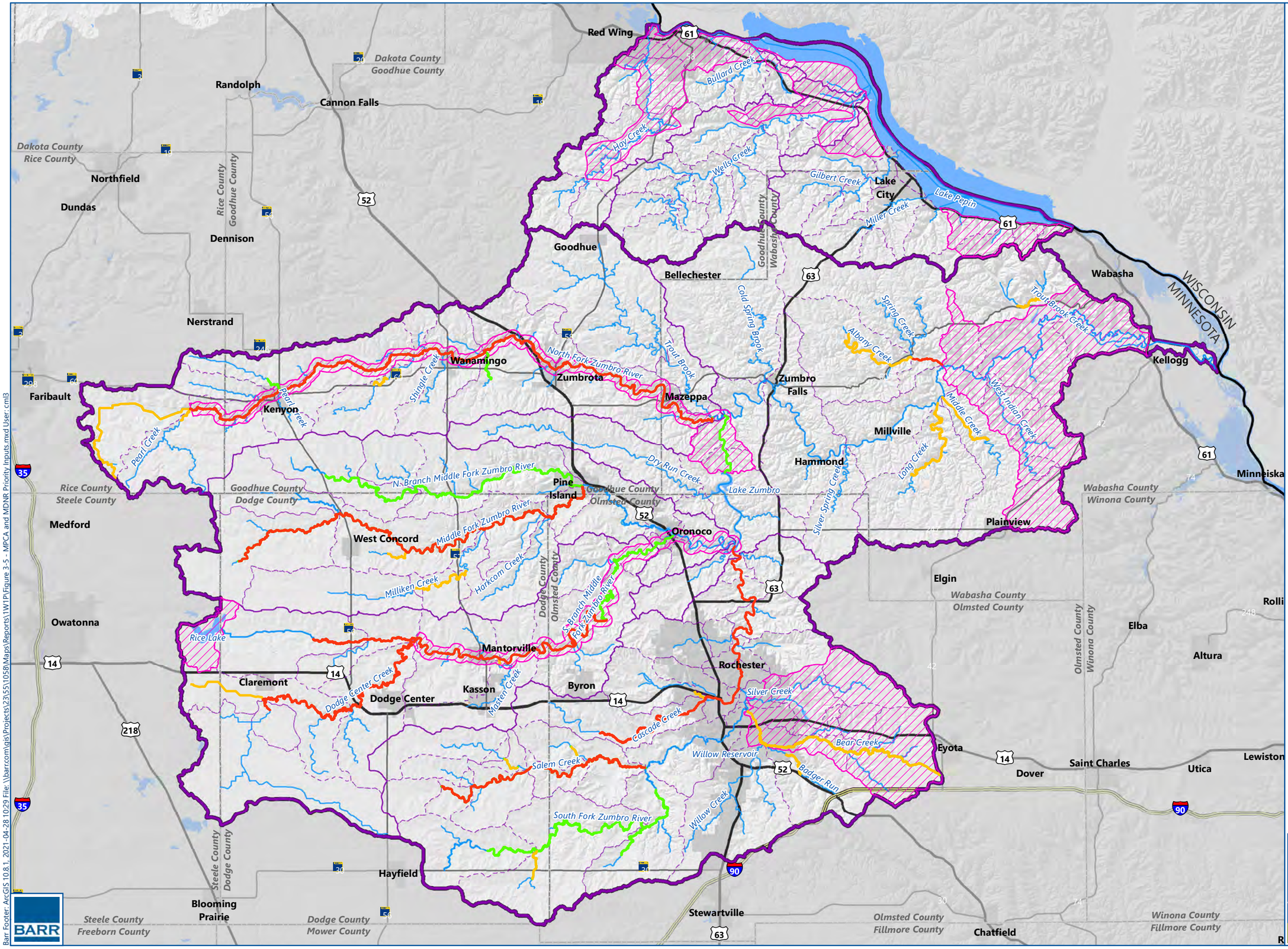
4. Subwatersheds were increased one priority level (i.e., priority 2 to priority 1) if they include an MDNR priority conservation area

5. Subwatersheds were decreased one priority level (i.e., priority 2 to priority 3) if the primary waterbody within the subwatershed was classified as "nearly exceptional" by the MPCA. *Note: while protection of existing good water quality is promoted by this Plan, the Partners incorporated this adjustment to distribute priority levels more evenly*

6. Subwatersheds were individually adjusted up or by one priority level at the discretion of the Planning Work Group based on specific resource knowledge (e.g., South Fork Zumbro River was increased in priority level due to local macroinvertebrate data from Dodge County which highlighted locations in the upper watershed with declining/poor macroinvertebrate numbers).

7. Subwatersheds in each priority level were subdivided into "Protect" or "Restore" categories based on whether the primary waterbody in each subwatershed is impaired or not. Classification as "protect" or "restore" is intended to focus or refine potential strategies, but does not affect relative priority level (i.e., priority Level 2 restore is equivalent to priority Level 2 protect)

The resulting surface water quality priority subwatersheds are presented in Figure 3-6. The percentage of area within the planning area according to surface water quality priority classification is presented in Table 3-4. Note that while the MPCA's delineation of nearly/barely impaired waters was initially considered, it is not omitted from the final prioritization sequence described above (nearly exceptional waters are considered in the prioritization).


Red Wing
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Rice County
Northfield
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Rice County
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Dennison
Nerstrand
Faribault
Kenyon
Wanamingo
Zumbrota
Goodhue
Bellechester
Lake City
Lake Pepin
Wabasha
WISCONSIN
MINNESOTA
Kellogg
Zumbro Falls
Mazeppa
Millville
Hammond
Minneiska
Pine Island
Oronoco
Plainview
Medford
West Concord
Owatonna
Rice Lake
Mantorville
Rochester
Claremont
Dodge Center
Kasson
Byron
Elgin
Elba
Altura
Eyota
Dover
Saint Charles
Utica
Lewiston
Hayfield
Blooming Prairie
Stewartville
Chatfield
Rice County
Steele County
Goodhue County
Dodge County
Goodhue County
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Fillmore County
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Freeborn County
Dodge County
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Olmsted County
Winona County
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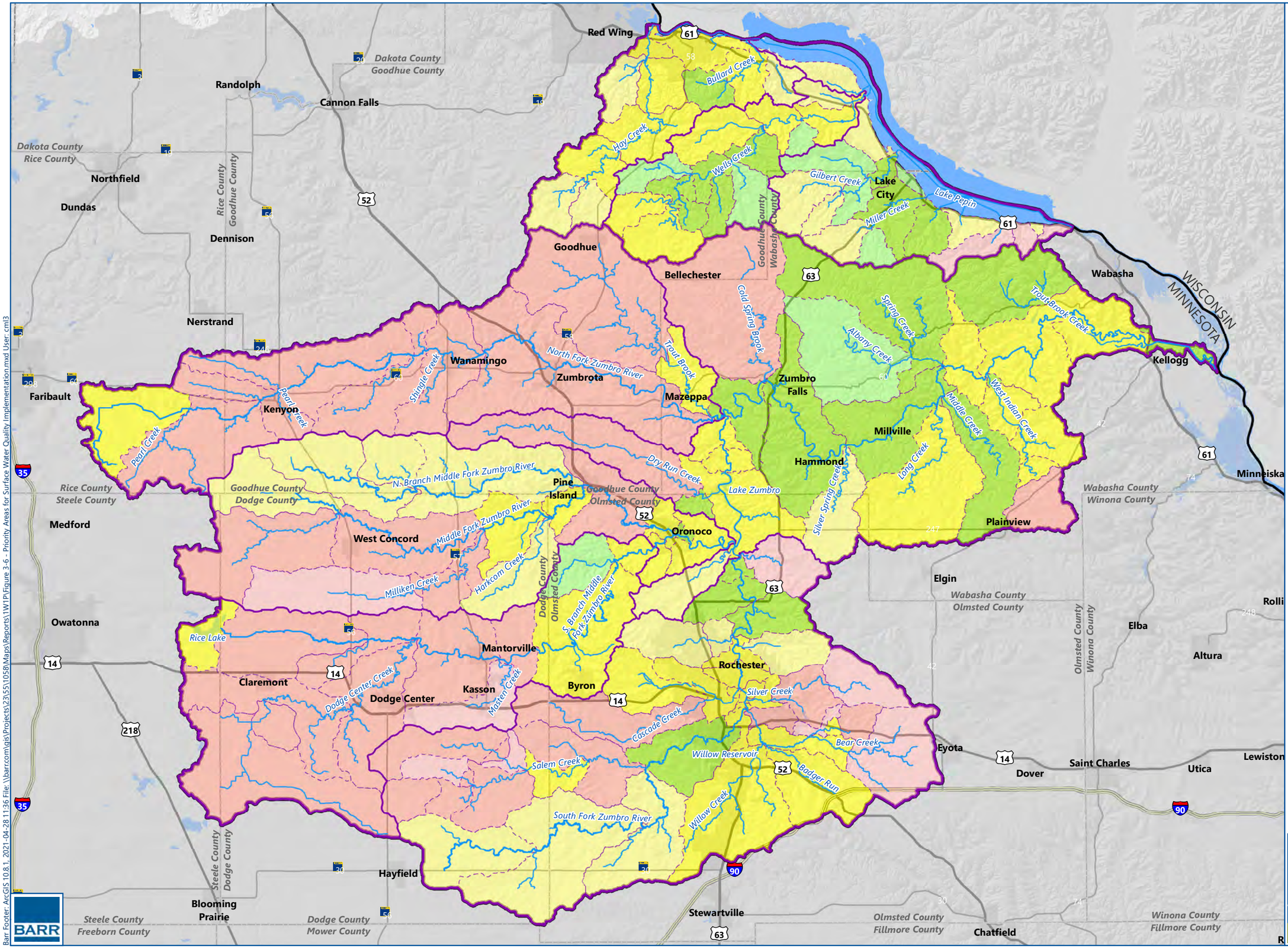
Bullard Creek
Hoy Creek
Wells Creek
Gilbert Creek
Miller Creek
Goodhue County
Wabash County
Cold Spring Brook
Trout Brook
Spring Creek
Albany Creek
Trout Brook Creek
West Indian Creek
Middle Creek
Long Creek
Dry Run Creek
Lake Zumbro
Silver Spring Creek
North Fork Zumbro River
Shingle Creek
Pearl Creek
N. Branch Middle Fork Zumbro River
Middle Fork Zumbro River
Milliken Creek
Harkcom Creek
Dodge County
Olmsted County
S. Branch Middle Fork Zumbro River
Rice Lake
Dodge Center Creek
Masten Creek
Cascade Creek
Silver Creek
Bear Creek
Willow Reservoir
Salem Creek
Badger Run
Willow Creek
South Fork Zumbro River
Steele County
Dodge County
Olmsted County
Winona County
Study Area
Watercourses
Pond or Lake
Municipal Boundary
County Boundary
State Boundary
Subwatersheds (HUC10)
HSPF Subwatersheds
Barely Impaired Stream
Nearly Impaired Stream
Nearly Exceptional Stream
MDNR Priority Areas
Nearly impaired and nearly exceptional are assessed relative to FIBI, MIBI, or both,
Suspected stressors for barely impaired include DO/eutrophication, nitrate, TSS, habitat, and flow/connectivity.
N
0
2.5
5
Miles
MPCA AND MDNR PRIORITIZATION INPUTS
WAGZ Comprehensive Watershed Management Plan
FIGURE 3-5
BARR
Barr Footer: ArcGIS 10.8.1, 2021-04-28 10:29 File: \\barrcom\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure 3-5 - MPCA and MDNR Priority Inputs.mxd User: cmb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Kenyon
Wanamingo
Goodhue
Zumbrota
Bellechester
Mazeppa
Zumbro Falls
Millville
Hammond
Lake City
Wabasha
Kellogg
Minneiska
WISCONSIN
MINNESOTA
Lake Pepin
Bullard Creek
Hay Creek
Wells Creek
Gilbert Creek
Miller Creek
Goodhue County
Wabasha County
Cold Spring Brook
Trout Brook
North Fork Zumbro River
Spring Creek
Albany Creek
Trout Brook Creek
Shingle Creek
Pearl Creek
Middle Creek
West Indian Creek
Long Creek
Silver Spring Creek
Dry Run Creek
Lake Zumbro
Pine Island
Goodhue County
Olmsted County
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Plainview
Elgin
Wabasha County
Olmsted County
Olmsted County
Winona County
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Goodhue County
Dodge County
N. Branch Middle Fork Zumbro River
Middle Fork Zumbro River
Medford
West Concord
Milliken Creek
Harkcom Creek
Dodge County
Olmsted County
S. Branch Middle Fork Zumbro River
Owatonna
Rice Lake
Mantorville
Rochester
Claremont
Dodge Center Creek
Dodge Center
Kasson
Masten Creek
Byron
Silver Creek
Cascade Creek
Bear Creek
Willow Reservoir
Salem Creek
Eyota
Dover
Saint Charles
Utica
Lewiston
Badger Run
Willow Creek
South Fork Zumbro River
Hayfield
Steele County
Dodge County
Blooming Prairie
Steele County
Freeborn County
Dodge County
Mower County
Stewartville
Olmsted County
Fillmore County
Chatfield
Winona County
Fillmore County
Study Area
Watercourses
Pond or Lake
Municipal Boundary
County Boundary
State Boundary
Subwatersheds (HUC10)
HSPF Subwatersheds
Priority Areas
Protect 1
Restore 1
Protect 2
Restore 2
Protect 3
Restore 3
Higher Priority
Lower Priority
Priority Areas (v3) are based on HSPF pollutant loading scores as follows:
Load 0-3 = Priority 3
Load 4-6 = Priority 2
Load 7-8 = Priority 1
and presence or absence of impaired waters to determine restore or protect, respectively. Priority adjusted 1 higher if in a Zonation area, and adjusted 1 lower if nearly exceptional
N
0
2.5
5
Miles
PRIORITY AREAS FOR SURFACE WATER QUALITY IMPLEMENTATION
WAGZ Comprehensive Watershed Management Plan
FIGURE 3-6
BARR
Barr Footer: ArcGIS 10.8.1, 2021-04-28 11:36 File: \\barr.com\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure 3-6 - Priority Areas for Surface Water Quality Implementation.mxd User: cml3

Table 3-4 Surface water priority area breakdown

Surface Water quality priority classification	Percent of Planning Area		
	Mississippi River-Lake Pepin	Zumbro River	Total
Protect 1	0.5%	5.5%	43%
Restore 1	--	37.6%	
Protect 2	3.4%	12.8%	39%
Restore 2	4.7%	18.5%	
Protect 3	1.8%	2.2%	17%
Restore 3	2.5%	10.8%	
Total	13.0%	87.0%	100%

See Figure 3-6.

During Plan development, the Partnership discussed possible ways to allocate resources to projects in areas of different priority. The Partnership will focus on Level 1 and Level 2 priority areas during the implementation of this Plan, with a significant portion of implementation funding directed to those areas (see Table 6-4). Focus on Level 3 priority areas will be deferred until later during Plan implementation and may receive fewer financial resources (see Table 6-4). Note that the final apportioning of resources between projects in Level 1, 2, and 3 priority areas is dependent upon individual project scoring criteria established and maintained by the Partners (see Section 6.1.1.1).

Field-scale targeting of best management practices within priority subwatersheds is described in Section 4.

3.3.2 Priority Areas for Groundwater Quality

The Partnership identified groundwater contamination as a Level 1 priority issue. During Plan development, the Planning Work Group and Technical Advisory Group reviewed available groundwater quality data and natural resource datasets to assess the scope of the issue (see Section C.5). Data considered during Plan development included:

- Soil types (see Figure C-5)
- Estimated groundwater recharge (see Figure C-8)
- Wellhead protection areas and drinking water supply management areas (DWSMAs, see Figure C-9)
- Pollution sensitivity of near-surface materials (see Figure C-10)
- Geologic formations including location of Karst geology (see Figure C-11)
- Pollution sensitivity of wells (see Figure C-12)
- Private well water quality monitoring data collected by counties, MDA's township testing program, and the Southeast Minnesota Groundwater Monitoring Network

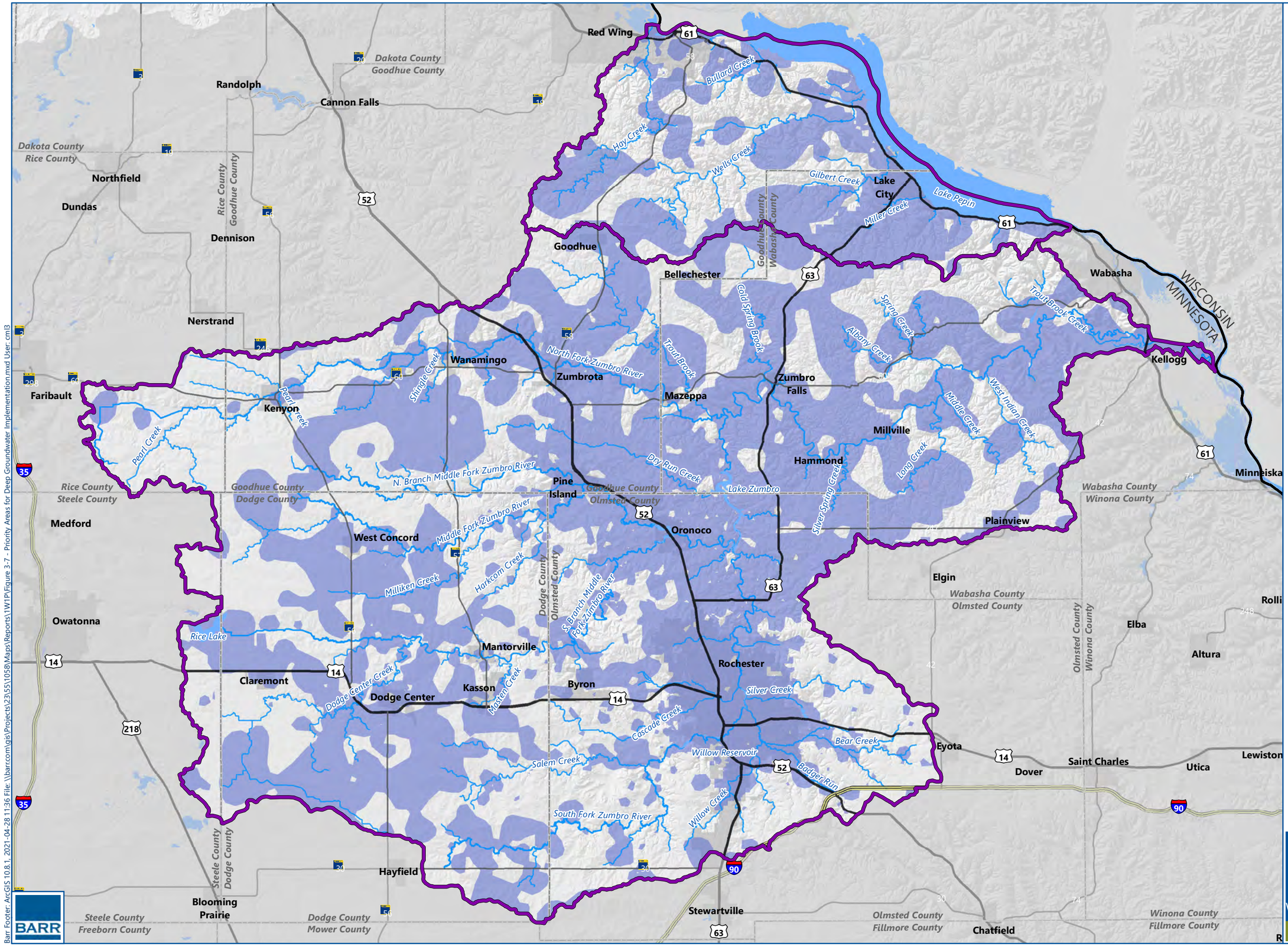
Because the nature of groundwater contamination and proposed protection strategies differ between deep and shallow aquifers, the Partnership delineated priority areas for deep groundwater and shallow groundwater issues separately.

Deep groundwater priority areas include areas of high or moderate pollution sensitivity of wells and DWSMAs categorized as having moderate or high vulnerability. These areas are presented in Figure 3-7.

The Partnership delineated priority areas to address near-surface groundwater issues through an iterative process that included convening a separate groundwater technical advisory group (including MDH, MDA, MDNR, Olmsted County/SWCD, Dodge County). Discussion and analysis considered the sensitivity of near surface materials to pollution as well as areas with concentrated occurrences of groundwater nitrogen above 10 mg/L as identified through recent monitoring. Discussion also addressed the extent of Decorah Edge areas (including areas protected by Olmsted County ordinance as an additional zoning overlay). The area mapped by Olmsted County was extended by mapping areas of similar geologic characteristics (surficial soil types and depth to bedrock less than 10 feet) outside Olmsted County. This information was used to delineate two levels of near-surface groundwater priority, presented in in Figure 3-8.

The groundwater priority areas presented in Figure 3-7 and Figure 3-8 will be used to guide future implementation, including coordination of a comprehensive groundwater monitoring plan developed in cooperation with state agencies (implementation item GWQ-10). The Partners will coordinate with MDH, MDA, and MDNR and other agencies that monitor groundwater to ensure that local monitoring needs are considered. Outcomes of groundwater monitoring may result in refinements to the groundwater priority areas and/or targeting of groundwater-related implementation activities.

While the groundwater priority areas serve as a basis for focusing partner action at a planning level, the implementation of BMPs at specific locations in the watershed should consider site-specific characteristics (e.g., well-depth, presence of confining layers) depending upon the primary goal of the BMP. Groundwater priority areas may also be cross-referenced with surface water priority areas (see Figure 3-6) for the prioritization and targeting of BMPs and projects with multiple benefits (e.g., manure management plans, cover crops).


Red Wing
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Goodhue
Zumbrota
Bellechester
Mazeppa
Zumbro Falls
Millville
Hammond
Lake City
Wabasha
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Lake Pepin
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Wells Creek
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Shingle Creek
Pearl Creek
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Albany Creek
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West Indian Creek
Middle Creek
Long Creek
Dry Run Creek
N. Branch Middle Fork Zumbro River
Lake Zumbro
Silver Spring Creek
Pine Island
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Winona County
Elba
Altura
Rolli
Owatonna
Rice Lake
Mantorville
Claremont
Dodge Center Creek
Dodge Center
Kasson
Masten Creek
Byron
Rochester
Silver Creek
Cascade Creek
Bear Creek
Willow Reservoir
Salem Creek
Eyota
Dover
Saint Charles
Utica
Lewiston
Badger Run
Willow Creek
South Fork Zumbro River
Steele County
Dodge County
Hayfield
Blooming Prairie
Steele County
Freeborn County
Dodge County
Mower County
Stewartville
Olmsted County
Fillmore County
Chatfield
Winona County
Fillmore County
Study Area
Watercourses
Pond or Lake
Municipal Boundary
County Boundary
State Boundary
Deep Groundwater/Well Priority Area
Priority areas include areas of high or moderate pollution sensitivity of wells and DWSMAs of moderate or high vulnerability.
N
0
2.5
5
Miles
PRIORITY AREAS FOR DEEP GROUNDWATER IMPLEMENTATION
WAGZ Comprehensive Watershed Management Plan
FIGURE 3-7
Barr Footer: ArcGIS 10.8.1, 2021-04-28 11:36 File: \\barrcom\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure 3-7 - Priority Areas for Deep Groundwater Implementation.mxd User: cml3
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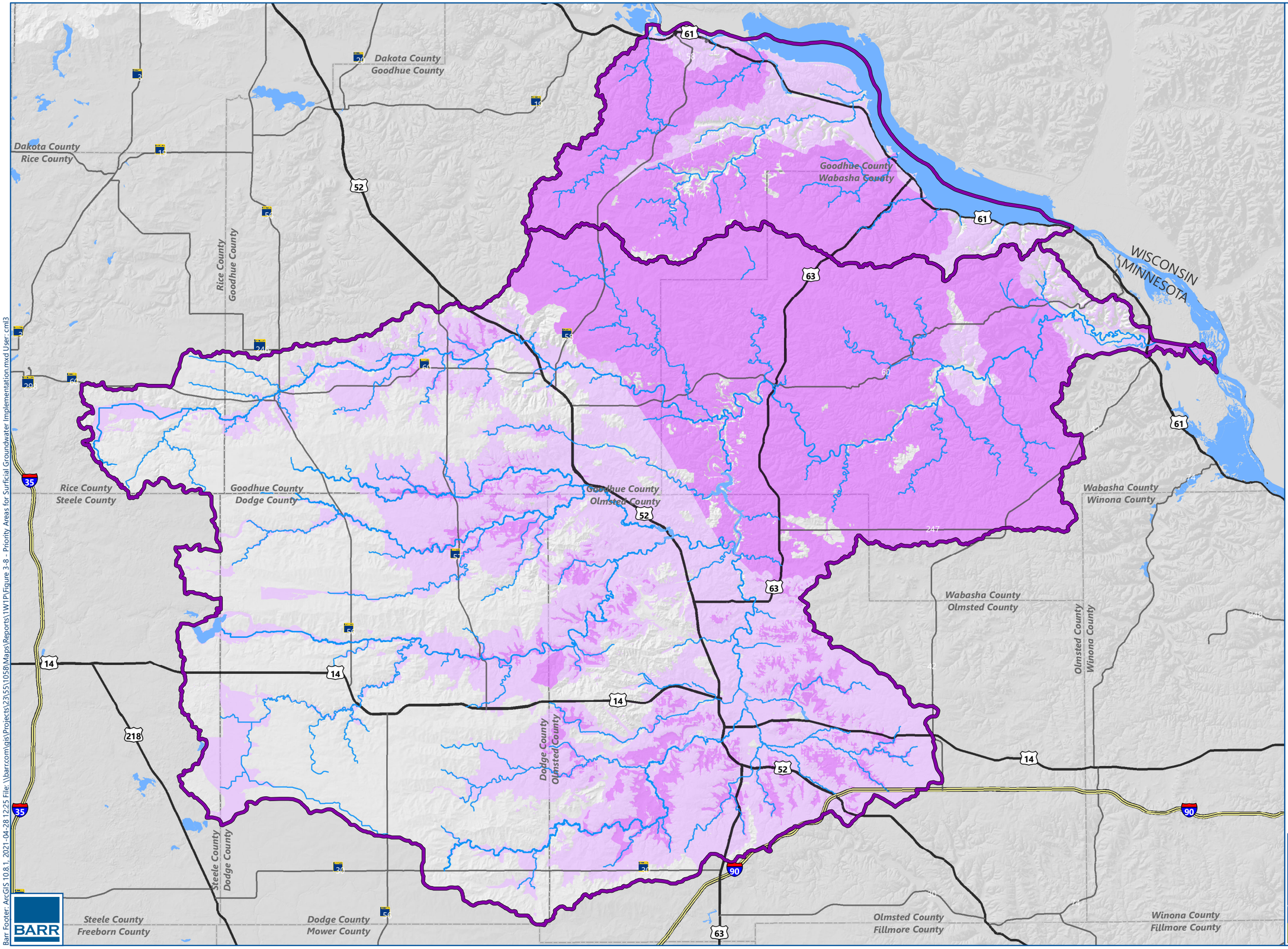


Study Area
Watercourses
Pond or Lake
County Boundary
State Boundary

Near Surface GW Priority

Lower Priority
Higher Priority

Lower priority areas include areas identified as having moderate or high pollution sensitivty of near surface materials and 1000 ft buffer around Decorah Edge areas.

Higher priority areas additionally include:
- Decorah Edge areas
- Areas with concentrated occurrances of ground-water N above 10 mg/L (based on Partner, MDH, and MDA township data)
- Areas tributary to trout streams

Data sources:
Watercourses from Public Water Inventory (PWI).
Ponds and lakes from National Hydrography Dataset (NHD).

N

0 2.5 5
Miles

PRIORITY AREAS FOR SURFICIAL GROUNDWATER IMPLEMENTATION
WAGZ Comprehensive Watershed Management Plan

FIGURE 3-8

BARR

Barr Footer: ArcGIS 10.8.1, 2021-04-28 12:25 File: \\barrcom\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure 3-8 - Priority Areas for Surficial Groundwater Implementation.mxd User: cml3

3.3.3 Priority Areas for Excessive Flooding

Excessive flooding was identified by the Partnership as a Level 1 priority issue. During Plan development, the Planning Work Group and Technical Advisory Group reviewed available hydrologic datasets, including flow monitoring, floodplain mapping, and runoff modeling (see Section C.9).

The Partnership recognizes that increased flow, river stage, and flood risk are affected by increased runoff (as well as climate trends and increased shallow groundwater flow). Therefore, the Partnership included runoff (as estimated by watershed-wide HSPF modeling, see Figure C-26) as a "pollutant" in prioritizing subwatersheds for implementation actions (see Section 3.3.1 and Figure 3-6), recognizing that many BMPs implemented with a primary goal of addressing surface water quality issues may also reduce runoff. The Partnership will also use subwatershed estimates of runoff (see Figure C-26) in prioritizing the implementation of BMPs focused on reducing runoff and peak flows, targeting projects in subwatersheds with higher runoff values. The Partnership has identified the lower reaches of the Zumbro River as a priority area for floodplain reconnection projects due to the presence of riparian wetlands and opportunities for multi-benefit improvements; the Partnership will coordinate with the MDNR to implement projects in this area,

Estimates of runoff are not necessarily correlated with flood risk or impacts. Hydrologic and hydraulic modeling exists for portions of the planning area, although model platforms, inputs, and scale vary. As part of implementation, the Partnership seeks to evaluate flood risk in previously unmodeled portions of the watershed and develop subwatershed-specific peak flow rate reduction goals (see Table 6-4). In addition, in 2020 the City of Rochester began updating the city's stormwater management plan that will evaluate flood risk issues and identify flood risk reduction efforts within the city. When additional hydrologic and hydraulic data is available, the Partnership may refine priority areas for flood risk reduction activities, as needed.

4 Targeting of Field Practices

The geographic prioritization performed at the subwatershed scale (see Section 3.3) is intended to focus the Partnerships efforts over the next 10 years. 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 Planning Work Group and Advisory Committee considered the results of existing water quality modeling and geospatial information to identify targeted potential project opportunities. Application of these assessments to identify potential project locations is summarized in the following sections. The potential project locations are presented in Figure 4-1.

4.1.1 Digital Terrain Analysis

Digital terrain analysis was used 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 beneficial field practices (e.g., filter strips, water and sediment control basins) could likely be implemented, as well as the area tributary to each location.

Digital terrain analysis is available for the Zumbro River watershed from 2015 work prepared for the Zumbro Watershed Partnership – that analysis identified 205 potential project locations and a top 50 priority locations (based on pollutant loading and local geospatial characteristics). Concurrent with the development of this Plan, similar analysis was performed for the 233 square mile Mississippi River-Lake Pepin watershed. That analysis identified 78 potential project locations that were ranked based on treated area and geospatial characteristics; the top 50 locations identified. Potential project locations in both the Zumbro River and Mississippi River-Lake Pepin watersheds are presented in Figure 4-1. 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.

This analysis also included development of a hierarchy of recommended practices for each location based on agro-ecoregion in which the potential project is located (see Table 4-1). Agro-ecoregions are presented in Figure 4-2. The suitability of practices relative to eco-region may be referenced during implementation as the Partners seek landowner cooperation for BMP implementation.

The partnership may not address all potential project locations within the next 10 years – the implementation schedule (see Table 6-4) lays out a 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 4-2. 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.

Table 4-1 BMP suitability by agro-ecoregions in the planning area

Natural Resource Conservation Service (NRCS) Practice Code	NRCS Number	Alluvium & Outwash	Blufflands	Level Plains	Rochester Plateau	Rolling Moraine	Steeper Alluvium	Undulating Plains
Conservation Crop Rotation	328	M	H	M	H	H	M	L
Conservation Tillage	329	M	L	M	L	H	M	M
Contour Buffer Strip	332	L	M	M	M	M	L	M
Contour Farming	330	M	H	M	H	H	M	M
Cover Crop	340	M	H	H	H	H	M	L
Critical Area Planting	342	M	L	M	M	M	H	L
Diversion	362	L	M	M	H	L	L	L
Drainage Water Management	554	M	L	M	M	M	M	L
Field Border	386	M	H	H	H	H	M	H
Grade Stabilization	410	L	H	M	H	L	M	L
Grass Filter Strip	393	M	M	H	H	H	H	M
Grass Waterway	412	H	H	H	H	M	H	H
Nutrient and Manure Management	590	H	H	H	H	H	H	H
Pasture & Hayland Planting	512	M	H	--	H	H	--	L
Prescribed Grazing	528A	M	M	--	M	M	--	L
Sinkhole Treatment	725	--	M	--	H	--	--	L
Streambank & Shoreline Protection	580	L	H	L	M	M	M	L
Strip-cropping	585	--	H	M	H	--	--	L
Terrace	600	--	M	--	H	M	--	M
Use Exclusion / Fencing	472/382	M	L	L	M	L	--	M
Upland Wildlife Habitat Mgmt.	645	--	M	--	M	--	--	--
Water & Sediment Control Basin	638	--	H	--	H	H	--	L
Wetland Restoration	657	L	--	M	--	L	--	L

Note: H = high suitability, M = moderate suitability, L = low suitability; "—" indicates practice/ecoregion combinations not evaluated at time of development.

4.2 Estimating Benefits and Costs of Field Water Quality Practices

Targeted locations for water quality improvement best management practices (BMPs) were developed based on digital terrain analyses (see Section 4.1.1). These locations include catchment outlets where field practices (e.g., filter strips, water and sediment control basins) could likely be implemented. These potential project opportunities are presented watershed-wide in Figure 4-1. Figure 4-3 presents a high-resolution example of this analysis applied to the Lake Pepin subwatershed, including the estimated drainage area tributary to each potential project location.

HSPF modeling of the Zumbro River watershed and Mississippi River-Lake Pepin watershed was performed prior to the development of this Plan and provides estimates of pollutant loading from the landscape (see Section C.8.7). 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 Zumbro WRAPS and MRLP WRAPS reports.

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 sediment (TSS) loading rates as presented in Figure C-18, Figure C-19, and Figure C-20, respectively. The watershed divides used in the HSPF modeling efforts are more refined relative to the planning subwatersheds used in Plan development (see Figure C-3). For planning level estimates of cumulative field scale project benefits, average unit area loading rates for the 8 planning subwatersheds were calculated using GIS and are presented in Table 4-2. The number of potential project locations and corresponding tributary drainage area in each planning subwatershed, as estimated from digital terrain analysis, are also included in Table 4-2.

Table 4-2 Estimated pollutant loading aggregated to planning subwatersheds

Planning Subwatershed	Total Area (acres)	TN loading[1] (lbs/acre/yr)	TP loading[1] (lbs/acre/yr)	Sediment loading[1] (tons/acre/yr)	Potential BMP Locations[3]	Treated Area (acres)
Hay Creek	45,809	9.03	0.40	0.02	15	229.9
Wells Creek	45,956	10.54	0.48	0.03	24	439.5
Lake Pepin	57,393	9.98	0.45	0.03	39	405.3
MRLP Subtotal[2]	**149,158**	**9.86**	**0.44**	**0.03**	**78**	**1,074.7**
North Fork Zumbro	153,538	17.89	0.75	0.23	48	5,000.3
Middle Fork Zumbro	139,649	18.94	0.82	0.26	50	5,682.7
S. Branch Middle Fork Zumbro	138,314	17.71	0.88	0.30	19	3,032.2
South Fork Zumbro	226,091	15.01	0.78	0.29	47	4,261.0
Zumbro River (lower)	251,776	11.51	0.55	0.21	41	6,077.2
Zumbro Watershed Subtotal[2]	**909,367**	**15.54**	**0.73**	**0.25**	**205**	**24,053.4**
Total	**1,058,525**	**--[2]**	**--[2]**	**--[2]**	**283**	**25,128.1**

(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) Average pollutant loading values are presented for the two major watersheds but are not averaged over the entire study area due to differences in the HSPF models for each major watershed.
(3) Potential project locations identified in Figure 4-1.

4.2.1.1 Pollutant Loading to Proposed BMP Locations – HSPF subwatershed scale

The data presented in Table 4-2 is aggregated to the 8 planning subwatersheds. The HSPF model subdivides the planning area into 151 subwatersheds, providing a much finer resolution of pollutant loading estimates (i.e., pollutant loading rates vary between drainage areas tributary to proposed BMPs). Subwatershed-specific estimates of sediment, total nitrogen, and total phosphorus loading to each individual BMP are useful for tracking the estimated benefit of constructed projects (see Section 4.2.5). HSPF subwatershed-specific pollutant loading rates are applied to the BMPs included in each HSPF subwatershed to estimate the cumulative project benefits using the HSPF-SAM tool (see Section 4.2.4.1).

The average drainage area treated per project location differs between the MRLP watershed and the Zumbro River watershed due in part to the disparate landscapes. The average area draining to the 78 potential project locations in the MRLP watershed is approximately 14 acres per project, versus approximately 90 acres per project in the Zumbro River watershed. This may result in lower absolute pollutant reductions within the MRLP watershed relative to Zumbro River watershed, but also lower implementation costs per project (due to generally smaller-scale projects),

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

Potential reduction in pollutant loading realized by the implementation of 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 4-3.

In practice, 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, however, the specific BMPs and location of implementation are unknown. Therefore, an approximate average pollutant removal efficiency was assumed for each pollutant based on the six BMP groups presented in Table 4-3. The pollutant reductions achieved will ultimately depend on the specific BMPs implemented and may vary widely according to the associated pollutant removal efficiencies. 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 6-4).

The estimated total pollutant load reduction for each pollutant in a given catchment (i.e., area tributary to a BMP) may be 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 4-4 presents an example of this analysis applied in the Middle Fork Zumbro River planning subwatershed, which includes 50 potential BMP locations treating approximately 5,700 acres. The corresponding cost may be estimated using the present value (or annualized) cost averaged for the six BMP groups in Table 4-3 and multiplying by the total treated area in the Middle Fork Zumbro River planning subwatershed.

For the purposes of developing planning level costs associated with these practices to be included in the implementation schedule (see Table 6-4), an average project cost was estimated for each planning subwatershed. The average costs are based on the approximate average per acre BMP cost derived from the SAM documentation (and summarized in Table 4-3), average project treated area, and including an additional 50% 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). Average project costs for planning range from approximately $3,000 per project in the Lake Pepin planning subwatershed to $43,000 in the South Branch Middle Fork Zumbro River planning subwatershed.

Table 4-3 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.)	Approx. cost per treated acre[4] (including 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	$135
	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	$330
	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	$30
	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	$900
	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	$195
	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[e]	90	$50	$75
Average		**~30%**			**~25%**			**~60%**	**$ 180**	**$ 270**

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 comment letter;

(4) Estimated costs are present value assuming 10-year lift extrapolated based on Table 5-1 of SAM BMP Reference Manual (RESPEC, 2017)

Table 4-4 Summary of estimated pollutant removal in the Middle Fork Zumbro River planning subwatershed

Pollutant	Total Pollutant Load[1]	Total Load to all potential BMPs[1]	Total Reduction	Reduction per BMP location
Total Nitrate	2,645,500 lbs/yr	107,650 lbs/yr	32,300 lbs/yr	646 lbs/yr
Total Phosphorus	114,100lbs/yr	4,643 lbs/yr	1,393 lbs/yr	27.9 lbs/yr
Sediment	35,800 tons/yr	1,460 tons/yr	873 tons/yr	17.5 tons/yr

(1) Sediment, TN, and TP loading based on HSPF model results

4.2.3 Establishing Field Scale Pollutant Load Reduction Goals for Subwatersheds

The methods described in Sections 4.2.1 and 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. In practice, water quality improvement practices may not be implemented at all locations identified in Figure 4-1. Some potential BMP locations identified in Figure 4-1 may ultimately not be suitable for field practices, while additional projects may be identified at other locations with different pollutant loading and spatial characteristics. In addition, fiscal resources may limit the Partnerships ability to implement all planned projects during the 10-year life of this Plan.

Therefore, the Partners established pollutant reduction goals corresponding to the planned implementation of a given number of projects within each planning subwatershed. The number of planned projects is shown distributed among the planning area in item SWQ-1 of the Implementation Schedule (see Table 6-4). The corresponding pollutant load reduction goals are presented in Table 5-3. The number of projects planned for each planning subwatershed and timing of implementation are based on the determination of priority areas (see Section 3.3) and implementation budget (see Section 6).

4.2.4 Establishing Resource-specific Pollutant Load Reduction Goals

The methods described in Sections 4.2.1 and 4.2.2 allow the Partners to estimate the potential pollutant reduction achieved by a BMP at the point of implementation. These reductions may be summed to estimate the total pollutant load reduction at field scale. However, this method may 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).

4.2.4.1 Estimating Pollutant Reduction using HSPF-SAM

The Partnership used the HSPF-SAM watershed assessment tool to estimate the cumulative in-stream pollutant load reduction at the outlets of the eight planning level watersheds. The HSPF-SAM tool allows the user to select the type of BMP, 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 pollutant trapping BMPs (e.g., water and sediment control basins) or cover crops. For both the Zumbro River watershed and the Mississippi River-Lake Pepin watershed, separate HSPF-SAM model runs were performed assuming the following implementation:

- 30% of applicable area treated with water and sediment control basins
- 50% of applicable area treated with water and sediment control basins
- 30% of applicable area treated with corn and soybean cover crops
- 50% of applicable area treated with corn and soybean cover crops

The pollutant removal efficiencies used in each HSPF-SAM model run were set to the values presented in Table 4-3 – 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 (averaged from both BMP types) at the downstream end of each planning subwatershed (e.g., North Fork Zumbro River). For planning subwatersheds with multiple outlets (e.g., Hay Creek) the pollutant load at each outlet tributary was summed to get a subwatershed load. The "per treated acre" pollutant reduction was multiplied by the estimated acres treated during the 10-year Plan implementation (according to the implementation schedule, see Table 6-4) in order to calculate the cumulative pollutant reduction at the outlet of each planning subwatershed. These pollutant reductions, estimated for total phosphorus, total suspended sediment, and total nitrogen, are presented in Table 5-3 under "10-year Plan Goals."

4.2.5 Tracking Pollutant Reduction Benefits through Implementation

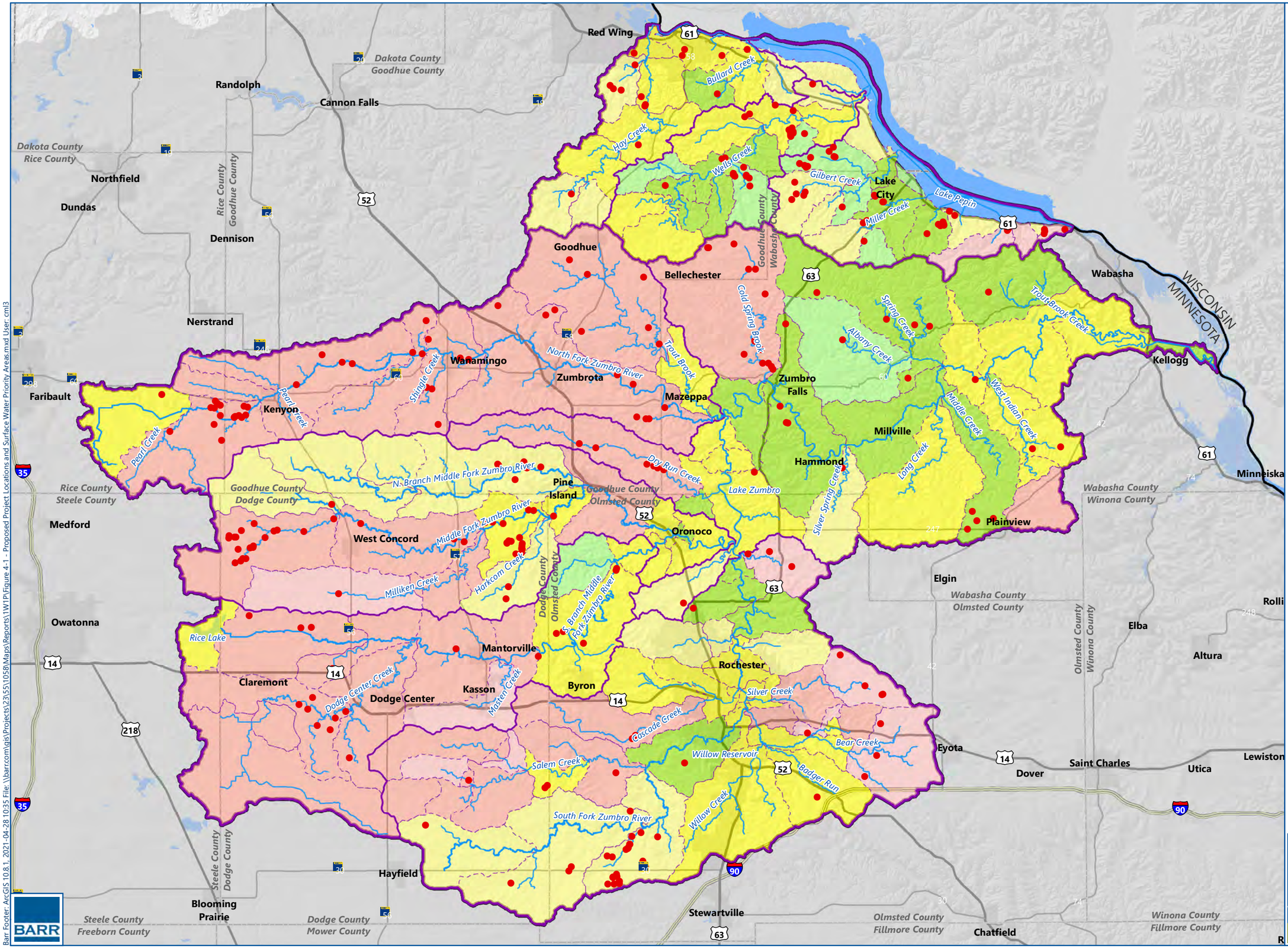
The methods described in Section 4.2.1 result in a tabular output for each planning subwatershed. The tabular output includes the following information for each proposed BMP location as a separate row within a spreadsheet:

- Drainage area (i.e., treated area)
- Sediment loading (tons/year)
- Total nitrogen loading (lbs/year)
- Total phosphorus loading (lbs/year)

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 4-3 of this Plan) or enter user-defined pollutant reduction estimates based on case-specific considerations. The user may also enter an "effective treated area" that differs from the total drainage area based on site-specific BMP design. The spreadsheet calculates the corresponding load reduction (i.e., mass/time) estimated for the BMP (based on existing field-scale load

estimates from HSPF modeling). The spreadsheet sums the 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 5-3.

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. Note that while only a few projects are within the direct drainage area of Lake Zumbro, approximately 90 proposed project sites are located upstream of Lake Zumbro and will contribute to the cumulative reduction of nutrients to Lake Zumbro, specifically phosphorus and sediment.



Study Area
Watercourses
Pond or Lake
Municipal Boundary
County Boundary
State Boundary
Subwatersheds (HUC10)
HSPF Subwatersheds
Priority Project Locations

Priority Areas

Protect 1	Higher Priority
Restore 1	
Protect 2	
Restore 2	
Protect 3	Lower Priority
Restore 3	

Priority Areas (v3) are based on HSPF pollutant loading scores as follows:
Load 0-3 = Priority 3
Load 4-6 = Priority 2
Load 7-8 = Priority 1
and presence or absence of impaired waters to determine restore or protect, respectively. Priority adjusted 1 higher if in a Zonation area, and adjusted 1 lower if nearly exceptional

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PROPOSED PROJECT LOCATIONS AND SURFACE WATER PRIORITY AREAS
WAGZ Comprehensive Watershed Management Plan
FIGURE 4-1

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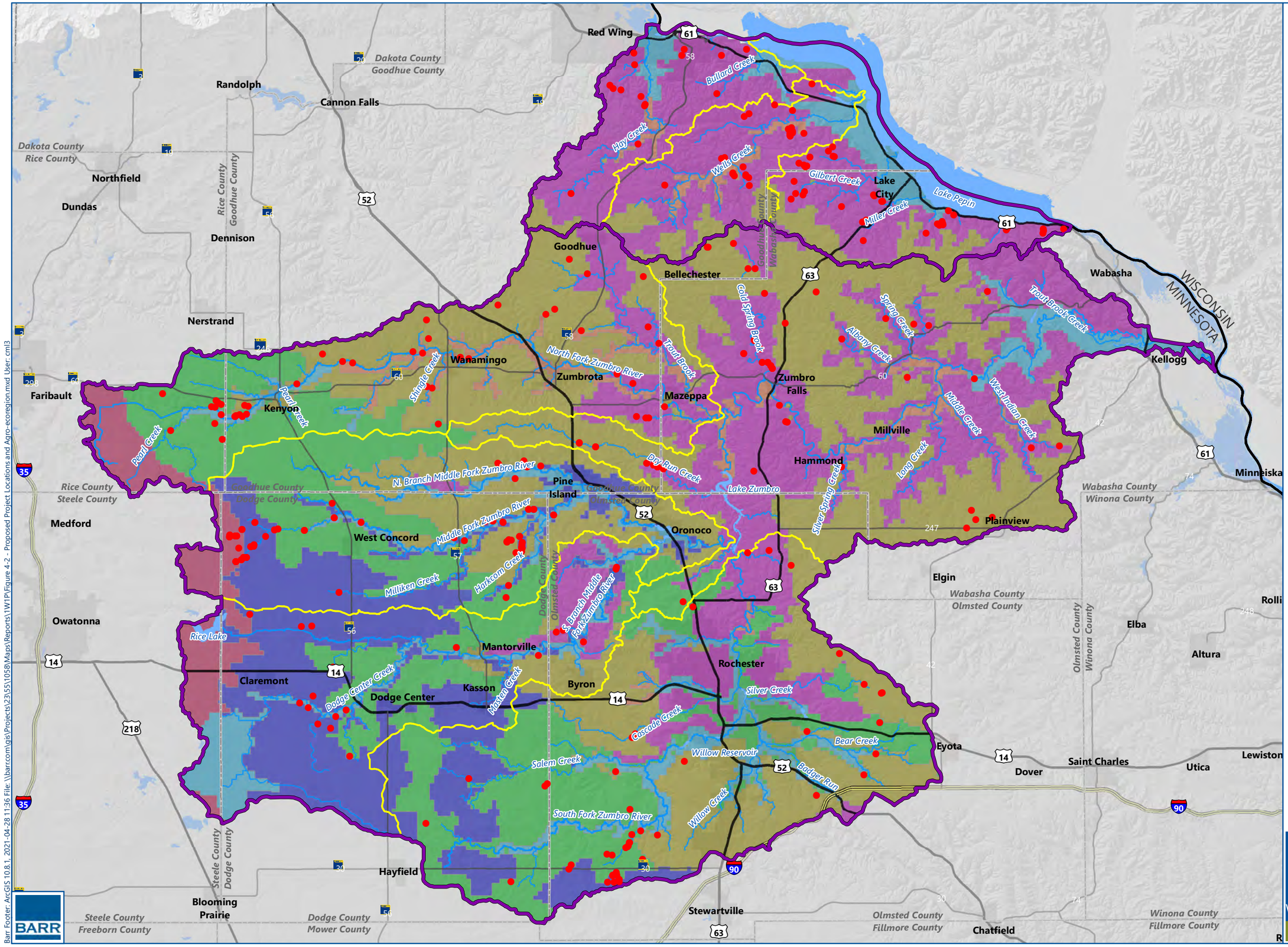
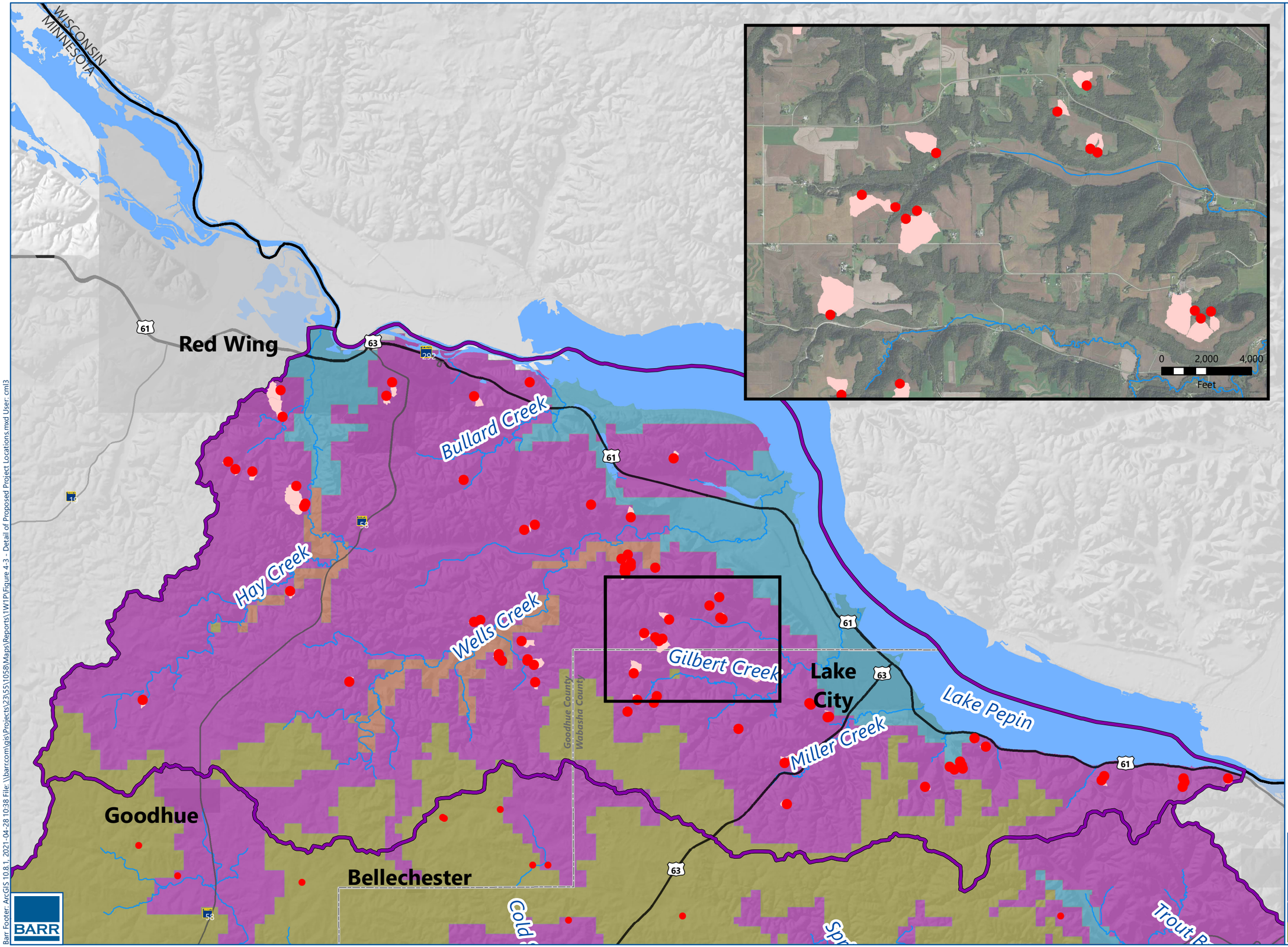


POTENTIAL PROJECT LOCATIONS AND AGRO-ECOREGIONS
WAGZ Comprehensive Watershed Management Plan

FIGURE 4-2

BARR

Barr Footer: ArcGIS 10.8.1, 2021-04-28 11:36 File: \\barrcom\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure 4-2 - Proposed Project Locations and Agro-ecoregion.mxd User: cml3



Study Area
Watercourses
Pond or Lake
Municipal Boundary
County Boundary
State Boundary
Potential Project Sites
Project Drainage Areas

Agro-ecoregions

Alluvium & Outwash
Blufflands
Rochester Plateau
Steeper Alluvium

Argo-ecoregions used in ZWP top 50 BMP analysis

DETAIL OF PROPOSED PROJECT LOCATIONS

WAGZ Comprehensive Watershed Management Plan

FIGURE 4-3

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Barr Footer: ArcGIS 10.8.1, 2021-04-28 10:38 File: \\barrcom\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure 4-3 - Detail of Proposed Project Locations.mxd User: cml3

5 Establishment of Measurable Goals

This section summarizes the development of measurable goals to address the issues prioritized by the Partners (see Section 3). Goals may be applicable watershed-wide or focused on specific spatial areas, natural resources, or target audiences. Goals should also consider the prevention of future water and natural resource management issues.

The measurable goals developed for this Plan are presented in Table 5-2 and Table 5-3.

5.1 Goal Development Process

The Partners developed measurable goals through an iterative process performed over several meetings involving the Planning Work Group, Technical Advisory Group, and Policy Committee (see Table 2-1).

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

- Goals from existing management plans, studies, reports, data and information, including:
    - County Water Management Plans
    - Mississippi River-Lake Pepin WRAPS report
    - Mississippi River-Lake Pepin TMDL report
    - Rochester Comprehensive Plan and Surface Water Management Plan
    - Zumbro River WRAPS report
    - Zumbro River TMDL report
    - Zumbro River Watershed Landscape Stewardship Plan
    - Zumbro River GRAPS report
- Results from previous modeling/analysis efforts:
    - Zumbro River priority project identification
    - Mississippi River-Lake Pepin Scenarios Report
- Existing implementation programs and schedules
- Input received during Waterside Chats (see Section 2.5 and Appendix B)
- Input from the Planning Work Group
- Input from Technical Advisory Group members
- Input from Policy Committee members

Generally, goals were developed first at a qualitative level and refined to include quantifiable elements where supported by data availability. 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 nine priority issue areas. To address the "degraded surface water quality" issue area, the Partners developed goals that are specific to particular water resources and pollutants of concern; these goals were separated into a second table specific to surface water quality (Table 5-3).

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. Therefore, the Plan identifies **10-year goals** 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.

In some cases, goals are anticipated to be refined or added to over the 10-year life of this Plan. For example, the Plan includes a goal to reduce runoff by an average of 0.25 inches across the watershed (goal FLD-1 in Table 5-2). More specific runoff reduction/storage goals will be developed for individual subwatersheds based on future hydrologic and hydraulic modeling to be completed during Plan implementation (goal FLD-2 in Table 5-2). Modeling results will further inform the overall watershed runoff reduction goal and allow the Partners to pursue the overall goal in a manner that maximizes available opportunities and achieves associated goals (e.g., reducing flood risk, goal FLD-4).

5.2 Measurable Goals and Associated Details

The measurable goals developed for this Plan are presented in Table 5-2 and Table 5-3. Table 5-2 includes goals to address all priority issues. Table 5-3 presents a subset of goals to address the "degraded surface water quality" issue area specific to the eight planning subwatersheds and applicable pollutants and/or stressors.

Table 5-2 and Table 5-3 includes the following information:

Priority Issue – Goals are grouped according to priority issues. Level 1 issues appear first in Table 5-2, followed by Level 2 and Level 3 issues. Table 5-3 includes goals addressing the Level 1 issue area of degraded surface water quality.

Subwatershed or Area – 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 level that is more specific than Level 1, Level 2, or Level 3. 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). Similarly, groundwater contamination is subdivided into goals addressing nitrate and goals addressing *E. coli*.

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. For priority issues related to water quality, the long-term goal includes achieving applicable water quality standards.

Long-term Goal Rationale – 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 Planning Work Group, Technical 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. Where existing data and analyses allow, quantitative goals have been assigned. Qualitative goals have been identified where data gaps exist, with an emphasis on filling those data gaps.

10-year Goal ID– This field presents an identifier unique to each goal such that implementation tasks presented in Table 6-4 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., Zumbro River WRAPS report) or input from the Planning Work Group, Advisory Committee, and/or Policy Committee.

10-year Goal Measures – 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 results, modeling results, reports or other measures tailored to the individual goal. Measures are cross-referenced to items included in the implementation schedule (Table 6-4).

Related Implementation Items – This field includes the "Item ID(s)" of items included in the implementation schedule (Table 6-4) 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.

5.2.1 Level 1 Goals – Groundwater Contamination

Long-term goals addressing groundwater contamination in Table 5-2 are based on Federal and State drinking water standards and Minnesota Department of Health (MDH) health risk limits (HRLs) for nitrate and *Escherichia coli* (*E. coli*), as well as PWG goals for well management and emerging contaminants. 10-year goals (see Table 5-2) are focused on monitoring, education, and other activities needed to fill data gaps and address sources of *E. coli* and nitrates within the planning area. 10-year Plan goals were developed by the Partnership with significant input from the Technical Advisory Group, including the MDA, MDH, and MPCA in particular.

Goals addressing groundwater contamination are generally applicable throughout the planning area. Specific activities to address groundwater contamination in the implementation schedule (see Table 6-4) are targeted to specific geographic areas and/or audiences where the most benefit is anticipated (see also groundwater priority areas presented in Figure 3-6Figure 3-7 and Figure 3-8 and discussed in Section 3.3.2). The MDA has developed the Nitrogen Fertilizer Management Plan (NFMP) and Groundwater Protection Rule, which outline a process to prevent or minimize the impact of nitrogen fertilizer on groundwater. In combination, the NFMP and Groundwater Protection Rule, provide a

comprehensive effort to address nitrate in groundwater through voluntary adoption of practices and regulation, if necessary. . Actions outlined in the NFMP include working at the local level to implement nitrogen fertilizer management and other practices to mitigate nitrate impacts and protect groundwater.

Additional information is available from the MDA regarding the:

- Nitrogen Fertilizer Management Plan: https://www.mda.state.mn.us/pesticide-fertilizer/minnesota-nitrogen-fertilizer-management-plan
- Groundwater Protection Rule: https://www.mda.state.mn.us/nfr

5.2.2 Level 1 Goals – Excessive Flooding

Long-term goals related to excessive flooding include reducing runoff and increasing storage within the planning area, mitigating increases in peak flows in streams, and reducing flood risk to structures and major infrastructure. These long-term goals are consistent with Zumbro WRAPS, Mississippi River-Lake Pepin WRAPS, and local resource management plans. 10-year goals are focused on steps needed to achieve long-term goals, including the following (see Table 5-2):

- increasing watershed storage (i.e., retention) by 22,000 acre-feet (equivalent to 0.25 inches of runoff over the watershed)
- establishing subwatershed-specific storage and peak flow goals based on modeling results
- characterizing flood risk in un-modeled portions of the watershed
- managing and restoring floodplain areas to reduce risk to structures and infrastructure

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 critical components of the overall strategy to mitigate or minimize increases in peak streamflow (and minimize the impacts of associated flooding) observed in the watershed (see Section C.9). Increased hydrologic storage is an opportunity to reduce the impacts of flooding; hydrologic storage refers to places in the landscape that provide temporary or permanent water storage, including surface depression storage, floodplain storage, wetlands, and soil storage. Increased stormwater retention also reduces pollutant loading and erosion, leading to water quality benefits.

Although reductions in runoff volume are not necessarily proportional to reductions in peak flows, significant storage volumes likely occupying large areas will be necessary to achieve the Partnership's long-term goals. A range of potential watershed storage values were considered by the Partnership in establishing the 0.25-inch (i.e., 22,000 acre-feet) retention goal (see Table 5-1). Table 5-1 presents a range of runoff retention (in inches) as a percentage of average annual runoff (for the 1981-2019 approximate climate normal period), an equivalent storage volume, and corresponding footprints and depths.

Through discussion with the Advisory Committee, the PWG ultimately recommended an initial storage (i.e., retention) goal of 0.25-inch (i.e., 22,000 acre-feet), which was adopted by the Policy Committee; the Partners believe this goal is achievable within the 10-year planning timeline while maintaining progress towards long-term goals related to excessive flooding.

Table 5-1 Potential watershed storage depths, volumes, and equivalent runoff

Inches of Runoff	Percent of Annual Runoff (1991-2019)	Storage Volume (acre-ft)	Storage Area (acres and % of total watershed) based on Average Depth (in feet)							
			0.5 ft		1 ft		2 ft		4 ft	
			acres	% area	acres	% area	acres	% area	acres	% area
0.25	2.2%	22,053	44,107	4.2%	22,053	2.1%	11,027	1.0%	5,513	0.5%
0.5	4.4%	44,107	88,213	8.3%	44,107	4.2%	22,053	2.1%	11,027	1.0%
0.75	6.6%	66,160	132,320	12.5%	66,160	6.3%	33,080	3.1%	16,540	1.6%
1.0	8.8%	88,213	176,427	16.7%	88,213	8.3%	44,107	4.2%	22,053	2.1%
1.25	11.0%	110,267	220,533	20.8%	110,267	10.4%	55,133	5.2%	27,567	2.6%
1.5	13.2%	132,320	264,640	25.0%	132,320	12.5%	66,160	6.3%	33,080	3.1%

Updated modeling and hydrologic assessments are currently being performed for portions of the planning area. The planning area surrounding Rochester has been modeled with hydrologic and hydraulic models of varying scales. Additional analysis of previously unmodeled areas is planned to further characterize flood risk and establish subwatershed-specific goals; this activity is included in the Plan implementation schedule (see Table 6-4).

5.2.3 Level 1 Goals – Degraded Surface Water Quality

Long-term surface water quality goals presented in Table 5-2 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 5-3) are similar but also incorporate target load reductions based on the TMDLs, where available.

Plan (i.e., 10-year) surface water quality goals are specific to the eight planning subwatersheds and are presented in Table 5-3. 10-year goals include cumulative target load reductions for nitrogen, phosphorus, and sediment for each subwatershed based on existing pollutant loading and estimated number of projects to be implemented. These goals were developed using established water quality tools and following the methodology described in Section 4.2. Note that while the discussion of surface water

quality degradation (see Section 3.2.3) specifically references nitrate, goals are presented as total nitrogen for consistency with available modeling tools.

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 Zumbro WRAPS and Mississippi River-Lake Pepin WRAPS reports.

5.2.4 Level 1 Goals – Accelerated Erosion and Sedimentation

Long-term goals related to accelerated erosion and sedimentation include reducing the occurrence and severity of eroded streambanks, reducing loss of sediment from the landscape, and reducing TSS concentrations in streams and rivers to achieve water quality standards (see Table 5-2). 10-year goals include increasing runoff retention and storage within the watershed, increasing the use of cover crops and vegetated buffers, and implementing streambank stabilization and sediment reduction BMPs. Accelerated erosion and sedimentation issues are closely linked to degraded surface water quality. As such, additional 10-year goals include reductions in TSS loading in individual subwatersheds (see Section 5.2.1 and Table 5-3).

5.2.5 Level 2 Goals – Degraded Soil Health, Landscape Resiliency and Altered Hydrology, and Threats to Fish, Wildlife, and Habitat

Table 5-2 includes long-term and 10-year goals addressing the Level 2 issues of degraded soil health, landscape resiliency and altered hydrology, and threats to fish, wildlife, and habitat. Goals addressing these issues acknowledge existing data gaps while simultaneously recognizing the opportunity to achieve benefits through proactive action by the Partners. 10-year goals include further study to quantify the use and benefit of soil health practices (such as cover crops, perennial vegetation, and crop residue management), increasing the use of cover crops, forest cover, and perennial vegetation, and preserving wetlands and sites of biodiversity significance. Goals addressing threats to fish, wildlife, and habitat are based, in part, on applicable State rules and MDNR program guidance. The MDNR provided watershed-specific guidance in goal development through staff participation in the Advisory Committee.

The Partners recognize that some of the activities performed to address issues of degraded surface water quality, accelerated erosion and sedimentation, and excessive flooding may indirectly make progress towards Level 2 goals. For example, increased runoff retention achieved through select water quality field practices may simultaneously improve soil health and landscape resiliency.

5.2.6 Level 3 Goals – Threatened Groundwater Supply and Reduced Livability and Recreation

Table 5-2 presents long-term and 10-year goals addressing the Level 3 issues of threatened groundwater supply and reduced livability and recreation. Goals addressing these issues are generally focused on education 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 6-4).

Table 5-2 WAGZ Plan Measurable Goals by Issue Area

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 (Table 6-4) and associated measures/outputs
Level 1	Groundwater Contamination	Nitrate	Achieve decreasing nitrate trends in all public drinking water supplies and private wells that are tested	US EPA Drinking Water Standards and Health Advisory Tables (2018); MDH Drinking Water Standards and Guidance	Provide annual education/outreach opportunities to all communities with MDH approved Wellhead Protection Plans, and BMP technical assistance for all moderate and high vulnerable public water suppliers	GWQ-1	10 workshops (GWQ-14); 10 articles/handouts (GWQ-12)
					In groundwater priority areas (see figures), provide all private well owners access to well testing programs and education about water quality specific to drinking water	GWQ-2	Number of tested wells (1,000 wells over 10 years) (GWQ-8); Groundwater quality monitoring report (GWQ-7); 20 educational articles/handouts (GWQ-13); 10 well testing/maintenance clinics (GWQ-20);
					Establish nitrate-nitrogen trends for all public systems with average concentrations ≥3ppm over the last 10 years; identify systems with chronically high nitrate concentrations relative to the MCL	GWQ-3	Monitoring plan (GWQ-10) Groundwater monitoring report (GWQ-7); Groundwater quality monitoring database (GWQ-15); Nitrate trend analysis of tested wells and identification of priority systems (GWQ-9)
					Establish nitrate-nitrogen trends for monitored private wells with average concentrations ≥3ppm over the last 10 years located in groundwater priority areas; identify wells/areas with chronically high nitrate concentrations relative to the MCL	GWQ-4	Monitoring plan (GWQ-10) Groundwater monitoring report (GWQ-7); Groundwater quality monitoring database (GWQ-15); Nitrate trend analysis of tested wells and identification of priority systems (GWQ-9)
					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-5	Implementation of applicable BMPs (e.g., cover crop, reduced fertilizer application) - number of projects and estimated nitrogen load reduction (see Table 5-3); Number of nutrient, fertilizer, and/or manure management plans (100 plans) (GWQ-16); Increased acres of cover crops/perennial vegetation (2,000 acres) (ESC-6); Field days/site visits to promote soil health pratices (GWQ-17); Engagement of a nutrient management expert as shared service (GWQ-18);
					Minimize groundwater contamination resulting from infiltration in the Decorah Edge, near sinkholes, and other areas of Karst geology through regulation, incentives, and education	GWQ-6	Reviewed/revised ordinances guiding or regulating infiltration practices in Karst and other vulnerable areas (GWQ-21); Practices to protect/maintain "Decorah Edge Support Areas" (e.g., 3,000 acres committed to RIM/easements, 30 workshops) (LR-12); 10 well testing/maintenance clinics (GWQ-20); Targeted outreach to 100 property owners in priority areas (LR-12);

Table 5-2 WAGZ Plan Measurable Goals by Issue Area

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 (Table 6-4) and associated measures/outputs
Level 1	Groundwater Contamination	*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	In groundwater priority areas (see figures), provide all private well owners access to well testing programs and education about water quality specific to drinking water (repeated from GWQ-3)	GWQ-7	Number of tested wells (1,000 wells over 10 years) (GWQ-8); Groundwater quality monitoring report (GWQ-7); 20 educational articles/handouts (GWQ-13); 10 well testing/maintenance clinics (GWQ-20);
					Reduce *E. coli* loading through management of SSTS, un-sewered discharges, and feedlots	GWQ-8	Projects to address non-functioning SSTS (500 over 10 years) (GWQ-4); Projects to improve feedlots (25 over 10 years) (SWQ-8); Number of nutrient, fertilizer, and/or manure management plans (100 plans) (GWQ-16);
		Emerging contaminants	Understand and minimize the environmental and public health risks from emerging contaminants in groundwater	Advisory Committee and Planning Work Group; MDH guidance	Increase understanding of emerging contaminant presence in the watershed through groundwater quality monitoring and education efforts.	GWQ-9	Number of tested wells (1,000 wells over 10 years) (GWQ-8); Groundwater quality monitoring report (GWQ-7); 20 educational articles/handouts (GWQ-13); 10 well testing/maintenance clinics (GWQ-20);
		Well Management	Reduce risk to public health through appropriate well management and maintenance	Advisory Committee and Planning Work Group; MDH guidance	Reduce risk of *E. coli* and other contamination through sealing of abandoned private and public wells	GWQ-10	Number of sealed private wells - 200 private wells (GWQ-1) and 2 high capacity wells (GWQ-2);
					Reduce risk to public health from wells through education and outreach regarding proper construction, maintenance, and sealing/abandonment of wells	GWQ-11	20 educational articles/handouts (GWQ-13); 10 well testing/maintenance clinics (GWQ-20);
Level 1	Excessive Flooding	Peak Flow	Increase storage and reduce runoff throughout the Greater Zumbro River watershed	Zumbro River WRAPS; Lake Pepin-Mississippi River WRAPS; Advisory Committee	Increase storage in the watershed corresponding to 0.25 inches of runoff (approximately 22,000 acre-ft), prioritizing headwater, high yield watersheds (based on HSPF modeling), and/or wetland storage areas	FLD-1	Estimated increase in watershed storage (22,000 acre-ft) resulting from implemented projects (FLD-1); Number of stormwater capture/reuse projects (2 projects) (FLD-10); Analysis to identify/evaluate feasible impoundment locations (FLD-4); Outreach events to promote low impact design (10 events) (FLD-11); Outreach events to promote runoff-reducing soil health practices (20 events) (GWQ-17);
			Mitigate/minimize increases in peak flow (relative to currently estimated conditions) resulting from increased precipitation and climate trends	Zumbro River WRAPS; Lake Pepin-Mississippi River WRAPS; Advisory Committee	Develop storage and discharge goals at a subwatershed level (e.g., <10 square miles) based on hydrologic and hydraulic analysis, to inform planned implementation activities	FLD-2	Development of hydrologic and hydraulic models for unmodeled areas (FLD-3); Development of subwatershed specific flow reduction goals (FLD-4); Analysis to identify/evaluate feasible impoundment locations (FLD-4; FLD-5);
		Floodplains	Reduce flood risk to structures and major infrastructure	Advisory Committee and Planning Work Group; Rochester Comprehensive Plan	Characterize flood risk in un-modeled areas and identify priority areas	FLD-3	Development of hydrologic/hydraulic models for unmodeled areas (FLD-3); Development of subwatershed specific flow reduction goals (FLD-4); Analysis to identify/evaluate impoundment locations (FLD-2; FLD-5);
					Manage and restore floodplains to reduce the risk to structures and critical infrastructure located adjacent to water resources	FLD-4	Acres of stream-adjacent lands in RIM/CRWP (500 acres) (FLD-8); Number of projects to stabilize/restore degraded streambanks (10 projects, 5,000 feet) (ESC-4); Projects to reconnect/restore riparian floodplain (6 over 10 years) (FLD-7);

Table 5-2 WAGZ Plan Measurable Goals by Issue Area

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 (Table 6-4) and associated measures/outputs
Level 1	Degraded Surface Water Quality	Phosphorus	Meet Western Corn Belt Plains water quality standards in Rice Lake (TP≤90 ug/L, chl a≤30 ug/L, SD≥0.7 m) by reducing total phosphorus loading by 88% (see TMDL)	MN Water Quality Standard (MN Rules 7050.0222 Subp.3); Zumbro River Watershed TMDL (MPCA, 2019)	Reduce phosphorus loading through implementation of practices identified in the Zumbro River Watershed TMDL and WRAPS studies	SWQ-2	- Identify and Implement 3 projects to reduce phosphorus loading in the Rice Creek watershed (SWQ-2) - Evaluate of carp management need (SWQ-3) - Evaluate in-lake alum treatment need (SWQ-4)
			Meet site-specific water quality standards in Lake Zumbro (TP≤65 ug/L, chl a≤22 ug/L, SD≥0.9 m) by reducing total phosphorus loading consisted with TMDL	Technical Justification for Draft Lake Zumbro (55-0004-00) Site-Specific Eutrophication Standard (MPCA, 2017); Zumbro River Watershed TMDL (MPCA, 2019)	Reduce phosphorus loading by up to 3,040 lbs/year through implementation of practices identified in the Zumbro River Watershed TMDL and WRAPS studies	SWQ-3	- Implement field practices at up to 88 priority sites upstream of Zumbro Lake identified through HSPF pollutant loading model (SWQ-1); - Cumulative reduction in phosphorus loading to Lake Zumbro by 3,040 lbs/year (as estimated with HSPF or similar) (SWQ-1)
		Phosphorus	Reduce phosphorus loading by 45% by 2040	MN Nutrient Reduction Strategy (MPCA, 2014)	See **Table 5-3** for subwatershed-specific goals addressing degraded surface water quality, including load reduction and project implementation targets	SWQ-1	Implemented projects (number and/or estimated benefit); see **Table 5-3** for values
		Total Suspended Solids	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)			Implemented projects (number and/or estimated benefit); see **Table 5-3** for values
		Nitrate	Reduce total nitrogen loading by 45% by 2040	MN Nutrient Reduction Strategy (MPCA, 2014)			Implemented projects (number and/or estimated benefit); see **Table 5-3** for values
		E. coli	Reduce *E. coli* concentrations in the Zumbro River, its tributaries, and tributaries to Lake Pepin 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)			Implemented projects (number and/or estimated benefit); see **Table 5-3** for values
		Fish Index of Biological Integrity	Achieve the following Fish Indices of Biological Integrity for streams: - Southern Rivers: 49 - Southern Streams: 50 - Southern Headwaters: 55 - Southern Coldwater: 50	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016)			Implemented projects (number and/or estimated benefit); see **Table 5-3** for values; Monitoring of water quality in trout streams (SWQ-11)
		Macroinvertebrate Index of Biological Integrity	Achieve the following Macroinvertebrate Indices of Biological Integrity for streams: - Southern Streams (high gradient): 37 - Southern Forest Streams (low gradient): 43 - Southern Coldwater: 43	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016)			Implemented projects (number and/or estimated benefit); see **Table 5-3** for values
Level 1	Accelerated Erosion and Sedimentation	Erosion	Reduce the occurrence and severity of eroded streambanks	Advisory Committee	Increase average runoff retention by increasing watershed storage by 0.25 inches (22,000 acre-feet)	ESC-1	Estimated increase in watershed storage (22,000 acre-feet) resulting from implemented projects (FLD-1)
					Achieve and maintain full compliance with MN Buffer Law with emphasis on diverse, high quality buffers	ESC-2	Ongoing education and outreach reagrding buffers (ESC-2); Site visits to cricital areas to promote buffer implementation/maintenance (ESC-3);
					Stabilize degraded and eroded streambank areas through 10 projects covering up to 5,000 feet (estimated sediment reduction up to 500 tons/year)	ESC-3	Inventory of highly degraded streambank as identified by streambank inventory (ESC-9); Number of projects to stabilize/restore degraded streambanks (10 projects, up to 5,000 feet) (ESC-4); Number of projects supported via technical support (10 projects, up to 5,000 feet) (ESC-5);

Table 5-2 WAGZ Plan Measurable Goals by Issue Area

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 (Table 6-4) and associated measures/outputs
Level 1	Accelerated Erosion and Sedimentation	Total Suspended Solids	Reduce the sediment loading to downstream water resources through the expanded us of conservation practices	Zumbro River WRAPS; Lake Pepin-Mississippi River WRAPS; Advisory Committee	Increase the use of cover crops, perennial vegetation, and conservation till strategies relative to baseline (established via implementation item SLH-4) (repeated from soil health goals)	ESC-4	Increased acres of soil health practices (2,000 acres) (ESC-6); Estimated/modeled reduction in sediment loading (see Table 5-3 for values, SWQ-1); 10 outreach events with agra-business (ESC-8); 5 demonstration projects to promote soil health BMPs (SLH-3)
			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 by approximately 14,000 tons/year (estimated at field scale) and 4,000 tons/year (at watershed outlet) through the implementation of field practices (see goal SWQ-1); See **Table 5-3** for subwatershed-specific goals	ESC-5	Implemented projects (number and/or estimated benefit), see Table 5-3 for values (SWQ-1); Number of projects to stabilize/restore degraded streambanks (10 projects, up to 5,000 feet) (ESC-4); Number of projects supported via technical support (10 projects, up to 5,000 feet) (ESC-5);
Level 2	Degraded Soil Health	Cover crops & perennial vegetation	Maintain and improve soil health to increase productivity while protecting and improving the environment	Planning Work Group and Advisory Committee; Stakeholder engagement	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-1	Increased acres of cover crops/perennial vegetation (2,000 acres) (ESC-6); Increased acres of pasture land conservation practices (1,000 acres) (ESC-7); Inventory of soil health best practices (SLH-4); Study and quantification of soil health practice benefits (e.g., reduced runoff, water storage, increased organic matter) (SLH-1)
					Implement educational programs to increase awareness of soil health best practices and community capacity to implement BMPs	SLH-2	Digital communication to promote soil health (10 communications) (SLH-2); Inventory of soil health best practices (SLH-4); 10 outreach events with agra-business (ESC-8); 20 field day events to tour demonstration projects (GWQ-17); Implemented demonstration projects (5 projects) (SLH-3); Investment in forestry conservtion program (SLH-7)
					Increase the use of cover crops, perennial vegetation, and conservation till strategies relative to baseline (established via implementation item SLH-4) (see Goal ESC-4)	SLH-3	Increased acres of cover crops/perennial vegetation (2,000 acres) (ESC-6); Increased acres of pasture land conservation practices (1,000 acres) (ESC-7); Inventory of soil health best practices (SLH-4); 20 field day events to tour demonstration projects (GWQ-17) 10 outreach events with agra-business (ESC-8); Distribute articles to promote soil health BMPs (10 articles) (SLH-2)
					Leverage political influence to promote regulatory and/or incentive-based programs that encourage sustainable agriculture and soil health	SLH-4	5 meetings with state legislators (SLH-6) Development of lobbying strategy (partners, actions, etc.) (SLH-6) Coordinated messaging on soil health issues (SLH-5)

Table 5-2 WAGZ Plan Measurable Goals by Issue Area

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 (Table 6-4) and associated measures/outputs
Level 2	Landscape Resiliency and Altered Hydrology	Altered Hydrology	Limit the adverse impacts to water quality, flooding, and ecology resulting from hydrologic alteration of the watershed	Planning Work Group and Advisory Committee; Stakeholder engagement Zumbro WRAPS; Lake Pepin-Mississippi River WRAPS	Increase storage in the watershed corresponding to 0.25 inches of runoff (approximately 22,000 acre-ft), prioritizing headwater and/or high yield watersheds (based on HSPF modeling) (from excessive flooding category)	LR-1	Estimated increase in watershed storage (22,000 acre-ft) resulting from implemented projects (FLD-1); Number of large-scale stormwater capture/reuse projects (2 projects) (FLD-10); Outreach events to promote low impact design (10 events) (FLD-11); Outreach events to promote runoff-reducing soil health practices (20 events) (GWQ-17);
					Manage and restore floodplains to reduce the risk to structures and critical infrastructure located adjacent to water resources (from excessive flooding category)	LR-2	Number of projects to stabilize/restore degraded streambanks (10 projects, 5,000 feet) (ESC-4); Develop invnetory of floodplain restoration opportunities (LR-2); Projects to reconnect/restore riparian floodplain (6 over 10 years) (FLD-7); 500 acres of floodplain added to conservation programs (FLD-8) ~~Updates to floodplain and related ordinances, as needed~~
					Increase the use of cover crops, perennial vegetation, conservation till strategies relative to established baseline (from soil health category)	LR-3	Increased acres of cover crops/perennial vegetation (2,000 acres) (ESC-6); Inventory of soil health best practices (SLH-4); 20 field day events to tour demonstration projects (GWQ-17); 10 outreach events with agra-business (ESC-8);
					Limit the increase of runoff from development through regulation, incentives, and low impact design	LR-4	Continued application of development/redevelopment with rate control (LR-3); Updates to stormwater and zoning ordinances (LR-3); 10 urban stormwater management workshops (FLD-11); 200 Cost-share projects for individual stormwater BMPs (e.g., raingardens) (LR-4)
		Landscape Resiliency	Enhance the ability of the landscape to mitigate impacts of climate change and increased precipitation and promote soil health, water quality, and water quantity benefits	Planning Work Group and Advisory Committee; Zumbro WRAPS; Stakeholder engagement; Lake Pepin-Mississippi River WRAPS	Protect and increase forest cover through site and climate appropriate plantings on 1,000 acres (based on Zumbro Land Stewardship Plan)	LR-5	Review and recommendations for ordinances updates, as needed (LR-5); 3 workshops/year promoting conservation programs (LR-12); Continued education and outreach (targeting 100 landowners) (LR-12); 1,000 acres of new/restored forest area (LR-8); Assitance provided to landowners for 10 forestry plans (FWH-5)
					Protect and increase wetland areas to promote soil health, water quality, and water quantity benefits	LR-6	Review and recommendations for ordinances updates, as needed (LR-5); 2 workshops/year promoting wetland functions (LR-7); Continued education and outreach (targeting 100 landowners) (LR-12); Review of ordinances protecting wetlands (LR-9); Targeted outreach to 100 landowners in high priority wetland areas (LR-10)
					Increase enrollment of lands in easement and/or conservation programs (e.g.,, CRP); target 3,000 acres (based on Zumbro Land Stewardship Plan)	LR-7	Number of acres enrolled in conservation programs (3,000 acres) (LR-12); Identificiation of opportunities for enrollment in conservation programs (LR-6);

Table 5-2 WAGZ Plan Measurable Goals by Issue Area

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 (Table 6-4) and associated measures/outputs
Level 2	Threats to Fish, Wildlife, and Habitat	Wetlands	Preserve the quality and quantity of natural areas	Planning Work Group and Advisory Committee; Wetland Conservation Act; MDNR Aquatic Invasive Species Program	Preserve the quality and quantity of wetlands (see also goal LR-6)	FWH-1	Recommended updates to wetland and zoning ordinances, as needed (FWH-3) Technical assistance for 5 projects focused on wetland restoration (FWH-1) Continued implementation of Wetland Conservation Act
		Sites of biological significance			Preserve sites of biological significance	FWH-2	Technical assistance for invasive species and natural conservation projects (5 projects over 10 years) (FWH-4) Education via digital communication and/or articles (10 activities over 10 years) (FWH-2) Recommended updates to ordinances, as needed (FWH-3)
		Invasive species			Characterize the presence and impact of invasive species	FWH-3	Projects to address invasive species (5 projects over 10 years) (FWH-4); Database of invasive species present (FWH-6); Continued implementation of Wabasha County Cooperative Weed Management Program (FWH-7)
		Fish and Macroinvertebrates	See fish and macroinvertebrate IBI goals above under degraded surface water quality	see surface water quality goals above	see surface water quality goals above and goal ESC-3	FWH-4	see surface water quality goals above and goal ESC-3; Monitoring of water quality and flow in trout streams (SWQ-11) Projects to improve stream connectivity (FWH-9; FWH-10)
Level 3	Reduced Livability and Recreation	Recreation	Increase recreational opportunities across the watershed	MDNR comment letter; Stakeholder engagement	Incorporate/promote access opportunities into Partnership projects	REC-1	Support for efforts to improve recreational water trail access (REC-1) 10 Public events to promote stewardship (REC-2) 10 Volunteer activities supported over 10 years (REC-3; REC-4)
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-1	200 Cost-share projects for individual stormwater BMPs (e.g., raingardens) (LR-4) Projects to capture and reuse stormwater (2 projects) (FLD-10) 10 educational communication via handouts, articles, or digital communications (GWS-1)
					Characterize the state and trend of groundwater supplies and use in the watershed	GWS-2	Study and quantification of soil health practice benefits (SLH-1); Development of a groundwater monitoring strategy (GWS-2); Assessment of groundwater trends (GWS-3)

Table 5-3 WAGZ Plan Surface Water Quality Goals by Planning Subwatershed

Issue Area	Subwatershed	Specific Issue, Pollutant, or Stressor	Long-term Goal	Long-term Goal Rationale	10-year Goal	10-year Goal ID	10-year Goal Rationale or Source	10-year Goal Measures
Degraded Surface Water Quality	South Fork Zumbro River	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)	MN Nutrient Reduction Strategy (MPCA, 2014)	Implement structural and non-structural projects and practices to reduce watershed TP loading by up to 992 lbs/year (as estimated at field scale) and 1862 lbs/year in the South Fork Zumbro River	SWQ-1.1	Strategies included in WRAPS tables specific to this resource/watershed; field scale and in-resource load reductions will be based on HSPF model results	Up to 34 implemented projects; watershed TP load reduction up to 992 lbs/year (as estimated at field scale) and 1862 lbs/year in the South Fork Zumbro 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	MN Water Quality Standard (MN Rules 7050.0222 Subp. 3, Subp. 4)	Implement structural and non-structural projects and practices to reduce watershed sediment loading by up to 734 tons/year (as estimated at field scale) and 958 tons/year in the South Fork Zumbro River	SWQ-1.2	Strategies included in WRAPS tables specific to this resource/watershed; field scale and in-resource load reductions will be based on HSPF model results	Up to 34 implemented projects; watershed sediment load reduction up to 734 lbs/year (as estimated at field scale) and 958 lbs/year in the South Fork Zumbro River
		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)	MN Nutrient Reduction Strategy (MPCA, 2014)	Implement structural and non-structural projects and practices to reduce watershed TN loading by up to 19182 lbs/year (as estimated at field scale) and 17541 lbs/year in the South Fork Zumbro River	SWQ-1.3	Strategies included in WRAPS tables specific to this resource/watershed; field scale and in-resource load reductions will be based on HSPF model results	Up to 34 implemented projects; watershed TN load reduction up to 19182 lbs/year (as estimated at field scale) and 17541 lbs/year in the South Fork Zumbro River
		E. coli	Reduce *E. coli* concentrations to monthly geometric means <126 CFU/100 mL (April 1 - October 31) by achieving *E. coli* loading defined in the Zumbro River TMDL (see TMDL)	MN Water Quality Standard (MN Rules 7050.0220 Subp. 3a.D, Subp. 4a.D, and Subp. 5a.D); Zumbro River Watershed TMDL (MPCA, 2018)	Implement structural and non-structural practices to reduce *E. coli* loading	SWQ-1.4	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of projects and practices to address non-functioning SSTS (500 over 10 years watershed-wide), and feedlots (5 over 10 years watershed-wide); see Implementation Schedule
		Fish Index of Biological Integrity	Achieve applicable Fish Indices of Biological Integrity for streams: - Southern Streams: 50 - Southern Headwaters: 55	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Zumbro River Watershed Assessment and Monitoring - Appendix 4.2 (MPCA, 2016)	Implement structural and non-structural practices to improve FIBI	SWQ-1.5	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of 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: - Southern Forest Streams (low gradient): 43	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Zumbro River Watershed Assessment and Monitoring - Appendix 4.3 (MPCA, 2016)	Implement structural and non-structural practices to improve MIBI	SWQ-1.6	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)
Degraded Surface Water Quality	South Branch Middle Fork Zumbro River	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)	MN Nutrient Reduction Strategy (MPCA, 2014)	Implement structural and non-structural projects and practices to reduce watershed TP loading by up to 799 lbs/year (as estimated at field scale) and 844 lbs/year in the South Fork Middle Branch Zumbro River	SWQ-1.7	Strategies included in WRAPS tables specific to this resource/watershed; field scale and in-resource load reductions will be based on HSPF model results	Up to 22 implemented projects; watershed TP load reduction up to 799 lbs/year (as estimated at field scale) and 844 lbs/year in the South Fork Middle Branch Zumbro 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	MN Water Quality Standard (MN Rules 7050.0222 Subp. 3, Subp. 4)	Implement structural and non-structural projects and practices to reduce watershed sediment loading by up to 544 tons/year (as estimated at field scale) and 489 tons/year in the South Fork Middle Branch Zumbro River	SWQ-1.8	Strategies included in WRAPS tables specific to this resource/watershed; field scale and in-resource load reductions will be based on HSPF model results	Up to 22 implemented projects; watershed sediment load reduction up to 544 lbs/year (as estimated at field scale) and 489 lbs/year in the South Fork Middle Branch Zumbro River
		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)	MN Nutrient Reduction Strategy (MPCA, 2014)	Implement structural and non-structural projects and practices to reduce watershed TN loading by up to 16110 lbs/year (as estimated at field scale) and 8638 lbs/year in the South Fork Middle Branch Zumbro River	SWQ-1.9	Strategies included in WRAPS tables specific to this resource/watershed; field scale and in-resource load reductions will be based on HSPF model results	Up to 22 implemented projects; watershed TN load reduction up to 16110 lbs/year (as estimated at field scale) and 8638 lbs/year in the South Fork Middle Branch Zumbro River
		E. coli	Reduce *E. coli* concentrations to monthly geometric means <126 CFU/100 mL (April 1 - October 31) by achieving *E. coli* loading defined in the Zumbro River TMDL (see TMDL)	MN Water Quality Standard (MN Rules 7050.0220 Subp. 3a.D, Subp. 4a.D, and Subp. 5a.D); Zumbro River Watershed TMDL (MPCA, 2018)	Implement structural and non-structural practices to reduce *E. coli* loading	SWQ-1.10	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of projects and practices to address non-functioning SSTS (500 over 10 years watershed-wide), and feedlots (5 over 10 years watershed-wide); see Implementation Schedule
		Fish Index of Biological Integrity	Achieve applicable Fish Indices of Biological Integrity for streams: - Southern Streams: 50 - Southern Headwaters: 55	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Zumbro River Watershed Assessment and Monitoring - Appendix 4.2 (MPCA, 2016)	Implement structural and non-structural practices to improve FIBI	SWQ-1.11	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of 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: - Southern Forest Streams (low gradient): 43	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Zumbro River Watershed Assessment and Monitoring - Appendix 4.3 (MPCA, 2016)	Implement structural and non-structural practices to improve MIBI	SWQ-1.12	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)

Table 5-3 WAGZ Plan Surface Water Quality Goals by Planning Subwatershed

Issue Area	Subwatershed	Specific Issue, Pollutant, or Stressor	Long-term Goal	Long-term Goal Rationale	10-year Goal	10-year Goal ID	10-year Goal Rationale or Source	10-year Goal Measures
Degraded Surface Water Quality	Middle Fork Zumbro River	Phosphorus (Rice Lake)	Meet Western Corn Belt Plains water quality standards in Rice Lake (TP≤90 ug/L, chl a≤30 ug/L, SD≥0.7 m) by reducing total phosphorus loading by 88% (see TMDL)	MN Water Quality Standard (MN Rules 7050.0222 Subp.3); Zumbro River Watershed TMDL (MPCA, 2019)	Reduce phosphorus loading through implementation of practices identified in the Zumbro River Watershed TMDL and WRAPS studies	SWQ-2	Load reduction estimates from TMDL/WRAPS	Identify and Implement 3 projects to reduce phosphorus loading in the Rice Lake watershed
		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)	MN Nutrient Reduction Strategy (MPCA, 2014)	Implement structural and non-structural projects and practices to reduce watershed TP loading by up to 1393 lbs/year (as estimated at field scale) and 1652 lbs/year in the Middle Fork Zumbro River	SWQ-1.13	Strategies included in WRAPS tables specific to this resource/watershed; field scale and in-resource load reductions will be based on HSPF model results	Up to 32 implemented projects; watershed TP load reduction up to 1393 lbs/year (as estimated at field scale) and 1652 lbs/year in the Middle Fork Zumbro 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)	MN Water Quality Standard (MN Rules 7050.0222 Subp. 3, Subp. 4)	Implement structural and non-structural projects and practices to reduce watershed sediment loading by up to 873 tons/year (as estimated at field scale) and 901 tons/year in the Middle Fork Zumbro River	SWQ-1.14	Strategies included in WRAPS tables specific to this resource/watershed; field scale and in-resource load reductions will be based on HSPF model results	Up to 32 implemented projects; watershed sediment load reduction up to 873 lbs/year (as estimated at field scale) and 901 lbs/year in the Middle Fork Zumbro 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)	MN Nutrient Reduction Strategy (MPCA, 2014)	Implement structural and non-structural projects and practices to reduce watershed TN loading by up to 32296 lbs/year (as estimated at field scale) and 17923 lbs/year in the Middle Fork Zumbro River	SWQ-1.15	Strategies included in WRAPS tables specific to this resource/watershed; field scale and in-resource load reductions will be based on HSPF model results	Up to 32 implemented projects; watershed TN load reduction up to 32296 lbs/year (as estimated at field scale) and 17923 lbs/year in the Middle Fork Zumbro River
		E. coli	Reduce *E. coli* concentrations to monthly geometric means <126 CFU/100 mL (April 1 - October 31) by achieving *E. coli* loading defined in the Zumbro River TMDL (see TMDL)	MN Water Quality Standard (MN Rules 7050.0220 Subp. 3a.D, Subp. 4a.D, and Subp. 5a.D); Zumbro River Watershed TMDL (MPCA, 2018)	Implement structural and non-structural practices to reduce *E. coli* loading	SWQ-1.16	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of projects and practices to address non-functioning SSTS (500 over 10 years watershed-wide), and feedlots (5 over 10 years watershed-wide); see Implementation Schedule
		Fish Index of Biological Integrity	Achieve applicable Fish Indices of Biological Integrity for streams: - Southern Streams: 50 - Southern Headwaters: 55	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Zumbro River Watershed Assessment and Monitoring - Appendix 4.2 (MPCA, 2016)	Implement structural and non-structural practices to improve FIBI	SWQ-1.17	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of 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: - Southern Forest Streams (low gradient): 43	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Zumbro River Watershed Assessment and Monitoring - Appendix 4.3 (MPCA, 2016)	Implement structural and non-structural practices to improve MIBI	SWQ-1.18	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)
Degraded Surface Water Quality	North Fork Zumbro River	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)	MN Nutrient Reduction Strategy (MPCA, 2014)	Implement structural and non-structural projects and practices to reduce watershed TP loading by up to 1122 lbs/year (as estimated at field scale) and 2015 lbs/year in the North Fork Zumbro River	SWQ-1.19	Strategies included in WRAPS tables specific to this resource/watershed; field scale and in-resource load reductions will be based on HSPF model results	Up to 32 implemented projects; watershed TP load reduction up to 1122 lbs/year (as estimated at field scale) and 2015 lbs/year in the North Fork Zumbro 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)	MN Water Quality Standard (MN Rules 7050.0222 Subp. 3, Subp. 4)	Implement structural and non-structural projects and practices to reduce watershed sediment loading by up to 699 tons/year (as estimated at field scale) and 928 tons/year in the North Fork Zumbro River	SWQ-1.20	Strategies included in WRAPS tables specific to this resource/watershed; field scale and in-resource load reductions will be based on HSPF model results	Up to 32 implemented projects; watershed sediment load reduction up to 699 lbs/year (as estimated at field scale) and 928 lbs/year in the North Fork Zumbro 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)	MN Nutrient Reduction Strategy (MPCA, 2014)	Implement structural and non-structural projects and practices to reduce watershed TN loading by up to 26838 lbs/year (as estimated at field scale) and 22289 lbs/year in the North Fork Zumbro River	SWQ-1.21	Strategies included in WRAPS tables specific to this resource/watershed; field scale and in-resource load reductions will be based on HSPF model results	Up to 32 implemented projects; watershed TN load reduction up to 26838 lbs/year (as estimated at field scale) and 22289 lbs/year in the North Fork Zumbro River
		E. coli	Reduce *E. coli* concentrations to monthly geometric means <126 CFU/100 mL (April 1 - October 31) by achieving *E. coli* loading defined in the Zumbro River TMDL (see TMDL)	MN Water Quality Standard (MN Rules 7050.0220 Subp. 3a.D, Subp. 4a.D, and Subp. 5a.D); Zumbro River Watershed TMDL (MPCA, 2018)	Implement structural and non-structural practices to reduce *E. coli* loading	SWQ-1.22	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of projects and practices to address non-functioning SSTS (500 over 10 years watershed-wide), and feedlots (5 over 10 years watershed-wide); see Implementation Schedule
		Fish Index of Biological Integrity	Achieve applicable Fish Indices of Biological Integrity for streams: - Southern Streams: 50 - Southern Headwaters: 55	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Zumbro River Watershed Assessment and Monitoring - Appendix 4.2 (MPCA, 2016)	Implement structural and non-structural practices to improve FIBI	SWQ-1.23	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of 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: - Southern Forest Streams (low gradient): 43	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Zumbro River Watershed Assessment and Monitoring - Appendix 4.3 (MPCA, 2016)	Implement structural and non-structural practices to improve MIBI	SWQ-1.24	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)

Table 5-3 WAGZ Plan Surface Water Quality Goals by Planning Subwatershed

Issue Area	Subwatershed	Specific Issue, Pollutant, or Stressor	Long-term Goal	Long-term Goal Rationale	10-year Goal	10-year Goal ID	10-year Goal Rationale or Source	10-year Goal Measures
Degraded Surface Water Quality	Zumbro River (Lower)	Phosphorus (Lake Zumbro)	Meet site-specific water quality standards in Lake Zumbro (TP≤65 ug/L, chl a≤22 ug/L, SD≥0.9 m) by reducing total phosphorus loading by 90% (see TMDL)	Technical Justification for Draft Lake Zumbro (55-0004-00) Site-Specific Eutrophication Standard (MPCA, 2017); Zumbro River Watershed TMDL (MPCA, 2019)	Reduce phosphorus loading through implementation of practices identified in the Zumbro River Watershed TMDL and WRAPS studies	SWQ-3	Load reduction estimates from HSPF modeling	Implement 88 field BMP projects upstream of Lake Zumbro, resulting in cumulative load reductions of 3,040 lbs/year of total phosphorus
		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)	MN Nutrient Reduction Strategy (MPCA, 2014)	Implement structural and non-structural projects and practices to reduce watershed TP loading by up to 994 lbs/year (as estimated at field scale) and 1846 lbs/year in the Zumbro River	SWQ-1.25	Strategies included in WRAPS tables specific to this resource/watershed; field scale and in-resource load reductions will be based on HSPF model results	Up to 33 implemented projects; watershed TP load reduction up to 994 lbs/year (as estimated at field scale) and 1846 lbs/year in the Zumbro 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	MN Water Quality Standard (MN Rules 7050.0222 Subp. 3, Subp. 4)	Implement structural and non-structural projects and practices to reduce watershed sediment loading by up to 755 tons/year (as estimated at field scale) and 835 tons/year in the Zumbro River	SWQ-1.26	Strategies included in WRAPS tables specific to this resource/watershed; field scale and in-resource load reductions will be based on HSPF model results	Up to 33 implemented projects; watershed sediment load reduction up to 755 lbs/year (as estimated at field scale) and 835 lbs/year in the Zumbro 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)	MN Nutrient Reduction Strategy (MPCA, 2014)	Implement structural and non-structural projects and practices to reduce watershed TN loading by up to 20979 lbs/year (as estimated at field scale) and 23685 lbs/year in the Zumbro River	SWQ-1.27	Strategies included in WRAPS tables specific to this resource/watershed; field scale and in-resource load reductions will be based on HSPF model results	Up to 33 implemented projects; watershed TN load reduction up to 20979 lbs/year (as estimated at field scale) and 23685 lbs/year in the Zumbro River
		E. coli	Reduce *E. coli* concentrations to monthly geometric means <126 CFU/100 mL (April 1 - October 31) by achieving *E. coli* loading defined in the Zumbro River TMDL (see TMDL)	MN Water Quality Standard (MN Rules 7050.0220 Subp. 3a.D, Subp. 4a.D, and Subp. 5a.D); Zumbro River Watershed TMDL (MPCA, 2018)	Implement structural and non-structural practices to reduce *E. coli* loading	SWQ-1.28	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of projects and practices to address non-functioning SSTS (500 over 10 years watershed-wide), and feedlots (5 over 10 years watershed-wide); see Implementation Schedule
		Fish Index of Biological Integrity	Achieve applicable Fish Indices of Biological Integrity for streams: - Southern Streams: 50 - Southern Headwaters: 55	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Zumbro River Watershed Assessment and Monitoring - Appendix 4.2 (MPCA, 2016)	Implement structural and non-structural practices to improve FIBI	SWQ-1.29	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of 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: - Southern Forest Streams (low gradient): 43	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Zumbro River Watershed Assessment and Monitoring - Appendix 4.3 (MPCA, 2016)	Implement structural and non-structural practices to improve MIBI	SWQ-1.30	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)
Degraded Surface Water Quality	Hay Creek	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)	MN Nutrient Reduction Strategy (MPCA, 2014)	Implement structural and non-structural projects and practices to reduce watershed TP loading to Lake Pepin by up to 27 lbs/year (as estimated at field scale) and 209 lbs/year from the Hay Creek subwatershed	SWQ-1.31	Strategies included in WRAPS tables specific to this resource/watershed; in-resource load reductions will be based on HSPF model results	Up to 21 implemented projects; watershed TP load reduction up to 209 lbs/year to Lake Pepin from the Hay Creek watershed
		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	MN Water Quality Standard (MN Rules 7050.0222 Subp. 3, Subp. 4)	Implement structural and non-structural projects and practices to reduce watershed sediment loading to Lake Pepin by up to 3 tons/year (as estimated at field scale) and 6.7 tons/year from the Hay Creek subwatershed	SWQ-1.32	Strategies included in WRAPS tables specific to this resource/watershed; in-resource load reductions will be based on HSPF model results	Up to 21 implemented projects; watershed sediment load reduction up to 6.7 tonsyear to Lake Pepin from the Hay Creek watershed
		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)	MN Nutrient Reduction Strategy (MPCA, 2014)	Implement structural and non-structural projects and practices to reduce watershed TN loading to Lake Pepin by up to 1390 lbs/year (as estimated at field scale) and 4040 lbs/year from the Hay Creek subwatershed	SWQ-1.33	Strategies included in WRAPS tables specific to this resource/watershed; in-resource load reductions will be based on HSPF model results	Up to 21 implemented projects; watershed TN load reduction up to 4040 lbs/year to Lake Pepin from the Hay Creek watershed
		E. coli	Reduce *E. coli* concentrations to monthly geometric means <126 CFU/100 mL (April 1 - October 31) by achieving *E. coli* loading capacity defined in the Mississippi River Lake Pepin Tributaries TMDL (see TMDL)	MN Water Quality Standard (MN Rules 7050.0220 Subp. 3a.D, Subp. 4a.D, and Subp. 5a.D); Mississippi River Lake Pepin Tributaries TMDL (MPCA, 2015)	Implement structural and non-structural practices to reduce *E. coli* loading	SWQ-1.34	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of projects and practices to address non-functioning SSTS (500 over 10 years watershed-wide), and feedlots (5 over 10 years watershed-wide); see Implementation Schedule
		Fish Index of Biological Integrity	Achieve applicable Fish Indices of Biological Integrity for streams: - Southern Streams: 50 - Southern Headwaters: 55	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Mississippi River Lake Pepin Monitoring and Assessment Report - (MPCA, 2012)	Implement structural and non-structural practices to improve FIBI	SWQ-1.35	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of 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: - Southern Forest Streams (low gradient): 43	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Mississippi River Lake Pepin Monitoring and Assessment Report - (MPCA, 2012)	Implement structural and non-structural practices to improve MIBI	SWQ-1.36	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)

Table 5-3 WAGZ Plan Surface Water Quality Goals by Planning Subwatershed

Issue Area	Subwatershed	Specific Issue, Pollutant, or Stressor	Long-term Goal	Long-term Goal Rationale	10-year Goal	10-year Goal ID	10-year Goal Rationale or Source	10-year Goal Measures
Degraded Surface Water Quality	Wells Creek	Phosphorus	Reduce phosphorus loading by 45% (from average 1980-1996 conditions) by 2040; (45% reduction equals 9,900 lbs/year TP based on HSPF watershed loading estimates)	MN Nutrient Reduction Strategy (MPCA, 2014)	Implement structural and non-structural projects and practices to reduce watershed TP loading to Lake Pepin by up to 63 lbs/year (as estimated at field scale) and 142 lbs/year from the Wells Creek subwatershed	SWQ-1.37	Strategies included in WRAPS tables specific to this resource/watershed; in-resource load reductions will be based on HSPF model results	Up to 30 implemented projects; watershed TP load reduction up to 142 lbs/year to Lake Pepin from the Wells Creek watershed
		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	MN Water Quality Standard (MN Rules 7050.0222 Subp. 3, Subp. 4)	Implement structural and non-structural projects and practices to reduce watershed sediment loading to Lake Pepin by up to 6.9 tons/year (as estimated at field scale) and 0.4 tons/year from the Wells Creek subwatershed	SWQ-1.38	Strategies included in WRAPS tables specific to this resource/watershed; in-resource load reductions will be based on HSPF model results	Up to 30 implemented projects; watershed sediment load reduction up to 0.4 tonsyear to Lake Pepin from the Wells Creek watershed
		Nitrate	Reduce total nitrogen loading by 45% (from average 1980-1996 conditions) by 2040; (45% reduction equals 220,000 lbs/year TP based on HSPF watershed loading estimates)	MN Nutrient Reduction Strategy (MPCA, 2014)	Implement structural and non-structural projects and practices to reduce watershed TN loading to Lake Pepin by up to 1390 lbs/year (as estimated at field scale) and 2613 lbs/year from the Wells Creek subwatershed	SWQ-1.39	Strategies included in WRAPS tables specific to this resource/watershed; in-resource load reductions will be based on HSPF model results	Up to 30 implemented projects; watershed TN load reduction up to 2613 lbs/year to Lake Pepin from the Wells Creek watershed
		E. coli	Reduce *E. coli* concentrations to monthly geometric means <126 CFU/100 mL (April 1 - October 31) by achieving E. coli loading capacity defined in the Mississippi River Lake Pepin Tributaries TMDL (see TMDL)	MN Water Quality Standard (MN Rules 7050.0220 Subp. 3a.D, Subp. 4a.D, and Subp. 5a.D); Mississippi River Lake Pepin Tributaries TMDL (MPCA, 2015)	Implement structural and non-structural practices to reduce *E. coli* loading	SWQ-1.40	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of projects and practices to address non-functioning SSTS (500 over 10 years watershed-wide), and feedlots (5 over 10 years watershed-wide); see Implementation Schedule
		Fish Index of Biological Integrity	Achieve applicable Fish Indices of Biological Integrity for streams: - Southern Streams: 50 - Southern Headwaters: 55	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Mississippi River Lake Pepin Monitoring and Assessment Report - (MPCA, 2012)	Implement structural and non-structural practices to improve FIBI	SWQ-1.41	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of 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: - Southern Forest Streams (low gradient): 43	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Mississippi River Lake Pepin Monitoring and Assessment Report - (MPCA, 2012)	Implement structural and non-structural practices to improve MIBI	SWQ-1.42	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)
Degraded Surface Water Quality	Lake Pepin	Phosphorus	Reduce phosphorus loading by 45% (from average 1980-1996 conditions) by 2040; (45% reduction equals 11,700 lbs/year TP based on HSPF watershed loading estimates)	MN Nutrient Reduction Strategy (MPCA, 2014)	Implement structural and non-structural projects and practices to reduce watershed TP loading to Lake Pepin by up to 55 lbs/year (as estimated at field scale) and 233 lbs/year from the Lake Pepin planning subwatershed	SWQ-1.43	Strategies included in WRAPS tables specific to this resource/watershed; in-resource load reductions will be based on HSPF model results	Up to 40 implemented projects; watershed TP load reduction up to 233 lbs/year to Lake Pepin
		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	MN Water Quality Standard (MN Rules 7050.0222 Subp. 3, Subp. 4)	Implement structural and non-structural projects and practices to reduce watershed sediment loading to Lake Pepin by up to 6.6 tons/year (as estimated at field scale) and 0.7 tons/year from the Lake Pepin subwatershed	SWQ-1.44	Strategies included in WRAPS tables specific to this resource/watershed; in-resource load reductions will be based on HSPF model results	Up to 40 implemented projects; watershed sediment load reduction up to 0.7 tonsyear to Lake Pepin
		Nitrate	Reduce total nitrogen loading by 45% (from average 1980-1996 conditions) by 2040; (45% reduction equals 258,000 lbs/year TP based on HSPF watershed loading estimates)	MN Nutrient Reduction Strategy (MPCA, 2014)	Implement structural and non-structural projects and practices to reduce watershed TN loading to Lake Pepin by up to 1213 lbs/year (as estimated at field scale) and 4017 lbs/year from the Lake Pepin planning subwatershed	SWQ-1.45	Strategies included in WRAPS tables specific to this resource/watershed; in-resource load reductions will be based on HSPF model results	Up to 40 implemented projects; watershed TN load reduction up to 4017 lbs/year to Lake Pepin
		E. coli	Reduce *E. coli* concentrations to monthly geometric means <126 CFU/100 mL (April 1 - October 31) by achieving *E. coli* loading capacity defined in the Mississippi River Lake Pepin Tributaries TMDL (see TMDL)	MN Water Quality Standard (MN Rules 7050.0220 Subp. 3a.D, Subp. 4a.D, and Subp. 5a.D); Mississippi River Lake Pepin Tributaries TMDL (MPCA, 2015)	Implement structural and non-structural practices to reduce *E. coli* loading	SWQ-1.46	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of projects and practices to address non-functioning SSTS (500 over 10 years watershed-wide), and feedlots (5 over 10 years watershed-wide); see Implementation Schedule
		Fish Index of Biological Integrity	Achieve applicable Fish Indices of Biological Integrity for streams: - Southern Streams: 50 - Southern Headwaters: 55	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Mississippi River Lake Pepin Monitoring and Assessment Report - (MPCA, 2012)	Implement structural and non-structural practices to improve FIBI	SWQ-1.47	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of 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: - Southern Forest Streams (low gradient): 43	Biological Criteria for Tiered Aquatic Life Uses (MPCA, 2016); Mississippi River Lake Pepin Monitoring and Assessment Report - (MPCA, 2012)	Implement structural and non-structural practices to improve MIBI	SWQ-1.48	Strategies included in WRAPS tables specific to this resource/watershed	Implementation of projects and practices to address stressors including TP, TSS, N, and altered hydrology (see related Implementation Schedule Items)

6 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 5. Recognizing that financial and staff resources limit the ability of the Partnership to completely address priority issues in the watershed (see Section 0), 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 6.2.2). Some funding sources (e.g., watershed-based implementation funding) may have specific requirements that affect program design.

6.1 Implementation Schedule

The Plan implementation schedule is presented in Table 6-4. 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 5-2) that the activity is designed to support.

Activities included in Table 6-4 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 6-4 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 5-2). 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 0. 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 3-6, Figure 3-7, and Figure 3-8).

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 2024-2025").

Estimated Total Cost – This field represents the total estimated cost (in 2020 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 2020 dollars) borne by members of the Partnership.
>
> **Estimated External Contribution** – This field represents the portion of the total estimated cost (in 2020 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.

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 6-4.

6.1.1 Projects and Project Support

Activities in Table 6-4 categorized as "projects and project support" represent approximately 90% of the overall Plan implementation costs (see Section 6.2.2). This category includes capital improvement projects and cost-share field practices designed primarily to address issues related to surface water quality, groundwater quality, erosion and sedimentation, 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 6.2.2).

6.1.1.1 Cost-Share Field Practices

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

> *Implement BMPs at protect/restore Level 1 and 2 sites identified through terrain analyses (see Figure 4-1) to reduce erosion and filter pollutants; specific BMPs to be determined based on site-specific feasibility, with target implementation by subwatershed as follows:* [see Table 6-4]

Table 6-4 outlines the number of planned surface water quality improvement projects planned for each of the 8 HUC10 level planning subwatersheds within the planning area. Information regarding the prioritization and estimation of costs and benefits for projects related to SWQ-1 is described in Section 4.

The Partners intend to incentivize these projects through cost-share. A cost-share program is where the costs of implementing BMPs are shared with the landowner (as nearly all of the proposed project locations are located on private lands). Several cost-share programs 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 implementation framework selected by the Partnership accelerates the implementation of these practices and efficiently works with the Partner entity that is sponsoring implementation at targeted locations within their jurisdiction. 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., infiltration may be discouraged in areas of groundwater sensitivity). The Partners anticipate that many of the projects implemented as part of activity SWQ-1 will provide multiple benefits related to flooding, groundwater quality, soil health, and other concerns, in addition to directly prioritizing the issue of degraded surface water quality.

The Partners will utilize the application process to score and rank cost share opportunities from landowners or applicants, as described in Section 6.4.4.1. The project scoring criteria promote projects in higher priority areas (see Figure 3-6) and multi-benefit projects, while also considering other factors.

6.1.1.2 Capital Improvements

For the purposes of this Plan, capital improvement projects are those projects that are larger scaled, more expensive, and have a longer effective life than the projects typically funded through agricultural incentive and cost-share programs (see Section 6.1.1.1). Capital projects are intended to provide significant benefits, often on a regional scale, rather than on a field scale, and will require feasibility studies before design and construction.

Capital projects typically exceed $100,000 in cost and have an expected life greater than 25 years. 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 intended life of the

project. Permanent easements may be required in order 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 with 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 for grant funding.

The City of Rochester and Olmsted County maintain and update capital improvement plans (CIPs) outlining stormwater management, water quality, and flood risk-reduction projects planned by the City and/or County. Many of these projects are specifically or generally aligned with the goals of this Plan and may have regional benefit depending upon the project's location in the watershed.

Specifically, the City of Rochester is in the process of updating its local surface water management plan and associated CIP. The Partners anticipated that there will be specific projects from the City's CIP that may be implemented as part of this Plan. At present, these opportunities have been included as placeholders awaiting further definition:

- FLD-6: Implement cooperative flood risk reduction projects identified and prioritized in the City of Rochester CIP (FLD-6)
- SWQ-5: Implement projects to reduce phosphorus and sediment loading in urban stormwater runoff (above and beyond current minimum requirements)

Other capital improvement projects may include larger-scale streambank and floodplain restoration projects (see ESC-5 and FLD-7/8 in Table 6-4) as well as multipurpose drainage improvements. The Partners will update the implementation schedule (Table 6-4), as needed, to incorporate additional details for capital projects as they become more defined. The Partners will review capital improvement projects annually as part of the regular review and work planning process.

This Plan also includes implementation activities seeking to maintain and expand land protections prioritizing forest and floodplain areas (implementation activities SLH-7 and FLD-8 in Table 6-4).

6.1.2 Monitoring and Studies

Table 6-4 includes several implementation activities categorized as "monitoring and studies." These activities include those necessary to evaluate Plan progress and address data gaps related primarily to the Level 1 issues of degraded surface water quality, groundwater contamination, and excessive flooding. Additionally, several activities address the Level 2 issue of degraded soil health as these activities have direct and indirect benefits across a range of Level 1 issues.

Information collected through monitoring and studies will be used to identify future (or modify current) Plan implementation activities and priorities. For example, assessment of trends in nitrate concentrations in private wells (activity GWQ-9) may lead to the revision (or addition) of priority areas for project implementation (activity GWQ-3 and SWQ-1). Development of targeted hydrologic and hydraulic modeling (activity FLD-3) will identify preferred locations to implement watershed storage and flood risk reduction projects (activity FLD-4).

Monitoring and study activities included in Table 6-4 will leverage past and present programs operated in the watershed. These include, but are not limited to:

- MPCA water quality monitoring and analyses:
  - Zumbro River Total Maximum Daily Load (TMDL) study (2018)
  - Zumbro River Watershed Restoration and Protection Strategies (WRAPS) study (2017)
  - Zumbro River Watershed Monitoring and Assessment report (2016)
  - Mississippi River-Lake Pepin TMDL study (2015)
  - Mississippi River-Lake Pepin WRAPS study (2015)
  - Mississippi River-Lake Pepin Watershed Monitoring and Assessment report (2012)
  - Data collected/used in MPCA analyses, including:
    - Water chemistry (chloride, DO, E. coli, nitrate + nitrite, TKN, temperature, TP, TSS)
    - Biological monitoring (fish and macroinvertebrate)
    - Fish contaminants (mercury and polychlorinated biphenyls (PCBs))
    - Cooperative stream gaging (MPCA, MDNR)
- MDH groundwater monitoring and analyses:
  - Groundwater Restoration and Protection Strategies (GRAPS) (2019, draft)
- MDA/SWCD township private well water quality testing
- USGS/MDNR stream gaging
- Rochester Wellhead Protection Program (WHPP) activities
- County/SWCD volunteer nitrate monitoring
- County septic/SSTS monitoring
- County well inspection/monitoring

Data collected as part of existing, new, and expanded monitoring will be used in support of other implementation tasks (e.g., implementation item GWQ-7: establishing trends in nitrate concentrations in wells).

Additional information about existing monitoring programs is presented in Section C.7. Monitoring locations are presented in Figure C-15. 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 6.2.2). The Partnership sees 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 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. Performance monitoring of capital improvements or other individual projects may be implemented on a project-by-project basis, to be detailed as part of project scoping (for example, MPCA monitoring of Cascade Creek following improvement projects implemented through cooperative effort of the MDNR, MPCA, and Olmsted County).

The Partnership will consider the execution of monitoring efforts as part of its biennial review (i.e., what was planned and what was completed) to identify potential gaps during implementation. The 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 analysis, 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.

6.1.3 Education and Public Involvement

Table 6-4 includes implementation activities categorized as "education and public involvement." 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 initial public meeting hosted by the Partners, an online survey, three waterside chats performed in fall 2019, and an online story map developed in early 2020 (see Section 2.5 and Appendix B). Additional stakeholder input received through a diverse Advisory Committee, including local residents and business owners, was considered throughout Plan development.

The education and public involvement activities in Table 6-4 are primarily focused towards promoting soil, water, and natural resource stewardship through increased public understanding of priority issues and providing varying levels of technical assistance. Groundwater quality education and outreach activities additionally focus on issues of public health and safety. Planned engagement activities, generally, include:

- Site visits and site-specific technical assistance to support:
    - Buffer maintenance, repair, and improvement
    - Soil health practices
    - Wetland protection
    - SSTS management actions
    - Nutrient and manure management plans

- Workshops (e.g., addressing SSTS and well maintenance)
- Demonstration projects/research sites (e.g., soil health practices)
- Volunteer events (e.g., river clean-ups)
- Targeted mailings (e.g., information targeting owners of non-functioning SSTS)
- News articles/press releases/digital media (project- or initiative-specific)
- Educational flyers (e.g., information about vegetated buffers, groundwater conservation)

Plan implementation presents an opportunity to increase and optimize the existing education and public involvement roles of the Partners. The Partners will leverage existing relationships and public outreach methods as a foundation to implement the activities in Table 6-4, further developing capacity and methods through the assistance of cooperating entities and the targeting performed as part of this Plan. Existing education and public involvement programs include:

- County fair booths
- Envirothon and similar events
- Dodge County Expo
- Field Days
- Photo contest/social media engagement
- Annual reports
- Nitrate screening events (funded through MDH grants)
- Public outreach/education plan promoting drinking water safety for private well owners

Template education and outreach materials will be developed for use within each County and be hosted online (see activity ALL-1 in Table 6-4). Activities will be locally administered and implemented, with individual Partners tailoring administration to the particular needs of their jurisdictions.

6.1.4 Regulation and Administration

The priority concerns identified by the Partners and discussed in Section 0 are addressed in part through Federal, State, and local regulations. Table 6-4 includes implementation activities categorized as "regulation and administration." These activities include those actions related to the development and enforcement of rules, ordinances, or other official controls.

The activities included in Table 6-4 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 6.2.

6.2 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. Local controls are described in Section 6.2.1. State and Federal agency roles and responsibilities are summarized in Appendix D.

6.2.1 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 6-1. Note that other local entities adopt and enforce local controls within the planning area (e.g., city stormwater ordinances and zoning regulations).

Table 6-1 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	Soil Loss Ordinance	Bluffland Ordinance	Well Management[3]
Bear Valley WD		X		X								
City of Rochester	X	X	X	X				X				
Dodge County	X		X	X	X		X	X	X			
Dodge SWCD							--[1]					
Goodhue County			X	X	X		X	X	X	X	X	X
Goodhue SWCD	X					X	--[1]					
Olmsted County			X	X	X	--[2]		X	X	X	X	X
Olmsted SWCD	X						--[1]					
Rice County			X	X	X	X	X	X	X			
Rice SWCD	X						--[1]					
Steele SWCD	X						--[1]					
Wabasha County			X	X	X		X	X	X		X	X
Wabasha SWCD	X						--[1]					

(1) SWCDs have a technical role in buffer law, but no enforcement authority
(2) Olmsted County has a feedlot officer, but have delegated feedlot regulatory authority to MPCA
(3) Partners have varying degrees of delegated authority from MDH

6.2.1.1 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, the City of Rochester, Dodge County, Goodhue SWCD, Olmsted SWCD, Rice SWCD, and Wabasha SWCD serve as the local government units (LGUs) that implement the WCA locally. The Minnesota Board of Water and Soil Resources (BWSR) administers the WCA statewide, and the MDNR enforces the WCA.

6.2.1.2 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.

Within the planning area, the SWCDs are tasked with implementing and assessing compliance with the buffer legislation and applicable city ordinances. SWCDs provide technical assistance, along with financial assistance options, for landowners to implement buffers. While SCWDs determine compliance with the buffer law, that information is provided to the Counties who are responsible for buffer law enforcement (with the exception of Olmsted County, where enforcement is the responsibility of BWSR). 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.

6.2.1.3 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 buffer 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 and city ordinances, as applicable. 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.

6.2.1.4 Floodplain Management

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 3.9.1) or floodplain areas designated by local entities (e.g., City of Rochester).

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.

6.2.1.5 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 (ITPHS) above activities to respond to non-compliant systems not classified as IHTs. An SSTS may be classified as an IHT 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.

6.2.1.6 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 (see Section D.5). 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 C-6).

Some counties (e.g., Olmsted County)) maintain well ordinances that allow MDH to delegate administrative responsibilities related to permitting, construction, repair, and sealing of wells. Olmsted County has an ongoing program to administer the well ordinance and program, as do Goodhue County and Wabasha County.

Well maintenance is an important aspect of protecting wells from contamination. Examples of well maintenance 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.

6.2.1.7 Feedlots

Minnesota Rules 7020 establish rules, regulations, and programs applicable to feedlots. At the State level, feedlot regulations and programs are administered by the MPCA. Within the planning area, Goodhue County and Rice 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 Dodge County, Minnesota Rules 7020 is administered by the MPCA. In Olmsted County and Wabasha County, the County and/or SWCD provides technical assistance, but does not retain regulatory oversight.

6.2.1.8 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 City or County ordinance. The City of Rochester and many other cities within the planning area enforce stormwater management ordinances. The Bear Valley Watershed District also implements a project review and permit program that addresses impoundments, stormwater conveyance, and drainage issues (see Section 6.2.1.11). Both Olmsted County and Goodhue County also maintain soil loss ordinances that help regulate erosion within their jurisdictions.

6.2.1.9 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:

- Dodge County
- Goodhue County
- Olmsted County
- Rice County
- Steele County (not a member of the Partnership)
- Wabasha County

The Partnership includes all drainage authorities within the planning area with the exception of Steele County. As part of their respective roles in overseeing the public drainage system, each drainage authority will seek to ensure that proposed modifications and improvements to public drainage systems are consistent with the goals of this Plan, including increased 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 (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, including increased storage.

For ditch projects, the land adjacent to public ditches is required by the MDNR 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 C.6.3.

6.2.1.10 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 6-2).

Table 6-2 Partner Comprehensive Plan Adoption

Partner	Plan	Date Adopted
Bear Valley Watershed District	2012 Overall Plan	2012
City of Rochester	Rochester Comprehensive Plan 2040	April 2018
Dodge County	Comprehensive Plan Dodge County, MN	September 10, 2019
Dodge SWCD	Dodge County Comprehensive Local Water Management Plan	December 15, 2016
Goodhue County	Comprehensive Plan Goodhue County, MN	June 21, 2016
Goodhue SWCD	Goodhue County Comprehensive Local Water Management Plan	May 26, 2020
Olmsted County	Olmsted County General Land Use Plan	March 25, 2014
Olmsted County, Olmsted SWCD	Olmsted County Comprehensive Local Water Management Plan	April 25, 2019
Rice County	2040 Rice County Comprehensive Plan	In progress
Rice SWCD	Rice County Comprehensive Local Water Management Plan	December 11, 2019
Steele SWCD	Steele County Comprehensive Local Water Management Plan	July 11, 2017
Wabasha County	Comprehensive Land Use Plan for Wabasha County, MN	August 4, 1998
Wabasha SWCD	Wabasha County Comprehensive Local Water Management Plan	October 20, 2015

Among the Partners, each County and the City of Rochester maintain zoning ordinances to regulate land use and development with consideration for natural resources (see Table 6-1). Each Partner 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 and SSTS
- Minimum building elevations relative to flood elevations
- Maximum allowable percent impervious surface
- Requirements for stormwater outfalls to waterbodies
- Protection of special groundwater recharge features (e.g., Decorah Edge provision)

In addition to the City of Rochester, most 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. Examples may include ensuring compliance with shoreland zoning requirements to limit the potential for future erosion issues or minimizing impervious area to reduce stormwater runoff volumes. This is especially relevant as the Rochester area continues to urbanize. As rural portions of the planning area are converted to less pervious residential, commercial, and urban land uses, application of ordinances with appropriate protections for water and natural resources is critical to prevent future problems.

As part of Plan implementation, the Partners will review existing ordinances and suggest revisions to minimize impacts to water and natural resources (see Table 6-4). 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.

6.2.1.11 Watershed District Rules and Permit Programs

Per the authority given to watershed districts in Minnesota Statutes 103D, the Bear Valley Watershed District (BVWD) adopted rules applicable within its jurisdiction. The BVWD enforces its rules through project review and permit programs. The BVWD Rules are summarized in this section but will be maintained and updated by the BVWD as a separate document outside of this Plan.

BVWD Rules

The BVWD Rules (2011, as amended) require a permit for projects seeking to:

- Create, remove, or alter water impoundments
- Alter the course, current, or cross section of any stream or watercourse
- Construct structures within the floodplain
- Construct bridges, culverts, or drains to manage stormwater runoff

Briefly, the BVWD Rules require:

1. 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 artificially obstructed so as to cause an overflow onto the property of others.
2. Water inlets, culvert openings, and bridge approaches shall have adequate should and bank protection in order to minimize land and soil erosion.
3. All septic tanks and drain fields, which outlet directly or indirectly into the waters of the district shall be constructed and maintained in accordance with the rules and recommendations of the State, as modified by the appropriate zoning ordinance of Goodhue and Wabasha Counties.
4. No reservoir for the impoundment of water may be constructed, removed, or abandoned without a permit from the managers, nor shall any dam be constructed to impound water without a permit from the managers.
5. No bridge or culvert and no drain from the disposal of storm waters, public or private, shall be constructed, reconstructed, laid or maintained in, to, or across any streams or public or private drain unless it has an adequate waterway opening.
6. To prevent obstruction to flood waters a permit shall be required from the managers for the construction of any building within the floodplain of Bear Valley.
7. No person or entity shall dispose of any waste, human, animal, or industrial by casting such waste directly or indirectly into any lake or stream, public or private drainage system, or road ditch within the district.
8. In order to preserve the same for beneficial use;
    a. No person or entity shall change or diminish the course, current or cross-section of any public waters within the watershed district without appropriate State permit(s) and a permit from the Watershed District.
    b. No person or entity shall alter, change, enlarge, diminish, straighten, deepen or otherwise dig in or interfere with the beds, banks, and shores of any stream or watercourse within the watershed district without a permit from the Managers of the Watershed District.
9. No person or entity shall abandon, deposit or dispose of any waste, litter, garbage, junk, or debris (natural or artificial) directly or indirectly, into the waters of the streams of the district.

Additional information is available from the BVWD at: https://www.goodhueswcd.org/bear-valley-watershed

6.2.2 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). There are opportunities to improve coordination and consistency across the planning area and address potential gaps in local control consistency. Examples include:

- Adoption of local soil loss ordinances by Partners in addition to Goodhue, Olmsted, and Wabasha Counties
- Adoption of zoning ordinance overlays similar to the Olmsted County Decorah Edge overlay in areas outside Olmsted County
- Expansion of low-impact design requirements or incentives within local stormwater management ordinances

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

- Review of stormwater ordinances to address infiltration in vulnerable areas (GWQ-22)
- Review of zoning and land use controls to assess protections for forests, wetlands, and areas of significant biodiversity (LR-5, LR-9, and FWH-3)

There may be additional opportunities to extend official controls implemented by some Partners across other portions of the planning area. For example, soil loss ordinances of Olmsted County and Goodhue County could serve as templates for others. Similarly, Partners may develop Karst area protections based on Olmsted County's protections for Decorah Edge areas.

6.3 Plan Implementation Costs and Funding

The implementation schedule (Table 6-4) 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 2021 dollars for planning purposes. More detailed cost estimates may be required for individual activities prior to execution. Costs presented in Table 6-4 are subtotaled by category and summarized in Figure 6-1 (total cost) and Figure 6-2 (local costs) and presented in tabular format in Table 6-3.

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. Therefore, the implementation schedule presented in Table 6-4 includes a "base funding scenario" representing expected funding values, as well as an "additional funding scenario" in which additional external funding is available. The implementation activity outputs and estimated costs associated with the additional funding scenario are presented in in red text in Table 6-4.

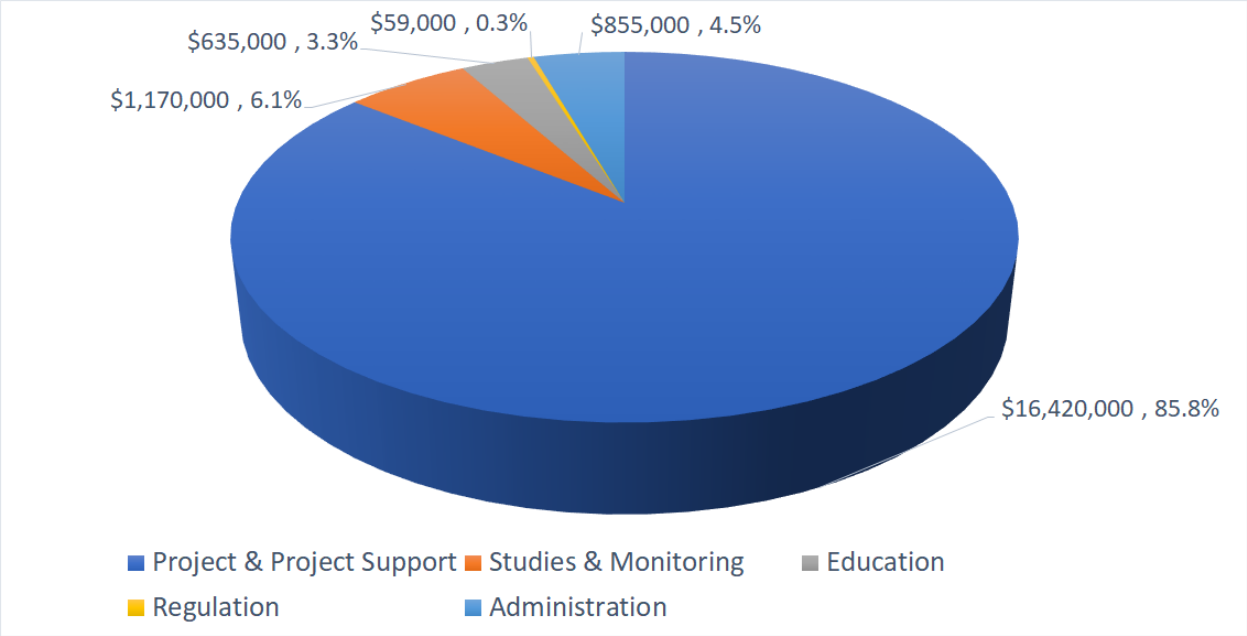

Figure 6-1 Summary of Implementation Schedule Total Costs – base funding scenario

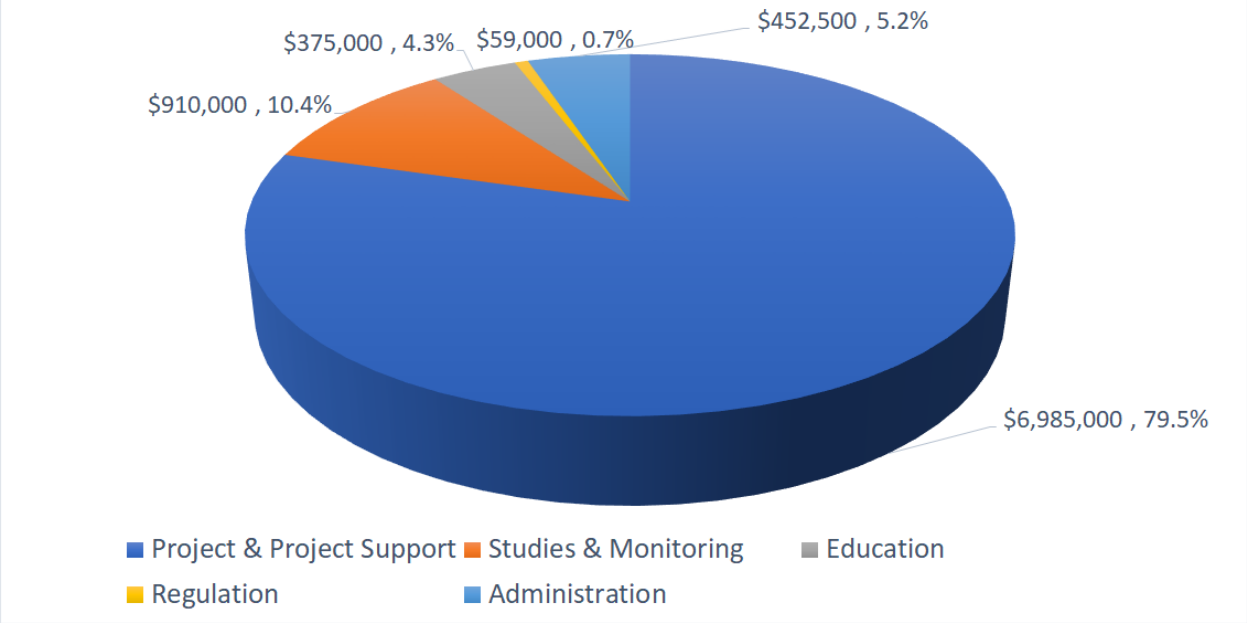

Figure 6-2 Summary of Implementation Schedule Local Costs – base funding scenario

This Plan includes an ambitious implementation schedule carrying a total estimated cost of approximately **$19.1M** for the base funding scenario and approximately **$25M** for the "additional funding scenario". Total estimated annual costs for the base funding scenario (approximately $1.9M) 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 $650,000 per year (or approximately $6.5M over the 10-year planning period). The current level of Partner funding to address Plan issues is less than the estimated total annual cost of implementation. Thus, additional local funding and funding through State, Federal, and private grant or cost-share dollars will be necessary to accomplish Plan goals.

Table 6-3 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 6-3 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	$452,500 $452,500	-- --	$402,500 $402,500	-- --	$855,000 $855,000
Project and Project Support	$6,235,000 $7,111,000	$750,000 $900,000	$5,600,000 $5,600,000	$3,835,000 $8,592,000	$16,420,000 $22,203,000
Studies and Monitoring	$910,000 $910,000	-- --	-- --	$260,000 $310,000	$1,170,000 $1,220,000
Education and Outreach	$375,000 $375,000	--	$110,000 $110,000	$150,000 $225,000	$635,000 $710,000
Regulatory Review/ Oversight	$59,000 $59,000	--	--	--	$59,000 $59,000
Total (base funding) **Total (additional funding)**	$8,031,500 $8,907,500	$750,000 $900,000	$6,112,500 $6,112,500	$4,245,000 $9,127,000	$19,139,000 $25,047,000

Notes: black text indicates base funding scenario; red text indicates additional funding scenario

6.3.1 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. RCPP has been used in the planning area through the Southeast Feedlot RCPP. 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.

Federal Funding has been utilized and implementation work has been supported in targeted areas in the watershed. Mississippi River Watershed Basin Initiatives, National Water Quality Initiative and other funding opportunities have been utilized. Partners including Olmsted SWCD and Wabasha SWCD are currently leveraging (or have recently used) Federal 319 funds to complete studies in the planning area in

the West Indian Creek and Cascade Creek watersheds. Continued use of this funding source is anticipated and will be pursued. Federal 319 implementation funds may also be used to implement BMPs and measure effectiveness of practices. Implementation will be addressed by expanding these efforts, along with other federal initiative opportunities.

The estimated implementation costs include anticipated external funding from Federal sources, although an exact quantity is not specified. Partners will seek Federal funding during Plan implementation, where appropriate. 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 6-4.

6.3.2 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 funding (WBIF).

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.

6.3.3 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

- City funds for stormwater management, drinking water supply, etc., if they are Plan activities
- 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.

6.3.4 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 (such as the University of Minnesota's Forever Green program). For example, the Partners will continue to support the Zumbro River Regional Water Trail Guiding Committee in their pursuit of shared goals.

Private sector companies, including those specifically engaged in agribusiness, may also be a potential source of funding for implementation. Partners may include Trout Unlimited, Fishers and Farmers Partnership, The Nature Conservancy, and others. Previous examples include collaboration between Wabasha SWCD and Trout Unlimited to perform improvement to Mazeppa Creek; this project is funded in part with EQIP and CPL funds.

The Partners will seek additional partnerships with private sector businesses as such opportunities arise. Future 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.

6.3.5 Collaborative Grants

The Partners recognize the importance of securing grant funding in completing the implementation activities identified in this Plan (see Table 6-4). The Partners will leverage this Plan in applying for competitive state and federal grants. As part of annual work planning (see Section 6.4.4).

6.4 Plan Administration and Coordination

The Parties, collectively known as the Watershed Alliance for the Greater Zumbro (WAGZ), will implement this Plan according to the governance structure established in the Joint Powers Agreement for implementation (JPA, see Appendix A). 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 shall keep their respective governing entities regularly informed on the implementation of the Greater Zumbro River 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 bylaws adopted, and have the power to modify the bylaws. The PAC will meet as needed (anticipated to be quarterly), but no less than twice per year, to advise implementation of the Greater Zumbro River Watershed Management work plan. Each member of the PAC shall have the authority to act on behalf of the party they represent in all matters relevant to the implementation of the Greater Zumbro River 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 Greater Zumbro River 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 PAC.

Technical Advisory Committee (TAC) – The PAC will appoint or invite technical representatives to a Technical Advisory Committee (TAC) to provide support and make recommendations on implementation of the Plan. The TAC may consist of the Local Implementation Work Group (LIWG) members, contacts for the State's main water agencies and/or plan review agencies, 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 limited to, local staff, including local county water planners, local watershed district staff, local SWCD staff, and local city staff, for the purposes of logistical, and day-to-day decision-making in the implementation of the Greater Zumbro River Comprehensive Watershed Management Plan. The LIWG shall prepare a draft annual work plan and budget consisting of an itemized statement of the Greater Zumbro River Comprehensive Watershed Management Plan revenues and expenses for the ensuing calendar year which shall be presented to the PAC for review. The LIWG will meet as needed.

6.4.1 Fiscal Agent and Administration

A partnership established with a JPA 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 in order 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 A). Grants obtained outside of the Partnership will be administered by the local governmental unit, as is currently done.

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 the Plan. 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 A).

6.4.2 Watershed District Plan Adoption

The BVWD is a watershed district subject to Minnesota Statutes 103D and is required to adopt a watershed management plan. In adopting the Greater Zumbro Comprehensive Watershed Management Plan (this Plan), the BVWD intends 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 BVWD shall maintain its rules (see Section 6.2.1.11) as a separate document outside of this Plan and independent of the Partnership. The BVWD also intends to maintain separate capital improvement programs (CIPs) informed by the implementation schedule included in this Plan. The BVWD CIP shall be integrated with the implementation schedule included in this Plan, as appropriate, by the LIWG through the annual work planning process.

6.4.3 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. This includes contracting a nutrient management expert as a shared service to provide technical assistance (see Table 6-4).

Future opportunities for shared services (e.g., outreach coordination, monitoring) will be considered by the Plan Implementation Work Group as additional needs are identified as part of annual work planning and progress assessment.

The Partners will coordinate the use and dispersal of WBIF to implement field practices according to the procedures described in Section 6.1.1.1 and following the priority area implementation sequence outlined in the implementation schedule (see Table 6-4).

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 2.5).

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, watershed districts, 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 6-4), 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 6-4). The "supporting entities" field in Table 6-4 notes those other governmental units or parties that the Partners will coordinate with in performing each activity.

6.4.4 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.

An annual work plan will be developed following the generalized process presented in Figure 6-3. The LIWG will develop a draft annual work plan based on the targeted implementation schedule (see Table 6-4) 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 6.4.4.1. Analysis of the degree of benefit may include estimates of pollutant load reduction based on HSPF, or similar model results, project location within priority Level 1, 2, or 3 watersheds (see Figure 3-6 and Figure 4-1, and/or project location relative to groundwater priority areas, if applicable (see Figure 3-7 and Figure 3-8).

The annual work plan will then be presented 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 Local Implementation Work Group (LIWG) will identify planned activities suited to available grant opportunities and make recommendations for pursuit of grants to the Policy Advisory Committee (PAC).

Figure 6-3 Generalized workflow for Plan implementation

6.4.4.1 Work Planning – Cost-share Grant Projects

The Partners intend to incentivize BMP projects through a cost-share program (see Section 6.1.1.1). The LIWG will utilize the application process to score and rank cost share opportunities from landowners or applicants. The scoring and ranking will consider:

- location of the project as it relates to the priority implementation areas (see Figure 3-6, Figure 3-7, and Figure 3-8)
- pollutants of concern/priority issues
- 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 individual project scoring and ranking criteria, as developed and maintained by the Partners, will be used to determine eligibility and priority.

The PIWG will work under the direction of the WAGZ Policy Advisory Committee to develop 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 WAGZ 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 how an application would be processed through local boards and check points with the WAGZ based upon policy adopted.

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 when completed.

6.4.5 Evaluation and Reporting

6.4.5.1 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 priority 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 function, adequacy of the current governance structure, and delivery of implementation. This may also include solicited input from external parties (e.g., service recipients.)

Local governmental units have a number of annual reporting requirements; their reporting responsibilities will be conducted per state agency requirements. Reporting related to grants and programs developed collaboratively and administered under this Plan will be reported by the LIWG. 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 with projects and practices illustrated spatially on Partner webpages and visible to the public. The Partners, State agencies, and many stakeholders will have interest in overall pollutant load reductions

achieved by BMPs and pace of progress relative to surface water quality goals. The project sponsor will provide BMP location and estimated pollution reduction of each practice installed. The Partnership will use that data to inform model runs (e.g., HSPF-SAM) that provide cumulative results and pace of progress (see also Section 4.2.5). The LIWG may use resources to assist in this effort, at the discretion of the PAC.

Biennial assessment of progress will consider the achievement of "outputs" for individual implementation items identified in Table 6-4. Some items in the implementation schedule will provide additional data that may impact Plan priorities and help define future implementation activities (e.g., using results of hydrologic and hydraulic modeling to identify opportunities for increased storage, see implementation item FLD-6). 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 biennial evaluation (i.e., what was planned and what was completed) to identify potential gaps.

6.4.5.2 Five Year Review

A more thorough evaluation of Plan progress is planned after five years (half way through the 2022-2031 period covered by this Plan). 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 6.5) needed to update elements of the Plan, as needed.

6.5 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 7.4.3).

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 amendment 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, determine that a Plan amendment is needed, the LIWG will complete the amendment according to the procedure described in State statute.

In recognizing the need to maintain flexibility during implementation, a Plan amendment is generally not required for the following situations (but may be 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 BVWD). 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 (e.g., City of Rochester, Bear Valley Watershed District) may periodically update their CIPs. The Partnership requests that Partners updating separate CIPs provide a courtesy notification and opportunity for discussion with the PAC.

Table 6-4 WAGZ Comprehensive Watershed Management Plan Implementation Schedule

Item ID	Implementation Action Description	Type (P = Project, S = Study, E = Educ., R = Reg.)	Applicable Goals (see Table 5-2)	Applicability to Goal Areas: Level 1 – Groundwater Contamination	Level 1 – Excessive Flooding	Level 1 – Degraded Surface Water Quality	Level 1 – Accelerated Erosion and Sedimentation	Level 2 – Degraded Soil Health	Level 2 – Altered Hydrology, Landscape Resiliency	Level 2 – Threats to Fish, Wildlife, and Habitat	Level 3 – Threatened Groundwater Supply	Level 3 – Reduced Livability and Recreation	Target or Focus Area	Measurable Output	Timeframe (Values are incremental for each 2-year period): 2022 to 2023	2024 to 2025	2026 to 2027	2028 to 2029	2030 to 2031	Estimated Total Cost	Estimated Local Contribution (landowner, SCWD/County locally budgeted/assessed)	Estimated External Contribution (WBIF, competitive grants, federal, 319)	Lead LGU	Supporting Entities
														Red text indicates higher level of planned implementation if additional external funding becomes available									
ADM-1	Develop template education materials and branding for consistent messaging between partners	E		●	●	●	●	●	●	●	O	O	Planning Area	Templates, Branding	X					$ 5,000	$ 2,500	$ 2,500	All Partners	BWSR
ADM-2	Annual work planning, budgeting, and reporting	S	All (indirectly)	●	●	●	●	●	●	●	O	O	Planning Area	Work plans, Annual report (1 per year)	X	X	X	X	X	$ 800,000	$ 400,000	$ 400,000	All Partners	BWSR
ADM-3	Interim progress assessment and possible amendment	S	All (indirectly)	●	●	●	●	●	●	●	O	O	Planning Area	Interim assessment report			X			$ 50,000	$ 50,000	$ -	All Partners	BWSR
																		ADM SUBTOTAL:		$ 855,000	$ 452,500	$ 402,500		
GWQ-1	Provide financial assistance to seal abandoned or unused **private wells** with a focus on groundwater target areas	P	GWQ-9	●									Groundwater Target Areas (see Figure 3-8)	Number of sealed wells (20 per year)	40	40	40	40	40	$ 200,000	$ 100,000	$ 100,000	County SWCD	MDH
														(40 per year)	60	60	60	60	60	$ 300,000	$ 100,000	$ 200,000		
GWQ-2	Seal abandoned or unused **high-capacity wells**, with an emphasis on groundwater target areas	P	GWQ-9	●									Groundwater Target Areas (see Figure 3-8)	Number of sealed wells (2 over 10 years)	2 high capacity wells over 10 years					$ 20,000	$ 10,000	$ 10,000	Cities County	MDH
														(4 over 10 years)	4 high capacity wells over 10 years					$ 40,000	$ 10,000	$ 30,000		
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-5	●	O	O	O	O	O				Groundwater Target Areas (see Figure 3-8)	Number of projects incorporating nitrogen reduction	See SWQ-1 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	Provide financial assistance for repair or replacement of non-functioning SSTS, and assistance for landowners to apply for loans to address SSTS issues	P	GWQ-8	●		●						O	Unsewered areas, Priority GW Areas (see Figure 3-8)	Number of addressed SSTS (50 per year)	100	100	100	100	100	$1,000,000	$ 700,000	$300,000	County	MPCA
														(75 per year); loan assistance	150	150	150	150	150	$1,500,000	$ 700,000	$800,000		
GWQ-5	Provide assistance for landowners to apply for loans to address SSTS issues	E	GWQ-8	●		●						O	Unsewered areas, Priority GW Areas (see Figure 3-8)	Loan assistance	X	X	X	X	X	$ 10,000	$ 10,000	$ -	County	MDH MDA
GWQ-6	Implement projects to provide adequate wastewater treatment to unsewered communities/areas.	P	SWQ-1, GWQ-8	●		●						O	Unsewered Areas	Communities connected to treatment	Two over the next 10 years					$ 300,000	$ 300,000	$ -	County	MPCA
GWQ-7	Monitor private groundwater wells for nitrate, bacteria, and other emerging contaminants; initiate special study on emerging contaminants	S	GWQ-3, GWQ-4, GWQ-8	●									Groundwater Target Areas (see Figure 3-8)	Groundwater monitoring report(s)	X	X	X	X	X	$ 100,000	$ 50,000	$ 50,000	County	MDH MDA
GWQ-8	Provide free and/or reduced cost well testing in groundwater quality priority areas, targeting non-community public suppliers (transient and non-transient)	S	GWQ-2. GWQ-3, GWQ-4, GWQ-7	●									Groundwater Target Areas (see Figure 3-8)	Number of wells sampled (1,000 over 10 years)	200	200	200	200	200	$ 100,000	$ 100,000	$ -	County	MDH MDA
														(1,500 over 10 years)	300	300	300	300	300	$ 150,000	$ 100,000	$ 50,000		
GWQ-9	Work with state partners to assess groundwater quality data, identify trends in nitrate concentrations in residential wells, and identify priority action areas	S	GWQ-4	●							●	O	Watershed-wide	Trend analyses; priority action areas		X				$ 20,000	$ 20,000	$ -	SWCD County	County MDH, MDA MDA, MPCA
GWQ-10	Develop a comprehensive strategy for groundwater monitoring and assessment within the watershed in coordination with MDH	S	GWQ-3, GWQ-4	●							●		Watershed-wide	Monitoring Plan	X					$ 10,000	$ 10,000	$ -	SWCD	County MDH MDA
GWQ-11	Develop inventory of non-functioning and/or non-compliant SSTS systems and contact landowners to address, prioritizing imminent threats	S	GWQ-8	●		●							Unsewered areas, Priority GW Areas (see Figure 3-8)	Inventory; 20 contacts per year	X 40	40	40	40	40	$ 20,000	$ 20,000	$ -	County	MPCA
GWQ-12	Distribute education materials increasing resident awareness of, and promoting practices to reduce, nitrogen loading to groundwater in DWSMAs	E	GWQ-1,	●									DWSMAs	News Article; digital communications (1 per year)	2	2	2	2	2	$ 5,000	$ 2,500	$ 2,500	County	MDH MDA
GWQ-13	Distribute education materials increasing resident awareness of groundwater issues, testing, and pollutant loading best practices	E	GWQ-2, GWQ-7	●									Unsewered areas, Priority GW Areas (see Figure 3-8)	News Article; digital communications (2 per year)	4	4	4	4	4	$ 10,000	$ 5,000	$ 5,000	County	MDH MDA
GWQ-14	Organize and/or facilitate meeting opportunities for public water suppliers to coordinate groundwater protection efforts	E	GWQ-1,	●									Public water suppliers	Meetings (1 per year)	2	2	2	2	2	$ 10,000	$ 10,000	$ -	County	MDH MDA
GWQ-15	Work with state agencies to compile and maintain a local database of groundwater quality data	S	GWQ-3, GWQ-4	●									Watershed-wide	Additions to monitoring database	X	X	X	X	X	$ 20,000	$ 20,000	$ -	County	MDH MDA
GWQ-16	Cooperate with agricultural producers to develop site-specific nutrient, fertilizer, and/or manure management plans	P	GWQ-5, GWQ-8	●		O		O					Priority GW Areas (see Figure 3-8)	Nutrient management plans (100 over 10 years)	20	20	20	20	20	$ 150,000	$ 75,000	$ 75,000	SWCD	MDA MPCA NRCS
														(150 over 10 years)	30	30	30	30	30	$ 225,000	$ 75,000	$ 150,000		
GWQ-17	Convene a group of local implementers to host field days/site visits to promote conservation tillage and other soil health practices.	E	GWQ-5	●		O	●	●					Watershed-wide	Volunteer Group; Field Day events (2 per year)	4	4	4	4	4	$ 30,000	$ 30,000	$ -	SWCD	MDA

Table 6-4 WAGZ Comprehensive Watershed Management Plan Implementation Schedule

Item ID	Implementation Action Description	Type (P = Project S = Study E = Educ. R = Reg.)	Applicable Goals (see Table 5-2)	Applicability to Goal Areas: Level 1 – Groundwater Contamination	Level 1 – Excessive Flooding	Level 1 – Degraded Surface Water Quality	Level 1 – Accelerated Erosion and Sedimentation	Level 2 – Degraded Soil Health	Level 2 – Altered Hydrology, Landscape Resiliency	Level 2 – Threats to Fish, Wildlife, and Habitat	Level 3 – Threatened Groundwater Supply	Level 3 – Reduced Livability and Recreation	Target or Focus Area	Measurable Output	Timeframe (Values are incremental for each 2-year period) 2022 to 2023	2024 to 2025	2026 to 2027	2028 to 2029	2030 to 2031	Estimated Total Cost	Estimated Local Contribution (landowner, SCWD/County locally budgeted/assessed)	Estimated External Contribution (WBIF, competitive grants, federal, 319)	Lead LGU	Supporting Entities
GWQ-18	Contract a nutrient management expert as a shared service to provide technical assistance	P	GWQ-5	●		O		O					Watershed-wide	Staff position and associated services	X	X	X	X	X	$ 800,000	$ 800,000	$ -	SWCD	County MDA MDNR
GWQ-19	Distribute education materials regarding private well maintenance, capping, and closure	E	GWQ-6	●									Watershed-wide	News Article; digital communications (1 per year)	X	X	X	X	X	$ 5,000	$ 2,500	$ 2,500	County	MPCA
GWQ-20	Host workshops for well maintenance	E	GWQ-2, GWQ-3, GWQ-5	●									Groundwater Target Areas (see Figure 3-8)	Workshops (1 per year)	2	2	2	2	2	$ 10,000	$ 10,000	$ -	SWCD County	MDH
GWQ-21	Review and recommend updates to local ordinances, if needed, addressing infiltration in vulnerable areas	R	GWQ-6	●		●							Groundwater Target Areas (see Figure 3-8)	Reviewed Ordinance(s)		X				$ 4,000	$ 4,000	$ -	Rochester County	MDH MDA
																		GWQ SUBTOTAL:		$ 2,824,000	$ 2,279,000	$ 545,000		
																				$ 3,569,000	$ 2,279,000	$ 1,290,000		
FLD-1	Implement projects to increase headwater storage and/or reduce peak flow rates at priority locations identified in below subwatersheds	P	FLD-1, ESC-1, LR-1		●	O	O	O					High yield subwatersheds (see Figure C-26)	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
	South Fork Zumbro Level 1-2 Areas	P	FLD-1		●	O	O	O						Up tp 33 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 BVWD Rochester	MDNR MPCA
	South Branch Middle Fork Zumbro Level 1-2 Areas	P	FLD-1		●	O	O	O						Up tp 28 projects over 10 years										
	Middle Fork Zumbro Level 1-2 Areas	P	FLD-1		●	O	O	O						Up tp 28 projects over 10 years										
	North Fork Zumbro Level 1-2 Areas	P	FLD-1		●	O	O	O						Up tp 25 projects over 10 years										
	Zumbro Level 1-2 Areas	P	FLD-1		●	O	O	O						Up tp 18 projects over 10 years										
	Hay Creek Level 1-2 Areas	P	FLD-1		●	O	O	O						Up tp 20 projects over 10 years										
	Lower Wells Creek Level 1-2 Areas	P	FLD-1		●	O	O	O						Up tp 18 projects over 10 years										
	Lake Pepin Level 1-2 Areas	P	FLD-1		●	O	O	O						Up tp 26 projects over 10 years										
	South Fork Zumbro Level 3 Areas	P	FLD-1		●	O	O	O						Up tp 5 projects over 10 years										
	South Branch Middle Fork Zumbro Level 3 Areas	P	FLD-1		●	O	O	O						Up tp 5 projects over 10 years										
	Middle Fork Zumbro Level 3 Areas	P	FLD-1		●	O	O	O						Up tp 5 projects over 10 years										
	North Fork Zumbro Level 3 Areas	P	FLD-1		●	O	O	O						Up tp 5 projects over 10 years										
	Zumbro Level 3 Areas	P	FLD-1		●	O	O	O						Up tp 5 projects over 10 years										
	Hay Creek Level 3 Areas	P	FLD-1		●	O	O	O						Up tp 5 projects over 10 years										
	Lower Wells Creek Level 3 Areas	P	FLD-2		●	O	O	O						Up tp 5 projects over 10 years										
	Lake Pepin Level 3 Areas	P	FLD-1		●	O	O	O						Up tp 5 projects over 10 years										
FLD-2	Use modeling results to define floodplain and identify properties and infrastructure subject to flood risk and prioritize areas for feasibility studies to reduce risk	S	FLD-1, FLD-4		●								Watershed-wide	Prioritized inventory of flood risk areas		X				$ 25,000	$ 25,000	$ -	SWCD Rochester	MDNR
FLD-3	Identify areas to targeted hydrologic modeling/analysis and develop hydrologic models/analyses using most current precipitation data	S	FLD-3		●								Previously unmodeled areas	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-2	O	●	O	O						Watershed-wide	Subwatershed storage and flow rate goals			X			$ 50,000	$ 50,000	$ -	SWCD County	MDNR
FLD-5	Work with the City of Rochester to identify remaining flood-prone areas and perform feasibility studies to identify preferred solutions	S	FLD-4		●							O	Areas to be identified by FLD-2	Inventory of priority flood risk areas (in 2 years); feasibility study (in 6 years)	X	X	X			$ 50,000	$ 50,000	$ -	Rochester Olmsted SWCD	MDNR
FLD-6	Implement cooperative flood risk reduction projects identified and prioritized in the City of Rochester CIP	P	FLD-4		●							O	Locations TBD	1 project (and associated peak flow and/or storage benefits); (2 projects with additional funding)				X		$ 1,000,000	$ 500,000	$ 500,000	Rochester	SWCD MDNR
																			X	$ 2,000,000	$ 1,000,000	$ 1,000,000		
FLD-7	Implement projects to reconnect or restore disconnected floodplain areas to increase flood resilience (including cooperative efforts with MDNR)	P	FLD-4, LR-2		●				●	O			Floodplains (emphasizing lower Zumbro River)	6 projects over 10 years			2	2	2	$ 500,000	$ 250,000	$ 250,000	SWCD	MDNR
														8 projects over 10 years				1	1	$ 680,000	$ 250,000	$ 430,000		
FLD-8	Promote the enrollment of floodplain lands in RIM, CREP, and similar programs (note: estimated costs excludes easement land cost/value)	E	FLD-4		●				●	●			Floodplains	500 ac stream-adjacent lands in RIM/CRWP	100	100	100	100	100	$ 50,000	$ 25,000	$ 25,000	SWCD	BWSR NRCS FSA
														(750 acres with additional funding)	150	150	150	150	150	$ 75,000	$ 25,000	$ 50,000		

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Item ID	Implementation Action Description	Type (P = Project S = Study E = Educ. R = Reg.)	Applicable Goals (see Table 5-2)	Applicability to Goal Areas: Level 1 – Groundwater Contamination	Level 1 – Excessive Flooding	Level 1 – Degraded Surface Water Quality	Level 1 – Accelerated Erosion and Sedimentation	Level 2 – Degraded Soil Health	Level 2 – Altered Hydrology, Landscape Resiliency	Level 2 – Threats to Fish, Wildlife, and Habitat	Level 3 – Threatened Groundwater Supply	Level 3 – Reduced Livability and Recreation	Target or Focus Area	Measurable Output	Timeframe (Values are incremental for each 2-year period): 2022 to 2023	2024 to 2025	2026 to 2027	2028 to 2029	2030 to 2031	Estimated Total Cost	Estimated Local Contribution (landowner, SCWD/County locally budgeted/assessed)	Estimated External Contribution (WBIF, competitive grants, federal, 319)	Lead LGU	Supporting Entities
FLD-9	Provide technical assistance and education for landowners regarding maintenance or removal of field dikes through targeted site visit	P	FLD-4		●				●	O			Floodplains	Site visits (5 per year)	10	10	10	10	10	$ 25,000	$ 25,000	$ -	SWCD	MDNR
FLD-10	Implement stormwater reuse projects to minimize urban stormwater runoff	P	FLD-1		●	●			●				Urban Areas	2 projects			X		X	$ 200,000	$ 80,000	$ 120,000	Rochester SWCD	MDNR
FLD-11	Host workshops to educate residents about local stormwater management, low impact design practices, and reuse	E	FLD-1		●	●			●				Urban Areas	1 workshop per year	2	2	2	2	2	$ 10,000	$ 10,000	$ -	Rochester SWCD	MPCA
FLD-12	Compile data on problem culverts from counties and toad authorities based on existing inventories; meet with Partner public works deparments annually to coordinate infrastructure improvements	S	FLD-4, FLD-3		●		O		●				Watershed-wide	Problem area database; meetings with PW depts	X	X	X	X	X	$ 20,000	$ 20,000	$ -	County	MnDOT
																		FLD SUBTOTAL		$ 2,080,000	$ 1,185,000	$ 895,000		
																				~~$ 3,265,000~~	~~$ 1,685,000~~	~~$ 1,500,000~~		
SWQ-1	Implement **BMPs** at protect/restore level 1 and 2 sites identified through terrain analyses (see **Figure X**) to reduce erosion and filter pollutants; specific BMPs to be determined based on site-specific feasibility, with target implementation by subwatershed as follows:	P	SWQ-3, SWQ-2, ESC-5	O	O	●	●	O	O	O	O	O	Level 1, 2, 3 Project Areas (see Figure 4-1)	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 Rochester	MDNR NRCS BWSR MDA
	South Fork Zumbro Level 1-2 Areas	P	SWQ-3, SWQ-2, ESC-5	O	O	●	●	O	O	O	O	O	Level 1 and 2	33 projects over 10 years	10	8	5	5	5	$ 825,000	$ 206,250	$ 618,750		
														~~38 projects over 10 years~~	~~12~~	~~10~~	~~6~~	~~5~~	~~5~~	~~$ 950,000~~	~~$ 206,250~~	~~$ 743,750~~		
	South Branch Middle Fork Zumbro Level 1-2 Areas	P	SWQ-3, SWQ-2, ESC-5	O	O	●	●	O	O	O	O	O	Level 1 and 2	28 projects over 10 years	10	5	5	4	4	$ 1,204,000	$ 301,000	$ 903,000		
														~~34 projects over 10 years~~	~~12~~	~~8~~	~~6~~	~~4~~	~~4~~	~~$ 1,462,000~~	~~$ 365,500~~	~~$ 1,096,500~~		
	Middle Fork Zumbro Level 1-2 Areas	P	SWQ-3, SWQ-2, ESC-5	O	O	●	●	O	O	O	O	O	Level 1 and 2	28 projects over 10 years	4	10	6	4	4	$ 868,000	$ 217,000	$ 651,000		
														~~33 projects over 10 years~~	~~5~~	~~12~~	~~8~~	~~4~~	~~4~~	~~$ 1,023,000~~	~~$ 255,750~~	~~$ 767,250~~		
	North Fork Zumbro Level 1-2 Areas	P	SWQ-3, SWQ-2, ESC-5	O	O	●	●	O	O	O	O	O	Level 1 and 2	25 projects over 10 years	1	4	8	8	4	$ 700,000	$ 175,000	$ 525,000		
														~~29 projects over 10 years~~	~~2~~	~~5~~	~~10~~	~~8~~	~~4~~	~~$ 812,000~~	~~$ 203,000~~	~~$ 609,000~~		
	Zumbro Level 1-2 Areas	P	SWQ-3, SWQ-2, ESC-5	O	O	●	●	O	O	O	O	O	Level 1 and 2	18 projects over 10 years	1	1	4	8	4	$ 720,000	$ 180,000	$ 540,000		
														~~22 projects over 10 years~~	~~2~~	~~2~~	~~6~~	~~8~~	~~4~~	~~$ 880,000~~	~~$ 220,000~~	~~$ 660,000~~		
	Hay Creek Level 1-2 Areas	P	SWQ-3, SWQ-2, ESC-5	O	O	●	●	O	O	O	O	O	Level 1 and 2	20 projects over 10 years	5	5	4	3	3	$ 80,000	$ 20,000	$ 60,000		
														~~27 projects over 10 years~~	~~7~~	~~7~~	~~5~~	~~4~~	~~4~~	~~$ 108,000~~	~~$ 20,000~~	~~$ 88,000~~		
	Lower Wells Creek Level 1-2 Areas	P	SWQ-3, SWQ-2, ESC-5	O	O	●	●	O	O	O	O	O	Level 1 and 2	18 projects over 10 years	5	5	3	3	2	$ 90,000	$ 22,500	$ 67,500		
														~~26 projects over 10 years~~	~~8~~	~~6~~	~~4~~	~~4~~	~~4~~	~~$ 130,000~~	~~$ 22,500~~	~~$ 107,500~~		
	Lake Pepin Level 1-2 Areas	P	SWQ-3, SWQ-2, ESC-5	O	O	●	●	O	O	O	O	O	Level 1 and 2	26 projects over 10 years	1	1	8	8	8	$ 78,000	$ 19,500	$ 58,500		
														~~31 projects over 10 years~~	~~2~~	~~2~~	~~9~~	~~9~~	~~9~~	~~$ 93,000~~	~~$ 19,500~~	~~$ 73,500~~		
	South Fork Zumbro Level 3 Areas	P	SWQ-3, SWQ-2, ESC-5	O	O	●	●	O	O	O	O	O	Level 3	5 projects over 10 years	1	1	1	1	1	$ 125,000	$ 31,250	$ 93,750		
														~~15 projects over 10 years~~	~~2~~	~~2~~	~~3~~	~~4~~	~~4~~	~~$ 375,000~~	~~$ 31,250~~	~~$ 343,750~~		
	South Branch Middle Fork Zumbro Level 3 Areas	P	SWQ-3, SWQ-2, ESC-5	O	O	●	●	O	O	O	O	O	Level 3	5 projects over 10 years	1	1	1	1	1	$ 215,000	$ 53,750	$ 161,250		
														~~15 projects over 10 years~~	~~2~~	~~2~~	~~3~~	~~4~~	~~4~~	~~$ 645,000~~	~~$ 161,250~~	~~$ 483,750~~		
	Middle Fork Zumbro Level 3 Areas	P	SWQ-3, SWQ-2, ESC-5	O	O	●	●	O	O	O	O	O	Level 3	5 projects over 10 years	1	1	1	1	1	$ 155,000	$ 38,750	$ 116,250		
														~~15 projects over 10 years~~	~~2~~	~~2~~	~~3~~	~~4~~	~~4~~	~~$ 465,000~~	~~$ 116,250~~	~~$ 348,750~~		
	North Fork Zumbro Level 3 Areas	P	SWQ-3, SWQ-2, ESC-5	O	O	●	●	O	O	O	O	O	Level 3	5 projects over 10 years	1	1	1	1	1	$ 140,000	$ 35,000	$ 105,000		
														~~15 projects over 10 years~~	~~2~~	~~2~~	~~3~~	~~4~~	~~4~~	~~$ 420,000~~	~~$ 105,000~~	~~$ 315,000~~		
	Zumbro Level 3 Areas	P	SWQ-3, SWQ-2, ESC-5	O	O	●	●	O	O	O	O	O	Level 3	5 projects over 10 years	1	1	1	1	1	$ 200,000	$ 50,000	$ 150,000		
														~~15 projects over 10 years~~	~~2~~	~~2~~	~~3~~	~~4~~	~~4~~	~~$ 600,000~~	~~$ 150,000~~	~~$ 450,000~~		
	Hay Creek Level 3 Areas	P	SWQ-3, SWQ-2, ESC-5	O	O	●	●	O	O	O	O	O	Level 3	5 projects over 10 years	1	1	1	1	1	$ 20,000	$ 5,000	$ 15,000		
														~~15 projects over 10 years~~	~~2~~	~~2~~	~~3~~	~~4~~	~~4~~	~~$ 60,000~~	~~$ 5,000~~	~~$ 55,000~~		
	Lower Wells Creek Level 3 Areas	P	SWQ-3, SWQ-2, ESC-5	O	O	●	●	O	O	O	O	O	Level 3	5 projects over 10 years	1	1	1	1	1	$ 25,000	$ 6,250	$ 18,750		
														~~15 projects over 10 years~~	~~2~~	~~2~~	~~3~~	~~4~~	~~4~~	~~$ 75,000~~	~~$ 6,250~~	~~$ 68,750~~		
	Lake Pepin Level 3 Areas	P	SWQ-3, SWQ-2, ESC-5	O	O	●	●	O	O	O	O	O	Level 3	5 projects over 10 years	1	1	1	1	1	$ 15,000	$ 3,750	$ 11,250		
														~~15 projects over 10 years~~	~~2~~	~~2~~	~~3~~	~~4~~	~~4~~	~~$ 45,000~~	~~$ 3,750~~	~~$ 41,250~~		
	Total (with base funding	P	SWQ-3, SWQ-2, ESC-5											236 projects over 10 years	**45**	**47**	**51**	**51**	**42**	**$ 5,460,000**	**$ 1,365,000**	**$ 4,095,000**		
	~~Total (with additional funding)~~													~~360 projects over 10 years~~	~~**66**~~	~~**68**~~	~~**78**~~	~~**78**~~	~~**70**~~	~~**$ 8,143,000**~~	~~**$ 1,891,250**~~	~~**$ 6,251,750**~~		
SWQ-2	Implement BMPs to reduce phosphorus loading in the watershed tributary to Rice Lake	P	SWQ-2			●	O			O		O	Rice Lake watershed	3 projects over 10 years		3				$ 100,000	$ 50,000	$ 50,000	Rice SWCD	NRCS MDA
SWQ-3	Evaluate the need for and Implement carp management in cooperation with MDNR	S	SWQ-2			●				●		O	Rice Lake watershed	Carp study	X					$ 5,000	$ 5,000	$ -	Rice SWCD	MDNR

Table 6-4 WAGZ Comprehensive Watershed Management Plan Implementation Schedule

Item ID	Implementation Action Description	Type (P = Project S = Study E = Educ. R = Reg.)	Applicable Goals (see Table 5-2)	Applicability to Goal Areas: Level 1 – Groundwater Contamination	Level 1 – Excessive Flooding	Level 1 – Degraded Surface Water Quality	Level 1 – Accelerated Erosion and Sedimentation	Level 2 – Degraded Soil Health	Level 2 – Altered Hydrology, Landscape Resiliency	Level 2 – Threats to Fish, Wildlife, and Habitat	Level 3 – Threatened Groundwater Supply	Level 3 – Reduced Livability and Recreation	Target or Focus Area	Measurable Output	Timeframe (Values are incremental for each 2-year period): 2022 to 2023	2024 to 2025	2026 to 2027	2028 to 2029	2030 to 2031	Estimated Total Cost	Estimated Local Contribution (landowner, SCWD/County locally budgeted/assessed)	Estimated External Contribution (WBIF, competitive grants, federal, 319)	Lead LGU	Supporting Entities
SWQ-4	Evaluate the feasibility and need for in-lake phosphorus reduction practices (e.g., alum treatment)	S	SWQ-2			●				O		O	Rice Lake watershed	Feasibility study			X			$ 10,000	$ 10,000	$ -	Rice SWCD	MDNR MPCA
SWQ-5	Implement projects to reduce phosphorus and sediment loading in urban stormwater runoff (above and beyond current minimum requirements)	P	SWQ-1, SWQ-3		O	●	●				●		Urban priority areas identified by City of Rochester (and others)	5 projects over 10 years	1	1	1	1	1	$ 500,000	$ 250,000	$ 250,000	Rochester SWCD	MPCA MDA
SWQ-6	Perform field verification of proposed project sites identified through terrain analysis (see Figure 4-1) to verify problems and evaluate feasibility	S	SWQ-1, SWQ-3		O	●	●	O		O	O	O	Level 1 and 2 Project Areas (see Figure 4-1)	Inventory of feasibility sites for future implementation	X	X				$ 50,000	$ 50,000	$ -	SWCD	MDNR MPCA
SWQ-7	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	SWQ-1, SWQ-3			●				●		●	Watershed-wide	Monitoring Plan	X					$ 10,000	$ 10,000	$ -	SWCD	MPCA
SWQ-8	Provide financial assistance to implement animal waste management systems to reduce waste loading to streams	P	SWQ-1, SWQ-3	●		●							Subwatersheds with bacterial impairments	Number of assisted feedlots (25 over 10 years)	5	5	5	5	5	$ 3,000,000	$ 1,000,000	$ 2,000,000	County SWCD	NRCS MPCA MDA
SWQ-9	Develop subwatershed assessment and prioritized implementation plan for West Indian Creek (319 program)	S	SWQ-1, ESC-5			●	●		O	O			West Indian Creek subwatershed	Subwatershed assessment and implementation plan	X					$ 100,000	$ 20,000	$ 80,000	Wabasha SWCD	MPCA
SWQ-10	Develop subwatershed assessment and prioritized implementation plan (9 element plan) for South Cascade Creek (319 program)	S	SWQ-1, SWQ-3, ESC-5			●	●		O				South Cascade Creek subwatershed	Subwatershed assessment and implementation plan	X					$ 100,000	$ 20,000	$ 80,000	Olmsted SWCD Rochester	MPCA
SWQ-11	Seek partnerships and support state and regional efforts (i.e., MDNR, MPCA) to monitor the flow and water quality of trout streams in the planning area	S	SWQ-1, FWH-4	O		●			O	●	O	O	Trout stream watersheds	Monitoring Plan, stream monitoring data	X	X	X	X	X	$ 100,000	$ 10,000	$ 90,000	SWCD	MPCA MDNR
																		SWQ SUBTOTAL			$ 9,435,000	$ 2,790,000	$ 6,645,000		
																					$ 12,118,000	$ 3,316,250	$ 8,801,750		
ESC-1	Evaluate the condition of landowner dams near Zumbrota and develop an action plan to address failing dams	S	ESC-1		O	O	●		O				Zumbrota area	Dam management plan			X			$ 20,000	$ 20,000	$ -	SWCD BVWD	MDNR
ESC-2	Distribute educational materials promoting the establishment, maintenance, and effectiveness of buffers	E	ESC-2			O	●		O	O			Watershed-wide	Handouts; Pamphlets; News Articles	X	X	X	X	X	$ 5,000	$ 5,000	$ -	SWCD County	BWSR
ESC-3	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-2			O	●		O	O			Riparian Areas	Site Visits	10	10	10	10	10	$ 25,000	$ 25,000	$ -	SWCD	BWSR
ESC-4	Implement projects to stabilize or restore degraded streambank areas (in addition to project sites identified in item SWQ-1)	P	ESC-3		O	O	●		O	O			See ESC-10; Wells Creek and tributaries	Number of projects; total restored feet	10 projects and/or up to 5,000 feet					$ 750,000	$ 375,000	$ 375,000	SWCD County	MDNR MPCA
															20 projects and/or up to 10,000 feet					$ 1,500,000	$ 375,000	$ 1,125,000		
ESC-5	Provide technical support for landowner projects to stabilize streambanks using natural design, in coordination with MDNR	P	ESC-3		O	O	●		O	O			See ESC-10; Wells Creek and tributaries	Number of projects; total restored feet	10 projects and/or up to 5,000 feet					$ 100,000	$ 100,000	$ -	SWCD County	MDNR MPCA
ESC-6	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-4, SH-3, LR-3		O	O	●	O	O				Cropland in Level 1 and 2 Project Areas (see Figure 4-1)	Number of acres added to soil health practices (>2000 over 10 years)	300 ac added	350 ac added	400 ac added	450 ac added	500 ac added	$ 300,000	$ 100,000	$ 200,000	SWCD	NRCS MDA BWSR
														(3000 acres over 10 years)	400 ac added	500 ac added	600 ac added	700 ac added	800 ac added	$ 450,000	$ 100,000	$ 350,000		
ESC-7	Implement and/or expand cost share assistance programs to promote the maintenance and increased use of BMPs focused on pasture land conservation	P	ESC-4, SH-3, LR-3		O	O	●	O	O				Pastureland in Level 1 and 2 Project Areas (see Figure 4-1)	Number of acres added to conservation practices (>1000 over 10 years)	100 ac added	150 ac added	200 ac added	250 ac added	300 ac added	$ 150,000	$ 50,000	$ 100,000	SWCD	NRCS BWSR
														(1,500 acres over 10 years)	150 ac added	200 ac added	300 ac added	400 ac added	450 ac added	$ 225,000	$ 50,000	$ 175,000		
ESC-8	Host outreach events for agri-business to promote soil health practices	E	ESC-4				●	O					Watershed-wide	1 Outreach event per year	2	2	2	2	2	$ 10,000	$ 10,000	$ -	SWCD	NRCS MDA BWSR
ESC-9	Watershed evaluation of streambank areas to determine priority restoration areas (leveraging HSPF and other model results, in partnership with MDNR)	S	ESC-3			●	●		O	O			Watershed-wide	Identification of priority areas	X					$ 10,000	$ 5,000	$ 5,000	SWCD	MDNR BWSR
ESC-10	Maintain impoundments in the Bear Valley Watershed District to minimize sediment loss and flood risk	P	ESC-3		O	O	●						Bear Valley Watershed District	Maintenance projects (1 per year)	2	2	2	2	2	$ 100,000	$ 100,000	$ -	BVWD	SWCD MDNR
																		ESC SUBTOTAL			$ 1,470,000	$ 790,000	$ 680,000		
																					$ 2,445,000	$ 790,000	$ 1,655,000		

Table 6-4 WAGZ Comprehensive Watershed Management Plan Implementation Schedule

Item ID	Implementation Action Description	Type (P = Project S = Study E = Educ. R = Reg.)	Applicable Goals (see Table 5-2)	Applicability to Goal Areas: Level 1 – Groundwater Contamination	Level 1 – Excessive Flooding	Level 1 – Degraded Surface Water Quality	Level 1 – Accelerated Erosion and Sedimentation	Level 2 – Degraded Soil Health	Level 2 – Altered Hydrology, Landscape Resiliency	Level 2 – Threats to Fish, Wildlife, and Habitat	Level 3 – Threatened Groundwater Supply	Level 3 – Reduced Livability and Recreation	Target or Focus Area	Measurable Output	Timeframe (Values are incremental for each 2-year period): 2022 to 2023	2024 to 2025	2026 to 2027	2028 to 2029	2030 to 2031	Estimated Total Cost	Estimated Local Contribution (landowner, SCWD/County locally budgeted/assessed)	Estimated External Contribution (WBIF, competitive grants, federal, 319)	Lead LGU	Supporting Entities
SLH-1	Assess/quantify the runoff reduction, water quality, water storage, and groundwater protection benefits of cover crops, perennial vegetation, and other soil health practices in the planning area, building on existing analysis at state level	S	SLH-1,	O	●	●	●	●			●		Soil health focus areas (to be determined)	Study; numeric benefit estimates	X	X	X	X	X	$ 50,000	$ 50,000	$ -	SWCD	NRCS MDA MOSH
SLH-2	Distribute education materials promoting the use of BMPs focused on soil health (e.g., cover crops, perennial vegetation, conservation tillage)	E	SLH-2,		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-3	Implement demonstration projects to show impact and implementation of soil health practices	E	SLH-2,		O	O	O	●					Watershed-wide	5 projects over 10 years	1	1	1	1	1	$ 50,000	$ 25,000	$ 25,000	SWCD	BWSR NRCS MDA MOSH
SLH-4	Collaborate with and utilize the products of the Tillage and Erosion Survey project to track soil health practice adoption. (e.g., cover crops, perennial vegetation)	S	SLH-3, LR-3	O	O	O	●	●					Watershed-wide	Inventory of soil health best practices	X	X	X	X	X	$ 15,000	$ 15,000	$ -	SWCD	BWSR UMN NRCS MDA
SLH-5	Work with regional partners to develop and coordinate messaging regarding soil health	E	SLH-4		O	O	O	●					Watershed-wide	Meetings (1/year); coordinated messaging	X	X	X	X	X	$ 5,000	$ 5,000	$ -	SWCD	BWSR NRCS MDA MOSH
SLH-6	Meet with state and federal legislators to communicate concerns and interests regarding soil health and sustainable agriculture	E	SLH-4		O	O	O	●					Watershed-wide	Meetings (biennial); Lobbying strategy	X	X	X	X	X	$ 10,000	$ 10,000	$ -	SWCD County	MASCWD BWSR MDA
SLH-7	Develop or increase incentive programs for implementing forestry conservation practices and easements	P	SLH-2	O	O	O	●	●					Level 1 and 2 Areas (see Figure 4-1)	Investment in forestry conservation program	X	X	X	X	X	$ 250,000	$ 125,000	$ 125,000	SWCD	NRCS MDNR
																		SLH SUBTOTAL		$ 385,000	$ 232,500	$ 152,500		
LR-1	Maintain an inventory of tile drainage within the watershed to apply for multipurpose drainage management (MDM) grants	S	LR-1		O				●				Watershed-wide	Tile drainage inventory	X	X	X	X	X	$ 40,000	$ 40,000		County	BWSR MDNR
LR-2	Develop an inventory of floodplain reconnection opportunities, critical habitat opportunities, and completed upstream projects	S	LR-2		O				●	O			Watershed-wide	Inventory of opportunities	X					$ 20,000	$ 20,000		SWCD	BWSR MDNR
LR-3	Review and revise, as needed, local stormwater ordinances and official controls to limit negative impacts from stormwater runoff	R	LR-4		O	O			●				Watershed-wide	Updated Ordinance(s)		X				$ 10,000	$ 10,000		County Rochester	MPCA
LR-4	Support cost-share programs for residential stormwater management practices (e.g., rainwater gardens, rain barrels)	P	LR-4		O	O			●				Cities and developed areas	20 cost-share stormwater BMPs per year	40	40	40	40	40	$ 100,000	$ 50,000	$ 50,000	Rochester SWCD	MPCA
LR-5	Review and recommend revisions for zoning ordinances and official controls to limit negative impacts to forested areas	R	LR-5		O	O			●	O			Watershed-wide	Updated Ordinance(s)		X				$ 10,000	$ 10,000	$ -	County	
LR-6	Identify priority opportunities for enrollment in conservation programs	S	LR-5		O	O			●	●		O	Level 1 and 2 Areas (see Figure 4-1)	Inventory of priority opportunities	X					$ 20,000	$ 20,000	$ -	SWCD	BWSR NRCS
LR-7	Host workshops in high priority protection areas addressing wetland and floodplain functions	E	LR-4		O	O			●	O			Level 1 and 2 Areas (see Figure 4-1)	2 workshops/year	4	4	4	4	4	$ 40,000	$ 20,000	$ 20,000	SWCD	MDNR
LR-8	Planting of additional forested areas in cooperation with USFS and/or MDNR	P	LR-5		O	O			●	O			Level 1 and 2 Areas (see Figure 4-1)	1,000 acres over 10 years (1,500 acres over 10 years)		100 acres	200 acres	300 acres	400 acres	$ 200,000	$ 100,000	$ 100,000	SWCD	BWSR MDNR
																150 acres	300 acres	450 acres	600 acres	$ 300,000	$ 100,000	$ 200,000		
LR-9	Review and recommend revisions for wetland protection ordinances to ensure adequate protection	R	LR-6, FWH-1		O	O			●	O			Watershed-wide	Updated Ordinance(s)		X				$ 10,000	$ 10,000	$ -	County	
LR-10	Targeted outreach to landowners with high priority wetland areas, including workshops and site visits	E	LR-6, FWH-1		O	O			●	O			See LR-6	Target 100 landowners (200 landowners in 10 years)	20	20	20	20	20	$ 50,000	$ 25,000	$ 25,000	SWCD	BWSR MDNR
															40	40	40	40	40	$ 100,000	$ 25,000	$ 75,000		
LR-11	Identify and Implement high priority wetland restoration projects in coordination with willing landowners	P	LR-6		O	O			●	O			See LR-6	Inventory of opportunities; 5 projects over 10 years	1	1	1	1	1	$ 250,000	$ 125,000	$ 125,000	SWCD	BWSR MDNR
LR-12	Promote enrollment in conservation programs through distribution of educational materials, hosting workshops, and/or targeted field visits	P	LR-7, FWH-1		O	O			●	O			See LR-6	3,000 acres (4,000 acres) enrolled over 10 years; 3 workshops/year; target 100 landowners over 10 years	200 acres	400 acres	600 acres	800 acres	800 acres	$ 300,000	$ 150,000	$ 150,000	SWCD	MDNR USFS
															200 acres	500 acres	800 acres	1,100 acres	1,400 acres	$ 400,000	$ 150,000	$ 250,000		
																		LR SUBTOTAL		$ 1,050,000	$ 580,000	$ 470,000		
																				$ 1,300,000	$ 580,000	$ 720,000		

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FWH-1	Provide local technical assistance in support of wetland restoration and other natural resource projects	P	FWH-1, FWH-2, FWH-3						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	Distribute education materials addressing protection of biologically significant elements in the watershed to adjacent landowners	E	FWH-2						O	●			Areas of biological significance	News articles; digital communications (1 per year)	2	2	2	2	2	$ 10,000	$ 5,000	$ 5,000	SWCD	MDNR
FWH-3	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 (e.g., trout streams)	R	FWH-2						O	●			Areas of biological significance	Updated Ordinance(s)		X				$ 10,000	$ 10,000	$ -	SWCD County Rochester	MDNR
FWH-4	Work with MDNR and other partners to provide local technical assistance in support of invasive species management and other natural resource projects	P	FWH-2, FWH-3						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 MDA
FWH-5	Provide financial assistance to assist landowners in developing forestry plans	P	FWH-3						O	●			Watershed-wide	2 plans per year (4 plans per year)	4 8	4 8	4 8	4 8	4 8	$ 40,000 $ 80,000	$ 40,000 $ 40,000	$ - $ 40,000	SWCD	MDNR
FWH-6	Maintain a database of invasive species presence in the watershed (U of MN has extensive mapping/inventory of IS priority areas)	S	FWH-3						O	●			Watershed-wide	GIS Database	X	X	X	X	X	$ 10,000	$ 10,000	$ -	SWCD	MDNR MDA UMN Ext
FWH-7	Continue to implement Wabasha County Cooperative Weed Management Area activities	P	FWH-3						O	●			Wabasha County	Program implementation	X	X	X	X	X	$ 50,000	$ 25,000	$ 25,000	Wabasha SWCD	MDNR
FWH-8	Participate in technical review of groundwater appropriations permits within or upstream of trout streams	R	FWH-4						O	●	●		Trout stream watersheds	Technical Review	X	X	X	X	X	$ 10,000	$ 10,000	$ -	SWCD	MDNR
FWH-9	Support Partner and local efforts to improve stream connectivity through financial or technical assistance	P	FWH-4			O			O	●		O	Streams with modified hydrology	Partner projects supported (5 over 10 years)	1	1	1	1	1	$ 50,000	$ 25,000	$ 25,000	SWCD	MDNR
FWH-10	Removal of Mantorville Dam and replacement with riffle.	P	FWH-4			O	O		O	●		O	South Branch Middle Fork Zumbro River	Dam replacement with riffle	X					$ 500,000	$ 50,000	$ 450,000	County	MDNR
																		FWH SUBTOTAL		**$ 780,000**	**$ 275,000**	**$ 505,000**		
																				$ 820,000	**$ 275,000**	**$ 545,000**		
REC-1	Support recreation opportunities/access points through support of Zumbro River Regional Water Trail Master Plan and similar opportunities; actions may include survey, inventory, and/or repair/enhancement of canoe launch areas in the planning area.	P	REC-1									●	Watershed-wide	Support for recreation plans	X	X	X	X	X	$ 5,000	$ 5,000	$ -	SWCD	MDNR
REC-2	Organize and host volunteer events related to environmental stewardship (e.g., river cleanup)	E	REC-1			O			O	O		●	Watershed-wide	Host events to promote stewardship (1 per year)	X	X	X	X	X	$ 25,000	$ 12,500	$ 12,500	SWCD	MDNR
REC-3	Provide financial assistance for environmental stewardship volunteer programs organized by others	P	REC-1			O			O	O		●	Watershed-wide	Fund 1 event per year	2	2	2	2	2	$ 10,000	$ 5,000	$ 5,000	SWCD	MDNR
REC-4	Assist MDNR and other agencies with recreational site maintenance through volunteer recruitment	P	REC-1									●	Watershed-wide	Volunteer group	X	X	X	X	X	$ 40,000	$ 40,000	$ -	SWCD	MDNR
																		REC SUBTOTAL		**$ 80,000**	**$ 62,500**	**$ 17,500**		
GWS-1	Provide educational materials regarding groundwater conservation practices used within the watershed, seeking feedback from existing practitioners (MS4 communities, other agencies, public water suppliers)	E	GWS-1								●		Watershed-wide (with focus on public water suppliers)	Handouts; Newsletters; Articles; Digital communication (1 per year)	X	X	X	X	X	$ 50,000	$ 40,000	$ 10,000	County Rochester	MDNR
GWS-2	Work with MDNR and other partners to develop/revise a groundwater quantity monitoring strategy	S	GWS-2								●		Watershed-wide (with focus on public water suppliers)	Monitoring Plan		X				$ 5,000	$ 5,000	$ -	County Rochester	MDNR
GWS-3	Review available data and work with MDNR to establish groundwater quantity trends in the watershed	S	GWS-2								●		Watershed-wide	Monitoring report			X			$ 50,000	$ 50,000	$ -	County Rochester	MDNR
																		GWS SUBTOTAL		**$ 105,000**	**$ 95,000**	**$ 10,000**		
																		PLAN TOTAL:		**$ 19,064,000**	**$ 8,741,500**	**$ 10,322,500**	Base funding scenario	
																				$ 24,962,000	**$ 9,767,750**	**$ 15,194,250**	Additional funding scenario	

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

Red text indicates estimated outputs/costs if additional external funding becomes available

● = implementation activity directly benefits the priority issue

o = implementation activity may indirectly benefit the priority issue

ADM = Administration of Partnership

GWQ = Groundwater Contamination

ESC = Accelerated Erosion and Sedimentation

SLH = Degraded Soil Health

LR = Landscape Resiliency and Altered Hydrology

FWH = Threats to Fish, Wildlife, and Habitat

Table 6-4 WAGZ Comprehensive Watershed Management Plan Implementation Schedule

Item ID	Implementation Action Description	Type P = Project S = Study E = Educ. R = Reg.	Applicable Goals (see Table 5-2)	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, SCWD/County locally budgeted/assessed)	Estimated External Contribution (WBIF, competitive grants, federal, 319)	Lead LGU	Supporting Entities
				Level 1				Level 2			Level 3				2022 to 2023	2024 to 2025	2026 to 2027	2028 to 2029	2030 to 2031					
				Groundwater Contamination	Excessive Flooding	Degraded Surface Water Quality	Accelerated Erosion and Sedimentation	Degraded Soil Health	Altered Hydrology, Landscape Resiliency	Threats to Fish, Wildlife, and Habitat	Threatened Groundwater Supply	Reduced Livability and Recreation												

FLD = Excessive Flooding
SWQ = Degraded Surface Water Quality
REC = Reduced Livability and Recreation
GWS = Threatened Groundwater Supply

7 References

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Appendices

Appendix A

Joint Powers Agreement (JPA)

GREATER ZUMBRO RIVER 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 Dodge, Olmsted, Goodhue, Wabasha, and Rice by and through their respective County Board of Commissioners, and
The Dodge, Olmsted, Goodhue, Wabasha, Rice, and Steele Soil and Water Conservation Districts, by and through their respective Soil and Water Conservation District Board of Supervisors, and
The Bear Valley Watershed District, by and through their respective Board of Managers, and
The City of Rochester, by and through their City Council.

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 Districts of this Agreement are political subdivisions 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 City of this Agreement is a political subdivision of the State of Minnesota, with statutory authority to control or eliminate stormwater pollution along with soil erosion and sedimentation within its boundaries, and to establish standards and specifications for conservation practices and planning activities that minimize stormwater pollution, soil erosion and sedimentation, pursuant to Minnesota Rules Chapter 7001 and 7090; and

WHEREAS, the parties to this Agreement have a common interest and/or statutory authority to implement the Greater Zumbro River 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 and conserve natural resources, ensure continued soil productivity, protect water quality, reduce damages caused by floods, 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 Greater Zumbro River Comprehensive Watershed Management Plan does not replace or supplant local land use, planning, 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 Greater Zumbro 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 Greater Zumbro River 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 Greater Zumbro River 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 Watershed Alliance for the Greater Zumbro (WAGZ).

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 Greater Zumbro River 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 Watershed Alliance for the Greater Zumbro. 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 30 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 Watershed Alliance for the Greater Zumbro 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 the respective employees or agents of each party shall remain the employees or agents of each individual respective party.

    d. **Records Retention and Data Practices:** The Parties agree that records created pursuant to the terms of this Agreement will be retained in a manner that meets their respective entity's adopted records retention schedules pursuant to Minnesota Statutes §138.17. The Parties further agree that records prepared or maintained in furtherance of the agreement shall be subject to the Minnesota Government Data Practices Act. The records retention will follow the Fiscal Agent's schedule. At the time this agreement expires, all records will be turned over to the Fiscal Agent for continued retention. (See 7. e. and 8. e.)

    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:** The Parties 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 Greater Zumbro River Comprehensive Watershed Management Plan:** Committees will be established to carry out the coordinated implementation of the Greater Zumbro River 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 Greater Zumbro River 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 Greater Zumbro River 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 Greater Zumbro River 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 Greater Zumbro River 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 Greater Zumbro River 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, local SWCD staff, and local city staff, for the purposes of logistical, and day-to-day decision-making in the implementation of the Greater Zumbro River 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 Greater Zumbro River 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 Greater Zumbro River 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 Greater Zumbro River 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 Greater Zumbro River 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. c.).

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 Greater Zumbro River Comprehensive Watershed Management Plan.

    a. Accept all day-to-day responsibilities associated with the implementation of grants received for implementing the Greater Zumbro River 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 Greater Zumbro River 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 Greater Zumbro River Comprehensive Watershed Management Plan.

10. **Authorized Representatives:** The following persons will be the primary contacts for all matters concerning this Agreement:

Dodge County
Jim Elmquist or successor
County Administrator
721 Main St. N.
Mantorville, MN 55955
Telephone: (507) 635-6239

Dodge Soil and Water Conservation District
Adam King or successor
District Manager
916 2nd St. S.E.
Dodge Center, MN 55927
Telephone: (507) 374-6364

Goodhue County
Scott Arneson or successor
County Administrator
509 W. 5th St
Red Wing, MN 55066
Telephone: (651) 385-3001

Goodhue Soil and Water Conservation District
Beau Kennedy or successor
District Manager
104 E 3rd Ave PO Box 335
Goodhue, MN 55027
Telephone: (651) 923-5286

Olmsted County
Heidi Welsch or successor
County Administrator
151 4th St SE
Rochester, MN 55904
Telephone: (507) 328-7967

Olmsted Soil and Water Conservation District
Skip Langer or successor
District Manager
2122 Campus Drive SE, Suite 200
Rochester, MN 55904
Telephone: (507) 328-7070

Rice County
Sara Folsted or successor
County Administrator
320 Third Street NW
Faribault, MN 55021
Telephone: (507) 332-6100

Rice Soil and Water Conservation District
Steve Pahs or successor
District Manager
1810 30th St NW
Faribault, MN 55021
Telephone: (507) 332-5408

Wabasha County
Michael Plante or successor
County Administrator
625 Jefferson Ave
Wabasha, MN 55981
Telephone: (651) 565-3073

Wabasha County Soil and Water Conservation District
Terri Peters or successor
District Manager
611 Broadway Ave. Suite 10
Wabasha, MN 55981
Telephone: (651) 565-4673

Bear Valley Watershed District
Paul Huneke or successor
Watershed District Board Member
254090 Co 16 Blvd
Goodhue, MN 55027
Telephone: (651) 923-4937

City of Rochester
Alison Zelms or successor
City Administrator
201 4th Street SE
Rochester, MN 55904
Telephone: (507) 328-2000

Steele County Soil and Water Conservation District
Eric Gulbransen or successor
District Manager
235 Cedardale Drive SE
Owatonna, MN 55060
Telephone: (507) 451-6730 ext. 3

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

PARTNER: **DODGE COUNTY**

APPROVED:

BY: DocuSigned by: E170031EF79842C...
Board Chair Date

BY: DocuSigned by: 410EC0D289604CA...
County Administrator Date

APPROVED AS TO FORM

5/3/2021

BY: DocuSigned by: Paul Kiltinen CC6F5FBB0EF2482...
County Attorney Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

PARTNER: **DODGE SOIL AND WATER CONSERVATION DISTRICT**

APPROVED:

BY: Larry Sickenger May/April 20-21
Board Chair Date

BY: [signature] May 14/21
District Manager Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

PARTNER: **GOODHUE COUNTY**

APPROVED:

BY: _____ 6/2/2021

Board Chair Date

BY: _____ 6/2/2021

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: **GOODHUE SOIL AND WATER CONSERVATION DISTRICT**

APPROVED:

BY: _____ 4/26/21
Board Chair Date

BY: _____ 4/26/21
District Manager Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

PARTNER: **OLMSTED COUNTY**

APPROVED:

BY: DocuSigned by: Stephanie Podulke 3F98A212909F415... 5/20/2021 | 2:10 PM CDT

Board Chair Date

BY: DocuSigned by: A8F097BBCC2244A... 5/24/2021 | 9:06 AM CDT

County Administrator Date

APPROVED AS TO FORM

BY: DocuSigned by: E89685A1A4F7441... 5/25/2021 | 4:11 PM CDT

County Attorney Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

PARTNER: **OLMSTED SOIL AND WATER CONSERVATION DISTRICT**

APPROVED:

BY: Cheryl A. Winters 4-23-21
Board Chair Date

BY: 4/29/2021
District Manager Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

PARTNER: **RICE COUNTY**

APPROVED:

BY: Jeff Docken 5/11/21

Board Chair Date

BY: Sara Sobolad 5-25-21

County Administrator Date

APPROVED AS TO FORM

BY: 5/20/2021

County Attorney Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

PARTNER: **RICE SOIL AND WATER CONSERVATION DISTRICT**

APPROVED:

BY: _____ 5-13-21
Board Chair Date

BY: _____ 5-13-21
District Manager Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

PARTNER: **WABASHA COUNTY**

APPROVED:

BY: Cheryl Key 5/18/2021

Board Chair Date

BY: 5/18/2021

County Administrator Date

APPROVED AS TO FORM

BY: 5/18/2021

County Attorney Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

PARTNER: **WABASHA COUNTY SOIL AND WATER CONSERVATION DISTRICT**

APPROVED:

BY: _____ 4/22/21
Board Chair Date

BY: _____ 4/22/21
District Manager Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

PARTNER: **BEAR VALLEY WATERSHED DISTRICT**

APPROVED:

BY: Paul Hmura 6-28-2021

President of the Watershed District Board Date

ATTEST: [signature] 6-28-2021

Secretary of the Watershed District Board Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

PARTNER: **CITY OF ROCHESTER**

APPROVED:

BY: Kim Norton 06/21/2021
Mayor Date

BY: ATTEST: Kelly K Smith CITY CLERK 06/21/2021
Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

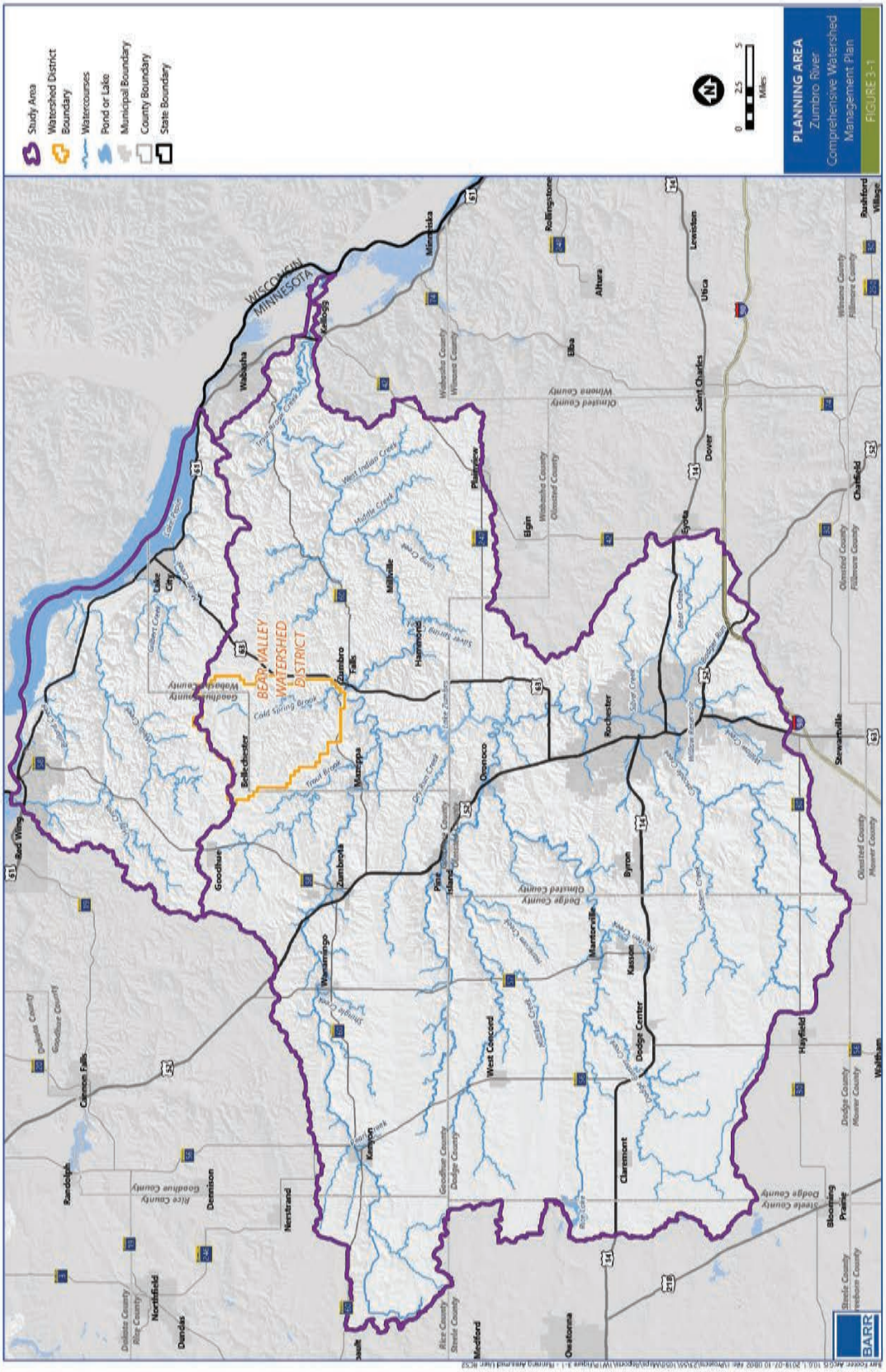
PARTNER: **STEELE COUNTY SOIL AND WATER CONSERVATION DISTRICT**

APPROVED:

BY: _____ 6-8-2021
Board Chair Date

BY: _____ 6/8/21
District Manager Date

Attachment A Map of the Greater Zumbro River Watershed Planning Area



Appendix B

Summary of Stakeholder Engagement Activities

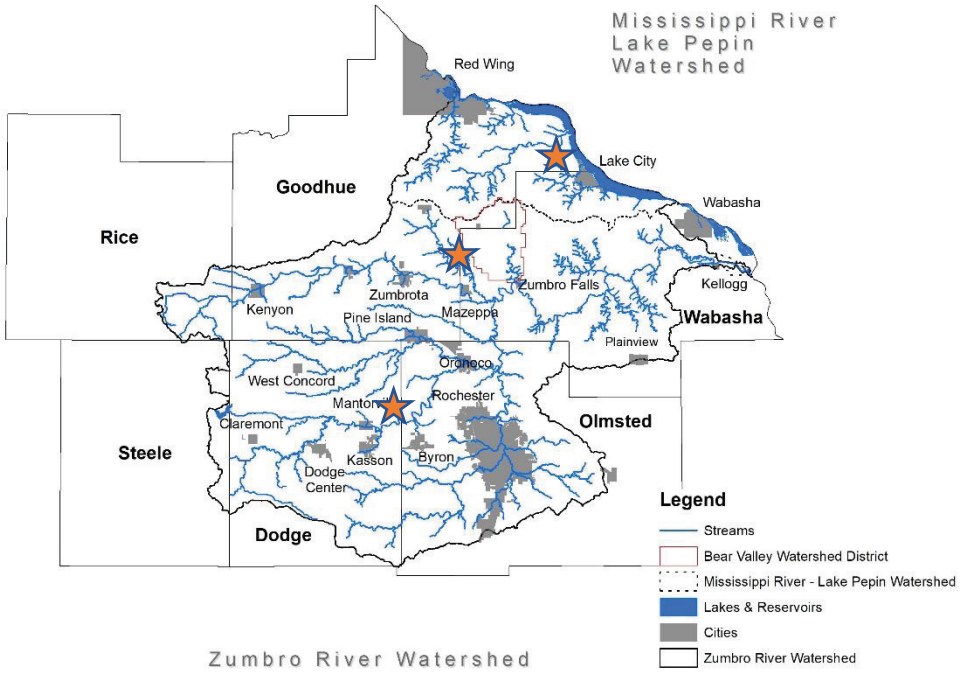
Greater Zumbro River Watershed

Comprehensive Watershed Management Plan

Waterside Chats Summary

Summary

The Greater Zumbro River Watershed Partnership hosted "Waterside Chats" in three communities throughout the watershed in October and November 2019. Waterside Chats were held on October 24th, 2019 at the Zumbro Valley Recreation Club in Mantorville, November 7th, 2019 at the Community Center in Mazeppa and November 14th, 2019 at the Sportsman's Club in Lake City.



The public was asked to attend the Waterside Chats to learn about the issues that had been identified by local partners and to provide feedback with their local knowledge of the watershed. Each Waterside Chat began with an overview presentation by the local SWCD or County Staff which included a summary of the One Watershed, One Plan program and plan development process, a summary of what has been accomplished, and information on how the public can participate. Following the overview, Barr Engineering summarized the priority resources and issues that had been identified in local and state plans, studies, reports, state agency feedback, and resident surveys. Initial results of the prioritization of these issues identified by a survey of watershed residents and ranked by the policy committee, planning workgroup and technical advisory group was also shared to aid in the table conversations (see figure 1 below).

Following the presentation, attendees were broken into small groups. Each small group discussed a series of questions to provide their input and feedback on the list of priority issues to be addressed in the 10-year scope of the plan. Comments were captured by a facilitator from the planning partnership, summarized, and reported out to the large group.

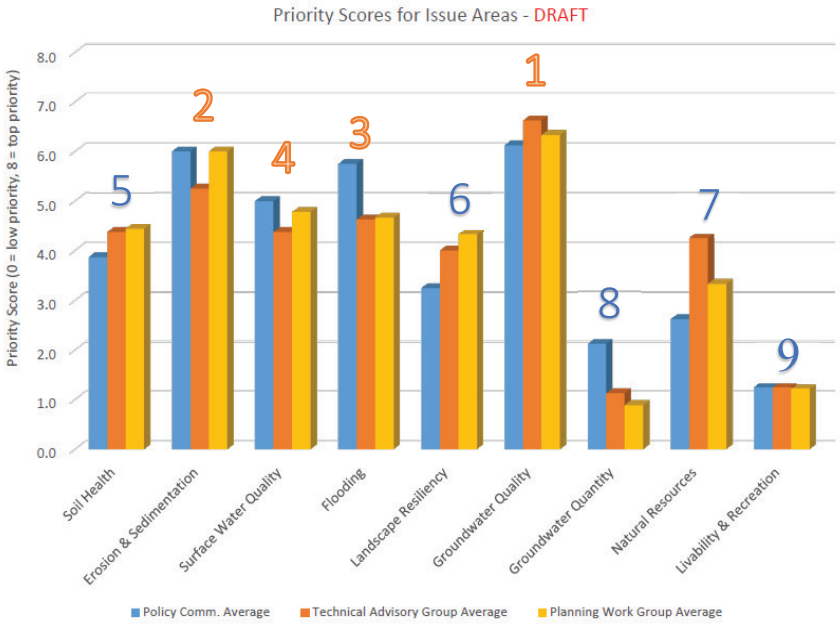


Figure 1. Priority Scores for Issue Areas (Policy Committee, Technical Advisory Group, and Planning Workgroup Ranking

Waterside Chats Framework & Participants:

The three Waterside Chats were hosted in late October and early November of 2019. The first was held on October 24th in Mantorville, the second on November 7th in Mazeppa, and the third on November 14th in Lake City. The Chats were facilitated by the local County or SWCD staff expert in each area. The Waterside Chat in Mantorville included 12 participants, and 10 staff from the planning Work Group and the consultant team. The 12 participants represented an assortment of local citizens and representatives from local and state government entities. The November 7th Chat in Mazeppa included 29 participants, and 10 staff from the Planning Work Group and consultant team. The composition of participants was diverse and included many local landowners and producers from the area. Other participants were affiliated with the Lake Zumbro Water Quality Committee, state agencies (MPCA, MDNR), and environmental advocacy

Photo: Waterside Chat in Mazeppa, MN

groups (Conservation Minnesota). The third chat on November 14th in Lake City included 23 participants, and 8 staff from the planning workgroup and consultant team. Participants included many citizens who live in the Mississippi River – Lake Pepin watershed area, state agency staff from MDNR and MPCA, the City of Lake City Environmental Committee, local SWCD supervisors, and The Nature Conservancy.

Emerging Themes:

The questions that were asked during the small group table conversations are presented below with a summary of the general themes. A full list of comments captured at the table conversations is included as an attachment to this summary.

Question 1. What do you think are the *major issues* in the watershed? Do you agree with the survey results and partnership prioritization?

Many of the participants strongly agreed with the issue prioritization ranked by the Policy Committee, Planning Workgroup and Technical Advisory Group. They felt that the issues which were ranked with the highest priority (Groundwater Quality, Erosion and Sedimentation, Flooding and Surface Water Quality) closely aligned with results from the resident survey and addresses the major issues in the watershed.

Attendees also discussed that many implementation actions to address the top priorities will have multiple benefits. For example, promoting soil health practices will address multiple issues such as surface water and groundwater quality. Addressing the top ranked issues first will also have beneficial impacts for some of the lower ranked priorities like "recreation and livability".

Question 2. What specific resources or areas are you concerned about?

Participants were asked to talk about specific areas of the watershed that they were concerned about. Many participants discussed specific areas that are prone to flooding with focus on areas that have erosion and sedimentation problems. Some examples of areas participants were concerned about in the *Zumbro River Watershed* included Middle Fork Zumbro River, Mayowood

Photo: Waterside Chat in Lake City, MN

area (Minnesota State Highway 63 and 52), the Lower Zumbro Watershed, and Lake Zumbro. Areas that were mentioned in the *Mississippi River-Lake Pepin Watershed* included Wells Creek, Gilbert Creek, West Indian creek and Hay Creek. Figure 2 includes the major subwatersheds in the planning area.

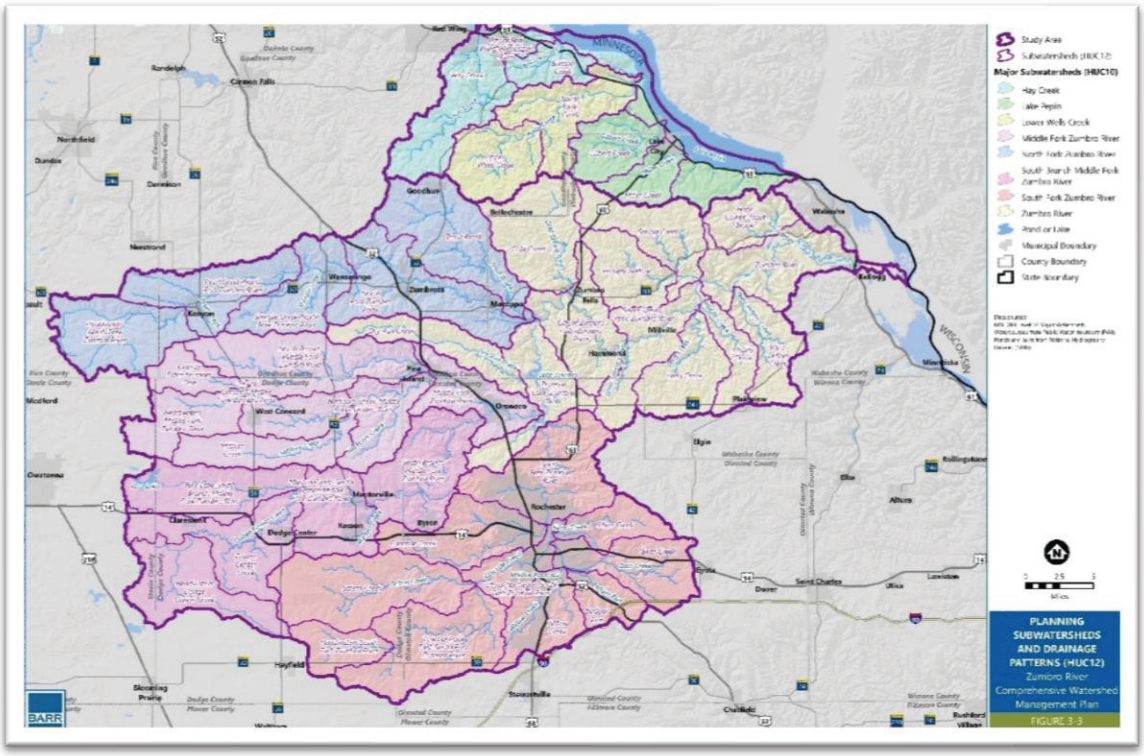


Figure 2. Planning Area Major Subwatersheds

Another focus of conversation across all three Waterside Chats was Groundwater Quality. Participants were concerned about specific areas with documented contamination issues, especially high nitrate levels as identified in the MN Department of Agriculture's Township Testing Program (ex. Florence Township, Goodhue County). Groundwater quality was a concern for private drinking water supplies and wellhead protection areas for municipal supplies. Lastly, participants discussed protection of recharge areas and wetlands.

Question 3. Within the broad issue categories, what specific problems are most important?

Participants were asked to discuss the specific problems that are most important within each broad issue category. The following summarizes major themes emerging from the Waterside Chat small group discussions:

Groundwater Quality

Participants felt that groundwater quality and groundwater protection is a major issue and should be a top priority as watershed residents rely on groundwater for their drinking water (Figure 3). The following bullets summarize comments related to Groundwater quality:

- Groundwater quality (drinking water quality) is threatened by contaminants like nitrate and bacteria as evidenced by the recent Township Testing Program monitoring results.
- Issues like unsealed wells and sinkholes continue to contribute to the contamination problem.
- There is concern about using lower aquifers for drinking water as they have other contaminants of concern.
- Desire for more public education and engagement to better inform the public regarding water quality issues.

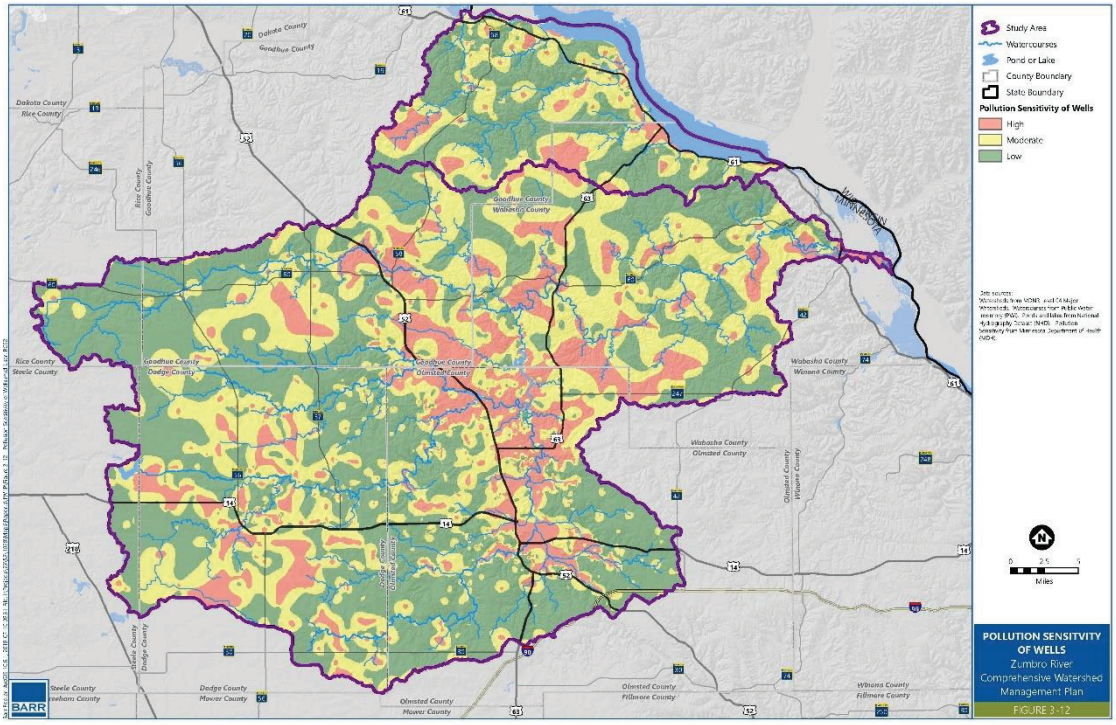


Figure 3. Pollution Sensitivity of Wells; Red (high sensitivity to pollution) Green (low sensitivity to pollution)

Conservation Practices & Soil Health

Conversations emphasized that loss of conservation practices have led to altered hydrology, altered landscapes, and altered habitat. Examples provided by participants included:

- Increased tillage is increasing sedimentation and leading to poor soil health in many areas.
- Waterways and contour strips are being removed and tiling has increased across the watershed.
- Poor fertilizer management is contributing nutrient loading from feedlots and agricultural land
- There is a lack of perennial vegetation; including increased tillage along fence lines and buffer strips.
- It is difficult to raise awareness of soil health practices and to find landowners willing to adopt the practices.

Some participants felt that the issue stems from our current agricultural system of incentivizing the production of corn and soybeans. Farms are converting from livestock operations to more cropland which means less diversified crops and less pasture/hay in rotation.

Discussions included suggestions to enforce existing standards and/or appropriate land use management to limit non-point source pollution like nutrients and sediment.

Flooding & Landscape Resiliency

A reoccurring discussion at the Waterside Chats included concern about the increased frequency of precipitation events and climate change contributing to high volumes of runoff, more frequent flooding, fast flows, and streambank erosion in many areas of the watershed. These issues are summarized below:

- Flooding is exacerbated by altered hydrology, such as loss of wetlands and water storage.
- Flooding leads to bank erosion, increases sedimentation, impacts water quality and creates public health issues throughout the watershed.
- Public infrastructure, transportation, agricultural land, and economies located in the floodplain are negatively impacted.
- More water storage is needed as wetlands have been impacted throughout the watershed.
- There is some disagreement over where and how to store water, for example where impoundments and dams should be restored versus where they should be recommended for removal (ie. Silver Lake Dam in Rochester MN).

Degraded Surface Water Quality

Participants discussed surface water quality impacts from both rural and urban sectors including the following:

- Surface water (and groundwater) are being polluted as municipal wastewater systems face aging infrastructure and capacity problems.
- Small community and private septic systems are failing and contributing to pollution downstream.
- Pollutants like road salt and urban trash in stormwater discharge impact our surface and groundwater quality.
- Nutrient loading from feedlots and agricultural land is degrading water quality (Ex. Figure 4).

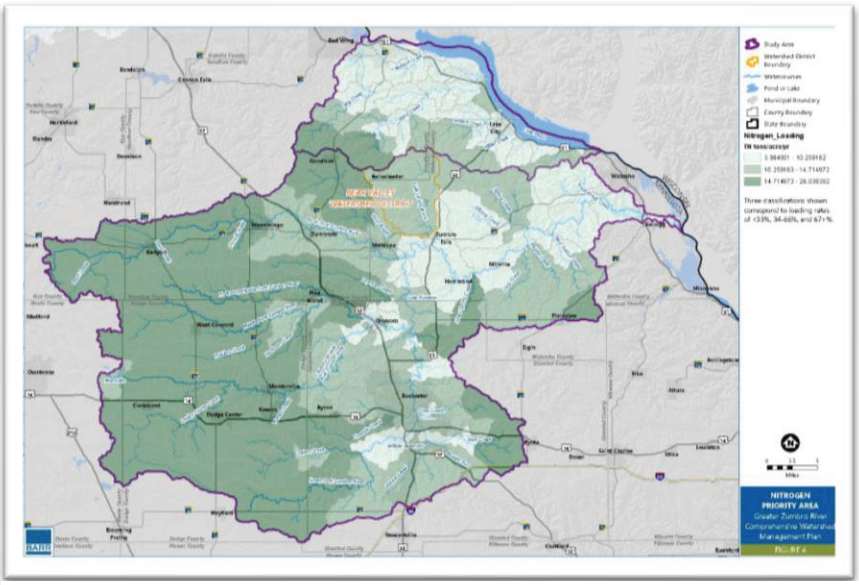


Figure 4 Total Nitrogen Loading in the Greater Zumbro River Watershed

Natural Resources

Forest health including terrestrial invasive species and brush/tree overgrowth along stream banks is an issue in the watershed and should be addressed in the plan.

Altered hydrology and lack of perennial vegetation may negatively impact habitat and health of fisheries.

Erosion & Sedimentation

Erosion and sedimentation contribute to nitrogen movement and affect our streams and lakes (Lake Zumbro & Lake Pepin).

Producers face many challenges including the cost of adopting beneficial soil health practices (ex. cover crop seed) which will keep soil on agricultural land and reduce erosion/sedimentation. There was agreement that requirements, such as buffers are effective but are a constant challenge for some landowners facing increased streambank erosion due to flooding.

Livability & Recreation

Waste left at campgrounds, overuse of trails, urban trash, and contaminated stormwater impacts the recreational quality of the resource.

Methods to Improve Water Quality

Some attendees voiced concern that voluntary conservation programs do not always work, and that regulation is needed in certain scenarios. There was also concern that lack of regulation or inefficient regulation have resulted in marginal or no water quality improvements over time, and stakeholders including state agencies, public and private sectors often lack joint coordination and have differing opinions on priorities.

Question 4. What solutions do you see to these problems?

Participants were asked to discuss actions that will make the biggest impact on water quality issues in the watershed. Below are general themes that emerged from the small group conversations.

Conservation Practices & Soil Health

Promote regenerative soil health practices and adoption of other agricultural/conservation BMPs, as they will impact many of the issues and problems the watershed faces. Some of the actions that should be promoted include:

- Promote cover crop adoption
- Increase peer to peer farmer education on soil loss and reduced tillage (or no till) farming practices.
- Keep the soil where it is and limit erosion and sedimentation

Photo: Cover Crops Planted on Olmsted SWCD's Soil Health Farm

- Improve nutrient management; fertilizer rate and timing
- Promote managed grazing, use of saturated buffers, and smart tiling
- Increase BMP education and instruction for renters
- Target commercial/co-op agronomists
- Lobby for large scale change to the farm bill

Education and Promotion

Participants discussed ways to increase and promote education around water quality issues through the following methods:

- Increase education in K-12 schools (ecology curriculum)
- Increase coverage on local news outlets to increase concern and provide for a more informed public
- Enhance outreach on groundwater contamination issues
- Adopt short term goals and deliverables in the Plan to demonstrate that practices are working. Share successes and failures with stakeholders
- Share and educate on the responsibilities that lie with both rural and urban communities.

Photo: Soil Health Field Day in SE MN to Promote Education

Incentivize Best Management Practices

Participants felt that landowners who are adopting best management practices should be incentivized. They also suggested methods for reaching more landowners and continued programmatic support.

- Provide better cost sharing for some practices (planting cover crops, renting/buying specialized equipment, trapping sediment, and structural BMPs)
- Offer subsidies to protect soils productivity
- Incentivize stewardship and tools. Promote neighboring farmers working together (sharing equipment and resources)
- Establish contracts with renters/absentee landowners that establish BMPs for nitrogen management
- Expand reinvest MN program (RIM) and CREP/CRP
- Support tax relief

- Make it easy, limit the red tape

Landscape Resiliency

Promote forest health practices; plant more trees with climate change in mind.

Water Storage, Floodplain Retention, Slowing the Flow, & Streambank Restoration

Solutions should focus on adding water storage capacity, tile management, floodplain retention, restoring wetlands and slowing the flow. Participants encouraged using water control structures and practices where they will make the biggest impact on water storage and habitat reconnection and included the following recommendations:

- Focus on managing failing structures
- Implement new terraces, basins, and grade stabilizations throughout the watershed
- Utilize dams and the transportation network for water storage where possible (floodplain culverts etc.)
- Promote perennial cover/prairie, CRP adoption on marginal lands. Reconnect wildlife corridors for habitat

Improve Water Quality

Focus on stabilizing and restoring streambanks by increasing vegetation/buffers along streams and waterways.

Implement urban Stormwater Best Management Practices (even in communities without MS4 permits). Maintain natural areas, reduce impervious surfaces, utilize raingardens, and reduce salt use.

Voluntary vs Regulatory

Participants also discussed voluntary measures versus regulatory action. Some felt that non-compliance in problem areas should have consequences such as enforcement action, and that political willpower is needed to address these issues. Other participants discussed increasing staff resources and expanding beyond the regular toolbox of state and federal programs to address water quality issues in the Greater Zumbro River Watershed.

Photo: Zumbro River Downstream of the Green Bridge

resourceful. naturally.
engineering and environmental consultants

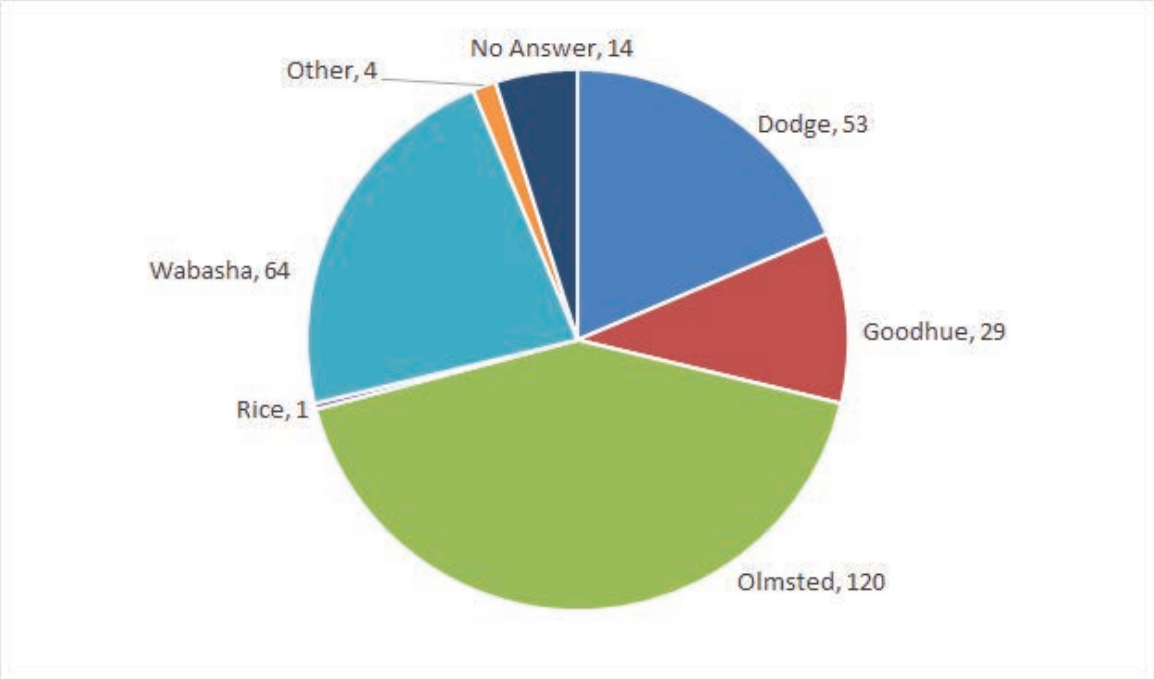
BARR

Memorandum

To: Greater Zumbro Watershed Partnership Planning Work Group
From: Greg Williams, PE, Barr Engineering Co.
Subject: Results of the Greater Zumbro One Watershed, One Plan public engagement survey
Date: October 22, 2019
Project: 23551058.00
c:

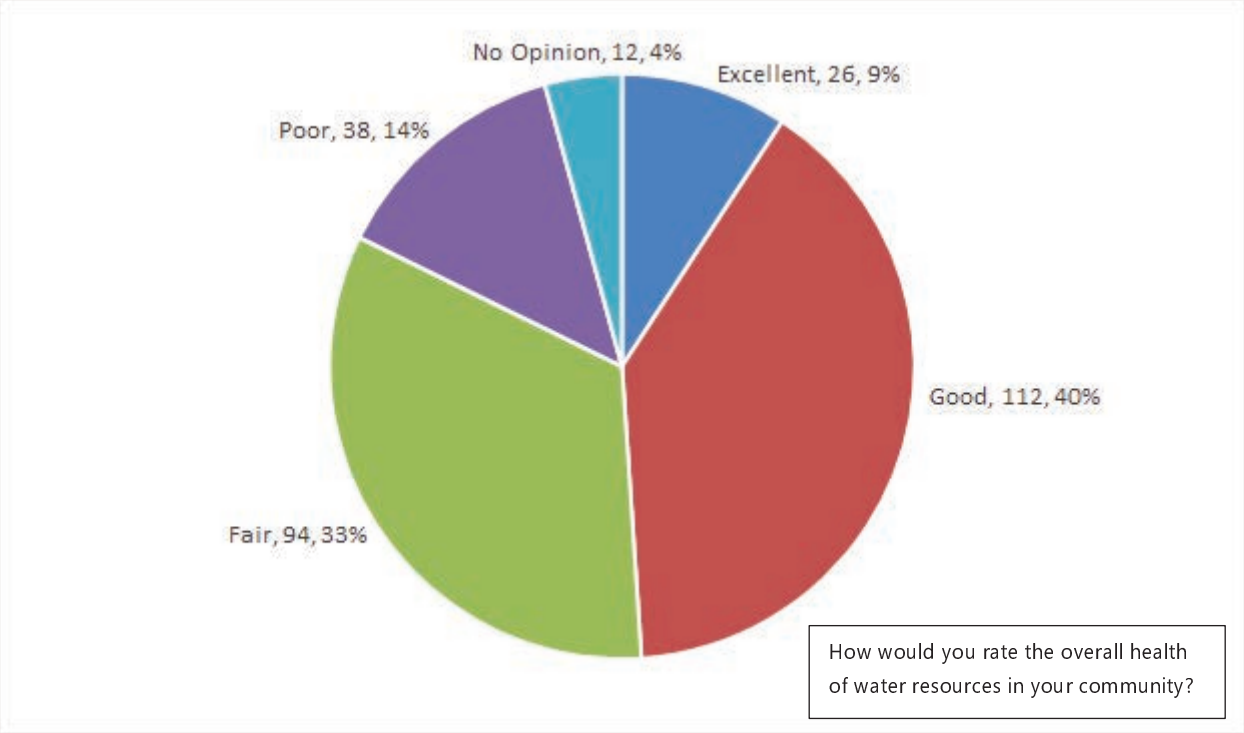
As part of an extensive stakeholder engagement effort, the Greater Zumbro Watershed Partnership Planning Work Group (PWG) developed a brief survey to characterize public opinions regarding natural resource management in the planning area. The survey was made available at the project public kickoff meeting hosted in Rochester on June 20, 2019, county fairs, online via the project webpage, and mailed to approximately 900 residents in the planning area. Through September 20, 2019 at total of 285 surveys had been completed. This memorandum summarizes the results of the surveys submitted through September 20, 2019.

Question 1 – What is your County of residence?



Dodge, Goodhue, Olmsted, and Wabasha Counties are well represented within the survey responses. About 5% of respondents did not answer the question, and 4 respondents (1.4%) identified another county outside the planning area (i.e., Dakota, Houston, Mower, or Pepin, WI). Responses to question 1 suggest the survey responses are largely representative of planning area.

Question 2 – How would you rate the overall health of water resources in your community?



Approximately 50% of survey respondents consider the health of water resources in their communities as "good" or "excellent." Only 38 respondents (14%) identified the health of water resources as poor. These results suggest that stakeholders may encourage the emphasis of protection strategies in the Plan implementation program.

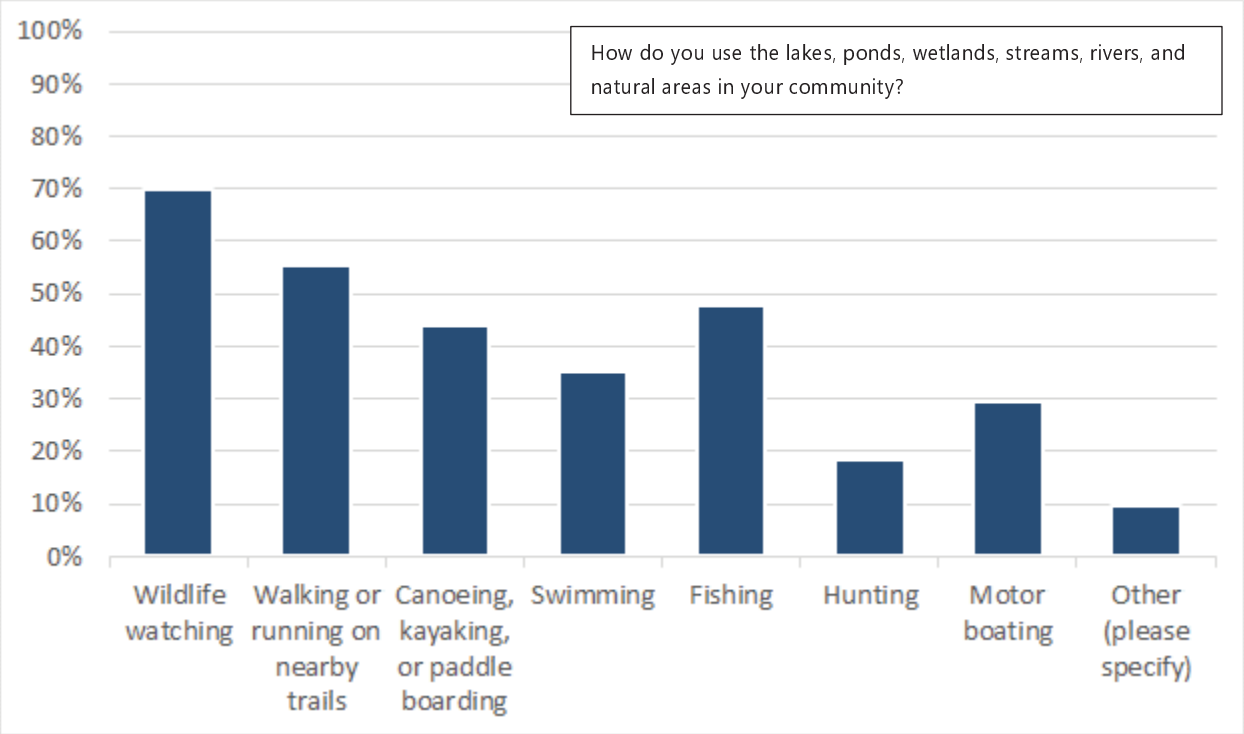
Question 3 – How do you use the lakes, ponds, wetlands, streams, rivers, and natural areas in your community?

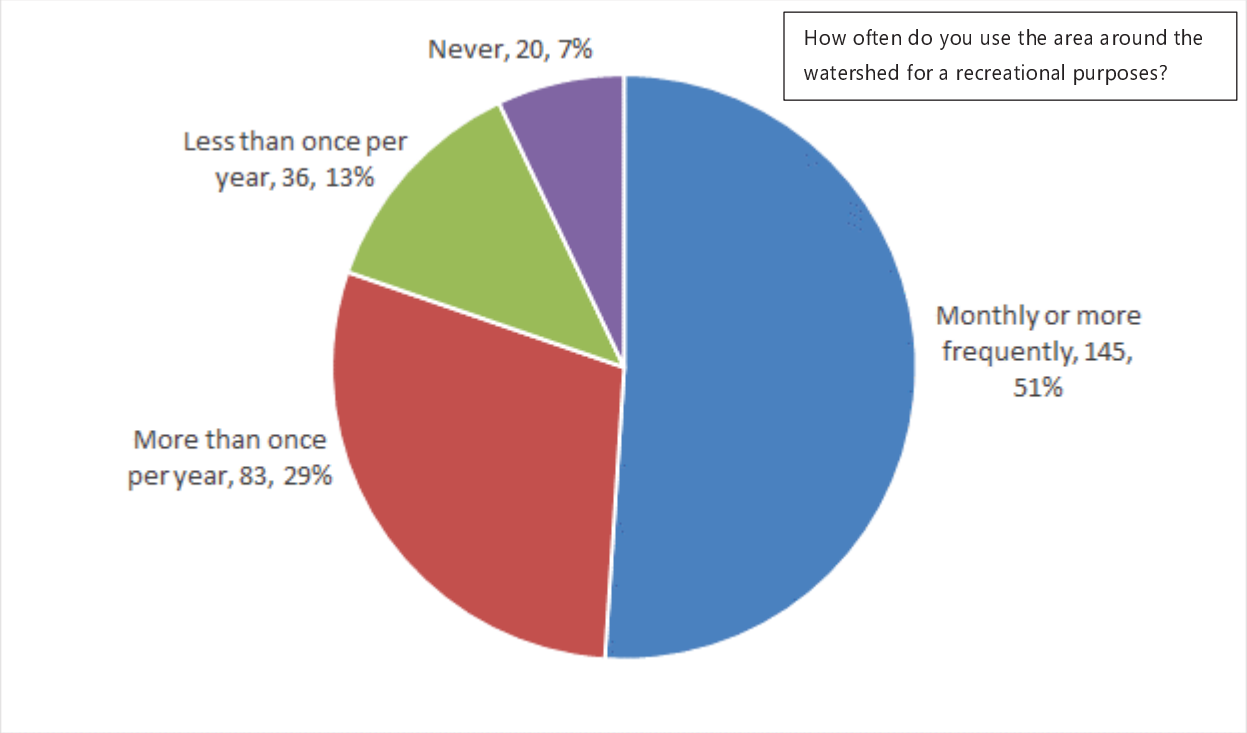
Question 4 – How often do you use the area around the Zumbro Watershed and/or Mississippi River Lake Pepin Watershed for a recreational purpose?

Questions 3 and 4 are related to public use or the water and natural resources within the planning area. Responses to question 3 indicate that residents use the water resources and natural areas in the planning area for a range of activities. Wildlife watching (70% of respondents) and nearby walking or running (55% of respondents) were the most popular. Over 30% of respondents use water resources for swimming. Other uses identified by respondents included:

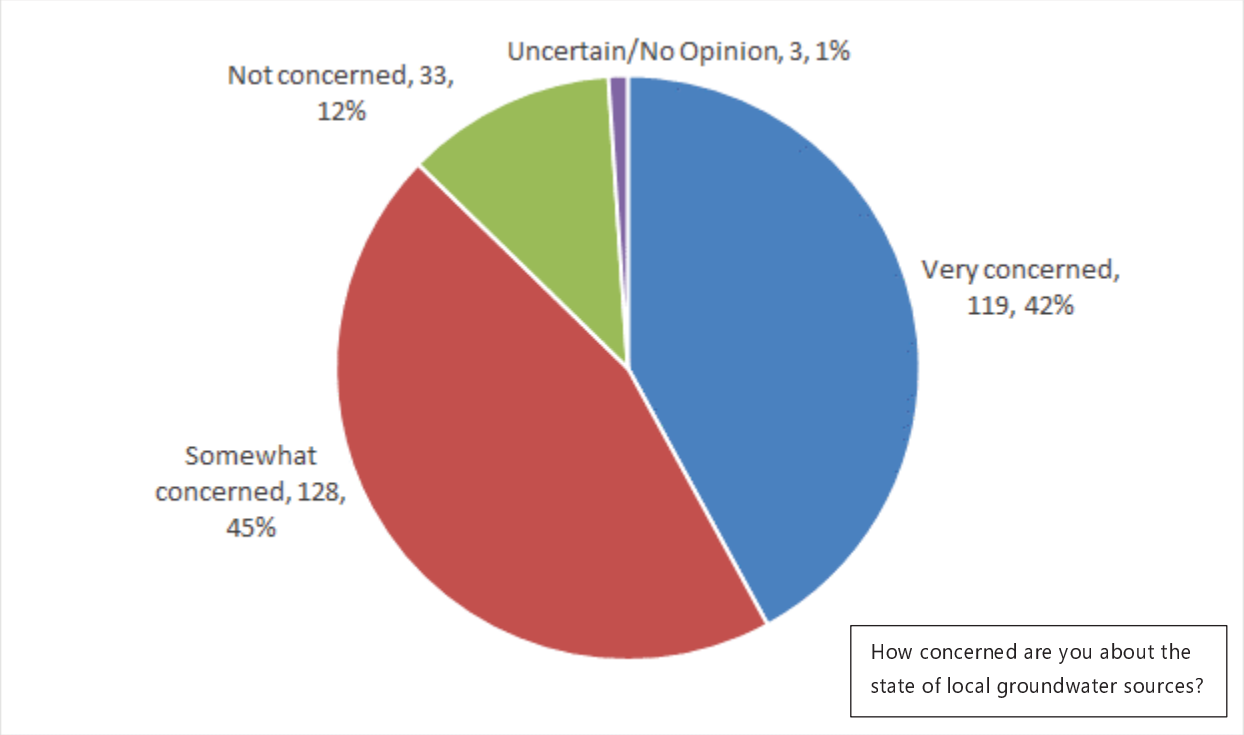
- Biking
- Education
- Photography
- Snowmobiling

Responses to question 4 indicate frequent (monthly or greater) recreational use of resources in the planning area by approximately half of survey respondents. Few survey respondents (7%) indicated that they never use the watershed for recreation.





Question 5 – Drinking water within the watershed comes from groundwater sources. How concerned are you about the state of local groundwater sources?



Groundwater supplies drinking water for the entire planning area. Nearly 90% of survey respondents expressed concern over the state of drinking water in the watershed. Only three survey respondents (1%) indicated they are uncertain or have no opinion; however, information from the Minnesota Department of Health (MDH) suggests that many residents lack water quality information for their wells. This suggests there may be gap in public awareness of groundwater quality issues.

Question 6 – How Important are each of the following water issues to you?

Question 6 asked respondents to select how important each of twelve water and natural resource management issues are from the following choices:

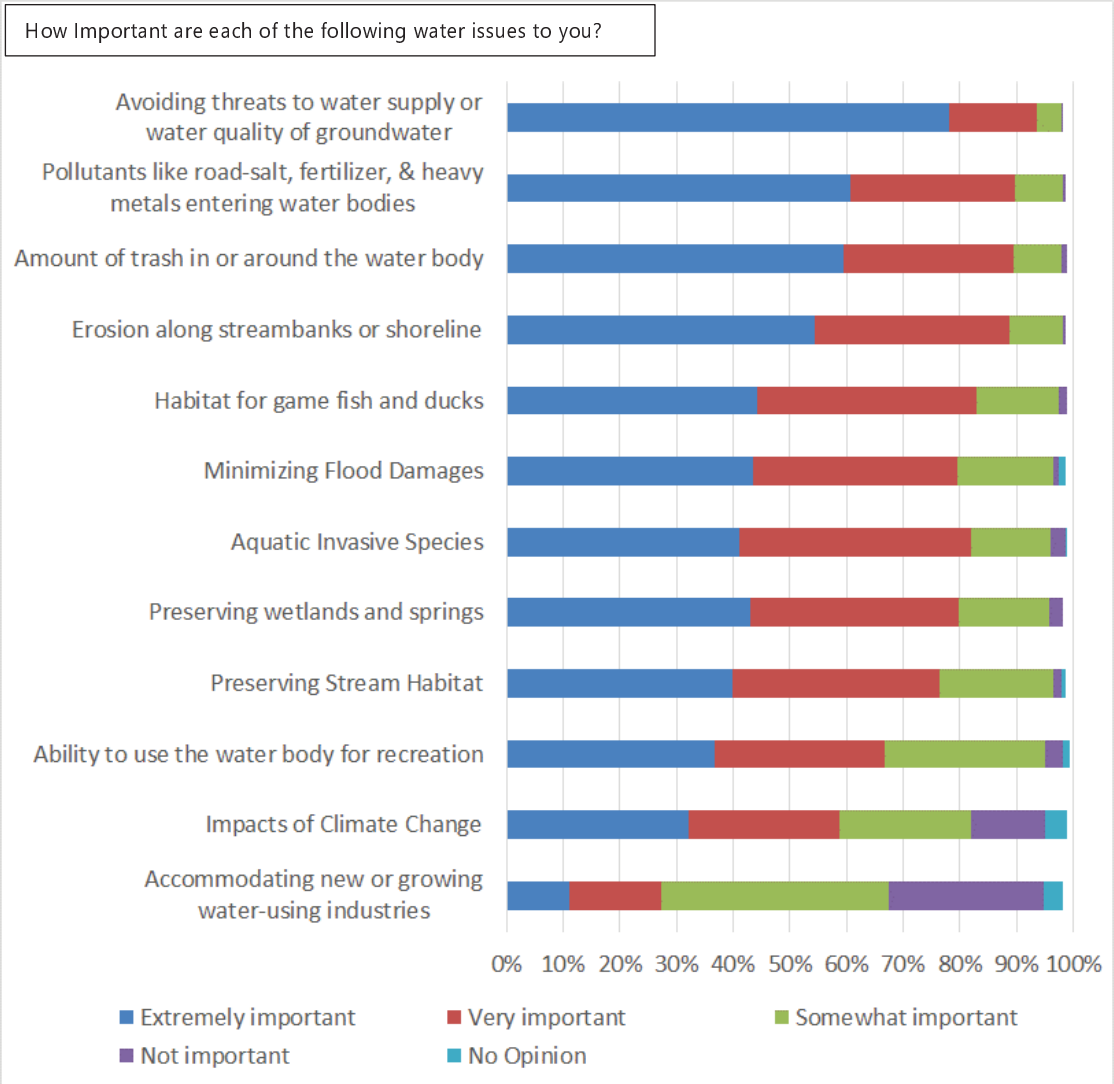
- Extremely important
- Very important
- Somewhat important
- Not important
- No opinion

Survey responses suggest that residents consider *all* of the pre-identified watershed issues to be at least "somewhat important," although some register as more important than others (see responses to question 7). Of the twelve pre-identified issues, only two were identified as "not important" by more than 10% of survey responses, including:

- Impacts of climate change ("not important" to 13% of survey respondents)
- Accommodating new or growing water-using industries ("not important" to 27% of survey respondents)

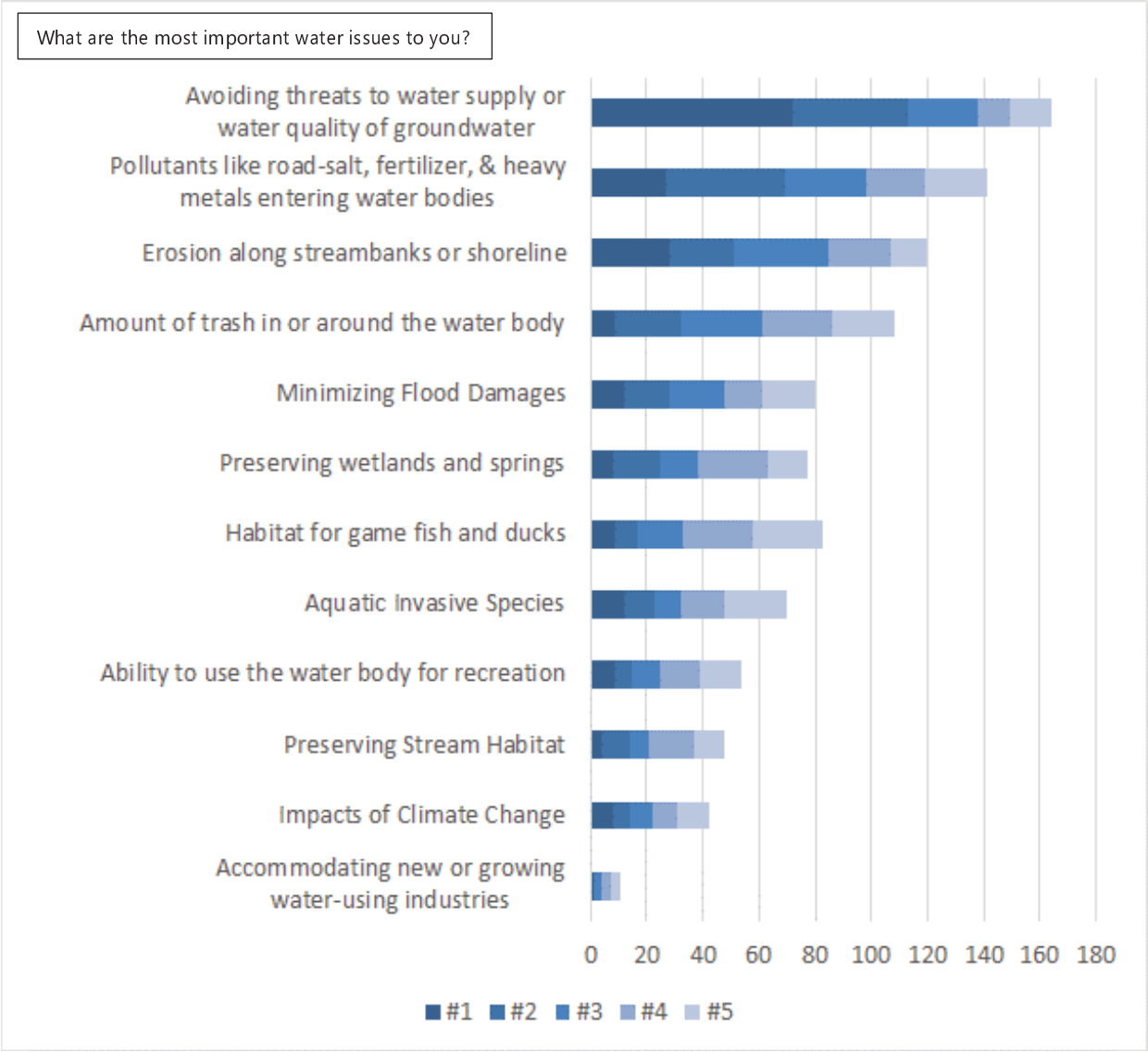
Thirteen survey respondents (5%) specified other issues as important in an open-ended response. All of the open-ended responses are related to, variations of, or specific examples of the pre-identified watershed issues identified in the question. Selected open-ended responses (paraphrased) include:

- Too much drain tile causing reducing soil capacity to hold water and causing flooding
- Controlling and reducing leakage/pollution from large contained animal feeding operations (CAFOs)
- Increasing access to new waters for recreation
- Public understanding of the benefits of regenerative soil management/soil health
- Animals pastured with/standing in water resources impacting water quality



Question 7 – What are the most important water issues to you?

Question 7 asked survey respondents to identify the their top 5 water issues from those listed in question 6 ranked in order of importance. Responses to question 7 generally corroborate the responses to question 6. "Avoiding threats to water supply or water quality of groundwater" was selected as the most important issue more than twice as frequently (72 times) as any other issue. Conversely, the "Amount of trash in or around the water body" was identified as an important issue, but received very few "#1" votes.



Question 8 – Are there specific waterbodies or natural areas you are concerned about?

One hundred twenty five survey respondents (57% of those answering question 8) answered "Yes" to question 8. Specific waterbodies of concern referenced most frequently in the open-ended responses to question 8 include:

- Lake Zumbro (44 responses)
- Zumbro River (37 responses) including references to:
    - North Fork Zumbro River (5 responses)
    - North Branch Middle Fork Zumbro River (1 response)
    - Middle Fork Zumbro River (5 responses)
    - South Fork Zumbro River (4 responses)
- Mississippi River (11 responses)
- Lake Pepin (9 responses)
- Groundwater sources (5 response)
- Salem Creek (4 responses)
- Bear Creek (3 responses)
- Masten Creek (2 responses)
- Smaller tributaries (2 responses)
- Trout streams (2 responses)

Other specific waterbodies identified once among the open ended responses include: Cascade Creek, Dodge Center Creek, Foster-Arend Lake, Mayowood Lake, Silver Spring Creek.

Question 9 – General Comments/Suggestions

Question 9 provided an opportunity for survey respondents to submit general comments and/or suggestions in an open-ended response. Fifty-seven survey respondents (20%) completed question 9. Responses to question 9 address a wide range of issues. Some common themes include:

- Emphasis on soil health practices to achieve direct (i.e., in-field) and downstream benefits (e.g., improved water quality, reduced flooding)
- Frequent flooding in the watershed (exacerbated by altered hydrology) leads to erosion, water quality, and public health issues
- The importance of groundwater quality and groundwater protection
- A desire for more public education and engagement regarding water quality issues
- The need for enforcement of existing standards and/or appropriate land use management to limit non-point source pollution (nutrients and sediment)

Conclusions

The responses to the survey indicate strong public interest in the quality and management of water and natural resources in the planning area. Results identify several issues of importance, but generally identify groundwater quality, pollutant loading, erosion, and flooding as top priorities.

Appendix C

Land and Water Resources Inventory

C Land and Water Resources Inventory

This section of the Zumbro River Comprehensive Watershed Management Plan (Plan) summarizes the physical land, water, and natural resources within the planning area. The planning area boundary – all within the State of Minnesota – follows the boundary of the Zumbro River watershed (HUC 07040004) and a portion of the Mississippi River Lake Pepin watershed (HUC 07040001, see Figure C-1). The planning area drains approximately 1421 square miles of the Zumbro River watershed and 233 square miles of the Mississippi River Lake Pepin watershed. The planning area includes portions of Dodge, Goodhue, Olmsted, Rice, Steele, and Wabasha Counties, as described in Table C-1.

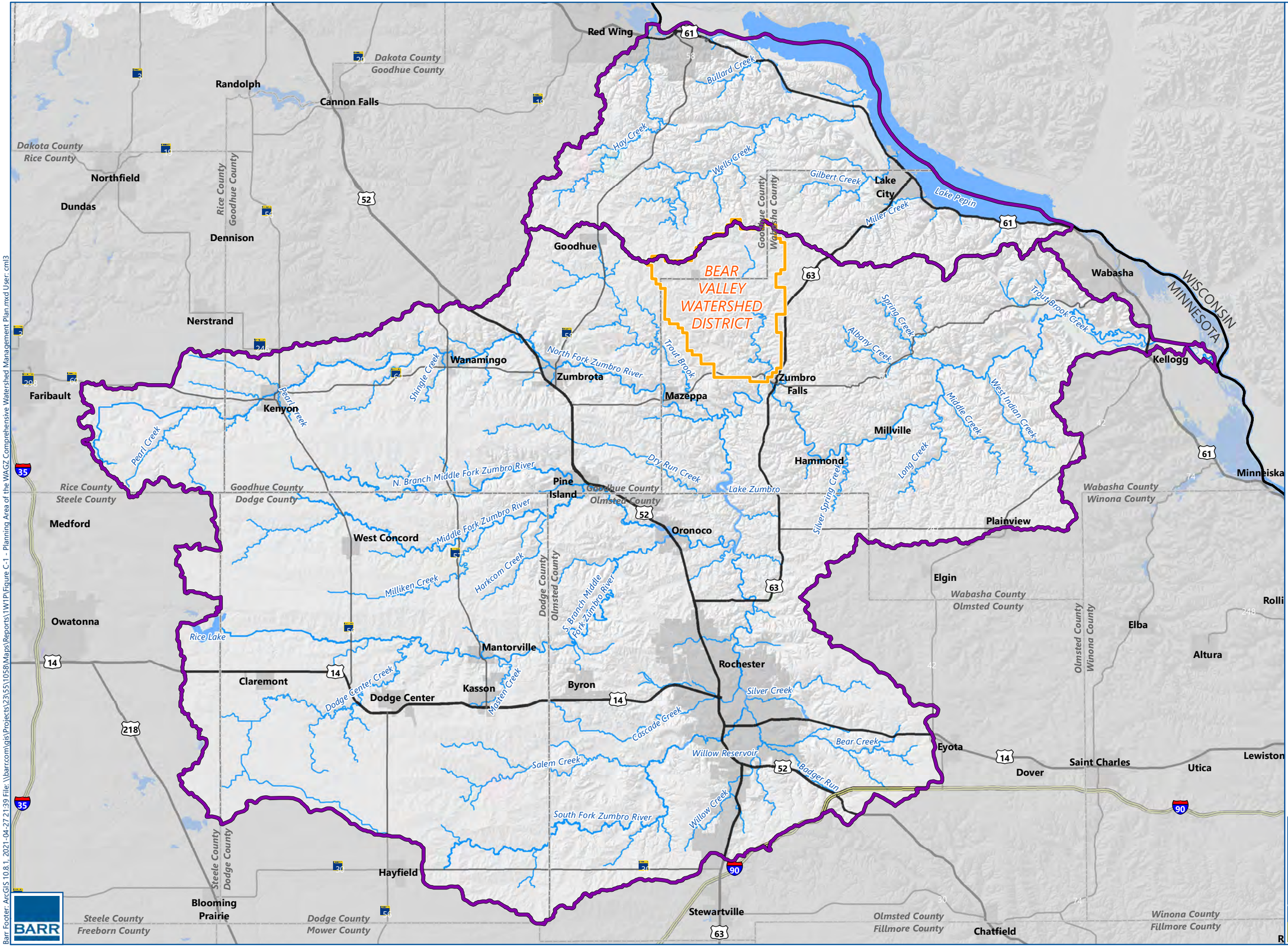
Table C-1 Counties located within the planning area

County	Area within Zumbro Watershed (mi^2)	Area within Mississippi River Lake Pepin Watershed (mi^2)	Percent of Planning Area within County (%)	Percent of County within Planning Area (%)
Dodge	364	0	22.0%	82.9%
Goodhue	277	169	27.0%	57.2%
Olmsted	370	0	22.4%	56.5%
Rice	47	0	2.8%	9.1%
Steele	26	0	1.6%	6.0%
Wabasha	336	64	24.2%	72.8%
Total	1421	233	100.0%	NA

Data presented in this section includes:

- Topography and drainage patterns
- Climate and precipitation
- Land cover and land use
- Soils
- Geology and groundwater
- Surface water resources (streams, lakes, and wetlands)
- Surface water quality
- Water quantity and flooding
- Wildlife habitat and rare features

Information presented in this section is a compilation intended for summary purposes. Much of the data presented herein is based on more complete data documented in other sources. These sources are referenced in the appropriate subsections of this section.



PLANNING AREA OF THE WAGZ COMPREHENSIVE WATERSHED MANAGEMENT PLAN

WAGZ Comprehensive Watershed Management Plan

FIGURE C-1

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Barr Footer: ArcGIS 10.8.1, 2021-04-27 21:39 File: \\barrcom\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure C-1 - Planning Area of the WAGZ Comprehensive Watershed Management Plan.mxd User: cml3

C.1 Topography and Drainage Patterns

The topography of the Zumbro River watershed includes gently rolling terrain in the western and central portions of the watershed transitioning to hills, bluffs, and ravines in the eastern portion of the watershed. The topography of the Mississippi River Lake Pepin portion of the planning area is characterized by rolling hills, ravines, and bluffs similar to the downstream part of the Zumbro River watershed.

Figure C-2 presents elevation information within the planning area based on the National Elevation Dataset (NED) in NAVD88 datum. Elevations in the Zumbro River watershed range from over 1,350 feet above mean sea level (ft MSL) in the southwest portion of Dodge County to less than 700 ft MSL at the watershed outlet to the Mississippi River. Elevations in the Mississippi River Lake Pepin portion of the watershed range from about 1,150 ft MSL along the southwestern watershed boundary to less than 700 ft MSL at Lake Pepin and along the Mississippi River.

C.1.1 Drainage Patterns

The planning area includes the area tributary to the Zumbro River and areas in Goodhue and Wabasha Counties that drain towards Lake Pepin and the Mississippi River along the border between Minnesota and Wisconsin. The western half of the Zumbro River watershed generally flows west to east, before flowing north and east towards the Mississippi River in the east. The Mississippi River Lake Pepin watershed generally drains from the southwest to the northeast. The entire planning areas is ultimately tributary to the Mississippi River.

Within the two major watersheds comprising the planning area, the Minnesota Department of Natural Resources has further delineated subwatersheds at the HUC12 level for natural resource planning and management purposes (see Figure C-3). HUC12 watersheds define the smallest federal drainage units. Watershed delineation data maintained by the Minnesota Department of Natural Resources (MDNR) is available from: https://www.mngeo.state.mn.us/chouse/water_watersheds.html

For the purposes of this Plan, the HUC12 subwatersheds have been grouped into 8 planning subwatersheds corresponding to the MDNR HUC10 level watershed delineations, including five in the Zumbro watershed and three in the Mississippi River Lake Pepin watershed (see Figure C-3). The HUC10 planning level subwatersheds coincide with the subwatershed delineations used to organize implementation strategies in the *Zumbro River Watershed Restoration and Protection Strategy Report* (Zumbro WRAPS) (MPCA, 2017) and the *Mississippi River Lake Pepin Watershed Restoration and Protection Strategy Report* (Mississippi-Pepin WRAPS) (MPCA, 2015). The HUC10 and HEC12 level subwatersheds are presented in Figure C-3 and are summarized in Table 3-2.

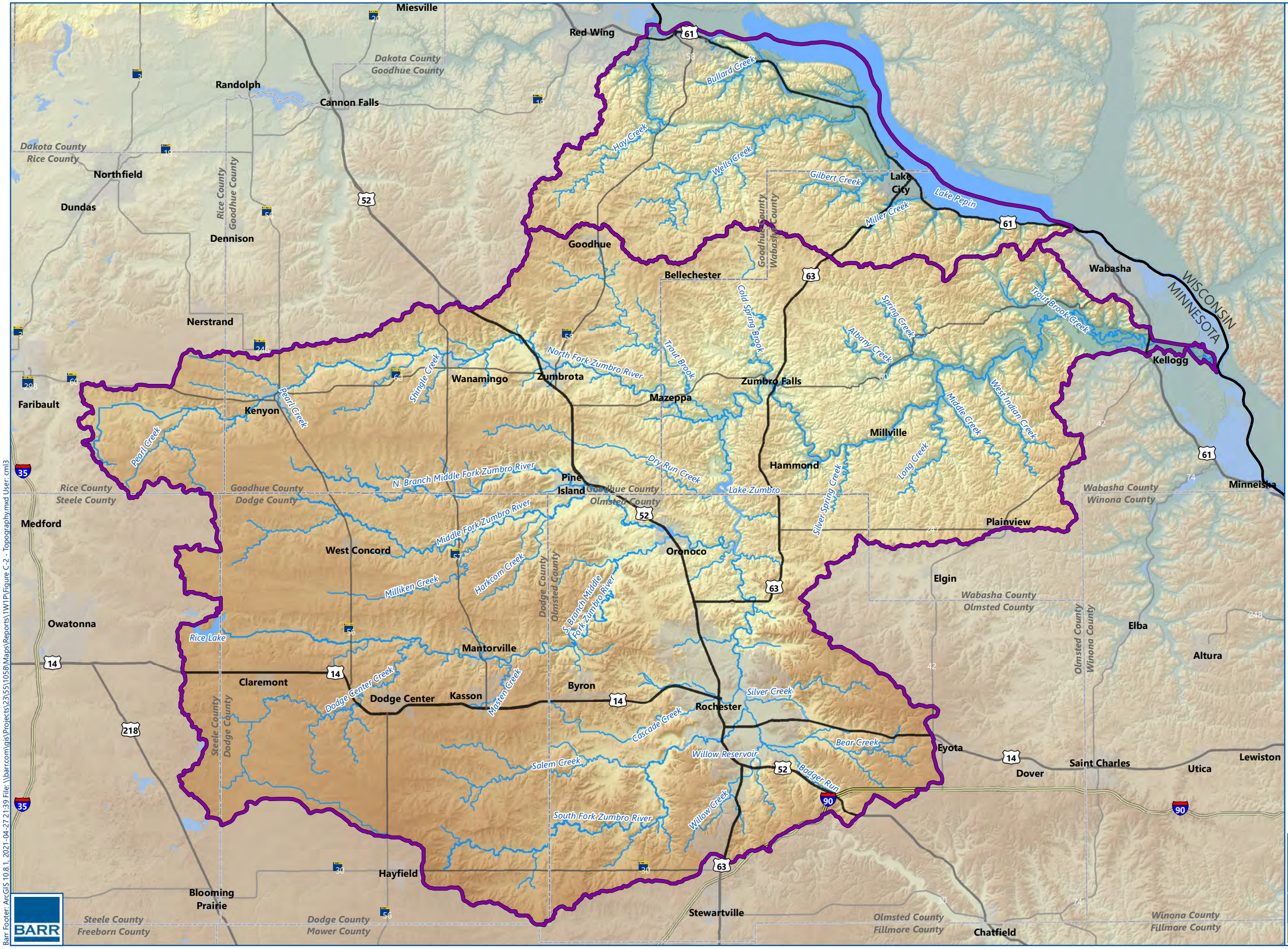
Table C-2 Subwatersheds within the planning area

Major Watershed	Planning Subwatershed (HUC10)	HUC10 Number	HUC10 Drainage Area (mi^2)	HUC12 Subwatershed Name	HUC12 Number	HUC12 Drainage Area (mi^2)
Mississippi River Lake Pepin	Hay Creek	0704000104	71.2	Hay Creek	070400010401	47.5
				Bullard Creek	070400010402	16.0
				City of Red Wing-Mississippi River	070400010403	7.6
Mississippi River Lake Pepin	Wells Creek	0704000106	71.9	Upper Wells Creek	070400010601	33.4
				Lower Wells Creek	070400010602	38.5
Mississippi River Lake Pepin	Lake Pepin	0704000107	77.3	Gilbert Creek	070400010703	25.0
				Miller Creek	070400010704	17.5
				Lake Pepin	070400010705	34.8
Zumbro River	South Fork Zumbro River	0704000401	353.5	Headwaters South Fork Zumbro River	070400040101	18.7
				Town of Rock Dell-S. Fork Zumbro R	070400040102	58.5
				Salem Creek	070400040103	62.2
				Willow Creek	070400040104	29.5
				Badger Run	070400040105	16.3
				Bear Creek	070400040106	35.7
				Silver Creek	070400040107	19.6
				City of Rochester-S. Fork Zumbro R	070400040108	18.6
				Cascade Creek	070400040109	38.6
				South Fork Zumbro River	070400040110	55.9
Zumbro River	South Branch Middle Fork Zumbro River	0704000402	216.3	Rice Lake-S. Br. Middle Fork Zumbro R	070400040201	42.4
				Headwaters Dodge Center Creek	070400040202	43.4
				Dodge Center Creek	070400040203	47.0
				Masten Ck-S. Br. Middle Fork Zumbro R	070400040204	33.8
				S. Br. Middle Fork Zumbro River	070400040205	49.7
Zumbro River	Middle Fork Zumbro River	0704000403	218.4	Headwaters Middle Fork Zumbro River	070400040301	29.3

Table C-2 Subwatersheds within the planning area

Major Watershed	Planning Subwatershed (HUC10)	HUC10 Number	HUC10 Drainage Area (mi^2)	HUC12 Subwatershed Name	HUC12 Number	HUC12 Drainage Area (mi^2)
				County Ditch Number One	070400040302	15.7
				City of Concord-Middle Fork Zumbro R	070400040303	23.8
				Milliken Creek	070400040304	31.3
				Harkcom Creek-Middle Fork Zumbro R	070400040305	29.0
				North Branch Middle Fork Zumbro River	070400040306	58.6
				Middle Fork Zumbro River	070400040307	30.7
Zumbro River	North Fork Zumbro River	0704000404	180.3	Headwaters North Fork Zumbro River	070400040401	46.5
				Pearl Creek-North Fork Zumbro River	070400040402	40.9
				Shingle Creek-North Fork Zumbro River	070400040403	37.1
				Trout Brook	070400040404	55.8
Zumbro River	Zumbro River	0704000405	453.5	North Fork Zumbro River	070400040405	59.8
				Dry Run Creek	070400040501	30.0
				Zumbro Lake-Zumbro River	070400040502	34.8
				Cold Creek	070400040503	45.9
				City of Zumbro Falls-Zumbro River	070400040504	39.4
				Long Creek	070400040505	32.9
				Middle Creek	070400040506	17.9
				Silver Spring Creek-Zumbro River	070400040507	34.5
				Hungry Hollow	070400040508	27.5
				Spring Creek	070400040509	36.5
				West Indian Creek	070400040510	26.9
				Hope Coulee-Trout Brook	070400040511	21.6
				Zumbro River	070400040512	45.9

* HUC12 delineation includes portions in Wisconsin; drainage area based on Minnesota areas only



Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses from Public Water Inventory (PWI). Ponds, lakes, subwatersheds from National Hydrography Dataset (NHD). Topography from National Elevation Dataset (NED).

TOPOGRAPHY
WAGZ Comprehensive Watershed Management Plan

FIGURE C-2

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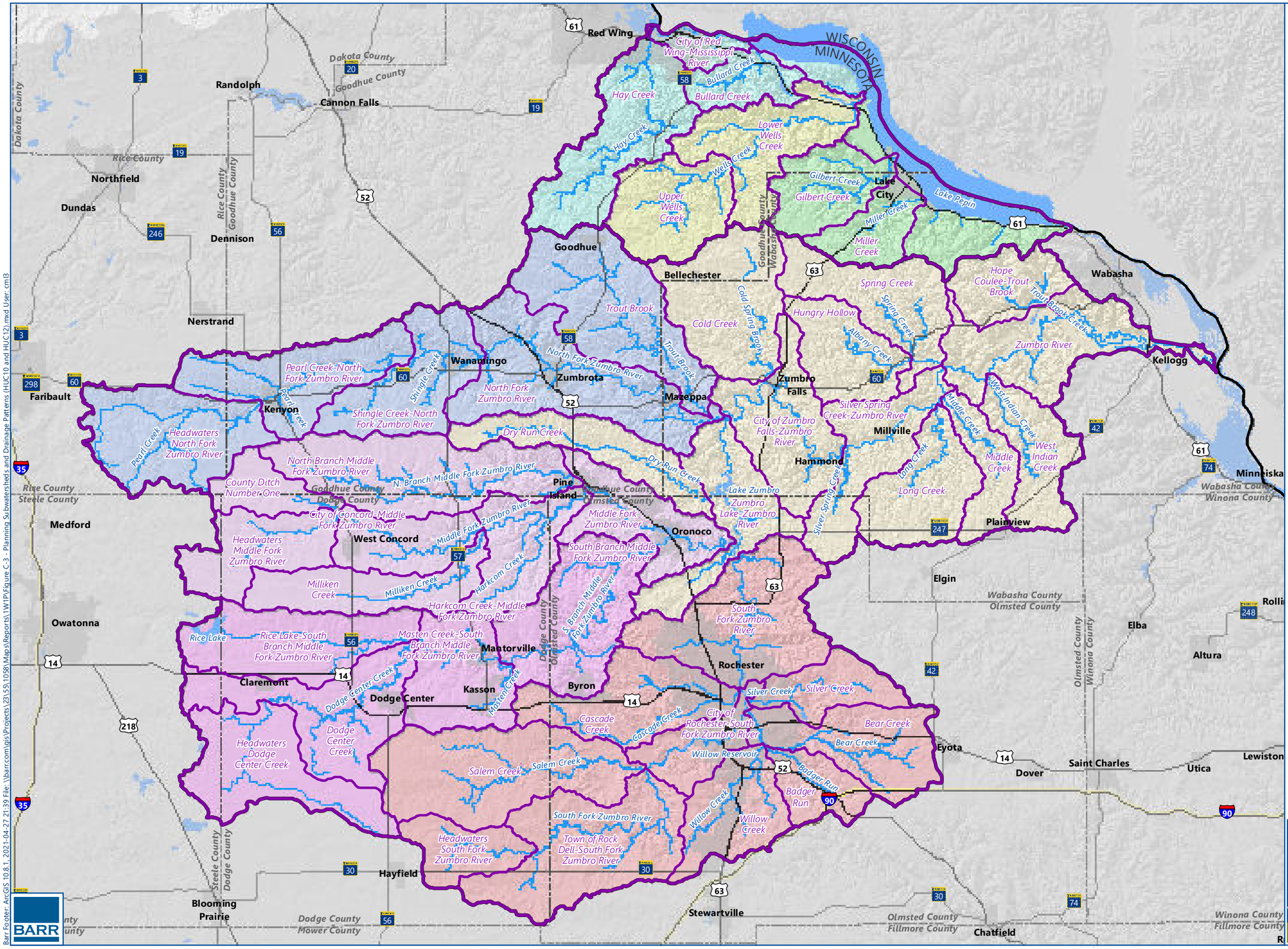
Barr Footer: ArcGIS 10.8.1, 2021-04-27 21:39 File: \\barrcom\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure C-2 - Topography.mxd User: cml3


Red Wing
City of Red Wing-Mississippi River
Bullard Creek
Hay Creek
Lower Wells Creek
Wells Creek
Upper Wells Creek
Gilbert Creek
Lake City
Miller Creek
Lake Pepin
WISCONSIN
MINNESOTA
Goodhue County
Wabasha County
Dakota County
Goodhue County
Randolph
Cannon Falls
Rice County
Northfield
Dundas
Rice County
Goodhue County
Dennison
Nerstrand
Goodhue
Bellechester
Trout Brook
Cold Creek
Cold Spring Brook
Hungry Hollow
Spring Creek
Albany Creek
Hope Coulee-Trout Brook
Trout Brook Creek
Wabasha
Kellogg
Zumbro River
Zumbro Falls
Millville
Silver Spring Creek-Zumbro River
City of Zumbro Falls-Zumbro River
Wanamingo
Zumbrota
North Fork Zumbro River
Mazeppa
Pearl Creek-North Fork Zumbro River
Shingle Creek
North Fork Zumbro River
Faribault
Kenyon
Pearl Creek
Shingle Creek-North Fork Zumbro River
Headwaters North Fork Zumbro River
Dry Run Creek
Hammond
Dry Run Creek
Lake Zumbro
Zumbro Lake-Zumbro River
Long Creek
Silver Spring Creek
Middle Creek
West Indian Creek
Middle Creek
Minneiska
Wabasha County
Winona County
Rice County
Steele County
Medford
North Branch Middle Fork Zumbro River
County Ditch Number One
Goodhue County
Dodge County
City of Concord-Middle Fork Zumbro River
N. Branch Middle Fork Zumbro River
Pine Island
Goodhue County
Olmsted County
Middle Fork Zumbro River
Oronoco
Plainview
West Concord
Headwaters Middle Fork Zumbro River
Middle Fork Zumbro River
South Branch Middle Fork Zumbro River
Milliken Creek
Harkcom Creek
Harkcom Creek-Middle Fork Zumbro River
Dodge County
Olmsted County
S. Branch Middle Fork Zumbro River
Elgin
Wabasha County
Olmsted County
Owatonna
Rice Lake
Rice Lake-South Branch Middle Fork Zumbro River
Masten Creek-South Branch Middle Fork Zumbro River
Mantorville
South Fork Zumbro River
Rochester
Olmsted County
Winona County
Elba
Altura
Claremont
Dodge Center
Kasson
Byron
Dodge Center Creek
Masten Creek
Silver Creek
Silver Creek
Cascade Creek
Cascade Creek
City of Rochester-South Fork Zumbro River
Bear Creek
Bear Creek
Willow Reservoir
Eyota
Dover
Saint Charles
Utica
Lewiston
Headwaters Dodge Center Creek
Dodge Center Creek
Salem Creek
Salem Creek
Badger Run
Badger Run
Willow Creek
Willow Creek
South Fork Zumbro River
Headwaters South Fork Zumbro River
Town of Rock Dell-South Fork Zumbro River
Hayfield
Stewartville
Chatfield
Olmsted County
Fillmore County
Winona County
Fillmore County
Steele County
Dodge County
Blooming Prairie
Dodge County
Mower County
Rice County
Steele County
Study Area
Pond or Lake
Municipal Boundary
County Boundary
State Boundary
Subwatersheds (HUC12)
Major Subwatersheds (HUC10)
Hay Creek
Lake Pepin
Lower Wells Creek
Middle Fork Zumbro River
North Fork Zumbro River
South Branch Middle Fork Zumbro River
South Fork Zumbro River
Zumbro River
Data sources:
MN DNR Level 04 Major Watersheds.
Watercourses from Public Water Inventory (PWI).
Ponds and lakes from National Hydrography Dataset (NHD).
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Miles
PLANNING SUBWATERSHEDS AND DRAINAGE PATTERNS (HUC10 AND HUC12)
WAGZ Comprehensive Watershed Management Plan
FIGURE C-3
BARR
Barr Footer: ArcGIS 10.8.1, 2021-04-27 21:39 File: \\barr.com\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure C-3 - Planning Subwatersheds and Drainage Patterns (HUC10 and HUC12).mxd User: cml3

C.2 Climate and Precipitation

Because of its location near the center of the North American continent, the Zumbro River 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 1981-2010 climate normal period, as reported by the National Oceanic and Atmospheric Administration (NOAA), is summarized in Table C-3 for weather stations in Zumbrota (Station 219249), Red Wing (Station 216817), and at Rochester International Airport (Station 14925).

Table C-3 Summary of climate data for select locations in the planning area (1981-2010)

Statistic	Zumbrota (Station 219249)	Rochester Int'l Airport (Station 14925)	Red Wing (Station 216817)
Average Annual Temperature	43.6°F	45.4°F	45.4°F
Average Minimum Monthly Precipitation	0.8" (February)	0.8" (February)	0.9" (February)
Average Maximum Monthly Precipitation	4.9" (August)	4.7" (June)	4.6" (August)
Average Annual Precipitation	33.97"	33.02"	33.43"
May-September Precipitation	21.35" (63% of annual)	20.83" (63% of annual)	20.48" (61% of annual)
Average First Freeze Date	September 24	October 5	NA
Average Last Freeze Date	May 12	April 28	NA
Growing Season	133 days	159 days	NA

Source: climate data obtained from NOAA at: https://www.ncdc.noaa.gov/cdo-web/datatools

The data in Table C-3 show similarities in precipitation among the three selected stations. Average annual precipitation (1981-2010) ranges from approximately 32 inches in the northwest part of the planning area to 34 inches in the southeast part (MDNR, 2020a). Average annual lake evaporation is about 33 inches according to the Minnesota Hydrology Guide (NRCS, 1975).

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 (1981-2010) data: https://www.ncdc.noaa.gov/cdo-web/datatools/normals

C.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 depths between TP-40 and Atlas 14 indicates increased precipitation depths for more extreme (i.e., less frequent) 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 Soil Conservation Service (now the National Resource Conservation Service (NRCS)) *National Engineering Handbook*, Hydrology, Section 4, 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 3-3 lists selected rainfall and snowmelt runoff events for the region.

Table C-4 Selected Precipitation and Runoff Events Used for Design Purposes

Type	Frequency	Duration	Depth (in) at Rochester (Station 21-7004)	Depth (in) at Zumbrota (Station 21-7004)	Depth (in) at Red Wing (Station 21-6817)
Rainfall[1]	2-year	24 hour	2.94	2.93	2.89
	5-year	24 hour	3.72	3.72	3.61
	10-year	24 hour	4.47	4.48	4.32
	25-year	24 hour	5.65	5.68	5.45
	50-year	24 hour	6.68	6.73	6.46
	100-year	24 hour	7.81	7.88	7.57
	10-year	10 day	7.35	7.00	6.90
	100-year	10 day	11.2	10.6	10.3
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		

Note(s):
(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)

C.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. Increased precipitation is correlated with increased average and peak flows observed in the watershed (see Section C.9). NOAA climate normal data indicates the following local trends:

- Rochester International Airport station – the average annual precipitation has increased from 30.20 inches (1971-2000 average) to 33.02 inches (1981-2010 average), a 9 percent increase

- Red Wing station – the average annual precipitation has increased from 31.50 inches (1961-1990 average) to 33.43 inches (1981-2010 average), a 7 percent increase

- Zumbrota station – the average annual precipitation has increased from 30.90 inches (1961-1990 average) to 33.97 inches (1981-2010 average), a 10 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. A range of estimates for the mid-21st century 100-year 24-hour rainfall event were identified. 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.

C.3 Land Cover and Land Use

Historically, the land within the planning area was covered by prairie, oak savanna, and maple-basswood woodlands. Pre-settlement vegetation data is available from the MDNR. Pre-settlement vegetation within the Zumbro River watershed consisted primarily of prairie, concentrated in the western half of the watershed, interspersed with oak openings and barrens and brush prairie. Big woods areas of oak, maple, basswood, and hickory and river bottom forest were also present adjacent to the Zumbro River and its tributary branches. Pre-settlement vegetation in the Mississippi River Lake Pepin watershed was mostly comprised of oak openings and barrens, with portions of Big Woods forest and brush prairie also present.

Table C-5 Summary of Land Use/Land Cover within the Planning Area

Land Cover	Zumbro River Watershed		Mississippi River Lake Pepin Watershed		Planning Area	
	Square Miles	Percent of Watershed	Square Miles	Percent of Watershed	Square Miles	Percent of Watershed
Barren Land	1.1	0.1%	0.2	0.1%	1.3	0.1%
Cultivated Crops	798.1	56.2%	77.3	33.2%	875.4	52.9%
Deciduous Forest	135.9	9.6%	59.1	25.4%	195.0	11.8%
Developed, High Intensity	3.9	0.3%	0.5	0.2%	4.5	0.3%
Developed, Low Intensity	35.2	2.5%	4.9	2.1%	40.1	2.4%
Developed, Medium Intensity	13.2	0.9%	1.5	0.6%	14.7	0.9%
Developed, Open Space	75.1	5.3%	10.6	4.5%	85.7	5.2%
Emergent Herbaceous Wetlands	4.9	0.3%	0.5	0.2%	5.4	0.3%
Evergreen Forest	1.5	0.1%	0.4	0.2%	1.9	0.1%
Hay/Pasture	165.0	11.6%	29.7	12.7%	194.7	11.8%
Herbaceous (grassland)	163.7	11.5%	25.3	10.9%	189.0	11.4%
Mixed Forest	0.1	0.0%	0.0	0.0%	0.1	0.0%
Open Water	6.6	0.5%	20.7	8.9%[1]	27.2	1.6%[1]
Shrub/Scrub	0.3	0.0%	0.3	0.1%	0.5	0.0%
Woody Wetlands	16.2	1.1%	1.9	0.8%	18.1	1.1%

Source: Minnesota Land Cover Classification Dataset (MLCCD)
(2) Includes a portion of the Lake Pepin water surface within Minnesota

Much of the modern landscape in the planning area has been modified by agriculture and human development. Remaining natural prairies are limited to the steep slopes of the blufflands along the Mississippi River, Zumbro River, and their tributaries (see Section C.10). Current land cover based on the Minnesota Land Cover Classification Dataset (MLCCD) is presented in Figure C-4 and Table C-5.

Table C-5 presents land cover/land use for both the Zumbro River watershed and the Mississippi River Lake Pepin watershed. Land cover/land use is generally similar between the two major watersheds, with the exceptions that:

- The Zumbro River watershed contains a higher percentage of cropland (56% versus 33%)
- The Mississippi River Lake Pepin watershed contains a higher percentage of deciduous forest (25% to 10%)

- The Mississippi River Lake Pepin watershed contains a higher percentage of open water (9% to less than 1%) owing to the presence of Lake Pepin and the Mississippi River

C.3.1 Agricultural Land Use

Within the planning area, land use is predominantly cropland (52% of the overall area), with rangeland (grassland and pasture) occupying an additional 23%. Row crop agriculture and scattered livestock operations are primarily located in the western half of the planning area and the areas north and south of the Zumbro River in the eastern half of the planning area. As slopes increase to the east (see Figure C-2) cropland transitions to pasture lands. Within the wide valleys of the eastern blufflands, there is a more even mixture of grain and rangeland operations and increasing amounts of forested, wetland and natural areas (MPCA, 2017). Cropland within the planning area is predominately planted in corn, forage for livestock and soybeans (USDA 2012).

The Natural Resources Conservation Service (NRCS) estimates that there are 2,730 farms in the Zumbro River watershed; 8% are larger than 1000 acres, 42% are less than 180 acres, and 50% are of medium size – 180 to 1000 acres (NRCS, 2016). Analysis by the NRCS suggests a similar breakdown of farm size within the Mississippi River Lake Pepin watershed, although a precise breakdown along the study area boundary is not available.

There are approximately 2,300 active, registered Animal Feedlot Operations (AFO) in the planning area, including about 2,000 in the Zumbro River watershed and 300 in the Mississippi River Lake Pepin watershed. About half of the AFOs in the planning area are primarily beef cattle and another quarter of the AFOs are dairy. Wabasha County and Goodhue County rank as the state's fourth and sixth leading dairy producers, respectively (USDA, 2012). Wabasha County and Goodhue County also ranks as the state's ninth and tenth leading cattle producers, by head, respectively (MDA 2018).

C.3.2 Urban Land Use

Although much of the planning area is covered by cropland, pasture, and forest, the planning area also includes several urbanized area. The Zumbro River watershed includes the City of Rochester in Olmsted County. Rochester is Minnesota's third largest city (population approximately 117,000 per census data). Other, smaller rural population centers (i.e., population greater than 1,000) in the Zumbro River watershed include:

- Byron
- Dodge Center
- Kasson
- Mantorville
- Pine Island
- Wanamingo
- Zumbrota

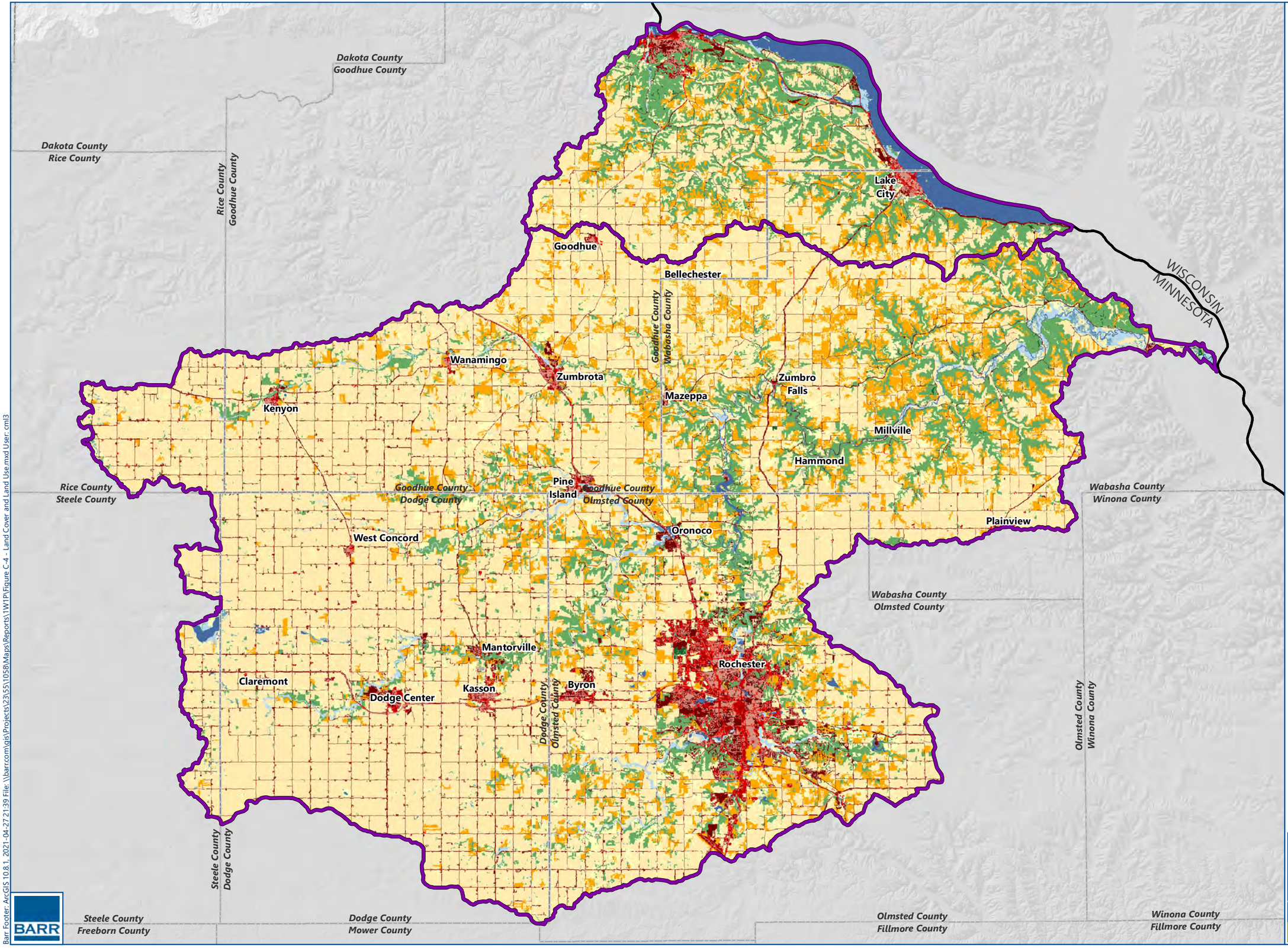
Urban centers in the Mississippi River Lake Pepin watershed include a portion of the City of Red Wing in Goodhue County (total population about 16,000 per 2010 census) and Lake City in Wabasha County (population about 5,000 per 2010 census).

Development and growth of urban and rural population centers within the planning area has been modest over the past 10 years (Minnesota Department of Administration population data, 2019), with the exception of growth in and around the City of Rochester (City of Rochester, 2018). Between 2000 and 2015, the population of Rochester increased from 86,000 to 110,000. An estimated 55,000 new residents (and 50,000 new jobs) are anticipated by 2040 (City of Rochester, 2018). The expected growth in Rochester will drive development, redevelopment, and land use changes over the life of this Plan. The City of Rochester Comprehensive Plan 2040, adopted by the City in May 2018, outlines a vision, principles, and policies to guide the future growth of the City.

C.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 soy beans, increase the risk of erosion and of elevated total suspended solids levels in streams because the land can be without vegetation cover for major periods of time due to the short Minnesota growing season.

Additional urbanization is expected to accompany growing populations within the watershed, concentrated in Rochester and the surrounding area. Outside of this area, it is expected that the land use in the planning area will remain primarily agricultural during the life of this Plan.



Study Area
County Boundary
State Boundary

NLCD 2011

- Barren Land
- Cultivated Crops
- Deciduous Forest
- Developed, High Intensity
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, Open Space
- Emergent Herbaceuous Wetlands
- Evergreen Forest
- Hay/Pasture
- Herbaceuous
- Mixed Forest
- Open Water
- Shrub/Scrub
- Woody Wetlands

Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Land cover from National Land Cover Database 2011.

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LAND COVER AND LAND USE

WAGZ Comprehensive Watershed Management Plan

FIGURE C-4

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C.4 Soils

Soils within the planning area consist of varying combinations of loess, till, and outwash (Cummins and Grigal, 1980). Soil types (grouped according to soil parent material) are presented in Figure C-5. The western third of the Zumbro River watershed is located within the Western Corn Belt Plains ecoregion (ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources). Rich organic glacial prairie soils provide a rich medium for cultivation in the western agricultural portion of the watershed, comprised of Central Iowa and Minnesota Till Prairie. Soils in this area are predominantly loess or loamy sediments over gray till (see Figure C-5).

Moving east, soils transition to the karst region and Northern Mississippi Valley Loess Hills (MPCA, 2017). The eastern part of the Zumbro River watershed and the Mississippi River Lake Pepin watershed lie within the Driftless Area ecoregion and includes Eastern Iowa and Minnesota Till Prairie and blufflands. Karst features occur with increasing slopes and more dramatic topography and are generally concentrated in the eastern two-thirds of the watershed corresponding to the Driftless Area ecoregion. Soils in the eastern part of the watershed include a mix of loess and till in upland areas and colluvium (loose, unconsolidated sediments that have been deposited at the base of hillslopes) and outwash adjacent to streams and rivers.

Local surface soils greatly affect the suitability of the land for agricultural production. Soils in the western part of the Zumbro River watershed are generally of high quality for agricultural production. Figure C-6 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. Degraded soils may be subject to increased runoff and erosion (see Section 3.2.4). Soil erosion risk in the planning area is presented in Figure C-7.

The thickness of the surficial soil in the planning area general decreases from west to east, decreasing from between 100 to 200 feet thick in the west (Dodge, Rice, and Steele Counties) to less than 100 feet in the east, with significant areas of exposed bedrock in Olmsted and Wabasha Counties (Olson and Mossler, 1982).

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 NRCS. The most current information may be found on the NRCS soil survey webpage at: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

Infiltration capacities of soils affect the amount of direct runoff resulting from rainfall. The higher the infiltration rate is 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 B, with moderate infiltration rates. Some soils, primarily in western Goodhue and Dodge Counties, are classified as group C with moderately low 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.

Dakota County
Goodhue County

Dakota County
Rice County

Rice County
Goodhue County

Goodhue County
Wabasha County

WISCONSIN
MINNESOTA

Rice County
Steele County

Goodhue County
Dodge County

Goodhue County
Olmsted County

Wabasha County
Winona County

Wabasha County
Olmsted County

Dodge County
Olmsted County

Olmsted County
Winona County

Steele County
Dodge County

Steele County
Freeborn County

Dodge County
Mower County

Olmsted County
Fillmore County

Winona County
Fillmore County

Study Area
Watercourses
Pond or Lake
County Boundary
State Boundary

Soil Parent Material

Alluvium
Gray Colluvium and Outwash
Gray Outwash
Gray Till
Gray Till, Outwash, and Residuum
Loess
Loess and Loess over Gray Till
Loess or Loamy Sediments and Erosional Lag over Dense Gray Till
Loess or Loamy Sediments over Dense Gray Till
Loess, Gray Till, Sandstone and Limestone, Residuum
Mixed gray and red outwash

Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses from Public Water Inventory (PWI). Ponds, lakes, subwatersheds from National Hydrography Dataset (NHD). Soil Parent Material from Soil and Land Surfaces from the University of Minnesota - Department of Soil, Water and Climate.

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SOIL TYPES
WAGZ Comprehensive Watershed Management Plan

FIGURE C-5

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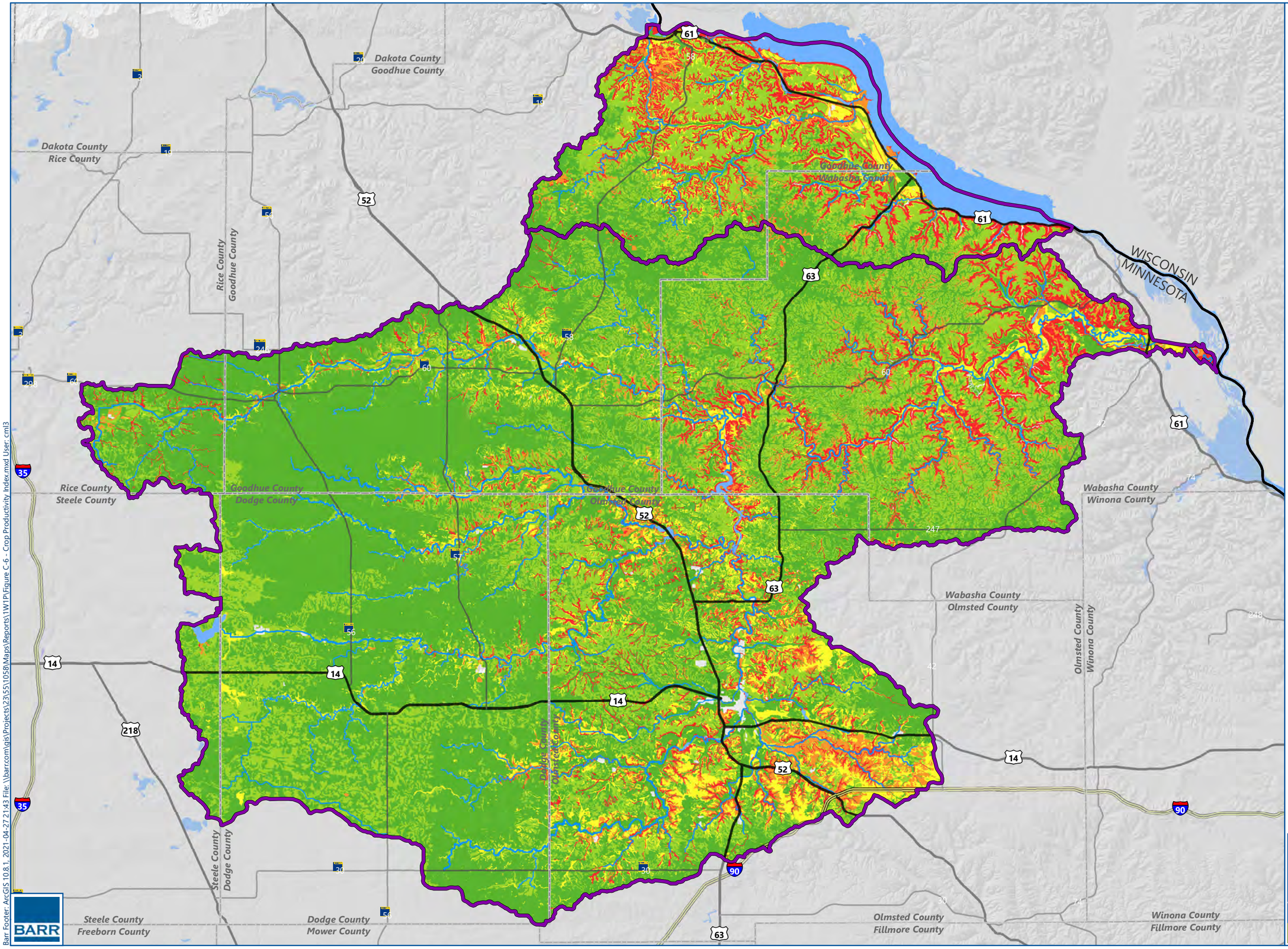
Barr Footer: ArcGIS 10.8.1, 2021-04-27 21:48 File: \\barrcom\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure C-5 - Soil Types.mxd User: cml3



Study Area
Watercourses
Pond or Lake
County Boundary
State Boundary

Crop Productivity Index

Less Productive
More Productive

Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses from Public Water Inventory (PWI). Ponds, lakes, subwatersheds from National Hydrography Dataset (NHD). Crop Productivity Index from USDA NRCS Gridded Soil Survey Geographic Database.

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CROP PRODUCTIVITY INDEX
WAGZ Comprehensive Watershed Management Plan
FIGURE C-6

Barr Footer: ArcGIS 10.8.1, 2021-04-27 21:43 File: \\barrcom\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure C-6 - Crop Productivity Index.mxd User: cml3

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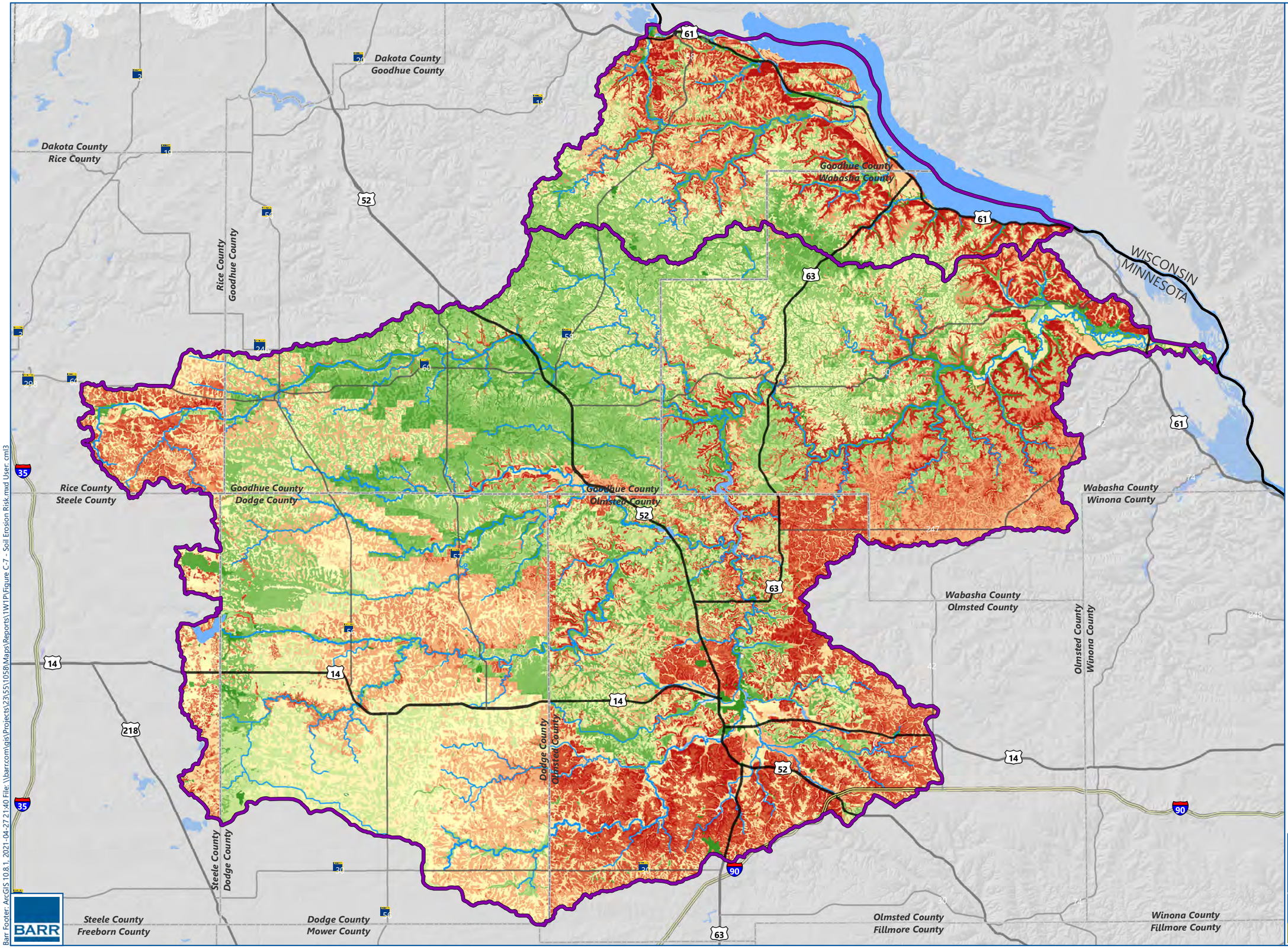


Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses from Public Water Inventory (PWI). Ponds, lakes, subwatersheds from National Hydrography Dataset (NHD). Soil Erosion Risk from the Minnesota Board of Water and Soil Resources (BWSR).

SOIL EROSION RISK
WAGZ Comprehensive Watershed Management Plan

FIGURE C-7

Barr Footer: ArcGIS 10.8.1, 2021-04-27 21:40 File: \\barrcom\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure C-7 - Soil Erosion Risk.mxd User: cml3

C.5 Geology and Groundwater

The bedrock underlying the planning area is part of the Upper and Lower Ordovician Series, which formed 375-450 million years ago (Jirsa et al., 2011). The south and west portions of the planning area are underlain by Upper Ordovician limestone, shaley limestone, and dolostone. The north and east portions of the planning area are underlain by the Lower Ordovician Series, which includes dolostone, sandy to silty dolostone, and sandstone, including the Prairie du Chein group. Between these two formations is Middle Ordivician shale, dolomitic limestone, and sandstone, including Decorah shale and St. Peter sandstone.

The river and creek valleys in the north and east of the planning area are underlain by Upper Cambrian bedrock and the Middle and Upper Cambrian bedrock (along the Mississippi River). The Upper Cambrian formation includes sandstone, siltstone, shale, and dolostone, including Jordan Sandstone. The Middle and Upper Cambrian formation also includes Wonewoc sandstone and Mt. Simon sandstone.

More information about geology is available in the Geologic Atlas of Goodhue, Rice, and Wabasha Counties; atlases for other counties are in progress (Dodge and Olmsted Counties) or not yet started (Steele County). County geologic atlases are available from the Minnesota Geological Survey (MGS) at: https://www.dnr.state.mn.us/waters/groundwater_section/mapping/index.html.

C.5.1 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. Estimated recharge rates within the planning area are presented in Figure C-8.

The depth of the surficial aquifer (i.e., water table) varies within the planning area, from less than 10 feet below the ground surface in the southwest to over 50 feet in the bluff areas in the northeast (Adams, 2016). Some residential wells in the planning area draw water from the surficial aquifer, although most residential wells in the planning area draw water from the following bedrock aquifers (MDH, 2016):

- Galena-Maquoketa
- St. Peter-Prairie du Chein-Jordan
- Tunnel City-Wonewoc (formerly Franconia-Ironton-Galeville)

Nearly all of the municipalities in the planning area rely on groundwater from bedrock aquifers for their drinking water supply. Rochester Public Utilities provides drinking water to their residents from 31 wells ranging from 400 to 1,000 feet deep that draw water primarily from the Jordan aquifer and multi-formations including Prairie du Chein-Jordan, Prairie du Chein-Wonewoc, Jordan-Wonewoc, and Prairie du Chein-Mt. Simon aquifers.

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 C-9 presents the extent of DWSMAs and active wells within the planning area.

Table C-6 lists the number and depths of wells for select municipalities and non-community systems in the planning area and the status of each entity's Wellhead Protection Plan (WHPP). In addition to these systems, the Minnesota Department of Health (MDH) also conducted source water assessments for privately owned water supply systems that serve water to the public, such as campgrounds, churches, golf courses, industrial facilities, etc.

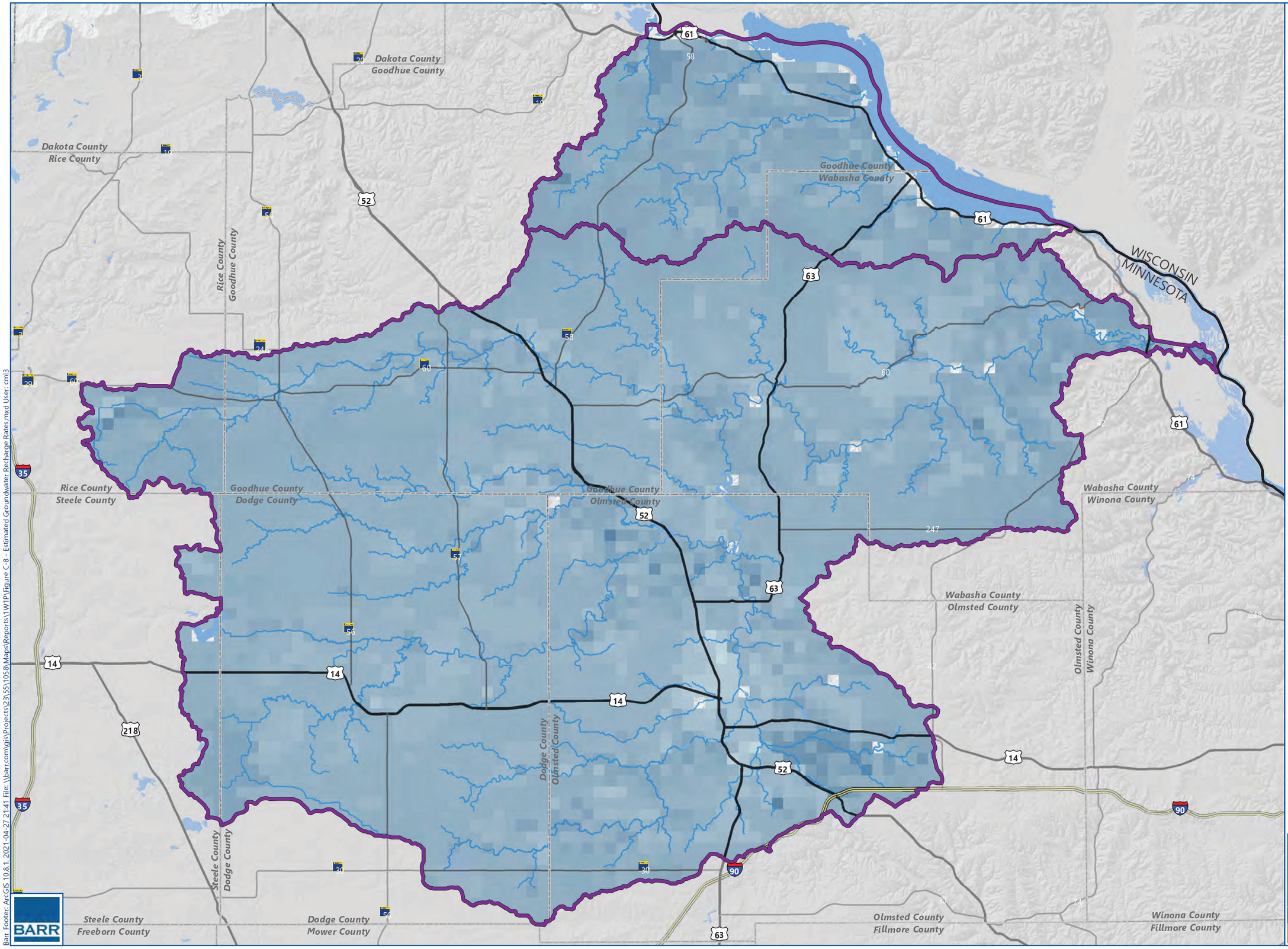
Table C-6 Municipal and non-municipal community well depths and WHPP status for select communities

Municipality/Entity	County	Number of Wells	Depths of Wells (feet)	Aquifer(s)	DWSMA vulnerability	Status of WHPP
Goodhue	Goodhue	2	440, 700	Jordan, Tunnel City-Wonewoc	low	starting amendment in 2021
Goodhue County Electric Coop	Goodhue	6	300 - 496	Wonewoc, Mt. Simon	Moderate/low	not started
MN Correctional Facility – Red Wing	Goodhue	2	470, 593	Mt. Simon	moderate	In progress
Pine Island	Goodhue	2	452, 555	PDC, Jordan	Moderate/high	completed
Twin Fawn Mobile Home Park	Goodhue	2	unknown	QWTA?	high	In progress
Oronoco	Olmsted	2	334, 400	Jordan	Low/moderate/high	completed
Rochester	Olmsted	31	400 - 1000	Shakopee, Jordan, Tunnel City, Wonewoc, Mt. Simon	Moderate/high	completed
Clearwater Well Company	Olmsted	1	384	Jordan	low	Not started
Briarwood Subdivision	Olmsted	1	412	Jordan	low	In progress
Chester Heights	Olmsted	1	600	Jordan	Moderate/high	not started
Sunrise Mobile Home Park	Olmsted	1	389	Jordan	low	In progress
Zumbro Ridge Estate	Olmsted	2	395, 410	Jordan	Low/high	not started
Lake City	Wabasha	4	130 - 163	Quaternary Water Table Aquifer	high	completed
Zumbro Falls	Wabasha	1	336	Jordan	Moderate/high	completed
Kellogg	Wabasha	2	141, 166	Quaternary Water Table Aquifer	Moderate/high	starting amendment in 2021
Millville	Wabasha	1	186	PDC-Jordan	Moderate/high	completed
Plainview	Wabasha	2	411, 444	Jordan	Moderate/high	completed
Hiawatha Estates I, II, III	Wabasha	2	400	Tunnel City-Wonewoc	low	In progress
Claremont	Dodge	2	250, 314	Stewartville-Cummingsville	low	completed
Dodge Center	Dodge	2	868, 913	Jordan	low	completed
Kasson	Dodge	3	807, 828, 852	PDC-Jordan	low	completed
Mantorville	Dodge	1	750	Jordan	low	completed

Table C-6 Municipal and non-municipal community well depths and WHPP status for select communities

Municipality/Entity	County	Number of Wells	Depths of Wells (feet)	Aquifer(s)	DWSMA vulnerability	Status of WHPP
West Concord	Dodge	2	803, 821	Jordan	low	completed
Bellechester	Goodhue	2	450, 550	Tunnel City-Lone Rock	low	completed
Kenyon	Goodhue	2	657, 710	Jordan	low	completed
Red Wing	Goodhue	5	630 - 665	Mt. Simon	low	completed
Wanamingo	Goodhue	2	590, 600	Jordan	Low/moderate	completed
Zumbrota	Goodhue	3	404 - 479	Jordan	low	completed
Byron	Olmsted	2	698, 706	Jordan	low	completed
Country Home Trailer Park	Olmsted	1	500	Jordan	low	not started
Hallmark Terrace Mobile Home Park	Olmsted	1	413	Jordan	low	not started
Kings Park – Hyland Addition	Olmsted	1	478	Jordan	low	not started
Oronoco Estates MHC, LLC	Olmsted	1	398	Jordan	low	not started
Hammond	Wabasha	1	500	Wonewoc	low	completed
Mazeppa	Wabash	2	567, 720	Tunnel City, Wonewoc, Mt. Simon	low	completed

Source: MDH response to Plan update notification



Study Area
Watercourses
Pond or Lake
County Boundary
State Boundary

Mean Groundwater Recharge

1996 - 2010 (in/km^2/year)
High : 18
Low : 0

Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses from Public Water Inventory (PWI). Ponds, lakes, subwatersheds from National Hydrography Dataset (NHD). Groundwater recharge data from Mean Annual Potential Groundwater Recharge Rates from 1996 - 2010 for Minnesota, U.S. Geological Survey.

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ESTIMATED GROUNDWATER RECHARGE RATES
WAGZ Comprehensive Watershed Management Plan
FIGURE C-8

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Red Wing
Dakota County
Goodhue County
Randolph
Cannon Falls
Dakota County
Rice County
Northfield
Rice County
Goodhue County
Dundas
Dennison
Goodhue
Lake City
Bellechester
Wabasha
WISCONSIN
MINNESOTA
Nerstrand
Goodhue County
Wabasha County
Kellogg
Wanamingo
Zumbrota
Zumbro Falls
Faribault
Mazeppa
Kenyon
Millville
Hammond
Minneiska
Rice County
Steele County
Goodhue County
Dodge County
Pine Island
Goodhue County
Olmsted County
Wabasha County
Winona County
Medford
West Concord
Oronoco
Plainview
Elgin
Wabasha County
Olmsted County
Owatonna
Olmsted County
Winona County
Elba
Altura
Mantorville
Rochester
Claremont
Kasson
Byron
Dodge Center
Dodge County
Olmsted County
Eyota
Dover
Saint Charles
Utica
Lewiston
Steele County
Dodge County
Hayfield
Blooming Prairie
Steele County
Freeborn County
Dodge County
Mower County
Stewartville
Olmsted County
Fillmore County
Chatfield
Winona County
Fillmore County

Study Area
Watercourses
Pond or Lake
Municipal Boundary
County Boundary
State Boundary
DWSMA Boundary
Active Wells (CWI)

MPARS Active Water Appropriations Permits

- Agricultural Irrigation
- Heating/Cooling
- Industrial Processing
- Non-Crop Irrigation
- Power Generation
- Special Categories
- Water Level Maintenance

Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses from Public Water Inventory (PWI). Ponds and lakes from National Hydrography Dataset (NHD). Active Wells from MN County Well Index (CWI). MPARS Active WA Permits from MN DNR. DWSMA from Minnesota Department of Health (MDH).

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DRINKING WATER SUPPLY MANAGEMENT AREAS, WELLS, AND GROUNDWATER APPROPRIATIONS

WAGZ Comprehensive Watershed Management Plan

FIGURE C-9

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Barr Footer: ArcGIS 10.8.1, 2021-04-27 21:40 File: \\barr.com\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure C-9 - Drinking Water Supply Management Areas, Wells, and Groundwater Appropriations.mxd User: cml3

C.5.2 Groundwater Quality

The quality of groundwater resources within the planning area is important to preserving public health and 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)
- Partner Counties

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, Minnesota Department of Agriculture (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.

In 2006, nine southeast Minnesota counties (including Dodge, Goodhue, Olmsted, Rice, and Wabasha Counties) coordinated planning to develop a Volunteer Nitrate Monitoring Network (VNMN) to monitor long term trends of nitrate concentrations in private drinking water wells in southeastern Minnesota. From 2006 until 2012 the project included nine counties and multiple state agencies funded by the EPA 319 Program and the MPCA Clean Water Partnership (CWP) Program. Sampling began in 2008. In 2013, the program was changed to incorporate more analytes in selected wells, but no longer sampled the entire network for nitrate. In 2014, the MDA coordinated with the County Water Planners and Southeast Minnesota Water Resources Board (SEMNWRB) to continue sampling all of the wells in the network on an annual basis to determine long term trends and keep the original network intact where possible. Results through 2015 are summarized in the MDH report *Southeast Minnesota Domestic Well Network 2016 Data Report* (MDH, 2016). Annual reports are available from MDA at: https://www.mda.state.mn.us/southeast-minnesota-volunteer-nitrate-monitoring-network

The MDA, in coordination with counties and SWCDs, also conducted a township well testing program. Through this program, nitrate testing was performed to townships that are vulnerable to groundwater contamination and have significant row crop production. Several townships within the planning area participated in the program. Results from township testing for nitrate may be used by private homeowners for information on their wells. MDA township testing was performed in Olmsted County in 2014, Dodge County in 2016, Goodhue, Rice, and Wabasha Counties in 2017, and Steele County in 2018 (note that areas of Rice County and Steele County included in township testing are located outside the planning area). Additional information regarding the MDA's township well testing and the most recent township testing results are available at: https://www.mda.state.mn.us/township-testing-program

Groundwater quality data collected through MDH and MDA programs indicate that nitrate concentrations in groundwater are a concern within the planning area (see Section 3.2.1). Nitrate concentrations from 2019 private well testing for counties within the planning area is summarized in Table C-7. The State of Minnesota health risk limit (HRL) for nitrate-nitrogen is 10 mg/L. Wells with results in the range of 3 to 10 mg/L are considered impacted but safe for drinking; the water is above natural levels of nitrate but below the HRL. Naturally occurring background concentrations of nitrate are generally considered less than 3 mg/L but have been observed as low as less than 1 mg/L (Dubrovsky, et al., 2010).

Table C-7 Well nitrate monitoring results (2019) by county

County	Total Wells[1]	Mean Nitrate-N (mg/L)	Percent of Wells <3 mg/L	Percent of Wells 3<10 mg/L	Percent of Wells ≥10 mg/L
Dodge	39	0.1	97.4%	2.6%	0.0%
Goodhue	48	2.8	60.4%	35.4%	4.2%
Olmsted	51	2.0	80.4%	13.7%	5.9%
Rice	37	0.8	91.9%	2.7%	5.4%
Steele	--[2]	--[2]	--[2]	--[2]	--[2]
Wabasha	25	5.7	36.0%	48.0%	16.0%

Source: Volunteer Nitrate Monitoring Network 2019 Results (previously SEMNWRB and now administered by Olmsted County

(1) Wells are reported by county and may include wells not located within the planning area

(2) Steele County results not reported by SEMNWRB and is no longer included in the program; 2018 township testing data is available from MDA but is limited to areas located outside the planning area

The data presented in Table C-7 represents sampling of357 private drinking water wells. Results from 2019 are similar to previous years with 70% of nitrate results <3 mg/L, 22% in the 3<10 mg/L range, and 9% ≥10 mg/L (MDA 2019).

From 2015 to 2019. MDA sampled wells in 44 townships in Dodge, Goodhue, Rice, Wabasha, and Olmsted Counties for the presence of pesticides through its private well pesticide sampling (PWPS) project. Results of this effort are summarized in Table C-8. The MDA annual water quality monitoring reports including nitrate and pesticide water quality data and long-term trends are available at: www.mda.state.mn.us/monitoring

Table C-8 Well pesticide monitoring results (2017-2019) by county

County (years sampled)	Number of townships sampled	Number of wells sampled	Total wells with pesticide detection	Detection frequency	Number of pesticides and degradates detected	Health ref. values (HRLs) exceeded (compound)
Dodge (2017-2018)	7	108	78	72%	24	0
Goodhue (2018-2019)	16	384	290	76%	39	0
Wabasha (2018-2019)	14	476	391	82%	37	0
Olmsted (2019)	7	93	76	82%	22	4 (total cyanazine)

Source: MDA PWPS project; Olmsted County was also sampled in 2015 but 2019 results are presented due to recency.

C.5.3 Groundwater Sensitivity to Pollution

The MDNR assessed the sensitivity of near-surface materials and the uppermost bedrock surface to groundwater contamination for much of the planning area (Adams, 2016). 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. This information is documented in the Minnesota Hydrogeology Atlas (MHA) 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 C-10. Groundwater sensitivity to pollution in the planning area is significantly affected by the presence of karst features (i.e., limestone that has been eroded, increasing groundwater conductivity) throughout the eastern two thirds of the planning area. Karst bedrock and other features (e.g., sinkholes, springs) in the planning area are presented in Figure C-11.

Because of the sensitivity of near surface material to pollution, the State of Minnesota has restricted the application of nitrogen fertilizer on cropland in the fall or on frozen soils will be restricted in vulnerable groundwater areas. This includes areas with vulnerable groundwater (mapped at the quarter section level) and in DWSMAs that have nitrate-nitrogen concentrations at or in excess of 5.4 mg/L nitrate-nitrogen. Vulnerable areas for Part 1 of the rule are defined as:

- coarse textured soils based on USDA NRCS soils maps
- shallow bedrock based on USDA NRCS soils maps; or
- karst geology based on MN DNR map (see Figure C-10 and Figure C-11).

Areas within a DWSMA which are low risk to groundwater contamination in the MDH Wellhead Protection Plan are exempt from fall application restrictions. Vulnerable areas where fall nitrogen fertilizer application is restricted are overlaid on Figure C-10.

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 and is presented in Figure C-12.

Study Area
Watercourses
Pond or Lake
County Boundary
State Boundary
Areas of Fall Nitrogen Application Restrictions

Pollution Sensitivity of Near-Surface Materials

High
Moderate
Low
Very low
Bedrock at or near surface
Karst
Water

Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses from Public Water Inventory (PWI). Ponds and lakes from National Hydrography Dataset (NHD). Pollution Sensitivity from MN DNR County Geologic Atlas Program. Areas of Fall N Appliication Restriction from MDA.

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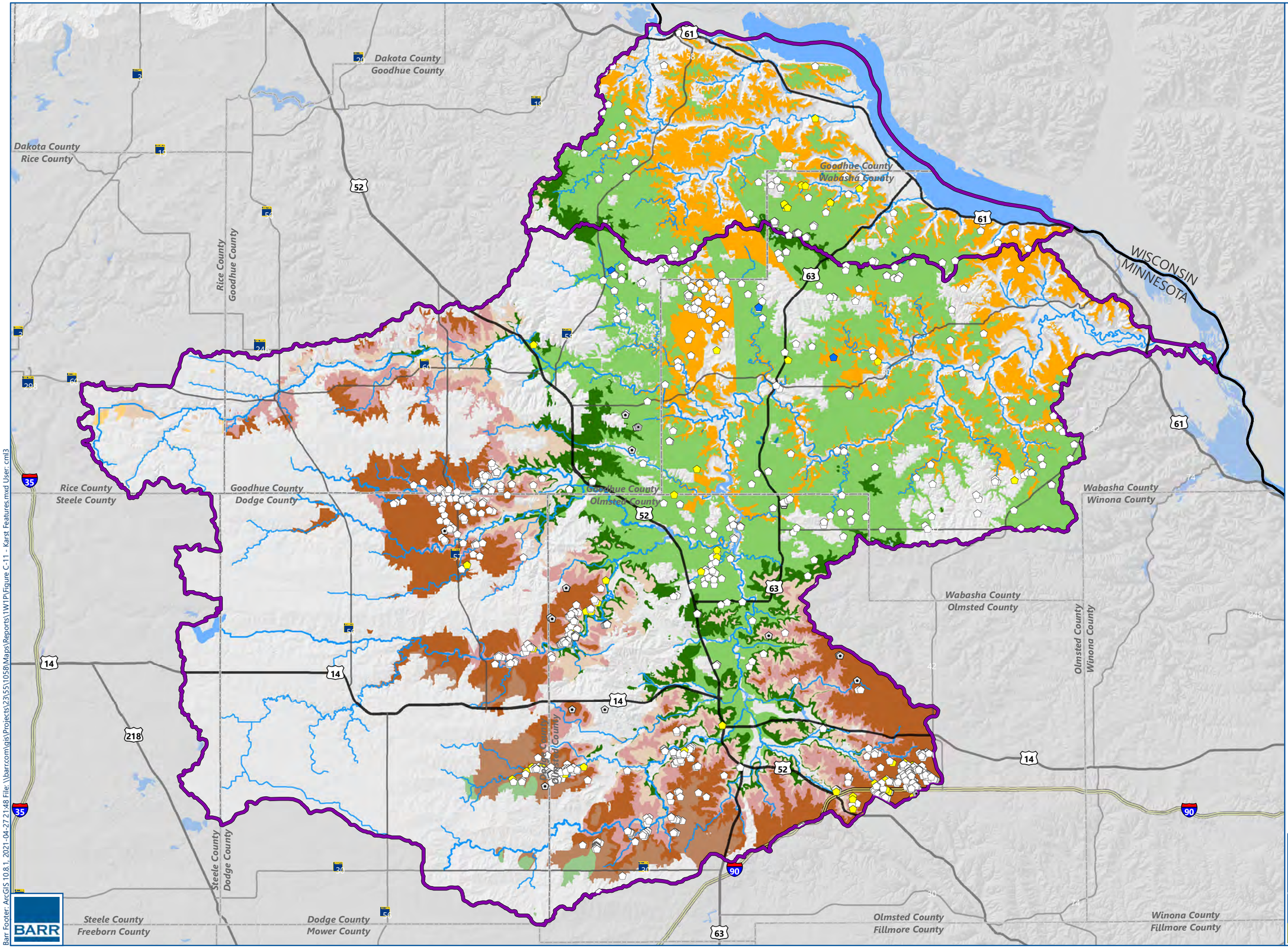
POLLUTION SENSITVITY OF NEAR SURFACE MATERIALS
WAGZ Comprehensive Watershed Management Plan
FIGURE C-10

Barr Footer: ArcGIS 10.8.1, 2021-04-27 21:40 File: \\barrcom\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure C-10 - Pollution Sensitivity of Near Surface Materials.mxd User: cml3



Study Area
Watercourses
Pond or Lake
County Boundary
State Boundary

Karst Features

Stream Sink/Sieve
Sinkhole
Surface Tile Inlet
Surface Tile Outlet
Miscellaneous

Surface Carbonate Karst and Sandstone Features

Cummingsville Formation
Decorah, Platteville, Glenwood, St. Peter
Galena / Prosser Fm
Galena / Stewartville Fm
Galena, Winnipeg, Red River
Maquoketa and Dubuque
Oneota Dolomite
Platteville and Glenwood Formations
Prairie du Chien Group
Shakopee Formation
St. Peter Sandstone
Stewartville and Cummingsville

Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses from Public Water Inventory (PWI). Ponds and lakes from National Hydrography Dataset (NHD). Karst Feature Inventory Points from University of Minnesota, Department of Geology and Geophysics; Minnesota Department of Natural Resources, Ecological and Water Resources Division. Surface Carbonate Karst and Sandstone Features from the Ecological and Water Resources Divsion, County Geologic Atlas Program.

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KARST FEATURES
WAGZ Comprehensive Watershed Management Plan

FIGURE C-11

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Study Area
Watercourses
Pond or Lake
County Boundary
State Boundary

Pollution Sensitivity of Wells

High
Moderate
Low

Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses from Public Water Inventory (PWI). Ponds and lakes from National Hydrography Dataset (NHD). Pollution Sensitivity from Minnesota Department of Health (MDH).

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POLLUTION SENSITVITY OF WELLS
WAGZ Comprehensive Watershed Management Plan
FIGURE C-12

Barr Footer: ArcGIS 10.8.1, 2021-04-27 21:48 File: \\barr.com\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure C-12 - Pollution Sensitivity of Wells.mxd User: cml3

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C.6 Surface Waters

The planning area is characterized by the Zumbro River and its tributaries, numerous streams, wetlands, ponds, and other surface waters. Figure C-13 presents surface water features within the planning area.

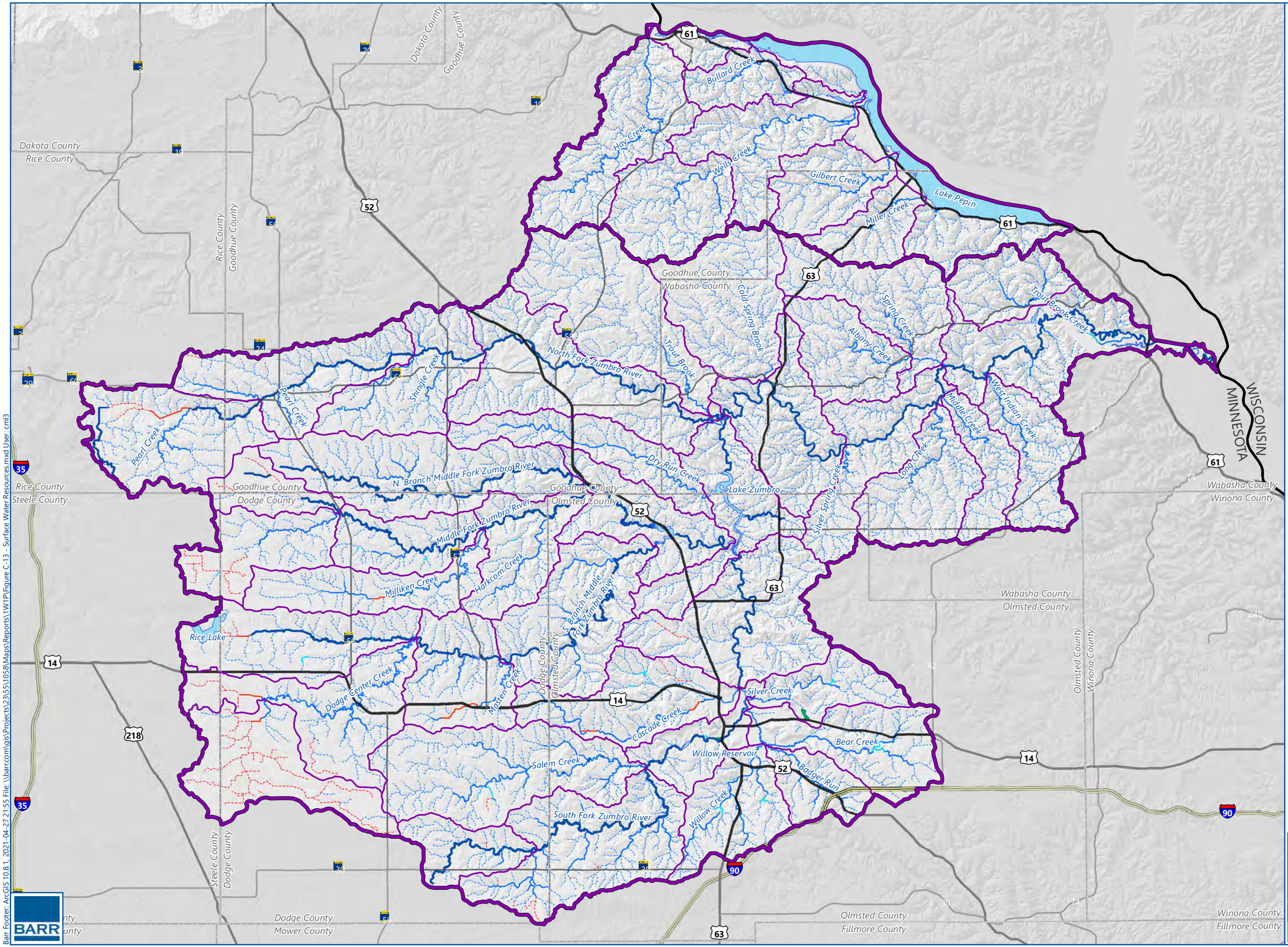
C.6.1 MDNR Public Waters

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 full 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 that are 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 and public waters wetlands (lakes, wetlands, and watercourses) under its regulatory jurisdiction. These maps are commonly known as Public Waters Inventory (PWI) maps. The regulatory "boundary" of these waters and wetlands is called the ordinary high-water level (OHWL). Public waters within the planning area are presented in Figure C-13. PWI maps are available from the MDNR website at: https://www.dnr.state.mn.us/waters/watermgmt_section/pwi/maps.html


Study Area
Subwatersheds (HUC12)
County Boundary
State Boundary
MDNR Public Waters
River Centerline
Stream (Perennial)
Stream (Intermittent)
Ditch (Perennial)
Ditch (Intermittent)
Connector
Public Water Basin
Public Water Wetland
Lake Pepin
Lake Zumbro
Rice Lake
Willow Reservoir
Bullard Creek
Hay Creek
Wells Creek
Gilbert Creek
Miller Creek
Trout Brook Creek
Cold Spring Brook
Spring Creek
Albany Creek
West Indian Creek
Middle Creek
Long Creek
Silver Spring Creek
Dry Run Creek
North Fork Zumbro River
Trout Brook
Shingle Creek
Pearl Creek
N. Branch Middle Fork Zumbro River
Middle Fork Zumbro River
Milliken Creek
Harkcom Creek
S. Branch Middle Fork Zumbro River
Dodge Center Creek
Master Creek
Cascade Creek
Silver Creek
Bear Creek
Badger Run
Willow Creek
Salem Creek
South Fork Zumbro River
Dakota County
Goodhue County
Rice County
Wabasha County
Olmsted County
Dodge County
Steele County
Winona County
Fillmore County
Mower County
WISCONSIN
MINNESOTA
Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses, Public Water Basins, and Public Water Wetland from Public Water Inventory (PWI). Ponds and lakes from National Hydrography Dataset (NHD).
N
0
2.5
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Miles
SURFACE WATER RESOURCES
WAGZ Comprehensive Watershed Management Plan
FIGURE C-13
Barr Footer: ArcGIS 10.8.1, 2021-04-27 21:55 File: \\barrcom\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure C-13 - Surface Water Resources.mxd User: cml3
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C.6.2 Rivers and Streams

The Zumbro River is the defining surface water feature within the Zumbro River watershed, draining approximately 1,420 square miles before discharging to the Mississippi River near Kellogg, MN. The Zumbro River watershed is subdivided into 5 major subwatersheds (HUC10 level) according to its major tributary forks (see also Figure C-3), which include:

- Zumbro River (main stem downstream of the South Fork and Middle Stem)
- South Fork Zumbro River
- North Fork Zumbro River
- Middle Fork Zumbro River
- South Branch Middle Fork Zumbro River

In addition, there are several named streams tributary to the Zumbro River and its multiple forks. Significant named streams in the watershed, divided among the five major River reaches, are listed in Table C-9.

Table C-9 Streams within the Zumbro River Watershed (by major Zumbro River segment)

Zumbro River	South Fork Zumbro River	North Fork Zumbro River	Middle Fork Zumbro River	South Branch Middle Fork Zumbro River
• Cold Creek • Dry Run Creek • Long Creek • Middle Creek • Silver Spring Creek • Spring Creek • Trout Brook • West Indian Creek	Badger Run • Bear Creek • Cascade Creek • Salem Creek • Silver Creek • Willow Creek	• Pearl Creek • Shingle Creek • Trout Brook (Mazeppa Creek)	• Harkcom Creek • Milliken Creek	• Dodge Center Creek • Masten Creek

Streams in the Zumbro River watershed are primarily classified by the MDNR as warm water. The presence of groundwater springs in the eastern part of the watershed supplies cold water to the following cold-water streams: Mazeppa Creek, Cold Creek, Spring Creek, and Trout Brook. Significant portions of these streams are classified as wild (naturally reproducing) or semi-wild trout waters (MPCA, 2017) (see also Section C.10).

The Mississippi River Lake Pepin watershed is bounded on the north by Lake Pepin, which is a flow-through lake on the Mississippi River. The watershed drains an area of 233 square miles via several named creeks tributary to the Mississippi River and Lake Pepin. Significant named streams in the watershed, divided among the three HUC10 watersheds, are listed in Table C-10.

Table C-10 Streams within the Mississippi River-Lake Pepin Watershed (by HUC10 watershed)

Hay Creek	Wells Creek	Lake Pepin
• Hay Creek • Bullard Creek	• Wells Creek	• Gilbert Creek • Miller Creek

Most of the stream reaches in the Mississippi River Lake Pepin watershed are classified as cold-water streams by the MDNR, and several are classified as trout waters (see also Section C.10).

Rivers and streams within the planning area are presented in Figure C-13. In addition to the perennial streams shown in Figure C-13, there are additional intermittent stream reaches throughout the watershed, located upstream of the perennial stream reaches.

The MPCA lists several of the river and stream reaches within the planning area as impaired due to stressors impacting stream uses for aquatic recreation, aquatic life, and an aquatic consumption (see Section C.8.6).

C.6.3 Drainage Systems

In addition to the natural streams and rivers, there are several altered watercourses and ditches within the planning area, concentrated in Dodge, Rice, and Steele Counties. 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. Many of the drainage ditches within the watershed are identified as MDNR public waters and shown on Figure C-13.

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.

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.

C.6.4 Lakes

Figure C-13 presents the public waters lakes located in the planning area. Significant lakes within the watershed include:

- Lake Zumbro
- Rice Lake
- Silver Lake
- Lake Pepin (downstream of the Mississippi River Lake Pepin watershed)
- Foster Arend Lake
- Will Creek Reservoir (WR-6A)

Of those listed above, only Rice Lake and Lake Pepin are naturally occurring lakes; the others are the result of impoundments. In addition to the above-named impoundments, there are many smaller impoundments located throughout the planning area. Local stakeholders continue to work to increase and improve connectivity between impoundments and their respective streams, while maintaining the integrity and public value of existing structures.

The following subsections summarize information about the lakes listed above. Table C-11 provides some key morphometric and lake classification statistics for lakes in the planning area. Additional information is available from the MDNR LakeFinder website at: https://www.dnr.state.mn.us/lakefind/index.html

C.6.4.1 Lake Zumbro

Lake Zumbro (public water ID 55-0004) is located near the town of Oronoco downstream of the confluence of the South Fork, Middle Fork, and South Branch Middle Fork of the Zumbro River. Lake Zumbro is a 600-acre reservoir created by a hydroelectric dam (Lake Zumbro Dam) located on the north side of the lake. The drainage area to Lake Zumbro is approximately 853 square miles and includes portions of Dodge, Goodhue, Olmsted, Steele, and Wabasha Counties (and less than 1 square mile of Rice County) and the City of Rochester. The lake has a maximum depth of 43 feet. There is a public boat launch at Ponderosa Campground on the northwest side of the lake in addition to several private access points.

Lake Zumbro dam was constructed from 1917-1919 and is currently owned and operated by Rochester Public Utilities (RPU). The dam is managed as "run-of-the-river" (i.e., what flows in must flow out) to minimize water level fluctuations, although water levels may fluctuate by several feet. The ordinary high water (OHW) level is 915 feet (NGVD29 datum). RPU monitors lake levels; data is available in real time at: https://www.rpu.org/education-environment/lake-zumbro-water-level.php

The large ratio of watershed to lake area has contributed to excessive nutrient and sediment loading to Lake Zumbro. The MPCA listed Lake Zumbro on its impaired waters list for excessive nutrients/ eutrophication and for mercury in fish tissue (see Section C.8.6). Over time, sediment accumulation within the lake has altered lake bathymetry and reduced the volume of the lake. In 2019, a dredging project began to remove accumulated sediment from Lake Zumbro.

The Lake Zumbro Improvement Association (LZIA) is a volunteer organization of watershed residents concerned about the restoration and management of Lake Zumbro. The LZIA monitors water clarity in the lake. In 2006, the LZIA established a new non-profit organization, Lake Zumbro Forever, Inc. (LZFI) "dedicated to the restoration and preservation of the beauty, environmental character, recreational quality, hydroelectric capacity, and regional value of Lake Zumbro." LZFI pursues funding for improvement projects and cooperates with LGUs regarding lake management activities.

C.6.4.2 Rice Lake

Rice Lake (public water ID 74-0001) is a shallow lake located in Steele County in the far western part of the planning area. Rice Lake forms the headwaters of the South Branch Middle Fork Crow River. The lake is approximately 600 acres in area and drains a tributary watershed of about 4,500 acres that includes portions of Steele and Dodge Counties. Rice Lake has a maximum depth of about 7 feet and an average depth of about 3 feet. The OHW level is 1238.2 feet (NGVD29 datum). Periodic water level measurements for Rice Lake date back to 1938; water levels during the open water period have been monitored approximately twice monthly since 2004. Public boat access to Rice Lake is available at Rice Lake State Park on the north side of the lake.

The MPCA listed Rice Lake as impaired for aquatic recreation due to excessive nutrients/ eutrophication (see Section C.8.6).

C.6.4.3 Lake Pepin

Lake Pepin is a flow-through lake located on the Mississippi River straddling the Minnesota and Wisconsin border. Lake Pepin is approximately 40 square miles in area and stretches for about 22 miles from the City of Red Wing to the City of Wabasha. The watershed area tributary to the Mississippi River (and Lake Pepin) at this location is approximately 47,000 square miles and includes the Upper Mississippi River, Minnesota River, St. Croix River, and Cannon River watersheds.

Lake Pepin has an average depth of about 21 feet and a maximum depth of about 60 feet. Lake Pepin is a popular recreational lake, used for boating, fishing, and swimming. Public boat access and beach access are located at several locations in Lake City. Frontenac State Park is also located on the west shore of Lake Pepin within the planning area.

C.6.4.4 Silver Lake

Silver Lake (public water ID 55-0003) is a reservoir formed by the Silver Lake dam, originally constructed from 1935 to 1936. The dam is currently operated by Rochester Public Utilities (RPU). Silver Lake has an approximate surface area of 50 acres and maximum depth of 11 feet. The lake slows the flow of the South Fork Zumbro River, resulting in sediment deposition upstream of the dam. Periodic dredging has been performed to maintain depth and recreational functions.

Silver Lake Park is a popular recreational location adjacent to Silver Lake and includes trails, non-powered boat access, and fishing pier. Many fish species are present, including sunfish, bullhead, largemouth bass, and northern pike.

C.6.4.5 Foster Arend Lake

Foster Arend Lake (public water ID 55-0019) is an artificial lake created from a sand and gravel mine pit. The City purchased the land in 1981 to convert to park space. Foster Arend Lake is complete surrounded by a City park with swimming beaches, a fishing pier, trails, and picnic facilities. The MDNR stocks Foster Arend Lake with brook trout and/or rainbow trout annually. Bluegill and largemouth bass are also present in strong numbers.

C.6.4.6 Willow Creek Reservoir (WR-6A)

Willow Creek Reservoir (public water ID 55-0021) is a 60-acre impoundment located on Willow Creek on the southwest side of the City of Rochester. The reservoir is surrounded by a walking trail. A fishing pier is located by on the east side of the lake.

The MPCA listed Willow Creek reservoir as impaired for aquatic consumption by the MPCA due to mercury in fish tissue (see Section C.8.6).

Table C-11 Summary of lake characteristics in the planning area

Category	Lake Zumbro	Rice Lake	Willow Creek Reservoir	Lake Pepin	Silver Lake	Foster Arend Lake
MDNR Lake ID	55-0004-00	74-0001-00	55-0021-00	25-0001-00	55-0003-00	55-0019-00
MPCA 7050 use classification	2B aquatic life; 3C industrial use	2B aquatic life; 3C industrial use	2B aquatic life; 3C industrial use	2B aquatic life; 3C industrial use	2B aquatic life; 3C industrial use	NA
Total surface area	600-700 acres (varies with water level)	609 acres	60 acres	40 square miles	50 acres	17.7 acres
Watershed area	853 square miles	4,352 acres	~5,600 acres	~47,000 square miles	259 square miles	--
Watershed to lake area ratio	~800:1	7.1:1	93:1	~1,200:1	~3,300:1	--
Mean depth	--	3.0 ft (0.9 m)	--	21 ft (6.4 m)	2 ft (0.6 m)	
Maximum depth	43 ft (2.4 m)	6.9 ft (2.1 m)	22 ft (6.7 m)	56 ft (17.1 m)	11 ft (3.4 m)	42 ft (12.9 m)
Shoreline length	22.8 miles	1.2 miles	2.2 miles	117 miles	3.0 miles	0.7 miles
Impairments (stressor) [1]	Aquatic consumption (mercury in fish); Aquatic life (excess nutrients/ eutrophication)	Aquatic life (excess nutrients/ eutrophication)	Aquatic consumption (mercury in fish)	Aquatic life (excess nutrients/ eutrophication)	NA	NA

Source: Zumbro River TMDL Report (MPCA, 2018); MDNR LakeFinder

(1) Listed impairments do not include Mississippi River impairments for reaches including Lake Pepin

C.6.5 Wetlands

Wetlands in the planning area are important community and ecological assets. These resources provide significant wildlife habitat and refuge, while also supplying, recreational, runoff retention, and water quality treatment benefits. Many wetlands in the planning area, concentrated in the western portion of the Zumbro River watershed, have been drained for agricultural development prior to the establishment of regulations protecting wetlands (MPCA, 2016); approximately 87% of presettlement wetlands in the Zumbro River watershed have been lost (MPCA., 2017). However, 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

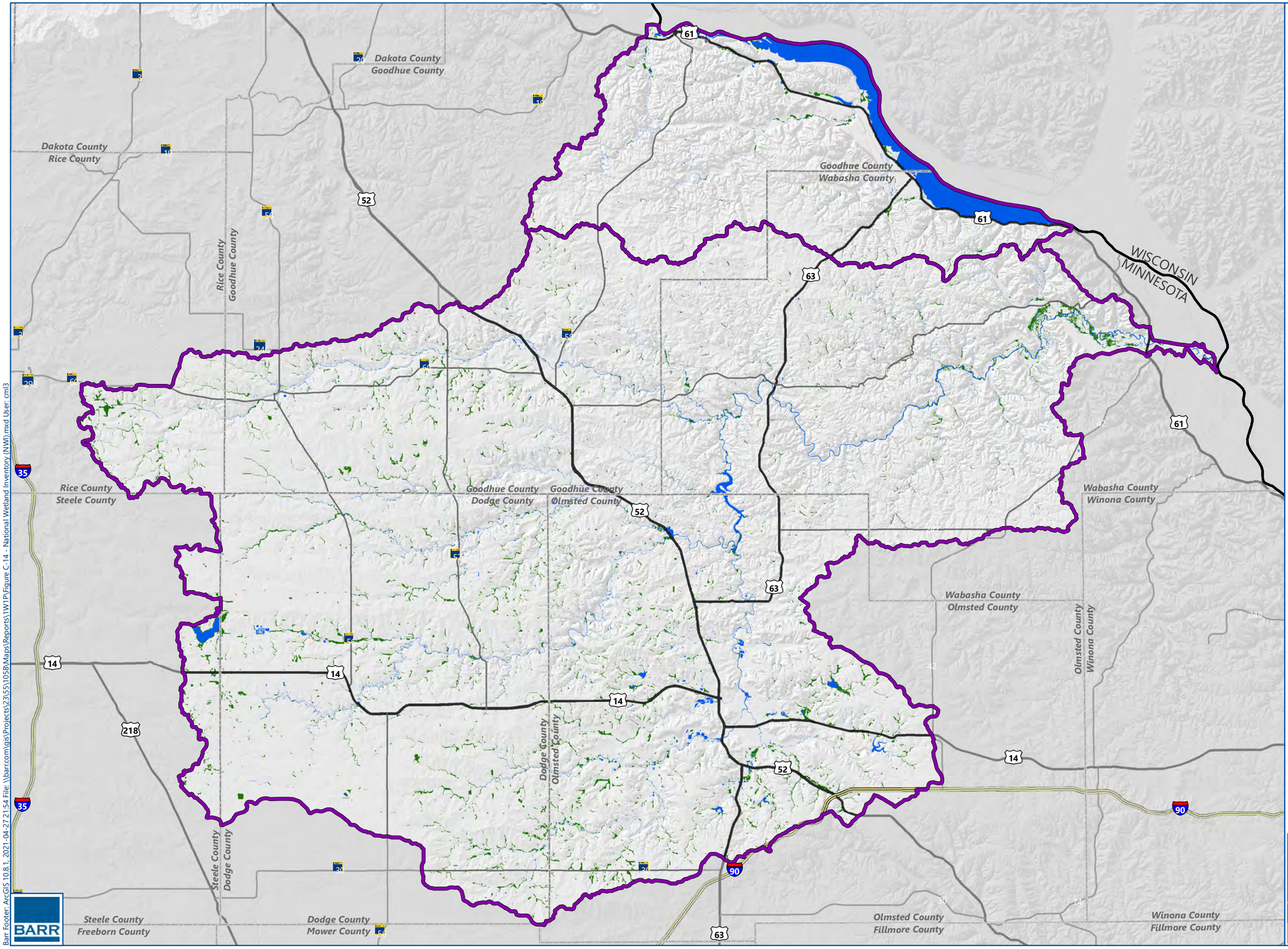
detailed maps on the characteristics and extent of wetlands, and maintains a national wetlands database as part of the National Wetlands Inventory (NWI). The NWI is periodically updated based on available imagery.

Figure C-14 shows the location of NWI wetlands within the planning area. Wetlands in the planning area are concentrated in the south and east Zumbro River watershed, with a few wetlands in the northwest Zumbro River watershed or Mississippi River Lake Pepin watershed. In total, there are approximately 22,000 acres of wetlands in the Zumbro River watershed (about 2% of the total area) and 1,300 acres of wetlands in the Mississippi River Lake Pepin watershed (not including portions of Lake Pepin classified as wetland). An extensive corridor of floodplain wetlands occurs along the lower reaches of the Zumbro River near the Mississippi River, accounting for a large percentage of the watershed's wetland area (MPCA, 2016).

The NWI classifies wetlands in the planning area are classified 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 C-14). 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



Study Area

County Boundary

State Boundary

National Wetlands Inventory

Freshwater Forested/Shrub Wetland

Freshwater Emergent Wetland

Freshwater Pond, Lake, River

Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses from Public Water Inventory (PWI). Wetlands from MN DNR National Wetlands Inventory (NWI) East Central Update.

N

0 2.5 5

Miles

NATIONAL WETLAND INVENTORY (NWI)

WAGZ Comprehensive Watershed Management Plan

FIGURE C-14

BARR

C.7 Watershed Monitoring

Several agencies, LGUs, and other stakeholders have focused monitoring efforts in the Zumbro River watershed and Mississippi River Lake Pepin 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 the monitoring efforts that are being carried out in the planning area. Monitoring locations are presented in Figure C-15. Additional discussion of watershed monitoring planned as part of the implementation of this Plan is included in Section 6.

C.7.1 Hydrologic Monitoring

There are 16 continuous stage and flow monitoring sites in the planning area (see Figure C-15), including 15 within the Zumbro River watershed and one on Wells Creek in the Mississippi River Lake Pepin watershed. Fourteen of these sites are currently active. These stream gages are summarized in Table C-12. Stream gages within the Zumbro River are operated in cooperative partnerships of the MPCA, MDNR, City of Rochester, 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 C-12 Summary of stream gages within the planning area

Stream/River	Site Description	MDNR ID	USGS ID	Period of Record	Drainage Area (square miles)
Bear Creek	Bear Creek at Rochester, US14	41051001	05372930	1981-2019	78.4
Cascade Creek	Cascade Creek at Rochester, 45th Ave SW	41065002	05372983	2013-2019	17.9
	Cascade Creek at Rochester, 7th St NW	41064001	05372990	1981-2019	38.2
Silver Creek	Silver Creek at Rochester, Silver Creek Dr NE	41050001	05372950	1981-2019	17.7
	Silver Creek near Rochester, Silver Creek Rd NE	41050002	--	2014-2016	--
Wells Creek	Wells Creek near Frontenac, US61	38006002		2009-2019	68.0
Middle Fork Zumbro River	Middle Fork Zumbro River near Oronoco,5th St	41071003	--	2012-2019	206
North Fork Zumbro River	North Fork Zumbro River near Wanamingo, CR30	41010001	05373720	1998-2019	106
	North Fork Zumbro River near Mazeppa, CSAH7	41006001	--	2012-2019	240
South Branch Middle Fork Zumbro River	South Br Mid Fork Zumbro River near Post Town, CR103	41067002	--	2011-2017	190
	South Branch Middle Fork Zumbro River near Oronoco,5th St	41071002	--	2012-2019	219
South Fork Zumbro River	South Fork Zumbro River near Rochester, CR104	41061002	--	2011-2019	141
	South Fork Zumbro River at Rochester, US14	41061001	05372800	1981-2019	155
	South Fork Zumbro River at Rochester, MN	41063001	05372995	1981-2019	303
Zumbro River	Zumbro River at Zumbro Falls, MN	41031002	05374000	1909-2019	1,150
	Zumbro River at Kellogg, US61	41043001	05374900	1975-2019	1,418

Source: MPCA/MDNR Cooperative Stream Gaging website: https://www.dnr.state.mn.us/waters/csg/index.html

C.7.2 Water Quality and Biological Monitoring

Several different agencies also conduct water chemistry and biological monitoring in the planning area. Through its Major Watershed Load Monitoring Program (MWLMP), the MPCA conducts (or coordinates with partners to conduct) annual pollutant load monitoring at continuous flow gaging locations (see Table C-12) within the planning area. The MPCA (or its partners) sample for total suspended solids (TSS), total phosphorus (TP), dissolved ortho-phosphorus (DOP), nitrate and nitrite, and total Kjeldahl nitrogen

(TKN). Approximately over 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 2012, 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.

Various Partners have performed targeted monitoring of resources on a limited basis in support of specific studies and/or projects (e.g., reservoirs in Olmsted County). Recently, the MDNR, MPCA, and Olmsted County have coordinated to perform monitoring of Cascade Creek following constructed improvements.

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

C.7.2.1 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 the Mississippi River Lake Pepin watershed and Zumbro Lake watershed (MPCA 2012, 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. Several of the Partners have used SWAG grants to perform water quality monitoring of streams in the past; collected data is entered into the MPCA system.

C.7.2.2 Stream Water Chemistry Monitoring

During the MPCA's most recent intensive monitoring efforts within the planning area, five stream locations in the Mississippi River Lake Pepin watershed and 13 locations in the Zumbro River watershed were monitored for water chemistry by the MPCA or its partners. Monitoring was performed primarily

from 2008-2009 for the Mississippi River Lake Pepin watershed and from 2012-2013 in the Zumbro River watershed. Stream water chemistry monitoring locations were generally located near subwatershed outlets. For trout streams, additional water chemistry monitoring was performed in upstream reaches (e.g., Hay Creek, Wells Creek). Additionally, citizen volunteers enrolled in the CSMP observed physical water characteristics at 33 stream stations in the Zumbro River watershed and submitted data to MPCA in 2014. Stream water chemistry monitoring locations are presented in Figure C-15.

Additional details regarding monitoring locations, parameters, and results are included in the *Mississippi River Lake Pepin Watershed Monitoring and Assessment Report* (MPCA, 2012) and the *Zumbro River Watershed Monitoring and Assessment Report* (MPCA 2016).

C.7.2.3 Stream biological monitoring

The MPCA completed the biological monitoring component of the intensive watershed monitoring in 2008-2009 in the Mississippi River Lake Pepin watershed and in 2012 for the Zumbro River watershed. Fifteen locations were monitored for biological parameters in the Mississippi River Lake Pepin watershed and 70 locations were monitoring for biological parameters in the Zumbro River watershed (including five locations originally established in 2002).

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. The MDNR also performs fishery surveys of several trout streams located within the planning area (see also Section C.10.4).

As part of the MPCA's intensive watershed monitoring, mercury was analyzed in fish tissue samples collected from the Zumbro River and 4 lakes, including Lake Zumbro. Polychlorinated biphenyls (PCBs) were measured in fish from the Zumbro River and10 lakes. In addition, fish from the Zumbro River and Lake Zumbro were tested for perfluorochemicals (PFCs) between 2007 and 2010. The MPCA analyzed mercury and PCBs in fish tissue samples collected from Wells and Hay Creeks in 2008 and 2010.

Additional detail regarding biological monitoring locations, parameters, and results are included the *Mississippi River Lake Pepin Watershed Monitoring and Assessment Report* (MPCA, 2012) and the *Zumbro River Watershed Monitoring and Assessment Report* (MPCA 2016).

C.7.2.4 Lake Water Quality Monitoring

The Zumbro River watershed has 17 lakes at least 10 acres in size. Lake Zumbro and Silver Lake were monitored for water clarity by citizens enrolled in the CLMP in partnership with MPCA. The MPCA and its partners have also collected lake water chemistry data for Lake Zumbro and Rice Lake. 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 standard requires eight observations/samples within a 10-year period for phosphorous, chlorophyll-a, and Secchi depth (clarity) (MPCA 2017).

The only lake in the Mississippi River Lake Pepin watershed is Lake Pepin. Due to the size and complexity of this basin and the ongoing work developing a TMDL, assessment of Lake Pepin monitoring and water quality results is outside of the scope of this document. More information can be found at: https://www.pca.state.mn.us/water/tmdl/lake-pepin-watershed-work-groups-tmdl-project

Additional detail regarding lake monitoring locations, parameters, and results are including the *Mississippi River Lake Pepin Watershed Monitoring and Assessment Report* (MPCA, 2012) and the *Zumbro River Watershed Monitoring and Assessment Report* (MPCA 2016).

C.7.2.5 Groundwater Monitoring

Through the Ambient Groundwater Monitoring Program, the MPCA has sampled 6 domestic wells and 10 monitoring wells within the Zumbro River watershed. The Minnesota Department of Agriculture (MDA) coordinates groundwater quality monitoring through its township testing program (TTP) (see Section C.5.2). The MDA also monitors pesticides in groundwater through a network of monitoring wells through its private well pesticide sample (PWPS) project. Southeast Minnesota, including the Zumbro River watershed, is one of two areas the MDA monitors more intensively due to the vulnerable geology. The Minnesota Department of Health (MDH) also coordinates voluntary well testing programs to monitor groundwater for nitrate and other contaminants.

The MDA samples 11 sites in the Zumbro River watershed including one spring, one monitoring well, and nine domestic wells. Twenty different pesticides or pesticide breakdown products (or degradates) have been detected in the wells and the spring. None have exceeded human health reference values. Monitoring of the MDA's sites in the watershed is expected to continue. More information is available at: http://www.mda.state.mn.us/monitoring

As part of the MDA PWPS project, wells in 44 townships in Dodge, Goodhue, Wabasha, and Olmsted Counties were sampled between 2015 and 2019. Samples were analyzed for 22 compounds in 2015 and 125 compounds beginning in 2016. The chemistry data is available on a township summary basis for the wells (well locations are not shared due to privacy issues).

Recent groundwater quality monitoring results are summarized in see Section C.5.2.

C.8 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 C.7.2. Surface water monitoring locations are presented in Figure C-15. 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 *Zumbro River Watershed Restoration and Protection Strategy Report* (Zumbro WRAPS) (MPCA 2017) and the *Mississippi River Lake Pepin Watershed Restoration and Protection Strategy Report* (Mississippi Pepin WRAPS) (MPCA 2015).

C.8.1.1 Watershed Restoration and Protection Strategies (WRAPS)

The MPCA completed Watershed Restoration and Protection Strategies (WRAPS) studies for the Mississippi River Lake Pepin watershed and the Zumbro River watershed in 2015 and 2017, respectively. 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 C.7.2). 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 Zumbro WRAPS and Mississippi Pepin WRAPS is summarized in this document. Additional information may be obtained from the MPCA website at: https://www.pca.state.mn.us/water/watersheds/zumbro-river and https://www.pca.state.mn.us/water/watersheds/mississippi-river-lake-pepin

C.8.2 Surface Water Quality Assessments

The Zumbro and Mississippi Pepin WRAPS include 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 Zumbro and Mississippi Pepin WRAPS, as well as the methodology for comparing data to those standards, are described in the *Mississippi River Lake Pepin Watershed Monitoring and Assessment Report* (MPCA, 2012) and the *Zumbro River Watershed Monitoring and Assessment Report* (MPCA 2016). 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 C.8.4). Impaired waterbodies within the planning area are presented in Figure C-16. The MPCA

further classifies stream reaches that "nearly impaired," "barely impaired," or "nearly exceptional" based on water quality data; these reaches are identified in Figure 3-6.

C.8.2.1 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 (Fish IBI) – which means an unhealthy fish community is present
- Low macroinvertebrate (i.e., aquatic bugs) index of biotic integrity (Invert IBI) – 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:

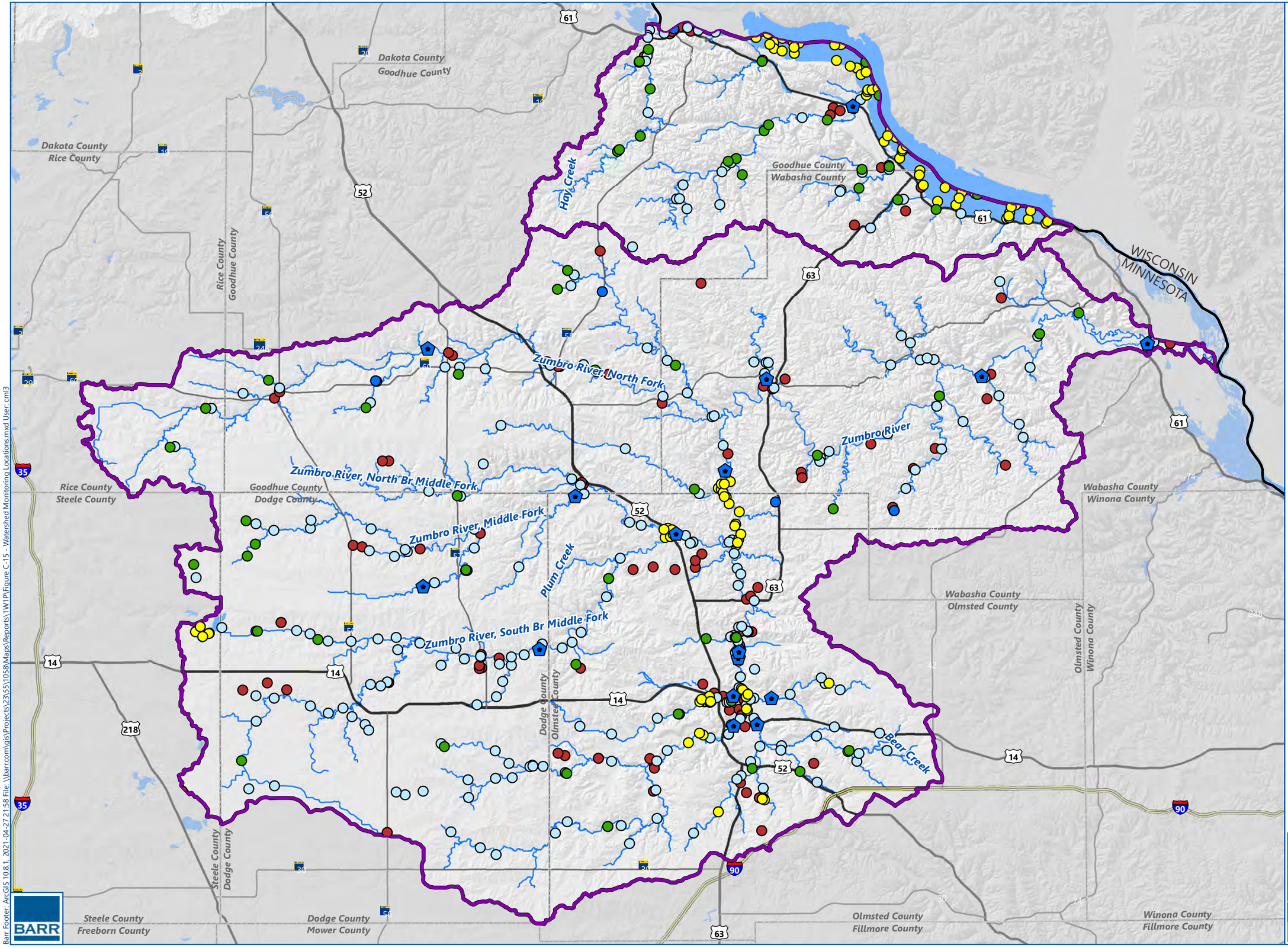
- Mercury in fish tissue (Hg-F) – fish tissue contains concentrations of mercury that pose a health risk if eaten
- Polychlorinated biphenyls in fish tissue (PCB-F) – fish tissue contains concentrations of polychlorinated biphenyls (PCBs) that pose a risk to health if eaten

The results of the stream assessments relative to aquatic life and aquatic recreation are presented in Table C-13 and are based on information published in the Zumbro and Mississippi Pepin WRAPS. Many of the subwatersheds listed in Table C-13 include several stream reaches and/or tributaries. A complete list of the stream reaches (AUIDs) identified as not supporting aquatic life and aquatic recreation uses is included in the WRAPS documents.

Table C-13 Stream aquatic life and aquatic recreation impairments from Zumbro River WRAPS and Mississippi River Lake Pepin WRAPS

HUC 10 Watershed	Subwatershed (from WRAPS)	Area (acres)	# Total AUIDs	# Assessed AUIDs	# Supporting Aquatic Life	# Supporting Aquatic Recreation	# Not supporting Aquatic Life	# Not supporting Aquatic Recreation	Insufficient Data	Delistings
South Fork Zumbro River 0704000401	Bear Creek	52,064	25	8	4	0	3	1	1	3
	Salem Creek	39,782	12	4	2	0	2	1	0	0
	Lower South Fork Zumbro River	84,860	28	9	1	0	5	1	3	2
	Upper South Fork Zumbro River	49,382	6	4	4	0	0	0	0	0
South Branch Middle Fork Zumbro River 0704000402	Dodge Center Creek	57,806	17	6	1	0	4	1	1	0
	South Branch Middle Fork Zumbro River	80,507	17	7	3	0	2	1	1	0
Middle Fork Zumbro River 0704000403	North Branch Middle Fork Zumbro River	37,460	12	2	2	0	0	0	1	1
	Lower Middle Fork Zumbro River	19,652	3	3	1	0	2	1	0	0
	Upper Middle Fork Zumbro River	82,535	23	7	4	0	3	1	0	0
North Fork Zumbro River 0704000404	Mazeppa Creek	35,661	16	1	0	0	1	1	0	0
	North Fork Zumbro River	117,876	50	12	5	0	7	1	0	0
Zumbro River 0704000405	Cold Creek	29,337	18	1	0	0	1	0	1	0
	Spring Creek	40,922	49	5	1	0	3	2	1	0
	Upper Zumbro River	66,647	42	6	4	0	0	2	3	0
	Lower Zumbro River	114,868	156	7	2	0	4	4	2	0
Zumbro River Watershed Totals		**909,359**	**474**	**82**	**34**	**0**	**37**	**17**	**14**	**6**
Hay Creek 0704000104	Hay Creek	30,483	2	2	0	0	0	1	0	2
	Bullard Creek	44,855	3	2	0	0	0	1	0	1
Wells Creek 0704000106	Wells Creek	34,498	1	1	0	0	0	1	0	2
Lake Pepin 0704000107	Miller Creek	11,377	1	1	0	0	0	1	0	1
	King Creek	27,061	1	1	0	0	0	0	0	0
	Gilbert Creek	23,938	3	1	0	0	1	1	0	2
Misssissippi River Lake Pepin Watershed Totals		**172,212**	**11**	**8**	**0**	**0**	**1**	**5**	**0**	**8**

Source: Zumbro River WRAPS (MPCA 2017) and Mississippi River Lake Pepin WRAPS (MPCA 2015)



Study Area
Watercourses
Pond or Lake
County Boundary
State Boundary
DNR/MPCA Stream Monitoring Locations

Monitoring Stations

MPCA Surface Water

- Biological
- Lake
- Stream

Other

- NPDES Discharge
- USGS Stream Gauge

Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses, Public Water Basins, and Public Water Wetland from Public Water Inventory (PWI). Ponds and lakes from National Hydrography Dataset (NHD). Monitoring Stations from the Minnesota Pollution Control Agency (MPCA). DNR/MPCA Stream Monitoring Locations from MN DNR and MPCA.

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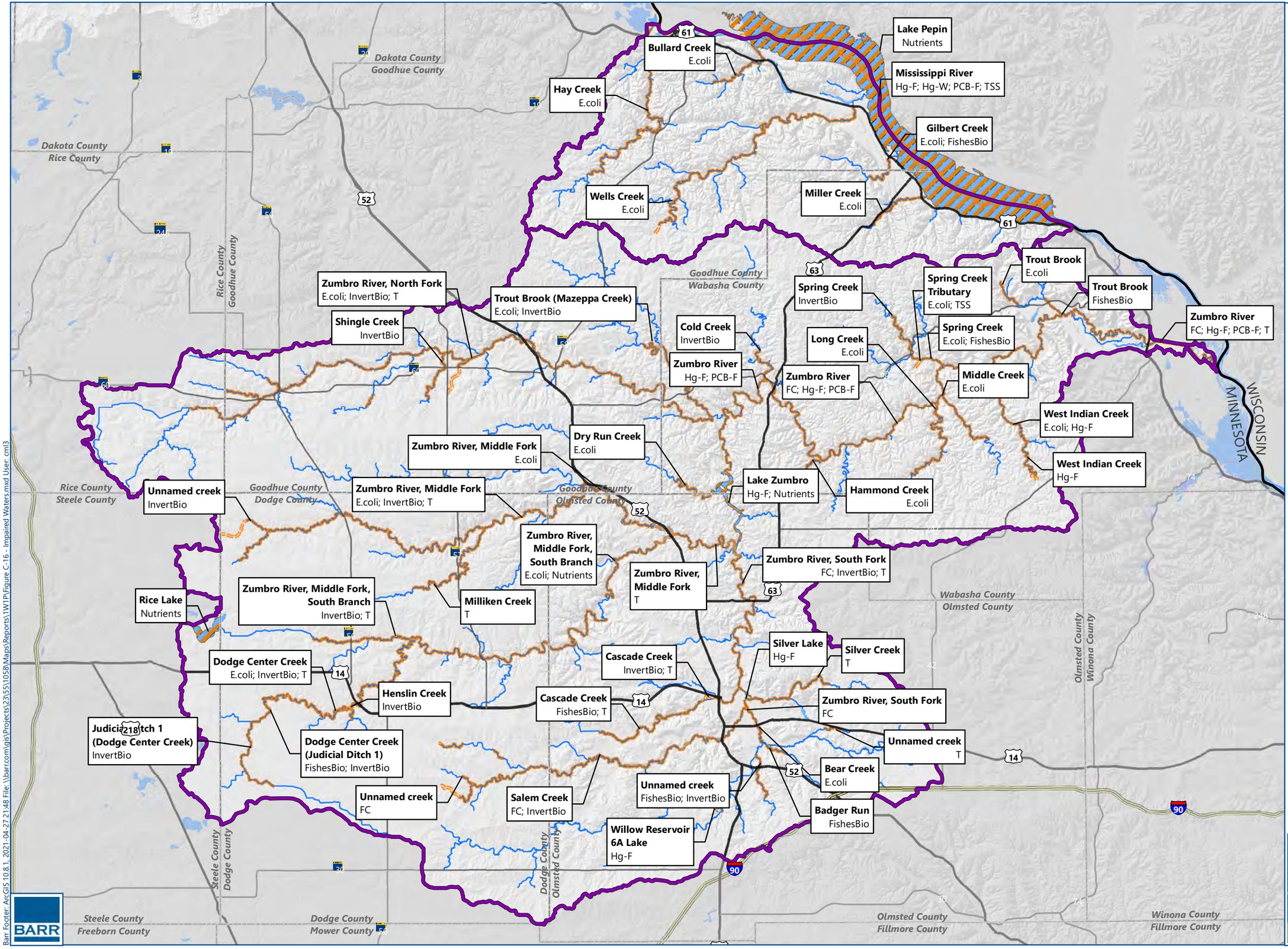
WATERSHED MONITORING LOCATIONS
WAGZ Comprehensive Watershed Management Plan

FIGURE C-15



Study Area
Watercourses
Pond or Lake
County Boundary
State Boundary
Impaired Streams (2018)
Impaired Lakes (2018)

Impairments:
FC = Fecal Coliform
Hg-F = Mercury in Fish Tissue
PCB-F = PCB in Fish Tissue
T = Turbidity
InvertBio = Invertebrate Bioassessments
FishesBio = Fishes Bioassessments

Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses, Public Water Basins, and Public Water Wetland from Public Water Inventory (PWI). Ponds and lakes from National Hydrography Dataset (NHD). Monitoring Stations from the Minnesota Pollution Control Agency (MPCA). DNR/MPCA Stream Monitoring Locations from MDNR and MPCA.

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IMPAIRED WATERS
WAGZ Comprehensive Watershed Management Plan

FIGURE C-16

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C.8.2.2 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.

Seventeen lakes in the Zumbro River watershed are assessed in the Zumbro WRAPS; the results are summarized in Table C-14. The only lake in the Mississippi River Lake Pepin watershed is Lake Pepin, which was not assessed in the Mississippi Pepin WRAPS, owing to the complexity of the lake watershed and ongoing work related to the Lake Pepin TMDL (MPCA 2015). More information about Lake Pepin impairments is available from the MPCA at: https://www.pca.state.mn.us/water/tmdl/lake-pepin-excess-nutrients-tmdl-project

Table C-14 Lake aquatic life and aquatic recreation impairments from Zumbro River WRAPS

HUC 10 Watershed	Subwatershed (WRAPS)	Area (acres)	Lakes > 10 acres	# Supporting Aquatic Life	# Supporting Aquatic Recreation	# Not supporting Aquatic Life	# Not supporting Aquatic Recreation	Insufficient Data	De-listings
South Fork Zumbro River 0704000401	Lower South Fork Zumbro River	84,860	9	0	0	0	0	0	0
	Bear Creek	52,064	3	0	0	0	0	0	0
	Upper South Fork Zumbro River	49,382	1	0	0	0	0	0	0
South Branch Middle Fork Zumbro River 0704000402	South Branch Middle Fork Zumbro River	80,507	1	0	0	0	1 (Rice Lake)	0	0
Zumbro River 0704000405	Lower Zumbro River	114,868	2	0	0	0	0	0	0
	Upper Zumbro River	66,647	1	0	0	0	1 (Lake Zumbro)	0	0
Zumbro River Watershed Totals		**909,440**	**17**	**0**	**0**	**0**	**2**	**0**	**0**

Source: Zumbro River WRAPS (MPCA, 2017)

Within the planning area, Rice Lake and Lake Zumbro were assessed and found to be impaired for aquatic recreation due to excessive nutrients/eutrophication (MPCA 2017). The nutrient impairment for Rice Lake is addressed in the Zumbro River Watershed TMDL (MPCA 2018). The nutrient impairment for Lake Zumbro is not addressed by the most recent TMDL due to the lake's relatively recent impairment listing (2016) – the TMDL was already underway when the lake was listed.

C.8.3 Stream and River Water Quality Trends

The Zumbro WRAPS included a limited analysis of water quality trends in the South Fork Zumbro River north of Rochester (at CSAH 14). Water quality data collected at this location date back to 1973. Water quality trends for the South Fork Zumbro River are summarized in Table C-15. While several parameters show improvements over the period of record, concentrations of nitrate-nitrite and chloride have increased.

Table C-15 Water quality trends in the South Fork Zumbro River (north of Rochester)

Parameter	Median Concentration (first 10 years)	Median Concentration (last 10 years)	Total Change, 1973-2008 (%)	Annual Change 1973-2008 (%)	Total Change 1995-2008 (%)	Annual Change 1995-2008 (%)
Total Suspended Solids	45 mg/L	16 mg/L	-64%	-2.9%	-42%	-6.7%
Total Phosphorus	0.9 mg/L	0.2 mg/L	-92%	-7.1%	--	--
Nitrate-Nitrite	3 mg/L	7 mg/L	+120%	+2.3%	--	--
Ammonia	0.5	<0.05 mg/L	-97%	-10.0%	--	--
Biochemical Oxygen Demand	5 mg/L	2 mg/L	-81%	-4.6%	--	--
Chloride	36 mg/L	54 mg/L	+186%	+3.0%	--	--

Source: Water Quality Trends for Minnesota Rivers and Streams at Milestone Sites (MPCA, 2014)

The MPCA also collected baseflow and storm flow water quality samples in West Indian Creek, a trout stream. Nitrate-nitrite concentrations in West Indian Creek show a statistically significant increase from 2007-2015 (MPCA 2017). Water quality collected from cold springs in southeastern Minnesota (not limited to the planning area) suggest potentially increasing nitrate-nitrate concentrations, although analysis of statistical significance is inconclusive (MPCA 2017). Assessment of stream water quality trends in the Mississippi River Lake Pepin watershed was not performed as part of the WRAPS study due to short periods of record (MPCA 2015).

C.8.4 Stressor Identification

To develop appropriate strategies for restoring or protecting waterbodies, the stressors and/or sources impacting or threatening them must be identified and evaluated.

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 Zumbro River watershed (MPCA October 2016) and the Mississippi River Lake Pepin watershed (MPCA June 2013). These studies identify 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 C-16 summarizes the primary stressors identified in streams with aquatic life impairments in the planning area. Common stressors were:

- **Elevated Temperature:** warmer water impacts organisms indirectly due to the relationship of warmer water with lower dissolved oxygen (DO) and aquatic toxicity of chemicals, as well as directly through changes in growth and reproduction, egg mortality, disease rates, and direct mortality.
- **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/Bedded Sediment:** 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.
- **Flow Alteration and Connectivity:** 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.
- **Elevated Chloride/Conductivity:** Aquatic organisms can become stressed by an increase in ion concentrations. Calcium, sodium, and magnesium are all necessary for aquatic health, but imbalances can be toxic (SETAC, 2004). Increased use of road salt and de-icing products has putting more streams at risk for this stressor (Kostick, 1993).
- **Elevated nutrients (phosphorus)**: very low or highly fluctuating dissolved oxygen levels due to excess nutrients (phosphorus) fertilizing stream algae growth.

Unionized ammonia and pesticides were identified as potential stressors, but there is insufficient information to determine a causal linkage between these potential stressors and impairments.

The MPCA listed Hay Creek as impaired by turbidity for aquatic life. More turbidity data are currently being collected to determine if this listing is accurate. Aquatic life (fish and invertebrates) is doing well throughout this watershed, and the MPCA does not believe that turbidity related to sediment is a stressor at this time (MPCA 2013).

Table C-16 Stressors for biotic impairments in the Zumbro River and Mississippi River Lake Pepin watersheds

Stream Name	AUID	Biological Impairment	Stressor						
			Temperature	Dissolved Oxygen and Eutrophication	Nitrate	Total Suspended Solids	Lack of Habitat	Flow Alteration/ Connectivity	Chloride/ Conductivity
Spring Creek	07040004-568	Inverts	●	---	o	●	---	---	---
Spring Creek	07040004-570	Fish	---	---	o	●	●	---	---
Cold Creek	07040004-510	Inverts	---	---	o	---	●	---	---
Trout Brook (Mazeppa Creek)	07040004-515	Inverts	---	---	o	---	●	o	---
Trout Brook (Dumfries)	07040004-585	Fish	---	---	---	---	●	o	---
Unnamed creek	07040004-964	Inverts	---	o	●	---	●	o	---
Unnamed creek (Spring Creek Tributary)	07040004-605	Inverts	---	---	●	o		---	---
Spring Creek	07040004-606	Inverts	---	●	●	---	●	---	---
Shingle Creek	07040004-562	Inverts	---	---	●	o		---	---
Unnamed Creek	07040004-579	Inverts	---	---	---	---	●	---	---
North Fork Zumbro	07040004-971	Inverts	---	o	o	●	●	---	---
Unnamed Creek	07040004-578	Inverts	---	---	●	o	●	●	---
Middle Fork	07040004-973	Inverts	---	---	●	o	---	---	---
Dodge Center Creek	07040004-989	Inverts	---	---	o	●	●	o	---
Henslin Creek	07040004-618	Inverts	---	---	●	o	---	---	---
Judicial Ditch 1	07040004-987	Inverts	---	●	●	o	●	●	---
Judicial Ditch 1	07040004-988	Fish and Inverts	---	o	●	o	●	●	---
South Branch Middle Fork	07040004-976	Inverts	---	---	o	●	---	---	---
South Branch Middle Fork	07040004-980	Inverts	---	---	o	●	●	●	---
Salem Creek	07040004-503	Inverts	---	---	●	---	●	---	---
Salem Creek Trib	07040004-597	Fish and Inverts	---	o	●	o	●	●	---
Unnamed Creek (Trib to Willow)	07040004-800	Fish and Inverts	---	---	---	---	●	●	---
Badger Run	07040004-620	Fish	---	---	---	o	●	●	---
Unnamed Creek	07040004-621	Fish	---	---	---	---	●	●	---
South Fork Zumbro	07040004-507	Inverts	---	o	o	●	●	●	o
South Fork Zumbro	07040004-536	Inverts	---	---	---	o	●	---	---
Cascade Creek	07040004-581	Inverts	---	o	---	●	●	●	---
Cascade Creek	07040004-991	Fish	---	---	o	o	●	●	---
Gilbert Creek	07040001-530	Fish	---	---	---	---	●	---	---

Source: Mississippi River Lake Pepin Tributaries Biotic Stress Identification (MPCA 2013); Zumbro River Watershed Stressor Identification Report (MPCA 2016)

C.8.5 Pollutant Sources

The Mississippi Pepin WRAPS, Zumbro WRAPS, and Zumbro TMDL identify pollutant sources to impaired waters. These sources include point sources and non-point sources of pollutants. More detailed discussion of the pollutant sources summarized here is included in Section 2.3 of the WRAPS documents.

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 over cropland, forests, developed areas, or other landscapes, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes and streams. Precipitation and runoff infiltrating through the soil can also leach pollutants and convey them to both groundwater and surface waters. Common non-point pollutant sources in the planning area include:

- **Cropland runoff and infiltration:** Cropland can deliver sediment, nitrogen and phosphorus when soil is disturbed or exposed to wind and rain. Nutrient loading can occur via overland runoff as well as leaching of nutrients from cropland soils by infiltrating precipitation collected by tile or conveyed to groundwater. Assessment of the Lower Mississippi River basin identified over 50% of nitrogen loading coming from agricultural groundwater (MPCA, 2013). Analyses of nitrate concentrations in trout streams in southeast Minnesota identify a strong correlation between row crop land use and stream nitrate concentrations (MPCA 2017).
- **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. While streams naturally transport water and sediment, erosion issues occur when the streams are out of balance /equilibrium.
- **Livestock facilities and manure application:** Fertilizer and manure contain high concentrations of phosphorus, nitrogen, and bacteria that can runoff into lakes and streams when not properly managed. Animal feedlots that are not properly managed may become significant sources of bacteria and nutrients. Feedlots located within the planning area are presented in Figure C-17.
- **Failing subsurface sewage treatment systems (SSTS):** SSTS (septic systems) that are not maintained or failing can contribute excess phosphorus, nitrogen, and bacteria.
- **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

Study Area
Watercourses
Pond or Lake
Municipal Boundary
County Boundary
State Boundary

Feedlots

< 100 animal units
100-999 animal units
1000+ animal units

Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses from Public Water Inventory (PWI). Ponds and lakes from National Hydrography Dataset (NHD). Feedlots from Minnesota Pollution Control Agency (MPCA).

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FEEDLOTS
WAGZ Comprehensive Watershed Management Plan

FIGURE C-17

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Barr Footer: ArcGIS 10.8.1, 2021-04-27 21:58 File: \\barr.com\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure C-17 - Feedlots.mxd User: cmb

C.8.6 TMDL Analyses

Figure C-16 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 recently completed the *Zumbro River Watershed Total Maximum Daily Load Report* (Zumbro TMDL, MPCA 2018) and the *Mississippi River Lake Pepin Tributaries Total Maximum Daily Load Report* (Mississippi Pepin TMDL, MPCA 2015). 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/zumbro-river and https://www.pca.state.mn.us/water/watersheds/mississippi-river-lake-pepin

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 Zumbro TMDL and Mississippi Pepin TMDLs address the impairments and stressors identified in Table C-17; these include impairments for total suspended solids (TSS), bacteria, and eutrophication (phosphorus). Note that there are recently identified impairments that are not addressed by TMDLs already completed.

Table C-17 Zumbro RIver watershed and Mississippi River Lake Pepin watershed 303(d) impairments addressed by Zumbro TMDL and Mississippi Pepin TMDL

HUC10 Watershed	Stream Name	AUID	Impaired Use	Pollutant	Year Listed
Hay Creek 0704000104	Hay Creek	07040001-518	Aquatic Recreation	E. coli	2012
	Bullard Creek	07040001-256	Aquatic Recreation	E. coli	2012
Wells Creek 0704000106	Wells Creek	07040001-708	Aquatic Recreation	E. coli	2012
Lake Pepin 0704000107	Miller Creek	07040001-534	Aquatic Recreation	E. coli	2012
	Gilbert Creek	07040001-530	Aquatic Recreation	E. coli	2012
Middle Fork Zumbro River 0704000403	Milliken Creek	07040004-555	Aquatic Life	TSS	2010
	Zumbro River	07040004-973	Aquatic Recreation	E. coli	2016
	Zumbro River	07040004-992	Aquatic Recreation	E. coli	2016
	Zumbro River	07040004-993	Aquatic Life	TSS	2010
North Fork Zumbro River 0704000404	Trout Brook	07040004-515	Aquatic Recreation	E. coli	2016
	Zumbro River	07040004-971	Aquatic Life	TSS	2016
			Aquatic Recreation	E. Coli	
South Branch Middle Fork Zumbro River 0704000402	Rice Lake	74-0001-00	Aquatic Recreation	Phosphorus	2016
	Zumbro River	07040004-978	Aquatic Recreation	E. coli	2016
	Dodge Center Creek	07040004-989	Aquatic Life	TSS	2016
			Aquatic Recreation	E. coli	
South Fork Zumbro River 0704000401	Bear Creek	07040004-538	Aquatic Recreation	E. coli	2016
	Unnamed Creek	07040004-595	Aquatic Recreation	Fecal coli	2008
	Unnamed Creek	07040004-596	Aquatic Recreation	Fecal coli	2008
Zumbro River 0704000405	Lake Zumbro	55-0004-00	Aquatic Recreation	Phosphorus	2002
	West Indian Creek	07040004-542	Aquatic Recreation	E. coli	2016
	Long Creek	07040004-565	Aquatic Recreation	E. coli	2016
	Middle Creek	07040004-567	Aquatic Recreation	E. coli	2016
	Spring Creek	07040004-568	Aquatic Life	TSS	2016
	Spring Creek	07040004-570	Aquatic Life	TSS	2016
			Aquatic Recreation	E. coli	
	Trout Brook	07040004-571	Aquatic Recreation	E. coli	2016
	Hammond Creek	07040004-575	Aquatic Recreation	E. coli	2016
	Dry Run Creek	07040004-576	Aquatic Recreation	E. coli	2016
	Spring Creek Tributary	07040004-769	Aquatic Life	TSS	2016
			Aquatic Recreation	E. coli	

Source: Zumbro River Watershed TMDL (MPCA 2018); Mississippi River Lake Pepin Tributaries TMDL (MPCA 2013)

C.8.6.1 Total Suspended Solids Impairments

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

- Permitted point sources in the Zumbro River watershed with regulated TSS limits include dewatering from gravel and quarry pits. Wastewater facilities within the watershed are required to treat TSS to below the water quality standard.
- Modeling estimates that upland sources contribute 42% of the sediment load for the entire watershed, which is consistent with the predominance of highly erodible/unstable soils in the watershed. The next highest sediment source is bed and bank erosion at 39% followed by gully and ravine erosion at 18%.
- Point sources and tile drainage contribute relatively small fractions to the overall sediment delivery.
- The TSS load duration curves document exceedances during higher flows, confirming the nonpoint source contributions and the significant loads delivered during large rain events.

The Mississippi Pepin TMDL does not address TSS loading as the impairments addressed in that TMDL do not include turbidity or TSS impairments (MPCA 2015).

C.8.6.2 Bacteria Impairments

The Zumbro TMDL and Mississippi Pepin TMDL include detailed analysis of bacteria loading to impaired reaches (see Section 4.3 of the Zumbro TMDL and Section 4 of the Mississippi Pepin TMDL). Considerations and conclusions from that analysis include:

- Permitted sources of bacteria include industrial and municipal wastewater treatment facility effluent, municipal stormwater, and livestock feedlots. 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 Zumbro TMDL include natural background.
- Fifteen of the 17 reaches included in the Zumbro TMDL analysis demonstrated bacteria loading exceedances during all flow regimes during which data was collected. For two reaches (North Fork Zumbro River and Middle Creek), bacteria exceedances were skewed towards high flow regimes.
- In the Mississippi River Lake Pepin watershed, bacterial loading exceeded targets during all flow regimes for all reaches included in the Mississippi Pepin TMDL, with the exception of Hay Creek. During very high flows, bacterial loading in Hay Creek was generally below target values, despite exceeding target values in all other flow regimes.

C.8.6.3 Eutrophication Impairment – Rice Lake

The Zumbro TMDL includes detailed analysis of nutrient loading to Rice Lake (see Section 4.2 of the Zumbro TMDL). A Hydrologic Simulation Program-Fortran (HSPF) watershed simulation model was used to estimate phosphorus loading to Rice Lake from the surrounding watershed (MPCA, 2018). A BATHTUB (Walker, 1999) in-lake model was used to estimate in-lake phosphorus concentrations. Considerations and conclusions from the TMDL analysis of Rice Lake include:

- Initial comparison between model-predicted and observed in-lake phosphorus concentrations showed model predictions (84 ug/L) significantly less than observed values (290 ug/L). These results suggest significant internal phosphorus loading from lake sediments may be present.
- Background sources of phosphorus include atmospheric deposition and low levels of soil erosion from stream channels and upland areas occurring under natural conditions. Given the estimated water quality improvement in Rice Lake resulting from internal load management, it is unlikely that natural background sources are a major component of phosphorus loading.
- An estimated 89% load reduction is necessary to achieve the total phosphorus water quality standard in Rice Lake.

Three other nutrient impairments in the Zumbro River watershed (including two stream reaches and Lake Zumbro) will be addressed by future TMDLs.

C.8.7 Water Quality Modeling

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. Past modeling efforts are summarized in this section.

C.8.7.1 HSPF Modeling – Nitrogen, Phosphorus, and TSS Loading

In support of the Zumbro WRAPS and Zumbro TMDL studies, HSPF modeling was performed for the entire Zumbro River watershed. HSPF modeling is also available in a separate model for the Mississippi River Lake Pepin tributary area (developed to support the MRLP WRAPS). 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. The HSPF model 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.

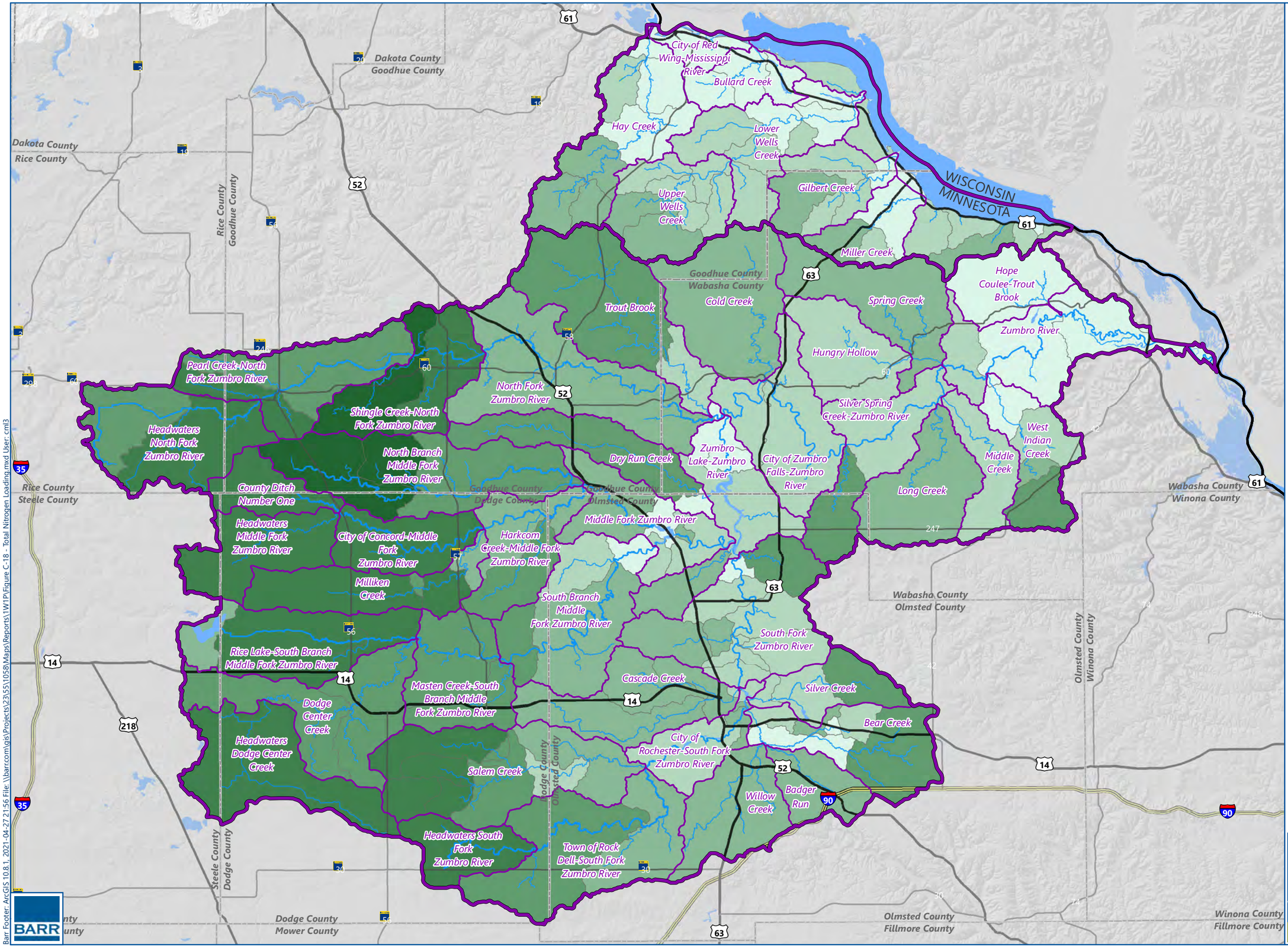
Estimated total nitrogen (TN) loading, TP loading, and TSS loading using HSPF are presented in Figure C-18, Figure C-19, and Figure C-20, respectively.

C.8.7.2 Urban Water Quality Modeling – P8

The City of Red Wing and City of Rochester developed water quality models for portions of their cities connected to storm sewer networks. The City of Red Wing and City of Rochester water quality models are built using the P8 Urban Catchment Model, or Program for Predicting Polluting Particle Passage thru Pits, Puddles, and Ponds, (P8) which is commonly used for predicting the generation and transport of stormwater runoff and pollutants in urban watersheds.

The P8 model tracks the movement of particulate matter (fine sand, dust, soil particles, etc.) as it is carried along by stormwater runoff traveling over land and pavement. Particle deposition in ponds along the way is also tracked, so that the model can estimate the amount of pollutants carried by the particles that eventually reach a water body.

The P8 model for the City of Red Wing was developed for existing land use and watershed conditions. The P8 model inputs were developed based on the information compiled for the development of the hydrologic and hydraulic model (XP-SWMM), where available. Model results are documented in the City's Local Surface Water Management Plan (City of Red Wing, 2014). The City of Rochester P8 water quality model was incorporated into the City's 1999 Stormwater Management Plan and updated in 2004 to include portions of the Bear Creek watershed.



TOTAL NITROGEN LOADING

WAGZ Comprehensive Watershed Management Plan

FIGURE C-18

BARR

Study Area
Subwatersheds (HUC12)
Watercourses
Pond or Lake
County Boundary
State Boundary

Total Phosphorus Loading

lbs/acre/yr

- <0.4
- 0.4 to 0.6
- 0.6 to 0.8
- 0.8 to 1.0
- 1.0 to 1.2
- >1.2

Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses from Public Water Inventory (PWI). Ponds and lakes from National Hydrography Dataset (NHD). Phosphorus Loading from HSPF modeling from MPCA WRAPS study.

N

0 2.5 5
Miles

TOTAL PHOSPHORUS LOADING
WAGZ Comprehensive Watershed Management Plan
FIGURE C-19

BARR

Barr Footer: ArcGIS 10.8.1, 2021-04-27 21:49 File: \\barrcom\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure C-19a - Total Phosphorus Loading.mxd User: cml3

Study Area
Subwatersheds (HUC12)
Watercourses
Pond or Lake
County Boundary
State Boundary

Sediment Loading (MRLP)

tons/acre/yr

- 0.007 - 0.01
- 0.01 - 0.02
- 0.02 - 0.03
- 0.03 - 0.04
- 0.04 - 0.06

Sediment Loading (Zumbro)

tons/acre/yr

- <0.1
- 0.1 to 0.2
- 0.2 to 0.3
- 0.3 to 0.4
- > 0.4

Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses from Public Water Inventory (PWI). Ponds and lakes from National Hydrography Dataset (NHD). Sediment Loading from HSPF modeling from MPCA WRAPS study.

N

0 2.5 5
Miles

SEDIMENT LOADING
WAGZ Comprehensive Watershed Management Plan

FIGURE C-20

BARR

Barr Footer: ArcGIS 10.8.1, 2021-04-27 22:05 File: \\barrcom\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure C-20 - Sediment Loading.mxd User: cml3

C.9 Water Quantity and Flooding

The Zumbro River is the defining surface water feature within the Zumbro River watershed. The Zumbro River drains approximately 1,420 square miles before discharging to the Mississippi River. The MDNR, in partnership with the USGS, maintains flow gages at several locations within the watershed (see Section C.7.1 and Table C-12). Gages with the longest period of record include the Zumbro River at Kellogg (operated since 1975), South Fork Zumbro River near Rochester (operated since 1975) and the Zumbro River at Zumbro Falls (operated since 1909).

Flow data for the above gages (as well as USGS 05457000) is available from the MDNR cooperative stream gaging website at: https://www.dnr.state.mn.us/waters/csg/index.html

Flow measured at the South Fork Zumbro River at Rochester gage (MDNR 41063001) provides the most complete record over the past 40 years (other, longer records include recent gaps). Average annual flow measured at this gage is presented in Figure C-21 in cubic feet per second (cfs) and as average annual runoff (in inches) over the 303 square mile tributary area. During the 1981-2010 climate normal period, the average annual flow was 218 cfs (or about 0.7 cfs per square mile); this corresponds to approximately 10 inches of runoff/groundwater inflow. These values increase to 254 cfs (or about 0.8 cfs per square mile) and 11.4 inches of runoff/groundwater inflow when measured over the 1991-2020 climate normal period.

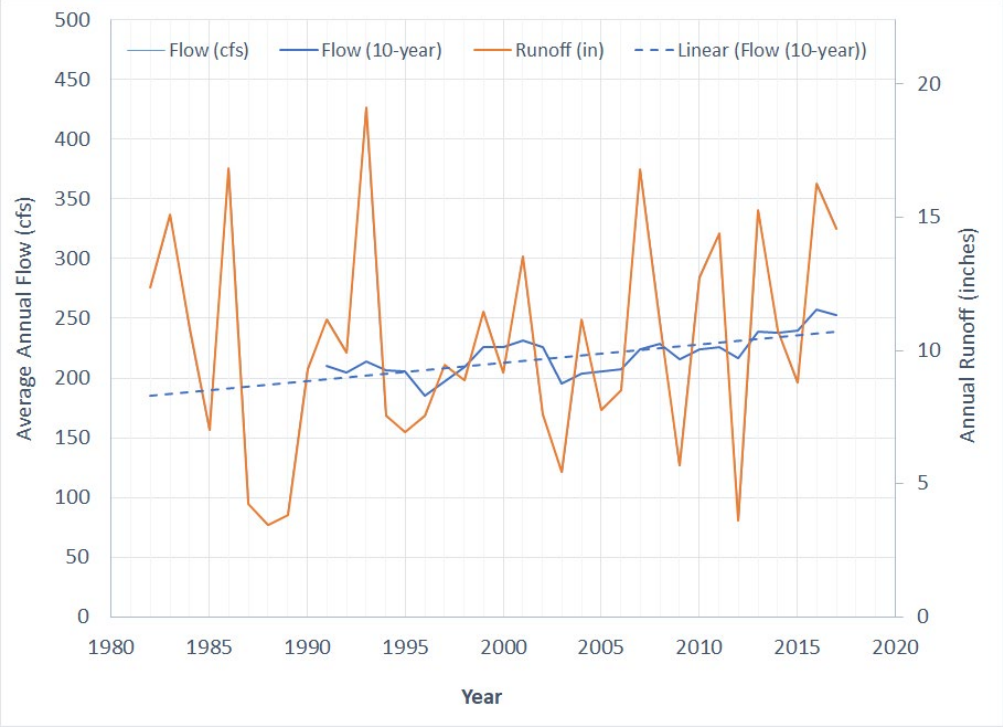


Figure C-21 Average annual flow in South Fork Zumbro River at Rochester (MDNR 41063001)

For comparison, flow measured at the Zumbro River at Kellogg gage (MDNR 41043001) dating back to 1975 corresponds to approximately 10 inches of runoff near the watershed outlet. Flow measured at the Zumbro River at Zumbro Falls gage (MDNR 41031002) from 1909-1980 corresponds to approximately 6 inches of runoff over the 1,150 square mile tributary watershed. The flow data suggests runoff in the planning area is increasing, although there is limited concurrent data. Annual flow at Rochester, averaged over a 10-year period, shows an increasing trend over the 1981-2019 period of record (see Figure C-21).

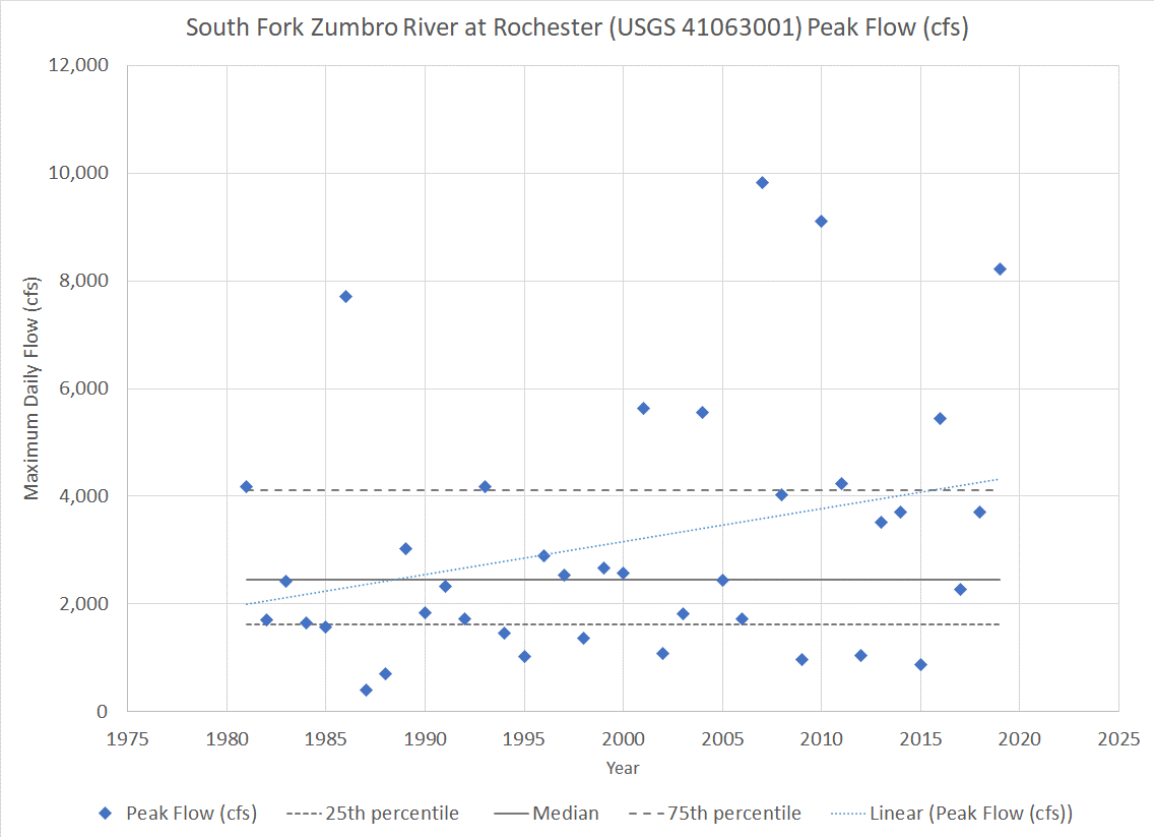


Figure C-22 Peak daily flow in South Fork Zumbro River at Rochester (MDNR 41063001)

Annual maximum daily flow data shows more frequent occurrence of peak flows since the flow record began in 1981 (see Figure C-22). Seven of the ten highest peak flows have occurred since 2000, including five of the top six peak flows. Comparison of annual peak flows to the 25th percentile, median, and 75th percentile of peak annual flows suggests this trend occurs for higher frequency (lower-return interval) events. Although the period of record is limited, estimation of the 5-year and 10-year flood events based on pre-2000 and post-2000 data show significant increases in peak flow for events of the same frequency.

In addition to increasing trends in average annual flow, the portion of precipitation that becomes flow (from runoff or groundwater discharge) appears to be increasing. Figure C-23 presents cumulative precipitation and cumulative flow at the Zumbro River at Kellogg gage (MDNR 41031002). Similar data from the South Fork Zumbro River at Rochester gage (MDNR 41063001) is presented in Figure C-24.

These figures, sometimes referred to as "double-mass curves" show an increase increased flow in relation to precipitation (i.e., steeper slopes) later in the period of record.

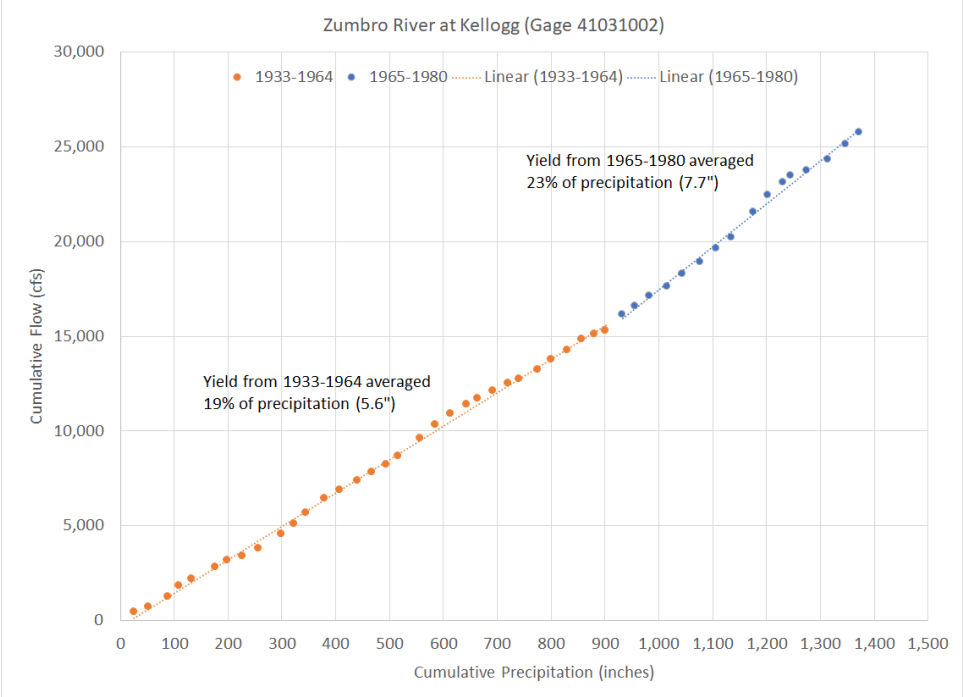


Figure C-23 Cumulative precipitation and flow at Zumbro River at Kellogg (MDNR 41031002)

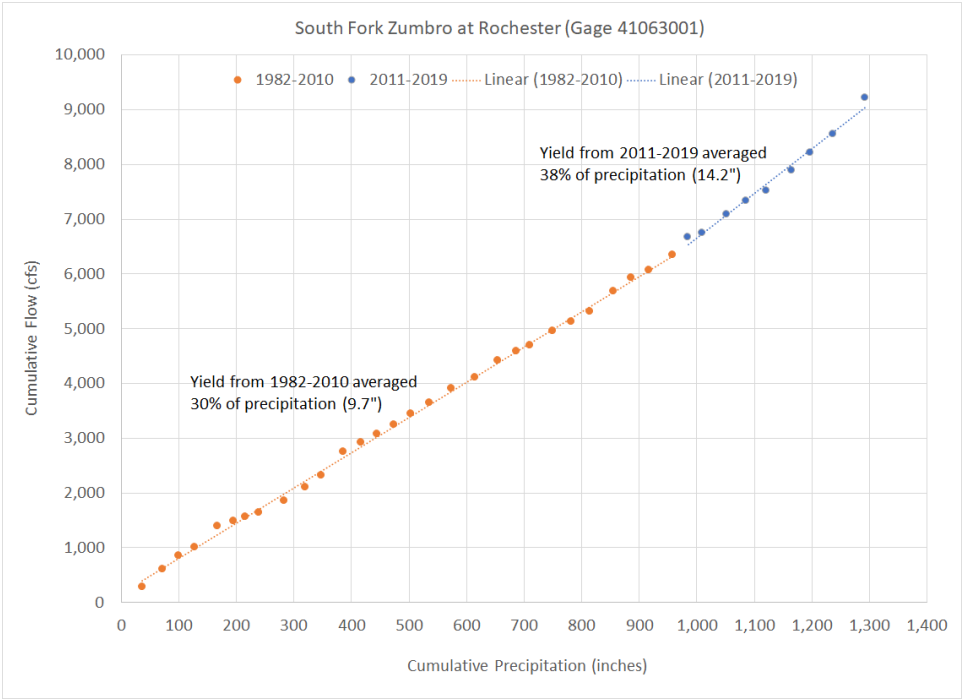


Figure C-24 Cumulative precipitation and flow at South Fork Zumbro River at Rochester (MDNR 41063001)

C.9.1 Floodplains and Historic 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. The Bear Valley Watershed District (BVWD) was formed in part to address flooding issues within its jurisdiction. Several Flood Insurance Studies (FIS) have been performed for areas located within the planning area. 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 in a given 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 C-25 presents the mapped 100-year (1 percent) floodplain within the planning area watershed.

Within the planning area, each county has adopted a floodplain ordinance that regulates land disturbing activity within the floodplain. Additionally, the Cities of Lake City, Red Wing, Rochester maintain floodplain zoning regulations as part of the city code of ordinances. The Partners have also performed capital projects throughout the planning area to minimize the risk and consequence of flooding.

Many of the flood mitigation projects constructed within the planning area were designed prior to the increases in estimated precipitation published in Atlas 14 (see Section C.2.1) and more recent analysis of climate trends (see Section C.2.2). The City of Rochester and other LGUs within the planning area continue to evaluate flood risk and develop strategies to mitigate flood damages.

C.9.1.1 Rochester Flood Control Project

From July 5 to July 6, 1978, intense rainfall around Rochester resulted in flooding of 2,000 homes and business, evacuation of 5,000 residents, and approximately $58 million in damages (in 1978 dollars) (City of Rochester, 2013). Following the 1978 flood event, the City of Rochester, Olmsted County, and the Olmsted SWCD, with assistance of the US Army Corps of Engineers and the Natural Resource Conservation Service (NRCS), constructed a flood protection project. The Rochester flood control project was constructed from 1984 to 1995 and included a river component and reservoir component. The flood control project incorporates a combination of upstream reservoir storage, streambank stabilization, channel improvements, and approximately 1.3 miles of levees.

The City's flood control project includes seven reservoirs specifically designed to store rainfall in headwater areas of the South Fork Zumbro River watershed and reduce peak flows. These reservoirs include:

- WR-4 (Willow Creek by Gamehaven)
- WR-6A (Willow Creek west of Trunk Highway 63)
- BR-1 (Chester Lake)

- SR-2 (Silver Lake)
- KR-3 (Kalmar Township, south of landfill)
- KR-6 (Kalmar Township, dry basin)
- KR-7 (Kalmar Township, east of landfill)

These reservoirs limit the peak outflow to between 2% and 10% of the peak inflow rate as estimated for a 500-year event (pre-Atlas 14) (City of Rochester, 2013). Although the reservoirs are designed primarily for flood risk reduction, they provide recreational and habitat benefits as well (see also Section C.6.4). The South Zumbro Joint Powers Board manages the reservoirs, provides necessary maintenance, and identifies sources or sediment and nutrients impacting the reservoirs.

Study Area
Watercourses
Pond or Lake
County Boundary
State Boundary
Floodplain

Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses, Public Water Basins, and Public Water Wetland from Public Water Inventory (PWI). Ponds and lakes from National Hydrography Dataset (NHD). Floodplain data from MN DNR Zonation Analysis and FEMA. Digital floodplain data for Wabasha County only available through Zonation Analysis.

N

0 2.5 5
Miles

FLOODPLAIN
WAGZ Comprehensive Watershed Management Plan

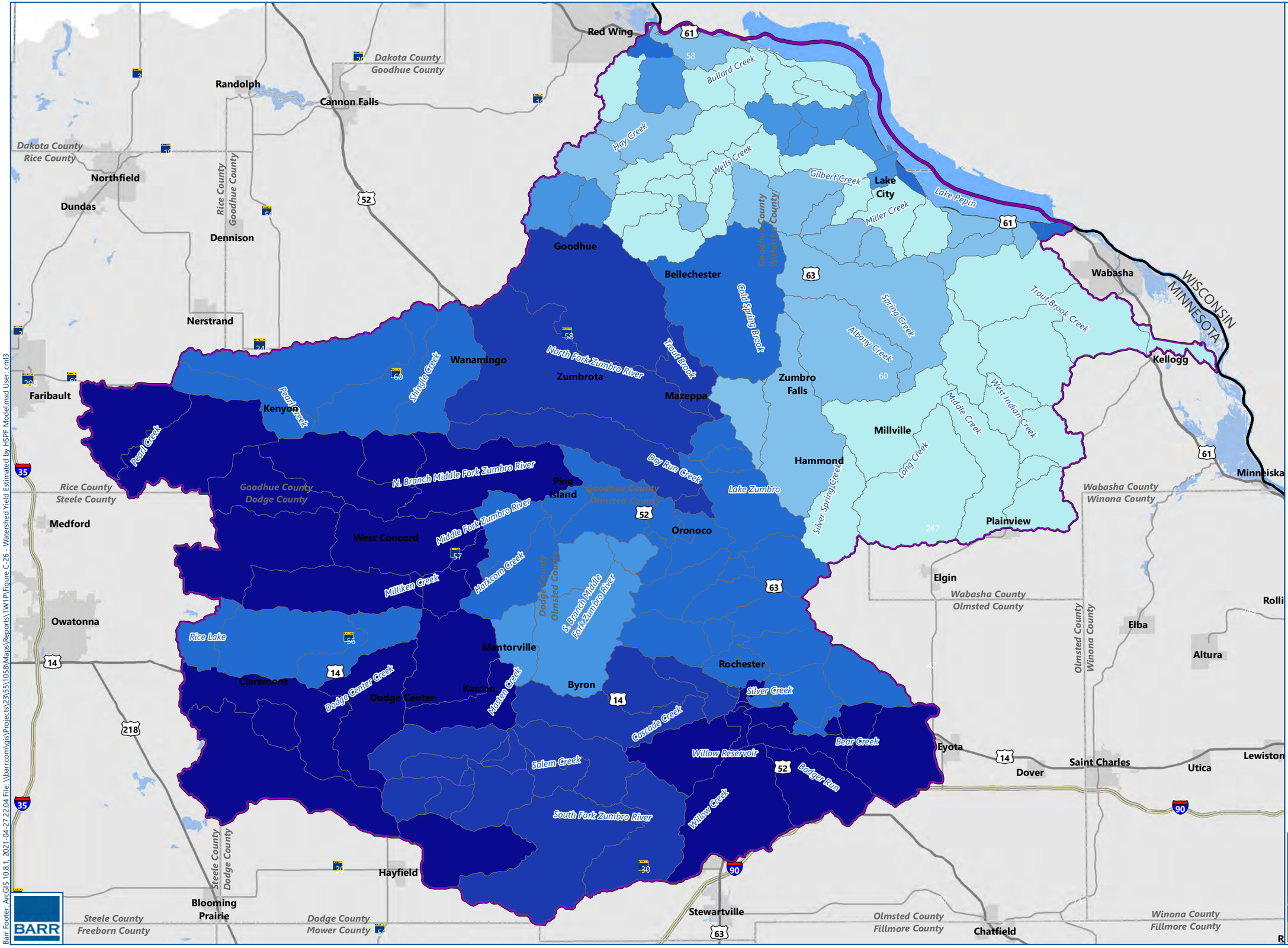
FIGURE C-25

BARR

C.9.2 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 City of Red Wing developed an XP-SWMM hydrologic and hydraulic model for the city as part of the development of its 1999 Surface Water Management Plan; the model is periodically updated. The City of Rochester developed an XP-SWMM model as part of its 1999 Surface Water Management Plan. Portions of the City of Rochester and the surrounding watershed have also been modeled HEC-RAS. Much of the XP-SWMM and HEC-RAS modeling covering the City of Rochester and surrounding watersheds has been updated to reflect Atlas 14 precipitation estimates (see Section C.2.1). The City of Rochester has used the updated analyses to update its floodplain ordinance and develop additional flood risk mitigation strategies.

Throughout the Zumbro River watershed, average runoff has been estimated at the subwatershed scale using the HSPF model for the watershed (see Section C.8.7.1). Runoff estimates from HSPF are presented in Figure C-26.


Red Wing
Randolph
Cannon Falls
Dakota County
Goodhue County
Dakota County
Rice County
Northfield
Dundas
Rice County
Goodhue County
Dennison
Nerstrand
Faribault
Kenyon
Wanamingo
Goodhue
Zumbrota
Bellechester
Mazeppa
Zumbro Falls
Millville
Hammond
Lake City
Wabasha
Kellogg
Minneiska
WISCONSIN
MINNESOTA
Lake Pepin
Bullard Creek
Hay Creek
Wells Creek
Gilbert Creek
Miller Creek
Goodhue County
Wabasha County
Gold Spring Brook
Spring Creek
Albany Creek
Trout Brook Creek
West Indian Creek
Middle Creek
Long Creek
Silver Spring Creek
Trout Brook
North Fork Zumbro River
Pearl Creek
Pearl Creek
Stringle Creek
Doy Run Creek
Lake Zumbro
Pine Island
Goodhue County
Olmsted County
Rice County
Steele County
Goodhue County
Dodge County
N. Branch Middle Fork Zumbro River
Middle Fork Zumbro River
Medford
West Concord
Oronoco
Plainview
Wabasha County
Winona County
Elgin
Wabasha County
Olmsted County
Olmsted County
Winona County
Elba
Altura
Rolli
Owatonna
Rice Lake
Milliken Creek
Harkcom Creek
Dodge County
Olmsted County
S. Branch Middle Fork Zumbro River
Mantorville
Rochester
Claremont
Dodge Center Creek
Dodge Center
Kasson
Byron
Mason Creek
Silver Creek
Cascade Creek
Willow Reservoir
Bear Creek
Badger Run
Salem Creek
South Fork Zumbro River
Willow Creek
Eyota
Dover
Saint Charles
Utica
Lewiston
Hayfield
Blooming Prairie
Steele County
Freeborn County
Dodge County
Mower County
Stewartville
Olmsted County
Fillmore County
Chatfield
Winona County
Fillmore County
Study Area
Pond or Lake
Municipal Boundary
County Boundary
State Boundary
Watershed Yield
inches/year
< 7
7 to 8
8 to 9
9 to 10
10 to 11
> 11
N
0
2.5
5
Miles
WATERSHED YIELD ESTIMATED BY HSPF MODEL
WAGZ Comprehensive Watershed Management Plan
FIGURE C-26
BARR
Barr Footer: ArcGIS 10.8.1, 2021-04-27 22:04 File: \\barrcom\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure C-26 - Watershed Yield Estimated by HSPF Model.mxd User: cml3

C.10 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

C.10.1 Native Plant Communities

There are approximately 50 native plant communities recognized within the planning area (MPCA 2017). 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). Native plant communities are assigned a conservation status (S-rank) by the MDNR that reflects its risk of elimination (MDNR 2009). Approximately half of the native plant community types in the planning area are identified as "Critically Imperiled" (S1), "Critically Imperiled to Imperiled" (S1S2), "Imperiled" (S2), or "Vulnerable to Extirpation" (S3).

Of the native plant communities in the planning area, calcareous fens are one of the rarest. Thirteen calcareous fens occur in the Zumbro River watershed. Most are only a few acres in area. Calcareous fens are characterized by non-acidic peat and depend on a continuous supply of cold, oxygen-poor groundwater rich in calcium and magnesium bicarbonates (MDNR 2015). Eight state-listed, rare plant species are known from calcareous fens, including four that occur in the Zumbro River watershed. These communities are highly vulnerable to disturbances, including reductions in the groundwater supply and increased in nutrient loading from surface waters (MDNR 2015).

In 1961, the Richard J Dorer Memorial Hardwood State Forest, which includes the Zumbro Bottoms State Forest, was created to promote conservation and responsible land use and restore a landscape damaged by flooding, a result of the land's overuse. A significant acreage of the forest lies within the watershed's eastern boundaries and serves as a valuable resource for wildlife and recreation in southeastern Minnesota (MDNR).

C.10.2 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 C-27 presents areas of biodiversity significance within the planning area. With the planning area there are a significant number of such sites.

In the Mississippi River Lake Pepin watershed, much of the river bluff area is classified as having moderate to high biodiversity significance. Areas surrounding Hay Creek (a trout stream) are classified as outstanding sites of biodiversity significance, as are some areas adjacent to the Mississippi River near the City of Red Wing, including Sorin's Bluff and Wacouta Bay.

The Zumbro River watershed also contains significant acreage of biodiversity sites. Some of the larger sites of high or outstanding biodiversity significance include:

- **Concord 13** – a 740-acre site of outstanding biodiversity significance on the Middle Fork Zumbro River. This site contains large blocks of sugar maple and basswood forest native plant communities and dolomite cliffs. Several rate plant and animal species are present in this area (MBS 2010).

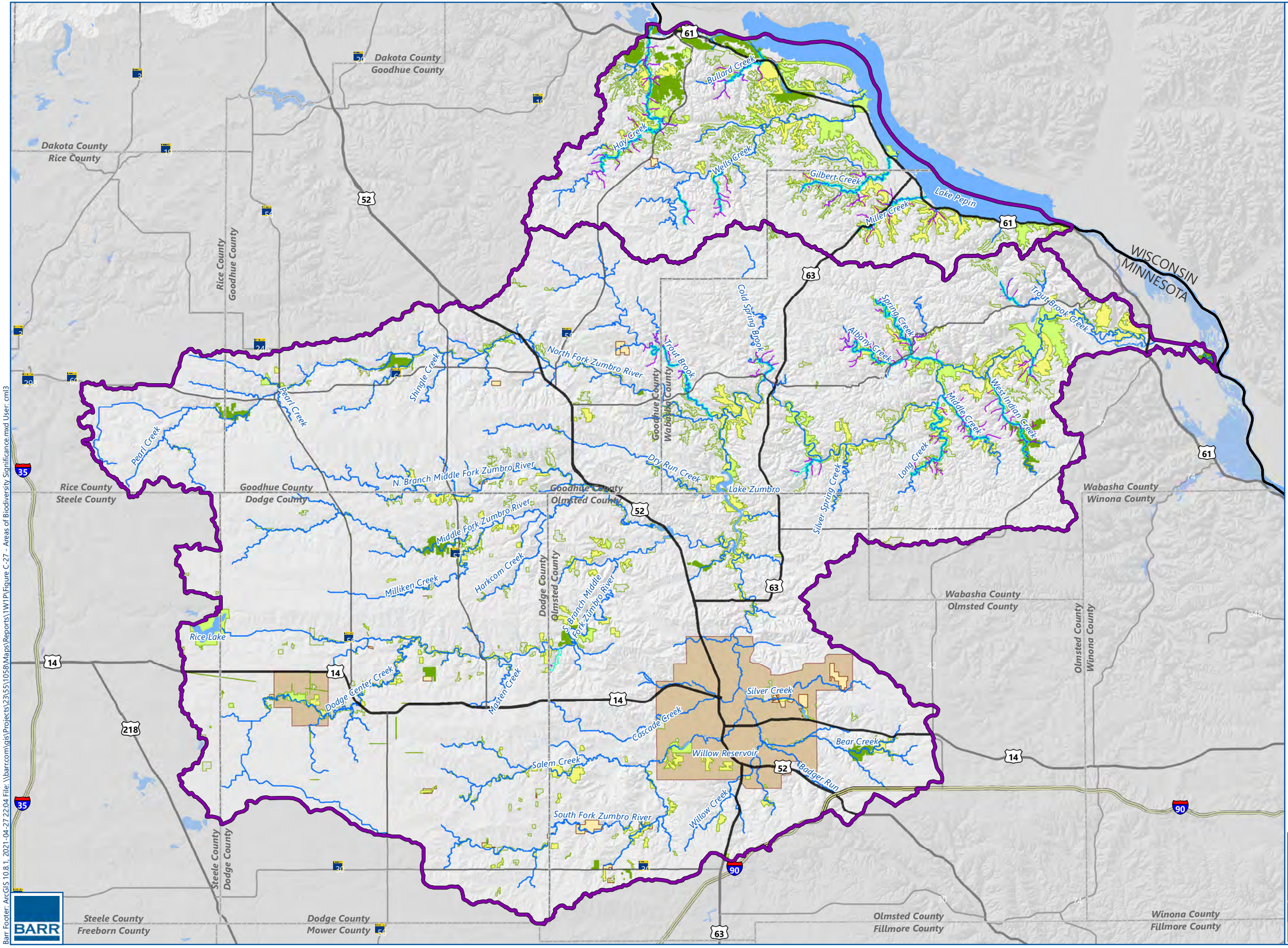
- **West Albany 35** – a 900-acre site of outstanding biodiversity significance located in the Zumbro River floodplain in Wabasha County. This site includes elm, ash, and basswood forest and several rare plant species.

- **Rice Lake State Park** – an approximately 1500-acre site of high biodiversity significance surrounding Rice Lake in Steele County.

- **West Indian Creek** – a 1200-acre site of outstanding biodiversity significance adjacent to the head waters of West Indian Creek, a trout stream. This area is also classified as a high conservation value forest and contains over 120 acres of old-growth forest.

Rice Lake is also classified as a lake of biological significance based on the presence of an outstanding bird community. Rice Lake hosts populations of wild rice, which has cultural significance and provides feed for local wildlife. Rice Lake is the only lake classified as a wild rice lake in the planning area.

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


Dakota County
Goodhue County
Dakota County
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Steele County
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Goodhue County
Olmsted County
Wabasha County
Winona County
Wabasha County
Olmsted County
Olmsted County
Winona County
Steele County
Freeborn County
Dodge County
Mower County
Olmsted County
Fillmore County
Winona County
Fillmore County
Steele County
Dodge County
Goodhue County
Wabasha County
Olmsted County
Bullard Creek
Hay Creek
Wells Creek
Gilbert Creek
Miller Creek
Lake Pepin
WISCONSIN
MINNESOTA
Cold Spring Brook
Trout Brook
Spring Creek
Trout Brook Creek
Albany Creek
North Fork Zumbro River
Shingle Creek
Pearl Creek
Pearl Creek
Middle Creek
West Indian Creek
Long Creek
Dry Run Creek
N. Branch Middle Fork Zumbro River
Lake Zumbro
Silver Spring Creek
Middle Fork Zumbro River
Milliken Creek
Harkcom Creek
S. Branch Middle Fork Zumbro River
Rice Lake
Dodge Center Creek
Masten Creek
Silver Creek
Cascade Creek
Willow Reservoir
Bear Creek
Badger Run
Salem Creek
South Fork Zumbro River
Willow Creek
52
61
63
14
218
35
90
42
74
243
30
Study Area
Watercourses
Pond or Lake
County Boundary
State Boundary
State Wildlife Management Area
State Game Refuge
Designated Trout Stream
Protected Tributary to Designated Trout Stream
Sites of Biodiversity Significance (MBS)
Outstanding
High
Moderate
Below
Data sources:
Watersheds from MDNR Level 04 Major Watersheds. Watercourses, Public Water Basins, and Public Water Wetland from Public Water Inventory (PWI). Ponds and lakes from National Hydrography Dataset (NHD). Sites of Biodiversity Significance from Minnesota Biological Survey (MBS). Trout Stream Designations from MDNR.
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AREAS OF BIODIVERSITY SIGNIFICANCE
WAGZ Comprehensive Watershed Management Plan
FIGURE C-27
BARR
Barr Footer: ArcGIS 10.8.1, 2021-04-27 22:04 File: \\barr.com\gis\Projects\23\55\1058\Maps\Reports\1W1P\Figure C-27 - Areas of Biodiversity Significance.mxd User: cml3

C.10.3 Rare Species

There are many rare plant, animal, and native plant communities (see Section C.10.1) 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

Rare species/communities in the planning area include:

- 59 plant species (7 endangered, 21 threatened, and 27 of special concern)
- 49 wildlife species (4 endangered, 8 threatened, and 26 of special concern)
- Bat colony in Wabasha County blufflands
- Native mussels at 12 sampled locations
- Waterbird colonies in multiple locations

A complete list of the rare species and communities present within the Zumbro River watershed is included as an appendix to the Zumbro WRAPS (MPCA 2017). More information regarding threatened or endangered plant species in the region is available from the USFWS at: https://www.fws.gov/midwest/endangered/plants/

C.10.4 Fisheries and Trout Streams

The rivers, streams, and lakes within the planning area are home to many species of fish, including 10 rare or protected species. The MDNR has performed fish surveys on several lakes and reservoirs within the planning area; this information is available from the MDNR LakeFinder website at: https://www.dnr.state.mn.us/lakefind/index.html

Additional fish surveys have been performed in support of establishing indices of biological integrity (IBI) as part of the Zumbro WRAPS and Mississippi Pepin WRAPS. Fish species identified during biological monitoring in the Zumbro River watershed is included in Appendix 6 of the *Zumbro River Watershed Monitoring and Assessment Report* (MPCA 2016). Fish IBI scores for Zumbro River watershed trout streams are discussed in Section 2.5 and summarized in Figure 36 of the *Zumbro River Watershed WRAPS* (MPCA, 2017).

Many of the streams in the planning area are classified as warm water streams. However, geologic conditions in the Driftless area have resulted in several groundwater-fed cold-water streams. Many of these cold-water streams have been classified as "trout streams" by the MDNR and are subject to additional fishing restrictions and management activities designed to protect and foster the propagation of trout. Trout streams in the planning area are presented in Figure C-27. The Zumbro River watershed contains twelve designated trout streams and 140 designated trout stream tributaries accounting for approximately 320 miles of stream. The Mississippi River Lake Pepin watershed contains 12 designated trout streams covering about 45 miles of stream and another 113 stream reaches (covering 60 miles) designated as trout stream tributaries. Trout streams have stricter water quality standards (e.g., minimum Fish IBI) and may be subject to additional project permitting considerations.

More information about trout streams present in southeaster Minnesota (including the planning area) is available from the MDNR at: https://www.dnr.state.mn.us/fishing/trout_streams/southeastern.html

The MDNR periodically stocks game fish in several lakes, reservoirs, and streams (including trout streams) within the planning area. Additional detail regarding the status of the fishery and stocking activities in each lake is available from the MDNR LakeFinder website at: https://www.dnr.state.mn.us/lakefind/index.html

Appendix D

State and Federal Roles and Responsibilities

D State and Federal Agency Responsibilities

Various units of state and federal government are involved in regulating water and natural resource management within the planning area. The roles of these agencies are described in this section.

D.1 Minnesota Department of Natural Resources (MDNR)

The MDNR Division of Ecological and Water Resources manages water resources through a variety of programs related to lakes, rivers and streams, watersheds, wetlands, groundwater, and climate. The MDNR Division of Ecological and Water Resources administers the Public Waters Work Permit Program, the Water Use (Appropriations) Permit Program, and the Dam Safety Permit Program. The MDNR Division of Fish and Wildlife administers the Aquatic Plant Management Program and other fishery related permits. The MDNR supports the WCA by providing technical and coordination assistance and by providing recommendations in the development of state wetland regulations, programs, and policies. The MDNR's shoreland program provides technical assistance to local governments in the adoption of shoreland ordinance controls and comments on land use applications within shoreland districts. The MDNR also has model shoreland ordinances that cities and counties can adopt.

Public Waters

The MDNR's Public Waters Work Permit Program (Minnesota Statutes 103G) requires an MDNR permit for any work below the Ordinary High-Water Level (OHWL) or any work that will alter or diminish the course, current, or cross-section of any public water, including lakes, wetlands and streams. For lakes and wetlands, the MDNR's jurisdiction extends to designated U.S. Fish and Wildlife Service Circular #39 Types 3, 4, and 5 wetlands which are 10 acres or more in size in unincorporated areas, or 2.5 acres or more in size in incorporated areas. The program prohibits most filling of public waters and public waters wetlands for the purpose of creating upland areas. The Public Waters Work Permit Program was amended in 2000 to minimize overlapping jurisdiction with the WCA. Under certain conditions, work can be performed below the OHWL without a Public Waters Work Permit. Examples include docks, watercraft lifts, beach sand blankets, ice ridge removal/grading, riprap, and shoreline restoration. The MDNR public waters in the planning area are shown in Figure C-13.

Water Appropriations and Transport

The MDNR regulates surface water and groundwater usage rate and volume as part of its charge to conserve and use the waters of the state. Water appropriations are regulated under Minnesota Rule 6115.0620. Generally, all appropriations of more than 10,000 gallons per day, or one million gallons per year, including construction dewatering, flood control, emptying storm water ponds for maintenance, and stormwater use for irrigation, need to be approved under a MDNR water appropriation permit. Appropriation permits from the MDNR are not required for domestic uses serving less than 25 persons for general residential purposes. An additional permit is required to appropriate or transport water from waters designated as infested with invasive species, regardless of the volume appropriated or transported.

Groundwater

In addition to regulating appropriations from groundwater, the MDNR is also responsible for mapping sensitive groundwater areas, conducting groundwater investigations, addressing well-interference problems, and maintaining the observation well network.

Dam Safety

The MDNR administers the state's Dam Safety Program (MN Rules 6115.0300 – 6115.0520), which applies to all impoundments that pose a potential threat to public safety or property. Dams 6 feet or lower in height and dams that impound 15 acre-feet or less of water are exempt from the rules. Dams less than 25 feet high that impound less than 50 acre-feet of water are also exempt unless there is a potential for loss of life. The dam safety rules require that the downstream impacts of a dam failure be analyzed under high-flow conditions (i.e., greater than a 100-year flood).

Other Regulations

In addition to permit programs, the MDNR oversees the Floodplain Management Program, the Public Waters Inventory Program, the Shoreland Management Program, the Flood Damage Reduction Grant Program, the Wild and Scenic Rivers Program, various surface and groundwater monitoring programs, and the Climatology Program.

Questions concerning the MDNR's role in water resource management should be directed to the MDNR Division of Ecology and Water Resources, Metro Region, 1200 Warner Road, St. Paul, MN 55106 (651-259-5774). More information is available at the MDNR website: http://www.dnr.state.mn.us.

D.2 Minnesota Department of Agriculture (MDA)

The Minnesota Department of Agriculture (MDA) is the lead agency for addressing agricultural chemicals in groundwater and developing and evaluating best management practices and other agricultural practices to protect water resources as directed by the Groundwater Protection Act (Minnesota Statute 103H). The MDA's roles include but are not limited to the following:

- Serve as lead agency for groundwater contamination from pesticide and fertilizer nonpoint source pollution
- Conduct monitoring and assessment of agricultural chemicals (pesticides and nitrates) in ground and surface waters
- Oversee agricultural chemical remediation sites and incident response
- Regulate use, storage, handling and disposal of pesticides and fertilizer

The MDA is statutorily responsible for the management of pesticides and fertilizer other than manure to protect water resources. The MDA implements a wide range of protection and regulatory activities to ensure that pesticides and fertilizer are stored, handled, applied and disposed of in a manner that will protect human health, water resources and the environment. The MDA works with the University of Minnesota to develop pesticide and fertilizer best management practices (BMPs) to protect water

resources, and with farmers, crop advisors, farm organizations, other agencies and many other groups to educate, promote, demonstrate and evaluate BMPs, to test and license applicators, and to enforce rules and statutes. The MDA has broad regulatory authority for pesticides and has authority to regulate the use of fertilizer to protect groundwater.

The MDA also administers the Minnesota Agricultural Water Quality Certification Program (MAWQCP). MAWQCP offers four endorsements on top of the Water Quality Certification. These include Integrated Pest Management, Wildlife, Soil Health and Climate Smart. These endorsements recognize producers for going above and beyond in their management and adoption of conservation practices that are beneficial to water quality. By going through the endorsement process, producers have an additional educational opportunity to see what activities and practices address resource concerns and how impactful each might be. The newest endorsement is particularly beneficial to producers as they can learn what they can do to address climate change as well as to be best able to take advantage of emerging carbon markets. The linkage of practices that reduce emissions and sequester carbon and soil health is strong and by promoting the Climate Smart endorsement gains in soil health and water quality are sure to follow. MAWQCP activities can correspond with implementation efforts described in Section 6 of this Plan.

Beginning in 2020, the MDA will oversee implementation of the Groundwater Protection Rule, adopted by the Minnesota Legislature in 2019. The rule will restrict application of fertilizer in areas of the state where soils are prone to leaching and where drinking water supplies are threatened (as defined by the MDA).

Questions concerning MDA's role in water resource management should be directed to the Minnesota Department of Agriculture, 625 Robert Street North, St. Paul, MN 55155 (651-201-6000). More information is available at the MDA website: https://www.mda.state.mn.us/

D.3 Minnesota Board of Water and Soil Resources (BWSR)

BWSR oversees the state's watershed management organizations (joint powers, county and watershed district organizations), oversees the state's Soil and Water Conservation Districts (SWCDs), and administers the rules for the WCA and metropolitan area watershed management. BWSR, in cooperation with the MDNR, Counties, and SWCDs, administers the statewide buffer rule (MN Statutes 103F.48) which establishes minimum buffer requirements for certain public waters. BWSR also administers the Clean Water Fund (CWF) grant program, funded by the Clean Water Land and Legacy amendment passed in 2008. The purpose of the CWF is to protect, enhance, and restore water quality in lakes, rivers, and streams and to protect groundwater and drinking water sources from degradation. Applicants eligible for CWF grants include counties, watershed districts, watershed management organizations, soil and water conservation districts, and cities working under a current BWSR-approved and locally adopted local water management plan.

Questions concerning BWSR's role in water resource management should be directed to the Minnesota Board of Water and Soil Resources, 520 Lafayette Road North, St. Paul, MN 55107 (651-296-3767). More information is available at the BWSR website: http://www.bwsr.state.mn.us.

D.4 Minnesota Pollution Control Agency (MPCA)

The MPCA administers the State Discharge System/National Pollutant Discharge Elimination System (NPDES) Permit program (point source discharges of wastewater), the NPDES General Stormwater Permit for Construction Activity, the NPDES General Industrial Stormwater Permit Program, the NPDES/SDS Individual Stormwater Permit program, the Small Municipal Separate Storm Sewer Systems General Permit (MS4 General Permit), and the individual sewage treatment system regulations (7080 Rules). The MPCA also reports the state's "impaired waters" to the U.S. Environmental Protection Agency. Spills should be reported directly to the MPCA.

The MPCA administers and enforces laws relating to pollution of the state's waters, including groundwater. The MPCA monitors ambient groundwater quality and administers subsurface sewage treatment system (SSTS) design and maintenance standards. The MPCA is responsible for administering the programs regulating construction and reconstruction of SSTS. The MPCA requires an inspection program for SSTS that meets MPCA standards. Minnesota Rules 7080 govern administration and enforcement of new and existing SSTS. The Tanks and Spills Section of the MPCA regulates the use, registration, and site cleanup of underground and above-ground storage tanks.

The MPCA resumed selective administration of Section 401 of the Clean Water Act Water Quality Certification program in 2007. The program is primarily administered by the U.S. Army Corps of Engineers (USACE). Section 401 Certification is required to obtain a federal permit for any activity that will result in a discharge to navigable waters of the United States. Formal applications for 401 Certification must be sent to the MPCA.

Construction Stormwater Permitting

Proposers of construction activity disturbing more than 1 acre of soil (or less than 1 acre if that activity is part of a larger common plan of development or sale that is more than 1 acre) must obtain permit coverage. The NPDES General Stormwater Permit for Construction Activity (construction stormwater permit), which went into effect in 2003, regulates discharges of stormwater affected by construction activity to waters of the state. The MPCA updated the construction stormwater permit in 2018. A key permit requirement is the development and implementation of a stormwater pollution prevention plan (SWPPP) with appropriate best management practices (BMPs). The SWPPP must be a combination of narrative and plan sheets that address foreseeable conditions, include a description of the construction activity, and address design requirements including temporary and permanent BMPs to control the discharge of stormwater, sediment, and/or other potential pollutants from the site. The project's plans and specifications must incorporate the SWPPP before applying for NPDES permit coverage. The permittee must also ensure final stabilization of the site, which includes final stabilization of individual building lots.

The SWPPP must address the following construction activity requirements:

- BMP selection and installation (Section 7)
- Erosion prevention practices (Section 8)
- Sediment control practices (Section 9)

- Dewatering and basin draining (Section 10)
- Inspections and maintenance (Section 11)
- Pollution prevention management measures (Section 12)

BMP-specific requirements and guidance are provided for:

- Temporary sediment basins (Section 14)
- Permanent stormwater treatment system (Section 15)
- Infiltration systems (Section 16)
- Filtration systems (Section 17)
- Wet sedimentation basins (Section 18)
- Regional wet sedimentation basins (Section 19)

A key element of the construction stormwater permit is a requirement for permanent stormwater treatment: For projects that replace vegetation or other pervious surfaces with 1 or more acres of cumulative impervious surface, the permittee must retain on-site a volume of stormwater equal to 1 inch of runoff over the new impervious surface. In situations where infiltration is prohibited, the construction stormwater permit requires stormwater treatment using wet ponds, filtration, regional ponding, or other equivalent methods.

Additional information about the MPCA construction stormwater permit is available at: https://www.pca.state.mn.us/water/construction-stormwater

Municipal Separate Storm Sewer System (MS4) Permitting

The federal Clean Water Act (CWA) established the National Pollutant Discharge Elimination System (NPDES) to regulate point sources of pollution, with the MPCA as the delegated permitting authority. This program was later expanded to include both point and non-point sources of pollution, including the regulation of stormwater runoff, and created a two-phase comprehensive national program to address stormwater runoff. After its initial implementation, the program was expanded to include construction sites, municipally owned or operated industrial activities, and municipalities with populations over 10,000 (MS4s).

In 2020, the MPCA reissued the MS4 General Permit. The permit generally contains the same or similar stormwater treatment performance standards, but several elements of the general permit have been updated. Some of the requirements of the reissued MS4 permit, briefly, include:

- Increased emphasis on chloride issues (through education, training, and operations)
- Revisions to documentation, tracking, and reporting of progress towards meeting waste load allocations (WLAs)
- Consideration for education and outreach to traditionally underserved populations
- Additional requirements regarding prioritizing and addressing illicit discharge
- Written procedures for prioritizing sites for inspection
- Clarification of water quality volume treatment standards for linear projects

Cities in the planning area required to maintain an MS4 permit from the MPCA include Rochester, Red Wing, and Lake City. As part of the permit program, each City must annually submit an MS4 report to the MPCA.

More information about the MPCA's MS4 stormwater program can be found at: https://www.pca.state.mn.us/water/2020-ms4-general-permit

Impaired waters and Total Maximum Daily Loads (TMDLs)

In administering the CWA in Minnesota, the MPCA also maintains a list of impaired waters (see also Section C.8). The CWA requires the development of a total maximum daily load (TMDL) study for impaired waterbodies. A TMDL is a threshold calculation of the amount of a pollutant that a waterbody can receive and still meet water quality standards. A TMDL establishes the pollutant loading capacity within a waterbody and develops an allocation scheme amongst the various contributors, which include point sources, non-point sources, and natural background levels, as well as a margin of safety. As a part of the allocation scheme a waste load allocation (WLA) is developed to determine allowable pollutant loadings from individual point sources (including loads from storm sewer networks). A load allocation (LA) establishes allowable pollutant loadings from non-point sources and natural background levels in a waterbody.

A watershed restoration and protection strategy (WRAPS) is similar to a TMDL and may examine other waterbodies in the watershed in addition to impaired waterbodies. Both TMDLs and WRAPSs may result in implementation plans to address water quality issues of the affected waterbodies. The MPCA has completed TMDL and WRAPS studies for the Mississippi River-Lake Pepin watershed and the Zumbro River watershed (see Section C.8).

Guidance for Dredged Materials

The MPCA considers material excavated below the OHWL of public waters (as defined by Minnesota Statutes 103G.005) to be dredged material. Dredged material is defined as waste and regulated by the MPCA. The MPCA provides guidance for the management of dredged material on its website: http://www.pca.state.mn.us/index.php/water/water-types-and-programs/wastewater/dredged-materials-management.html.

Additional information is available from the MCPA regarding the management of material removed from stormwater ponds: https://www.pca.state.mn.us/sites/default/files/wq-strm4-16.pdf

More information is available at the MPCA website: http://www.pca.state.mn.us.

D.5 Minnesota Department of Health (MDH)

The MDH is the official state agency responsible for addressing all public health matters, including drinking water protection. The MDH administers the Well Management Program, the Wellhead Protection Program, and the Safe Drinking Water Act rules. The MDH also issues fish consumption advisories. The MDH is responsible for ensuring safe drinking water sources and limiting public exposure to

contaminants. Through implementation of the federal Safe Drinking Water Act, the MDH conducts the Public Water Supply Program, which allows the MDH to monitor groundwater quality and train water supply system operators. The 1996 amendments to the federal Safe Drinking Water Act require the MDH to prepare source water assessments for all of Minnesota's public water systems and to make these assessments available to the public.

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.

The Wellhead Protection Program rules (Minnesota Rules 4720.5100 to 4720.5590) went into effect in 1997. These rules require all public water suppliers that obtain their water from wells to prepare, enact, and enforce wellhead protection plans (WHPPs, see Section C.5.3). The MDH prepared a prioritized ranking of all such suppliers in Minnesota. Regardless of the ranking, Minnesota Rules 4720 required all public water suppliers to have initiated wellhead protection measures for the inner wellhead management zone prior to June 1, 2003. If a city with an existing WHPP drills a new well and connects it to the distribution system, the WHPP must be amended.

Wellhead protection plans include delineation of groundwater "capture" areas (wellhead protection areas), delineation of drinking water supply management areas (DWSMA), an assessment of the water supply's susceptibility to contamination from activities on the land surface, management programs such as identification and sealing of abandoned wells, and education/public awareness programs. As part of its role in wellhead protection, the MDH developed the guidance document *Evaluating Proposed Stormwater Infiltration Projects in Drinking Water Supply Management Areas* (MDH 2016).

See the Minnesota Department of Health website for more information about these programs: http://www.health.state.mn.us/divs/eh/water/index.html.

D.6 Minnesota Environmental Quality Board (EQB)

The EQB administers the state's environmental review program, including Environmental Assessment Worksheets (EAW), Environmental Impact Statements (EIS), and Alternative Urban Area-wide Reviews (AUAR). With respect to water resources, the EQB is responsible for developing the state water plan, a state water monitoring plan, biennial water policy and priorities reports, and biennial reports on trends in water quality and availability and research needs.

More information is available at the EQB website: http://www.eqb.state.mn.us

D.7 Minnesota State Historic Preservation Offices (SHPO)

Following the National Historic Preservation Act of 1966, Minnesota's State Historic Preservation Office (SHPO) was established by state statute in 1969. The director of the Minnesota Historical Society serves as State Historic Preservation Officer. The mission of the SHPO is to preserve and promote Minnesota history

by identifying, evaluating, registering, and protect Minnesota's historic and archaeological properties and assisting government agencies in carrying out their historic preservation responsibilities. The SHPO maintains the National Register of Historic Places (NRHP) for the state. This includes listed or eligible to be listed places within the planning area. To ensure the protection of places eligible for listing or listed in the NRHP, SHPO review is required for all state and federally funded projects, and all United States Army Corps of Engineers (USACE) projects.

More information is available at the SHPO website: http://www.mnhs.org/shpo/.

D.8 Minnesota Department of Transportation (MnDOT)

The MnDOT is responsible for major maintenance and reconstruction of stormwater infrastructure associated with state highways. In the planning area, these locations include Interstate 90, US Highway 14, US Highway 52, US Highway 61, US Highway 63, and several State Highways. The Partnership will cooperate with MnDOT to identify water storage opportunities that reduce flood flows in the watershed to protect infrastructure and public safety.

More information is available at the MnDOT website: http://www.dot.state.mn.us.

D.9 U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS)

The NRCS works in close partnerships with farmers and ranchers, local and state governments, and other federal agencies to maintain healthy and productive working landscapes. The NRCS manages conservation programs that help people reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters. The NRCS offers technical and financial assistance services.

NRCS Technical Assistance

The NRCS is the USDA's principal agency for providing conservation technical assistance to private landowners, SWCDs, tribes, and other organizations. NRCS delivers conservation technical assistance through its voluntary Conservation Technical Assistance Program (CTA). CTA is available to any group or individual interested in conserving natural resources and sustaining agricultural production. The CTA program functions through a national network of locally based, professional conservationists.

This assistance can help land users:

- Maintain and improve private lands and their management
- Implement better land management technologies
- Protect and improve water quality and quantity
- Maintain and improve wildlife and fish habitat
- Enhance recreational opportunities on their land
- Maintain and improve the aesthetic character of private land
- Explore opportunities to diversify agricultural operations and

- Develop and apply sustainable agricultural systems

This assistance may be in the form of resource assessment, practice design, resource monitoring, or follow-up of installed practices. Although the CTA program does not include financial or cost-share assistance, clients may develop conservation plans, which may serve as a springboard for those interested in participating in USDA financial assistance programs. CTA planning can also serve as a door to financial assistance and easement conservation programs provided by other Federal, State, and local programs.

All owners, managers, and others who have a stake and interest in natural resource management are eligible to receive technical assistance from NRCS. To receive technical assistance, the individual may contact their local NRCS office or the local conservation district.

NRCS Financial Assistance

The NRCS provides financial assistance to its partners through a variety of programs. Not all programs are available in all states or regions. A complete list of available financial assistance programs is available from the NRCS website at: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/

An available financial assistance program available within the planning area is the Environmental Quality Incentives Program (EQIP). Through EQIP, NRCS provides agricultural producers with financial assistance to plan and implement conservation practices. Financial assistance covers part of the costs from implementing conservation practices. NRCS offers about 200 practices depending on location. These practices are geared towards working farms, ranches and forests and provide producers with many options for conservation. Payment rates for conservation practices are reviewed and set each fiscal year. The EQIP program is implemented through local NRCS offices.

Easement Programs

The Agricultural Conservation Easement Program (ACEP) provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits. Under the Agricultural Land Easements component, NRCS helps Indian tribes, state and local governments and non-governmental organizations protect working agricultural lands and limit non-agricultural uses of the land. Under the Wetlands Reserve Easements component, NRCS helps to restore, protect and enhance enrolled wetlands.

The Healthy Forests Reserve Program (HFRP) helps landowners restore, enhance and protect forestland resources on private lands through easements and financial assistance. Through HRFP, landowners promote the recovery of endangered or threatened species, improve plant and animal biodiversity and enhance carbon sequestration.

Contact information for the NRCS offices in Minnesota may be found from the NRCS website at: https://offices.sc.egov.usda.gov/locator/app?agency=nrcs

D.10 U.S. Department of Agriculture (USDA) Farm Service Agency (FSA)

The Farm Service Agency (FSA) is an agency of the USDA that provides services to farm operations. The FSA administers farm commodity loan and purchase programs, farm ownership and operating loans, and the conservation reserve program, in order to maintain a self-sustaining food supply in the United States. It also provides disaster assistance and administrative support to the Commodity Credit Corporation, which funds most of the commodity and export programs of the USDA. Programs in the FSA include:

- Farm Loan Programs
- Conservation Programs
- Disaster Assistance Programs
- Energy Programs
- Financial Management Programs
- Farm Payment Programs
- Commodity Operations

The FSA Minnesota office is located at 375 Jackson Street, Suite 400, St. Paul, MN 55101 (651-602-7700). Additional information about FSA programs is available from the FSA website at: https://www.fsa.usda.gov/programs-and-services/index

D.11 U.S. Army Corps of Engineers (USACE)

The USACE administers several regulatory permit programs, including Section 10 of the Rivers and Harbors Act permit program, the Section 404 permit program, and Section 401 Certifications. The USACE updated Section 10 of the Rivers and Harbors Act Permit and the Section 404 Permit in March 2012 to streamline the requirements of the Clean Water Act (CWA). The updated permits provide expedited review of projects that have minimal impact on the aquatic environment. These projects may include linear transportation projects, bank stabilization activities, residential development, commercial and industrial development, aids to navigation, and some maintenance activities. Permit programs are described briefly in this section.

Through Section 10 of the Rivers and Harbors Act, the USACE is responsible for administering this program, which regulates the placement of structures and/or work in, or affecting, navigable waters of the United States.

The Federal Clean Water Act requires that anyone who wants to discharge dredged or fill material into U.S. waters, including wetlands, must first obtain a Section 404 Permit from the USACE. Examples of activities that require a Section 404 Permit include: construction of boat ramps, placement of riprap for erosion protection, placing fill in a wetland, building a wetland, construction of dams or dikes, stream channelization, and stream diversion. When Section 404 Permit applications are submitted to the USACE, the applications are typically posted for the U.S. Fish and Wildlife Service, the U.S. Forest Service, the U.S. EPA, and other federal agencies to review and provide comments. The USACE evaluates permit requests for the potential impact to various functions and values of the wetland.

Section 401 Certification is required to obtain a federal permit for any activity that will result in a discharge to navigable waters of the United States. The program is primarily administered by the USACE along with the MPCA. A Section 401 Water Quality Certification may be granted if the applicant demonstrates that the proposed activity "will not violate Minnesota's water quality standards or result in adverse long-term or short-term impacts on water quality." Greater protection is given to a category of waters designated by the MDNR as Outstanding Resource Value Waters (ORVW). The waters in this category have received this designation because of their exceptional value. These waters include such groups as scientific and natural areas, wild, scenic and recreational river segments, and calcareous fens.

More information is available at the USACE website: http://www.usace.army.mil/.

Appendices

Appendix A

Joint Powers Agreement (JPA)

Appendix B

Summary of Stakeholder Engagement Activities

Appendix C

Land and Water Resources Inventory

Appendix D

State and Federal Roles and Responsibilities