Lower Mississippi River Watershed Management Organization

Watershed Management Plan

Fourth Generation 2023-2032

July 2022
60-DAY REVIEW DRAFT

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LMR WMO
LOWER MISSISSIPPI RIVER
WATERSHED MANAGEMENT ORGANIZATION

LOWER MISSISSIPPI RIVER WMO
C/O Dakota County Soil & Water Conservation District
4100 220th St. West, # 102
Farmington, MN 55024

Watershed Management Plan

Julyne 2022

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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.

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Acronyms

Acronym	Description
AIS	Aquatic Invasive Species
BMP	Best Management Practice
BWSR	Minnesota Board of Water and Soil Resources
CAMP	Citizen Assisted Monitoring Program
CIP	Capital Improvement Program
CLP	Clean Lakes Program
CRWD	Capitol Region Watershed District
CWA	Clean Water Act
CWF	Clean Water Fund
DWSMA	Drinking Water Supply Management Area
EDA	Environmental Data Access (MPCA website)
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FiN	Fishing in the Neighborhood (MDNR Program)
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
HSG	Hydrologic Soil Group
JPA	Joint Powers Agreement
LA	Load Allocation
LGU	Local Governmental Unit
LiDAR	Light Detection and Ranging
LMRWD	Lower Minnesota River Watershed District
LMRWMO	Lower Mississippi River Watershed Management Organization
MDH	Minnesota Department of Health
MDNR	Minnesota Department of Natural Resources
MGS	Minnesota Geological Society
MNRRA	Mississippi National River and Recreation Area
MPCA	Minnesota Pollution Control Agency
MRCCA	Mississippi River Critical Corridor Area
MS4	Municipal Separate Storm Sewer System
MSL	Mean Sea Level
NCDC	National Climatic Data Center
NHIS	Natural Heritage Information System
NHNRP	Natural Heritage and Nongame Research Program
NLCD	National Land Cover Dataset
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service

NWI	National Wetland Inventory
OHWL	Ordinary High Water Level
PAH	Polycyclic Aromatic Hydrocarbon
PWI	Public Waters Inventory
RWMWD	Ramsey Washington Metro Watershed District
SCS	Soil Conservation Service
SSURGO	Soil Survey Geographic Dataset
SSTS	Subsurface Sewage Treatment System
SWA	Subwatershed Assessment
SWCD	Soil and Water Conservation District
SWMM	Stormwater Management Model
SWMP	Surface Water Management Plan
SWPPP	Storm Water Pollution Prevention Program
TAC	Technical Advisory Committee
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
TSS	Total Suspended Solids
UAA	Use Attainability Analysis
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VRWJPO	Vermillion River Watershed Joint Powers Organization
WBIF	Watershed-based Implementation Funding
WCA	Wetland Conservation Act
WHPP	Wellhead Protection Plan
WLA	Waste Load Allocation
WMO	Watershed Management Organization
WOMP	Watershed Outlet Monitoring Program
WRAPS	Watershed Restoration and Protection Strategy

Executive Summary

The Lower Mississippi River Watershed Management Organization (LMRWMO) *Watershed Management Plan* (Plan) sets the vision and guidelines for protection, restoring, and managing surface waters within the boundaries of the LMRWMO. The Plan provides resource data and background information, identifies and prioritizes watershed-wide and resource-specific issues, establishes measurable goals, sets policies and performance standards for the LMRWMO and its cities, and lays out a 10-year implementation schedule including projects and programs. The Plan is organized into five major sections, summarized as follows:

Section 1 – Introduction

Section 1.0 of this Plan summarizes the LMRWMO's role as a watershed management organization (WMO), its location and history, and management structure. Like all WMOs, the LMRWMO is a special purpose unit of local government that manages water resources on a watershed basis. The LMRWMO's jurisdiction spans approximately 58 square miles in northern Dakota County and southern Ramsey County and includes portions of the Cities of Inver Grove Heights, Lilydale, Mendota, Mendota Heights, South St. Paul, St. Paul, Sunfish Lake, and West St. Paul (see Figure ES-2). Consistent with Minnesota Statutes 103B.201, the purposes of LMRWMO water management programs are as follows:

1. Protect, preserve, and use natural surface and groundwater storage and retention systems;
2. Minimize public capital expenditures needed to correct flooding and water quality problems;
3. Identify and plan for means to effectively protect and improve surface and groundwater quality;
4. Establish more uniform local policies and official controls for surface and groundwater management;
5. Prevent erosion of soil into surface water systems;
6. Promote groundwater recharge;
7. Protect and enhance fish and wildlife habitat and water recreational facilities; and
8. Secure the other benefits associated with the proper management of surface and groundwater.

The LMRWMO has established goals, strategies policies, and an implementation program to support its statutory purposes and pursue the following vision:

Healthy lakes, streams, and River through partnerships, education, and coordinated action

The LMRWMO is governed by a seven-member Board of Managers including one member representing each city party to the Joint Powers Agreement (JPA – see Appendix A). The powers of the Board are detailed in the most current iteration of the LMWMO JPA and are summarized in Section 1.0.

Section 2 – Land and Water Resources Inventory

Section 2.0 of this Plan contains information about the water and natural resources located within the LMRWMO. Information is provided as text, tables, and maps and organized according to the following topics and resources:

- Climate and precipitation
- Topography and drainage patterns
- Population, demographics, and land use
- Soils
- Geology
- Groundwater
- Surface water resources, including:
    - LMRWMO priority waterbodies
    - Wetlands
    - Surface water modeling and monitoring
    - Water quality
    - Stormwater systems
    - Flooding and floodplain management
    - Shorelands and shoreland management
- Natural areas, habitat, and rare features
- Open space and recreational areas
- Potential pollutant sources

Understanding the condition of water and natural resources present in the LMRWMO is key to identifying priority issues, establishing goals, and targeting the actions of the LMRWMO, its member cities, and other partners.

Section 3 – Priority Issues and Resources

Section 3.0 of the Plan presents and discusses the priority issues and resources that will be the focus of the LMRWMO during the life of this Plan. As part of Plan development, the LMRWMO Board of Managers solicited input on priority issues and concerns from residents, state agencies, member cities, and regional partners through multiple stakeholder engagement activities illustrated in Figure ES-1.

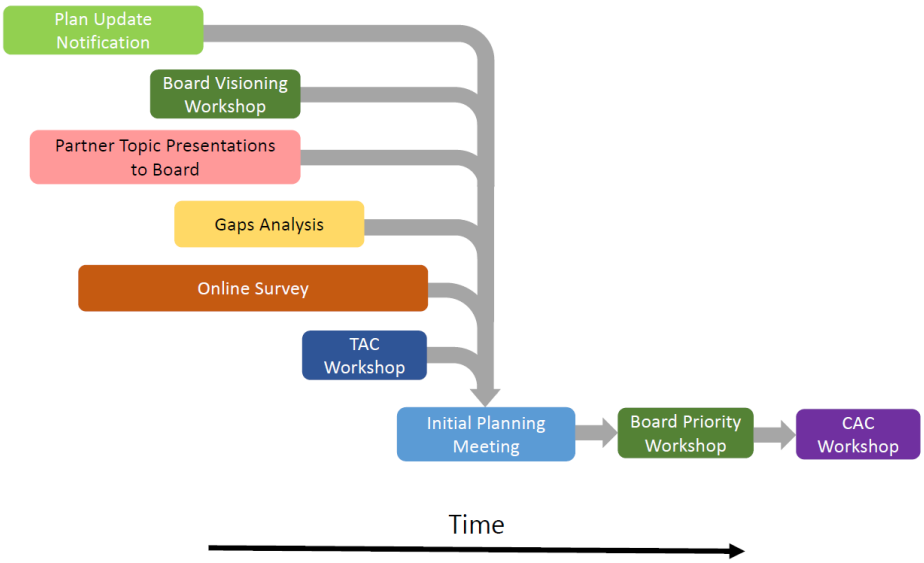

Figure ES-1 Stakeholder engagement workflow

Stakeholder engagement and issue identification activities are summarized in Appendix C. With consideration for the stakeholder engagement and data review activities, the LMRWMO Board of Managers established the following Plan priorities:

Higher Priority Issues	Lower Priority Issues
▪ **Water quality**, including: o Stormwater runoff management o In-lake and in-stream water quality o Impaired waters (Lake Augusta, Thompson Lake) o Chloride management o Mississippi River outfalls and bluff erosion ▪ **Education and engagement** ▪ **Partner collaboration**, including: o Grant and cost-share projects o Regulatory framework	▪ **Flooding and water levels** ▪ **Groundwater management, including:** o Drinking water quality o Groundwater conservation ▪ **Ecological Health**, including: o Upland area protections o Invasive species management o Vegetated buffers

The LMRWMO Board of Managers established priority classifications for waterbodies to prioritize monitoring, protection, and restoration activities. These include:

Priority Level	LMRWMO Waterbodies
Priority 1A	• Mississippi River • Interstate Valley Creek • Ivy Falls Creek • Kaposia Creek • Thompson Lake • Rogers Lake • Seidls Lake
Priority 1B	• Hornbeam Lake • Lake Augusta • Sunfish Lake
Priority 2	• Copperfield Pond • Lemay Lake • Ohmans Lake (Marcott) • Pickerel Lake • Rosenberger Lake (Marcott) • Simley Lake

The priority issues and the resource and issue prioritization process are described in greater detail in Section 3.0.

Section 4 – Goals and Policies

Section 4.0 presents the goals, strategies, and policies of the LMRWMO. Goals in Section 4.0 are generally organized according to the resource or operational issue they most closely address along with the strategies (i.e., LMRWMO-led activities) and policies (i.e., member city-led activities) to support those goals. LMRWMO policies also include performance standards member cities must implement through their respective project review and permitting programs.

Key LMRWMO goals, strategies, and policies include those primarily addressing water quality issues of priority waterbodies and include:

Section 4.1.1 Goal A – Maintain or improve water quality in LMRWMO priority 1 lakes to meet applicable state standards or existing 10-year (2012 – 2021) summer average water quality, if better than state standards:

Priority 1 Lakes	Total Phosphorus (ug/L)	Chlorophyll *a* (ug/L)	Secchi Depth (m)
Lake Augusta[1]	40	14	1.4
Hornbeam Lake[2]	45	17	1.8
Rogers Lake[2]	27	5	1.6
Seidls Lake[2]	54	18	1.2
Sunfish Lake[2]	30	19	2.6
Thompson Lake[1]	60	20	1.0

Notes:
(1) Goals based on applicable state standards for shallow and deep lakes (MN Rules 7050)
(2) Goals based on summer average (June – September) water quality observed from 2012-2021

Section 4.1.2, Strategy 7 – The WMO will maintain a list of priority waterbodies classified according to water quality issues, recreational and ecological value, intercommunity location, and other factors. The WMO will consider waterbody priority level when designing and executing the WMO implementation schedule (see Section 5.0) and in annual work planning.

Section 4.1.3, Policy 2 – Member cities shall require permanent water quality treatment for projects that disturb ½ acre or more if more than half the parcel is located within a watershed tributary to LMRWMO Regulatory Waterbodies, as noted in Figure 2-3. Permanent water quality treatment requirements shall be consistent with those described in Policy 4.1.3-1. Member cities are encouraged to apply similar requirements throughout their jurisdiction. Member cities that contain an area comprising less than 10% of the area tributary to a Regulatory Waterbody are exempt from this policy.

The Plan includes many other goals, strategies, and policies addressing other water resource management issues (see Section 4.0). The LMRWMO is not a permitting entity. The LMRWMO requires that member cities adopt and enforce performance standards and local official controls at least as stringent as those in this Plan to manage stormwater, erosion and sedimentation, wetlands, floodplains, and shorelands.

Section 5 – Implementation Program

Section 5.0 describes the major elements of the LMRWMO implementation program. The roles, responsibilities, and activities of the LMRMWMO reflect the strategies detailed in Section 4.0 and cooperative relationships with member cities and other partners. Table 5-1 (implementation schedule) describes the LMRWMO's planned activities over the next 10 years is subdivided among the following categories:

- Studies
- Projects
- Monitoring
- Education and outreach
- Engineering and Planning
- Administration

The LMRWMO implementation schedule includes the continuation of ongoing activities as well as new activities to address emerging issues and changing priorities. Notable new or expanded activities include (activity IDs are based on Table 5-1):

- Mississippi River direct drainage study (item S-1) and follow-up projects (item P-1)
- LMRWMO stream monitoring feasibility study (item S- 8) and subsequent:
    - Monitoring of Interstate Valley Creek (item M-4)
    - Monitoring of Ivy Falls Creek (item M-5)
    - Monitoring of Kaposia Creek (item M-6)
- Stream stabilization projects along Interstate Valley Creek (item P-3)
- Stream stabilization projects along Ivy Falls Creek (item P-4)
- Stormwater management and/or shoreline improvement projects at Lake Augusta (item P-5)
- Providing financial support for voluntary projects providing stormwater management, erosion control, and shoreline/streambank restoration exceeding applicable standards (item P-8)
- Develop comprehensive watershed-wide water quality, hydrologic and hydraulic models (items S5 and S6)
- Coordination with Dakota County SWCD and member cities for K-12 programming (item E-5)
- Providing multi-lingual education and outreach material and/or training (item E-8)
- Providing chloride reduction training and/or educational materials (item E-9)

Section 5.0 describes the funding mechanisms used and available to the LMRWMO, assessment and reporting practices, and the process for amending this Plan. Requirements for City local water management are also presented in this section. Requirements for LMRWMO member cities are generally consistent with those of the previous LMRWMO Plan and include, briefly:

- Developing local water management plans consistent with Minnesota Statutes 103B.235 and Minnesota Rules 8410.0160
- Continuing to enforce local performance standards addressing water quality, erosion, wetlands, and floodplains
- Operate and maintain city-owned stormwater management infrastructure
- Require and enforce maintenance agreements for privately-owned stormwater management infrastructure

Placeholder for location Figure

Figure ES-2 Location of the LMRWMO

1.0 Introduction

1.1 The Role of Watershed Management Organizations

Like all watershed management organizations (WMOs), the Lower Mississippi River Watershed Management Organization (LMRWMO) is a special purpose unit of local government that manages surface water resources on a watershed basis. Watershed management organization boundaries generally follow natural watershed divides, rather than political boundaries. Thus, they may include several municipalities and counties.

Addressing resource management issues at the watershed scale is important because water does not respect political boundaries. Activities occurring in one city may cause impacts in another community. By managing water resources on a watershed basis, communities within the watershed can jointly plan to prevent, minimize, and correct problems, and coordinate and equitably pay for projects.

Recognizing these issues and opportunities, the State of Minnesota established the Watershed Act (Minnesota Statutes 103D) in 1955, which provided for the creation of watershed districts anywhere in the state. In 1982, the Minnesota Legislature enacted the Metropolitan Surface Water Management Act (Minnesota Statutes 103B.201 – 103B.255). This act required the formation of a WMO, and the development and implementation of a watershed management plan, for each of the watersheds in the seven county Twin Cities metropolitan area. WMOs can be organized as joint powers agreement organizations among municipalities (e.g., LMRWMO), as watershed districts (e.g., Lower Minnesota River Watershed District (LMRWD)), or under county government (e.g., Vermillion River Watershed Joint Powers Organization (VRWJPO)).

Per Minnesota Statutes 103B.201, the purposes of WMO water management programs are as follows:

1. Protect, preserve, and use natural surface and groundwater storage and retention systems;
2. Minimize public capital expenditures needed to correct flooding and water quality problems;
3. Identify and plan for means to effectively protect and improve surface and groundwater quality;
4. Establish more uniform local policies and official controls for surface and groundwater management;
5. Prevent erosion of soil into surface water systems;
6. Promote groundwater recharge;
7. Protect and enhance fish and wildlife habitat and water recreational facilities; and
8. Secure the other benefits associated with the proper management of surface and groundwater.

1.2 Lower Mississippi River Watershed Management Organization

1.2.1 Location

The LMRWMO is located in the southeast part of the Twin Cities metropolitan area, in northern Dakota County and southern Ramsey County. Figure ES-2 shows the location of the LMRWMO in relation to the adjacent watershed management organizations in the seven-county metropolitan area. The Mississippi River borders the LMRWMO on the northwest, north, and east sides from the confluence with the Minnesota River to the boundary of the City of Inver Grove Heights and the City of Rosemount.

On the east side of the Mississippi River, the LMRWMO is bounded by the Lower Minnesota River Watershed District (LMRWD), Eagan-Inver Grove Heights WMO (EIGHWMO), and the Vermillion River Watershed Joint Powers Organization (VRWJPO). The Capitol Region Watershed District (CRWD) and Ramsey-Washington Metro Watershed District (RWMWD) are located adjacent to the LMRWMO across the Mississippi River.

The LMRWMO is mostly developed with generally suburban land use (see Figure 2-4) and covers approximately 35,500 acres (55.~~8~~ 5 square miles). The LMRWMO includes part or all of eight cities, including:

- Inver Grove Heights
- Lilydale
- Mendota
- Mendota Heights
- St. Paul
- South St. Paul
- Sunfish Lake
- West St. Paul

As of the writing of this Plan, the City of Mendota is not a signatory of the JPA (see Appendix A). The majority of the LMRWMO is tributary to the Mississippi River through direct drainage or routed through lakes, ponds, creeks, and municipal stormwater systems. ~~Some~~ Large portions of the watershed are landlocked (see Figure 2-3).

1.2.2 History and Accomplishments since the 2011 Plan

The LMRWMO was first established by a joint powers agreement (JPA) between the member cities that was executed on October 25, 1985. The WMO was formed in response to the requirements of the Metropolitan Surface Water Management Act (see Section 1.1). The original JPA was updated and executed in 2003, and again revised in 2011 to extend the expiration until 2013. The second amendment to the JPA in 2013:

- Revised language to include City representatives in Technical Advisory Committees.
- Revised language to specifically cite State Statute 103B.227 (see attached) regarding appointment of Members and general WMO organization.

- Repealed language regarding removal of Managers.
- Revised language for capital cost allocation of construction improvements in the WMO's watershed management plan which are related to both water quantity and water quality.
- Provided four cost allocation methods for water quality projects and maintenance, attached to the JPA as Exhibit C.
- Extended expiration date of JPA from January 1, 2013, to January 1, 2023.

The LMRWMO amended the JPA a third time to its boundary to include additional areas of the Cities of Mendota and Mendota Heights.

Since its formation in 1985, the LMRWMO has developed and adopted four watershed management plans. This document, adopted by the LMRWMO in _____, 202X, is the fourth generation LMRWMO Plan and supersedes the third-generation plan adopted in 2011 and last amended in 2015. This Plan shall extend 10-years from the date of BWSR approval (through _____, 202X), unless otherwise superseded. Accomplishments of the LMRWMO since the adoption of the third generation Plan are summarized in the LMRWMO annual report and include, but are not limited to:

- Funding water quality monitoring of select LMRWMO waterbodies performed via the Metropolitan Council's Citizen Assisted Monitoring Program (CAMP)
- Developing a cost allocation method to equitably allocate the cost for intercommunity water quality improvement projects based on an "allowable load" concept
- ~~Publishing of the LMRWMO watershed annual report and the annual activity report (submitted to BWSR) to document work performed in the prior year~~
- Working with the Minnesota Pollution Control Agency (MPCA) to conduct a Watershed Restoration and Protection Strategies (WRAPS) study addressing water quality in ~~several~~ five LMRWMO lakes
- Securing and administering a Metropolitan Council grant to construct low impact stormwater infrastructure near Seidls Lake in partnership with the City of South St. Paul
- Securing and administering a Clean Water Fund (CWF) grant to construct stormwater treatment upstream of Thompson Lake in partnership with Dakota County and the City of West St. Paul
- Securing and administering a Clean Water Fund (CWF) grant to stabilize degraded ravines and provide stormwater treatment in Cherokee Heights Park in partnership with the City of St. Paul
- Securing and administering a Clean Water Fund (CWF) grant to perform an in-lake alum treatment of Lake Augusta in partnership with residents and the City of Mendota Heights
- Securing and administering a Clean Water Fund (CWF) grant to perform an in-lake alum treatment of Sunfish Lake in partnership with Sunfish Lake residents, leading to the delisting of Sunfish Lake from the MPCA's impaired waters list
- Facilitating the distribution of BWSR Clean Water Fund WBIF funds
- Funding educational workshops and implementation of residential~~small~~-scale raingarden, native planting, and shoreline restoration ~~and runoff capture~~ projects via Dakota County's Landscaping for Clean Water program
- Funding educational opportunities for residents to complete the Minnesota Water Stewards volunteer program

- Distributing educational materials to support ~~natural~~ water resources stewardship through the LMRWMO website, member city communication channels, and participating in the Metro Watershed Partners program

1.2.3 Management Structure

The LMRWMO Board of Managers consists of a manager and alternate manager appointed by each member cities to serve at the ~~City's~~ city's discretion. Each manager (or alternate in the manager's absence) casts one vote for decisions requiring Board of Manager action. Member city staff attend board meetings on a regular basis as informal technical advisors and are invited to participate in a technical advisory committee (when convened). Regular meetings are held on the second Wednesday of the month hosted by member cities on a rotating basis. The public is invited to attend the LMRWMO meetings. The Dakota County SWCD serves as the Administrator and day to day staff contact for the LMRWMO via an annual work plan and cooperative agreement for services.

Meeting schedules, agendas, and materials are posted on the LMRWMO website at: lmrwmo.org

1.2.4 LMRWMO Vision and Purpose

Within the context of the statutory authority granted to WMOs and contained in the JPA, the LMRWMO Board has established the following vision to provide strategic direction to its work. The following vision helps to focus the organization's efforts and is a reminder of what the LMRWMO is working to achieve:

Healthy lakes, streams, and River through partnerships, education, and coordinated action

In addition to the statutory authority and purposes identified in the JPA and Minnesota Statutes 103B (see Section 1.1), the LMRWMO has developed the following purposes to further clarify its roles in relationship to it members:

A. Assist member cities in achieving current and future water quality and water quantity regulations collaboratively, equitably, and cost-effectively for all members within the watershed.
B. Identify and effectively communicate member concerns to other government jurisdictions to better align their policies and activities with those of the WMO and its members.
C. Educate citizens about the use, protection, and management of water resources and engage them in WMO water management programs and decision making.
D. Consider potential impacts of WMO decisions on natural resources and habitat.
E. Govern the WMO with a citizen led Board and keep regulation at the local level –the WMO will not administer a permit program.
F. Assist member communities with intercommunity runoff and water resource management issues. The WMO, at the discretion of the Board, may also work with individual member cities to address water resource issues within individual city boundaries. This may include but is not limited to monitoring of water bodies or outlets to the Mississippi River.
G. Assess performance of the WMO and the member cities toward achieving the goals stated in this plan.

H. Provide member cities with useful information about the WMO, its activities, and water resource management.

These purposes are further developed through the goals, strategies, and policies included in Section 4.0 of this Plan.

1.2.5 Authority Granted by the Joint Powers Agreement

The authority of the LMRWMO is established by Minnesota Statutes 103B and by the JPA. The LMRWMO JPA is included as Appendix A of this Plan. The responsibilities of the LMRWMO defined in Section 7 of the JPA include:

1. Prepare and adopt a watershed management plan.
2. Review and approve local water management plans.
3. Review local land use and development at the request of a municipality, in the absence of an approved local water management plan, or for projects requiring a variance from the adopted local water management plan or implementation program.
4. Adopt an annual work plan
5. Employ persons as necessary to perform its duties
6. Contract for space, materials, or supplies as needed to carry out its activities
7. Acquire necessary personnel or property to perform its duties
8. Conduct surveys (or use other data) and develop projects to accomplish the WMO's purposes.
9. Cooperate or contract with federal and state entities and public or private organizations to accomplish its purposes.
10. Order any member city to carry out the LMRWMO-approved local water management plan.
11. Acquire, operate, construct, and maintain the capital improvement programs included in its adopted Watershed Management Plan.
12. Contract for or purchase insurance.
13. Establish and maintain devices for acquiring and recording hydrological and water quality data.
14. Enter upon lands to make surveys and investigations to accomplish the WMO's purposes.
15. Provide any member city with technical data or other information to assist the city in preparing land use classifications or its local water management plan.
16. Provide legal and technical assistance in connection with litigation or other proceedings between one or more of its members and any other entity relating to the planning or construction of facilities relating to hydrology or water quality in the WMO.
17. Accumulate reserve funds and invest funds not currently needed for WMO operations.
18. Collect money from the WMO members and from any other WMO-approved source.
19. Make contracts, incur expenses, and make expenditures.
20. Obtain an annual audit of the books and accounts of the WMO.
21. Make the WMO's books, reports, and records available for member cities or the public.
22. Recommend changes to the JPA to its members (amendments will require ratification by members)

23. Exercise all other powers necessary to the purposes of the WMO as authorized by Minnesota Statues 103B.
24. Solicit proposals for legal, engineering, auditing, and other technical services in accordance with Minnesota Statutes 103B.227.
25. Coordinate its planning activities with adjacent WMOs and counties conducting water planning and implementation under Minnesota Statutes 103B.
26. Designate one or more legal newspapers of general circulation published in the counties the WMO is located.

In addition to the above authorities of the WMO specified in Section 7 of the JPA, Section 10 of the JPA specifies the following financial authorities of the WMO:

- Establish an annual budget and collect money from the WMO members (or other WMO-approved source).
- Apportion/allocate costs of capital improvements (including engineering, legal and administrative costs) listed in the WMO watershed management plan, based on "allowable flow" methodology, "allowable load" methodology, or other cost sharing allocations determined by the WMO Board of Managers.

2.0 Land and Water Resource Inventory

This section summarizes the land and water resources located within the LMRWMO. It contains information on climate and precipitation, topography and drainage, land use, soils, geology, groundwater, surface waters, natural areas, habitat, and rare species, recreation, and potential pollutant sources. Land and water resource information is important because it describes the condition of the watershed and how those conditions impact decisions about infrastructure, development, and resource management.

2.1 Climate and Precipitation

The climate of the seven county Twin Cities Metropolitan Area is a humid continental climate, characterized by moderate precipitation (normally sufficient for crops), wide daily temperature variations, large seasonal variations in temperature, warm humid summers, and cold winters with moderate snowfall. Climate data is often presented according to 30-year "climate normal" periods, the most recent spanning the period from 1991-2020. Several of the wettest years on record have been observed during the most recent climate normal period, including several wet years since 2010. Climate trends are discussed in Section 2.1.2. Climate data presented in this section is based on the 30-year period from 1991 through 2020, unless otherwise noted.

The mean annual temperature as measured at the Minneapolis-St. Paul international (MSP) airport is 46.6°F (1991-2020). Mean monthly temperatures vary from 15.9°F in January to 74.1°F in July (1991-2020). For the 1991-2020 climate normal period, the average frost-free period (growing season) is approximately 160 days.

Table 2-1 summarizes monthly precipitation data the approximate centroid of the LMRWMO based on the Minnesota Climatology Working Group gridded precipitation dataset for the most recent complete climate normal period (1991-2020) and 10-year period (2011-2020). Average total annual precipitation is 34.4 inches (1991-2020). The mean monthly precipitation varies from 5.1 inches in June to 1.0 inches in January (1991-2020). From May to September, the growing season months, the average rainfall (1991-2020) is 21.35 inches, or 62% of the average annual precipitation. Snowfall averaged 52 inches annually at the MSP station during the 1991-2020 climate normal period.

Additional information about local and regional climate is available from the Minnesota Department of Natural Resources (MDNR) State Climatology office and NOAA at:

- Minnesota State Climatology Office: https://www.dnr.state.mn.us/climate/index.html
- National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC): https://www.ncdc.noaa.gov/cdo-web/

Table 2-1 Monthly Precipitation Data

Month	1991-2020 Mean Temperature (F)	2012-2021 Mean Temperature (F)	1991-2020 Precipitation (inches)	2012-2021 Precipitation (inches)
January	15.9	17.9	0.97	0.88
February	20.4	18.4	1.00	1.18
March	33.1	35.1	1.86	1.93
April	46.8	45.8	3.16	3.75
May	59.3	60.2	4.36	5.35
June	69.5	71.5	5.06	5.51
July	74.1	75.3	4.24	4.10
August	71.6	72.5	4.39	4.64
September	63.3	65.5	3.30	3.10
October	49.3	49.3	2.92	3.16
November	34.6	35.0	1.75	1.63
December	21.7	22.9	1.43	1.80
Total	**46.6**	**47.4**	**34.4**	**37.0**

Source: Minnesota Climatology Working Group gridded precipitation dataset (precipitation); NWS monthly summaries, MSP station (temperature);

2.1.1 Precipitation-Frequency Data (Atlas 14)

The amount, rate, and type of precipitation are important in determining flood levels and stormwater runoff rates. 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. Table 2-2 lists selected rainfall events within the LMRWMO. Note that member cities typically use Atlas 14 design precipitation depths specific to their jurisdictions.

Runoff from spring snowmelt is not provided in Atlas 14 and current regional snowmelt runoff data is not available (Minnesota Stormwater Manual, 2019). Older estimates of snowmelt runoff come from the

Hydrology Guide for Minnesota (USDA Soil Conservation Service – NRCS, 1975, see Table 2-2). 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 to a lake or pond is large and the outlet is small.

Table 2-2 Selected Rainfall Events Used for Design Purposes

Type	Frequency	Duration	Depth (in)
Rainfall	2-year	24 hour	2.80
	5-year	24 hour	3.48
	10-year	24 hour	4.17
	25-year	24 hour	5.30
	50-year	24 hour	6.31
	100-year	24 hour	7.44
	10-year	10 day	6.61
	100-year	10 day	9.98
Snowmelt	10-year (10%)	10 day	4.7
	25-year (4%)	10 day	5.7
	50-year (2%)	10 day	6.4
	100-year (1%)	10 day	7.1

Source: NOAA Atlas 14 – Volume 8 interpolated to approximate centroid of LMRWMO; depths reflect the 50% exceedance limit. Snowmelt values from Hydrology Guide for Minnesota (USDA Soil Conservation Service – NRCS) and reported as liquid water.

2.1.2 Climate Trends and Future Precipitation

There are typically wide variations in climate conditions in the ~~District~~LMRWMO. However, climatologists have found four significant recent climate trends in the Upper Midwest (NOAA, 2013):

- Warmer winters—decline in severity and frequency of severe cold; warming periods leading to mid-winter snowmelt
- 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.

Annual precipitation in the LMRWMO averaged 37.1 inches from 2011-2020, a 2.7 inch increase over the 1981-2010 climate normal period. Annual precipitation exceeded the previous 1981-2010 climate normal average (34.4 inches) in 7 of 10 years since 2010.

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. Precipitation data from the Mississippi River-Twin Cities basin dating back to 1895 (available from the MDNR climate trends website) indicates that annual precipitation, averaged over 30-year climate normal periods, is increasing (see Figure 2-1).

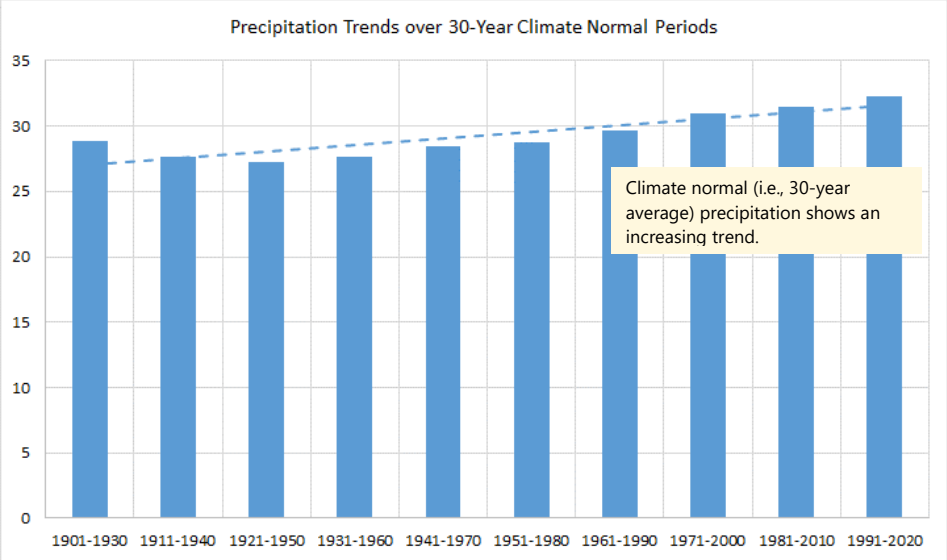

Figure 2-1 Trends in Average Annual Precipitation (Twin Cities Region)

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 was 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 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 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 (Stack et al., 2014).

Additional information about climate change is available from NOAA and the Minnesota Department of Natural Resources (MDNR) at:

- https://www.noaa.gov/categories/climate-change
- https://www.dnr.state.mn.us/climate/climate_change_info/index.html

2.2 Topography and Drainage

The topography of the watershed consists of rolling to hilly terrain. Areas of steep bluffs are located along the west, north, and east boundary of the watershed adjacent to the Mississippi River and its tributary streams, ravines, and drainages. Below the bluffs, flat areas are located within the Mississippi River floodplain.

The local topographic gradient varies across the watershed. In the north, high areas centered in West ~~Saint~~ St. Paul generally drain outward to west, north, and east towards the Mississippi River. Portions of Mendota Heights and Mendota drain northwest towards the Minnesota River. In the southern portion of the watershed, high ground in southwest Inver Grove Heights drains north and east towards the Mississippi River. The local topography creates many landlocked basins, most of which are located in the southern portion of the watershed.

High ground in the north-central portion of the watershed reaches heights of approximately 1,070 feet above mean seal level (MSL). The minimum elevation of approximately 690 feet MSL occurs the downstream boundary with the Mississippi River. LiDAR elevation data collected in 2011 by the MDNR is presented in Figure 2-2.

The LMRWMO includes areas that drain to both the Minnesota River and the Mississippi River. The area of the LMRWMO is subdivided among watersheds of varying levels of detail as defined by the MDNR and USGS. The LMRWMO member cities have further subdivided drainage areas for local water resource planning purposes. Local subwatershed divides are also presented in Figure 2-2.

Placeholder for Topography Figure

Figure 2-2 Topography

Placeholder for Topography Figure

Figure 2-3 LMRWMO Planning Subwatersheds

2.3 Population, Demographics, and Land Use

The LMRWMO, occupying portions of Ramsey County and Dakota County, is located in within the Twin Cities Metropolitan Area. Land use within the watershed (2016 data provided by the Metropolitan Council) is summarized in Table 2-3 and Figure 2-4.

Over time, the land within the LMRWMO has been transformed from a natural landscape (see Section 2.8) first to agricultural land use and, over time, to more urban and suburban land uses. Agricultural land use now occupies approximately 3% of the watershed. Residential land use occupies approximately 35% of the watershed; approximately 95% of residential land use is single-family homes. The watershed is mostly developed, with approximately 7,700 acres (about 20% of the watershed) remaining undeveloped. Most of the remaining undeveloped areas are concentrated in the City of ~~cities of Sunfish Lake and~~ Inver Grove Heights and portions of the City of Sunfish Lake. Some areas currently identified as undeveloped may not be suitable for future development.

Development of the watershed has coincided with population growth among the member cities. Population within the LMRWMO increased by approximately 40% between 1960 and 1970. Since about 1980, significant population growth in the LMRWMO has occurred primarily in the cities of Mendota Heights and Inver Grove Heights. Current (2020) population within the LMRWMO is approximately 105,000. By 2040, population within the LMRWMO is projected to be approximately 120,000, with over half that growth expected within Inver Grove Heights (see City 2040 Comprehensive Plans for additional information). In addition to population increase, the population of within the LMRWMO (and greater Dakota County) is expected to age and grow more racially and ethnically diverse (Dakota County, 2019; St. Paul, 2020).

Additional population and demographics data for LMRWMO communities is available from the Metropolitan Council at: Community Profile - Research Web Community Profiles (state.mn.us).

The conversion of natural areas and vegetation over time for residential, commercial, and other land uses increases the amount of impervious surfaces (i.e., surfaces through which water cannot infiltrate). Approximate percentages of impervious areas (and other types of land cover) are available from the National Land Cover Dataset (NLCD) and are presented in Figure 2-6. The increase of impervious surfaces reduces opportunities to infiltrate precipitation, resulting in increases in stormwater runoff volume and associated pollutant loading. Thus, the continued implementation of stormwater management performance standards for development and redevelopment are key to addressing water quality and water quantity issues.

Because much of the watershed is already developed, most land use changes and construction activity within the watershed will likely occur through redevelopment. Estimated 2040 land use available from the Metropolitan Council is presented in Figure 2-5. Redevelopment presents an opportunity to implement stormwater best management practices previously omitted or augment existing practices. State regulatory requirements (e.g., NPDES Construction Stormwater Permit), LMRWMO policies, and local controls (i.e., city ordinances) require stormwater treatment for redevelopment projects meeting certain criteria.

~~Major redevelopment opportunities anticipated by LMRWMO member cities include, but are not limited to:~~

- ~~Signal Hills Commercial Center?~~
- ~~Others?~~

More detailed information about current and future land use, anticipated population growth, and land development is presented in the 2040 comprehensive plans for the LMRWMO member cities.

Table 2-3 Existing Land Use (~~2016~~2020)

~~Land Use~~	~~Acres~~	~~Percent Area~~
~~Agricultural or Farmstead~~	~~1,158.2~~	~~3.3%~~
~~Commercial or Retail~~	~~1,008.9~~	~~2.8%~~
~~Office~~	~~462.4~~	~~1.3%~~
~~Golf Course~~	~~754.7~~	~~2.1%~~
~~Industrial and Utility~~	~~2,121.9~~	~~6.0%~~
~~Institutional~~	~~1,369.5~~	~~3.9%~~
~~Mixed Use~~	~~167.3~~	~~0.5%~~
~~Open Water~~	~~2,270.6~~	~~6.4%~~
~~Park, Recreational, or Preserve~~	~~3,096.0~~	~~8.7%~~
~~Residential, Single Family~~	~~11,764.3~~	~~33.1%~~
~~Residential, Multifamily~~	~~745.9~~	~~2.1%~~
~~Transportation (Highway, Rail, Airport)~~	~~2,620.9~~	~~7.4%~~
~~Undeveloped~~	~~7,671.2~~	~~21.6%~~
~~Other~~	~~302.6~~	~~0.9%~~
~~**Total**~~	~~**35,514.3**~~	~~**100.0%**~~

~~Source: Metropolitan Council~~

Land Use	Acres	Percent Area
Residential, Single Family	11,894	33.5%
Undeveloped	7,651	21.5%
Park, Recreational, or Preserve	3,143	8.8%
Transportation (Highway, Rail, Airport)	2,630	7.4%
Industrial and Utility	2,109	5.9%
Open Water	2,075	5.8%
Institutional	1,440	4.1%
Agricultural or Farmstead	1,155	3.2%
Commercial or Retail	1,012	2.8%
Golf Course	755	2.1%
Residential, Multifamily	750	2.1%
Office	460	1.3%
Mixed Use	168	0.5%
Other	306	0.9%
Total	**35,548**	**100.0%**

Source: Metropolitan Council, 2020

Placeholder for Land Use Figure

Figure 2-4 Existing Land Use (2018)

Placeholder for Future Land Use Figure

Figure 2-5 Estimated Future Land Use (2040)

Placeholder for Impervious Area and Land Cover figure

Figure 2-6 Percent Impervious Area and Land Cover

2.4 Soils

Soil composition and slope are important factors affecting the rate and volume of stormwater runoff. The shape and stability of aggregates of soil particles—expressed as soil structure—influence the permeability, infiltration rate, and erodibility (i.e., potential for erosion) of soils. Slope is important in determining stormwater runoff rates and susceptibility to erosion.

Prevalent soil series located within the watershed include are described in the Dakota County Soil Survey, available online from the Natural Resources Conservation Service (NRCS). General soil map units prevalent in the LMRWMO portion of Dakota county include:

The **Waukegan-Wadena-Hawick** unit includes well drained soils on glacial outwash plains and terraces. These soils vary from level to very steep. These soils are formed in loamy or silty sediments and generally underlain by sandy outwash. These soils are well suited for agricultural land use and building but are sensitive to groundwater pollution.

The **Kingsley-Mahtomedi** unit includes well drained soils that range from gently sloping to very steep. These soils are formed in loamy and sandy glacial till and outwash in uplands and outwash plains. Soils within this unit are complex and intermixed. These soils are not well suited to agricultural land use and can be subject to erosion on steeper slopes.

Detailed mapping of soil series present in Ramsey County, Dakota County, and the LMRWMO is available from the NRCS Web Soil Survey at: https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Soil infiltration capacity affects the amount of direct runoff resulting from rainfall. Higher infiltration rates result in lower potential for runoff, as more precipitation is able to enter the soil. Conversely, soils with low infiltration rates produce high runoff volumes and high peak discharge rates, as most or all of the rainfall moves as overland flow. The Natural Resources Conservation Service (NRCS – formerly the Soil Conservation Service) has established four general hydrologic soil groups (HSGs). These groups are:

Hydrologic Soil Group A— (Low runoff potential): Group A soils have a high infiltration rate and are typically composed of more than 90% sand and gravel.

Hydrologic Soil Group B— (Moderately low runoff potential): Group B soils have a moderate infiltration rate and are typically composed of 50-90% sand.

Hydrologic Soil Group C— (Moderately high runoff potential): Group C soils have a slow infiltration rate and are composed of less than 50% sand.

Hydrologic Soil Group D— (High runoff potential): Group D soils have a very slow infiltration rate and are composed of more than 40% clay. These soils have a combination of high swelling potential, a permanently high water table, and a clay layer at or near the surface.

Dual HSGs (types A/D, B/D, and C/D) are soils that are considered D soils primarily because of a high water table. However, if the soil were drained it would be classified into a different group. The second

group listed for dual HSG soils is for an undrained condition. For the purpose of evaluating infiltration capacity, dual HSGs are usually considered as D soils. The most current HSG data within the watershed are based on the Soil Survey Geographic dataset (SSURGO) from the NRCS and are presented in Figure 2-7.

Areas in the north and east of the watershed are not rated with respect to HSG. The "Not Rated/Not Available" classification is typically assigned to areas where development has altered the existing soil, or data were unavailable prior to development. Development may increase the potential for high volumes of runoff. As land is developed for urban use, much of the soil is covered with impervious surfaces, and soils in the remaining areas are significantly disturbed and altered. Development often results in consolidation of the soil and tends to reduce infiltration capacity of otherwise permeable soils, resulting in significantly greater amounts of runoff. Grading, plantings, and tended lawns tend to dominate the pervious landscape in urbanized areas and may become more important factors in runoff generation than the original soil type.

Figure 2-7 provides general guidance about the infiltration capacity of soils. Site specific data such as geologic borings, piezometers, and other engineering studies are necessary to evaluate soil infiltration capacity for individual project sites.

Placeholder for Soils Figure

Figure 2-7 Hydrologic Soil Groups

2.5 Geology

2.5.1 Surficial Geology

The geology of the watershed includes consolidated bedrock formations overlain by unconsolidated glacial sediments (also known as quaternary deposits). Unconsolidated glacial sediments are from glacial deposits left from the quaternary geologic period and modified by post-glacial erosion and soil formation processes. Most of the quaternary deposits in the watershed were deposited approximately 12,000 to 20,000 years ago by the Superior lobe (Cromwell Formation) of the Wisconsin Glaciation (the most recent local glacial episode) (Hobbs, Aranow, Patterson, 1990). Glacial till underlies most of the LMRWMO, while a channel of mixed outwash extends from the northwest to southeast across the watershed. Terrace deposits also underlie portions of South St. Paul adjacent to the Mississippi River.

Depth to the surficial deposits vary widely within the watershed. Surficial deposits are less than 50 feet thick along the bluffs in the north and east portions of the watershed; exposed bedrock occurs in some locations along the cliffs of the Mississippi River banks. Much of the interior of the watershed contains surficial deposits from 100-250 feet thick, although depth to bedrock can exceed 500 feet in portions of Inver Grove Heights.

More information about the ~~surficial~~ geology of the LMRWMO is included in the Minnesota county geological atlases available at:

- Dakota County Geologic Atlas at: https://conservancy.umn.edu/handle/11299/58494
- Ramsey County Geologic Atlas at: https://conservancy.umn.edu/handle/11299/58233

2.5.2 Bedrock Geology

Consolidated bedrock formations (bedrock deposits) are much older than, and lie below, the glacial deposits. They include overlapping sequence of sandstones, limestones, dolostones, and shales from the Cambrian or Ordovician series. The uppermost layer of bedrock varies with location within the watershed and include:

- Decorah Shale
- Platteville and Glenwood dolostone, limestone, and shale
- St. Peter sandstone
- Prairie du Chien dolomite
- Jordan sandstone
- St. Lawrence shale

The youngest subcropping bedrock units, such as the Decorah shale, occur in the northern part of the WMO, while the older subcropping bedrock units, such as the Jordan Sandstone, occur in the southern part of the WMO. All of these bedrock units are sedimentary rocks deposited by shallow seas during late Cambrian and Ordovician times, approximately 500 million years ago. The bedrock formations form part of a gently sloping bowl-like structure centered under the Minneapolis-St. Paul metropolitan area, known as the Twin Cities basin. Bedrock characteristics are summarized in Table 2-4.

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Table 2-4 Bedrock geology characteristics

Geologic Unit	Approximate Thickness (feet)	Description	Approximate Subcropping Locations	Water-Bearing Characteristics
Glacial Drift	<50 to 500+	Till, sand, gravel, lake deposits	Present throughout watershed, varying in thickness by location	May yield small supplies for domestic use
Decorah Shale	50-90	Green, calcareous shale with interbeds of limestone	North and east, including portions of St. Paul, West St. Paul, and Mendota Heights	Low yield; acts as a confining layer
Platteville and Glenwood Formation	20-40	Fine-grain dolostone and limestone over green, sandy shale	Portions of South St. Paul, West St. Paul, and Mendota Heights	Low yield; acts as a confining layer
St. Peter sandstone	130-160	Fine to medium-grain quartzose sandstone, underlain by siltstone and shale	Along Mississippi River in northeast; portions of South St. Paul, Sunfish Lake, and Inver Grove Heights	Widely used for domestic wells
Prairie du Chien dolomite	145-300	Thin-bedded with thin beds of sandstone and chert	Southern portion Mendota Heights; eastern portion of South St. Paul and Inver Grove Heights	Major high-capacity aquifer
Jordan Sandstone	100	Medium- to coarse-grain quartzose sandstone	Southern portion of Inver Grove Heights; along Mississippi River in South St. Paul	Major high-capacity aquifer
St. Lawrence Formation	40-50	Dolomitic siltstone and sandstone	Southern portion of Inver Grove Heights	Confining bed with little yield

Source: Dakota County Geologic Atlas

More information about the ~~surficial~~ bedrock geology of the LMRWMO is included in the Minnesota county geological atlases (see Section 2.5.1) ~~available at:~~.

- ~~Dakota County Geologic Atlas at: https://conservancy.umn.edu/handle/11299/58494~~
- ~~Ramsey County Geologic Atlas at: https://conservancy.umn.edu/handle/11299/58233~~

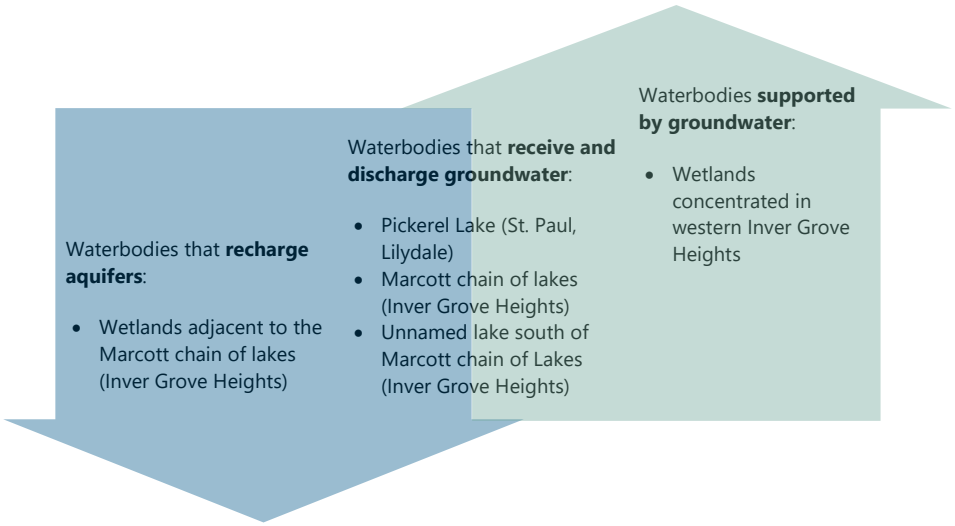
2.6 Groundwater

The LMRWMO serves a limited role related to groundwater resources. Groundwater management is generally performed by the Minnesota Department of Natural Resources (MDNR), Minnesota Department of Health (MDH), Metropolitan Council, and counties. Groundwater information is provided here for reference as it relates to the management of surface water resources within the LMRWMO.

The glacial and bedrock deposits form a layered sequence of aquifers and confining unit. An aquifer is a geologic formation capable of supplying sufficient quantities of water to a well. A confining unit is a geologic deposit that impedes the flow of water between aquifers.

The uppermost aquifers in the LMRWMO are glacial deposits. Glacial aquifers (also known as surficial aquifers) include the water table and buried glacial aquifers, which are primarily used for domestic and irrigation purposes in Dakota County. ~~Glacial~~ Surficial aquifers are variable in location and yield. Water yield from surficial aquifers is generally low (<5 gallons per minute) throughout most of the LMRWMO but can reach 500-1000 gallons per minute in the southern portion of Inver Grove Heights. Groundwater quality in ~~glacial~~ surficial aquifers is often correlated to the quality of the water that is infiltrating at the surface; these aquifers are not used locally for public water supplies due to their susceptibility to contamination (Balaban and Hobbs, 1990). Figure 2-8 presents the approximate depth from the surface to groundwater.

Surficial groundwater may be a source or a sink for local surface waters depending on relative elevation, soil conditions, and other factors. For many landlocked basins, seepage to groundwater may be significant. Shallow, exposed bedrock along the Mississippi River bluffs, for example, results in visible groundwater seeps. Generally, data characterizing the relationship between surficial groundwater and surface water features in the LMRWMO is limited due in part to the lack of surficial aquifer use within the watershed (Balaban and Hobbs, 1990). Most surface waters in the ~~LMRMOW~~ LMRWMO lack significant connection to groundwater (Metropolitan Council, 2010); surface waters with ~~notable~~ likely groundwater/surface water interaction (Metropolitan Council, 2015) include (but may not be limited to):



Most high-capacity wells draw water from bedrock aquifers. Below the surficial aquifers, five bedrock aquifers are present under the LMRWMO. The major bedrock aquifers are, in order of use and development:

- Prairie du Chien-Jordan
- Mount Simon-Hinckley
- St. Lawrence-Tunnel City
- Wonewoc
- St. Peter
- Platteville

The aquifer used most often for water supply in the area is the Prairie du Chien-Jordan aquifer. The Prairie du Chien-Jordan aquifer is high yielding, more easily tapped than deeper aquifers, has very good water quality, and is continuous throughout most of the area.

Groundwater levels in the Prairie du Chien-Jordan aquifer range from than 700 feet MSL to more than 800 feet MSL (Balaban and Hobbs, 1990). The aquifer is recharged in areas where thin permeable ~~drift~~ glacial deposits ~~overlies~~ overly the limestone layers. Some recharge of this aquifer occurs locally from percolation through the overlying glacial deposits or St. Peter sandstone.

Local recharge to the aquifer is generally low. The drift-filled bedrock valley in the southern portion of LMRWMO (see Section 2.4) cuts deeply into the Prairie du Chien-Jordan aquifer, creating a direct connection between the aquifer and the surficial groundwater in the glacial drift and increased potential for contamination. Regional recharge of the Prairie du Chien-Jordan aquifer occurs to the south, in Freeborn and Mower Counties. Groundwater movement in the aquifer is generally from south to north, toward the Minnesota and Mississippi Rivers.

The aquifer with the highest water quality and highest possible yields is the Mt. Simon-Hinckley aquifer, but it is more expensive to use than the Prairie du Chien-Jordan because of its greater depth and there are limitations to its use. Minnesota statutes limit appropriations from the Mt. Simon-Hinckley aquifer to potable water uses, where there are no feasible or practical alternatives, and where a water conservation plan is incorporated with the appropriations permit. The water level of the Mt. Simon-Hinckley aquifer is approximately 700 feet MSL. Recharge of the Mt. Simon-Hinckley takes place far north of the watershed, where the bedrock is closer to the surface, and occurs by percolation through the overlying drift and bedrock. Groundwater movement in the aquifer is generally to the southeast. The local direction of groundwater flow in the Twin Cities area tends to be toward the western suburbs, due to pumping of the aquifer.

Municipal water supply wells within South St. Paul and Inver Grove Heights draw drinking water from a combination of the Prairie du Chien - Jordan and the Mount Simon Hinckley aquifers. Some domestic supply wells in Mendota Heights, South St. Paul, and Inver Grove Heights also draw water from the Platteville aquifer. Users of groundwater meeting certain use criteria are required to obtain a water

appropriation permit from the MDNR; more information is available from: https://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/index.html

The Metropolitan Council completed the Regional Water Supply, Enhanced Groundwater Recharge, and Stormwater Capture and Reuse Study for the Southeast Metro Study Area in 2016. Groundwater modeling performed as part of the study estimates future drawdown of local aquifers from continued development of groundwater sources, as well as potential recovery if other water sources are developed. The study estimates continued development of the Prairie du Chien – Jordan may result in 10 feet of drawdown by 2040.

Additional information about the aquifers within the watershed is available from the following sources:

- Dakota County Geologic Atlas (Balaban and Hobbs, 1990), available at: https://conservancy.umn.edu/handle/11299/58494
- Ramsey County Geologic Atlas (Meyer and Swanson, 1992), available at: https://conservancy.umn.edu/handle/11299/58233
- Metropolitan Council Water Supply Planning, available at: https://metrocouncil.org/Wastewater-Water/Planning/Water-Supply-Planning.aspx

2.6.1 Groundwater Recharge

Recharge to groundwater occurs throughout the watershed. The local surficial geologic characteristics affect the rate, volume, and distribution of recharge. Water infiltrates most rapidly into sandy deposits and flows easily through sandy materials; clay deposits tend to slow and impede infiltration and subsurface flows. Relative to natural conditions, impervious surfaces (e.g., buildings, streets, parking lots) in developed areas have reduced the amount of open space and decreased the amount of land available to infiltrate runoff and recharge groundwater.

Groundwater recharge reaches the water table (i.e., quaternary or surficial aquifer) at a fast rate through sandy geologic deposits. The presence of sandy soils within portions of the LMRWMO creates potential for high local infiltration rates and associated groundwater contamination from pollutants carried from the ground surface. Groundwater sensitivity to pollution is presented in Figure 2-9.

Surficial aquifers usually have higher static water levels than deeper aquifers, indicating that water flows downward into the aquifer system and that surficial aquifers help recharge deeper aquifer systems. Deeper bedrock aquifers are recharged through bedrock valleys (like the one present in the southern LMRWMO), leakage through confining layers, fractures in tills and confining layers, improperly constructed wells, and other areas where good hydraulic connections and unforeseen flow paths exist with upper aquifer units.

The Metropolitan Council's Regional Water Supply, Enhanced Groundwater Recharge, and Stormwater Capture and Reuse Study for the Southeast Metro Study Area (Metropolitan Council, 2016) considered opportunities for enhanced recharge within the LMRWMO based on infiltration rate, depth of the water table, and drinking water protection factors. Approximately 1,400 acres of "Tier 1" (i.e., higher recharge

potential) enhanced recharge areas area identified in the LMRWMO, located almost entirely within the south and west portion of Inver Grove Heights (see Figure 2-9). Groundwater recharge in these areas has greater potential to recharge bedrock drinking water aquifers.

2.6.2 Drinking Water Supply, Wellhead Protection, and Pollution Prevention

Residents within the LMRWMO obtain their drinking water from a combination of surface water supplies (through St. Paul Regional Waters Services, or SPRWS, which serves the cities of Lilydale, Mendota Heights, St. Paul, and West St. Paul), municipal groundwater wells (South St. Paul, Inver Grove Heights), and private domestic wells (primarily in Inver Grove Heights and Sunfish Lake). Municipal wells in the Cities of South St. Paul and Inver Grove Heights tap the Mt. Simon-Hinckley and Prairie du Chien – Jordan aquifers.

In 1989 the state of Minnesota instituted the Minnesota Groundwater Protection Act, which identified the Minnesota Department of Health (MDH) as responsible for the protection of groundwater quality. Through its wellhead protection 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 the recharge zones of public well supplies. In 1997, the Wellhead Protection Program rules (Minnesota Rules 4720.5100 to 4720.5590) went into effect.

Some public water suppliers are required to prepare wellhead protection plans (WHPPs), including the Cities of South St. Paul and Inver Grove Heights. Through these wellhead protection plans, public water suppliers delineate drinking water supply management areas (DWSMA) for groundwater wells, assess the water supply's susceptibility to contamination from activities on the land surface, and establish management programs, such as identification and sealing of abandoned wells and education/public awareness programs. The DWSMA represents the boundaries of the recharge area to the well and is the area to be protected and managed by the wellhead protection plan. DWSMAs located within the LMRWMO are presented in Figure 2-10.

The LMRWMO and its cities rely on infiltration practices to improve water quality and reduce stormwater volumes. Thus, the LRRWMO and its member cities will continue to consider the possible impacts of infiltrated stormwater on groundwater quality. The MDH and MPCA also provide guidance for evaluating infiltration projects in areas with vulnerable groundwater supplies; the guidance considers the presence of wellhead protection areas, aquifer characteristics, land use, and other factors. For example, infiltration is not allowed within DWSMA emergency response zones. Infiltration guidance is available from the MPCA website: https://stormwater.pca.state.mn.us/index.php/Stormwater_and_wellhead_protection

Additional information regarding groundwater resource protection and management is available from the following sources:

- 2020-2030 Dakota County Groundwater Plan available at: https://www.co.dakota.mn.us/Environment/WaterResources/WellsDrinkingWater/Pages/groundwater-plan.aspx

- Metropolitan Council Water Supply Planning, available at: https://metrocouncil.org/Wastewater-Water/Planning/Water-Supply-Planning.aspx

Placeholder for depth to groundwater map

Figure 2-8 Depth to Groundwater

Placeholder for surface geology vulnerability

Figure 2-9 Sensitivity of the Water Table to Pollution

Placeholder for DWSMAs

Figure 2-10 Drinking Waters Supply Management Areas

2.6.4 Groundwater Monitoring and Groundwater Quality

~~Limited g~~Groundwater monitoring data is available within the watershed and includes data collected by Dakota County, MDA, MPCA, USGS, and others. Results presented to the LMRWMO in 2020 generally indicate that pesticide and nitrate concentrations within the LMRWMO are low. High, naturally-occuring manganese concentrations have been observed in wells in Inver Grove Heights. Groundwater quality monitoring locations within the LMRWMO are presented in Figure 2-14. Groundwater quality monitoring information and data is available online from the MPCA at: https://www.pca.state.mn.us/water/groundwater-monitoring

Potential sources of groundwater contamination in the watershed include: commercial and industrial waste disposal, landfills, leaking petroleum tanks, unsealed wells, non-compliant subsurface sewage treatment systems (SSTS), fertilizer/pesticide applications, animal waste, and road salt application (see also Section 2.10). Groundwater contamination also occurs due to naturally occurring elements in the soil and bedrock (e.g., arsenic, manganese). Emerging contaminants include pharmaceuticals, industrial effluents, personal care products, fire retardants, and other items that are washed down drains and not able to be processed by municipal wastewater treatment plants or septic systems.

The MDNR also coordinates an observation well network and collects static groundwater-level data to assess groundwater resources, determine long term trends, interpret impacts of pumping and climate, plan for water conservation, and evaluate water conflicts. The observation well network includes 1 active well located within the ~~LRRWMO~~ LMRWMO in West St. Paul (see Figure 2-14). More information is available from the MDNR at: https://www.dnr.state.mn.us/waters/cgm/program.html

2.7 Surface Water Resource Data

The LMRWMO is located downstream of the confluence of the Minnesota River and the Mississippi River. The Mississippi River forms the north and east boundary of the LMRWMO and is a major regional resource serving power generation, recreation, navigation, and ecological functions. The LMRWMO also contains multiple named lakes, a few ~~several~~ named streams, as well as numerous ~~lakes,~~ ponds~~, and other surface waters~~ and wetlands.

~~There are many surface water resources within the LMRWMO. Many of these are classified as public waters by the MDNR (see Figure 2-11).~~ In order to prioritize resource protection and management efforts, the LMRWMO has classified the waterbodies as LMRWMO priority waters (see Section 3.3 and Table 3-1~~Table 2-6~~).

Table 2-6 LMRWMO Priority Waterbodies

Priority Level	LMRWMO Waterbodies
Priority 1A	Mississippi River Interstate Valley Creek Ivy Falls Creek Kaposia Creek Thompson Lake Rogers Lake Seidls Lake
Priority 1B	Hornbeam Lake Lake Augusta Sunfish Lake
Priority 2	Copperfield Pond Lemay Lake Ohmans Lake (Marcott) Pickerel Lake Rosenberger Lake Simley Lake

Note: Additional information about classification process and criteria is presented in Section 3.3 and Table 3-1.

These waters have been classified as LMRWMO priority waters have been identified as priorities due to a combination of recreational use and value, ecological function and quality, and local priorities (see Section 3.3). As priority waters, the LMRWMO has established measurable water quality goals for these resources (see Section 4.1) and identified implementation activities (see Section 5.0 and Table 5-1) to manage these resources. The LMRWMO also cooperates with its member cities, Metropolitan Council, MPCA, and others to monitor the water quality of these resources. Omission of a waterbody from the LRRWMO priority waters list does not prevent or prohibit the LMRWMO from taking action to manage these waterbodies, if need should arise (note: an amendment to this Plan may be required).

2.7.1 Mississippi River

Runoff from most of the LMRWMO ultimately discharges to the Mississippi River. Approximately 20 miles of the Mississippi River form the north and south boundary of the District LMRWMO (see Figure 2-11). The confluence of the Minnesota River and Mississippi River occurs on the northwest boundary of the LMRWMO. The drainage area tributary to the Mississippi River stream of the confluence with the Minnesota River is approximately 37,000 square miles; the LMRWMO makes up approximately one one-thousandth (0.15%) of the Mississippi River drainage area at this location.

The Mississippi River has been managed for navigation since 1930 and contains a series of locks and dams and an uninterrupted navigation channel. The Upper Mississippi River has a maintained navigation channel depth of at least 9 feet. The Saint Paul District of the United States Army Corps of Engineers (USACE) operates and maintains 12 locks and dams beginning ~~at Lower St. Anthony Falls~~ in downtown Minneapolis and ending at lock and dam 10 in Guttenberg, Iowa (no lock and dams are adjacent to the LMRWMO).

The Mississippi River corridor within the District is part of the Mississippi River Corridor Critical Area (MRCCA), a designation given under the Critical Areas Act of 1973 (Minnesota Statutes 116G). The designation was intended to allow management of the corridor as a multi-purpose resource while preserving and enhancing the area's natural, aesthetic, cultural, and historic value for public use, and protecting the corridor's environmentally sensitive areas. Land development within the MRCCA is subject to requirements of Minnesota Rules 6106, which are implemented through local plans and ordinances.

Additional information is available from the MDNR at:
https://www.dnr.state.mn.us/waters/watermgmt_section/critical_area/faqs.html

2.7.2 Public Waters

~~Development of the LMRWMO member cities has resulted in alterations to the natural hydrologic system. To facilitate development, natural drainages have been diverted or piped, wetlands had been drained or filled, and stormwater infrastructure was constructed.~~

Surface waters classified by the MDNR as public waters are presented in Figure 2-11. The MDNR designates certain water resources as public waters to indicate those lakes, wetlands, and watercourses over which the MDNR has regulatory jurisdiction. By statute the definition of public waters includes both "public waters" and "public waters wetlands." The collection of public waters and public waters wetlands designated by the MDNR is generally referred to as the public waters inventory, or PWI.

Public waters are all water basins (i.e., lakes, ponds, wetlands) and watercourses (i.e., streams, rivers) that meet the criteria set forth in Minnesota Statutes, Section 103G.005, Subd. 15 that are identified on public water inventory maps and lists authorized by Minnesota Statutes, Section 103G.201. The regulatory boundary of public waters and public water wetlands is called the ordinary high water level (OHWL). For watercourses, the OHWL is generally the elevation of the top of the bank of the channel. A MDNR permit is required for work within designated public waters. Additionally, shoreland development requirements may exist for public waters with shoreland classifications. Table 2-5 summarizes the public waters located within the watershed. PWI maps and lists are available on the MDNR's website: http://www.dnr.state.mn.us/waters/watermgmt_section/pwi/maps.html.

Table 2-5 Major Public Waters and Streams within the LMRWMO

Resource Name	Public Water ID Number	City	Area (acres)	Length[2] (miles)	Lake (P) or Wetland (W)	MDNR Shoreland Classification[3]	LMRWMO Priority Water[4]
Mississippi River	01001a	Lilydale; St. Paul; South St. Paul; Inver Grove Heights; Mendota Heights	--	19	--	--	1A
Interstate Valley Creek	--[1]	Lilydale, Mendota Heights	--	2.5	--	--	1A
Ivy Falls Creek	--[1]	Lilydale, Mendota Heights	--	2.2	--	--	1A
Kaposia Creek	--[1]	South St. Paul, West St. Paul	--	3.0	--	--	1A
Lake Augusta	19-0081	Mendota Heights	33	--	P	Recreation	1B
Dickman Lake	19-0046	Inver Grove Heights	20	--	P	--	--
Golf Course Pond	19-0049	Inver Grove Heights	14	--	P	Recreation	--
Hornbeam Lake	19-0047	Sunfish Lake; Inver Grove Heights	20	--	P	Recreation	1B
Horseshoe Lake	19-0051	Sunfish Lake	15	--	P	Recreation	--
Lemay Lake	19-0082	Mendota Heights	36	--	W	Natural	2
Marcott Lakes	19-0039	Inver Grove Heights	12	--	W	--	--
(Unnamed)	19-0040		7	--	W	Natural	--
(Rosenberger)	19-0041		22	--	P	Recreation	2
(Ohmans)	19-0042		27	--	P	Natural	2
Pickerel Lake	19-0079	Lilydale; St. Paul	78	--	P	Natural	2
Rogers Lake	19-0080	Mendota Heights	107	--	P	Recreation	1A
Schmitt Lake	19-0052	Inver Grove Heights	57	--	P	General	--
Seidls Lake	19-0095	South St. Paul; Inver Grove Heights	4	--	W	--	1A
Simley Lake	19-0037	Inver Grove Heights	11	--	P	Recreation	2
Sunfish Lake	19-0050	Sunfish Lake	51	--	P	Recreation	1B
Thompson Lake	19-0048	West St. Paul	7	--	W	Natural	1A

Source: MDNR Public Waters Inventory; MDNR Streams and Rivers dataset

(1) Interstate Valley Creek, Ivy Falls Creek, and Kaposia Creek are not classified as Public Waters

(2) Length within or adjacent to the LMRWMO

(3) https://www.dnr.state.mn.us/waters/watermgmt_section/shoreland/lake_shoreland_classifications.html

(4) See LMRWMO priority waterbody classifications in Section 3.3.

Placeholder for public waters

Figure 2-11 Public waters within the LMRWMO

~~2.7.3 LMRWMO Priority Waters~~

~~There are many surface water resources within the LMRWMO. Many of these are classified as public waters by the MDNR (see Figure 2-11). In order to prioritize resource protection and management efforts, the LMRWMO has classified the waterbodies as LMRWMO priority waters (see Table 2-6).~~

~~**Table 2-6 LMRWMO Priority Waterbodies**~~

~~Priority Level~~	~~LMRWMO Waterbodies~~
~~**Priority 1A**~~	~~• Mississippi River • Interstate Valley Creek • Ivy Falls Creek • Kaposia Creek • Thompson Lake • Rogers Lake • Seidls Lake~~
~~**Priority 1B**~~	~~• Hornbeam Lake • Lake Augusta • Sunfish Lake~~
~~**Priority 2**~~	~~• Copperfield Pond • Lemay Lake • Ohmans Lake (Marcott) • Pickerel Lake • Rosenberger Lake • Simley Lake~~

~~Note: Additional information about classification process and criteria is presented in Section 3.3 and Table 3-1.~~

~~These waters have been classified as priority waters due to a combination of recreational use and value, ecological function and quality, and local priorities (see Section 3.3). As priority waters, the LMRWMO has established measurable water quality goals for these resources (see Section 4.1) and identified implementation activities (see Section 5.0 and Table 5-1) to manage these resources. The LMRWMO also cooperates with its member cities, Metropolitan Council, MPCA, and others to monitor the water quality of these resources. Omission of a waterbody from the LRRWMO priority waters list does not prevent or prohibit the LMRWMO from taking action to manage these waterbodies, if need should arise (note: an amendment to this Plan may be required).~~

~~2.7.4~~2.7.3 Wetlands

Wetlands in the LMRWMO are important community and ecological assets. Wetlands provide recreational value, runoff storage and retention, nutrient and sediment reduction, groundwater recharge, and wildlife habitat benefits. To protect these valuable resources, the LMRWMO and its member cities cooperate to manage wetlands to achieve no net loss of acreage, functions, and value. Within the watershed, the

member cities serve as the Local Government Units (LGUs) responsible for administration of the Wetland Conservation Act (WCA) (except for on Minnesota Department of Transportation projects) and implement local performance standards (see Table 4-1). The LMRMWO has established minimum wetland buffer standards (see Section 4.4.3). More information about WCA guidance is provided at the BWSR website: https://bwsr.state.mn.us/wetlands-regulation-minnesota

The US Fish and Wildlife Service (USFWS) maintains an inventory of wetlands known as the National Wetland Inventory (NWI). Wetlands identified in the NWI are presented in Figure 2-12. The NWI is periodically updated and was last updated for the area of the LMRWMO from 2010 to 2013 (MacLeod and Paige, 2013). Some member cities have completed comprehensive wetland inventories that include functions and values assessment. Additional detail is available in the 2040 Comprehensive Plans of the member cities.

Within all LMRWMO member cities, wetlands are inventoried on an individual basis as part of development proposals. The LMRWMO requires functional values assessment of wetlands to be performed using the Minnesota Routine Assessment Method for Evaluating Wetland Functions (MnRAM), version 3.2, or similar methodology. Information about wetland functional assessment is available from BWSR are: www.bwsr.state.mn.us/wetlands/mnram/index.html.

Placeholder for NWI

Figure 2-12 National Wetland Inventory

~~2.7.5~~2.7.4 Surface Water Monitoring and Modeling

Surface water quality data exists for many of the water bodies within the watershed. Several organizations have performed monitoring based on particular needs and priorities, including:

- LMRWMO
- LMRWMO member cities
- Metropolitan Council
- Minnesota Pollution Control Agency (MPCA)
- U.S. Geological Survey (USGS)

Monitoring parameters vary by monitoring program, but may include:

- Water chemistry (e.g., phosphorus, total suspended solids, chloride)
- Biological data (e.g., indices of biological integrity, macroinvertebrates, fish inventories)
- Hydrologic data (e.g., flow, water level)
- Physical parameters (e.g., water clarity (Secchi depth), temperature)

Monitoring locations within the watershed are presented in Figure 2-14. Much of the historical monitoring data for the watershed is available from the MPCA's Environmental Data Access (EDA) database at: https://www.pca.state.mn.us/eda-surface-water-data

~~2.7.5.1~~2.7.4.1 Water Quality Monitoring

The LMRWMO and its member cities sponsor regular or semi-regular water quality monitoring of several waterbodies through the Metropolitan Council's Citizen Assisted Monitoring Program (CAMP). Through CAMP, volunteers collect water samples from the top 0-2 meters of the lake and measure water clarity approximately 7 to 14 times between April and October. Collected samples are analyzed by the Metropolitan Council for nutrients and other water quality parameters. More information is available from the Metropolitan Council at: https://metrocouncil.org/Wastewater-Water/Services/Water-Quality-Management/Lake-Monitoring-Analysis/Citizen-Assisted-Monitoring-Program.aspx

Lakes and streams within the LMRWMO have been monitored at varying frequencies; a summary of water quality monitoring is presented in Appendix B and is available from the LMRWMO website. The LMRWMO creates water monitoring factsheets to track trends for specific waterbodies. These factsheets can be found on the LMRMWO website at: https://lmrwmo.org/water-resources/

Water quality and clarity trends in LMRWMO lakes are summarized in Table 2-6; data presented in Table 2-6 is summarized from MPCA analysis available at: https://webapp.pca.state.mn.us/surface-water/search

Table 2-6 LMRWMO Lake Water Quality Monitoring Data and Trends (2012-2021)

Resource Name	MDNR ID	Secchi Depth (m)[1]	Total Phosphorus (ug/L)[1]	Chlorophyll *a* (ug/L)[1]	Trends[2]	Monitored Years
Sunfish Lake	19-0050	2.6	30	19	Improving ~~SD~~Secchi depth	2012-2021
Hornbeam Lake	19-0047	1.8	45	17	No trends	2014-2021
Horseshoe Lake	19-0051	2.7	34	9	Improving Secchi depth~~SD~~	2012-2021
Seidls Lake	19-0095	1.3	54	18	Improving TP	2012, 2014, 2019-2021
Pickerel Lake	19-0079	1.1	73	26	No Trends	2012-2019, 2021
Dickman Lake	19-0046	3.3	104	48	NA	2020-2021
Thompson Lake	19-0048	1.4	65	15	No trends	2016-2021
Rogers Lake	19-0080	1.6	27	5	No trends	2012-2021
Schmitt Lake	19-0052	--	55	20	NA	2020-2021
Lake Augusta	19-0081	0.3	138	136	No trends	2013, 2016-2021
Lemay Lake	19-0082	1.7	35	5	No trends	2013-2021

Source: CAMP monitoring data; select data available from MPCA at https://webapp.pca.state.mn.us/surface-water/search

(1) Secchi depth, total phosphorus (TP), and chlorophyll *a* values are summer average of each monitored year, averaged over all monitored years between 2012-2021.

(2) Trends are calculated using Mann-Kendall test on last 10-years of data with 95% confidence; trends are not calculated for lakes with fewer than 5 years of data from 2012-2021.

Data collected for the Mississippi River in the Twin Cities Metro Area has been summarized by the MPCA and is available at: https://www.pca.state.mn.us/water/watersheds/mississippi-river-twin-cities

~~2.7.5.2~~2.7.4.2 Water Quality Modeling

Water quality modeling has been performed for portions of the LMRWMO support of the LMRWMO Watershed Restoration and Protection Strategies Report (MPCA, 2017). WRAPS modeling included water quality modeling of the following lakes and their tributary watersheds:

- Sunfish Lake
- Lake Augusta
- Rogers Lake

- Pickerel Lake
- Thompson Lake

Implementation strategies and activities recommended in the WRAPS report that have not already been completed have been incorporated, as needed, into the LMRWMO implementation schedule (see Section 5.1.4).

In addition to the WRAPS modeling, member cities have developed water quality models for all or portions of their jurisdictions to support local water and natural resource management efforts. More information is available in the local water management plans of each member city.

~~2.7.5.3~~2.7.4.3 Water Quantity and Hydrologic Monitoring and Modeling

Within the LMRWMO, various entities perform water quantity (e.g., flow, lake levels) monitoring. The United States Geological Survey (USGS) collects continuous streamflow data on the Mississippi River in Saint Paul dating back to 1892. Average annual flow at this location is approximately 12,500 cubic feet per second (cfs). Peak flows often occur in late spring and early summer and can exceed 100,000 cfs and raise the river level by over 20 feet (most recently reaching 116,000 cfs and 20.1 feet gage height on April 1, 2019). Peak annual flows from 1920 through 2019 are presented in Figure 2-13. Gage data is available from the USGS at: https://waterdata.usgs.gov/nwis/inventory/?site_no=05331000

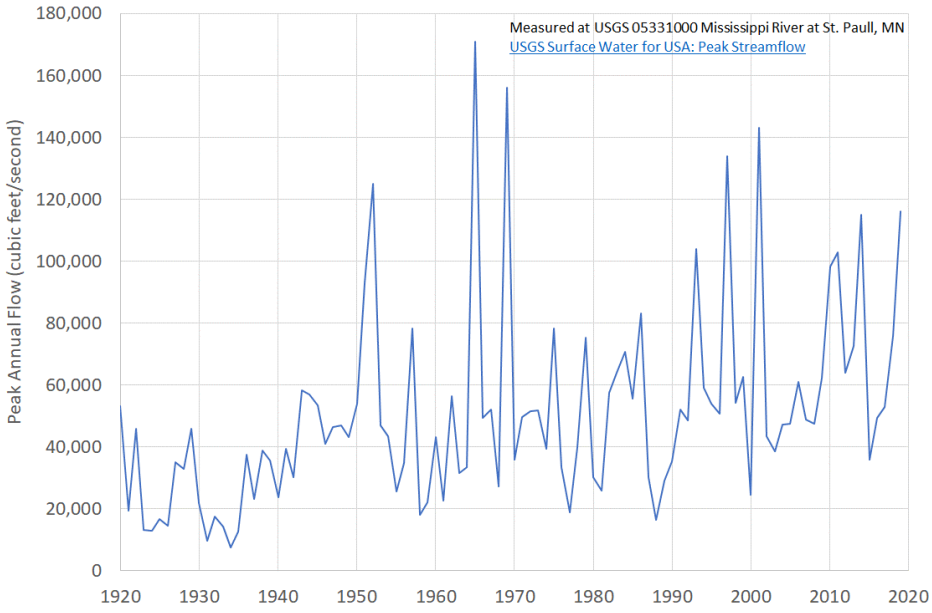


Figure 2-13 Mississippi River Peak Annual Flow at St. Paul from 1920 to 2019

The MPCA has performed limited continuous flow monitoring of Interstate Valley Creek in support of water quality studies (e.g., *Upper Mississippi River Bacterial TMDL*, MPCA, 2016) but does not plan to continue regular monitoring. Member cities have performed limited stormwater flow monitoring in support of specific studies.

~~*Any additional city monitoring efforts that should be noted here?*~~

Lake level data for several LMRWMO waterbodies is routinely collected and is available from the MDNR at: https://www.dnr.state.mn.us/lakefind/index.html

LMRWMO member cities have developed and maintain hydrologic and hydraulic models, as needed, to support local stormwater management (e.g., infrastructure planning, MS4 reporting). Additional information about city hydrologic and hydraulic models is included in the local water management plans of the member cities. The LMRWMO has developed hydrologic and hydraulic models for portions of the watershed in support of specific projects and analyses; these models vary in platform and level of detail and include:

- Highway 110-494 watershed (including Seidls Lake)
- Simon's Ravine
- Ivy Falls Creek
- East Lexington Avenue
- Mayfield Heights Road
- Akron Avenue

The LMRWMO plans to develop a watershed-wide hydrologic and hydraulic model leveraging existing models during the life of this Plan (see Table 5-1).

Placeholder for monitoring locations figure

Figure 2-14 Monitoring Locations

~~2.7.6~~2.7.5 Water Quality and Impaired Waters

The federal Clean Water Act (CWA) requires states to adopt water quality standards to protect the nation's waters. Water quality standards designate beneficial uses for each waterbody and establish criteria that must be met to support its designated use(s). The criteria differ depending on the waterbody's classification as a wetland, shallow lake, or deep lake. Section 303(d) of the CWA requires each state to identify and establish priority rankings for impaired waters that do not meet the water quality standards. The list of impaired waters, sometimes called the 303(d) list, is maintained by the MPCA and updated every 2 years.

For impaired waterbodies, the CWA requires an assessment that addresses the causes and sources of the impairment. This process is known as a total maximum daily load (TMDL) analysis. 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 for a waterbody and develops an allocation scheme amongst the various contributors, which include point sources, nonpoint sources, and natural background, 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 in MS4 communities), and a load allocation (LA) establishes allowable pollutant loadings from nonpoint sources and natural background levels in a waterbody.

Impaired waters within or adjacent to the LMRWMO are presented in Figure 2-15 and include the following:

- Interstate Valley Creek
- Mississippi River
- Lake Augusta
- Thompson Lake
- Pickerel Lake

The MPCA has identified Hornbeam Lake as nearly impaired though data collected since 2017 show the lake meeting applicable eutrophication water quality standards (see Appendix B). Table 2-7 summarizes ~~these~~ impairments and the status of applicable TMDLs. Completed TMDLs and associated implementation plans may contain actionable steps for the LMRWMO and its member cities. The LMRWMO and member cities have completed some actions recommended in the applicable TMDLs, while others are incorporated into the implementation schedule of this Plan. The LMRWMO will continue to review completed TMDLs and TMDL implementation plans and incorporate recommended actions into the LMRWMO implementation plan, where appropriate.

Current impaired waters listings are available from the MCPA website:
https://www.pca.state.mn.us/water/minnesotas-impaired-waters-list

Water quality standards vary according to lake depth and location (the LMRWMO is located in the North Central Hardwood Forest, or NCHF, ego-region); select standards are presented in Table 2-8.

Table 2-7 Impaired Waters within or Adjacent to the LMRWMO

Waterbody[1]	Impaired Use	Pollutant or Stressor	Year Listed	TMDL Study Target Completion	TMDL Study Approved
Lake Augusta	Aquatic Recreation	Nutrients/ Eutrophication	2010	--	2014[2]
Thompson Lake	Aquatic Recreation	Nutrients/ Eutrophication	2014	--	2014[2]
	Aquatic Life	Chloride	2016	--	2016[3]
Interstate Valley Creek	Aquatic Life	*E. coli*	2014	--	2016[5]
Pickerel Lake	Aquatic Consumption	Mercury in fish tissue	1998	--	2007[4]
Mississippi River	Aquatic Consumption	Mercury in fish tissue	1998	--	2007[4]
		Mercury in water	1998	--	2007[4]
		PCB in fish tissue	1998	2020	--
		PFOS in fish tissue	2008	2025	--
		PFOS in water	2014	2025	--
	Aquatic Life	Total suspended solids	2014	--	2015[6]
	Aquatic Life Aquatic Recreation	Nutrients/ Eutrophication	2016	2018	--
		Fecal coliform	1994	2022	2016[5]

Source: 2022 MPCA Impaired Waters 303(d) List.

PFOS = Perfluorooctane Sulfonate; PCB = Polychlorinated Biphenyl

(1) Sunfish Lake and Pickerel Lake were previously listed as impaired for nutrients/eutrophication
(2) Addressed by the *LMRWMO Watershed Restoration and Protection Strategies and Total Maximum Daily Loads* (MPCA, 2014)
(3) Addressed by the *Twin Cities Metro Area Chloride Total Maximum Daily Load* (MPCA, 2016)
(4) Addressed by the *Minnesota Statewide Mercury Total Maximum Daily Load* (MPCA, 2007, as revised)
(5) Addressed by the *Upper Mississippi River Bacteria Total Maximum Daily Load* (MPCA, 2016)
(6) Addressed by the *South Metro Mississippi River Total Suspended Solids Total Maximum Daily Load* (MPCA, 2015, as revised)

Table 2-8 Water quality standards applicable to LMRWMO Priority Waterbodies

MPCA Lake Classification	LMRWMO Priority Waterbodies (1A, 1B, and 2)	Select Water Quality Standards[1]				
		Total Phosphorus (µg/L)	Chloro-phyll *a* (µg/L)	Secchi Disk Depth (m)	Chloride (mg/L)[2]	Total Suspended Solids (mg/L)
Shallow Lake	Copperfield Pond Hornbeam Lake Lemay Lake Pickerel Lake Rogers Lake Rosenberger Lake Seidls Lake Simley Lake Thompson Lake	< 60	< 20	> 1.0	230	--
Deep Lake	Sunfish Lake Lake Augusta Ohmans Lake	< 40	< 14	> 1.4	230	--
Central Region River[3]	Ivy Falls Creek Interstate Valley Creek Kaposia Creek	<100	--	--	230	<30

Source: Minnesota Rules 7050 for NCHF eco-region; note that water quality standards for additional parameters are also applicable to District water resources

(1) Standards for total phosphorus, chlorophyll-a, and Secchi Disk Depth are summer average (June – September)
(2) The 230 mg/L chloride standard is the chronic standard, where two or more exceedances within a three year period are considered an impairment (as opposed to the acute standard which deems one exceedance over 860 an impairment).
(3) Site specific standards are established for the Mississippi River adjacent to the LMRMWO

Placeholder for:

Figure 2-15 Impaired Waters within the LMRWMO

~~2.7.6.1~~2.7.5.1 Watershed Restoration and Protection Strategies and Total Maximum Daily Loads (WRAPS and TMDLs)

The MPCA, in cooperation with the ~~LMRWOM~~LMRWMO, completed the *LMRWMO Watershed Restoration and Protection Strategies and Total Maximum Daily Loads* report (MPCA, 2014). In support of this study, the MPCA and its partners used water quality monitoring data from 2003-2012 to develop water quality models for five lakes within the LMRWMO:

- Sunfish Lake
- Lake Augusta
- Rogers Lake
- Pickerel Lake
- Thompson Lake

The WRAPS analysis identified internal loading from lake sediment as a primary source of phosphorus to Sunfish Lake and Lake Augusta (and a minor source to Rogers Lake and Pickerel Lake). In response, the LMRWMO, in partnership with the City of ~~ and the cities of Sunfish Lake and~~ Mendota Heights and residents of Lake Augusta~~s~~ and Sunfish Lake, performed in-lake alum treatments of these lakes in 2017 to reduce internal loading of phosphorus.

The WRAPS identified nutrient loading from the Mississippi River during seasonal flooding as a primary source of phosphorus to Pickerel Lake. Based on this data, Pickerel Lake was removed from the impaired waters list for excess nutrients.

Watershed phosphorus loading from untreated stormwater was identified as the primary source of phosphorus to Thompson Lake. Water quality in Thompson Lake is further impacted by the presence of polycyclic aromatic hydrocarbons (PAHs) in lake sediments. From 2017-2020, the LMRWMO, Dakota County, and city of West St. Paul cooperated to remove contaminated sediment and implement stormwater treatment practices in the north end of Thompson Lake to address nutrient loading and PAH issues.

More information about the MPCA's water quality analysis of the LMRWMO watershed is available at: https://www.pca.state.mn.us/water/tmdl/lower-mississippi-river-wmo-watershed-restoration-and-protection-strategy-wraps-project

~~2.7.7~~2.7.6 Stormwater Systems

The LMRWMO includes a mix of urban, suburban, and rural land use (see Section 2.3~~0~~). In developed areas, pre-settlement drainage patterns have been significantly altered as part of development activity, resulting in networks of stormwater management infrastructure designed to collect stormwater and convey it downstream. The stormwater system includes pipes, ponds, lakes, wetlands, ditches, streams, swales, and other drainageways. Most stormwater in the LMRWMO is ultimately routed to the Mississippi River. Public stormwater systems within the LMRWMO are presented in Figure 2-16. Figure 2-16 also includes minor subwatersheds delineated by member cities for stormwater management purposes.

Various units of government and private entities have jurisdiction over different parts of the stormwater system within the watershed. The Minnesota Department of Transportation (MNDOT) is responsible for maintaining the stormwater systems within their rights-of-way, such as U.S. highways (e.g., Interstate 494), and state highways (e.g., Highway 110). Dakota County is responsible for maintaining at least part of the stormwater systems within their rights-of-way, such as county roads and county state aid highways.

Each city within the LMRWMO has jurisdiction and maintenance responsibility over its own stormwater management systems. These systems include lateral (also called primary) stormwater systems (i.e., street gutters, pipes, and ditches) and outflow (also called main, trunk, or secondary) conveyors, which collect flows from city lateral systems and move the water downstream. Cities generally design lateral stormwater systems with capacity to convey runoff from 5- or 10-year frequency storms without significant flooding and protecting public health and safety for storms up to the 100-year frequency interval (these design levels are sometimes referred to as "level of service" and "level of protection"). City stormwater management systems are described in greater detail in each City's local water management plan.

Each city within the LMRWMO must obtain Municipal Separate Storm Sewer System (MS4) permit coverage from the MPCA. The MS4 Stormwater Program is designed to reduce the amount of sediment and pollution that enters surface water and groundwater from storm sewer systems. As a requirement of the permit, each city must develop and maintain a stormwater pollution prevention program (SWPPP) which outlines programs and practices to minimize pollutant loading and water quality impacts resulting from stormwater management. The SWPPP contains six areas of focus, known as minimum control measures, including:

- Public Education and Outreach
- Public Participation/Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Stormwater Runoff Control
- Post-Construction Stormwater Management
- Pollution Prevention/Good Housekeeping for Municipal Operations

A new general MS4 permit was issued by the MPCA in November 2020. Each member city will revise its MS4 program, if needed, to meet current MS4 permit and SWPPP requirements. Each MS4 permittee submits a report to the MPCA annually documenting the implementation of its SWPPP. Presently, the LMRWMO is not required to obtain MS4 permit coverage because it does not own stormwater management infrastructure. The MPCA periodically updates the MS4 General Permit. More information is available from the MPCA at: https://www.pca.state.mn.us/water/municipal-stormwater-ms4

Owners of private stormwater systems in the LMRWMO are generally responsible for maintaining their facilities. Member cities require maintenance agreements for private systems as part of project permitting.

Placeholder for:

Figure 2-16 Stormwater Systems

~~2.7.8~~2.7.7 Flooding and Floodplain Management

Floodplains are lowland areas adjacent to lakes, wetlands, and rivers that are susceptible to inundation of water during a flood. For regulatory purposes, the term "floodplain" refers to the area inundated during a flood or storm event with a 1 percent chance of occurring in any year (i.e., a 100-year event).

The Federal Emergency Management Agency (FEMA) performs flood insurance studies (FIS) and develops Flood Insurance Rate Maps (FIRMs) to identify areas prone to flooding during 100-year storm events. The water level corresponding to the 100-year flood event is referred to as the Base Flood Elevation (or BFE) and is the basis for the mapped floodplain extent. Figure 2-17 presents floodplains delineated by FEMA.

Each of the cities within the LMRWMO has a FIS. The FIS, together with a city's floodplain ordinance, allow the city to take part in the national flood insurance program (NFIP). Homeowners within FEMA-designated floodplains are required to purchase flood insurance. NFIP is implemented independently of the ~~District~~ LMRWMO and ~~are~~ is described herein for informational purposes. FEMA-established floodplains and 100-year flood levels are available from FEMA at: https://msc.fema.gov/portal/home

The Mississippi River is subject to periodic flooding during spring snowmelt and in response to intense, large-scale precipitation events. Adjacent to the Mississippi River, the cities of Saint Paul, South St. Paul, and Inver Grove Heights maintain levees to protect lands from periodic river flooding.

In addition to flooding adjacent to waterbodies, excessive runoff can overwhelm storm sewer infrastructure, resulting in localized nuisance flooding issues (e.g., standing water in streets, flooding in backyard swales). The LMRWMO member cities have prepared local water management plans containing more detailed information regarding localized flooding issues and management actions.

The performance standards of the LMRWMO and member cities include stormwater volume and rate control requirements to limit negative flooding impacts. Performance standards include criteria for minimum building elevations relative to the 100-year flood levels (see Section 4.2.3).

Placeholder for:

Figure 2-17 FEMA Floodplains

~~2.7.9~~2.7.8 Shorelands and Shoreland Management

Protection and management of shoreland areas is key to maintaining the beneficial uses of surface waters in the LMRWMO. Stable, vegetated shoreland areas ~~preserve~~ filter pollutants, slow runoff, and create habitat. The LMRWMO member cities implement shoreland protections through standalone shoreland ordinances and/or zoning requirements. The MDNR has established minimum shoreland protection requirements based ~~on~~on the following MDNR lake classifications (see Table 2-5):

- **Natural Environment Lakes** – Usually have less than 15 total acres, less than 60 acres per mile of shoreline, and less than three dwellings per mile of shoreline. They have some winterkill of fish; may have shallow, swampy shoreline; and are less than 15-feet deep.
- **Recreational Development Lakes** – Usually have between 60 and 225 acres of water per mile of shoreline, between 3 and 25 dwellings per mile of shoreline and are more than 15-feet deep.
- **General Development Lakes** – Usually have more than 225 acres of water per mile of shoreline, between 3 and 25 dwellings per mile of shoreline and are more than 15-feet deep.

The MDNR lake shoreline classification system is intended to help local governments appropriately regulate development in shoreland areas adjacent to each lake.

LMRWMO cities adjacent to the Mississippi River also maintain specific local controls to regulative development activity within the Mississippi River Critical Corridor Area (MRCCA), a 72-mile stretch of the Mississippi River including the LMRWMO. MRCCA protections established by the MDNR are implemented through local governments. More information about the MRCCA and associated critical area regulations is available at: https://www.dnr.state.mn.us/waters/watermgmt_section/critical_area/index.html

2.8 Natural Areas, Habitat, and Rare Features

The Mississippi River, as well as local lakes, streams, wetlands, and adjacent uplands, provide habitat for many species. White-tailed deer, gray and fox squirrels, cottontail rabbits, snowshoe hares, beavers, minks, muskrats, raccoons, loons, great blue herons, songbirds, and waterfowl are a few of the animals found along the Mississippi River.

Through the Natural Heritage and Nongame Research Program (NHNRP) the MDNR collects, manages, and interprets information about rare natural features, native plants and plant communities, and nongame animals, including endangered, threatened, and special concern species, including those within the LMRWMO. ~~As part of the NHNRP, t~~The MDNR maintains the Natural Heritage Information System (NHIS) as a statewide database of these resources. ~~The MDNR limits publication of spatial attributes and locations of these items to protect rare features or species from damage or collection~~. Additional information about rare, threatened, and endangered species is available from the NHNRP at: https://www.dnr.state.mn.us/nhnrp/index.html

Several lakes within the LMRWMO are MDNR-managed fisheries. The MDNR has regularly stocked walleye in Simley Lake and several species in Thompson Lake, including bluegill sunfish, channel catfish, and largemouth bass. The MDNR has periodically stocked Lemay Lake (last stocked in 2015 with black

crappie) and Rogers Lake (last stocked in 2014 with northern pike). The MDNR performs fishery surveys of these and other lakes. Lake-specific stocking and survey information is available from the MDNR lakefinder website at: https://www.dnr.state.mn.us/lakefind/index.html

The MDNR and its partners have also periodically performed fishery surveys of the Mississippi River. More information about the Mississippi River fishery is available from the MDNR at: https://www.dnr.state.mn.us/areas/fisheries/eastmetro/rivers/pool2.html

~~*Are there other local fish and game management activities that should be referenced?*~~

The MDNR's Minnesota County Biological Survey for Dakota County (1994, with Ramsey County) identifies pre-settlement vegetation. Prior to settlement, the LMRWMO was covered primarily by river bottom forest, oak barrens, and deciduous forest. River bottom forests occurred along the Mississippi River below the bluff, while areas of dense deciduous forest known as the "Big Woods" were concentrated in the center of the LMRWMO. Elm, sugar maple, and basswood are representative Big Woods tree species. Oak openings and barrens generally occupied the area between the bluffs and Big Woods. Small areas of prairie occurred in Mendota Heights and the south end of Inver Grove Heights. Figure 2-18 presents presettlement vegetation once present in the LMRWMO. Dakota County SCWD's Landscaping for Clean Water and other grant programs support native plantings to promote the benefits of native vegetation and their incorporation into the urban landscape.

~~*Do any member cities have additional natural area and/or wildlife preserve areas worth noting?*~~

Minnesota County Biological Survey also identifies sites of biodiversity significance. Several sites of moderate and outstanding biodiversity significance are present within the LMRWMO (see Figure 2-19). Areas of moderate biodiversity occur along Mississippi River Bluffs in Lilydale, St. Paul, and South St. Paul, along Kaposia Creek in South St. Paul, and around Marcott (Ohmans) Lake Inver Grove Heights. A large are of outstanding biodiversity occurs along the Mississippi River bluffs in the southeast of Inver Grove Heights. Additional information is available from the Minnesota Biological Survey at: https://www.dnr.state.mn.us/mbs/index.html

Placeholder for:

Figure 2-18 Presettlement Vegetation

Placeholder for:

Figure 2-19 Sites of Biodiversity Significance

2.9 Open Space and Recreation Areas

Approximately 9% of the watershed is occupied by park, open space, or preserve land uses. Open space and recreational areas are presented in Figure 2-20 and include regional and municipal parks. These areas provide opportunities for residents and people who recreate in the watershed to appreciate and connect with local water and natural resources. Major parks located within the watershed include:

- Cherokee Heights/Lilydale Regional Park
- Thompson County Park (Dakota County)
- Dodge Nature Center
- Kaposia Park

Popular recreational opportunities within the LMRWMO include activities like boating, fishing, hiking, walking, biking, and others. There are several public water access points within the watershed, including parks adjacent to Rogers Lake, Thompson Lake, Seidls Lake, Simley Lake, and the Mississippi River. The Mississippi River is a State Canoe Route operated by the MDNR Division of Trails and Waterways; the MDNR maintains public boat access on the Mississippi River in Lilydale and South St. Paul. Dakota County Parks maintains a listing and maps of trail systems throughout the county.

Parks, trails, and other open spaces may also provide stormwater management opportunities for the LMRWMO and its member cities. In addition to providing physical space for BMPs, these spaces are often in an ideal location situated between the non-point pollutant source (e.g., urban development) and the receiving water (e.g., lakes, ponds, wetlands). Implementing BMPs in parks and other areas frequented by the public can further enhance demonstration and education benefits.

2.9.1 Mississippi National River and Recreational Area (MNRRA)

The Mississippi National River and Recreational Area (MNRRA) is a 72-mile corridor of the Mississippi River that stretches through the Minneapolis-St. Paul metropolitan area (see Figure 2-20). The MNRRA was established by the federal government to develop policies and programs for:

- the preservation and enhancement of the environmental values of the area
- enhanced public outdoor recreation opportunities in the area
- the conservation and protection of the scenic, historical, cultural, natural, and scientific values of the area
- the commercial use of the area and its natural resources, consistent with the protection of the values for which the area was established

The extent of the MNRRA coincides with the Mississippi River Corridor Critical Area (MRCCA) Program. The MRCCA Program is a joint state, regional and local government program that provides coordinated land planning and regulation within the MNRRA. Within this area, management plans, ordinances, and zoning regulations limit development activity to protect critical areas including bluffs, wetlands, floodplains, native vegetation, and cultural/historical sites. Regulations are administered by local government units, including the LMRWMO cities adjacent to the Mississippi River. More information is

available from the MDNR at:
https://www.dnr.state.mn.us/waters/watermgmt_section/critical_area/index.html

Placeholder for:

Figure 2-20 Open Spaces and Recreational Areas

2.10 Potential Pollutant Sources

The sources of water pollution in the LMRWMO are many and varied. Potential pollutant sources in the watershed include permitted pollutant sources, potentially contaminated sites, leaking above- and below-ground storage tanks, unsealed wells, and non-point sources (stormwater runoff and associated pollutants from roads, parking lots, other impervious surfaces).

The MPCA maintains a database of potential environmental hazards, which includes permitted sites (air, industrial stormwater, construction stormwater, wastewater discharge), hazardous waste generating sites, leak sites, petroleum brownfields, tank sites, unpermitted dump sites, and sites enrolled in the Voluntary Investigation and Cleanup (VIC) program. This information is available online through the MPCA's What's in My Neighborhood program. Sites identified in this database are presented in Figure 2-21.

The presence of potentially contaminated or hazardous waste sites should be considered as sites are redeveloped and BMPs are implemented. The presence of soil contamination at many of these sites, if not removed, may limit or prevent infiltration as a stormwater management option due to the potential for infiltrating stormwater to carry or spread contamination to surrounding soils and groundwater.

More information about potential pollutant sources is available from the MPCA website: http://www.pca.state.mn.us/index.php/data/wimn-whats-in-my-neighborhood/whats-in-my-neighborhood.html

In addition to point sources of pollution, stormwater runoff can be a significant source of some pollutants (see Table 2-9). Each city within the LMRWMO maintains a stormwater pollution prevention program (SWPPP) which outlines programs and practices to minimize pollutant loading and water quality impacts resulting from stormwater management (see Section 2.7.6).

Table 2-9 Pollutants Commonly Found in Stormwater

Stormwater Pollutant	Examples of Sources	Related Impacts
Nutrients: Nitrogen, Phosphorus	Decomposing grass clippings, leaves and other organics, animal waste, fertilizers, failing septic systems, atmospheric deposition	Algal growth, reduced clarity, other problems associated with eutrophication (oxygen deficit, release of nutrients and metals from sediments)
Sediments: Suspended and Deposited	Construction sites, other disturbed and/or non-vegetated lands, eroding streambanks and shorelines, road sanding	Increased turbidity, reduced clarity, lower dissolved oxygen, deposition of sediments, smothering of aquatic habitat including spawning sites, and benthic toxicity
Organic Materials	Leaves, grass clippings	Algal growth, reduced clarity, other problems associated with eutrophication (oxygen deficit, release of nutrients and metals from sediments)
Pathogens: Bacteria, Viruses	Domestic and wild animal waste, failing septic systems	Human health risks via drinking water supplies, contaminated swimming beaches
Hydrocarbons: Oil and Grease, PAHs (Naphthalenes, Pyrenes)	Tar-based pavement sealant, industrial processes, automobile wear, emissions and fluid leaks, waste oil.	Toxicity of water column and sediment, bioaccumulation in aquatic species and throughout food chain
Metals: Lead, Copper, Cadmium, Zinc, Mercury, Chromium, Aluminum, others	Industrial processes, normal wear of auto brake linings and tires, automobile emissions & fluid leaks, metal roofs	Toxicity of water column and sediment, bioaccumulation in aquatic species and through the food chain, fish kill
Pesticides: PCBs, Synthetic Chemicals	Pesticides (herbicides, insecticides, fungicides, rodenticides, etc.), industrial processes	Toxicity of water column and sediment, bioaccumulation in aquatic species and through the food chain, fish kill
Chlorides	Road salting and uncovered salt storage	Toxicity of water column and sediment
Polycyclic Aromatic Hydrocarbons (PAH's)	Tar based pavement sealant	Carcinogenic to humans
Trash and Debris	Litter washed through storm drain networks	Degradation of the beauty of surface waters, threat to wildlife

Based on *Minnesota Urban Small Sites BMP Manual* (Barr Engineering Co, 2001).

Placeholder for:

Figure 2-21 Potential Pollutant Sources

3.0 Priority Issues and Resources

Prioritizing issues and resources to be addressed by the LMRWMO is an important step in focusing implementation activities over the life of this Plan (see Section 5.0). The LMRWMO designed an engagement plan to gather input on priority issues from various stakeholder groups. ~~LMRWMO~~ The LMRWMO Board of Managers reviewed ~~staff summarized and presented~~ the results of stakeholder input (see Appendix C) ~~to the Managers who ultimately~~and identified the priority issues and resources to be the focus of this Plan. This section of the Plan summarizes stakeholder input, priority issues (organized generally by topic area), and identification of priority resources.

3.1 Stakeholder Engagement and Issue Identification

At the outset of Plan development, LMRWMO staff and the Board of Managers designed a stakeholder engagement plan to solicit input from watershed residents, member cities, and technical partners. The Managers revised the engagement plan in response to public health recommendations related to the onset of the COVID-19 pandemic – many of the activities were shifted to virtual formats.

Figure 3-1 presents the sequence of stakeholder engagement ultimately leading to the Board of Managers issue and resource prioritization workshop.

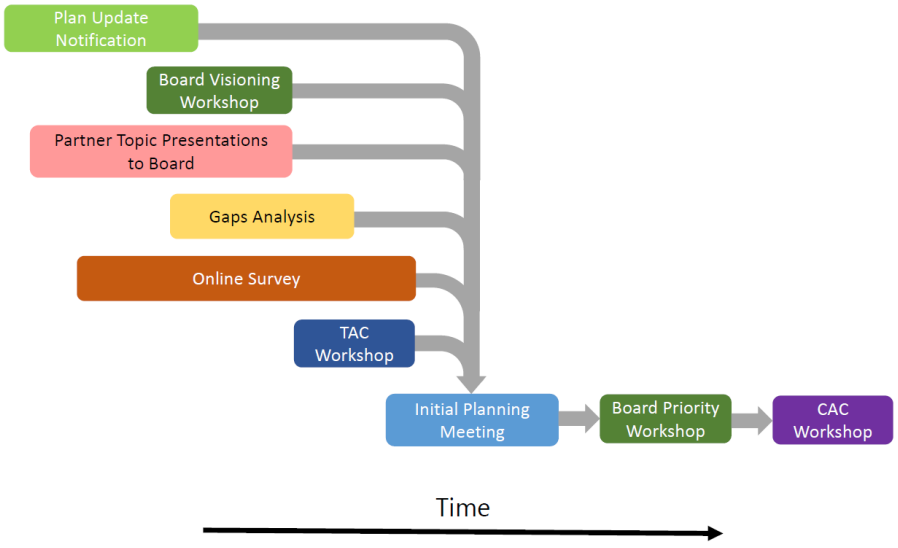


Figure 3-1 Stakeholder engagement workflow

Completed activities included:

- Soliciting responses to the Plan updated notification letter (see MN Rules 8410.0045)

- Board of Managers visioning workshop
- Gaps analysis based on review of 2011 LMRWMO Plan, member city plans, and current data
- Presentations to the Board of Managers from regional partners (Fall 2020 – Winter 2021)
- Resident survey hosted online from February 2021 through May 2021
- Technical Advisory Committee (TAC) issue identification meeting on June 3, 2021
- Public kickoff (initial planning) meeting (virtual) hosted June 9, 2021 (see MN Rules 8410.0045)
- Board of Managers workshop to discuss priority issues and resources on September 8, 2021
- Citizen Advisory Committee (CAC) priority issue discussion on September 16, 2021

LMRWMO staff summarized the results of member city/partners staff interviews, the online survey, and responses to the Plan update notification letter in individual memoranda to the LMRWMO managers. These memoranda were appended to a summary memorandum aggregating all stakeholder engagement results that was used to facilitate a Board of Managers issue and resource prioritization workshop on September 16, 2021. The summary memorandum and attachments are included as Appendix C.

3.1.1 Responses to the Plan update notification letter

The responses to Plan notification identified several focus areas related to natural resources as well as topics related to LMRWMO operations (i.e., how the Plan is implemented). Resource issues identified include:

- Focus on restoration of impaired waterbodies and those close to impairment, including:
  - Mississippi River
  - Interstate Valley Creek
  - Lake Augusta
  - Sunfish Lake
  - Thompson Lake
- Protection of high-quality resources like Rogers Lake
- Chloride reduction
- Habitat and natural area protection near Pickerel Lake
- Updating outdated hydrologic modeling (e.g., Sunfish Lake)
- Aquatic invasive species prevention
- Management of subsurface sewage treatment systems (SSTS)
- Practices and outreach to promote groundwater protection and sustainability
- Drainage/erosion issues near County Road 43 and Trunk Highway 13
- Continued management of intercommunity flow issues to prevent future issues

Additional focus areas more closely related to "how" the Plan is implemented include:

- Emphasis of prioritized, targeted, and measurable methodology for goals and actions
- Evaluation of LMRWMO progress through implementation
- ~~Communicating~~ Communication of water quality data to the public

- ~~Focus~~ Clarification ~~on~~ of operation and maintenance ~~of~~ roles related to stormwater infrastructure
- Collaboration with partners regarding grants, education, monitoring, and technical assistance

3.1.2 Board of Managers Visioning

In June 2020, the Board of Managers reviewed the LMRWMO vision statement. Managers and City staff responded to questions about LMRWMO legacy, organizational objectives, leadership, and broad strategies for achieving its goals. Discussion of answers to the questions yielded consensus around the importance of partnerships and collaboration as core strategies to achieve WMO goals. There was also consensus regarding the priority and importance of the Mississippi River as a local and regional resource, but disagreement about whether it should be identified in the vision while other resources are not. The Board of Managers revisited the vision statement in May 2022, with consideration for other work completed as part of Plan development. Further discussion resulting in the proposal and adoption of the following LMRWMO vision statement:

Healthy lakes, streams, and River through partnerships, education, and coordinated action

3.1.3 Gaps Analysis of the 2011 Plan

Barr Engineering Co. (Barr) reviewed the 3rd generation LMRWMO Plan (2011 Plan) to identify potential gaps, conflicts, and/or inconsistencies between the 2011 Plan and current data, regulatory and guidance documents, studies, and water resource management practice. The gaps analysis also considered input received in response to the 2021 Plan update notification. The gaps analysis results are presented in detail in the August 5, 2020, memorandum to the Board of Managers entitled *LMRWMO 2021 Plan Update – Review of Existing Plans and Identification of Gaps*.

Themes and issues noted in the gaps are listed below:

- Additional/updated water quality impairments
- Prioritization of water resources for monitoring and action
- Data gaps regarding outfalls to the Mississippi River
- Chloride loading
- Precipitation trends and climate change
- Invasive species management
- Roles for LMRWMO in groundwater management
- Opportunities for increased public engagement (e.g., citizen advisory committee)
- Need for measurable goals and assessment of implementation progress

3.1.4 Technical Presentations from Regional Partners

From late 2020 through early 2021, Administrator Staff from Dakota County SWCD, Dakota County, and Barr presented on Plan-related topics including,

- Alternate Capital Improvement Project (CIP) funding options
- Water monitoring of LMRWMO waterbodies

- Addressing groundwater concerns in the LMRWMO
- Hydrology and modeling of landlocked basins
- LMRWMO/member city regulatory roles

These presentations provided additional information and discussion regarding potential priority issues identified in the responses to the Plan update notification letter (see Section 3.1.1) and gaps analysis (see Section 0).

3.1.5 Technical Advisory Committee (TAC) issue identification meeting

The Plan update Technical Advisory Committee (TAC) – comprised of staff of the LMRWMO member cities, Dakota County, Dakota SWCD, Metropolitan Council, and State plan review agencies – met on June 3, 2021, to discuss issues to be addressed in the Plan update. Discussion at the TAC meeting largely reiterated the issue topics and resources noted in the responses to the Plan update notification and those identified by the gaps analysis.

Issues specifically noted and discussed by the TAC included:

- Valley Creek as a priority stream
- Lake Augusta and Thompson Lake as water quality improvement priorities
- Consideration for focusing on high-recreational value lakes (e.g., Thompson, Seidls)
- Chloride is high priority for Dakota County, Metropolitan Council, and MPCA
- Groundwater quality related to manganese (with limited options to address)
- Groundwater use and overall sustainability
- Management and water quality impact of aquatic invasive species
- Focus in upland areas that drain to priority waterbodies
- Data gaps regarding outfalls to the Mississippi River
- Maintaining a priority on education and engagement
- High water levels, flooding of some landlocked areas

3.1.6 Public survey results

The LMRWMO hosted an online survey which was completed by 72 participants as of May 27, 2021. Survey participants skewed towards residents of Mendota Heights and West St. Paul but represented all LMRWMO member cities. The survey asked participants to describe how they interact with water resources, how they are affected by the health of water resources, and how specific waterbodies could be improved.

Issues frequently cited in the survey included:

- Water quality issues including aesthetics, algae, and water clarity concerns (57% of responses)
- Desire for improved recreational access/usability
- Need for more green infrastructure/low impact stormwater BMPs
- Need for continued/more resident education

- Degraded wildlife habitat
- Need for more/wider vegetated buffers around waterbodies
- Less salt use

Several specific water resources were identified for restoration and/or protection efforts, including:

- Lake Augusta
- Mississippi River
- Stormwater ponds
- Lily Pond
- Lemay Lake
- Thompson Lake
- Pickerel Lake
- Valley Creek
- Rogers Lake
- Mud Lake
- Mississippi River bluff areas

3.1.7 Public Kickoff Meeting

The LMRWMO Board of Managers virtually hosted a public kickoff meeting consistent with Minnesota Rules 8410.0045 on June 9, 2021. The LMRWMO Administrator and Barr staff presented Information on prior engagement and issue identification activities at the public meeting. The public kickoff meeting included a discussion period for attendees to provide input. Attendee comments focused primarily on water quality issues, specifically related to Lake Augusta. No previously unidentified issues were noted in the public meeting discussion.

3.2 LMRWMO Issue Prioritization

The LMRWMO Board of Managers participated in a workshop on September 16, 2021, to review issues ~~and~~ identified through stakeholder engagement (see Section 3.1 and Appendix C) and discuss priorities to be addressed in the 2023-2032 Watershed Management Plan. Discussion included identification of broad themes (e.g., water quality) as well as specific issues (e.g., Lake Augusta nutrient impairment). The Board of Managers also acknowledged that while there are many resource concerns in the watershed, focusing LMRWMO activity on priorities is necessary to achieve meaningful action with available financial resources. The Board also recognizes that there are other local and regional agencies who carry responsibility for and prioritize the issues identified as lower priority by the LMRWMO.

Ultimately, the LMRWMO Board of Managers identified the following priorities for this Plan:

Higher Priority Issues	Lower Priority Issues
▪ **Water quality**, including: o Stormwater runoff management o In-lake and in-stream water quality o Impaired waters (Lake Augusta, Thompson Lake) o Chloride management o Mississippi River outfalls and bluff erosion ▪ **Education and engagement**	▪ **Flooding and water levels** ▪ **Groundwater management, including:** o Drinking water quality o Groundwater conservation ▪ **Ecological Health**, including: o Upland area protections o Invasive species management o Vegetated buffers

▪ **Partner collaboration**, including: o Grant and cost-share projects o Regulatory framework	

Specific elements of the above issues ~~topics~~ are discussed in greater detail in the following sections. The LMRWMO Board of Managers will use issue priority levels as a guide for work planning and allocation of funding. Many of the resource issues identified in this Plan are interconnected. Thus, many of the goals, policies, and activities included in this Plan address multiple resource issues.

3.3 LMRWMO Priority Waterbodies

There are many ponds, lakes, wetlands, and streams within the LMRWMO. As part of Plan development, the LMRWMO Board of Mangers established a waterbody priority framework with consideration for stakeholder input, physical criteria, and water quality and hydrologic factors. Characteristics considered during the prioritization process included:

- Impairment status (i.e., listed as impaired by MPCA, omitting mercury impairments)
- Water quality trends and classification as "nearly impaired" or "barely impaired" by MPCA
- Waterbody size
- Intercommunity location
- Intercommunity drainage area
- Public access
- Enrollment in Fishing in the Neighborhood (FiN) program managed by MDNR
- Classification as a deep lake or shallow lake
- Ecosystem functions (including classification as a "natural development" lake by MDNR and/or subjectively scored)

The characteristics of 29 public waters (and three non-public waters streams) within the LMRWMO relative to these criteria were summarized and presented to the Board of Managers for consideration. Ultimately, the LMRWMO Board of Managers established a tiered priority framework including as described in Table 3-1. Note that the criteria listed in Table 3-1 are intended as a general guide for waterbody prioritization. The Board of Managers recognizes that each waterbody has unique water quality issues and watershed; the Board may adjust individual waterbody priority level based on changing conditions or considerations documented on a case-by-case basis.

Table 3-1 Priority Waterbody Classifications and Criteria

Priority Level	Description/criteria[1]	LMRWMO Waterbodies[2]
Priority 1A	Includes **major streams** or lakes with **public access** that meet one or more of the following **water quality criteria**: • Waterbody is **impaired** (excluding mercury impairments) • Waterbody is **nearly impaired** • Waterbody is **prioritized for protection** by the MPCA, or • Waterbody exhibits **degrading water quality trend** in clarity or total phosphorus	• Mississippi River • Interstate Valley Creek • Ivy Falls Creek • Kaposia Creek • Thompson Lake • Rogers Lake • Seidls Lake
Priority 1B	Includes lakes meeting priority 1A criteria but **lacking public access**	• Hornbeam Lake • Lake Augusta • Sunfish Lake
Priority 2	Includes waterbodies not identified as priority 1A or priority 1B that meet at **least two** of the following criteria: • Waterbody has **intercommunity drainage area** • Waterbody has **public access** • Waterbody has **high ecosystem value** • Waterbody is classified as a **deep lake** • Waterbody is included in the MDNR **Fishing in the Neighborhood (FiN)** program	• Copperfield Pond • Lemay Lake • Ohmans Lake (Marcott) • Pickerel Lake • Rosenberger Lake (Marcott) • Simley Lake

(1) Criteria are intended as a guide; the Board of Managers may adjust individual waterbody priority level on a case-by-case basis based on unique waterbody factors.

~~(1)~~(2) Other major LMRWMO waterbodies considered in planning but not elevated to Level 1A, 1B, or 2 priority include: Anderson Pond, Bohrer Pond, Dickman Lake, Friendly Marsh, Levander Pond, Lily Lake, Marthaler Pond, McGroarty Pond, Mud Lake, Pagel Pond, and Schmitt Lake.

Figure 3-2 LMRWMO Priority Waterbodies

3.4 Water Quality Issues

This section describes the significant water quality issues ~~of significance~~ present in the LMRWMO, including stormwater runoff quality and pollutant loading, ravine/bluff erosion and sedimentation, in-lake water quality, water quality, impairments,

3.4.1 Stormwater runoff and pollutant loading

Over time, development of the land within the LMRWMO for residential, commercial, industrial, and other uses has converted much of the naturally vegetated landscape to land uses with greater imperviousness (see Section 2.3~~0~~). Development and the associated increase in impervious surface (i.e., surfaces through which water cannot infiltrate) results in increased amounts of nutrients, chloride, sediment, and other pollutants carried in stormwater runoff (i.e., pollutant loading). Imperviousness and land disturbance (e.g., construction) also result in increased stormwater runoff rates and volumes which can contribute to erosion, threaten existing infrastructure, and increase flood risk. Figure 2-6 illustrates the extent of impervious area within the watershed.

Development also limits the natural ability of the landscape to mitigate the negative environmental impacts of stormwater runoff by reducing infiltration and retention. Infiltration or retention of stormwater runoff is often the most effective means of limiting the impacts of urbanization, as these methods reduce the total volume of runoff to the downstream receiving waterbodies and capture pollutants carried in that runoff. The LMRWMO, its member cities, partners, and private developers seek to limit negative environmental impacts of stormwater runoff through the design, installation, and operation and maintenance of best management practices (BMPs) designed to remove pollutants from stormwater. Proper operation and maintenance of these BMPs is necessary to achieve the intended benefits. As stormwater management infrastructure continues to age, maintenance, repair, and eventual replacement of infrastructure may place additional financial burden on cities and owners of private infrastructure.

Due to the already built up and very developed nature of the LMRWMO watershed with existing structures, utilities, and land ownership, the opportunities for the LMRWMO, member cities, and partners to implement cost-effective stormwater best management practices (BMPs) are limited. Therefore, redevelopment provides a key opportunity to retrofit or implement new stormwater BMPs in areas that may currently have inadequate treatment or none at all.

Regulatory standards implemented by member cities require private BMPs be installed and maintained to improve the quality of stormwater runoff for development or redevelopment projects meeting specific criteria (see Table 4-1). In areas tributary to select impaired waters (i.e., ~~regulatory~~ Regulatory ~~watersheds~~Watersheds, see Figure 2-3), the LMRWMO has established criteria to require stormwater treatment BMPs for smaller projects. (see Section 4.1.3). Monitoring of private stormwater facilities and enforcement of maintenance actions also presents a burden for member city staff capacity. Therefore, the LMRWMO seeks to generally maintain consistency between LMRWMO standards and NPDES standards in areas outside of the Regulatory Watersheds.

3.4.1.1 City MS4 Programs

Each city within the LMRWMO is required to maintain coverage under the State of Minnesota's Municipal Separate Storm Sewer System (MS4) permit program, The permit program is implemented by ~~The~~ the Minnesota Pollution Control Agency (MPCA) ~~is~~ as the delegated permit authority for the National Pollutant Discharge Elimination System (NPDES) in Minnesota. ~~Through this authority, the MPCA implements the Municipal Separate Storm Sewer System (MS4).~~ The MS4 permit program is designed to reduce the amount of sediment and other pollutants entering state waters from stormwater systems owned by cities or other public entities. Cities ~~with populations over 10,000 (or other qualifying criteria) must obtain MS4 permit coverage and~~ required to obtain permit coverage must develop a stormwater pollution prevention program (SWPPP) and adopt best practices. The SWPPP must address the following six minimum control measures (as they related to city stormwater management operations):

- Public education and outreach
- Public participation
- Detection and elimination of illicit discharges (non-stormwater discharges to stormwater systems)
- Construction site runoff controls (see Section 3.4.1.2)
- Post-construction runoff controls (see Section 3.4.1.2)
- Pollution prevention and municipal "good housekeeping" measures (e.g., maintenance)

~~They~~Each member city must ~~also~~ identify best management practices (BMPs) for each minimum control measure and submit an annual report on the implementation of the SWPPP. ~~The regulated entity~~ Cities must also identify ~~best management practices (~~BMPs~~)~~ they implement to reduce pollutant loading to impaired waters covered by a total maximum daily load (TMDL) study. ~~They must also identify BMPs for each minimum control measure and submit an annual report on the implementation of the SWPPP.~~

Requirements applicable to cities under the MS4 program are independent of LMRWMO requirements promulgated via LMRWO policy (see Section 4.0) but address many similar issues. Thus, the LMRWMO seeks to minimize redundancy and promote cooperative efficiency by generally aligning its activities and triggers for performance standards with the cities MS4 permits. For example, the LMRWMO provides member cities with public education materials that may be used to satisfy city MS4 permit requirements. Member cities may also satisfy local water plan content requirements (see Section 5.5.2) with MS4 permit materials.

~~The LMRWMO partners with Member Cities to assist in implementing programs or BMPs which overlap across City MS4 requirements and LMRWMO priorities to reduce redundancies in local water resource project implementation as well as providing public education, outreach, and engagement programming.~~

~~Each LMRWMO member city is an MS4 community and maintains permit coverage under this program.~~ More information is available from the MPCA at: https://www.pca.state.mn.us/water/municipal-stormwater-ms4

3.4.1.2 Erosion and Sedimentation

Sediment is a major contributor to water pollution. Although erosion and sedimentation are natural processes, they are often accelerated by human activities, including construction and redevelopment. Stormwater from streets, parking lots, and other impervious surfaces carries suspended sediment consisting of fine particles of soil, dust, and dirt in moving water. ~~Although erosion and sedimentation are natural processes, they are often accelerated by human activities, including construction and redevelopment.~~ In addition to excess sediment from upland areas, increased peak flows in streams can accelerate ravine and streambank erosion

Regardless of its source, sediment deposition decreases water depth, degrades water quality, smothers fish and wildlife habitat, and degrades aesthetics. Sediment deposition can also wholly or partially block stormwater infrastructure and contribute to flooding. Sediment deposition in stormwater ponds and wetlands also reduces the storage volume capacity, diminishing water retention and/or water quality functions of these resources.

Suspended sediment, carried in water, clouds lakes and creeks and disturbs aquatic habitats. Sediment also reduces the oxygen content of water and is a major source of phosphorus, which is frequently bound to the fine particles. Erosion also results in channelization of stormwater flow, increasing the rate of stormwater runoff and further accelerating erosion.

The Minnesota Pollution Control Agency (MPCA) implements the National Pollutant Discharge ~~Pollution~~ Elimination System (NPDES) Construction Stormwater General Permit to prevent or limit negative impacts from erosion and sedimentation. The program requires a permit for projects disturbing one acre or more and requires that the project ~~proposed~~ proposer develop a Stormwater Pollution Prevention Plan (SWPPP) that includes temporary and permanent erosion controls and water quality treatment practices. More information is available from the MPCA at: https://www.pca.state.mn.us/water/construction-stormwater

Within the LMRWMO, each member city implements and enforces erosion and sedimentation controls through their local water management plans, ordinances, and/or engineering design standards. Some member city erosion and sediment control regulations apply to much smaller development activities than the one acre threshold of the NPDES construction permit (see Table 4-1). Member cities may request the LMRWMO administrator and/or engineer review grading and erosion control plans at their discretion

3.4.1.3 Chloride loading

Chloride loading from runoff carrying road salt applied to roadways, parking lots, sidewalks, and other paved areas throughout the winter months is also a significant pollutant source. The chemical properties of sodium chloride make it effective at melting ice, but these properties also result in the chloride dissolving in water and persisting in the environment. At levels exceeding the water quality standard, chloride is toxic to aquatic life. Water samples from lakes, wetlands, streams, and groundwater show high chloride levels in urban areas across the state, including the Twin Cities Metropolitan Area (MPCA, 2016).

The LMRWMO member cities mitigate the environmental impact of their chloride use through practices outlined in their MS4 permits and following guidance in the Twin Cities Metro Area Chloride Management

Plan (MPCA, 2016). As of 2022, Thompson Lake is the only LMRWMO waterbody listed as impaired for chloride (listed in 2016). The City of West St. Paul's local water management plan contains more information regarding the City's efforts to reduce chloride loading. The LMRWMO is performing chloride monitoring of Thompson Lake in partnership with Dakota County.

The LMRWMO is also engaging in outreach and education campaigns in partnership with member cities to reduce chloride use in the LMRWMO, including a pilot Spanish Language chloride reduction training in partnership with the MPCA.

3.4.2 In-lake water quality

The lakes, wetlands, streams, and rivers within and downstream of the LMRWMO are valued resources that provide recreational and ecological benefits. Protecting the water quality of these resources by reducing pollutant loading (i.e., the accumulation of pollutants in a waterbody) is key to ensuring these benefits. Potential pollutant sources in the watershed include permitted sources, potentially contaminated sites, leaking above- and below-ground storage tanks, unsealed wells, and non-point sources such as stormwater runoff (see Section 3.4.1).

In LMRWMO lakes and wetlands, phosphorous is the pollutant of primary concern. As total phosphorus (TP) loads increase, it is likely that water quality degradation will accelerate, resulting in unpleasant consequences such as profuse algae growth or algal blooms (reflected in high chlorophyll-*a* concentrations). Algal blooms, overabundant aquatic plants, and nuisance/exotic species, such as Eurasian watermilfoil, purple loosestrife, and curly-leaf pondweed, will flourish and interfere with ecological function as well as recreational use and the aesthetics of waterbodies. Sediment is also a pollutant of concern. Sediment contributes to poor water clarity that affects vegetation growth and deposits onto stream and lake beds, impacting aquatic habitat. It is also a substrate to which phosphorus and other pollutants bind.

Internal loading is the movement of phosphorus from lake sediments up and into the water column. The phosphorus in the sediment may have accumulated over many years. ~~under~~ Under anoxic conditions and the presence of aquatic vegetation ~~(e.g.,~~such as curlyleaf pondweed,~~)~~ internal loading can be a major source of nutrients to lakes, leading to ~~water quality issues~~poor water quality. These impacts may be amplified in shallow lakes where wind action can mix the resuspended phosphorus into the lake's epilimnion (upper water layer). Internal loading presents a unique problem in that the load is already present in the water body, resulting from the cumulative effect of past loading, often from multiple sources.

The LMRWMO, Metropolitan Council, and/or member cities perform regular water quality monitoring of select waterbodies to identify and track water quality issues (See Section 5.1.4). Recent water quality data (2012-2021) for LMRWMO priority waterbodies is summarized in Table 2-6 and Appendix B. The LMRWMO performed an in-lake aluminum sulfate (alum) treatment of Sunfish Lake in 2017 resulting in water quality improvement (see Section 3.4.2.1). The LMRWMO also performed an alum treatment of Lake Augusta in 2017 (see Section 3.4.2.3); future Lake Augusta water quality improvement projects are also planned (see Table 5-1).

3.4.2.1 Impaired waters and TMDLs

The Minnesota Pollution Control Agency (MPCA) is the state regulatory agency primarily tasked with protecting and improving water quality in Minnesota. The MPCA maintains a list of "impaired waters" – lakes and streams in which pollutant concentrations are above thresholds considered the minimum to maintain the intended uses (e.g., aquatic recreation) of the lake or stream (see Section 2.7.5). For impaired waters, the MPCA partners with local governmental units (like the LMRWMO) to perform total maximum daily load (TMDL) studies that estimate pollutant reductions needed to achieve water quality standards (referred to as a waste load allocation, or WLA). WLA's are assigned to local governmental units (e.g., Cities, Counties, MnDOT) who are required to show progress towards pollutant reductions. WLAs for phosphorus often include reductions in phosphorus loading from the tributary watershed as well as reductions in in-lake phosphorus loading from sediment.

As of 2022, LMRWMO waterbodies listed on the MPCA impaired waters (303(d)) list include:

- **Thompson Lake** – impaired due to excess nutrients and chloride
- **Lake Augusta** – impaired due to excess nutrients
- **Interstate Valley Creek** – impaired due to bacteria (*Escherichia coli)*
- **Pickerel Lake** – impaired due to mercury
- **Mississippi River** – impaired due to mercury, mercury in fish tissue, PCB in fish tissue, PFOS in water, PFOS in fish tissue, total suspended sediment, excess nutrients, and fecal coliform

Additional information about impaired LMRWMO waterbodies and applicable TMDLs are presented in Section 2.7.5 and Table 2-7. Sunfish Lake and Pickerel Lake were previously listed as impaired due to excess nutrients but were delisted. Pickerel Lake was delisted because high nutrient levels are a result of Mississippi River flooding. Sunfish Lake was delisted in 2022 due to improved water quality following an in-lake ~~aluminum sulfate (~~alum~~)~~ treatment performed by the LMRWMO in 2017 to reduce phosphorus loading from sediments. The Sunfish Lake alum treatment was funded in part by state Clean Water Funds.

Current impaired waters listings are available from the MCPA website:
https://www.pca.state.mn.us/water/minnesotas-impaired-waters-list

3.4.2.2 Thompson Lake Nutrient Impairment

Thompson Lake was added to the MPCA's impaired waters list due to excess nutrients in 2014 (MPCA, 2014). Nutrient (specifically phosphorus) loading to Thompson Lake was evaluated as part of the Lower Mississippi River WRAPS study (see Section 2.7.5.1). Stormwater ~~runoff~~ discharges from Dakota County, MnDOT, and the City of West St. Paul with limited water quality treatment prior to reaching Thompson Lake ~~are~~ were identified as nutrient sources in the WRAPS study. The TMDL identified that a total phosphorus load reduction of approximately 30 lbs/growing season total phosphorus (or about 30%) from existing watershed sources was needed to achieve applicable water quality standards. In 2016, the LMRWMO partnered with Dakota County and the City of West St. Paul to construct stormwater treatment practices to improve the quality of stormwater entering Thompson Lake from the north. The project was partially funded with a Clean Water Fund (CWF) competitive grant and is estimated to reduce watershed

phosphorus loading by approximately 35%. The LMRWMO ~~will partner to~~ continues to monitor Thompson Lake to assess the impact of the project on water quality.

3.4.2.3 Lake Augusta Nutrient Impairment

Lake Augusta was added to the MPCA's impaired waters list due to excess nutrients in 2010 (MPCA, 2014). Nutrient loading to Lake Augusta was evaluated as part of the Lower Mississippi River WRAPS study (see Section 2.7.5.1). The WRAPS study estimated that the majority (>80%) of total phosphorus loading to Lake Augusta is due to internal release of phosphorus from lake sediments (i.e., internal loading). The TMDL identified a 76% reduction of total phosphorus (approximately 250 lbs/growing season) from internal loading as needed to achieve water quality standards. In 2016, the LMRWMO partnered with the City of Mendota Heights to perform an in-lake alum treatment to bind phosphorus to lake sediments and reduce internal loading. The project was funded in part by state Clean Water Funds. Post-treatment monitoring demonstrated the alum treatment reduced internal loading. However, high concentrations of total phosphorus have persisted in the lake (see Section 2.7.4). In 2022, the LMRWMO commissioned an additional diagnostic study of Lake Augusta (using state watershed-based implementation funding, or WBIF) to better understand possible sources of phosphorus and identify potential opportunities to improve water quality.

3.4.3 Mississippi River Outfalls and Bluff Erosion

Much of the stormwater runoff (and the sediment and pollutants carried in that runoff) in the LMRWMO watershed ultimately drains to the Mississippi River. Development of the watershed over time has led to increasingly concentrated stormwater and pollutant discharges, as larger areas of imperviousness are routed and discharged through stormsewer networks. Higher water volumes and peak flow rates can lead to erosion downstream of these stormsewer outfalls. Erosion and sedimentation concerns at stormwater outfalls are of particular concern near bluff areas. In these areas, steep natural topography can exacerbate ravine formation, increasing sediment loading and risks to public safety and infrastructure due to unstable ground.

While stormwater outfalls to the Mississippi River may be locations of concentrated erosion and sedimentation, they also provide opportunities for concentrated water quality treatment and trash and floatable debris collection. The degree to which problems and opportunities exist throughout the LMRWMO has not been fully characterized. During Plan implementation, the LMRWMO seek to better characterize issues related to Mississippi River stormwater outfalls through monitoring and assessment, identify opportunities for improvements, and implement practices to improve water quality and/or ecological stability.

3.5 Education and Public Engagement Issues

Education and public engagement are important avenues to protecting natural and water resources. Pollution prevention and other behaviors practiced by residents can cumulatively mitigate negative impacts to resources, limiting the need for expensive restoration action. Through communication and engagement, the LMRWMO and member cities can empower local advocates for watershed stewardship who are examples in their neighborhoods and communities. Engaged and supportive citizen advocates

can also support public funding for water quality improvement projects. Outreach and engagement also strengthen the relationships between the LMRWMO and the communities the LMRWMO and its partners serve. Partnerships to distribute outreach content and materials also provide the public with consistent messaging between and from the LMRMWO and cities.

The input received throughout the issue identification process highlighted continued priorities of education and outreach to achieve LMRWMO goals. Challenges include engaging a population of residents with diverse uses of water, diverse values and ideas about water, and varying capacity for action. Residents may lack the time, information, or financial resources to become aware of and engage in stewardship practices or participate in available programs. Over time, the LMRWMO's population has grown more racially and ethnically diverse (see Section 2.3~~0~~). Cultural and/or language barriers may limit the effectiveness of education and engagement strategies that do not consider such differences. The LMRWMO is beginning to address~~ing~~ such issues through activities including a pilot Spanish Language chloride reduction training in partnership with the MPCA.

The LMRWMO has provided financial support for outreach programs including Minnesota Water Stewards and Dakota County SWCD's Landscaping for Clean Water programs. The LMRWMO provides an avenue of access for the ~~Member~~ member ~~Cities~~ cities to participate in multiple educational programs, the Adopt-a-Drain program, Metro Watershed Partners educational resources, and other programs. Engagement with schools provides an avenue to reach large groups of residents but is challenging due to the LMRWMO including multiple school districts. Participation at community events is also an opportunity for the LMRWMO to engage with residents. Cooperation with regional partners may help overcome these issues. Generally, partners identified collaboration between the LMRWMO, member cities, Dakota County SWCD, and Ramsey County as an opportunity to provide consistent and effective water resources management outreach to ~~effectively achieve~~address shared water resource goals.

Potential water resource management issues identified for increased focus through education and outreach include, but are not limited to:

- Buffers and shoreline management
- Groundwater conservation
- Opportunities for residential cost-share BMPs (e.g., rain gardens, native plantings)
- Chloride and salt application

The LMRWMO continues to maintain its website as a primary means of sharing information and engaging residents and other stakeholders. The LMRWMO fully updated its website in 2022. The LMRWMO website is located at: www.lmrwmo.org

3.6 Partner Collaboration ~~Issues~~ and Funding Opportunities

The LMRWMO operates as a joint powers organization. The LMRWMO contracts with partner organizations to provide administrative, engineering, and other services. With limited staff, the LMRWMO relies heavily on collaboration with its member cities and other partners to pursue its goals.

Leveraging the staff resources and technical knowledge of member cities, Dakota County SWCD, Ramsey Conservation District, and other partners allows the LMRWMO to carry out its planned activities most efficiently. For example, the LMRWMO funds the water quality monitoring of priority waterbodies through the Metropolitan Council's citizen assisted monitoring program (CAMP). The LMRWMO partners with the Dakota County SWCD via an annual agreement for services to provide organizational staff (Administrator, project management, water monitoring, etc.) services. The LMRWMO provides ~~Member~~ member ~~Cities~~ cities with educational materials for them to use in their outreach programs. Member city outreach programs, newsletters, and social media distribute tailored educational messaging and promote opportunities for residents to get involved.

During Plan development, stakeholders noted that the LMRWMO implementation program should continue to emphasize partnerships with other entities to achieve shared goals. The LMRWMO implementation schedule (see Table 5-1) identifies potential partners for many planned ~~LMRMOW~~ LMRWMO activities.

3.6.1 Cost-share and Grant Funding

The LMRWMO general fund is paid by member city dues (see Section 5.3). The LMRWMO strives to be a responsible steward of public funds. As such, the LMRWMO balances its projects and programs to pursue its goals ~~is balanced~~ against a reasonable tax burden to its member cities. During Plan development, both the TAC and CAC generally cited funding as barriers to implementing resource protection or restoration projects (e.g., funding additional water quality retrofits beyond minimum requirements as part of commercial site redevelopment).

To maximize its financial capacity, the LMRWMO seeks to leverage cost-share opportunities and grant funding. Partnering with other entities may allow for the completion of projects that might be otherwise cost-prohibitive (e.g., collaboration with Dakota County to construct Thompson Lake improvements, partnering with Mendota Heights to perform the Lake Augusta alum treatment). Additionally, grant funding and BWSR's recently implemented watershed-based implementation funding (WBIF) will provide ~~additional~~ much needed financial resources to the LMRWMO and its member cities for Plan implementation. The LMRMWO will continue to use WBIF and pursue competitive State and local grants (e.g., BWSR, MDNR, MPCA, Met Council) as a means to carry out its implementation program (see Table 5-1).

3.6.2 Regulatory Framework

The LMRWMO does not implement a project review and permitting program. The LMRWMO ~~staff~~ may be asked to review specific projects but do not approve or deny permits. The LMRWMO instead relies on member cities to ensure that development and redevelopment projects meet applicable LMRWMO performance standards, which are~~,~~ quantitative criteria that member cities must meet and/or require developers to meet when implementing projects. LMRWMO and member city performance standards (current as of 2022) are briefly summarized in Table 4-1. The Board of Managers affirmed this arrangement as the preferred regulatory framework during Plan development.

Member cities must adopt standards at least as stringent as the LMRWMO within 2 years of Plan adoption; local standards are documented in city code/ordinances, local water management plans, and/or city engineering standards documents. Each city executes a project review, permitting, and enforcement program to ensure compliance with LMRWMO and local standards. With this Plan, the LMRWMO has established water quality performance standards for development and redevelopment projects disturbing one acre or more throughout the LMRWMO (see Section 4.1.3 – Policy 1). ~~In~~ Within the LMRWMO's identified ~~"~~Regulatory Watersheds~~"~~ (watersheds tributary to select impaired Priority Level 1 lakes as shown in~~, see~~ Figure 2-3 and Figure 4-1), the trigger for water quality performance standards is ½ acre of disturbance (see Section 4.1.3 – Policy 2).

Alignment of LMRWMO and city performance standards can promote efficiency, while differences between LMRWMO and city performance standards can result in confusion for project proposers, inconsistent application of requirements, and a burden on member city resources. The LMRMWO has striven to maintain relative consistency with other applicable standards in developing its own performance standards to promote efficiency and limit the burden on cities. Additionally, ~~t~~The policies included in this Plan (see Section 4.0) include an active role for the LMRWMO in ensuring the ~~Member~~ member ~~Cities~~ cities have updated their code/ordinances to reflect local regulatory procedures and performance standards consistent with this Plan.

3.7 Flooding and Water Quantity Issues

In a natural, undeveloped setting, pervious ground cover allows water, including stormwater runoff, to infiltrate the soil. Land development and increased impervious areas alter natural drainage patterns and increase the rate and volume of stormwater runoff. The additional volume of runoff can increase water levels in ponds, lakes, ~~streams,~~ and wetlands, which increases the potential for erosion and flooding. Increased peak flows and volumes can cause significant erosion and bank stability issues in streams. ~~It also causes l~~Large, flashy flows in storm sewers can overwhelm design capacities~~, which~~ and increase~~s~~ the potential for flooding and property damage. Increased precipitation also results in high water tables ~~and increased groundwater flow to springs,~~ potentially threatening the stability and capacity of downstream structures.

Managing the risk of flooding is a focus of the LMRWMO and its member cities due to the potential threat to public health and safety, infrastructure, and the environment. In addition to property damage, flooding may cause other impacts that are harder to quantify, including the following:

- Flooding of roads making them impassable to emergency vehicles and residents
- Shoreline and streambank erosion
- Destruction or alteration of riparian habitats
- Restricted recreational use of waterbodies, trails, and adjacent lands
- More strain on budgets and personnel for repairing flood-damaged facilities and controlling public use of facilities during flooding events

The Federal Emergency Management Agency (FEMA) has identified areas prone to flooding during 100-year flood events to assist cities and residents in managing flood risk. FEMA-mapped floodplains

within the LMRWMO are generally limited to areas surrounding lakes, ponds, and streams and may not reflect localized flood risk related to stormwater conveyance systems (see Figure 2-17). Flooding of the Mississippi River has historically caused significant damage to LMRWMO communities. Several LMRWMO communities maintain levees to reduce flood risk adjacent the Mississippi River. This flooding is generally beyond the scope of the LMRWMO due to its regional nature.

During plan development, member cities did not identify intercommunity or significant local flood risk issues needing LMRWMO assistance. Member cities have identified minor local flooding issues (e.g., temporary backyard flooding). Many of these local issues are described in the member city local water management plans and do not warrant inclusion in this Plan.

While there are few existing flood risk issues, precipitation patterns are trending towards larger, more intense storms (see Section 2.1.2). NOAA's 2013 assessment of climate trends for the Midwest found that precipitation amounts are predicted to increase significantly over what is historically used in floodplain assessments and infrastructure design (NOAA, 2013). Stack et al. (2014) estimates that mid-21st century 24-hour precipitation events with a 1% chance of occurring in a given year (i.e., 100-year event) may exceed 10 inches in the Twin Cities Metropolitan Area, a significant increase over current design values (approximately 7.4" in the LMRWMO for the 100-year event, see Section 2.1.2). Understanding the hydrologic response of the watershed to large precipitation events is critical to identifying areas of flood risk and evaluating strategies to reduce flood risk or damages. The LMRWMO plans to create a comprehensive and updated watershed-wide stormwater model leveraging member cities modeling information ~~WMO plans to update watershed-wide modeling~~ (see Table 5-1) to better understand these risks and their interconnections.

Existing development throughout much of the LMRWMO limits the available physical space for stormwater BMPs to provide additional runoff detention or otherwise address the sources of local flooding issues. Appropriate rate and volume controls applied throughout the watershed are necessary to minimize future flooding issues. Regulatory controls implemented by member cities (e.g., floodplain ordinances) include criteria intended to limit adverse impacts to floodplains and minimize flooding (see Table 4-1). The negative impacts of flooding may be further minimized through future capital projects to increase storage or reduce flood risk in targeted areas~~by thoughtful management of the floodplain achieved through education and other activities~~.

3.8 Groundwater Management Issues

Maintaining clean, safe groundwater supplies is critical to human and environmental health and to the economic and social vitality of communities. Many residents within the LMRWMO obtain their drinking water from municipal groundwater wells and private domestic wells located primarily in Inver Grove Heights and Sunfish Lake (see Section 2.6.2).

Groundwater quality in northern Dakota County is generally good (Dakota County, 2020). However, surficial groundwater within the watershed is sensitive to contamination (see Figure 2-9). Potential sources of contamination include leaking underground storage tanks, unsealed wells, failing or non-performing subsurface sewage treatment systems (SSTS), infiltration of contaminated surface water, and others (see

2.10). Owners of private wells may not be aware of water quality issues (which may include elevated concentrations of nitrates, arsenic, and the presence of pesticides) due to the lack of any required testing.

Prevention of groundwater contamination through best management practices is critical to preserving existing groundwater quality. Once contaminated, groundwater may remain contaminated for long periods of time. Groundwater clean-up is expensive and technically complex, even when feasible. Increased public awareness of the importance of drinking water protection on the public's general health and well-being is critical to promote practices that protect the quality of groundwater. Groundwater susceptibility to contamination is presented in Figure 2-9.

While the LMRWMO and member cities promote infiltration as a preferred method of stormwater treatment, it may have negative consequences in areas with vulnerable groundwater resources. To protect these resources, member cities requires that infiltration practices be implemented with consideration of guidance provided by the MPCA MS4 general permit (2020, as amended), NPDES General Construction Stormwater permit (2018, as amended) and Minnesota Stormwater Manual.

Groundwater is a finite resource with inputs and outputs. The input is generally rainwater and snowmelt that ~~seeps~~ infiltrates into the ground (recharge). The outputs can be groundwater that is pumped out for human use and groundwater that naturally discharges to lakes, wetlands, and streams. The inputs and outputs need to be managed to ensure a sustainable and safe groundwater supply. Development generally results in more impervious area and more compacted soils decreasing opportunities for infiltration and recharge. Development often parallels population increases that may lead to additional groundwater use, further depleting this finite resource.

The Metropolitan Council estimated the impact to the Prairie du Chien-Jordan aquifer below the LMRWMO under several future scenarios in its *Regional Drinking Waters Supply, Groundwater Recharge and Stormwater Capture and Reuse Study – Southeast Metro Study Area* (2016). In that study, continued development of groundwater resources is estimated to result in aquifer drawdown in the south and west portions of the LMRWMO. In Inver Grove Heights, modeling suggests aquifer drawdown of up to 20 feet based on continued development of groundwater sources.

Various agencies such as the are responsible for aspects of managing groundwater quality and quantity in the LMRWMO including the MDNR, Minnesota Department of Health (MDH), MPCA, and Dakota County. For this reason, the LMRWMO' strategies related to groundwater issues focus on assisting other governmental organizations in their program implementation~~assistance for partners~~.

3.9 Ecological Health Issues

The water resources within the LMRWMO and the land that drains to them (i.e., watershed) provide many beneficial functions. Healthy lakes and adjacent shoreline areas provide valuable habitat for many types of wildlife including waterfowl, songbirds, raptors, mammals, fish, and amphibians. Healthy upland areas slow down and infiltrate runoff, filter pollutants from stormwater, provide habitat for wildlife, and increase resilience against negative impacts of climate change. The protection and restoration of vegetated buffers, wetland areas, and native species is important to maintain these functions.

3.9.1 Vegetated Buffers

Buffers are upland, vegetated areas located adjacent to waterbodies and are critical to waterbody health. Vegetation and organic debris shield the soil from the impact of rain and bind soil particles with root materials, reducing erosion. Vegetation obstructs the flow of runoff, thereby decreasing water velocities, allowing infiltration, and reducing the erosion potential of stormwater runoff. Leaf litter from vegetation can also increase the organic content of the soil and increase adsorption and infiltration. As a physical barrier, vegetation also slows the flow of water and filters sediment and other insoluble pollutants from runoff. Buffers also have habitat benefits; native plants provide the best food and shelter for native wildlife, fish, and amphibians. Buffers provide needed separation and interspersion areas for animals, to reduce competition and maintain populations.

The presence of adequate buffers is critical to preserving the ecological functions and environmental benefits of LMRWMO waterbodies. Establishing buffers in developed areas may be difficult, as existing structures may be located within the desired buffer area. Redevelopment offers an opportunity to establish adequate buffers in areas that are already developed. The LMRWMO requires member cities implement minimum wetland buffer widths, see Section 4.4.3. Member cities maintain vegetated buffer standards that require the establishment of buffers as part of new and/or redevelopment activity; many local buffer standards are linked to the quality/classification of the adjacent resource (e.g., wetland).

3.9.2 Aquatic Invasive Species (AIS)

The term "aquatic invasive species" (AIS) describes plants, animals, or microorganisms within lakes, wetlands, streams, and rivers that are non-native and threaten natural resources, economic resources, and/or human health. Under direction from the Minnesota Legislature, the MDNR established the Invasive Species Program in 1991. The program is designed to implement actions to prevent the spread of invasive species and manage invasive aquatic plants and wild animals (Minnesota Statutes 84D).

Invasive aquatic plant species including curlyleaf pondweed and Eurasian watermilfoil are present in some LMRWMO waterbodies (see ~~Member~~ member ~~City~~ city local water management plans). Curlyleaf pondweed is of special concern due to its potential as a source of internal phosphorus loading and may promote algal blooms which may further inhibit native macrophytes by reducing water clarity and blocking sunlight necessary for growth. Several invasive species of carp are present in the Mississippi River adjacent to the LMRWMO. Carp disrupt the native aquatic food chain resulting in recreational, economic, and ecological damage. Zebra mussels have not been identified in LMRWMO lakes but are present in the Mississippi River. Zebra mussels can clog water intakes and in large populations can impact the food chain by reducing food for larval native fish.

Although AIS are present in the LMRMWO, they are generally not present in significant density. AIS are managed locally by member cities in cooperation with Dakota County and the MDNR. Additional information about AIS is available from the MDNR at:
https://www.dnr.state.mn.us/invasives/ais/index.html

3.9.3 Wetlands Management

Healthy wetland systems are critical components of the hydrologic system and positively affect soil health, groundwater, surface water quality and quantity, wildlife, fisheries, aesthetics, and recreation. The ability of wetlands to attenuate runoff and filter pollutants ~~are~~ is important for protecting the water quality and ecological health of downstream resources. Overloading wetlands beyond their natural capacity with water, sediment, or nutrients can diminish their effectiveness in providing these ~~benefits~~water quality, aesthetic, and habitat benefits. The capacity of wetlands to perform these ecological functions is linked to the presence of vegetated buffers (see Section 3.9.1).

Development of the watershed for residential, commercial, and other land uses (see Section 2.3~~0~~) has resulted in the loss of many wetland areas and/or the degradation of remaining wetlands through hydrologic alteration and increased pollutant loading. Despite historical impacts, many wetlands areas remain (see Figure 2-12)

Within the watershed, member cities protect wetlands from further loss and degradation through administration of the Wetland Conservation Act (WCA) and local development standards (see Table 4-1.). The LMRWMO will support member cities in their efforts to protect, manage, and restore wetlands, where appropriate.

3.9.4 Upland and Natural Areas

Prior to settlement, the LMRWMO was covered primarily by river bottom forest, oak barrens, and deciduous forest (see Section 2.8 and Figure 2-18). Much of the landscape has been altered to accommodate residential, commercial, and other land uses. The remaining upland (i.e., non-wetland or shoreland) open spaces and are important resources. These areas include with native species that provide wildlife habitat benefits, infiltrate stormwater, filter pollutants, and mitigate suburban heat island impacts, among others. The loss or degradation of these areas limits the ability of the landscape to perform these functions as well as support recreational opportunities for residents and visitors.

Many of the natural areas present within the LMRWMO are located in municipal or regional parks and preserve areas (see Figure 2-20). Some include rare and diverse species and features (see Section 2.8). During Plan development, stakeholders identified the preservation, restoration, and expansion of natural areas as an important issue. The LMRWMO supports member cities and partners in their efforts to protect and restore natural areas. These issues and opportunities, however, are generally considered a lower priority for the LMRWMO due to the deferral of land use/zoning controls to member cities. When water quality and natural resources issues and improvement opportunities converge, the LMRWMO may partner on projects that address natural resources issues.

4.0 Goals, Strategies, and Policies

This section sets goals, strategies, and policies that reflect the vision and purposes of the LMRWMO and ~~to~~ minimize the negative impact of development and redevelopment on water ~~and natural~~ resources. This section is ~~generally~~ organized by issue area, although several goals, strategies, and policies will impact multiple issues. Within this ~~Plan~~section, ~~goals, strategies, and policies are defined as~~relevant definitions include:

Goals: Desired outcomes to help achieve the vision of the LMRWMO and the purposes of this plan.

Strategies: Activities the LMRWMO will undertake to help achieve their goals.

Policies: Standards that have been developed that require specific action or enforcement ~~of~~ by the member cities to help achieve the goals of the LMRWMO.

Included among the policies are **performance standards** – quantitative criteria that member cities must meet and/or require developers to meet when implementing projects. As the LMRWMO does not implement a project review and permitting program, member city adoption and enforcement of these (or more stringent) performance standards is necessary to ensure their effectiveness. LMRWMO and ~~Member~~ member city performance standards (current as of 2022) are briefly summarized in Table 4-1.

4.1 Water Quality

4.1.1 Water Quality Goals

G1. Maintain or improve water quality in LMRWMO priority 1A and 1B lakes to meet applicable state standards or existing 10-year (2012 – 2021) summer average water quality, if better than state standards, including:

Waterbody	Total Phosphorus (ug/L)		Chlorophyll *a* (ug/L)		Secchi Depth (m)	
	Lake Goal	MPCA Standard	Lake Goal	MPCA Standard	Lake Goal	MPCA Standard
Lake Augusta[1]	40	40	14	14	1.4	1.4
Hornbeam Lake[2]	45	60	17	20	1.8	1.0
Rogers Lake[2]	27	60	5	20	1.6	1.0
Seidls Lake[2]	54	60	18	20	1.2	1.0
Sunfish Lake[2]	30	40	19	14	2.6	1.4
Thompson Lake[1]	60	60	20	20	1.0	1.0

Notes:
(1) Goals based on applicable state standards for shallow and deep lakes (MN Rules 7050)
(2) Goals based on summer average (June – September) water quality observed from 2012-2021

G2. Reduce sediment and phosphorus loading to the Mississippi River and priority 1A streams.

G3. Reduce bacteria loading to Interstate Valley Creek through landowner education, outreach, and member city support.

G4. Work with member cities to implement practices to minimize chloride use in the watershed.

4.1.2 Water Quality Strategies

S1. The WMO will monitor (or fund member city/partner monitoring) of WMO ~~priority~~ Priority ~~level~~ 1A, 1B, and 2 lakes and streams through the Citizen Assisted Monitoring Program (CAMP) or similar programs. The WMO will annually determine monitoring activities based on impairments and water quality conditions. The WMO will cooperate with member cities to recruit and leverage volunteers, where possible. The WMO will defer monitoring of the Mississippi River to state and regional partners.

S2. The WMO will use available monitoring data to evaluate water quality trends in WMO ~~priority~~ Priority 1A, 1B, and 2 waterbodies.

S3. The WMO will maintain a list of priority waterbodies classified according to water quality issues, recreational and ecological value, intercommunity location, and other factors. The WMO will consider waterbody priority level when designing and executing the WMO implementation schedule (see Section 5.0) and in annual work planning.

S4. The WMO will assist member cities in designing and implementing water quality improvement projects to address pollutant load reductions identified in current and future Total Maximum Daily Load (TMDL) studies.

S5. The WMO will work with member cities to maintain or improve the water quality of LMRWMO priority waterbodies through technical assistance, feasibility studies, project cost-share, grant application and/or administration, public/landowner education and outreach, and other means appropriate to the waterbody priority and water quality issues.

S6. The WMO will use the "allowable load" water quality cost allocation methodology to allocate intercommunity water quality project costs among affected member cities, as needed.

S7. The WMO will collaborate with member cities and other partners to implement training and outreach designed to minimize chloride use in the watershed, targeting municipal and private users.

4.1.3 Water Quality Policies

P1. Member cities shall require permanent water quality treatment for projects ~~disturbing~~ that disturb one acre or more (including projects less than one acre that are part of a larger common plan of

development totaling one acre or more). Volume reduction practices shall be considered as the preferred water quality treatment practice provided that infiltration can be achieved consistent with the guidance and prohibitions described in the MPCA's MS4 Stormwater General Permit and Minnesota Stormwater Manual. Minimum water quality treatment volumes are defined for non-linear and linear projects as:

- **Non-linear projects:** 1 inch of runoff from new or redeveloped impervious surface.
- **Linear projects:** 1 inch of runoff from new impervious surface or 0.5 inch of runoff from new and redeveloped impervious surface, whichever is greater.

Where volume reduction practices are prohibited or cannot be achieved at reasonable cost, member cities may require wet detention, filtration, or other water quality treatment methods consistent with the most current version of the MPCA's MS4 Stormwater General Permit and Minnesota Stormwater Manual to achieve at least 50% total phosphorus removal (annual load from the total project site). Member cities may choose to enforce more stringent water quality performance standards.

P2. Member cities shall require permanent water quality treatment for projects that disturb ½ acre or more if more than half the parcel is located within a watershed tributary to LMRWMO Regulatory Waterbodies, as noted in Figure 4-1. Permanent water quality treatment requirements shall be consistent with those described in Policy 4.1.3-1. Member cities are encouraged to apply similar requirements throughout their jurisdiction. Member cities that contain an area comprising less than 10% of the area tributary to a Regulatory Waterbody are exempt from this policy.

P3. Member cities are encouraged to identify local priority areas implement more stringent stormwater treatment performance standards and/or engage developers in private/public partnerships to achieve water quality treatment above and minimum city-wide performance standards.

P4. Member cities shall require linear projects that disturb one acre or more (including projects less than one acre that are part of a larger common plan of development totaling one acre or more)~~disturbing more than one acre~~ to provide permanent stormwater treatment for consistent with member city performance standards and NPDES Construction Stormwater Permit requirements, as applicable.

P5. Member cities shall provide pretreatment of new stormwater discharges prior to reaching wetlands and other water resources. Member cities shall strive to provide pretreatment for reconstructed discharges. Pretreatment shall collect sediment, skim floatables, and be easily accessed for inspection and maintenance. (General Water Quality)

P6. Structural BMPs that treat stormwater shall conform to standard engineering practices documented in the Minnesota Stormwater Manual or equivalent design standard.

P7. The WMO requires MnDOT, Ramsey County, Dakota County, and other governmental agencies to meet the water quality treatment requirements outlined in this plan for runoff leaving their right-of-way, facilities, or easements. Regular maintenance of their stormwater facilities shall also be performed. (Goal 5.3.1 B)

P8. Member cities are encouraged to identify and pursue opportunities for stormwater quantity and stormwater quality improvement retrofits during reconstruction of existing City infrastructure.

4.2 Water Quantity and Flood Risk

4.2.1 Water Quantity and Flood Risk Goals

G5. Promote infiltration and reuse to reduce stormwater runoff volumes through member city volume control performance standards and the support of education and outreach activities.

G6. Minimize flood potential and reduce the number and/or flood risk of habitable structures within local floodplain areas in cooperation with member cities.

4.2.2 Water Quantity and Flood Risk Strategies

S8. The WMO will establish stormwater volume reduction requirements taking into consideration variable development and redevelopment conditions. This may include establishing LID policies to provide increased volume control for development and redevelopment projects. (Goal 5.2.1 A, Goal 5.2.1 B) ~~Suggest the deletion of this strategy concurrent with the addition of a new policy referencing city volume control standard (currently implemented by all cities by Lilydale).~~

S9. ~~B.~~ The WMO will continue to use the previously established intercommunity "design flows" (stormwater flow rates that the stormwater management system is expected to convey with fully developed conditions in the watershed) as the design parameters for downstream improvements.

S10. The WMO will ~~also~~ continue to use the previously established "allowable flows" (stormwater flow rate that an upstream community can discharge to a downstream community without incurring financial obligation for the stormwater system in the downstream community) as the basis for determining the financial obligation of member cities for intercommunity flooding and erosion control projects. Refer to ~~Appendix A for~~ the ~~joint~~ Joint ~~powers~~ Powers ~~agreement~~ Agreement and attached memoranda regarding established intercommunity design flow (allowable flow).

S11. The WMO will coordinate intercommunity stormwater runoff design and planning with the member ~~communities~~ cities by:

a. Reviewing the member cities' local watershed management plans for consistency with WMO goals and consistency with intercommunity planning.
b. Calculating the cost allocation between cities for water resources projects with intercommunity participation. (General Water Quantity)
c. Reviewing individual projects for consistency with applicable standards at the request of member cities.

S12. The WMO will continue to perform or require feasibility studies for projects impacting intercommunity drainage. Feasibility studies shall consider hydrologic and hydraulic impacts and intercommunity costs (if applicable). Studies performed by cities shall be provided to the WMO for review and comment prior to ~~project implementation~~finalization of project plans.

S13. The WMO will promote the use of infiltration, stormwater reuse, and other low impact development (LID) practices through its own education and outreach activities and support for partner programs (e.g., Dakota County SWCD's Landscaping for Clean Water program~~, Minnesota Water Stewards~~).

4.2.3 Water Quantity and Flood Risk Policies

P9. Member cities shall require Atlas 14 design storms (or newer LMRWMO-approved precipitation data) be used for assessment of hydrologic and hydraulic impacts, compliance with performance standards, and relevant calculations.

~~P9.~~P10. The level of protection along all trunk conveyors, streams, and channels and around all wetlands, ponds, detention basins, and lakes resulting from new development shall be based on the critical duration 100-year event. Member cities shall strive to meet this standard for redeveloped and/or reconstructed systems.

~~P10.~~P11. New non-trunk stormwater facilities shall provide discharge capacity for the critical-duration runoff event that is not less than the current five-year frequency event, preferably the current 10-year frequency event (level of service). Member cities shall strive to meet this standard for redeveloped and/or reconstructed systems.

~~P11.~~P12. Member cities are to ensure that proposed development, redevelopment, and/or infrastructure projects will not exceed the capacity of the existing downstream stormwater drainage system without consultation and approval of affected communities and/or organizations.

~~P12.~~P13. Member cities are to incorporate emergency overflow structures (e.g., swales, spillways), where feasible, into pond outlet structure designs to prevent undesired flooding resulting from storms larger than the 100-year (one percent) event or plugged outlet conditions.

~~P13.~~P14. Member cities are to incorporate multi-stage outlets into their pond designs to control flows from smaller, less frequent storms and help maintain base flows in downstream open channels, where practicable.

~~P14.~~P15. Member cities shall require minimum building elevations (including basement) at least one foot above the critical 100-year flood elevation for habitable structures adjacent to inundation areas. Member cities are encouraged to require higher minimum building elevations.

~~P15.~~P16. Regarding landlocked basins:

a. Member cities shall consider potential impacts to vegetation, erosion, water quality and public safety when designing, evaluating, and implementing strategies to manage water levels in landlocked basins (including evaluation of potential basin outlets).
b. Member cities shall prohibit increases in tributary drainage area to landlocked basins unless improvements (e.g., outlet) are implemented to prevent increased flood risk (or analysis demonstrates no increased flood risk).

~~P16.~~P17. Member cities are encouraged to consider long-duration precipitation and snowmelt events, prolonged periods of wet and dry conditions, past observed trends, and precipitation events larger than the 100-year event in evaluating and managing flood risk.

~~P17.~~P18. Member cities shall require the following for projects triggering a City stormwater management plan:

a. For new development and redevelopment, the peak stormwater runoff rate shall not exceed the existing peak rate for the 2-year, 10-year, and the 100-year storm events. "Subwatershed" may be the project site or may be an area of greater size for which an approved local water management plan meets this criterion.
b. Analysis of peak stormwater rates shall be performed using a hydrograph method based on sound hydrologic theory and Atlas 14 (or more recent) precipitation data.
c. Rates may be further restricted when the capacity of the downstream conveyance system is limited.

4.3 ~~Fish, Wildlife, and Habitat~~Ecological Health

4.3.1 ~~Fish, Wildlife, and Habitat~~Ecological Health Goals

G7. Promote fish and wildlife habitat and recreational opportunities by maintaining or improving water quality and shoreline integrity.

G8. Promote the incorporation of habitat benefits into stormwater BMPs.

4.3.2 ~~Fish, Wildlife, and Habitat~~Ecological Health Strategies

S14. The WMO will promote and support partner cost-share programs to implement shoreline protection, shoreline restoration, and upland restoration projects (e.g., Dakota County SWCD Landscaping for Clean ~~water~~ Water program or similar programs)

S15. The WMO will work with member cities to identify shoreline degradation issues and prioritize opportunities for shoreline restoration and protection actions, as requested.

S16. The WMO will work with member cities and partners to identify and pursue opportunities to incorporate habitat and/or recreations benefits into WMO and member city projects, as requested.

S17. The WMO will support engagement and outreach programs to promote habitat improvement via support in collaboration with member citiesy and partners environmental services staff (e.g., Dakota County SWCD Landscaping for Clean Water programMinnesota Water Stewards).

S18. The WMO will collaborate with Dakota County and member cities, as requested, to prevent the increase or minimize the occurrence of aquatic invasive species in collaboration with member cities.

S18.S19. C. The WMO will collaborate with member cities, as requested, to promote access to water bodies for recreation and education.

4.3.3 ~~Fish, Wildlife, and Habitat~~Ecological Health Policies

P19. Member cities shall maintain and enforce stream and lake vegetated buffer requirements for development and redevelopment projects that disturb one acre or more that average at least 15 feet and conform to applicable MnDNR shoreland rules.

P20. Member cCities are encouraged to implement native vegetation requirements on buffers as well as buffer requirements for smaller projects that disturb less than one acre, including residential development or redevelopment projects. ~~Stream and lake buffers shall be an average of at least 15 feet and conform to applicable MDNR shoreland rules.~~

P18.P21. Member cities shall consider and pursue, as feasible, opportunities to incorporate habitat, wildlife, and other ecological benefits during reconstruction of City infrastructure.

P19.P22. Member cities are encouraged to recommend or require project proposers to meet with City environmental staff to evaluate opportunities to incorporate, maximize, or preserve habitat and ecological benefits as part of project development.

P20.P23. Member cities shall maintain and enforce shoreland development standards that are at least as stringent as the requirements of the Minnesota DNR and included in Minnesota Rules 6120. Member Cities are encouraged to evaluate waterbodies and apply minimum buffer widths or shoreland ordinances to provide transitional habitat.

P21.P24. Member cities shall maintain and enforce local land use controls within the Mississippi River Critical Corridor Area (MRCCA) consistent with Minnesota Rules 6106, as revised.

4.4 Wetlands

4.4.1 Wetland Goals

G9. Pursue no net loss of wetlands due to human activity via support of member city roles as local governmental units (LGUs) responsible for wetland management.

4.4.2 Wetland Strategies

~~S19.~~S20. The WMO will support member city roles as LGU for administration of the Wetland Conservation Act (WCA) via technical assistance and participation in technical evaluation panels (TEPs), as requested.

~~S20.~~S21. The WMO will collaborate with partners to develop and distribute educational information regarding the protection and preservation of wetlands by property owners.

4.4.3 Wetland Policies

~~P22.~~P25. A. Member cities shall continue to serve as local governmental units (LGUs) responsible for administering the Wetland Conservation Act (WCA). MnDOT is the LGU for the WCA on its rights-of-way.

~~P23.~~P26. Member cities shall maintain and enforce wetland buffer requirements for development and redevelopment projects disturbing one acre or more. Vegetated wetland buffer distances shall be based on wetland classification (MnRAM or similar methodology) and shall be an average of at least 15 feet.

~~P24. Member cities shall maintain and enforce stream and lake buffer requirements for development and redevelopment projects disturbing one acre or more. Vegetated buffers adjacent to streams and lakes shall be an average of at least 15 feet and conform to applicable MDNR shoreland rules.~~

~~P25.~~P27. Member cities shall inventory, classify, and determine the functions and values of wetlands, either through a comprehensive wetland management plan or through the review of development and redevelopment projects that disturb one acre or more. Member cities developing or updating their comprehensive wetland management plans shall submit these plans to the WMO for review and comment.

4.5 Groundwater Protection

4.5.1 Groundwater Protection Goals

G10. Promote the protection of groundwater quality and quantity through annual collaboration with Dakota County, Ramsey County, Minnesota Department of Natural Resources, and/or other agencies managing groundwater.

G11. Promote groundwater conservation, infiltration, and water reuse through implementation of member city volume control performance standards, education, and outreach.

4.5.2 Groundwater Protection Strategies

~~S21.~~S22. The WMO will collaborate with the Metropolitan Council, Dakota County, member cities, and other partners to identify priority recharge zones, groundwater-surface water interactions, and other areas relevant to groundwater management.

~~S22.~~S23. The WMO will participate in regional groundwater planning efforts through annual collaboration with Dakota County, Minnesota DNR, Minnesota Department of Health, and other agencies managing groundwater.

~~S23.~~S24. The WMO will collaborate with member cities and other partners to promote individual landowner practices that protect groundwater resources through the development and distribution of educational materials, support of partner cost-share, workshops, and other events.

4.5.3 Groundwater Protection Policies

~~P26.~~P28. City stormwater performance standards shall be consistent with the MPCA's Minimal Impact Design Standards (MIDS) or National Pollutant Discharge Elimination System (~~NDPES~~NPDES) Construction Stormwater General Permit. Member cities shall restrict or prohibit infiltration when site conditions warrant consistent with the guidance provided in the General Construction Stormwater Permit, MPCA's MS4 Stormwater General Permit, and Minnesota Stormwater Manual.

P29. Member cities shall require that infiltration/abstraction ~~or stormwater reuse~~ best management practices include pretreatment and be designed consistent with guidance provided in the Minnesota Stormwater Manual and applicable City stormwater design guidance documents.

P30. Member cities are encouraged to incorporate review of potential pollutant sources and susceptibility of groundwater to contamination in planning and approving permitted stormwater BMPs.~~.....can rework language.....~~

~~P27.~~P31. Member cities are encouraged to incorporate water conservation and stormwater reuse best management practices into their city code/ordinances as appropriate.

~~P28.~~P32. Member cities with wellhead protection plans shall follow the requirements outlined in those plans for managing groundwater within wellhead protection areas.

4.6 Erosion and Sedimentation

4.6.1 Erosion and Sedimentation Goals

G12. Reduce sediment loading to the Mississippi River.

G13. Reduce sediment loading to LMRWMO priority waterbodies.

G14. Prevent or mitigate the impact of local erosion issues through the promotion of partner cost-share and educational programs (e.g., Dakota County SWCD cost-share).

4.6.2 Erosion and Sedimentation Strategies

~~S24.~~S25. The WMO will cooperate with member cities and other partners to reduce sediment loading through technical assistance, programmatic support, and/or support for implementation of capital projects as applicable to specific issues and locations, prioritizing areas that drain to priority waterbodies, areas of in-stream erosion, and areas draining directly to the Mississippi River.

~~S25.~~S26. The WMO will continue to support partner cost-share, grant, and public education programming (e.g., Landscaping for Clean Water & Adopt-a-Drain) that seeks to implement small-scale stabilization and restoration projects (e.g., shoreline stabilization) and increase the use of pollution prevention practices within watershed communities.

4.6.3 Erosion and Sedimentation Policies

~~P29.~~P33. Member cities shall continue to maintain and enforce local controls addressing erosion and sediment control, including the permitting and inspection of such controls. Local controls must be in conformance with the NPDES Construction Stormwater General Permit and City MS4 Stormwater Permit.

P34. Member cities shall require erosion and sediment control plans for projects that disturb one acre. Erosion and sediment control plans shall be consistent with NPDES Construction Stormwater Permit requirements.

Member cities are encouraged to require erosion and sediment control plans for projects ~~disturbing~~ that disturb less than one acre of land to minimize erosion and sedimentation during construction, especially when located in LMRWMO Regulatory Watersheds ~~(and less than ½ acre of land in areas draining to waters with nutrient and/or chloride impairments) to minimize erosion and sedimentation during construction~~.

~~P30.~~P35. Member cities shall require that design of stream bank stabilization and streambed control measures ~~should~~ consider unique or special site conditions, energy dissipation potential, adverse effects, preservation of natural processes and habitat, and aesthetics, in addition to standard engineering and ~~economic~~ feasibility criteria.

4.7 Education and Engagement

4.7.1 Education and Engagement Goals

G15. Increase community awareness of water ~~and natural~~ resource management issues via outreach activities and cooperation with member city and partner education and outreach programs.

G16. Increase community capacity to implement water ~~and natural~~ resource stewardship practices via outreach and support of partner engagement programs (e.g., Dakota County SWCD's Landscaping for Clean Water program, MN Water Stewards).

4.7.2 Education and Engagement Strategies

~~S26.~~S27. The WMO will develop and maintain electronic communication distribution lists as necessary to communicate WMO activities and information.

~~S27.~~S28. The WMO will maintain its website to communicate watershed news, events, and other applicable water ~~and natural~~ resource information.

~~S28.~~S29. The WMO will engage with Metro Watershed Partners, member cities, and/or other partners to develop and distribute educational materials addressing priority water ~~and natural~~ resource issues within the watershed.

~~S29.~~S30. The WMO will work with member cities to increase engagement of diverse communities within the watershed through targeted outreach activities.

~~S30.~~S31. The WMO will work with partners to develop and implement education and engagement programming aimed at K-12 students.

~~S31.~~S32. The WMO will continue to promote watershed resident involvement through volunteer opportunities and programs (e.g., Minnesota Water Stewards or similar programs).

~~S32.~~S33. The WMO will continue to support partner community engagement and outreach programs (such as Dakota County SWCD's Landscaping for Clean Water).

4.7.3 Education and Engagement Policies

~~P31.~~P36. Member cities' City engineers, environmental, and public works staff are encouraged to attend LMRWMO Board Meetings to provide technical advice and information to the Board.

~~P32.~~P37. Member cities shall continue to implement education and outreach programs consistent with MS4 permit requirements and engage the WMO in these efforts, as appropriate.

~~P33.~~P38. Member cities shall continue to communicate water ~~and natural~~ resource management information to residents and community groups (e.g., lake associations) as needed to support WMO and City goals.

4.8 Administration

4.8.1 Administration Goals

G17. Execute the activities included in the LMRWMO implementation program while promoting efficiency, limiting organizational redundancy, and leveraging skills of partner organizations.

G18. Maximize the financial capacity of the WMO through the pursuit and use of grant and cost-share funding.

4.8.2 Administration Strategies

~~S33.~~S34. The WMO will continue to pursue partnerships with member cities, Dakota County SWCD, Ramsey County Soil and Water Conservation Division~~CD~~, and other organizations to achieve common objectives. Partnerships may include ~~shared expertise and financial support for planning, education, programs, and/or projects.~~ annual agreements for services providing shared expertise in support of LMRWMO planning, project implementation, education programming, water monitoring, or other efforts.

~~S34.~~S35. The WMO will continue to summarize its activities in an annual report made available via the WMO website.

~~S35.~~S36. The WMO will assess progress towards goals at least biennially and update the status of items included in its implementation program.

~~S36.~~S37. The WMO may~~will~~ assist member cities (including being the applicant) in pursuing/securing/managing grants for water resources improvement projects ~~contained within an individual city and those that cross city boundaries.~~ .

~~S37.~~S38. The WMO will convene a citizen advisory council (CAC) only as needed to provide input on WMO programs and projects.

~~S38.~~S39. The WMO will convene a technical advisory committee (TAC) at least annually to review implementation and align the LMRWMO implementation schedule with City priorities, as needed.

~~S39.~~S40. The WMO will continue to use its allowable flow and/or allowable load cost allocation methodologies to apportion project costs between participating member cities, as needed.

~~S40.~~S41. The WMO will provide technical review of projects, if requested by the member cities. Costs to complete these reviews, if excessive, may be charged to member cities.

~~S41.~~S42. The WMO will seek grants and other funding opportunities to help offset the costs of the WMO implementation activities. The WMO will assist member cities in pursuing grants, as requested.

~~S42.~~S43. The WMO will assign operation and maintenance costs of intercommunity improvement projects according to the methods described in the joint powers agreement.

~~S43.~~S44. Although the WMO will not be administering a permit program, the WMO will:

a. Review projects for consistency with the WMO plan, as requested by member cities or other governmental agencies.

b. Review and comment on any proposed changes to the intercommunity stormwater system as requested by member cities or other governmental agencies.

c. Review member city local plan updates or amendments for consistency with WMO Plan.

d. Verify that member city official controls are updated, as needed, within two years of WMO Plan adoption or amendment

4.8.3 Administration Policies

~~P34.~~P39. Member cities shall adopt (as needed) and maintain local official controls/ordinances addressing stormwater management, erosion and sediment control, wetlands, buffers, floodplains, and any others as necessary to comply with the policies and performance standards presented in this WMO Plan within 2 years of WMO Plan adoption or amendment~~. (within 2 years~~ (per Minnesota Rules 8410).

~~P35.~~P40. ~~Member cities shall maintain or strengthen stormwater management, erosion and sediment control, wetland, floodplain and shoreland official controls.~~ Member cities shall inform the WMO of updates to their local controls and seek WMO comment on consistency with the WMO Plan and performance standards.

~~P36.~~P41. Member cities are to maintain ordinances or policies that allow the cities to secure easements over floodplains, detention areas, wetlands, ditches, and all other parts of the stormwater system as areas develop or redevelop.

~~P37.~~P42. Member cities shall be responsible for operating and maintaining city-owned stormwater facilities to achieve the intended water quality improvement, flood risk reduction, and other beneficial functions originally intended.

~~P38.~~P43. Member cities shall require maintenance agreements for privately owned stormwater facilities that identify maintenance activities and the responsible party.

Placeholder for excel table summarizing performance standards

Table 4-1 Summary of LMRMWO member city performance standards

Placeholder for detailed figure of Regulatory Watersheds

Figure 4-1 LMRWMO Regulatory Watersheds Detail

5.0 Implementation

The LMRWMO implementation program summarizes the activities the LMRWMO plans to perform (alone or in collaboration with partners) over the next 10 years. The implementation program includes administrative activities, programs (e.g., monitoring), studies, and projects necessary to pursue LMRWMO goals. Methods for prioritizing and funding programs, projects, and capital improvements are also discussed in this section.

5.1 LMRWMO Roles and Responsibilities

The roles and responsibilities of the LMRWMO are described in this section, subdivided into the following categories:

- Administration
- Engineering and planning
- Education and outreach
- Monitoring
- Projects, studies, and capital improvements

5.1.1 Administration

The LMRWMO's administration activities include work performed to satisfy Minnesota Rules for watershed management organizations and those that pertain to the organization, administration, and operation of the LMRWMO. This includes time and expenses for an administrator, ~~recording services~~audit, and legal counsel. This category also includes activities related to annual work planning, reporting, and progress assessment, activities performed in pursuit of external funding (e.g., grant) opportunities, and management of projects, studies, or programs implementation as part of this Plan.

5.1.2 Engineering and ~~planning~~Planning

Engineering and planning activities include work performed by the LMRWMO administrator and/or LMRWMO engineer(s) to address technical issues identified by the managers, member cities, partners, or other stakeholders, as needed. This category also includes LMRWMO review and comment on member city local water management plans (see Section 5.5) and ordinances, coordination with partner planning efforts, and updates and amendments to the LMRWMO Watershed Management Plan (this document).

The LMRWMO is not a permitting authority. The member cities are responsible for primary management of stormwater and water resources within their boundaries through local controls and processes. In turn, the LMRWMO ensures that the member cities adopt and implement the policies and performance standards in the LMRWMO Plan.

The member cities will continue as the local government units (LGUs) responsible for administering the Wetland Conservation Act (WCA) within their boundaries and will continue to implement and enforce their existing local controls related to water resource management. Mn/DOT serves as the LGU for the

WCA within its right-of-way. The member cities, other units of government, and private parties are responsible for maintaining their respective stormwater systems.

5.1.3 Education and Outreach

Education activities include those activities performed by LMRWMO staff and in cooperation with member cities, Dakota County SWCD, Ramsey County Soil and Water Conservation ~~District~~Division, and other partners. These activities are identified in Table 5-1. The LMRWMO carries out much of its educational programming through the member cities and SWCDs. Member cities distribute articles and newsletters that address water and natural resource information, including, but not limited to:

- Pollution prevention stewardship practices
- Wetland protection
- Invasive species prevention and management
- Groundwater quality
- Water conservation
- Hazardous waste disposal
- Reducing winter salt application
- Small-scale rain garden, native planting, and shoreline stabilization cost-share opportunities

Consistent with Minnesota Rules 8410.0160, the LMRWMO maintains a website that contains the LMRWMO meeting information, manager and staff contact information, monitoring reports and studies, planning documents, annual reports, and links to additional information. The LMRWMO website is: www.lmrwmo.org

Through the implementation of this Plan, the LMRWMO seeks to expand its cooperative roles with Dakota County SWCD, Ramsey County Soil and Water Conservation Division~~Conservation District~~, and member cities to engage residents and stakeholders through:

- Providing water resource related programming for K-12 schools
- Recruiting volunteers water resource management activities (e.g., citizen monitoring)
- Engaging residents at community events to share information
- Supporting workshops for design of residential stormwater BMPs and other stewardship activities

The LMRWMO will continue to prepare an annual report summarizing the relevant LMRWMO and member city activities from the prior year. The LMRWMO posts the report on its website and member cities advertise/distribute the report through their respective social media and electronic communication resources.

5.1.3.1 Technical Advisory Committee

The LMRWMO encourages member city staff to regularly attend and contribute to LMRWMO Board of Manager meetings. The LMRWMO also convenes a larger technical advisory committee (TAC), as needed, to receive input and/or technical assistance on selected issues, studies, and projects. In addition to member city staff, the TAC includes, but is not limited to:

- Minnesota Board of Water and Soil Resources (BWSR)
- Minnesota Pollution Control Agency (MPCA)
- Minnesota Department of Natural Resources (MDNR)
- Metropolitan Council Environmental Services
- Dakota County (Environmental and Groundwater divisions)
- Dakota County Soil and Water Conservation District

The LMRWMO may invite additional stakeholders to participate in the TAC, as appropriate. In addition to meetings of the larger TAC (or in coordination with those meetings), the LMRWMO will convene a "local" TAC consisting of member city and SWCD staff at least annually to align the LMRWMO implementation schedule with member city capital improvement programs and establish a work plan for the coming year.

5.1.4 Monitoring Program

The LMRWMO cooperates with member cities and state and regional partners to monitor the water resources within the watershed. The different monitoring programs active within the watershed are summarized in Section 2.7.4.

Specifically, the LMRWMO plans to fund water quality monitoring of the following Priority ~~Level~~ 1A and 1B lakes (see Section 3.3) through the Metropolitan Council's Citizen Assisted Monitoring Program (CAMP) or similar program(s):

- Lake Augusta
- Hornbeam Lake
- Rogers Lake
- Seidls Lake
- Sunfish Lake
- Thompson Lake

Some LMRWMO priority lakes are monitored annually while others are monitored on a rotating basis. The LMRWMO will work with member cities to identify volunteers to collect samples or collect samples with LMRWMO/city staff if volunteers are unavailable. Through CAMP, samples will be collected from May through September and analyzed for total phosphorus and chlorophyll *a*. Secchi depth (transparency) will be measured during each sampling event. The LMRWMO will work with the Metropolitan Council to add chloride analysis; chloride monitoring is currently performed on Thompson Lake in partnership with Dakota County. As resources and volunteers are available, the LMRWMO will cooperate with the member cities to monitor the water quality of Priority Level 2 lakes over the life of this Plan to establish or augment water quality data.

The LMRWMO will continue to use CAMP monitoring results and other publicly available data to assess water quality trends and evaluate progress towards water quality goals. The LMRWMO annually publishes a monitoring report summarizing the results of the previous year's LMRWMO monitoring results.

During the life of this Plan, the LMRWMO seeks to establish a stream monitoring program. The monitoring program will evaluate the hydrology and water quality of the LMRWMO Priority 1A streams:

- Interstate Valley Creek
- Ivy Falls Creek
- Kaposia Creek

The scope of the monitoring program will be further defined via a comprehensive watershed-wide water monitoring analysis scheduled in the first few years of Plan implementation (see Table 5-1 and Table 5-2). Likely monitoring parameters will include flow, total phosphorus, and sediment. Water quality samples will be collected to represent baseflow and high-flow events.

5.1.4.1 Water quality trend analysis and goal evaluation

The LMRWMO has established lake water quality goals for Priority Level 1 lakes based on state water quality goals or existing water quality data (see Section 4.1.1). To assess progress towards goals, the LMRWMO will review water quality data (at least biennially) to identify trends in summer (June-September) averages of total phosphorus, chlorophyll-a, and Secchi depth transparency. The LMRWMO will use a regression analysis using data from the most recent 10-year period and ~~identifies~~ identify trends that are significant at the 90th percentile.

For water quality goals based on existing 10-year (2012 – 2021) summer average water quality, the LMRWMO will use the trend analysis performed every year to identify the presence or absence of statistically significant degrading water quality trends as a first step to evaluate if current water quality deviates from the goal values. If a statistically significant degrading trend is identified, additional statistical tests may be used to determine if the average water quality is statistically different from goal values.

5.1.5 Projects, Studies, and Capital Improvements

Projects, studies, and capital improvements known or planned at the time of Plan development are identified in Table 5-1. Several of these activities are likely to be implemented in cooperation with the SWCDs and/or member cities as partners in funding, implementation, or both. The LMRWMO seeks to utilize BWSR Clean Water Fund Watershed-Based Implementation Funding (WBIF) to support some of these projects, as well as competitive grants, city cost-share, and LMRWMO funds. For projects with intercommunity drainage areas and/or intercommunity impacts, project costs will be apportioned consistent with the methods included in the LMRWMO joint powers agreement (e.g., "allowable flow" or "allowable load" methodologies) or individual agreements acceptable to all contributors.

Since the adoption of the 2011 Plan (as amended), the LMRWMO and its member cities have completed several significant projects to address water quality issues. This includes aluminum sulfate treatments of Lake Augusta and Sunfish Lake, construction of stormwater treatment facilities upstream of Thompson Lake, and ravine stabilization in Cherokee Heights park upstream of Pickerel Lake and the Mississippi River (all funded in part by state Clean Water Funds). These projects have improved water quality and resulted in the delisting of Sunfish Lake from the impaired waters list. The LMRWMO and member cities continue to seek opportunities to implement projects to improve water quality of LMRWMO waterbodies.

Specific project opportunities not yet identified are likely to arise during the life of this Plan (e.g., water quality retrofits implemented with road reconstruction). The LMRWMO has attempted to anticipate and include placeholders for these opportunities, where appropriate. The LMRWMO will coordinate with member cities at least annually to clarify these opportunities and will perform Plan amendments (see Section 5.6), as needed, to incorporate future projects.

Additional project definition (e.g., feasibility studies) may be needed to further develop planned projects and may be performed prior to adding potential projects to the implementation schedule. Note that several of the items in the "projects" section of Table 5-1 have corresponding items included in the "studies" section of the table.

5.2 Implementation Schedule

5.2.1 Implementation Plan Structure

The LMRWMO implementation schedule is organized into the following major categories:

- Studies
- Projects
- Monitoring
- Education and Public Involvement
- Engineering and Planning
- Administration

Proposed activities are listed and described in Table 5-1 according to the above categories. Table 5-1 includes the following planning-level information:

- Activity category
- Activity title
- Priority level (see Section 5.2.2)
- Goals addressed by the activity (see Section 4.0)
- Potential partners
- Estimated total cost over the 10-year Plan life (planning level)

Estimate costs broken down by year of planned implementation are presented in Table 5-2. Various implementation activities that have been completed since the development of the 2011 LMRWMO Plan (as amended) are presented in Section 1.2.2.

5.2.2 Prioritization and Targeting

The LMRWMO has prioritized issues and solutions based on their relative benefit and targeted the highest value waterbodies ~~resources~~ to effectively make use of finite staff and financial resources. Through the implementation of this Plan, the LMRWMO will focus on its priority waterbodies (see Section 3-3) and the

watersheds tributary to those resources (see Section 3.3). The LMRWMO will also prioritize the most cost-effective solutions for improving the water quality of those resources.

The LMRWMO has classified activities presented in Table 5-1 as having high, medium, or low priority with consideration for several factors.

> **High Priority** – high priority activities include those actions necessary for the LMRWMO to exist and operate, activities required by Minnesota Statute 103B and Minnesota Rules 8410 (e.g., plan development, annual reporting), activities that primarily address high priority issues identified in Section 3.0 and Priority Level 1 waterbodies.
>
> **Medium Priority** – medium priority activities include those that are not required by statute or rule, may address waterbodies that are not Priority Level 1 waterbodies, or have factors that may ~~adversity~~ adversely impact feasibility (e.g., extensive collaboration, high cost).
>
> **Low Priority** – low priority activities include partner studies and projects identified through the Plan update process but not assigned high priority by the LMRMWO and/or its partners and address lower priority issues identified in Section 3.0 and/or non-priority waterbodies.

This classification system is qualitative and intended to serve as a guide for annual work planning and budgeting. Activities in the annual work plan may be accelerated, delayed, delegated, or omitted through the 10-year implementation schedule. For example, activities led by member cities or other partners may be implemented earlier or later than planned due to changing partner priorities, funding, and schedules. Factors considered in the development of the annual work plan may include the following:

- Annual budget commitments from previous years (i.e., ongoing responsibilities)
- Available revenues, grants, and cost-share funding (e.g., from cities or agencies)
- Activity priority
- Estimated benefits (e.g., pollutant reduction, potential to address multiple goals)
- Feasibility considerations
- Risk (of performing or not performing the activity)
- Results of monitoring or studies
- Opportunities for partner cooperation
- Input from member cities, TAC, and other partners

Final decisions on implementation activities rest with the LMRWMO Board of Managers to budget for and authorize via the annual work plan. During implementation, the LMRWMO may add additional projects, programs, studies, or other activities to Table 5-1 via a Plan amendment (see Section 5.6), as needed.

Placeholder for Implementation Table page 1

Table 5-1 LMRWMO 2023-2032 implementation schedule with activity descriptions

Implementation table 5-1 page 2 placeholder

Implementation table 5-1 page 3 placeholder

Implementation table 5-1 page 4 placeholder

Placeholder for Implementation Table by year page 1

Table 5-2 LMRWMO 2023-2032 implementation schedule estimated costs by year

Implementation table 5-2 page 2 placeholder

Implementation table 5-2 page 3 placeholder

Implementation table 5-2 page 4 placeholder

5.3 Funding Sources

The LMRWMO joint powers agreement calls for implementation activities (see Table 5-1) to be funded through either the LMRWMO general fund, grant funds, and/or partner cost-share. The proposed funding methods presented in Table 5-1 ~~varies~~ vary by the specific activity~~.~~, are preliminary ,and may change throughout the life of the Plan.

5.3.1 LMRWMO General Fund

Per the LMRWMO JPA, each member city contributes annually to the LMRWMO general fund. The annual contribution amount is split such that 50 percent of the total is apportioned based on the area within the LMRWMO and 50 percent is apportioned based on the taxable market value. The LMRWMO uses the general fund for administrative costs, monitoring, education, studies, and planning projects, including the development of this Plan.

5.3.2 Capital Improvement Funds

The LMRWMO JPA calls for the establishment of a capital improvement fund for each capital improvement project ordered by the Managers not paid for out of the LMRWMO general fund. Capital improvement funds may be accumulated over time to pay for large future projects. Project costs paid out of capital improvement funds are apportioned with consideration for stormwater runoff generation, pollutant loading, or other factors as allowed by the JPA.

5.3.3 Ad Valorem Taxing Authority

Minnesota Statute 103B.251 allows WMOs to certify capital improvements to the county for payment, if those improvements are included in the WMO's watershed management plan. The county then issues bonds and levies an ad valorem tax on all taxable property in the WMO (or subwatershed unit of the WMO) to pay for the projects. This process requires sufficient lead time and coordination with the County, as formal County approval of any amendments to a WMO's plan and associated levy amounts is required.

A WMO may also raise funds through direct ad valorem taxation (Minnesota Statutes 103B.241), but only if the WMO is specifically listed as a special taxing district in Minnesota Statutes 275.066. If a WMO is given taxing authority, the WMO may also accumulate funds to finance improvements as an alternative to issuing bonds (Minnesota Statutes 103B.241).

Historically, the LMRWMO has not used this method to fund improvements and is not currently listed as a special taxing district per MS 275.066.

5.3.4 Member City Funding

Funding mechanisms available to the member cities include:

- City General Funds
- Special Assessments
- Ad Valorem Taxes

- Stormwater Utilities
- Development Fees
- Tax Increment Financing

Additional information about member city funding mechanisms is available in member city local water management plans.

5.3.5 Grant Funding and Partner Cost-Sshare

BWSR Clean Water Fund (CWF) grants and other competitive grants provide an opportunity for the LMRWMO to offset the cost of large studies, non-structural projects, and capital improvements. Such opportunities must be identified in the LMRWMO implementation schedule (see Table 5-1). The LMRWMO will continue to seek and apply for grants to offset project costs when project or program goals align with funding opportunities.

In addition to competitive grants, BWSR's Watershed Based Implementation Funding (WBIF) is expected to become the primary mechanism through which BWSR distributes Clean Water Fund grants. The WBIF program will supply a steady source of grant funding allocated every 2 years to metro watershed management organizations including the LMRMWO. The LMRWMO will work with other WBIF-eligible units of government within the watershed (e.g., cities, counties, SWCDs) to equitably allocate those dollars among competing projects and partners. Additional information is available from BWSR at: https://bwsr.state.mn.us/watershed-based-implementation-funding-program

The LMRWMO has collaborated with member cities and other partners to successfully complete water and natural resources improvement projects through cost-share opportunities. Without cost-sharing, such projects may otherwise be cost-prohibitive. Examples of past cost-share partnerships include Dakota County SWCD's Landscaping for Clean Water program.

5.4 Reporting and Assessment

5.4.1 Annual Reporting

The LMRWMO is responsible for evaluating progress towards achieving its goals and reporting annually to BWSR, per Minnesota Rules 8410.0150. Within the first 120 days of the calendar year, the LMRWMO must submit to BWSR an activity report for the previous calendar year. Reporting requirements specified in Minnesota Rules 8410 will be followed. Generally, the LMRWMO's annual report includes:

- An assessment of the previous year's annual work plan that indicates whether the planned activities were performed
- A work plan and budget for the current year specifying which activities will be undertaken
- At a minimum of every 2 years, an evaluation of progress on goals and the implementation actions, including the capital improvement program, to determine if amendments to the implementation actions are necessary

- A summary of significant trends identified in monitoring data

5.4.2 Evaluation of Progress

The LMRWMO will work with member cities and other partners to achieve the goals established in this Plan (see Section 4.0). Biennially, the LMRWMO will perform a more detailed evaluation to assess the level of progress achieved on each of the LMRWMO's adopted goals. The format of this evaluation may be based on the organization of LMRWMO goals, cross referenced to the most applicable implementation activities and the associated outputs. Resource goal tracking summaries may be developed for LMRWMO priority waterbodies.

The LMRWMO's water quality goals for priority lakes have a clear, quantifiable metric to assess achievement or progress (i.e., water chemistry data). Some LMRWMO goals are more qualitative in nature and progress may not be accurately measured by strictly quantitative metrics. Thus, progress assessment may include quantitative values and/or qualitative (narrative) discussion of progress towards each goal. The measurable outputs of the implementation activities most directly correlated with each goal will also be reported.

Results of the biennial progress assessment may be used for annual work planning and identifying potential amendments to the implementation schedule.

5.5 Local (City) Water Management

The LMRWMO maintains a highly cooperative relationship with its member cities representatives and staff. Member city engineering, public works, and natural resources staff regularly attend LMRWMO Board of Managers meetings and were actively involved in the development of this Plan. The relationships between the LMRWMO and its member cities are key to the successful implementation of this Plan.

This section summarizes the regulatory responsibilities of the member cities, requirements for local water management planning, and impacts on of this Plan on local governments.

5.5.1 City Regulatory Framework

The LMRWMO member cities manage the impacts of development and redevelopment on water resources through their official controls (e.g., ordinances, design manuals), local water management plans (LWMPs) and Municipal Separate Storm Sewer System (MS4) permits.

Each member city is a regulated MS4 under the Clean Water Act and is required to maintain coverage under the MS4 General Permit, issued by the State of Minnesota. The MS4 General Permit requires each regulated MS4 to develop a Storm Water Pollution Prevention Program (MS4 SWPPP) that addresses how the MS4 will reduce the amount of sediment and other pollutants entering waters from stormwater systems. Member cities are also responsible for maintaining their stormwater infrastructure and for implementing programs to require and enforce the maintenance of private stormwater infrastructure. Information regarding municipal stormwater responsibilities and the MS4 program is available from the MPCA at: https://www.pca.state.mn.us/water/municipal-stormwater-ms4

Each member city maintains local ordinances (or other official controls) regulating land development, natural resource protection, and stormwater management within their jurisdiction. Local performance standards and official controls must be consistent with (or more stringent than) the LMRWMO performance standards included among Plan policies (see Section 4.0). Table 4-1 summarizes local performance standards of LMRMWO member cities related to water resource management. With this Plan, the LMRWMO established a volume control performance standard applicable to select priority subwatersheds (i.e., Regulatory Watersheds, see Figure 2-3). Member cities are encouraged to apply this and/or other more stringent performance standards to additional areas to mitigate the impacts of stormwater runoff and pollutant loading as described in Section 3.4.1.

The LMRWMO assumes that the member cities will continue to be the permitting authority for all land alteration activities. To continue as the permitting authority, the local government must outline its permitting process in its LWMP, including the preliminary and final platting process. The LMRWMO may appeal a member city's approval of a project if the LMRWMO believes the project is not consistent with the LWMP or LMRWMO Plan.

~~The LMRWMO reviews updates to LWMPs and updates to member city official controls to confirm they are consistent with the LMRWMO Plan (see Section 5.5.2).~~ Within 30 days of the LMRWMO Board of Manager's adoption of this Plan, the LMRWMO will notify each member city of the requirements regarding revision of local controls. If updates to local controls are necessary to be consistent with this Plan, member cities shall complete~~initiate~~ those updates within 2 years ~~180 days~~ of adoption of this Plan (and any future WMO Plan amendments, as needed). The LMRWMO shall verify that local controls/ordinances have been update via a request for verification from member cities one year and 1.5 years after adoption of this plan. If no verification has been provided, the LMRWMO will verify adoption of local controls/ordinances by member cities via WMO review of local controls/ordinances 2 years after adoption of this plan. If the LMRWMO determines that a member city is out of compliance with this Plan, the LMRWMO will coordinate with member city staff to clarify the source of the issue and determine a schedule to achieve compliance.

5.5.2 Local Water Management Plans

Each LMRWMO member city is required to complete a local water management plan (LWMP) that conforms to Minnesota Statutes 103B.235, Minnesota Rules 8410.0160, and is consistent with the current LMRWMO Plan. Minnesota Rules 8410.0160 and Minnesota Statutes 103B.235 Subd. 2 include specific requirements for LWMP content, review, approval, and adoption. LWMPs must be adopted no more than two years prior to the adoption of a local comprehensive plan and extensions of local comprehensive plans due dates do not alter the LWMP schedule. The status of member city LWMPs is presented in Table 5-3.

The policies, goals, and performance standards established in each city's LWMP must be consistent with this Plan. The section of the LWMP covering assessment of problems must include those problems identified in the LMRWMO Plan that affect the city. The corrective action proposed must consider the individual and collaborative roles of the city and the LMRWMO. In addition to LMRWMO content required

per Minnesota Rules 8410.0160 and Minnesota Statutes 103B.235 Subd. 2, the LMRWMO requires that LWMPs include the following:

- Water quality management actions performed or proposed by the member cities for priority waterbodies (see Section 3.3) and MDNR public waters.
- Maps of the existing stormwater system, as defined in the MPCA's NPDES Municipal Separate Storm Sewer System (MS4) general permit. The cities may use maps prepared for their respective MS4 permits.
- A list or map that identifies water quality issues, if known, and actions to address these issues.
- Description of operating and maintenance procedures for the cities' stormwater management system (or reference to the city's MS4 general permit stormwater pollution prevention program, or SWPPP).

Table 5-3 Local Water Plan Status

City	Date of LMRWMO Approval
Inver Grove Heights	December 12, 2018
Lilydale	September 12, 2018
Mendota	June 8, 2022
Mendota Heights	June 13, 2018
St. Paul	May 9, 2018
South St. Paul	December 12, 2018
Sunfish Lake	November 14, 2018
West St. Paul	December 12, 2018

5.5.2.1 Local Water Management Plan Review and Approval

LWMPs must be submitted to the LMRWMO for review and approval per the requirements of Minnesota Statutes 103B.235. LMRWMO staff will review the LWMP following the process and schedule described in Minnesota Statutes 103B.235. Upon LMRWMO approval of the local plan, the city must adopt and implement its LWMP within 120 days and amend its official controls within 180 days of plan approval, as needed. Member cities shall notify the LMRWMO within 30 days of LWMP adoption and adoption of revised official controls, if needed.

If a member city later wishes to amend its LWMP, it must submit the proposed amendment to the LMRWMO for review following the procedure described in Minnesota Rules 8410.0160. Member cities are encouraged to consult with the LMRWMO staff early on in their local planning process. The LMRWMO will work closely with member cities in local plan preparation, review, and implementation.

5.5.3 Impact on Local Governments

The LMRWMO seeks to limit additional requirements imposed upon member cities while also providing services throughout the watershed that accomplish shared LMRWMO/city goals and thereby reduce redundancies. Many of the activities in the LMRWMO implementation schedule (see Table 5-1) elements will be implemented in partnership with the member cities. Thus, the LMRWMO Plan will have a financial impact to member cities budgets.

Some of the implementation activities reflect the goals, policies, and requirements of state and regional units of government that member cities must address regardless (e.g., MS4 permit requirements). In addition, all the performance standards included in this Plan (see Section 4.0) are currently implemented by the member cities through their existing regulatory programs. Therefore, the implementation of regulatory standards is not expected to create additional cost or burden to member cities. The LMRWMO is not increasing the wetland regulation burden for the member cities because they are already acting as the LGU for the Wetland Conservation Act.

There will be continued cost and effort placed on the member cities and the LMRWMO to address water quality protection and restoration issues in the LMRWMO. Ongoing monitoring of strategic waterbodies will be implemented by the LMRWMO and the member cities and the results will be used to inform future actions.

The LMRWMO implementation schedule (see Table 5-1) includes activities to be performed by the LMRWMO and member cities. These activities will be funded through funds provided by member cities and augmented with Watershed-Based Implementation Funds (WBIF). The LMRWMO developed the implementation schedule with consideration for existing budgets, staff, services, and capacity of member cities and partners to promote efficiency, limit costs, and maximize productive collaboration.

5.6 Plan Amendment Procedures

This Plan will guide LMRWMO activities through 2032, or until superseded by adoption of a subsequent Plan. During this time, the LMRWMO may revise its Plan through an amendment procedure, as needed. Amendments to this Plan will follow the procedures described in this section and will proceed in accordance with the process provided in Minnesota Rules 8410.0140 and Minnesota Statutes 103B.231. Plan amendments may be proposed by any person to the LMRWMO, but only the Board of Managers may initiate the amendment process. All recommended plan amendments must be submitted to the LMRWMO in writing, along with a statement of the problem and need, the rationale for the amendment, and an estimate of the cost. Amendments identified by LMRWMO staff and member city staff will similarly be presented to the Board of Managers for approval.

The LMRWMO anticipates that only significant changes or additions to goals, issues, administrative procedures, or implementation (i.e., programs, projects, and capital improvements) will prompt an amendment to the Plan, although final discretion resides with the managers. Minnesota Rules 8410.0140 Subp. 1a defines changes that do not require an amendment (e.g., reformatting/reorganization of the

plan, clarification of existing plan goals or policies, and adjustment to how the LMRWMO will carry out program activities within its discretion).

Amendments to this Plan are subject to the review process provided in Minnesota Statutes 103B.231 Subd. 11, except when the proposed amendments are determined to be minor-amendments by satisfying all the following criteria:

- BWSR has either agreed that the amendments are minor or failed to act within five working days of the end of the 30-day comment period specified in item B (unless an extension has been mutually agreed upon);
- The LMRWMO has sent copies of the amendments to the plan review authorities for review and comment allowing at least 30 days for receipt of comments, has identified that the minor amendment procedure is being followed, and has directed that comments be sent to the LMRWMO Managers;
- No county board has filed an objection to the amendments with the LMRWMO and BWSR within the comment period specified in item B (unless an extension is mutually agreed upon);
- The LMRWMO has held a public meeting to explain the amendments and published a legal notice of the meeting twice, at least seven days and 14 days before the date of the meeting; or
- The amendments are not necessary to make the Plan consistent with an approved and adopted Dakota County or Ramsey County groundwater plan.

Draft and final amendments will be formatted and distributed consistent with the requirements of Minnesota Rules 8410.0140, subparts 4 and 5, respectively.

Approximately 2 years prior to the expiration date of this Plan, the LMRWMO will begin the process of updating its Plan (unless a revised schedule is developed by BWSR in accordance with Minnesota Statutes section 103B.231, subdivision 3a).

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Appendix A

LRMWMO Joint Powers Agreement

Appendix B

Lake Water Quality Summary (2012-2021)

Appendix C

Summary of Stakeholder Engagement Activities