



**MISSISSIPPI  
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ORGANIZATION**

# Watershed Management Plan 2011-2021

(11-09-2016 Amended Version)



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**MWMO Watershed Bulletin: 2011-3**

Prepared for the MWMO by:

Emmons and Olivier Resources and Barr Engineering

## **Watershed Management Plan 2011-2021 (11-09-2016 Amended Version)**

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### Acknowledgements

The Mississippi Watershed Management Organization (MWMO) would like to thank individuals for participating in the Science Advisory Group, the Implementation Advisory Group, the MWMO Citizen Advisory Committee, and the MWMO Board of Commissioners for their valuable input into the direction and content of this Watershed Management Plan.

### Plan Approval and Adoption

This MWMO Watershed Management Plan was approved by Board of Water and Soil Resources on April 27, 2011 and adopted by the MWMO Board of Commissioners on May 10, 2011. Amended by the MWMO Board of Commissioners on: 05-08-2012; 07-09-2013; 05-12-2015; 06-17-2016 Changes Notification; 11-09-2016



Suggested citation:

Mississippi Watershed Management Organization. 2011. *Watershed Management Plan 2011-2021 (11-09-2016)*  
MWMO Watershed Bulletin 2011-3. 186 pp.

Front Cover:

Clockwise, St Anthony Falls from the Stone Arch Bridge, Land cover in the MWMO, The River Gorge, Monitoring outfalls discharging to the Mississippi River. *Photograph by B. Jastram, Mississippi Watershed Management Organization.*  
*Courtesy of the MWMO Museum of Natural History*



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## **Abstract**

The Mississippi Watershed Management Organization (MWMO) is committed to protecting, managing, and improving the water resources within its boundaries. This Plan has been developed to guide the MWMO Board and staff in the implementation of Watershed goals. When the previous Watershed Management Plan was adopted in 2000, the MWMO established its own offices and added new staff members to develop the programmatic areas needed to successfully implement goals established within the Plan. A few of these successes include: the Heritage Park Capital Improvement Project, the Stewardship Grant Fund, the Hmong Community Project, a study on the Historic Waters of the MWMO, and the establishment of a monitoring network for the Watershed.

Through this Third Generation Plan, the MWMO lays out an implementation schedule which requires the continued growth and leadership of the organization to achieve its stated goals. The Plan sets out goals, strategies, and implementation actions based on past studies and current data on the status of the water and natural resources of the Watershed. The MWMO staff and Board use the Plan to guide watershed management decisions based on the established goals and strategies and the summarized land and water resource information. Additionally, the MWMO staff and Board use the Plan to assist in the development of annual work plans based on the outlined implementation actions in concert with the goals and strategies.

Member organizations will find the Plan of use in developing local surface water management plans. Additionally, member organizations can use the MWMO implementation plan to assist in scheduling and coordinating capital improvements and programs.

Residents, businesses, and other organizations within the Watershed can use the Plan to learn more about the natural and water resources within the Watershed and to be aware of the projects, activity areas, and operations of the MWMO.



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# Watershed Management Plan 2011-2021

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## GLOSSARY

<b>Aeration</b>	The addition of air to a waterbody in order to increase the oxygen content of the water to benefit the health of the living organisms within the waterbody
<b>Abstraction</b>	The permanent retention of runoff on a site through structures and practices such as infiltration, evapotranspiration, and capture and reuse.
<b>Bacteria</b>	Microorganisms that can live in a variety of conditions, some types can cause illness in humans. The quantity of <i>E. coli</i> , a specific type of bacteria, is used as a metric to evaluate potential fecal contamination in surface water resources.
<b>Benthic/Benthic zone</b>	Ecological region at the lowest level of a body of water such as a lake or river, including the sediment surface and some sub-surface layers.
<b>Biochemical Oxygen Demand (BOD)</b>	The oxygen used by microorganisms that decompose organic matter such as dead algae, leaves, and waste. It is used as a measure of water quality because it is linked to the level of dissolved oxygen in the water, a compound needed to sustain fish and other organisms.
<b>Capacity</b>	The total amount of a certain characteristic, e.g. total volume of water stored or total ability to provide water-related education.
<b>Chloride</b>	A chemical used as a water quality metric. Chloride is a component of many common road salts used for deicing in the winter.
<b>Climate change</b>	A long-term change in climate measures such as temperature and rainfall. Changes in climate have a large impact on water quality as well as lake and wetland water levels and stream and river flows.
<b>Converted lands</b>	Land areas that are no longer covered with native vegetation.
<b>Design Guidelines</b>	Any document adopted by the MWMO to provide non-regulatory guidance for development activities occurring in the watershed to protect, manage, and restore water and natural resources.; MWMO grant recipients must meet adopted guidelines to receive funding.
<b>Development</b>	Any land disturbance that alters or creates impervious surface and any redevelopment creating/replacing impervious surface, including but not limited to, road and/or parking lot construction or reconstruction; see also Redevelopment.
<b>District Systems</b>	The integrated development and management of stormwater, traffic and parking, public utilities, street construction, energy and open space. At a scale that generates a more efficient system overall than if each part was developed and managed independently
<b>Drainageway</b>	A route for the transport of stormwater, e.g. ditch, channel, swale, pipe.

<b>Disturbance area</b>	The area of a site, impacted by land disturbing activities..
<b>Ecological integrity</b>	The quality of the plant community compared to a representative plant community for the local area. Higher quality communities have a higher ecological integrity.
<b>Ecosystem</b>	The group of all living organisms in a certain area that are expected to interact within the same habitat.
<b>Floodplain</b>	The land adjacent to a waterbody that is expected to be inundated with water after a large rainfall event of a specific size. For example, flood insurance rate maps typically depict the floodplains for 100-year and 500-year events.
<b>Fully Reconstructed Impervious surfaces</b>	Areas where impervious surfaces have been removed down to the underlying soils. Activities such as structure renovation, mill and overlay projects and other pavement rehabilitation projects that do not alter the underlying soil material beneath the structure, pavement or activity are not considered full reconstruction. In addition, other maintenance activities such as catch basin and pipe repair/replacement, lighting, and pedestrian ramp improvements shall not be considered fully reconstructed impervious surfaces. Reusing an existing building foundation and re-roofing of an existing building are not considered fully reconstructed.
<b>Greenway system</b>	Interconnected areas of vegetated open space. Greenways may include built features as well as natural or vegetated areas.
<b>Green infrastructure</b>	The design of infrastructure systems, such as roadways and building sites, to maintain key existing soils and vegetated areas and to incorporate vegetated approaches for stormwater management.
<b>Groundwater</b>	Water located below ground in the spaces present in soil and bedrock.
<b>Groundwater recharge</b>	Water moving through the soil surface and deeper underground to become groundwater.
<b>Historic condition</b>	A term used in the MWMO Standards to refer to the condition of the land in the past based on the MWMO study <i>Historic Waters of the MWMO</i> (MWMO, 2011). The study evaluated the historic soil and vegetation condition of the MWMO. The results of this analysis are used as an upper level goal for water and runoff management within MWMO.
<b>Hydrology</b>	The movement of water. Often used in reference to water movement as runoff over the soil after a rainfall event as it contributes to surface waterbodies.
<b>Impervious surface</b>	Means a surface that impedes the infiltration of rainfall and results in an increased volume of surface runoff.

<b>Infiltration</b>	The movement or passage of water into the soil.
<b>Land Disturbance</b>	Means any activity that results in a change or alteration in the existing ground cover (both vegetative and non-vegetative) and/or the existing soil topography. Land disturbing activities include, but are not limited to, development, redevelopment, demolition, construction, reconstruction, clearing, grading, filling, stockpiling, excavation and borrow pits. Routine vegetation management, and mill and overlay/resurfacing activities that do not alter the soil material beneath the pavement base, are not considered land disturbance. In addition, other maintenance activities such as catch basin and pipe repair/replacement, lighting, and pedestrian ramp improvements shall not be considered land disturbance for the purposes of determining permanent stormwater management requirements.
<b>Macroinvertebrates</b>	Aquatic insects used as a metric of water quality. Different macroinvertebrates will live in water with poor water quality than live in water with high water quality; thus, the different types of macroinvertebrates present are an indication of the quality of the water.
<b>Members</b>	The municipalities and organizations that make up the Mississippi Watershed Management Organization: City of Columbia Heights, City of Hilltop, City of Fridley, City of Lauderdale, City of Minneapolis, Minneapolis Park and Recreation Board, City of Saint Anthony Village, and the City of Saint Paul.
<b>Mercury</b>	A metal that recycles between land, air, and water. The primary source of mercury in waterbodies is air pollution. Mercury accumulates in fish and often results in fish consumption advisories for lakes and rivers. Mercury can have toxic effects on the nervous system of animals, including humans, who eat large quantities of fish.
<b>Multi-functional corridors</b>	Interconnected areas serving a number of functions, e.g. stormwater treatment as well as habitat, recreation, and transit.
<b>Native plants</b>	A species of plant that developed or occurred naturally in Minnesota prior to approximately the 1850s.
<b>Natural areas</b>	An area or site mostly unaltered by modern human activity that contains native plants and habitat. Natural areas may include areas such as wetlands, forests, prairie, shoreland, and bluffs.
<b>Natural resources</b>	Living and non-living systems that provide benefits to humans and wildlife. In this plan the term refers primarily to water-based systems such as wetlands, rivers, and streams as well as the upland areas that sustain the quality of water in these resources.
<b>Natural waterbodies</b>	Any waterbody, including wetlands, that was not human-made for the explicit purpose of managing stormwater.
<b>Nonpoint sources</b>	Waterbody pollution originating from diffuse sources.
<b>Nutrients</b>	A group of chemicals that are needed for the growth of an organism. Within surface water systems, nutrients such as phosphorus and nitrogen can lead to the excessive growth of algae.

<b>Official Controls</b>	As defined in MN Statute 473.852, as amended: ordinances and rules which control the physical development of a city, county, or town or any part thereof or any detail thereof and implement the general objectives of the comprehensive plan. Official controls may include ordinances establishing zoning, subdivision controls, site plan regulations, sanitary codes, building codes, and official maps.
<b>Open Space</b>	Land areas that are primarily vegetated and are maintained for public benefits such as recreation, wildlife habitat, water quality, water and natural resource protection, and stormwater management.
<b>Performance standards</b>	A set of criteria or definitions for the implementation and function of management practices and stormwater management systems.
<b>Pesticides</b>	A substance intended to prevent, repel, or destroy a pest (insects, mice, bacteria, etc.).
<b>Pipeshed</b>	A smaller geographic section within a larger watershed unit that drains through a system of pipes to a single outfall.
<b>Point sources</b>	Waterbody pollution originating from an identifiable location, such as an industrial facility or stormsewer system.
<b>Pollutant loadings</b>	The total amount of a pollutant entering a waterbody over a certain time period.
<b>Polychlorinated biphenyls (PCBs)</b>	A compound historically used in coolants, transformers, and other uses. They are highly persistent in the environment and are suspected to be detrimental to human health.
<b>Pre-development</b>	Is defined as the runoff conditions resulting from open space in fair condition.
<b>Public</b>	Residents, citizens, and community groups within the MWMO.
<b>Quaternary</b>	Quaternary period is geologic time beginning about 1.5 million years ago to present. Term is often used with respect to geologic deposits: unconsolidated soils deposited during the Quaternary geologic period.
<b>Recodification</b>	Renumbering or reorganizing the Plan without altering content.
<b>Redevelopment</b>	The reconstruction or significant alteration or renovation of existing structures, roadways, or other permanent constructed features. See Development.
<b>Resource-based standards</b>	A specific form of performance standards focusing on protection or restoration of the downstream resource.

<b>Restorative Development</b>	Is a distributed network of Integrated Utility Systems (IUS) that includes food production, energy, information technology, solid waste, materials management, and water systems. It transforms cities and regions into places with zero waste, energy independence, closed loop water systems and food security. By design it is highly interwoven into the public realm's buildings, green space, public space, streets, traffic and parking.
<b>Re-suspend</b>	Putting back into suspension particles that had previously settled to the bottom of a waterbody or stormwater management device.
<b>Riparian</b>	The interface between land and a waterbody such as a stream or river.
<b>Source water assessment area</b>	The area surrounding a public water supply source that contributes water to the supply within a given timeframe. This is the area to be evaluated for susceptibility to contamination. The source water assessment may lead to a protection plan, either through a source water protection plan for surface water, or through a wellhead protection plan for groundwater.
<b>Source water protection plan</b>	A plan identifying protection methods to address surface water supply contaminants that could impact human health, to establish protection measures, and to reduce pollution.
<b>Stormwater Hotspots</b>	Point source potential pollution generating land uses such as gas stations, chemical storage facilities, industrial facilities, etc.
<b>Stormwater management practices</b>	Techniques, methods, or structural controls used within a given set of conditions to control the speed and total amount of stormwater that flows off a site after a rainstorm. Also used to improve the quality of the runoff water.
<b>Stormwater/ Stormwater runoff</b>	Water that is generated by rainfall or snowmelt that runs off the land and may be routed into drain systems for treatment or conveyance.
<b>Subwatershed</b>	A smaller geographic section within a larger watershed unit with a drainage area of typically between 2 and 15 square miles and whose boundaries include all the land area draining to a specified point.
<b>Support</b>	Providing financial contribution, technical resources, or in-kind contributions to a certain project or initiative.
<b>Surficial Geology</b>	The material starting at approximately 3-feet below the surface, and mapped at 1:100,000 scale. Note the level of accuracy of data does not account for up to 20-feet of fill in urban areas.
<b>Streamlining of a Procedure</b>	Altering a procedure or process to make it more efficient.
<b>Total Maximum Daily Loads (TMDLs)</b>	The total amount of a pollutant that a waterbody can receive and still meet state water quality standards. TMDL also refers to the process of allocating pollutant loadings among point and nonpoint sources.

<b>Total phosphorus</b>	The total amount of the nutrient phosphorus present in a water sample. Increased phosphorus is a key factor leading to decreased water quality.
<b>Water reuse</b>	The use of water more than once in a building or in a landscape prior to discharge. This may include greywater use, storage of rainwater for irrigation, and other methods.
<b>Water supply</b>	A source of potable or non-potable water for human use.



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# Watershed Management Plan 2011-2021

## 1.0 INTRODUCTION

The Mississippi Watershed Management Organization (MWMO) is committed to protecting, managing, and improving the water resources within its boundaries. The MWMO Board of Commissioners has directed staff to lead efforts to accomplish the mission by assisting, educating, supporting, and cooperating with its member organizations, other units of government, nonprofit agencies, and a variety of community groups to achieve a diverse, functional urban river ecosystem.

Mission Statement articulates why the organization exists:

*To lead, and to foster stewardship of the watershed and its waters with actions that promote civic ownership and responsibility and through measures that achieve diverse and functional ecosystems.*

Vision statement describes what the organization hopes to achieve by 2020:

*To lead, to inspire, to act, to educate, and to create a shared vision for a river system with ecological integrity.*

## **2.0 EXECUTIVE SUMMARY**

### **2.1. History**

Today's organization began as the Middle Mississippi River Watershed Management Organization in 1985 with a joint powers agreement executed by the Cities of Minneapolis, Saint Paul, Lauderdale, Falcon Heights, Saint Anthony Village, the Minneapolis Park and Recreation Board, and the University of Minnesota. For business purposes, the organization shortened its name to the Mississippi Watershed Management Organization. The current joint cooperative agreement, bylaws and legal description are included in Appendix A.

The First Generation Watershed Management Plan (Plan), published in December of 1986, was never officially approved, resulting in no projects being implemented. In January 1997, the University of Minnesota left the organization and a Second Generation planning effort was initiated. In 1998 the Capitol Region Watershed District was formed adjacent to the MWMO. A geographically small community, Falcon Heights chose to remove itself and its accompanying land area from the MWMO, thus stewarding its watershed solely within the Capitol Region Watershed District. In 2000, the Bassett Creek Watershed Management Commission, MWMO, and the City of Minneapolis entered into a joint and cooperative agreement, which resulted in a boundary change that transferred 1,002 acres from the Bassett Creek Watershed Management Commission to the MWMO to address the completion of the new Bassett Creek tunnel that now provides 50cfs in overflow (Appendix K).

In 2000, the MWMO Second Generation Plan was approved. In 2006, the Plan was amended to add the Greening Program and clarify existing programmatic efforts. The MWMO's Third Generation Plan was adopted by the MWMO Board of Commissioners on May 10, 2011. An amendment to the Plan's Capital Improvement Schedule to add additional member projects was adopted by the MWMO Board of Commissioners on May 8, 2012.

In 2011 the Six Cities WMO was dissolved. By August 21, 2012, the cities of Columbia Heights, Fridley, and Hilltop past members of Six Cities WMO, became members of the MWMO. Stormwater management projects in the cities of Columbia Heights, Fridley and Hilltop were identified and added to the MWMO Plan's Capital Improvement Schedule via a 2013 plan amendment.

### **2.2. Accomplishments**

When the 2000 Watershed Management Plan (Plan) was adopted, the MWMO consisted of a five-member Board with staffing provided by the City of Minneapolis Environmental Services. In the fall of 2002, the MWMO Board hired an administrator and program manager to build an organization capable of implementing the goals and activities outlined in the 2000 Plan. Since then, the MWMO has established its own offices and added new staff members to develop the programmatic areas needed to successfully implement goals and activities found in the 2000 Plan. A few of these successes include: the Heritage Park Capitol Improvement Project, the Stewardship Grant Fund, the Hmong Community Project, a study on the Historic Waters of the MWMO, and the establishment of a monitoring network for the Watershed.

In the Heritage Park Capitol Improvement Project, the MWMO worked with the City of Minneapolis to incorporate new and innovative stormwater management practices into a city-led neighborhood redevelopment project. This is the first effort within the Watershed to demonstrate the benefits that an integrated stormwater management effort can make in a land use redevelopment project, providing water quality and quantity improvement and quality of life enhancement.

Stewardship Fund activities have awarded grants and provided technical assistance and information to community organizations within the Watershed. Since 2003, the Stewardship Fund has supported the installation of stormwater management practices to improve water quality as well as the implementation of water quality communication and outreach activities.

The MWMO's Communications and Outreach Program, in partnership with the City of Minneapolis, is leading the way to a better understanding of the cultural connections the Hmong community has with water resources. This allows the MWMO to provide relevant information using appropriate, meaningful methods.

The MWMO study, Historic Waters of the MWMO (MWMO, 2011), is exemplary of the scientific approach the MWMO is taking to better understand historic and present day water, land, and geological characteristics that influence water resources.

The MWMO also partnered with its member organizations to initiate a monitoring network. The MWMO currently monitors several parameters of water quality and river stage at seven locations in the Mississippi River as well as the quality and amount of water that flows from six stormwater outfalls draining into the river and one stormwater drainage system at the jurisdictional boundary of Minneapolis and Saint Anthony Village. This is the beginning of a comprehensive monitoring network that will provide the MWMO the data needed to evaluate its progress in managing the water resources within the Watershed.

Through these and other accomplishments, the MWMO has proven to be an effective and motivated organization. Through this Third Generation Plan the MWMO lays out an implementation schedule which requires the continued growth and leadership of the organization to achieve its stated goals. In 2012, the organization completed construction of a facility that will meet future organizational needs.

### **2.3. Statutory Background**

The 1972 Federal Clean Water Act authorized the US Environmental Protection Agency (EPA) to “protect . . . rights of States to prevent, reduce, and eliminate pollution of . . . land and water resources” (Sec 101, b). The EPA transferred portions of this authority to state legislative bodies. In 1982, the legislature approved the Metropolitan Surface Water Management Act. It was later recodified as M.S. 103B (See Appendix B-Minnesota Statutes Chapter 103B).

Since passage of the act, all local units of government in the seven-county metropolitan area have been involved in the preparation and implementation of comprehensive surface water management plans through membership in a watershed management organization based on natural watershed boundaries.

These first plans resulted in two key advances in comprehensive surface water resource management. First, the plans required the adoption, amendment, or update of a variety of local controls to reduce erosion and sedimentation, establish stormwater design standards, and protect wetlands. Second, during the planning and implementation of the plans, communities within the watersheds developed stronger working relationships.

In 1992, the Board of Water and Soil Resources developed rules (Minnesota Rules Chapter 8410) for plan content. WMOs use these rules in plan revisions, which are required every 5 to 10 years. The rules require, among other items, more specificity in citizen participation, control of erosion and sedimentation, wetland assessment, and the design of new stormwater conveyance and treatment systems.

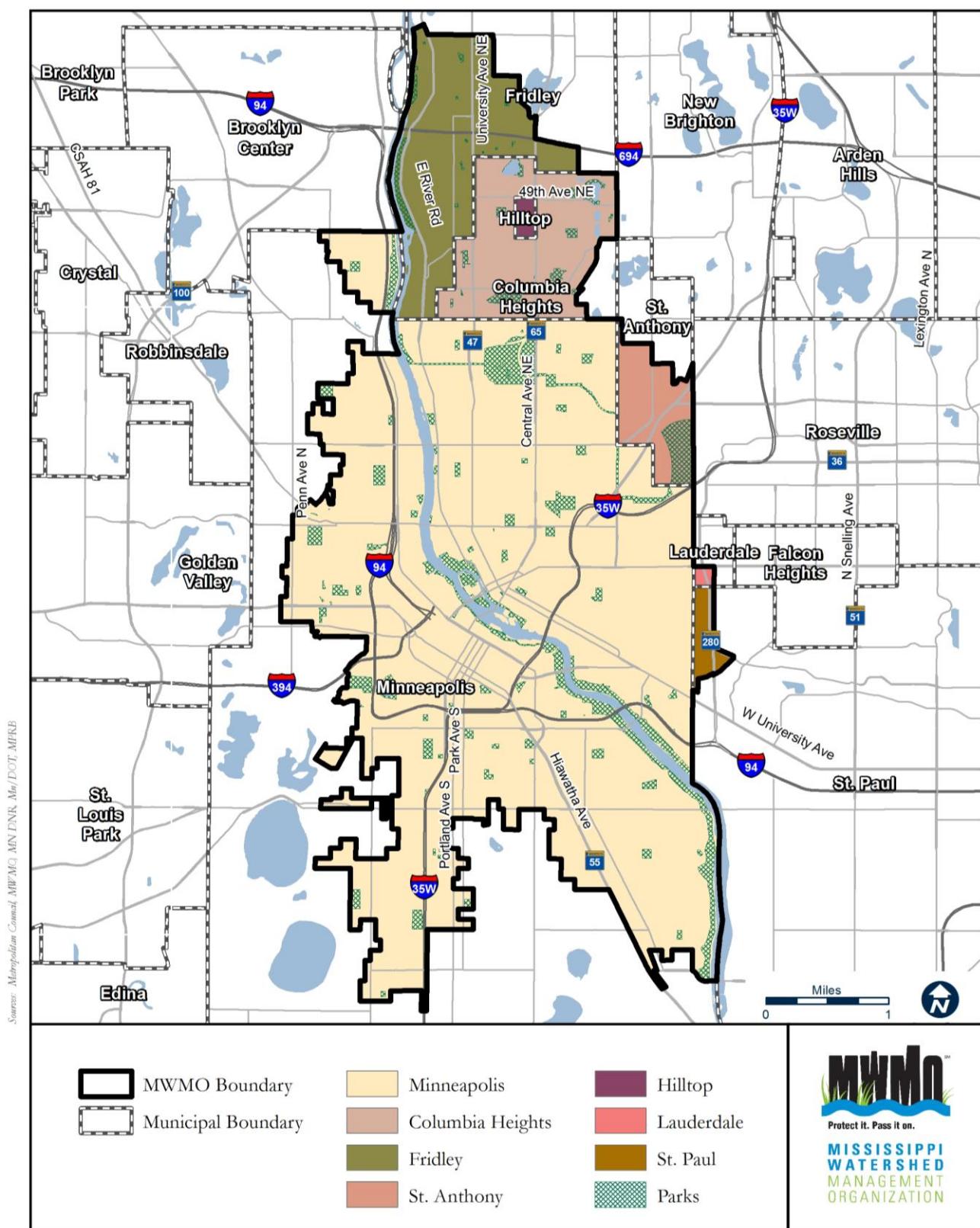
The Metropolitan Surface Water Management Act lists a number of responsibilities watershed management organizations can elect to accept and carry out (see Appendix B). The MWMO has the authority to protect, to preserve, and to improve surface and groundwater systems; to establish more uniform local policies and official controls for surface and groundwater management; to prevent erosion of soil; and to protect and enhance fish and wildlife habitat and water recreational facilities. These responsibilities affect more than just water resource management; they impact land use, habitat and ecosystem planning, and management connected to water resources.

Additionally, in 2001 the legislature granted the authority of a Special Purpose Taxing District under Minnesota Statute Section 275.066 to the MWMO. This authority continues to be vital to implementing plans and goals of the MWMO.

#### **2.4. Present Day Jurisdictional Area**

The MWMO's jurisdictional area includes portions of the Cities of Columbia Heights, Fridley, Hilltop, Lauderdale, Minneapolis, Saint Anthony Village, and Saint Paul, as well as lands owned by the Minneapolis Park and Recreation Board. The MWMO's legal boundary is shown in Figure 1.

Figure 1: MWMO Legal Boundary and Location of Cities and Parks



**Table 1: Percent Coverage of Member Organizations within the MWMO**

Municipality	Percent Area of MWMO	Acres within MWMO	Square Miles
Columbia Heights	7.92%	2025.04	3.16
Fridley	9.51%	2431.89	3.80
Hilltop	0.32%	81.57	0.13
Lauderdale	0.16%	40.46	0.06
Minneapolis	73.26%	18729.70	29.27
MPRB*	5.42%	1386.50	2.17
Saint Anthony Village	2.55%	653.13	1.02
Saint Paul	0.85%	217.34	0.34
Totals	100.00%	25565.63	39.95

\*The MPRB's landholdings are within the Cities of Minneapolis and Saint Anthony Village

## 2.5. Board of Commissioners

The MWMO's governing Board of Commissioners consists of seven commissioners. There is one commissioner appointed by each member organization with the exception of a shared seat for the cities of Columbia Heights and Hilltop.

**Table 2: 2014 Board of Commissioners of the MWMO\***

Member	Position	Member Community
Kevin Reich	Chair	City of Minneapolis
Scott Vreeland	Vice-chair	Minneapolis Park and Recreation Board
Karen Gill-Gerbig	Treasurer	City of Lauderdale
Jerry Faust	Commissioner	City of Saint Anthony Village
Betty Wheeler	Commissioner	City of Saint Paul
James Saefke	Commissioner	City of Fridley
Donna Schmitt	Commissioner	City of Columbia Heights / Hilltop

\* Note: see [www.mwmo.org](http://www.mwmo.org) for a current list of commissioners and alternates

## 2.6. Committees

The Citizen Advisory Committee (CAC) meets at the request of the MWMO Board of Commissioners to assist in managing the water resources of the MWMO. The CAC reviews MWMO's annual budget, funding proposals for Capital Improvement Projects, and Stewardship Fund grants and makes recommendations to the Board. The committee also participates in strategic planning for the Watershed. The CAC Volunteer Position Description in Appendix C and/or subsequent revisions will guide the MWMO in working with the MWMO's Citizen Advisory Committee.

A Technical Advisory Committee also meets at the request of the MWMO Board of Commissioners to assist in managing the water resources of the MWMO. This committee does not have a standing membership; rather, a panel of experts is assembled based on the project or program need. For example, a technical advisory committee was assembled to provide guidance on funding green infrastructure in the MWMO. The members on this committee had extensive background and knowledge in stormwater management practices and other complementary programs in the Watershed. This background allowed them to recommend objectives for MWMO's Capital Projects that developed synergies with other programs and avoided duplicating services. The MWMO will continue to call on experts from public and private organizations to evaluate, review, and further develop existing and new programs and projects and the MWMO's Standards.

## **2.7. Summary of Issues, Goals, and Strategies**

Following an extensive public input process planning staff aggregated the public comments and issues (Appendix M) into the following ten key focus areas and nineteen related focus area statements from which all of the final goals, strategies, and actions of the plan resulted (see section 6.2 table 20 for a complete listing of all focus areas, focus statements, goals, strategies, and actions).

### Water Quality Focus Area

- Protect and improve the water resources of the MWMO
- Account for water quality conditions upstream that impact the MWMO
- Participate in the development and implementation of TMDLs
- Identify the role the MWMO will take in addressing soil contamination and groundwater quality

### Water Rate and Volume Focus Area

- Manage the causes and reduce the effects of flooding that impact the watershed
- Manage the causes and reduce the effects of drought that impact the watershed

### Monitoring & Data Assessment Focus Area

- Make decisions based on science and best available data

### Communications and Outreach Focus Area

- Provide resources and opportunities to build capacity and leadership and promote responsible stewardship of water and natural resources
- Create communication and outreach connections within MWMO programs
- Enhance communications between MWMO and constituents

### Ecosystem Health Focus Area

- Find ways to protect, create, and enhance vegetated areas, springs, native plant communities, habitat, open space, and green infrastructure
- Protect land that significantly impacts surface and groundwater resources and natural resources

### Regulations & Enforcement Focus Area

- Promote consistency in rules, regulations, standards, and enforcement across jurisdictions
- Improve compliance and enforcement of regulations related to water and natural resources

### Urban Stormwater Management Focus Area

- Promote unique and innovative solutions for stormwater management in highly developed urban areas

#### **Emergency Preparedness & Response Focus Area**

- Protect natural resources when natural disasters and emergencies occur

#### **Emerging Issues Focus Area**

- Develop new approaches that protect water and natural resources as conditions change and emerging issues arise

#### **Financial Responsibilities and Strategies Focus Area**

- Develop a comprehensive financial framework to implement goals, strategies, and actions of the plan
- Maintain a funding strategy that is effective, efficient, and transparent

The plan identifies a number of activity areas and implementation actions to address each of the focus areas. The implementation actions are outlined in Section 6.2. The MWMO activity areas are:

- Capital Projects
- Communications and Outreach
- Monitoring
- Planning
- Watershed Assessment

### **2.8. Using the Plan**

This Plan has been developed to guide the MWMO Board and staff in the implementation of Watershed goals. The Plan sets out goals, strategies, and implementation actions based on past studies and current data on the status of the water and natural resources of the Watershed. The MWMO staff and Board use the Plan to guide watershed management decisions based on the established goals and strategies and the summarized land and water resource information. Additionally, the MWMO staff and Board use the Plan to assist in the development of annual work plans based on the outlined implementation actions in concert with the goals and strategies.

Member organizations will find the Plan of use in developing local surface water management plans through the use of land and water resource information and by reviewing the requirements for local plans outlined in the Member Authorities and Responsibilities section. Additionally, member organizations can use the MWMO implementation plan to assist in scheduling and coordinating capital improvements and programs.

Residents, businesses, and other organizations within the Watershed can use the Plan to learn more about the natural and water resources within the Watershed and to be aware of the project, activities, and operations of the MWMO. For individual MWMO studies, content, and resources beyond this Plan, please see our website at <http://www.mwmo.org/>.

## **2.9. Navigating the Plan**

This plan outlines the projects, activities, services and expertise of the MWMO. Different groups may be interested in different sections of the plan:

- Residents of the MWMO may be particularly interested in the services and expertise MWMO offers and can find this information in the Administrative/Internal Operations section where each area of staff expertise is described.
- Member organizations may find the Member Authorities and Responsibilities section especially useful for developing their local plans and for evaluating which organization has authority over certain water-related concerns. In addition, member organizations may find valuable resource information in the Resource Inventory. Information on opportunities for cooperation on common efforts and joint funding of projects is found in section 3.7 Accessing MWMO Funding.
- MWMO staff may be especially interested in the Administrative/Internal Operations section and the Implementation Schedule in the Issues, Goals, Strategies, and Actions section as a guide to their day-to-day activities through activity areas and implementation actions. In addition, MWMO staff will find the Member Authorities and Responsibilities section useful as a guide to the roles of the MWMO and member organizations when coordinating and planning activities. The Resource Inventory will be a reference for staff to increase understanding of the system they are working to manage, protect, and improve.
- The MWMO Board may find the Executive Summary and Watershed Issues, Goals, and Strategies sections particularly useful when discussing with others the mission and goals of the MWMO and the issues addressed by the organization. The MWMO Board may also want to be familiar with the Member Authorities and Responsibilities section and the Administration/Internal Operations section to assist in coordinating with the member organizations they represent.
- Developers may be interested in the Resource Inventory to gather basic information about the physical setting and drainage of their properties. In addition, developers will want to reference the MWMO Standards in the Member Authorities and Responsibilities section to determine the water-related requirements that will be implemented by the member organizations.

## **2.10. General Content of Local Plans**

The required content of local plans is specified further in Section 3.4 and generally includes:

- Water, Natural Resources, and Land Use Goals and Policies
- Infrastructure Assessments and Programs
- MWMO Standards
- Surface Water Appropriations
- Evaluation

# **3.0 MEMBER AUTHORITIES AND RESPONSIBILITIES**

The MWMO will work with member organizations and other water-related authorities to implement the goals and strategies of this Plan. Coordination between the MWMO and member organizations requires that each organization has a clear role. This section of the Plan clarifies these roles by describing the MWMO's expectations of each authority in the areas of MWMO's Standards, members' Local Water Plans, all water-related authorities in the MWMO, and MWMO Funding.

### **3.1. Adopting MWMO's Standards**

The MWMO recognizes that the control and determination of appropriate land uses is the responsibility of the Local Units of Government. Since the MWMO is responsible for the protection and management of surface and groundwater systems, it is well equipped to develop resource-based standards (MWMO Standards) that will best address the impact of the surrounding land use on the quality of these resources. The MWMO does not issue permits or provide approval letters for construction projects; rather, it relies on the existing permitting and enforcement bodies of its member organizations. To continue this efficiency in government, the MWMO prefers to have member organizations integrate the implementation and enforcement of MWMO Standards into their existing regulatory departments (see Appendix D). The MWMO is ready to assist its member organizations by providing additional staff expertise and funding for the writing of these standards into ordinance. The following standards have been written with the acknowledgement that more details may need to be added as the city ordinances are written.

#### ***3.1.1. VOLUME CONTROL IN URBAN AREAS***

It is clear, that the MWMO's highly urban setting and non-native soils presents limitations to implementing volume controls in the Watershed. The MWMO acknowledges these limitations and believes the Design Sequence Flow Chart developed through the Minnesota Pollution Control Agency's Minimal Impact Design Standards process adequately addresses these limitations by providing suitable alternatives to volume control on difficult sites.

Volume controls are a proactive approach to watershed management and necessary to maintain a viable ecosystem within the challenging urban environment of the Watershed. The MWMO's volume control standards will reduce the loading of pollutants entering receiving waters; may maintain the longevity of the pipeshed system; may promote ground water recharge; may contribute to river baseflow; will improve consistency with adjacent watersheds' rules and be consistent with the Minnesota Pollution Control Agency's Construction Stormwater Permit volume control requirements.

Infiltration practices are used to implement a volume control standard. Among stormwater best management practices, those practices that infiltrate stormwater (reduce volume) have the highest efficiency in removal of pollutants and the remove the greatest numbers pollutants. As a result of these unique characteristics, infiltration practices save future time, money, land and other scarce resources because, they proactively manage for future pollutants not yet identified and regulated. In addition, onsite infiltration practices replicate as close as possible a watershed's natural hydrologic cycle, limiting pollutant concentrations, and preventing higher downstream cleanup costs.

Infiltration practices may attenuate 2-year, 24 hour storm event flows, i.e., the maximum rate of discharge for smaller storm events for which volume practices are sized, and reduce long-term wear and maintenance costs on the pipeshed

By adopting a volume control standard, the MWMO would be promoting a consistent approach to achieving water quality goals across much of the Twin Cities. Developers who work across the Twin Cities repeatedly spoke up during the Minimal Impact Design Standards process in favor of more consistent standards among jurisdictions.

Although triggers vary, the MWMO is surrounded by watershed organizations that require retaining approximately the first 1 inch of runoff to be held onsite. These currently include the Capitol Region Watershed District, the Minnehaha Creek Watershed District, the Rice Creek Watershed District, the Coon Creek Watershed District, and the Shingle Creek Watershed Management Commission. The Bassett Creek Watershed Management Commission draft Watershed Management Plan includes a policy adopting MPCA's minimal impact design standards. The draft plan is out for review, with BWSR approval expected in 2015. In addition, the MWMO's new volume standard will be inline the Minnesota Pollution Control Agency's current Construction Stormwater Permit requirements of retaining 1 inch volume on site. A requirement all MS4's need to currently follow.

### **3.1.2. LIMITING COSTS OF STORMWATER TREATMENT**

Initially, stormwater management practices were designed to meet conditions found in new growth areas, outside of urban core, where there were few limiting conditions to site development. However, in highly urbanized areas, where a property may have had multiple land uses and been redeveloped many times there is a great likelihood there will be factors that limit certain types of stormwater management practices on the site. Thus, when the same stormwater management practices are fitted to the urban core the costs may rise significantly due to site conditions; such as, higher land values, polluted soil conditions, inappropriate fill or placement of existing infrastructure. Therefore the MWMO may set limits on cost of stormwater treatment any site incurs in complying with the MWMO's Standards. A limit of the stormwater costs is needed to balance the environmental and financial tradeoffs to the public and private sectors to achieve the protection and restoration of the water quality and quantity in the watershed.

On occasions, the limiting conditions on urban sites may inflate the cost of site stormwater treatment to a level that exceeds what is reasonable to expect, so the MWMO will consider shifting the treatment to the next best site opportunity elsewhere in the watershed or further upstream. The opportunity lost, when this shift occurs, is the management of stormwater as close as possible to its source. Source management of stormwater is the preferred option for replicating a watershed's natural hydrologic cycle, limiting pollutant concentrations, and preventing higher downstream cleanup costs.

### **3.1.3. THE MWMO'S STANDARDS LANGUAGE**

#### **1. Stormwater Management Standards**

- a. Any project creating greater than one acre of land disturbance is subject to the standards below.
- b. The MWMO's Standards, or higher, must be adopted by local units of government and incorporated into their stormwater ordinance or other regulatory control.
- c. In order to reduce regulatory complexity, a member may request the MWMO to allow stormwater rules set forth by adjacent watershed management organizations to govern development so long as they can be shown to be substantially equal to or greater than the level of protection afforded by the MWMO Standards.
- d. Road mill and overlay project activities need only to comply with MWMO erosion and sediment control standards.
- e. See the land disturbance definition for activities that shall not be considered land disturbance for the purposes of determining permanent stormwater management requirements.

#### **2. Rate Control**

Runoff rates for the proposed activity shall meet the member cities and MS4's runoff rate control requirements, using the member cities' and MS4's required critical storm events (as defined by Atlas 14 Volume 8 and/or subsequent revisions). Runoff rates for the proposed activity and pre-development shall be determined using an Atlas 14-based (nested, regional, state) rainfall distribution using NRCS-approved methodology.

All area contributing to the practice shall be accounted for in the design of the rate control practice. This includes areas off site and beyond the public right-of-way that will be contributing to the practice.

#### **3. Water Quality / Volume Control**

- a. For nonlinear projects, without limitations, that disturb one or more acre of land, 1.1 inches of runoff from the new and fully reconstructed impervious surfaces shall be captured and retained on site.
- b. For linear projects on sites, without limitations, that disturb one or more acre of land, the larger of the following shall be captured and retained on site:
  - i. 0.55 inches of runoff from the new and fully reconstructed impervious surfaces

- ii. 1.1 inches of runoff from the net increase in impervious area
  - c. For projects on sites with limitations, the MWMO Design Sequence Flow Chart (Appendix Q) or a MWMO-approved alternative shall be used to identify a path to compliance through Flexible Treatment Options.
    - i. The MWMO will develop a MOU with individual member cities and MS4's to address flexible treatment option #3 off site mitigation conditions.
- 4. Volume Control Guidance (recommended procedures for volume control projects)**
- a. Infiltration volumes and facility sizes shall be calculated using the appropriate hydrologic soil group classification, ASTM Unified Soil Class Symbol, and design infiltration rate from Table B. Select the design infiltration rate from Table B based on the least permeable soil horizon within the first five feet below the bottom elevation of the proposed infiltration management practice. The information provided in Table B is intended to be used in the following manner:
    - i. For preliminary design purposes, refer to the NRCS soil survey to identify the hydrologic soil groups found on site. This information provides a preliminary indication of the infiltration capacity of the underlying soils.
    - ii. After volume control/infiltration practices have been located on the grading plans, perform soil borings in the exact location of the proposed practices and in the quantity as described in the Minnesota Stormwater Manual Wiki (Minnesota Pollution Control Agency, 2014) as amended. Soil borings should be logged using the USDA Soil Textural Classification System and the ASTM Unified Soil Class Symbol.
    - iii. The combination of all the aforementioned information will allow the designer to identify the appropriate design infiltration rate. As the Minnesota Stormwater Manual States, "these infiltration rates represent the long-term infiltration capacity of a constructed infiltration practice and are not meant to exhibit the capacity of the soils in the natural state". A permit applicant can submit field measurements and revised rates (using the correction factors provided in the Minnesota Stormwater Manual) if there is reason to believe the long-term infiltration rates will be other than the design infiltration rates provided in Table B.
  - b. A geotechnical investigation shall be performed in the location of the proposed volume control practices to confirm or determine underlying soil types, the depth to the seasonally high groundwater table, and the depth to bedrock or other impermeable layer.
  - c. Infiltration BMPs shall drawdown in the time specified in the Minnesota Stormwater Manual Wiki for that BMP, or less if required by another entity with jurisdiction. Drawdown time and maximum ponding depths are defined in the Minnesota Stormwater Manual Wiki.
  - d. Infiltration stormwater management practices must be designed to include adequate pretreatment measures before discharge of runoff to the primary infiltration area, consistent with the Minnesota Stormwater Manual Wiki.
  - e. Design and placement of infiltration stormwater management practices shall be done in accordance with the Minnesota Department of Health guidance called "Evaluating Proposed Stormwater Infiltration Projects in Vulnerable Wellhead Protection Areas." (Final version to govern)
  - f. Specific site conditions may make infiltration difficult, undesirable, or impossible. Some of these conditions are listed in Table A. A more comprehensive list is provided in the MWMO Design Sequence Flow Chart in Appendix Q.

**Table A: Site Conditions Considered Undesirable for Infiltration Stormwater Management Practices**

Type	Specific Site Conditions	Submittal Requirements
Potential Contamination	Potential Stormwater Hotspots (PSHs)	PSH locations and flow paths, Remediation Alternatives Considered
	Contaminated Soils	State Permitted Brownfield Documentation, Soil Borings, Remediation Alternatives Considered, Site design alternatives considered
Physical Limitations	Low Permeability (Type D Soils)	Soil Borings
	High Permeability (soils infiltrating greater than 8.3 inches/hour)	Soil Borings
	Bedrock within 5 vertical feet of bottom of infiltration area	Soil Borings
	Potential Adverse Hydrologic Impacts (e.g., impacting perched wetland)	Documentation of Potential Adverse Hydrologic Impacts
	Seasonal High Groundwater within 5 vertical feet of bottom of infiltration area	Soil Borings
	Karst Areas	Soil Borings
	Steep Slopes	Steep Slope Determination
Land Use Limitations	Utility Locations	Site Map, Alternatives considered
	Zoning or Land Use Limitations (Parking, Density, Setbacks, etc.)	Alternatives considered, Documentation of Infeasibility
	Adjacent Wells within 200 feet or inside Wellhead Protection Area or Drinking Water Supply Management Areas (DWSMA)	Well Locations or DWSMA
	Building Foundation	Ten (10) feet

Source: Modified from Minnesota Pollution Control Agency Minimal Impact Design Standards Design Sequence Flow Chart, December 5, 2013

Note: the most recent version of the Minnesota Stormwater Manual should be used; Table A is provided as optional guidance to the cities

**Table B. Design Infiltration Rates**

Hydrologic Soil Group	Soil Textures <sup>1</sup>	ASTM Unified Soil Class Symbols	Rate
A	Gravel, sandy gravel, silty gravel	GW, GP, GM, SW	1.63 in/hr
	Sand, loamy sand, sandy loam		
B	Loam, silt loam	SP	0.80 in/hr
C	Sandy clay loam	SM	0.45 in/hr
D	Clay, clay loam, silty clay loam, sandy clay, silty clay	MH ML CL, CH, OH, OL, GC, SC	0.30 in/hr 0.20 in/hr 0.06 in/hr

*Source: Minnesota Stormwater Manual Wiki, October 2014*

Note: Design infiltration rates from the most recent version of the Minnesota Stormwater Manual should be used

1 Adapted from the U.S. Department of Agriculture, Natural Resources Conservation Services, 2005. National Soil Survey Handbook, title 430-VI.

## 5. Maintenance

- a. Practices must continue to perform as approved. Owners must follow an inspection and maintenance schedule that has been approved by the permitting entity and correct any post-construction performance issues that arise.
- b. All stormwater management structures and facilities, including volume reduction stormwater management practices, shall be maintained to assure that the structures and facilities function as originally designed. The maintenance responsibilities must be assumed by either the municipality's acceptance of the required easements dedicated to stormwater management purposes, or by the applicant executing and recording a maintenance agreement, or by another enforceable means acceptable to the LGU. If used, the recordable executed agreement must be submitted to the municipality prior to issuance of the project approval from the city." Public developments will require a maintenance agreement in the form of a Memorandum of Agreement or an approved Local Water Management Plan or in compliance with an MS4 Permit that details the methods, schedule, and responsible parties for maintenance of stormwater management facilities for permitted development. A single Memorandum of Agreement for each local government unit may be used to cover all stormwater management structures and facilities required herein, including volume reductions management practices, within the LGU's jurisdiction. This maintenance plan shall address snow management.

## 6. Drainage Alterations

No person shall alter stormwater flows (resulting in an increase in stormwater flows or a change in existing flow route) at a property boundary by changing land contours, diverting or obstructing surface or channel flow, or creating a basin outlet, without first obtaining any necessary permits from the city.

## 7. Bounce and Duration Control

- a. The project must meet hydroperiod standards adapted from "Stormwater and Wetlands Planning and Evaluation Guidelines for Addressing Potential Impacts of Urban Stormwater and Snowmelt Runoff on Wetlands," (Minnesota Stormwater Advisory Group, June 1997), as follows:
  - i. Wetland Susceptibility Class = Highly Susceptible; Permit Storm Bounce = Existing; Inundation Period for 2-Year event = Existing; Inundation Period for 10-year or Greater Event = Existing

- ii. Wetland Susceptibility Class = Moderately Susceptible; Permit Storm Bounce = Existing plus 0.5 feet; Inundation Period for 2-Year event = Existing plus 1 days; Inundation Period for 10-year or Greater Event = Existing plus 7 days
- iii. Wetland Susceptibility Class = Slightly Susceptible; Permit Storm Bounce = Existing plus 1.0 feet; Inundation Period for 2-Year event = Existing plus 2 days; Inundation Period for 10-year or Greater Event = Existing plus 14 days
- iv. Wetland Susceptibility Class = Least Susceptible; Permit Storm Bounce = No Limit; Inundation Period for 2-Year event = Existing plus 7 days; Inundation Period for 10-year or Greater Event = Existing plus 21 days

## **8. Flood Control**

Flood control for the proposed activity shall meet the member cities or MS4's flood control requirements. Member cities and MS4's flood control requirements should minimize property damage due to excess water.

## **9. Erosion and Sediment Control**

- a. Erosion and sediment control measures shall meet the standards for the General Permit Authorization to Discharge Stormwater Associated with Construction Activity Under the National Pollutant Discharge Elimination System/State Disposal System Permit Program, Permit MN R100001 (NPDES General Construction Permit), issued by the Minnesota Pollution Control Agency, except where more specific requirements are required.
- b. Activity shall be phased to minimize disturbed areas subject to erosion at any one time.
- c. All construction site waste—such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site—shall be properly managed and disposed of so they will not have an adverse impact on water quality.
- d. If silt fence is installed it shall conform to sections 3886.1 and 3886.2, Standard Specifications for Construction, Minnesota Department of Transportation (2005 ed.), as it may be amended.

### ***3.1.4. IMPLEMENTATION OF THE MWMO'S STANDARDS***

With respect to the financial impact of these standards, the MWMO does not foresee a significant increase in administrative, permitting, and enforcement costs for Local Units of Government adopting these standards. However, studies conducted by the MWMO demonstrated that it is going to cost more to meet the MIDS standard than the existing cities standards. Yet, when it comes to linear projects the MWMO's new MIDS based standard is anticipated to be less costly than MWMO's existing 90% TSS standard.

As required by statute, each member organization shall amend their local water plans and adopt local ordinances and or official or local controls that are consistent with the MWMO Standards in this Plan. The MWMO is committed to ensuring the implementation of its standards in cooperation with member organizations. To promote consistency in application of the MWMO Standards, the MWMO recommends members adopt its ordinance-ready MWMO Standards language into their local ordinances and or their official or local controls. In addition, the MWMO may provide training for local staff to ensure their familiarity with the standards. The MWMO may provide funding or staff to assist local inspection and enforcement efforts.

The MWMO may allow a member community to comply with the rules and regulations of another watershed if the MWMO deems the standards of the other watershed management organization to be comparable to MWMO Standards set forth in this Plan. The MWMO Board of Commissioners reserves the right to review and comment on site alteration plans that affect the quality and quantity of water within and across its watershed and subwatershed

boundaries. If this action is taken, a process will be coordinated with the subject city's development review approval timelines.

To ensure ongoing improvement of the standards and their enforcement, the MWMO will convene annual meetings with member organizations and adjacent watersheds to review implementation of the standards and enforcement procedures (see Appendix G). Based on the results of these meetings, the MWMO may revise the MWMO Standards and/or work with the cities to design more efficient and effective implementation and enforcement processes that ensure the protection of natural and water resources in the MWMO. A summary of this meeting will be provided in MWMO's annual report to BWSR.

If the MWMO determines that a member organization is not adequately carrying out the adoption, implementation and enforcement of the (stormwater related) local controls then, the MWMO may pursue all actions necessary to ensure the MWMO's standards are being efficiently adopted, and effectively implemented and enforced. During this period of time the MWMO may withhold project funding or services from the entity and or the jurisdictional area which is not in compliance with the MWMO's Standards.

Evaluation of the effectiveness of MWMO's Standards and enforcement will be based in part on monitoring of the water resources and installed practices in the MWMO. The MWMO may also conduct periodic on-site reviews of permitted activities within member organizations' jurisdictions.

### **3.2. Local Water Plans and Local/Official Controls: Adoption Timeline**

Member organizations are responsible for preparing and adopting a local water plan that is consistent with the MWMO Plan. The local water plan must include information on land use, stormwater runoff, stormwater storage, water quality, and implementation methods to protect local resources. The specific content requirements of local water plans are found in sections 3.2, 3.3, 3.4 of this plan; defined in Minnesota Statue 103B.235; and defined in Minnesota Rule 8410(the MWMO will follow the most recent versions of these documents).

The MWMO will be requesting pre-draft meetings with member city staff to discuss content requirements and set up a draft review schedule that allows MWMO staff with ample time to review, comment, and seek MWMO Board motions on the updated seven local water plans and related local/official controls. To comply with the 8410 Rules (revised in 2015) all local water plans must be adopted after December 31, 2016 and prior to the cities' comprehensive plan updates deadline of December 31, 2018. As such the MWMO recommends cities set up a local water plan pre-draft meeting with the MWMO during June or July of 2016 to discuss content requirements, schedule future preliminary reviews, and schedule the future 60 Day draft review period. See Table 3 for deadlines to be scheduled with each city prior to the final submittal deadline of December 31, 2018.

The local water plans must be consistent with all of the Watershed Management Plans that fall within the municipal boundary. Each local water plan shall be adopted not more than two years before the local comprehensive plan is due. Extensions of local comprehensive plan due dates do not alter the local water plan schedule. Each local water plan must be adopted and implemented in accordance with the time requirements of Minnesota Statutes, section 103B.235, subdivision 4 as summarized below:

The updated local water plan should be submitted for review to the MWMO, County, and Metropolitan Council. The County and Metropolitan Council have 45 days to review and provide comment on the updated plan. The MWMO has 60 days to complete its review and approve or disapprove the local water plan or parts of the local water plan. The review by Metropolitan Council, County, and the MWMO runs concurrently. If the Metropolitan Council fails to complete its review and make comments to the MWMO within the 45-day period, the MWMO should conclude its own

review. If the MWMO fails to complete its review within the prescribed 60 day period, the local water plan shall be deemed approved unless an extension is agreed to by the city.

After approval of the local water plan by the MWMO, the local government unit shall adopt and implement its local water plan within 120 days and shall amend its official controls accordingly within 180 days. Each city must notify MWMO and the Metropolitan Council within 30 days of adoption and implementation of the local water plan or local water plan amendment, including the adoption of necessary official controls.

The Minnesota Department of Transportation will need to be operating in compliance with the MWMO's Standards by November 2016.

**Table 3: Local Water Plan and Local/Official Controls Review, Approval and Adoption Schedule**

Year - Month	Task
2016 - June / July	Discuss Local Water Plan Content Requirements and set Schedule for any Previews of Preliminary Drafts and MWMO's 60 Day Review and Comment Period
2016 - August / Varies by City	Previews of Preliminary Drafts or Meetings with the MWMO <sup>1</sup>
When Draft is Ready Start 60 Day Review Period	Submittal of Local Water Plans to MWMO, County, and Metropolitan Council
When Draft is Ready Start 60 Day Review Period	Submittal of Member Organizations Preliminary Local/Official Controls <sup>2</sup>
Within the 60 Day Review Period	MWMO Approves or Denies Local Water Plans and Local/Official Controls or Member Organizations Agree to Extension
Within the Extension Review Period	Extended Deadline for Local Water Plan and Local/Official Controls Approval or Denial by MWMO
120 Days After Approval of Local Water Plan	Deadline for Member Organizations to Adopt Local Water Plans if Approved by MWMO
180 Days After approval of Local/Official Controls	Member Organizations Adopt, Implement and Enforce Local/Official Controls

<sup>1</sup>MWMO is requesting a preview of preliminary drafts from our larger member cities of Minneapolis and St Paul.

<sup>2</sup>MWMO will require Local/Official Controls and all other supporting documentation for the local water plan to be available for review with the local water plan.

Over time the MWMO will determine the effectiveness of stormwater management efforts in the Watershed by correlating the intended impacts of stormwater management practices installed in a given subwatershed with changes in pollutant concentrations found in that subwatershed. In this manner, monitoring data on end of the pipe concentrations discharging to the river will be used to adjust management efforts over the long term. The MWMO will also collect in-stream Mississippi River data and review the long-term cumulative impact occurring from all pipes discharging into the Mississippi River within the MWMO. Ultimately these findings will guide decisions on whether the MWMO's Standards are sufficient to achieve the goals of the MWMO and its members.

If the MWMO determines that a member organization is not taking the necessary steps to complete, within the timeframe provided in Table 3, one or more of the following actions:

- Amended its local water plan
- Followed through with adoption to local controls
- Carried out enforcement/implementation of local controls enacted

Then, the MWMO may pursue all actions necessary to ensure the MWMO's standards are being efficiently adopted, and effectively implemented and enforced. During this period of time the MWMO may withhold project funding or services from the entity and or the jurisdictional area which is not in compliance with the MWMO's Standards.

### **3.3. Local Water Plans: Content Requirements**

Minnesota Statutes, section 103B.235 and Minnesota Rule 8410, discuss the particular requirements and format of a local water plan (see most recent version of MN Statutes and Rules). The MWMO is especially interested in problems identified in the local water plan and corrective actions that affect the MWMO concerns stated in this Plan or that require MWMO collaboration.

Member organizations may adopt by reference all, or part, of this MWMO Plan. If a member organization does not adopt the MWMO Plan, their local water plan will need to meet the requirements outlined in Minnesota Statutes, section 103B.235 and Minnesota Rule 8410, as well as the content in the MWMO's Table 4. If a member organization partially adopts the MWMO Plan, then any requirements in the MWMO Plan not adopted will need to be completed and included in their local water plan, along with the content described in Table 4. Member organizations that adopt by reference all of the MWMO Plan into their local water plan also need to complete and include content elements found in Table 4 in their local water plan.

Cities should use information currently available to complete Table 4 requirements. No new studies are required to provide the information requested in Table 4. Organizations only need to cite the source of information requested in Table 4 if it is already a part of another organizational document. Table 4 may require content that goes beyond what is requested by other agencies. However, if there is a conflict between another agency's requirements and Table 4 the MWMO will defer to the agency's requirement. If available, each local water plan must contain the following information regarding the management of its water and natural resources:

**Table 4: Local Water Plan Content Requirements**

Water, Natural Resources, and Land Use Goals and Policies
<ol style="list-style-type: none"><li>1. Include an executive summary that summarizes the highlights of the local water plan. Highlights should include local water plan goals, policies and implementation programs that address problems identified in the MWMO's Plan (Focus Statements in Section 2.7); corrective actions that affect these MWMO concerns; and any actions requiring MWMO's collaboration.</li><li>2. Provide a citation and brief description of (Annotated bibliography) water resource management-related agreements that have been entered into by the community, including joint powers agreements related to water management that the LGU may be party to between itself and watershed management organizations, adjoining communities, or private parties.</li><li>3. Describe the city's current water resource and ecosystem health-related problems and any problems that are expected to worsen or emerge over the next 10 years given the projected changes in the city's growth and land use. Identify how MWMO can help address these problems through: implementation programs; monitoring or research needs; temporary maintenance activities associated with innovative projects; capital improvement programs; or where MWMO funding, technical expertise, project management assistance is desired.</li><li>4. As a part of the Local Water Plan and City Comprehensive Plan development process, LGUs should carefully examine how water resources and ecosystems management and protection can be integrated into land use planning and development. The MWMO will look for each local plan to do the following:<ol style="list-style-type: none"><li>a. Describe how decisions on land use, regional water and natural resource needs are being reconciled to secure the greatest degree of long-term water resource and ecosystem protection (see 2.7 e.g. water quality and ecosystem health focus areas)</li><li>b. Address the order of authority between city: planning, policies, ordinances, permitting (e.g. city: policy, comprehensive plan, permitting, zoning ordinances).</li><li>c. The MWMO is interested in increasing opportunities for stormwater infrastructure that treats runoff from multiple parcels. In particular, we are interested in opportunities that provide increased greening, habitat potential and options for stormwater reuse. Note any modifications to ordinances or best practices that could improve these opportunities. Consider how ordinances can better accommodate the co-location of stormwater treatment for multiple sites or provide more flexibility in locating stormwater treatment when limitations are present due to the soil type, geology, slope, groundwater and contaminated soils. Some example ordinances and best practices to review are as follows: zoning ordinances related to parcel combination, setbacks and parking requirements etc...; subdivision ordinance design standards for large lots; building code; ordinances related to stormwater, street sweeping, sanitary, potable supply systems, etc...; ordinances related to groundwater, protection of natural features, the critical area, shoreline protection, etc..</li><li>d. Identify a future amendment process and schedule for reassessing ordinances that impact water resources and ecosystem protection.</li><li>e. Describe efforts to integrate Safe Drinking Water Act and other wellhead protection plans, as well as the protection of sensitive surface- and groundwater resources, into the local zoning code.</li><li>f. Describe how water resource and ecosystem protection priorities will be integrated into local parks, open space, recreation and land acquisition plans.</li><li>g. Describe how local authority to require land or easement dedication as a part of redevelopment regulation is being used for water resource and ecosystem protection purposes</li></ol></li></ol>

## Infrastructure Assessments and Programs

5. Include a local implementation program that covers the term of the local water plan. The local implementation program must describe nonstructural, programmatic, and structural solutions to existing or potential water resource and ecosystem health-related problems identified by the city. The local implementation program shall include:
  - a. Describe the existing and proposed physical environment and land use. Include wetlands, natural resources, and land conservation areas identified by the municipality
  - b. Define drainage areas and the volumes, rates, and paths of stormwater runoff, including a map of the stormwater system.
  - c. Include a stormwater system map that shows ponds, streams, lakes and wetlands that are part of your system; structural pollution control devices (grit chambers, separators, etc.) that are part of your system; pipes and pipe sizes and other conveyances in your system; and outfalls and all other points of discharge from your system that are outlets.
  - d. Include a table that briefly describes each component of the implementation program and clearly details the schedule, estimated cost, and funding sources for each component including annual budget totals;
  - e. Include a table for a capital improvement program that sets forth, by year, details of each contemplated capital improvement that includes the schedule, estimated cost, funding source and a description of the water quality protection methods used to meet the MWMO's Standards (Section 3.13).
  - f. Provide a schedule and annual process for assessing the need for water resource-related capital improvement programs or projects in the city
  - g. Clearly define the responsibilities of the local government unit from that of the MWMO and other entities for carrying out the implementation program components
6. Explain interdepartmental coordination of water and natural resource issues in the city:
  - a. Identify a communications process the city uses to coordinate activities between departments making policy, planning or regulatory decisions that impact surface and groundwater resources, stormwater and sanitary sewer systems. How is coordination between city council initiatives and policies; land use planning; management and planning of parks; development reviews; construction site inspections, permitting, and enforcement; operations and maintenance of city streets and infrastructure carried out? Explain what the city is does to avoid inconsistency and inefficiencies between the departments' activities. Identify a staff position/s contact in each department. (e.g. Representatives from the Mayor's Office, Parks & Recreation Department, Planning & Economic Development, Public Works, Regional Water Services, and Safety & Inspection Department)
  - b. Provide a description of the interdepartmental city process that facilitates the approval and installation of innovative stormwater management facilities (a liaison and roadmap for navigating the many stages of city design, review and approval processes).
7. Provide a summary of the member organizations' Storm Water Pollution Prevention Program and conformance with the requirements of the Environmental Protection Agency's National Pollutant Discharge Elimination System (NPDES) for municipal separate storm sewer systems (MS4s) or summarize relevant plans and programs of the member organization that address:
  - a. Inspection and maintenance plans (wet ponds, infiltration basins, raingardens, stormsewer systems, etc.)
  - b. Street sweeping, right-of-way maintenance, road icing, salt storage, snow plowing, and snow storage programs

- c. Spill response and containment plans
- d. Identify who (e.g. private, city, state entities) is responsible for inspection, operation, and maintenance of all storm water infrastructure, public works facilities, and natural and artificial watercourses within in the MWMO's city boundaries.

### MWMO Standards and Agency Regulations

- a. Describe your permitting process for land and wetland alteration work
- b. Identify city ordinances that address permitting, site review and enforcement processes for implementing MWMO Standards
- c. Describe how the city will comply with County groundwater plan requirements
- d. List any lakes within the city that are on the Metropolitan Council's priority lake list
- e. List any lakes within the city that are on MPCA's list of impaired waters
- f. Summarize all Total Maximum Daily Load (TMDL) compliance requirements for the city
- g. Summarize all current activities completed to date to comply with TMDL requirements

### Surface Water Appropriations

Identify city administration of appropriations from small watercourses in accordance with MS 103B.211 Subd. 4

### Evaluation

Identify how protections and improvements to water and natural resources will be measured through implementation of the local water plan

The member organizations should determine if other management programs are necessary to meet their local water plan goals, and the goals of this Plan.

The MWMO will discuss with each member organization the options that address its circumstances and will collaboratively determine the most practical approach to meeting the requirements of this Plan and Minnesota Rules Chapter 8410. The MWMO understands the need to be sensitive to consistency with adjacent watershed districts and water management organizations. Coordination is required to successfully implement watershed standards and projects and maintain the integrity of the MWMO's goals. The MWMO will work closely with cities as needed in local water plan preparation, review, and implementation. The MWMO will apply its goals, objectives, and policies to its review of local water plans.

### 3.4. General Compliance Requirements

1. Make Local Water Plans available at city offices and provide the MWMO an office reference copy.
2. The MWMO requires member cities to have a Department of Natural Resources approved Floodplain Ordinance and a Department of Natural Resources approved Shoreline Ordinance. If no ordinance is applicable, the MWMO requires that there be no encroachment on floodways that results in reduced capacities or expedited flood flows. The only structures allowed in the flood zone are those that have been flood proofed and approved by the Department of Natural Resources.
3. Member cities are required to comply with TMDL requirements as required by their respective MS4 permits.

4. Member cities are required to address the following stormwater management and stormwater maintenance standards in a manner consistent with MWMO Standards, applicable TMDL and NPDES standards for MS4s:
  - Target pollutant loads
  - Maximum allowable runoff rates (MWMO standard)
  - Design criteria for stormwater facilities to address target pollutant loads
  - Schedule for street sweeping, stormwater facility inspection, and maintenance
  - Spill containment and clean-up plan
5. Member cities in Hennepin and Ramsey Counties are required to carry out administration of appropriations from small watercourses in accordance with MS 103B.211 Subd. 4.

### 3.5. MWMO and All Water-Related Authorities

The MWMO is formed under a Joint Powers Agreement in accordance with the Minnesota Statute Section 103B. Joint Powers Agreements may have a narrowing or broadening effect on the authorities allotted to Watershed Management Organizations by Minnesota Statute Section 103B. Authorities held in common by all member cities may be transferred to the Watershed Management Organization, with the exception of revenue-related authorities. However, the MWMO's current Joint Powers (Cooperative) Agreement does not narrow or expand the authorities allotted by Minnesota Statute Section 103B.

The Water Resource-Related Activities of MWMO Member Organizations Table 5 (included as Appendix H) identifies the water resource-related activities of each member organization and the MWMO. The Wetland Conservation Act authority held in common by the cities is an example of an authority that could be wholly or partially transferred to the MWMO. This table should also be utilized for identifying partnership opportunities that generate synergies and efficiencies in managing water resources in the Watershed.

Table 5 is organized by the “regulated water feature” (e.g. wetland, surface waters, navigable waters, and so on). These water categories were chosen because they often have a spatial dimension and they reflect common areas for water resource laws and regulations. Within each water category there are related subtopic areas. See the complete Table 5 included as Appendix H for definitions on each subtopic area.

The MWMO and its member organizations' roles in terms of “Authority” or “Responsibility” are designated for each water subtopic shown in Table 5. The following definitions define the meaning of these terms for use in Table 5 (included as Appendix H):

**Authority** - authority refers to a claim of legitimacy, the justification and right to exercise police powers. Police power is the capacity of a government authority to regulate behaviors and enforce order within its territory, often framed in terms of public welfare, security, health, and safety. Regulations pertaining to the environment and aesthetics have been ruled by courts to be within the police powers of government. The exercise of police power can be in the form of making laws, and compelling obedience to those laws through physical means with the aim of removing liberty, introducing legal sanctions, or other forms of coercion and inducements. In this project, activities defined as “authority” most often include permitting, ordinance development, enforcement, and approval of a plan, project, or program by some other entity. It also includes ability to elevate a particular strategy or issue to a higher authority or additional level of review.

**Responsibility** – responsibility includes a variety of activities that government is required, either by law or by choice, to conduct. This may include planning activities that set strategy and program direction; capital improvement programs;

informational programs such as monitoring, data gathering, and reporting; and reviewing and commenting on others' plans and programs. Responsibility may also include grants and other incentive programs to encourage behavior.

The Water Resource-Related Activities of MWMO Member Organizations Table 5 in Appendix H is a subset of information from a more extensive study the MWMO has completed identifying all of the entities with water-related jurisdictional authorities and responsibilities operating within the MWMO. Contact the MWMO to request a copy of this study.

**Table 5: Water Resource-Related Activities of MWMO Members (see Appendix H)**

### **3.6. Accessing MWMO Funding**

MWMO's staff expertise and funding is available to assist with local projects and program efforts. Local projects and programs need to align with MWMO goals in order to qualify for funding. Member organizations and others seeking funding will need to seek out and propose innovative projects that primarily improve water resources.

All capital improvement projects (CIP) proposed to the MWMO will be judged by the MWMO's CIP selection considerations. This criterion has been developed to prioritize projects that meet or exceed the MWMO's Standards and are cost effective. In addition, the MWMO will also prioritize funding innovative projects that demonstrate new technologies, practices, and programs relating to improving the health of water resources.

To streamline the funding of capital improvement projects members' implementation schedules for water resource-related capital improvement projects should align with the MWMO's planning and annual budget processes.

Applicants seeking capital project funding are encouraged to involve MWMO staff early in the project's schematic design process. Applicants need to provide a one-year funding request notice, from spring to spring. For example, the funding application period starts in the spring of 2014 closes in the spring of 2015 and approved projects from the round are a part of the MWMO's 2016 budget cycle.

The list of capital improvement project selection considerations below will be used to determine if a capital project is eligible for MWMO funding. Please contact staff or see the MWMO's website for the most recent version approved by the MWMO Board.

Projects not eligible:

- Paving (roads, trails)
- Maintaining or replacing pipes or other gray infrastructure
- Road-reconstruction projects with status-quo stormwater design
- Projects that cannot be completed within three years of submitting an application.
- Projects under \$50,000 [possible referral to a Stewardship Fund grant] If the project is not eligible, the CIP selection process ends for the applicant.

Location:

- on public land within an MWMO member community (All else equal public CIPs are priorities):
- on private land in MWMO boundaries and with a demonstrable public benefit
- provides stormwater treatment for connected parcels and areas of land (regional treatment)
- synergistic benefits with other infrastructure (i.e., the sum of the whole is greater than its parts)
- high visibility and/or educational value

Conformance with MWMO's Mission and Watershed Management Plan goals:

- Water quality improvement
- Surface-water rate and volume control

- Habitat improvement, connectivity, and restoration
- Erosion control, riverbank stabilization

Design:

- Life span of at least 20 years
- Replicable in other locations
- Quantified water quality or volume control benefits
- Innovative design with cost-efficiencies and improved stormwater-management effectiveness
- 

Public Support and Partnerships:

- Strong partnerships and/or community support, including neighborhood involvement.
- Any matching funds

Timing:

- Due diligence is completed (soils, pollution, surveys, topo maps, title work, etc.)
- Project is shovel-ready and can begin as soon as seasonal conditions allow

Opportunity:

- A site is being redeveloped or a road reconstructed. If we wait, we miss our chance to retrofit the site's stormwater features: e.g., A road reconstruction corridor with known flooded sites in the corridor

Operations and Maintenance Plan:

- 20-year maintenance plan and estimated life-cycle maintenance costs
- MWMO will have access to inspect and monitor BMP performance

“But-for” test:

- But for MWMO’s funding and guidance, a project that is highly beneficial to the public would not happen.

Quantifying the pollutant removal:

- Comparative site selection: The project’s water quality calculations are compared against other treatment areas available within the watershed to determine locations with the greatest water quality treatment potential. (measure used: achieve the greatest amount of treatment at the lowest cost)
- Water quality results are reported in the Pollutant’s Term Cost/lb/yr (over the practices lifecycle)
- Market-trading-value site selection: Select sites where the revenue gained from trading one more pound of the pollutant is greater than the cost to remove the next pound of the pollutant (measure used: Marginal Rate of Return).
- Comparative site selection: Modeling results of the project are compared against other rate and flood-control areas available within the watershed to determine locations with the greatest rate and flood-control potential
- Water quantity results from any given project site are evaluated using the following measures: reduction in property damages due to flooding; available capacity to contain a 100-year storm event without damage to properties; and the reduction in system-maintenance costs.
- Cost comparisons demonstrating how new technology or innovative design solutions reduce treatment costs relative to the status quo.

Additional Performance Criteria the MWMO may Consider:

- Manage stormwater
- Avoid adverse geology
- Preserve floodplain functions

- Avoid unsuitable development on steep slopes
- Preserve open space
- Preserve prime habitat
- Protect wetlands and surface water
- Prevent surface and groundwater contamination
- Preserve species bio-diversity
- Control invasive species
- Restore disturbed soils
- Maintain wetland and surface-water functions
- Reduce chloride use and impacts
- Reduce climate threat to stormwater infrastructure
- Protect freshwater availability
- Monitor stormwater systems Protect and maintain aquifers
- Project is consistent with environmental district overlays e.g. Mississippi River Critical Corridor Area

### **3.7. Financial Impact of this Plan on Member Organizations**

This plan lays out requirements for local water plans, sets standards to be implemented by the member organizations, and outlines MMWO partnership and funding opportunities for member organization. The plan does not outline specific capital improvements or other projects for member organizations. Costs to member organizations associated with the implementation of the requirements of this plan will include the development or revision of local water plans, the development or revision of ordinances to address MWMO standards, the implementation of standards in member organization projects, and the completion of project reviews based on adopted standards. The MWMO may assist member organizations in paying for capital improvement projects that meet the goals and standards of the MWMO. MWMO also provides expertise to assist with planning, monitoring, science, assessments, communications and outreach activities.

The most recent version of the following Capital Improvement Programs/Projects (CIPs) or similar documents will be used to guide future MWMO funding requests.

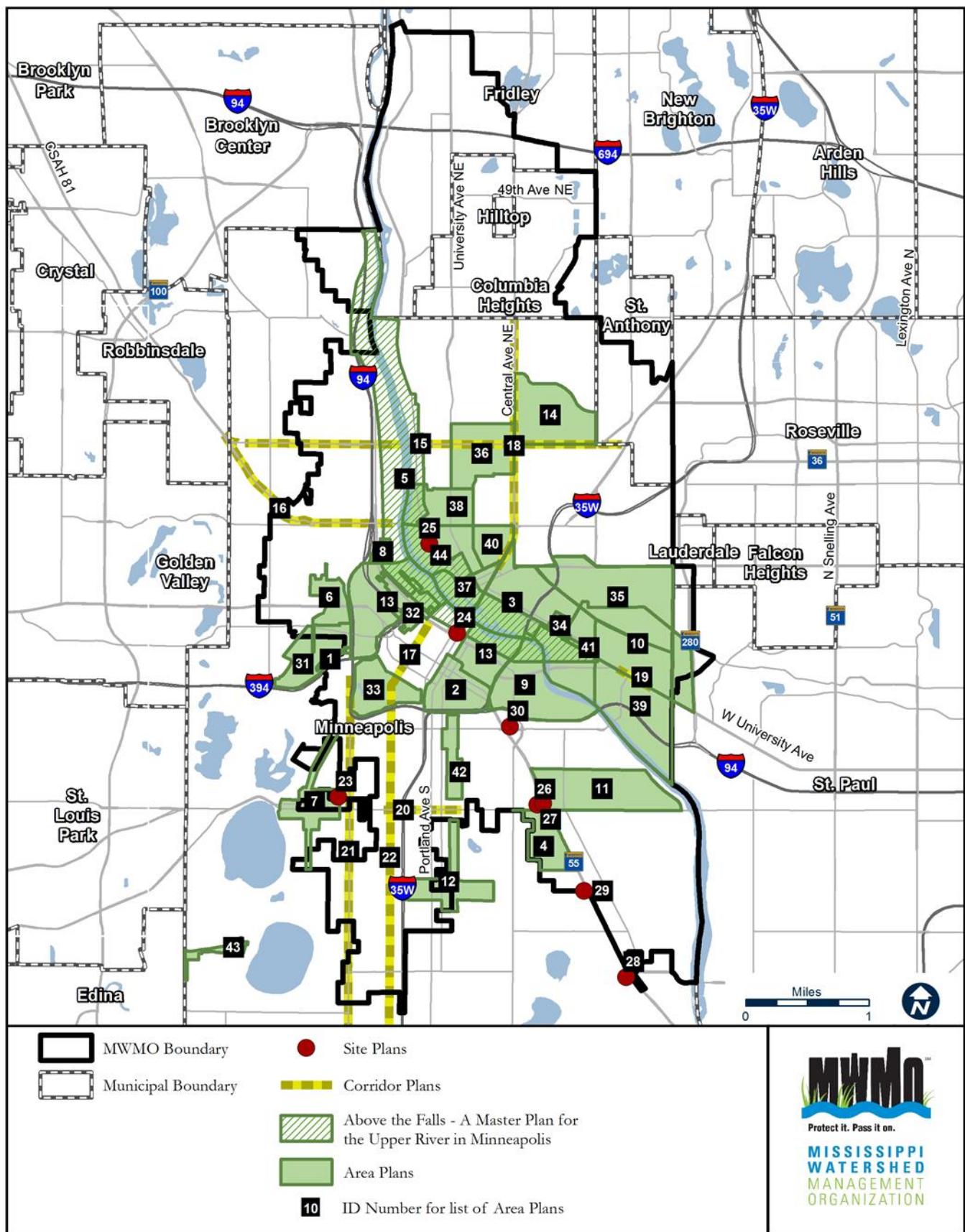
- City of Minneapolis 2014 – 2018 Capital Program  
<http://www.ci.minneapolis.mn.us/www/groups/public/@finance/documents/webcontent/wcms1p-119392.pdf>
- Lauderdale Capital Improvement Plan 2008 to 2017 (July 14, 2008)  
<http://www.ci.lauderdale.mn.us/vertical/sites/%7B5F73237E-9F78-407B-A785-DA0D9F5C945F%7D/uploads/%7BE79F3CAE-9102-4FDC-B999-80F61E2E5858%7D.PDF>
- Hennepin County 2014 - 2018 Transportation CIP (<http://www.hennepin.us/~media/hennepinus/your-government/budget-finance/documents/2014-capital-budget-public-works.pdf>)
- US Army Corps of Engineers (USACOE) Projects, Studies, and Managed Facilities Finder (web-based, List Date: March 18, 2009)
- 2009 Draft Ramsey County Groundwater Protection Plan (2009)
- Ramsey County Transportation Improvement Program (TIP) 2014-2018 <http://www.co.ramsey.mn.us/pw/index.htm>
- The City of St Anthony Village's Comprehensive Plan (2008) [http://www.ci.saint-anthony.mn.us/vertical/Sites/%7B5ED4AFB9-D450-4F68-BA29-2600D3C2A620%7D/uploads/Silver\\_Lake\\_SW\\_Treatment\\_Project\\_Info\\_Sheet.pdf](http://www.ci.saint-anthony.mn.us/vertical/Sites/%7B5ED4AFB9-D450-4F68-BA29-2600D3C2A620%7D/uploads/Silver_Lake_SW_Treatment_Project_Info_Sheet.pdf)
- Minneapolis Park and Recreation Board 2014 – 2019 Capital Improvement Program  
<http://www.minneapolisparks.org/documents/design/CIP.pdf>
- City of Fridley Capital Improvement Plan/Capital Outlay 2013-2017
- City of Fridley Street Resurfacing Plan 2012-2020
- Columbia Heights capital Improvement Plan 2012-2020

In addition to the CIPs received, we were also made aware of a variety of small area or neighborhood-scale plans. The following plans are shown on Figure 2:

<b>ID#</b>	<b>Plan Name</b>	<b>Year</b>
1	Bryn - Mawr Neighborhood Land Use Plan	2005
2	Elliot Park Neighborhood Master Plan	2003
3	Master Plan for the Marcey Holmes Neighborhood & Supplement	2007
4	Corcoran Midtown Revival Plan	2002
5	Above the Falls - A Master Plan for the Upper River in Minneapolis	2000
6	Near Northside Master Plan	2000
7	Uptown Small Area Plan	2008
8	Northside Jobs Park Design Guidelines	1997
9	Cedar Riverside Small Area Plan	2008
10	Southeast Minneapolis Industrial (SEMI) / Bridal Veil Refined Master Plan	2001
11	Steward and Longfellow Greenway Area Land Use and Predevelopment Study	2007
12	38th Street and Chicago Avenue Small Area/Corridor Framework Plan	2008
13	Downtown East/North Loop Master Plan	2003
14	Audubon Park Neighborhood Master Plan	2008
15	Lowry Avenue Corridor Plan	2002
16	West Broadway Alive	2008
17	Development Objectives for North Nicollet Mall	2000
18	Central Avenue Small Area Plan	2008
19	University Avenue SE & 29th Ave SE Development Objectives and Design Guidelines	2007
20	Midtown Minneapolis Land Use Development Plan	2005
21	Lyndale Avenue: A Vision	2007
22	Nicollet Avenue: The Revitalization of Minneapolis Main Street	2000
23	Midtown Greenway Land Use and Development Plan	2007
24	Historic Mills District Master Plan and Update	2001
25	Grain Belt Development Objective	1996
26	Hi-Lake Shopping Center Development Guidelines and Objectives	2001
27	Hiawatha/Lake Station Area Master Plan	2001
28	46th Street Station Area Master Plan	2001
29	38th Street Station Area Plan	2006
30	Franklin-Cedar/Riverside Area Master Plan	2001

31	Bassett Creek Valley	Underway
32	Heritage Street Plan	Ongoing
33	Loring Park Master Plan	Underway
34	Dinkytown Small Area Plan	Underway
35	Como Blueprint	Underway
36	Holland Neighborhood Small Area Plan	Underway
37	Nicollet Island – East Bank Small Area Plan	Underway
38	Sheridan Neighborhood Small Area Plan	Underway
39	Stadium Village Station Area Plan	2012
40	St. Anthony East Neighborhood Small Area Plan	Underway
41	University District Zoning and Planning Regulatory Review	Underway 2010
42	Minneapolis Lifesciences Corridor	Ongoing
43	Linden Hills Small Area Plan	Underway
44	St. Anthony West	

Figure 2: Location Map for the Special Area Plans



## 4.0 MWMO RESOURCE INVENTORY

### 4.1. Introduction

The MWMO resource section will review land, water, and human resources within the MWMO boundaries and assess the need for management of these resources based on the current knowledge of the Watershed. This resource assessment section influences what, why, when, where, and how issues identified in Appendix M of this Plan are addressed.

The Physical Environment section includes information on topography and geomorphology, geology, and soils. The Biological Environment section includes information on vegetation and wildlife. The Human Environment section includes information on land use and growth patterns, population dynamics, recreation, and potential environmental hazards. The Hydrologic System section includes information on climate, precipitation, surface water resources, groundwater resources, water quantity, water quality, impaired waters, and surface water appropriations.

### 4.2. Physical Environment

#### 4.2.1. POTENTIAL LIMITATIONS TO INFILTRATION

A map of potential limitations to infiltration is shown in Figure 3. Information from this resource inventory was used to generate this planning level review of where infiltration limitations may exist in the Watershed.

Any information required for development purposes requires a site scale review. Table 6 below provides more information on limitations analyzed and the data sources.

**Table 6: Infiltration Limitations and Data Sources**

Limitation <sup>1</sup>	Data Source	Data Source Confidence Interval	Year of Data Source
Karst conditions may exist between ground level and a depth of 20 feet	Minnesota Department of Health Well Data	+/- 5 feet vertical accuracy Horizontal Accuracy <sup>5</sup>	2014
Low infiltration potential may exist due to hydrologic soil group D consisting of clay, silt and organics with an infiltration rate of < 0.2 in/hr	Natural Resources Conservation Service County Soil Survey and Minnesota Geological Survey <sup>7</sup>	Minnesota Geological Survey shows the material expected to be encountered approximately 3-feet below the surface, however the level of accuracy of data does not account for up to 20-feet of fill in urban areas and is mapped at 1:100,000 scale <sup>8</sup> . County Soil Survey applicable to the first 6-feet of soil and is mapped at 1:24,000.	2006 – Soils Data 2007 – Geology Data
Shallow bedrock may exist between ground level and a depth of 20 feet <sup>2</sup>	Minnesota Department of Health Well Data	+/- 5 feet vertical accuracy Horizontal Accuracy <sup>5</sup>	2014

Limitation <sup>1</sup>	Data Source	Data Source Confidence Interval	Year of Data Source
Rough terrain may exist where slopes are steeper than 20%	Light Detection and Ranging	+/- 6 inches	2011
Hotspots and groundwater contamination may exist	Minnesota Pollution Control Agency "What's in my backyard"	See Note 6	2014
Shallow groundwater may exist between ground level and a depth of 20 feet <sup>2</sup>	Minnesota Department of Health Well Data	+/- 5 feet vertical accuracy Horizontal Accuracy <sup>5</sup>	2014
The Minnesota Department of Health recommends no infiltration within the 1-year travel zone (Emergency Response Area) of Drinking Water Supply Management Area (DWSMA) <sup>4</sup>	Minnesota Department of Health Source Water Protection Unit	Minimum scale requirement for data and/or maps is 1:24,000.	2014
A minimum of a 50-foot setback is required from water supply wells <sup>3</sup>	Minnesota Department of Health Well Data	+/- 5 feet vertical accuracy Horizontal Accuracy <sup>5</sup>	2014

1) Based on Minnesota Pollution Control Agency limitations to meeting Minimum Impact Design Standards

2) National Pollution Discharge Elimination System Construction General Permit requires 3-feet minimum separation. 20' used as buffer to account for site grading

3) Per Minnesota Rule 4725.4350

4) Minnesota Department of Health recommends no infiltration within 1-year travel zone of DWSMA and limited infiltration within 10-year travel zone

5) Horizontal Accuracy depends on the location method for each well

Accuracy of each well location can be viewed in the GCM\_CODE - Geographic Method Code (identifies location accuracy).

\*A = Digitized - scale 1:24,000 or larger

\*B = Digitized - scale 1:100,000 to 1:24,000

\*DN1 = Digitization (screen) - Map (1:24,000) - NOT Field checked

\*DN2 = Digitization (screen) - Map (1:12,000) - NOT Field checked

\*DS1 = Digitization (Screen) - Map (1:24,000)

\*DS2 = Digitization (Screen) - Map (1:12,000)

\*G3 = GPS Code Measurements (Pseudo Range) Differentially Corrected

\*G6A = GPS Code Measurements (Pseudo Range) Standard Positioning Service Selective Availability On (averaged)

\*G6O = GPS Code Measurements (Pseudo Range) Standard Positioning Service Selective Availability Off (averaged)

\*I = GPS; accuracy 3 to 12 meters (+6 to 40 feet)

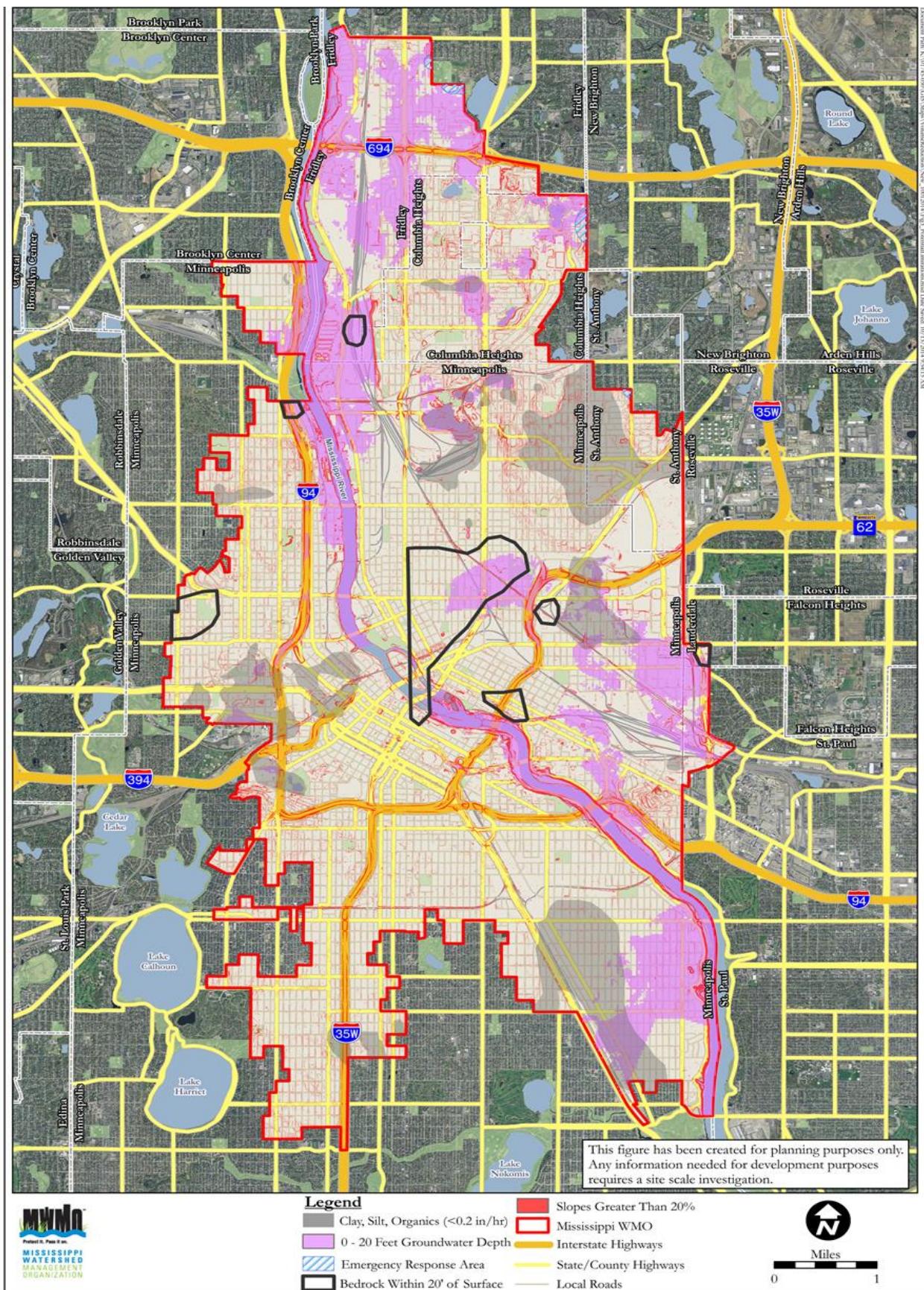
\*PQ6 = Public Land Survey - QQQQQQ Section

6) Coordinates for these features were collected using a variety of methods of varying accuracy. The 'COORD\_METH' column in the attribute table describes the method used to determine the coordinate for each feature.

7) In areas that show up as urban fill on the Soil Survey (approximately 50% of the MWMO) the Geological Survey was used to determine the soil characteristics.

8) Scale refers to the frequency of sampling. The larger the second number, the larger the ground area and less detail. For instance, 1:12,000 scale depicts a sample taken approximately every 1/4 acre. Whereas a 1:100,000 scale depicts a sample taken every 2 acres.

**Figure 3: Potential Limitations to Infiltration**



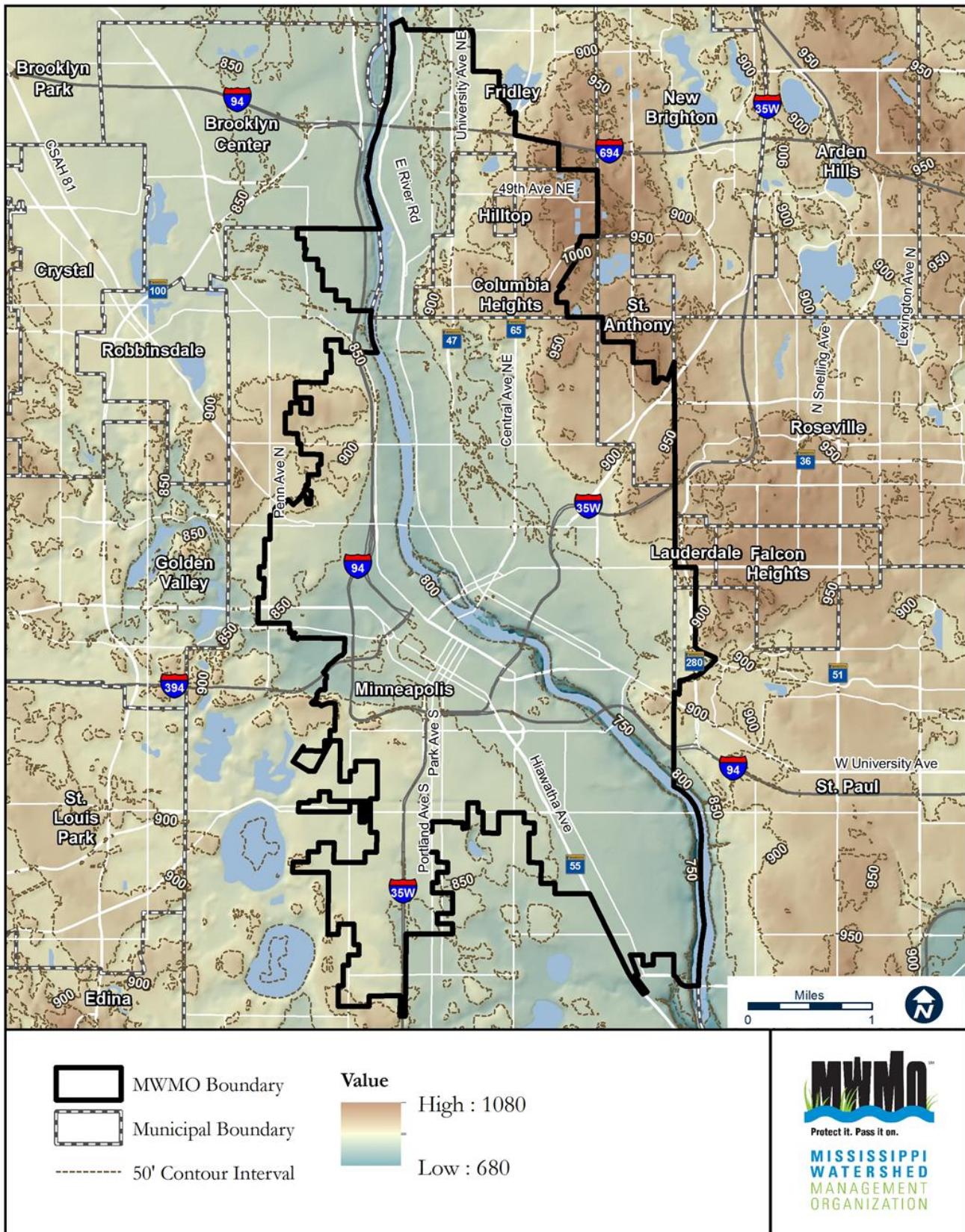
#### **4.2.2. TOPOGRAPHY AND GEOMORPHOLOGY**

The topography of the MWMO influences the way resources respond to events such as precipitation and urban development. The topography of the MWMO varies greatly, from rolling terrain at higher elevations distant from the Mississippi River to nearly flat terraces close to the river. Total relief in the MWMO is roughly 300 feet from high points in the Saint Anthony Village area—with an elevation of 1020 feet above sea level—to low points of 725 feet along the shores of the Mississippi River (Figure 4).

Geomorphology is the study of landform and the processes that lead to varying landform shapes. The topography of the MWMO was created by geomorphic processes such as glaciation, fluvial transport (sediment transport by water), eolian processes (sediment transport by wind), mass wasting (gravity-driven sediment transport), and weathering. These processes created nearly all of the current landscapes visible throughout the Watershed. In addition to geologic processes, influences from humankind have drastically shaped the landform of the MWMO. Significant grading has flattened rolling hills for the creation of flat roadbeds and building pads. In addition, some portions of the MWMO that were peat-filled wetlands prior to European settlement in the Twin Cities Metropolitan Area have since been artificially filled to promote the development of these areas.

Figure 4 illustrates the topography of the MWMO. Four prominent colors are visible as elevations above mean sea level. These prominent regions are due to the geomorphic processes that shaped these areas. Topographically high regions—visible as brown/red in Saint Anthony Village and west of I-94—are glacial depositional highs formed by the advancement of the Des Moines lobe glaciation. These depositional highs are above 900 feet and consist of clay rich till. Adjacent tan/yellow hues located at lower elevations toward the Mississippi River, between 850 and 900 feet, are terrace deposits known as the Richfield Terrace. Terraces are platforms of land created by past higher levels of the Mississippi River. As the Mississippi River down cuts, removing material and lowering the river bed, these flat areas become prominent past indicators of river floodplain elevations. Terrace deposits are typically sequences of sand and silt. Green/blue hues located at an even lower elevation toward the Mississippi River, between 800 and 850 feet, represent a different and younger terrace known as the Langdon Terrace. Finally, the reddish-tan color prominent west of 35-W and in the vicinity of Lyndale Ave and 46th Street in Minneapolis represents an area formed by glacial outwash. This area was formed by sand and gravel deposited by melting along a glacier's ice margin.

Figure 4: Topography of the MWMO



The landscape topography and the geomorphic domain of regions within the MWMO influences water quality and quantity by affecting the dynamics of the hydrologic cycle. Influences of these factors include:

- Topography directly affects the direction and rate of water flow, and the retention of water
- Geologic strata influence characteristics of MWMO soils and groundwater flow through the subsurface
- Soil type determines the ability of subsurface materials to attenuate pollutants
- Together topography and geology affect detention and retention of water, runoff rates, and infiltration rates
- Infiltration rates, aquifer properties, and groundwater flow paths influence flow of pollution from a spill site and throughout aquifers once pollution has reached the water table

Understanding the dynamics of these factors assists resource managers in identifying sites that are appropriate for infiltration practices or wetland/detention basin construction as well as sites that are sensitive to disturbances such as construction sites sensitive to pollution or sites that are prone to flooding.

#### **4.2.3. GEOLOGY**

The geology of the MWMO influences the Watershed greatly. Unconsolidated geologic material deposited by glaciation and subsequent processes created the landform visible in the Watershed. Chemical and physical weathering of the geologic materials deposited influences soil type, soil properties, and shallow groundwater storage and movement. Consolidated geologic material, known as bedrock, acts as either aquitards (geological formations that are not capable of transmitting significant quantities of groundwater under normal hydraulic gradients) or aquifers (underground beds or layers of earth, gravel, or porous stone that yield water) depending on whether or not water is easily transmitted through the rock.

Aquifers are specific types of bedrock units which, because of their unique properties, are used for drinking water and industrial water use. These aquifers are important to Member Organizations and industries located in and near the MWMO. Understanding the properties and lateral distribution of the unconsolidated and bedrock geology of the Watershed is imperative to identifying areas where there is potential for contamination, where infiltration may be a viable stormwater management practice, and where unique groundwater-dependent plant communities could be present. Maintaining groundwater recharge areas in this highly impervious Watershed is important to protect groundwater baseflow to surface waters.

The surficial geology (or uppermost geologic formations) within the MWMO consists of Quaternary deposits associated with the Des Moines Lobe (Grantsburg Sublobe) and Superior Lobe of the Wisconsin Glaciation, and also with terrace deposits and post-glacial stream and peat deposits (Figure 5). The distribution of the surficial deposits varies dependent upon the source of the original material and the erosional and depositional processes affecting them. Directly along the Mississippi River are stream deposits (alluvial fan deposits and floodplain alluvium) and one area of exposed bedrock. Depth to bedrock along the tops of the bluffs lining the Mississippi River is typically 10 feet or less. Two relatively flat platforms at separate elevations above sea level border each side of the Mississippi River: these are the Langdon and Richfield river terrace deposits. The river deposits and terrace consist of sand and gravel with some silty deposits.

Moving further away from the Mississippi River, and above the terrace deposits, are regions of glacial outwash and till. The southwest portion of the MWMO includes the outwash deposits and the northeast and northwest portions include loamy till. There are also sand facies in the northern portion of the watershed. Surficial deposits vary in depth throughout the MWMO, from less than 10 feet along the Mississippi River bluffs to about 200 feet over areas where the Prairie du Chien is the first encountered bedrock.

Bedrock geologic units underlie the surficial deposits of the MWMO. The bedrock geologic units are of early Paleozoic age (525 – 400 million years old) and were originally deposited as marine sedimentary rocks (Mossler and Blomgren, 1990). Shallow seas covered southeastern Minnesota and parts of adjacent states during most of this period. The five bedrock groups of the Watershed which outcrop (are exposed directly at the surface) or subcrop (are exposed in the subsurface directly below surficial sediments) are, from youngest to oldest, the Decorah shale, Platteville-Glenwood Formation, Saint Peter Sandstone, and the Prairie du Chien Group (Figure 6). See Figure 7 for a schematic of all the bedrock groups of the region.

The uppermost bedrock unit underlying the Quaternary deposits is the Decorah Shale. This unit is discontinuous through the Watershed. Where it is present, it acts as a confining layer, protecting lower units from contamination. The Decorah Shale is green calcareous shale with thin limestone interbeds. This unit crops out along the bluffs of the Mississippi River.

The Platteville and Glenwood Formations underlie the Decorah Shale. The Platteville consists of fine-grained dolostone and limestone. The Glenwood consists of thin green sandy shale (3-5.5 feet thick). This formation also crops out along the Mississippi River bluff line and is discontinuous throughout the Watershed.

The Saint Peter Sandstone underlies the Platteville and Glenwood Formations. The Saint Peter is divided into two parts in this area of the metro. The upper two-thirds consists of fine- to medium-grained quartz sandstone. The lower third is known as the basal Saint Peter and acts as a confining unit where present. It consists of mudstone, siltstone, and shale with interbeds of coarse sandstone. This formation is exposed in areas along the Mississippi River bluffs.

The Saint Peter is underlain by the Prairie du Chien Group. The upper two-thirds is sandy with thin bedded dolostone and often fractured. The lower part consists of massive or thick bedded dolostone. The Prairie du Chien is present continuously within the MWMO and exhibits solution enhanced flow characteristics where fractures and joints are present.

Below the Prairie du Chien Group are the Jordan Sandstone, Saint Lawrence Formation, Franconia Formation, Ironton-Galesville Sandstone, Eau Claire Formation, and the Mount Simon Sandstone. These bedrock units are regionally important aquifers and confining layers.

Also visible in Figure 6 are the trends of deep buried bedrock valleys. Deep valleys were cut into the bedrock of the Watershed by erosional processes related to glaciation. Scouring and weathering of bedrock surfaces by glaciers and glacier meltwater created deep and broad bedrock valleys that cut deep through the top of the bedrock surface. These valleys were subsequently filled in by sediments from later glacial activity. Although they are not visible at the surface, they influence groundwater flow patterns in some regions of the Twin Cities Metropolitan Area. The most prominent of these valleys runs in a northeast-southwest trend in Minneapolis and Columbia Heights.

Figure 5: Surficial Geography of the MWMO

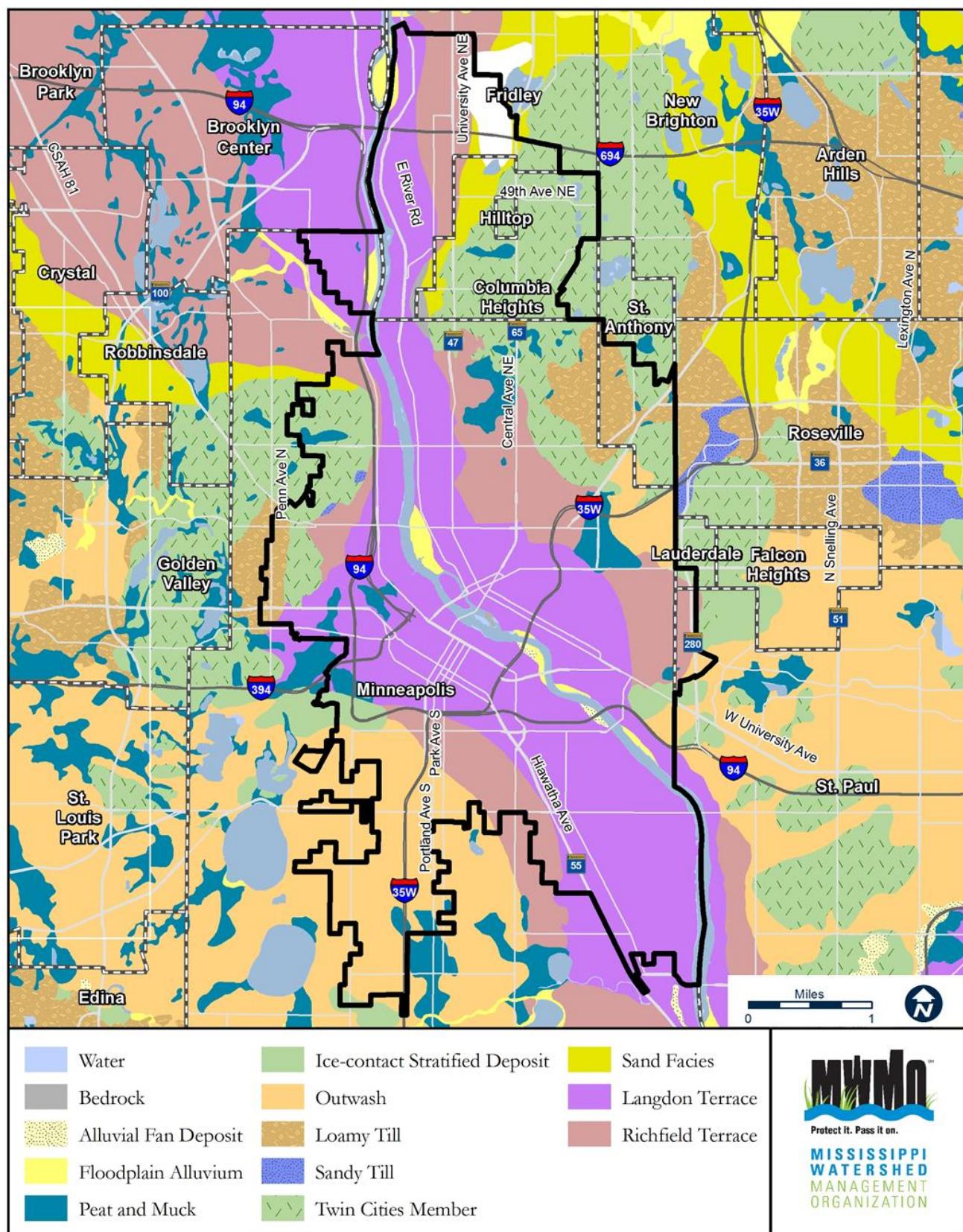
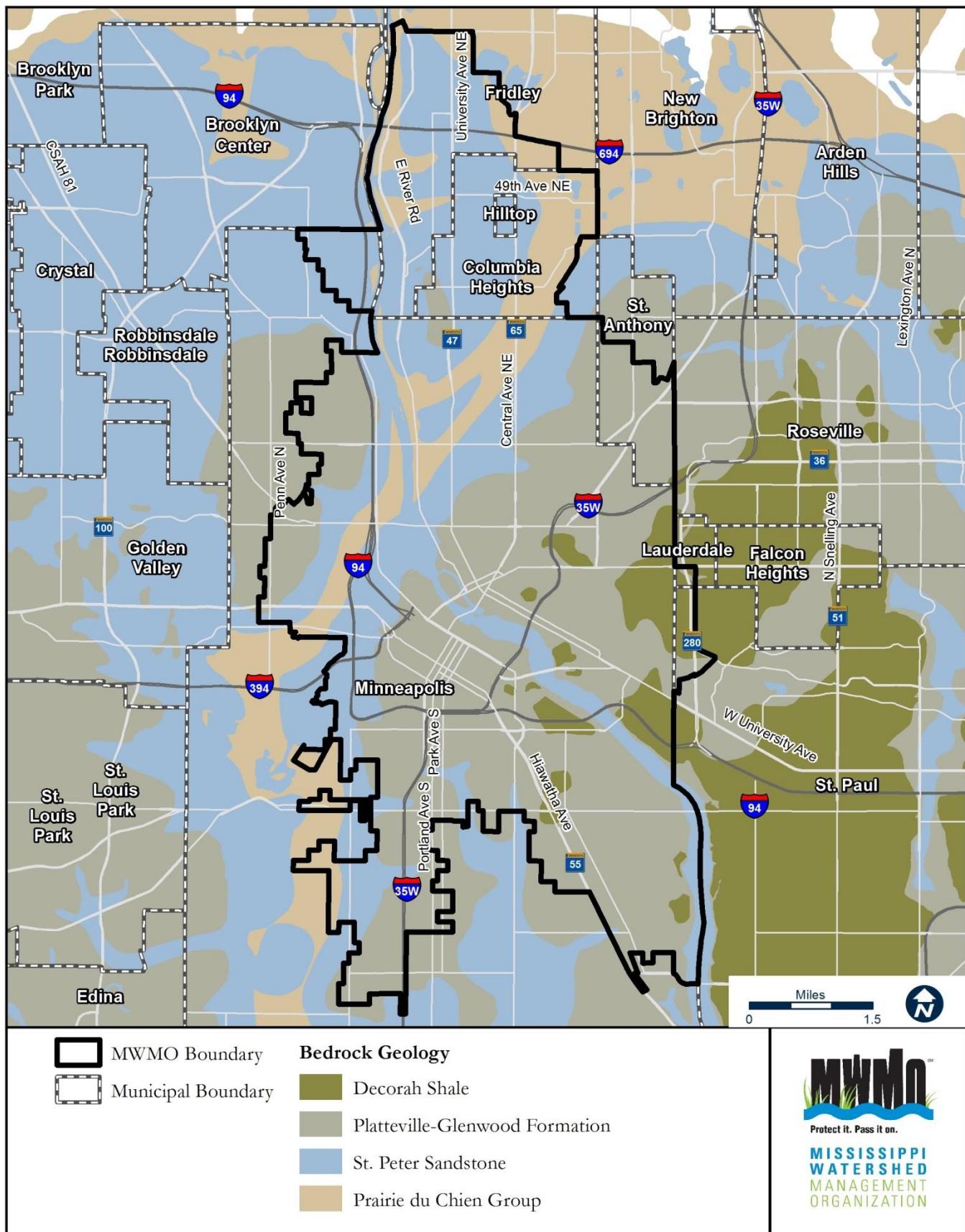
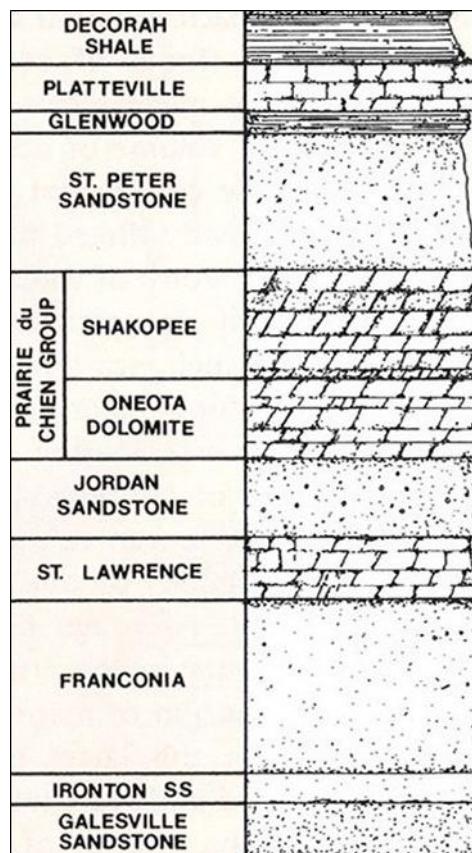


Figure 6: Bedrock Geology of the MWMO



**Figure 7: Bedrock units (Ojakangas and Marsh, 1982)**



#### 4.2.4. Soils

The properties of soils in the MWMO impact the water and natural resources of the Watershed in a variety of ways. Soil properties impact the capacity for growth of vegetation, the likelihood for erosion to occur, the feasibility for rainfall to recharge groundwater, the potential for contaminants to move through the soil, and the possibility of transport of soil-bound nutrients and other pollutants to waterbodies.

As stated in the *Historic Waters of the MWMO* (MWMO, 2011), soil characteristics are the result of physical, chemical, and biological interactions that take place over time. Natural soils are influenced by the weathering of parent material—the biological, chemical, and mechanical activity that takes place in the oxygen-rich environment of the earth's surface. The characteristics of soils, by extension, are a reflection of the interaction between climate, plant, and animal community life, surface and subsurface hydrology, and the base parent materials of the underlying geologic formations.

The soils of the MWMO project area are largely a reflection of the previously discussed surficial geology and the formative processes of the ancient Mississippi River Valley. Additionally, the soils of the MWMO are a reflection of plant community relationships with the physical world since the retreat of the glacial epoch approximately 10,000 years before the present. During the current epoch, soils have developed in conjunction with advancing and retreating vegetation communities. The establishment, disruption, reestablishment, and shifting of vegetation communities in concert with the physical landscape provide the underlying basis of the pre-settlement Twin Cities landscape.

Soil composition played a significant role in the development of the Twin Cities Metropolitan Area. This region lies at the interface between major continental biomes, each with a different set of ecological characteristics and soil qualities. The economic growth of the Twin Cities was first and foremost based on the presence of the Mississippi River. Secondly, the Twin Cities had a vast supply of timber to supply its own growth and drive the growing national economic booms of the 19th Century. Following the establishment of the Twin Cities based on timber, the vast prairies with deep rich soils provided the basis for the ongoing economic growth based on agriculture. In each case, regional soils based on the presence of post-glacial shifting vegetation communities provide an additional pathway to reconstructing the pre-European settlement landscape. Without these diverse pre-settlement vegetation and soil types, the Twin Cities may not have remained the continuously thriving metropolis that it has over the past century and a half.

As in most urbanized areas, soil mapping in the MWMO area has been seriously affected by the early and rapid urbanization of the area. Soils surveys were published for Ramsey County in 1916 and for Hennepin County in 1929. These maps have been georeferenced from the original soil surveys and are shown in Figure 8. Soil surveys are based on field data collection of soil plots, and mapped with a taxonomic description developed by the Natural Resources Conservation Service (NRCS). NRCS soil surveys were, historically, created primarily to identify suitable soils for agricultural uses, and urbanized lands were typically lumped into categories that reflected the disturbed nature of the land. To a significant degree, the urban soils of the MWMO have been largely disrupted and moved to accommodate development and industry.

Though developed largely as a tool for agriculture and protection against overuse, soils maps today are used for a range of applications, from mineral extraction, wetland identification, buildability, and climate analysis among others. In 1916, Ramsey County was rapidly developing, but large areas of native soils remained intact, and the soil survey was quite extensive, providing mapping units for nearly the entire county. Unfortunately, only a very limited area of the MWMO lies within the Ramsey County survey area. By the time the first Hennepin County Soil Survey was published in 1929, the Minneapolis urban core was largely built-out, so most of the central portion of the MWMO area was labeled “unclassified”. Mapped exceptions in the 1929 survey are confined largely to the extremities of the MWMO area, where roads had been developed, but lot scale build-out was not fully complete. By the 1974 publication of the soils surveys for Hennepin and Ramsey Counties, urban lands dominated virtually all polygons within the MWMO boundary.

At first glance, the 2008 soil survey of the MWMO project area continues to describe the soils of the urban core as “Urban Land” since much of the land has been moved, and soils disrupted. The most recent (modern) soil surveys for Hennepin and Ramsey Counties have reincorporated more refined data into the urban mapped areas. Figure 9 shows the extent to which the NRCS has determined the MWMO area to be predominantly urban or disturbed soils. Very few areas are mapped to the natural soil series level. The NRCS recommends that, in these disturbed soils where soil analysis for site-based work is required, borings and soils tests are required, as it is assumed that the natural soil properties may no longer be present.

As Figure 9 (Map 15A, MWMO, 2011) depicts, the majority of soils in the Watershed are disturbed and classified as “Urban Land.” Updates to the 2007 NRCS Soil Survey now include data collected in the urban core to provide soil “complexes” (Appendix K) within the predominant (often “urban”) soil types. A soil complex is a mapped soil unit with a mix of soil series: in this case, areas with a predominant urban matrix with substantial “inclusions” of natural soils. According to the Hennepin County NRCS, where urban soils have been mapped as a complex with other soil series these can be read as an interpretation by the NRCS of the likely dominant series prior to disruption (telephone conversation with NRCS office staff). Using the interpretation of the most prevalent soil within an urban complex as the likely pre-settlement matrix, soil attributes that assist in understanding general landscape characteristics provide additional insight into pre-settlement conditions.

Figure 10 (Map 15B, MWMO, 2011) shows areas in the most recent surveys where “urban lands” are mapped as soil complexes (light green). Where map units are described as urban lands and udorthents (undifferentiated soil fill) with a more in-depth description (complex or substratum), new fields have been added to the GIS layers to piece together an interpretation of possible pre-settlement conditions. In addition, many of the soils mapped as “urban land” in the MWMO area are associated with a more detailed “soil complex”. Soil complexes are mapped units that contain two or more recognizable units. In urban soils settings, the author has made the assumption that highest level natural soil in the complex was considered by the author of the Soil Survey as the dominant pre-settlement soil, confirmed by the Hennepin County NRCS (Telephone conversation with NRCS office staff). Using this methodology, soils descriptions can be used to assist in piecing together pre-settlement vegetation, wetlands, and drainage class among other characteristics. While this information may not be useful on a site-specific scale, it can be used to develop pre-settlement baseline conditions on a neighborhood or regional level. This new mapping provides the potential for more refined landscape scale interpretations of pre-settlement vegetation and hydrological characteristics than previously available.

Figure 11 shows the combined historic and modern data available for the MWMO area. Only those areas depicted in gray contain no information on natural soil characteristics.

Combining the attributes from different mapping periods, Figure 12 (Map 15D, MWMO, 2011) shows the synthesis of soil series data. Where a modern soil complex is described for a soil map unit, the most common inclusion is shown, presuming the pre-settlement soil matrix. In the northeastern portion of the MWMO, the large area of Hayden soils mapped in 1929 is shown within boundaries of the modern soil survey units. Within the northeast portion of the MWMO, Udorthents with a wet substratum are shown as such, but were described as either peat or Webster silty loam in the 1929 survey. Appendix K, excerpted from the *Historic Waters of the MWMO* (MWMO, 2011), provides detailed NRCS soil series descriptions of soils shown on Figure 12 (Map 15D, MWMO, 2011). For descriptions of the Hayden and Webster soils from the 1929 Hennepin County Soil Survey, see Appendix A of the *Historic Waters of the MWMO* (MWMO, 2011).

Using the synthesized data described above, Figures 13, 14, and 15 (Maps 16A, 16B and 16C, consecutively, MWMO, 2011) provide a synthesis of data provided in modern and historic soils survey to assist in establishing an image of the pre-settlement landscape of the MWMO.

Figure 13 (Map 16A, MWMO, 2011) shows the soil orders associated with the map units in Figure 12 (Map 15D, MWMO, 2011). Soil orders are the major categories of soil types largely defined by large scale landscape characteristics where these soils formed. The formative soils of the MWMO fall into four major orders, each typical of distinct vegetation communities that formed at the surface. The four major orders of the MWMO are described briefly here, and shown on Figure 13:

**Mollisols** - This order of soils covers a large area of western Minnesota and provides the deep rich soils of the agricultural regions of the state. Most significantly, these soils have a nutrient rich surface layer of dark colored thick material occurring throughout the grassland pre-settlement prairie regions of the state. These soils typically have a surface layer that is low density and loose.

**Alfisols** - The other major order in the MWMO area, the Alfisols are typically forest soils. These soils are generally found along and east of the Mississippi River, with high accumulations of aluminum (Al) and Iron (Fe). These fertile soils formed in loam or clay. Alf is the formative element and is coined from a soil term, pedalfer. The surface layer typically has less clay than the subsurface. These soils usually also contain a leached zone of eluviation, or E horizon. This layer is typical of forest soils where this E horizon has been washed of some mineral content through the percolation of water down the horizon. These soils often remain moist throughout the year. These are the soils of Maple Basswood Forests and are found west of the MWMO area.

**Histosols** - These soils are formed of organic materials from the remains of plants found in marshes and bogs. The soils are comprised of the dead and decaying matter of leaf and root tissue of plants growing in wet environments. The soils range from Saprists (most material is decomposed and original constituents are unrecognizable) to Hemists (moderately decomposed soils where some recognizable plant material is distinguishable) to Fibrists (plant materials remain distinguishable).

**Entisols** - These are soils of recent origin, often developing in river bottom alluvium and sand. They are defined by the combination of being comprised of parent material not easily weathered (quartz) and being in a relatively early stage of development. The Entisols most commonly found in the MWMO area are confined to the Mississippi River floodplain, the highly urbanized downtown of Minneapolis, the area of the old Bassett Creek tunnel, and the base of steep moraine slopes in the northeast portion of the Watershed.

The Soil Orders Map clearly corresponds with the Surficial Geology Glacial Phase Map presented as Map 11 in the *Historic Waters of the MWMO* (MWMO, 2011). Note the highlands of the Grantsburg Lobe in North and Northeast Minneapolis, here mapped distinctly as Alfisols. Entisols, the still-developing soils of the Mississippi River floodplain and the well-drained prairie soils of the Mississippi River terraces, are each represented by refining the information provided in the most recent Hennepin County soil survey. Udorthents are a disturbed soil. Where these units were mapped with the “wet substratum” qualifier, these were added as wetland soils. These soils correspond very closely with the historic wet features mapping (see Map 9 in the *Historic Waters of the MWMO* (MWMO, 2011)).

Figure 14 represents the vegetation communities listed as typical for each of the NRCS Soils Series Descriptions. These descriptions are provided by the NRCS for every soil series at: <http://ortho.ftw.nrcc.usda.gov/cgi-bin/osd/osdname.cgi>. While these descriptions do not entirely correspond with the soil orders, they are a reflection of the mosaic of vegetation communities that would have existed at the time of settlement, and indicate shifting patterns of vegetation during the postglacial period. Of note here is the extent to which the communities described are significantly dominated by the transitional savanna community. Only in the moraine region of the northeast portion of the MWMO are soils described as fully typical of forests, and likewise, specifically prairie soils are limited mostly to the river terrace area of the Seward, Cooper, Howe, and Longfellow neighborhoods of Minneapolis.

Figure 15 (Map 16C, MWMO, 2011) shows the Hydrologic Soil Group (HSG) for the map units from the synthesized soil survey. The hydrologic soil groups presented are based on an estimate of the historic native soils in the MWMO and are used in developing the MWMO Standards to determine the hydrologic soil group. The hydrologic group designation is used to describe the runoff potential of soils and is divided into four groups (A to D). HSG A soils generally have the least runoff potential, and HSG D soils the greatest. According to the ‘Urban Hydrology for Small Watersheds’ published by the Engineering Division of the Natural Resource Conservation Service, United States Department of Agriculture, Technical Release–55, the soil groups are described as follows:

**Group A** soils are sand, loamy sand, or sandy loam types of soils. They have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels, and have a high rate of water transmission.

**Group B** soils are silt loam or loam. They have a moderate infiltration rate when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.

**Group C** soils are sandy clay loam. They have low infiltration rates when thoroughly wetted and consist chiefly of soils with moderately fine to fine structure and a layer that impedes downward movement of water and soils.

**Group D** soils are clay loam, silty clay loam, sandy clay, silty clay, or clay. This HSG has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a clay pan or clay layer at or near the surface and shallow soils over nearly impervious material.

#### **4.2.5. UNIQUE FEATURES AND SCENIC AREAS**

The Watershed contains many scenic areas and unique features. The regional and municipal parks located within the Watershed have preserved scenic views of the Mississippi River Valley and other water resources within the Watershed. These parks and open spaces often allow recreational access to these resources.

The Watershed includes downtown Minneapolis. As a result, many of the metropolitan area's cultural features are found within the Watershed. Some of these include:

- Saint Anthony Falls
- Stone Arch Bridge
- Nicollet Island
- Mill City Museum
- University of Minnesota Campus
- Minneapolis Institute of Arts
- Walker Art Center and Sculpture Garden

The Mississippi River through the metropolitan area was designated a Critical Area by the State of Minnesota in 1979 and was designated the Mississippi National River and Recreation Area (MNRRRA) of the National Park Service in 1988 by the United States Congress. In addition, the Mississippi River from Minnesota to Missouri was designated as an American Heritage River in 1998 allowing greater coordination of river-related efforts. The cities of Minneapolis and Saint Paul have developed Critical Area Plans and management plans to protect the natural, cultural, historic, commercial, and recreational values of the corridor.

Figure 8: Historic Soils Orders of the MWMO

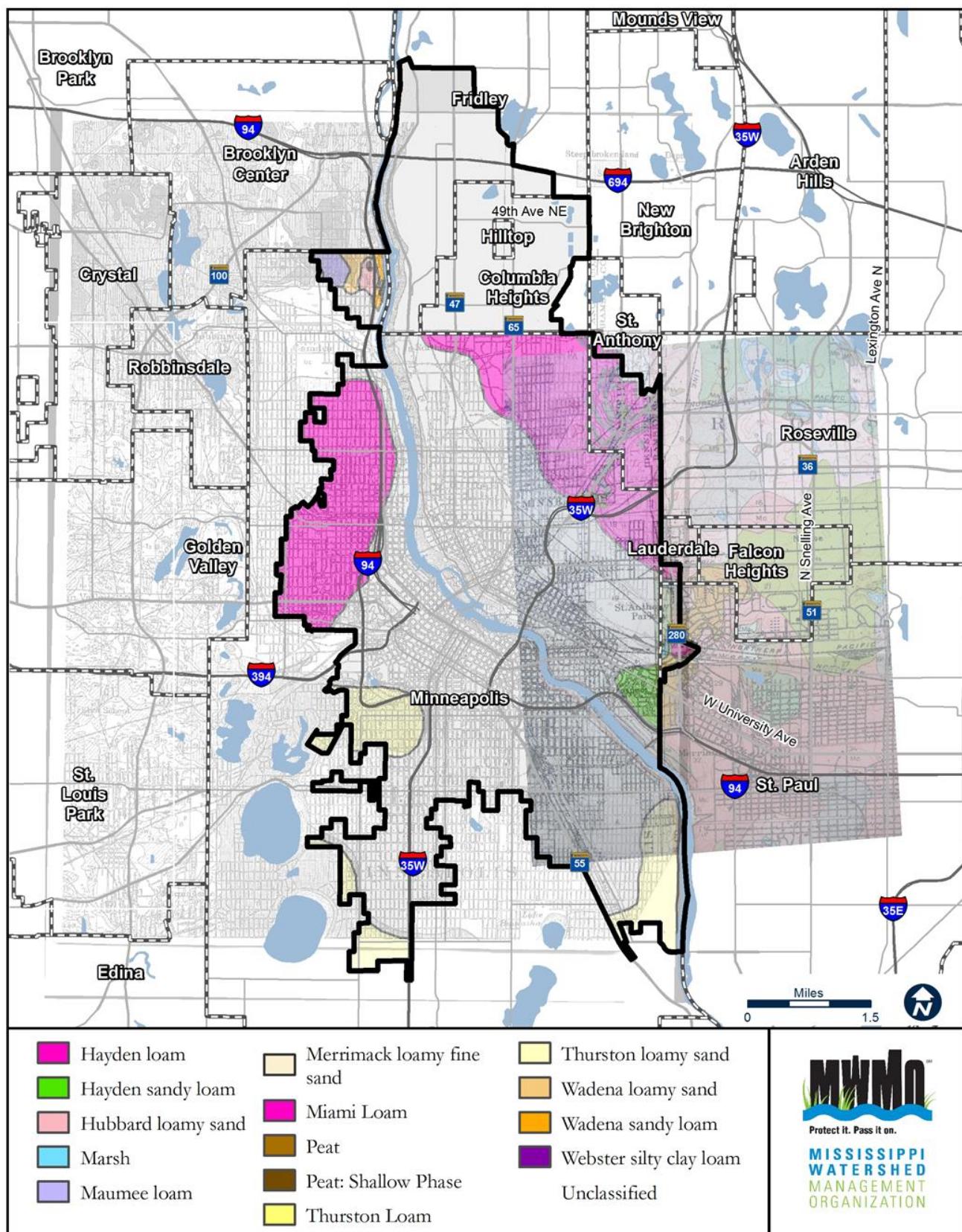
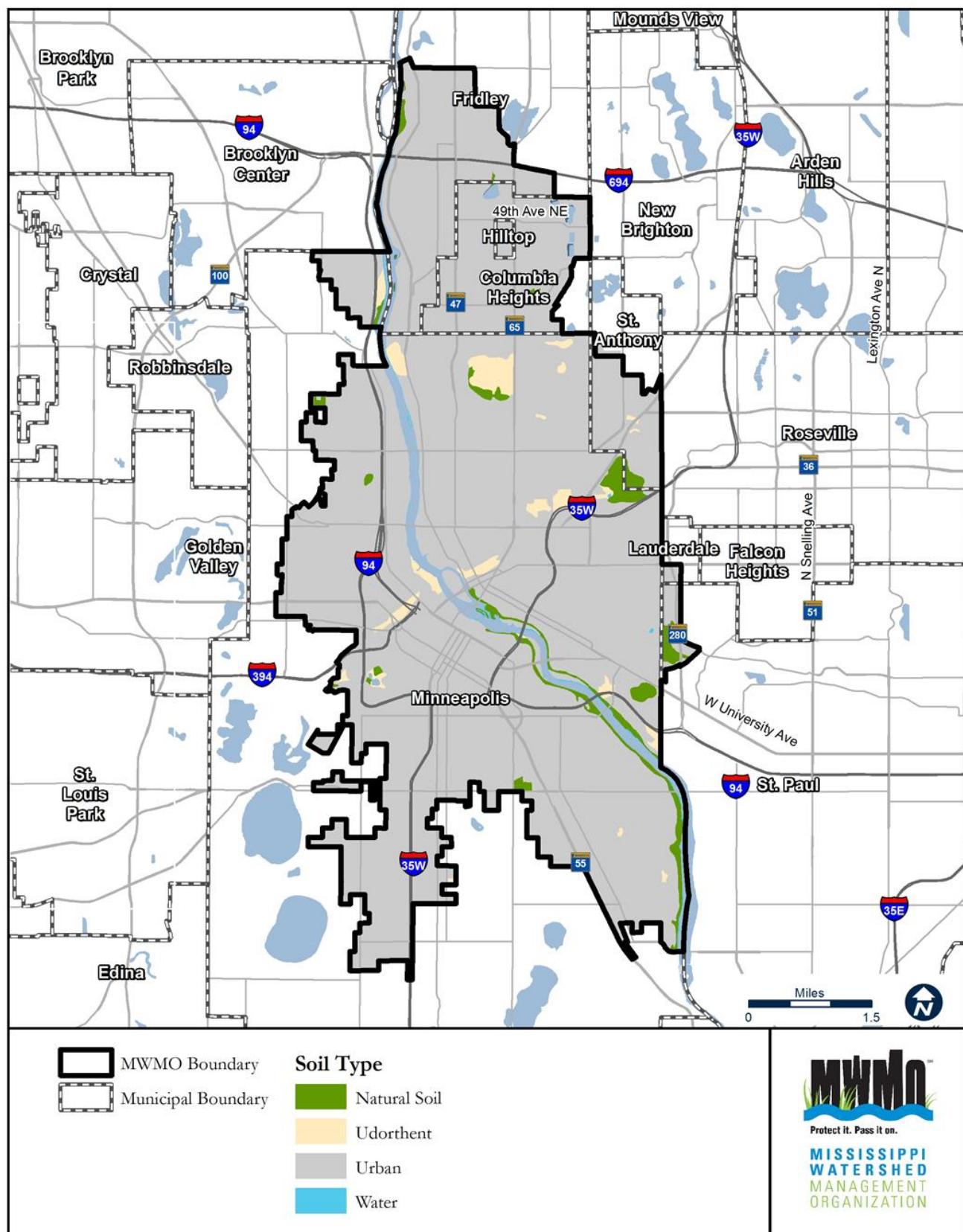


Figure 9: Present Day Urban Soils



**Figure 10: Modern Secondary Soil Information**

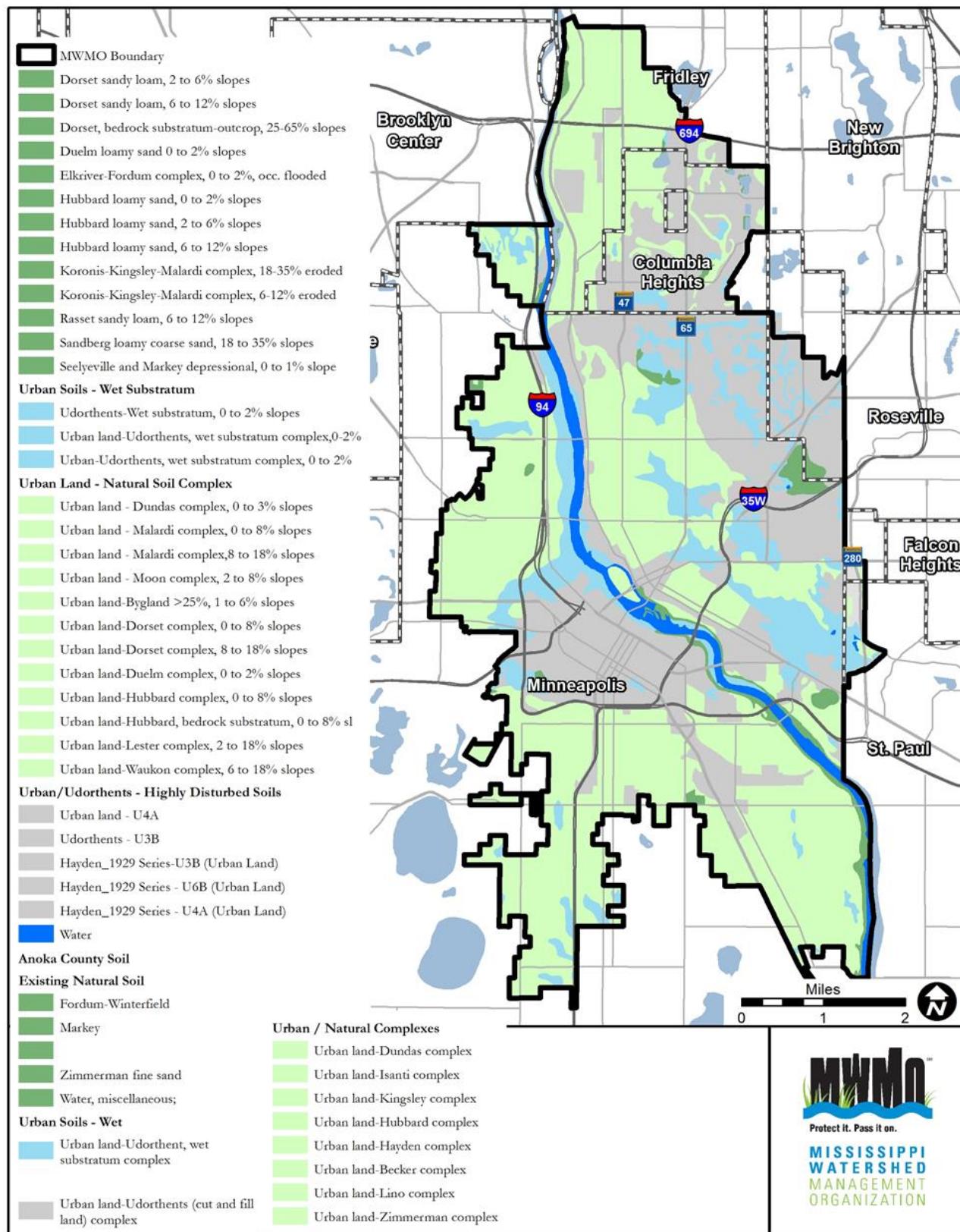
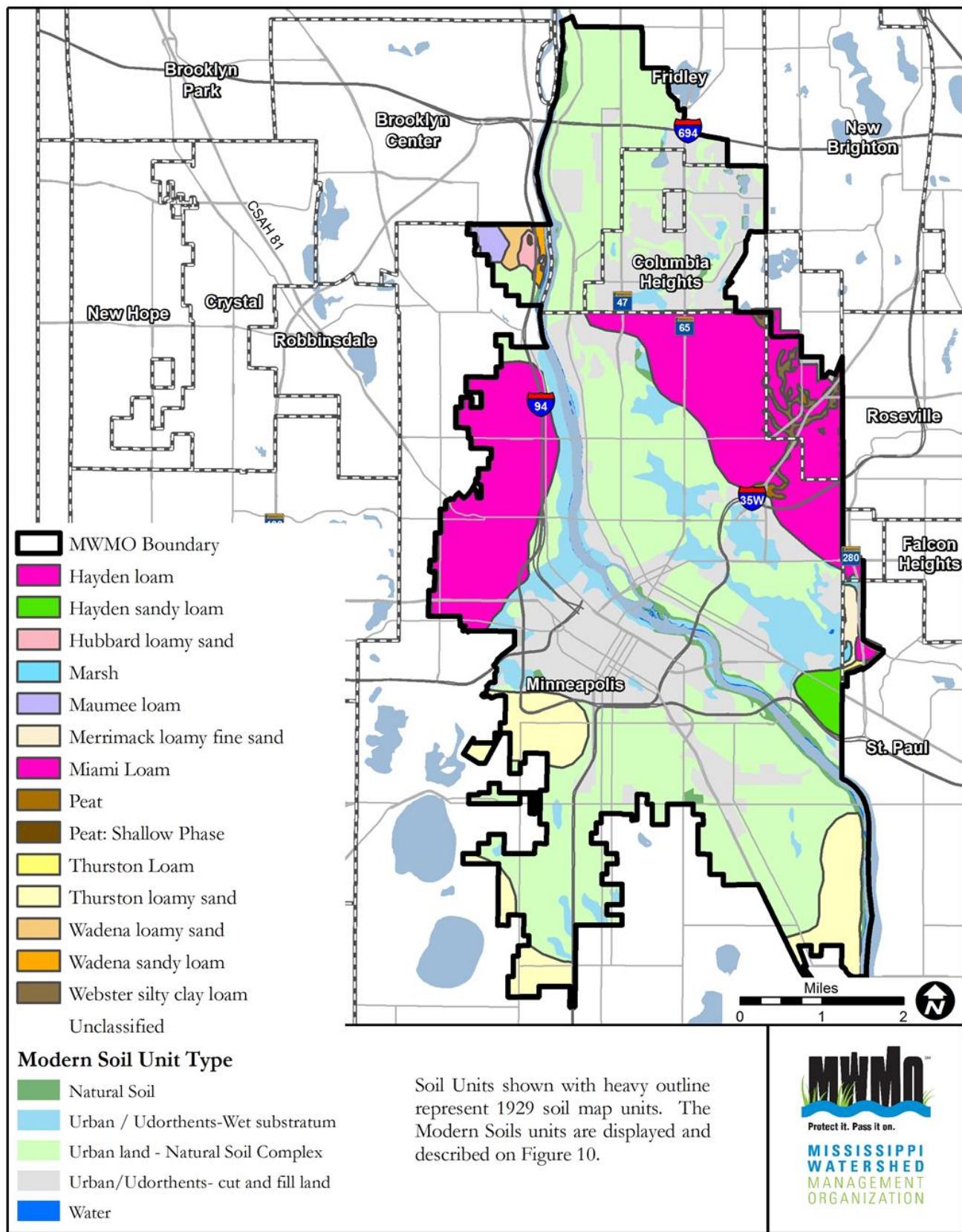


Figure 11: Combined Historic and Modern Soil Information



**Figure 12: Soil Series**

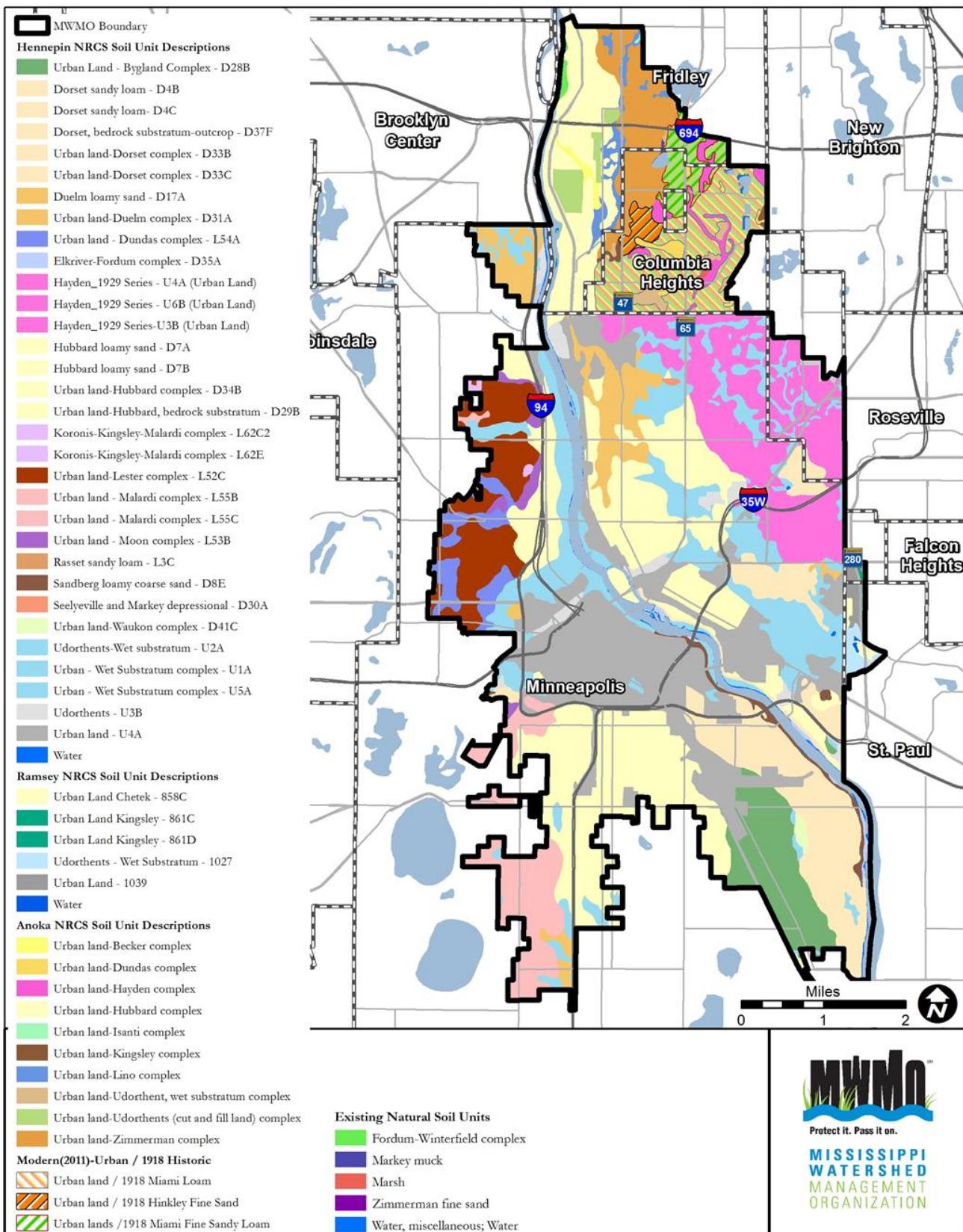
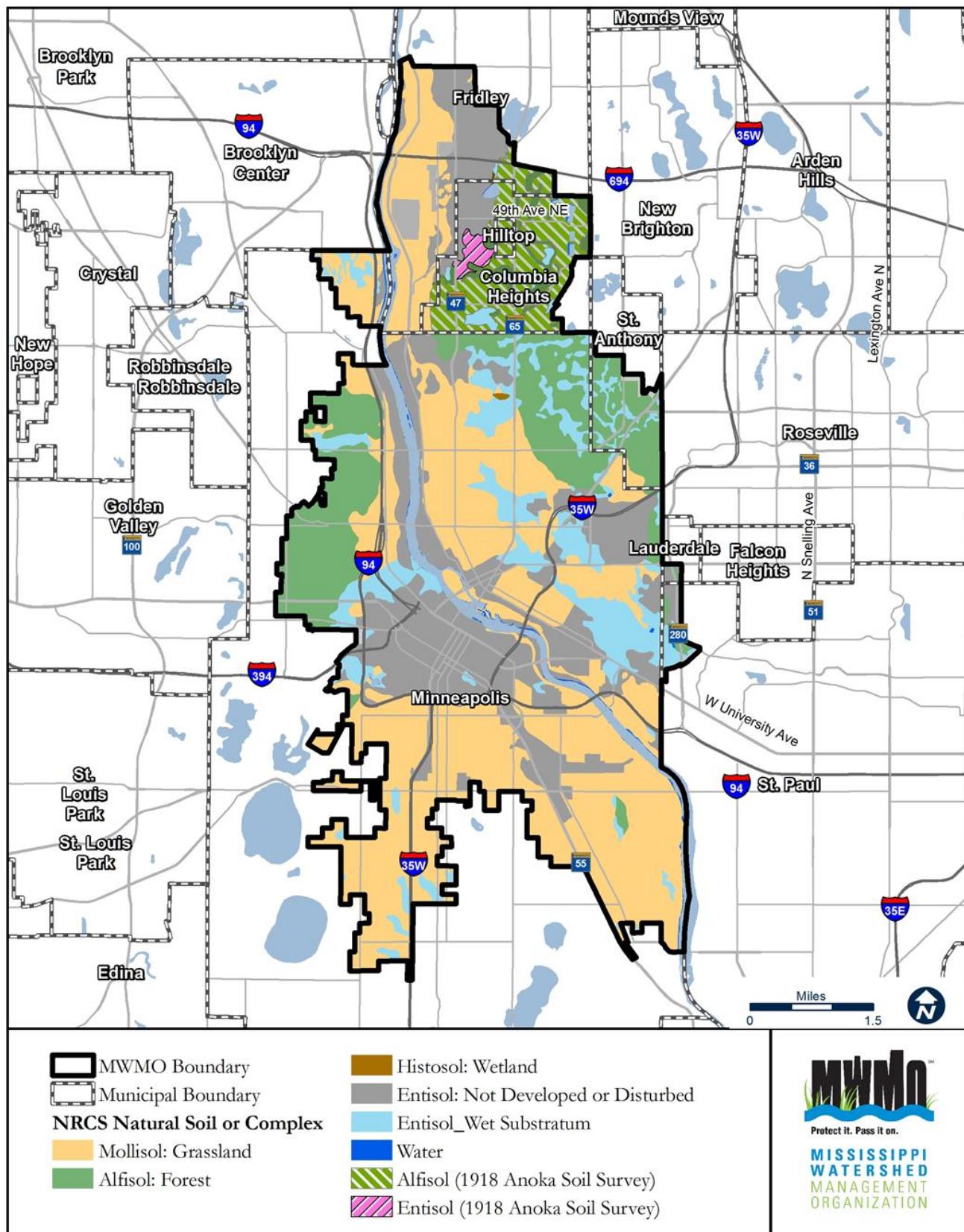


Figure 13: Soil Orders



**Figure 14: NRCS Based Vegetation**

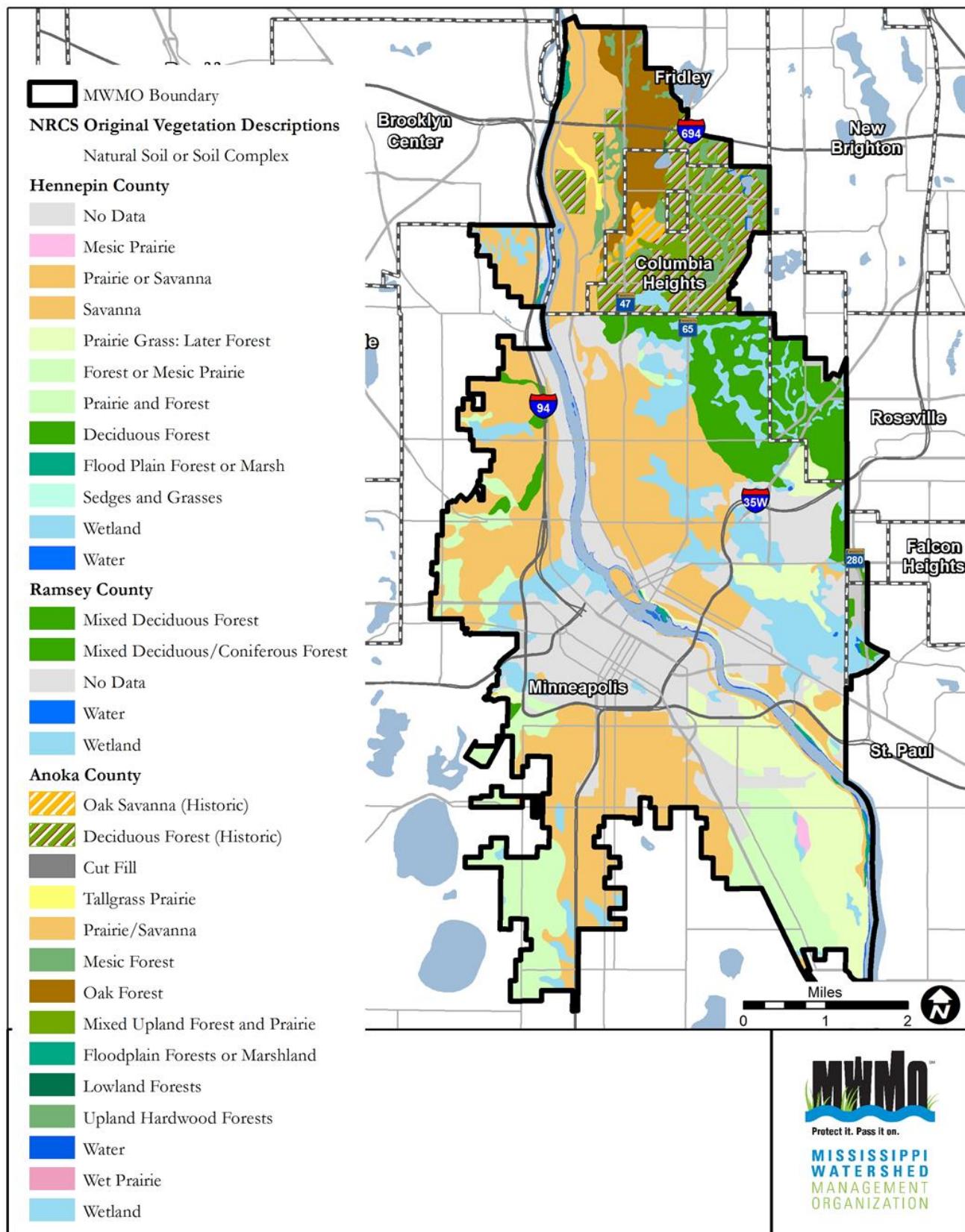
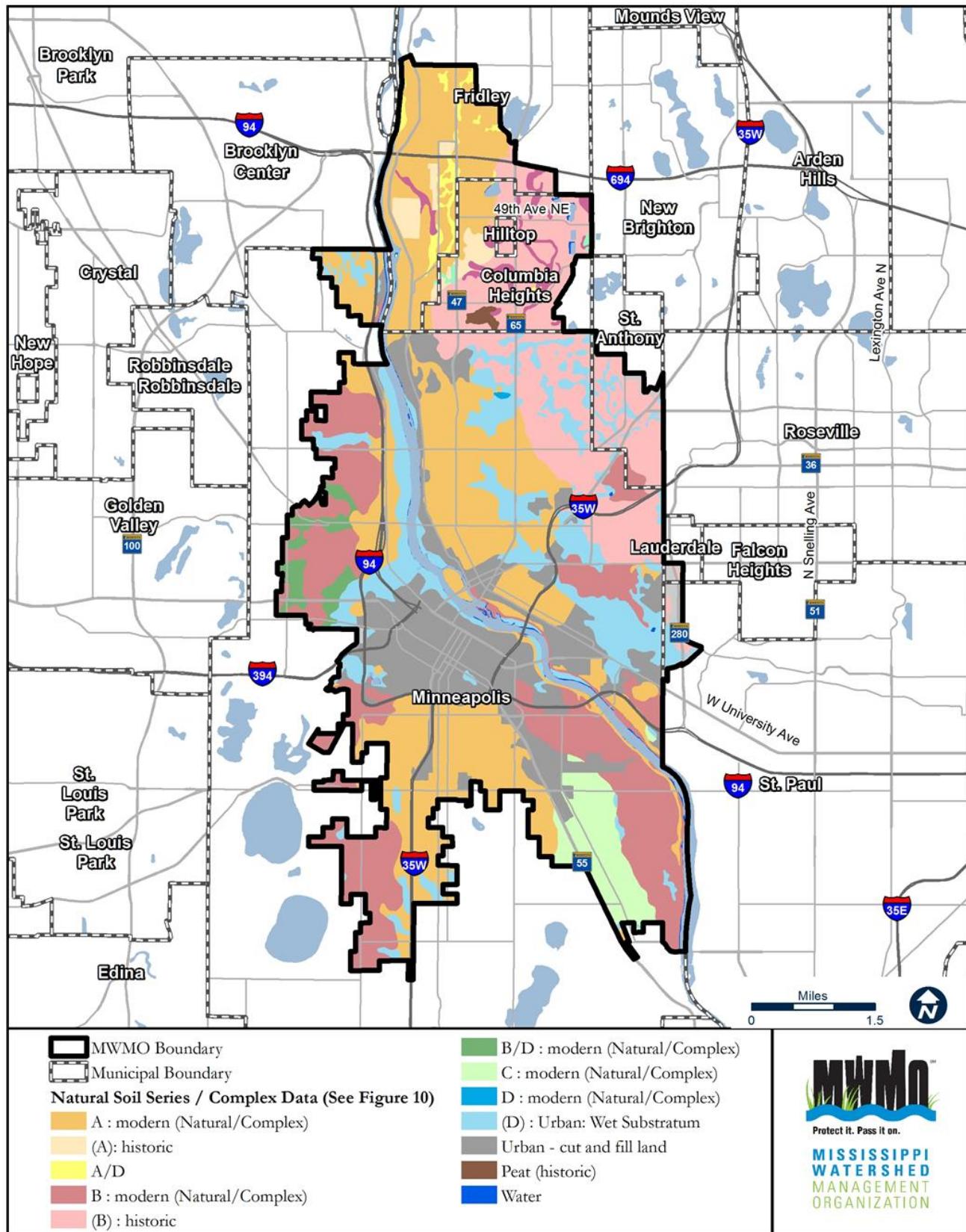


Figure 15: A Historic Estimate of Soil Hydrologic Group



#### **4.2.6. DISCUSSION OF CHALLENGES, GAPS, AND NEXT STEPS**

The MWMO should continue to partner with the City of Fridley, the City of Minneapolis, the Minneapolis Park and Recreation Board, and the National Park Service in maintaining the water quality, habitat, and natural aesthetics of the Mississippi River and Critical Area.

Many studies done on natural resources by federal, state, and local levels of government pass over urbanized areas. As such, MWMO started with a scant amount of information on the characteristics and quality of water and natural resources in the Watershed. This is problematic because effective watershed management is based on a thorough scientific understanding of the unique physical characteristics and complex ecosystems that make up a Watershed. In addition, plants, soils, water, and air are a part of natural systems that do not acknowledge political boundaries. So, when managing natural resources, organizations many times need to consider a scale that goes beyond their individual city or watershed area. Thus, the MWMO should continue to conduct appropriately-scaled studies that inventory, characterize, and assess the condition of water resources and related natural and human resources within the Watershed.

### **4.3. Biological Environment**

#### **4.3.1. NATURAL COMMUNITIES**

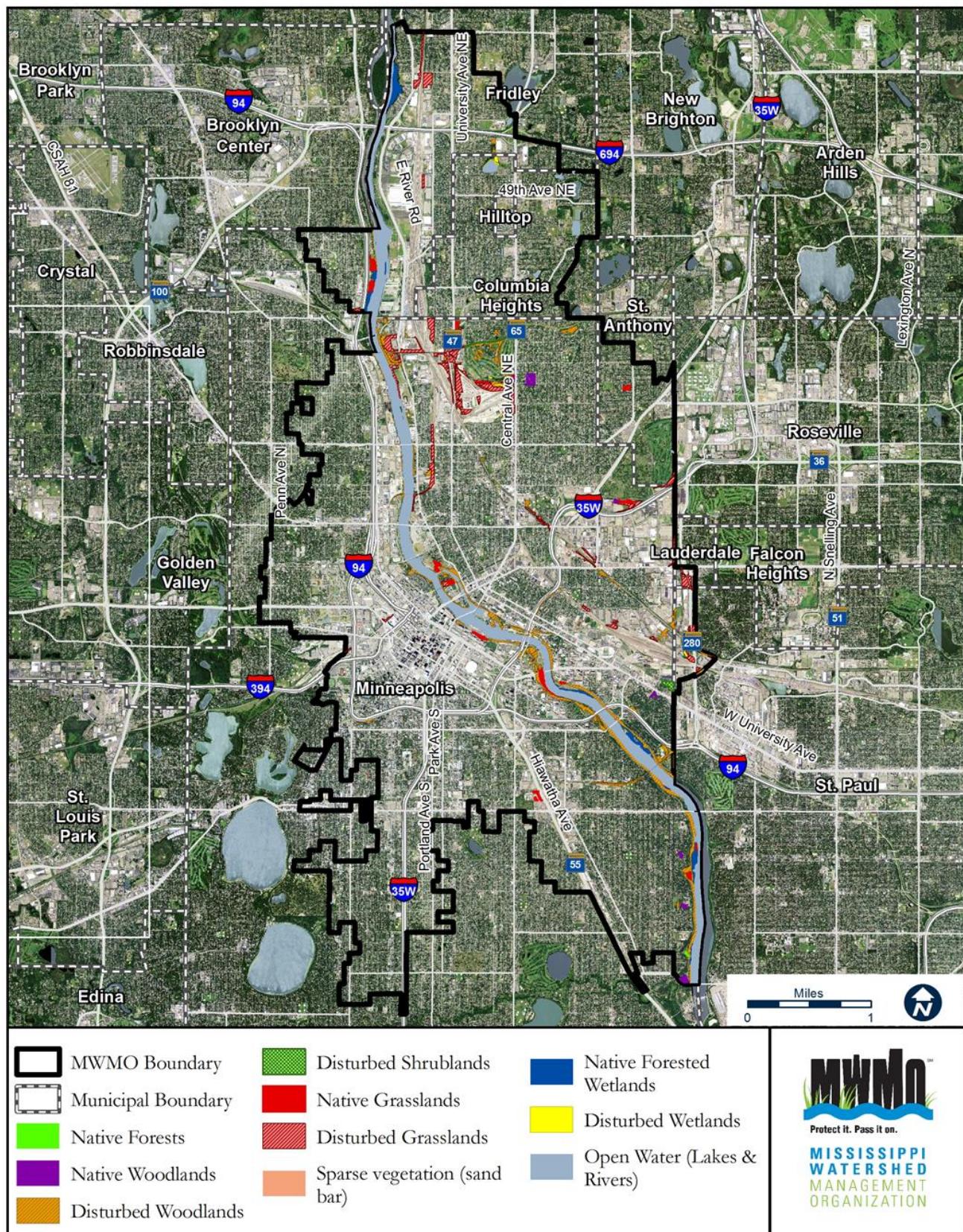
The majority of the MWMO has been developed for commercial, industrial, or residential uses and covered in impervious surfaces. However, some areas of natural and semi-natural vegetation remain (Figure 16). The majority of natural and semi-naturals areas are located within close proximity of the Mississippi River. Table 7 summarizes the acreage of remaining natural and semi-natural areas within the Watershed.

**Table 7: Natural and Semi-natural Areas of the MWMO Planning Area**

Natural and Semi Natural Areas	Acres	% Watershed Area
Open Water	893.83	3.5
Non-native or Disturbed Woodlands	189.85	0.74
Non-native or Disturbed Grasslands	226.33	0.89
Disturbed Woodlands	115.05	0.45
Non-native or Disturbed Wetlands	13.58	0.05
Native Forested Wetlands	73.24	0.29
Native Grasslands	41.12	0.16
Native Woodlands	28.63	0.11
Non-native or Disturbed Wooded Wetlands	5.46	0.02
Non-native or Disturbed Shrublands	11.16	0.04
Native Forests	2.08	0.01
Sparse vegetation (sand bar)	1.21	0.00
<b>Totals</b>	<b>1601.56</b>	<b>6.27</b>

*Source: FEMA, (MWMO, 2008), MN DNR, Mn/DOT*

Figure 16: Natural and Semi-natural Area of the MWMO



#### **4.3.2. RARE BIOLOGICAL FEATURES**

The Minnesota County Biological Survey identifies significant native plant communities throughout the State of Minnesota. Native plant communities typically appear where there is little alteration by humans and development. Native plant communities are named for the characteristic plant species within them or for characteristic environmental features. The Minnesota County Biological Survey program completed a survey of remaining areas of natural vegetation in Hennepin County from 1995-1997 and in Ramsey County from 1989-1990, identifying several intact native plant communities. The native plant communities identified in the survey are located along the Mississippi River and are listed here:

- Mesic prairie
- Red oak/sugar maple/basswood forest
- Silver maple floodplain forest

The Minnesota Department of Natural Resources queried the Minnesota Natural Heritage Information System Rare Features Database to find all records of rare species and other significant natural features within one mile of the Watershed. Table 8 summarizes the records of federal- and state-listed species—plants or animals that are listed as Endangered, Threatened, or Special Concern status in the State of Minnesota Department of Natural Resources Natural Heritage Program. The habitats where these species have been located need to be protected and potentially enhanced. The MWMO will give special consideration and protection to these areas during planning.

Because these rare features data are not based on a comprehensive inventory, there may be additional rare or otherwise significant natural feature occurrences in the MWMO that were not reported and therefore not entered into the database or the table below. Additional information on rare species can be found on the Minnesota Department of Natural Resources website's Rare Species Guide at <http://www.dnr.state.mn.us/rsg/index.html>. The index report of rare features and additional information on Blanding's Turtles can be found in Appendix H.

**Table 8: Rare, Sensitive, and Endangered Species within the MWMO**

Common Name	Genus and Species	Status
Acadian Flycatcher	<i>Empidonax virescens</i>	Minnesota – Special Concern Species
Black Sandshell	4.3.2.1.1. <i>recta</i>	Ligumia Minnesota – Special Concern Species
Blanding's Turtle	4.3.2.1.2. <i>blandingii</i>	Emydoidea Minnesota – Threatened Species
Blue Sucker	<i>Cyclopterus elongatus</i>	Minnesota – Special Concern Species
Dwarf Trout Lily	<i>Erythronium propullans</i>	Federal – Endangered Species Minnesota – Endangered Species
Eastern Pipistrelle	<i>Pipistrellus subflavus</i>	Minnesota – Threatened Species
Elktoe	<i>Alasmidonta marginata</i>	Minnesota – Threatened Species
Handsome Sedge	<i>Carex formosa</i>	Minnesota – Endangered Species
Higgins' Eye	<i>Lampsilis higginsi</i>	Federal – Endangered Species Minnesota – Endangered Species
Hooded Warbler	<i>Wilsonia citrina</i>	Minnesota – Special Concern Species

Common Name	Genus and Species	Status
Lake Sturgeon	<i>Acipenser fulvescens</i>	Minnesota – Special Concern Species
Least Darter	<i>Etheostoma mocroperca</i>	Minnesota – Special Concern Species
Little White Tiger Beetle	<i>Cicindela lepida</i>	Minnesota – Threatened Species
Mucket	<i>Actinonaias ligamentina</i>	Minnesota – Threatened Species
Paddlefish	<i>Polyodon spathula</i>	Minnesota – Threatened Species
Peregrine falcon	<i>Falco peregrinus</i>	Minnesota – Threatened Species
Plantain-leaved Sedge	<i>Carex plantaginea</i>	Minnesota – Endangered Species
Prairie Vole	<i>Microtus ochrogaster</i>	Minnesota – Special Concern Species
Pugnose Shiner	<i>Notropis anogenus</i>	Minnesota – Special Concern Species
Rock Clubmoss	<i>Huperzia porophila</i>	Minnesota – Threatened Species
Spike	<i>Elliptio dilatata</i>	Minnesota – Special Concern Species
Valerian	<i>Valeriana edulis ssp. ciliata</i>	Minnesota – Threatened Species
Wartyback	<i>Quadrula nodulata</i>	Minnesota – Endangered Species
Waterwillow	<i>Decodon verticillatus</i>	Minnesota – Special Concern Species
Bat concentration	(multiple species)	Unique Wildlife Feature
A species of mushroom	<i>Psathyrella rhodospora</i>	Minnesota – Endangered Species

Source: MDNR Natural Heritage Information System: Rare Features Database

Database Query: March 2009

#### 4.3.3. FISH AND WILDLIFE

The MWMO is a highly-developed Watershed with limited viable fish and wildlife habitat. The areas within the Watershed that do foster fish and wildlife populations are important to preserve, monitor, and enhance throughout the Watershed. These areas provide economic, aesthetic, and recreational benefits to the Watershed. In addition, natural systems directly impact water quality. Preserving aquatic, riparian, and upland fish and wildlife habitats can increase the overall ecological integrity of the Watershed. The Mississippi River, Loring Park Pond and Mallard Marsh are the main fish and wildlife habitats in the MWMO.

#### Mississippi River

The Mississippi River is the major source of viable fish and wildlife habitat in the Watershed. The river supports a diverse fishery with over 100 species of fish including walleye, panfish, sturgeon, bass, and paddlefish. The Mississippi River provides for fishing year-round and is enjoyed by many residents of the Watershed.

The river is home to a large population of waterfowl, including mallards, teals, pintails, Canadian geese, swans, and many others. Minnesota has one of the largest populations of American Bald Eagles and many utilize the Mississippi River for nesting and fishing. Millions of migratory birds travel along the Mississippi Flyway during spring and fall migrations. Different species from small songbirds to waterfowl to large raptors utilize the River's north-south orientation to guide them to their final destinations. The shoreline and wetland areas adjacent to the River provide vegetative cover for birds to nest but also supplies habitat for many reptiles and amphibians.

*Water Resources Information and Issues Overview Report*, a report sponsored by the National Park Service on the Mississippi National River and Recreation Area, compiled the findings of multiple studies on aquatic birds, fish, freshwater mussels, and benthic macroinvertebrates (Lafrancois et al., 2007). The report supports the Upper Mississippi River Valley's reputation for its biological productivity and diversity, including over 105 species of water-based birds, 15 species of which are threatened, endangered, or species of special concern. The Mississippi National River and Recreation Area corridor is home to the American Beaver, River Otter, mink, and muskrat. Over 100 fish species were historically found below Saint Anthony Falls and over 60 or so above.

Changes to the river due to dams, land use changes, and dispersal barriers have changed the quantity of species and their composition. In recent years, 72 species have been identified. Freshwater mussels have been the focus of multiple studies, including documentation of a total of 14 live mussel species and an additional 11 present as empty shells. In other studies, nearly 30 species of live mussels have been documented. Species lists for amphibians and reptiles include 14 frog and salamander species, 8 turtle species, and the Northern Water Snake. Fewer inventories have been done on algae and invertebrates in the Mississippi National River and Recreation Area corridor though they have found that algae generally increases from upstream to downstream.

### **Loring Park Pond**

Loring Park Pond is a recreational fishing lake utilized by many people within the Watershed. The lake has been stocked annually by the Department of Natural Resources with bluegill and black crappie since 2003 and channel catfish since 2005.

### **Mallard Marsh**

Saint Anthony Park Community Council sponsors annual cleanups around Mallard Marsh to recover discarded trash and appliances from the water and shoreline areas. Saint Anthony Park Community Council volunteers have monitored Mallard Marsh including three surrounding ponds for at least 15 years. Besides water quality monitoring, a basic wetland inventory was done by Saint Anthony Park Community Council and University of Minnesota faculty and students in 1999-2000. The inventory included three turtle species, vegetation, fish and other wildlife including reptiles, amphibians, birds, and mammals. Fathead Minnows, Brook Stickleback, Crayfish, and Salamanders have also been found in Mallard Marsh and surrounding ponds (MWMO, 2006).

#### **4.3.4. DISCUSSION OF CHALLENGES, GAPS, AND NEXT STEPS**

As discussed above, natural plant communities and wildlife are scarcer in the terrestrial areas of the MWMO, while the Mississippi River is the major source of viable fish and wildlife habitat in the Watershed. Yet all of these resources provide economic, ecological, and social benefits for residents living in the Watershed. The MWMO can use this information to guide its restoration, land conservation, and multifunctional corridor planning efforts.

## **4.4. Human Environment**

### **4.4.1. DEMOGRAPHICS**

Current population and population trends inform the direction of MWMO's natural resource management toward any use or combination of the following: preservation, protection, restoration, recreation, or acquisition. Population density in the MWMO in the year 2010 census is found in Figure 17. Each of the neighborhoods within the MWMO is identified in Figure 18. The population of the Watershed based on the 2010 census is estimated at 257,844 people (Table 9). Based on Metropolitan Council demographic forecasts as of May 28, 2014, it is projected that the overall population of cities within the MWMO will increase by 2040. The anticipated population growth indicates that higher density redevelopment within the already urbanized Watershed is likely to occur.

Figure 17: Population Density of the MWMO Based on the 2010 Census

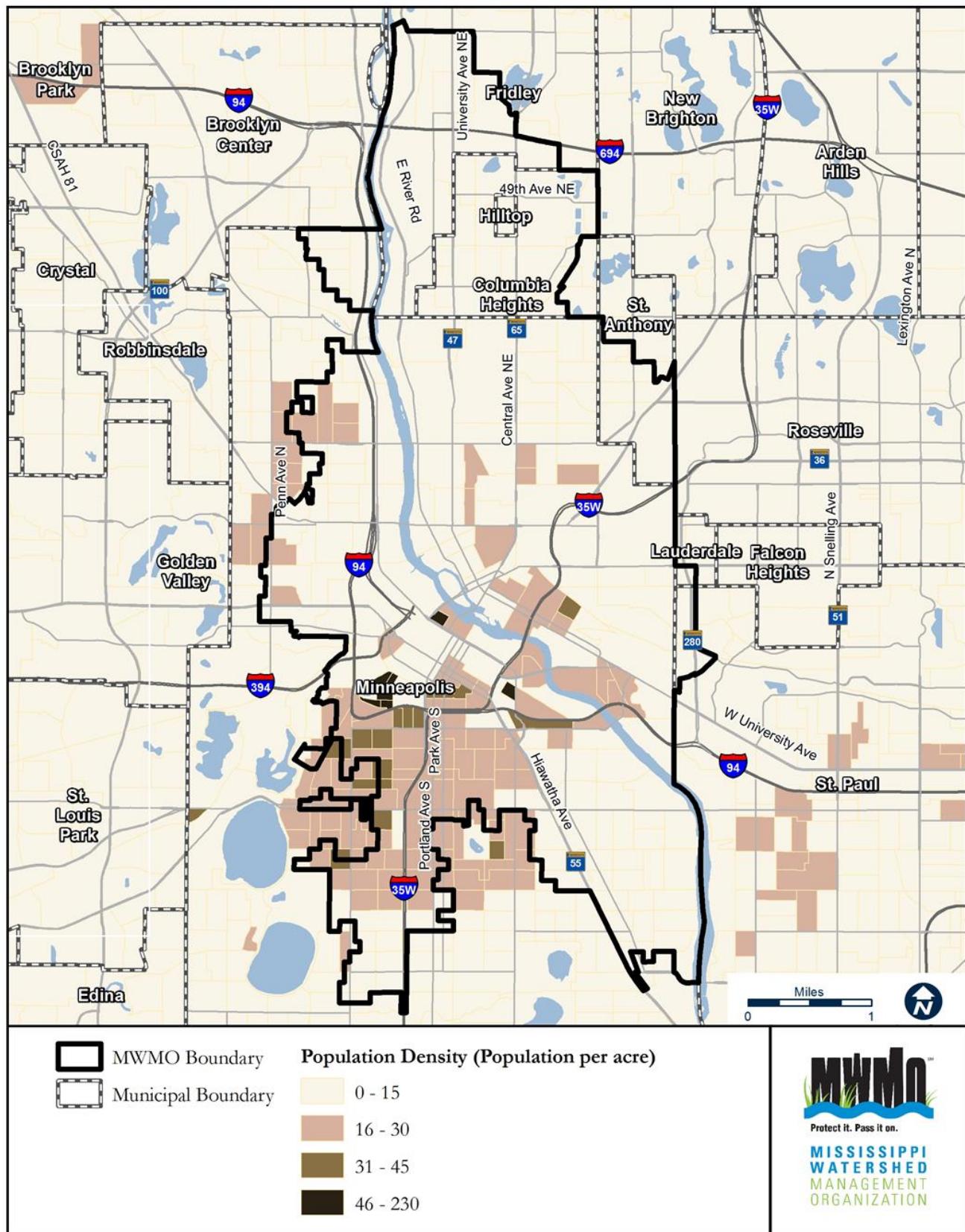
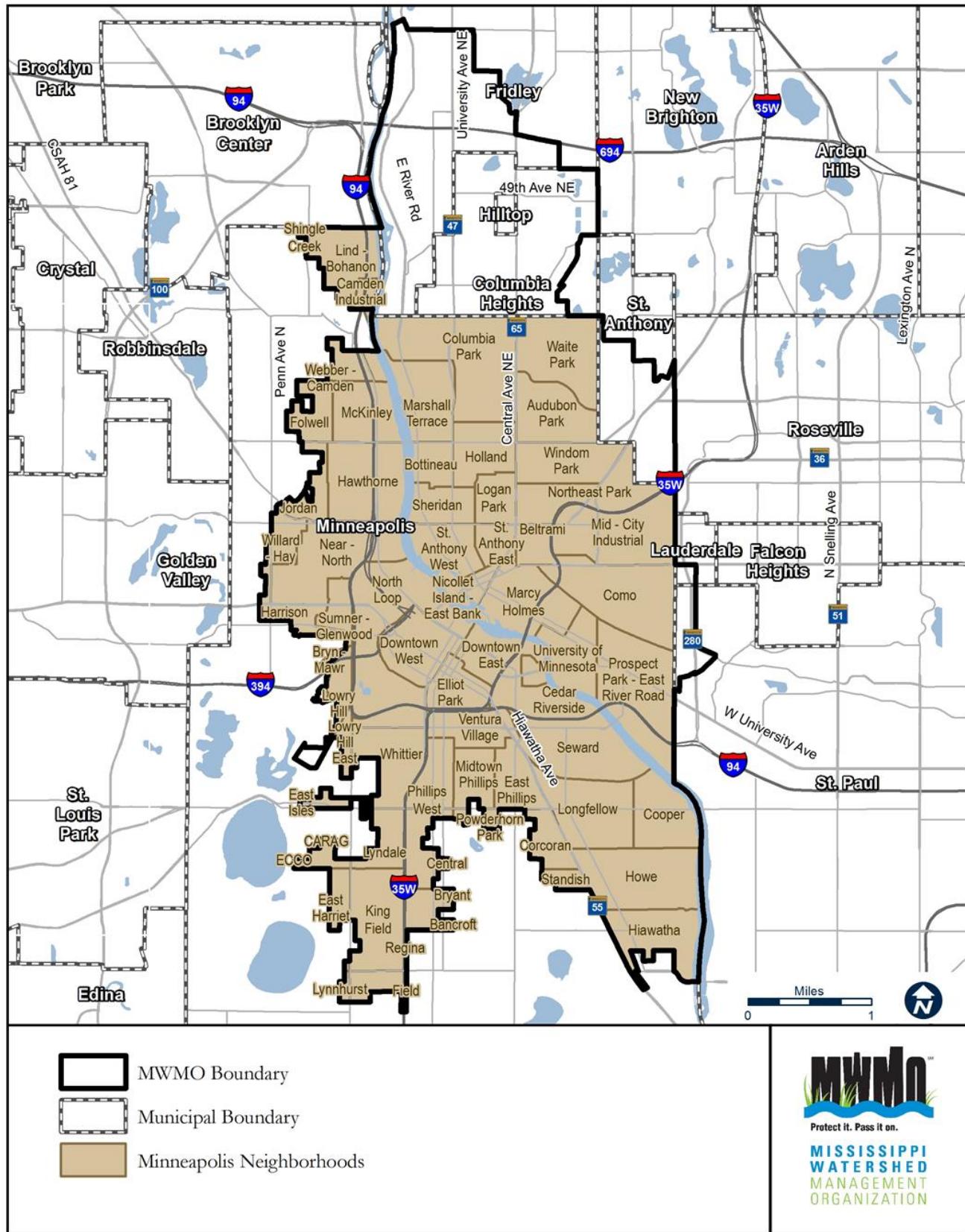


Figure 18: Minneapolis Neighborhoods in the MWMO



**Table 9: Population Projections for Cities within the MWMO**Source: (*Metropolitan Council Thrive MSP 2040 Forecasts, Metropolitan Council, 2014*)

City	2010 Population*	2010 Forecast**	2040 Forecast**
Columbia Heights	17,867	19,496	21,700
Fridley	8,407	27,208	29,400
Hilltop	744	744	1,100
Minneapolis	226,050	382,578	466,400
Saint Anthony Village	3,464	3,070	4,300
Saint Paul	969	285,068	334,700
Lauderdale	344	2,379	2,400
<b>Totals:</b>	<b>257,844</b>	<b>720,543</b>	<b>860,000</b>

\*Based on 2010 US Census Block Group. For the portion of the city that is within the MWMO.

\*\* With the exception of Saint Anthony Village, Population forecasts are for the full city as estimated by Metropolitan Council, (2014) rather than the portion of the city's population that is within the MWMO. Population estimates do not differentiate among residential and non-residential areas.

## Diversity

Understanding the diverse nature of the population within the Watershed will help MWMO staff design and implement relevant information and stewardship campaigns for its different populations. In fact, the MWMO and the City of Minneapolis Department of Public Works developed with Katherine Barton the *Hmong Water Research Project (Kev Cob Qhia Zej Tsoom Hmoob Txog Dej): Assessing Attitudes, Perception and Behavior about Water in Minnesota's Hmong Community* (Barton, 2007).

Hmong refugees first arrived in the metro area in the 1970s and 1980s, joining the growing population of immigrants from Africa, Southeast Asia, South America, and Mexico. The *Hmong Water Research Project* takes an important look at the Hmong community to learn and understand how the community communicates and receives information, its knowledge, behavior, and attitudes about water issues, and its worldview and cultural context. The Hmong served as a pilot group for this thorough cultural analysis with respect to water resources management. The information in the report is for the design and implementation of a focused stewardship campaign about water. It will be possible to repeat and adapt this approach with other underserved diverse communities in the MWMO.

The City of Minneapolis is a source of significant diversity within the MWMO. Table 10 summarizes the estimated population within the City for seven major categories of race. In 1950, only 1.6% of the City was non-white; by 2006, the City was 36% non-white. Minneapolis has the largest urban population of Native Americans in the United States. Recent increases in diversity are due to new residents from Mexico, Latin America, and Asia, as well as African countries like Somalia and Ethiopia. Many of these new residents are children and working-age adults. In fact, the city boasts that over 90 languages are spoken in its households.

**Table 10: Minneapolis 2006 Population by Race**

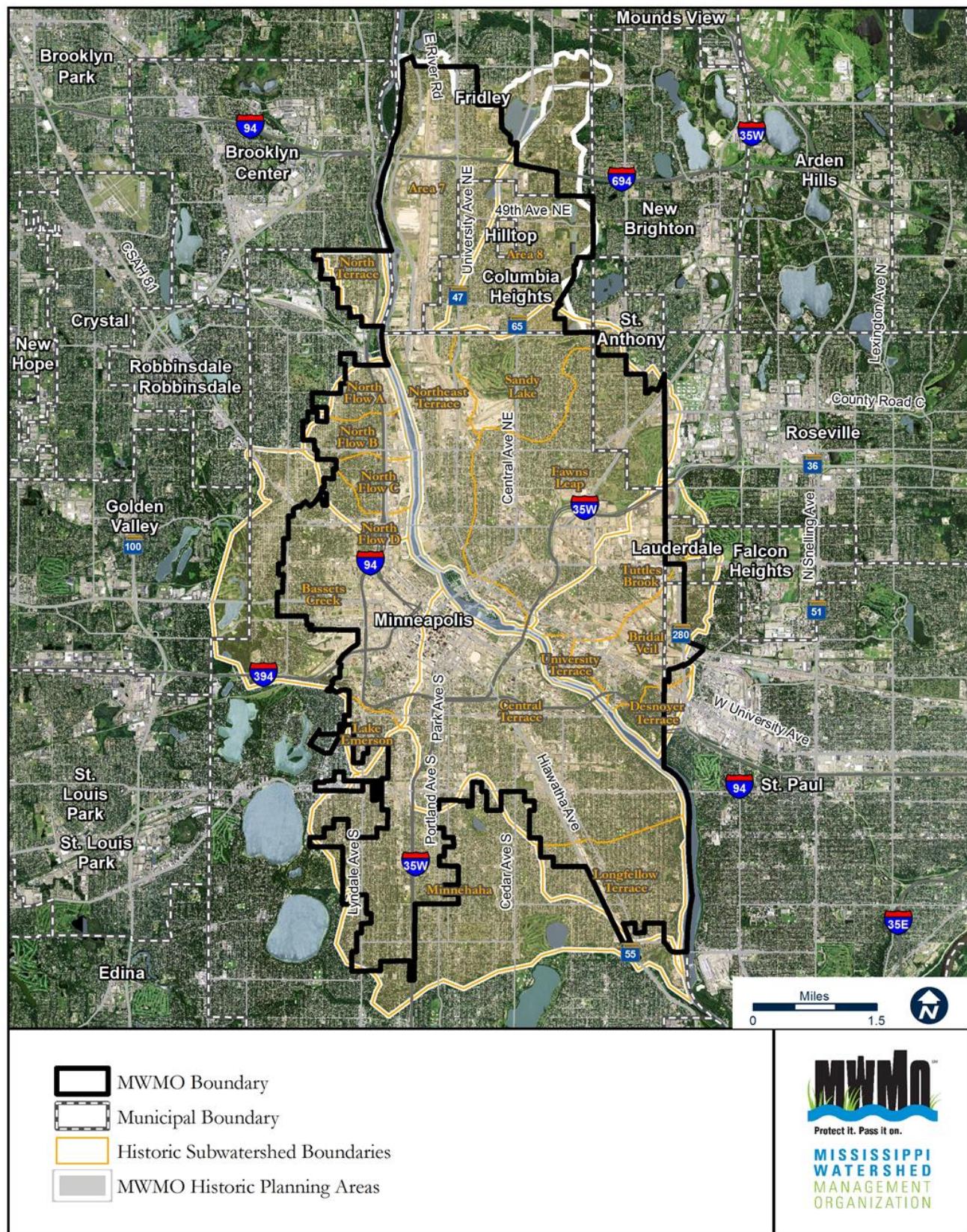
Race	Estimated % of Total Population
White	64 %
Black or African American	18 %
Hispanic or Latino (of any race)	9 %
Asian and Native Hawaiian	5 %
Two or more races	3 %
American Indian and Alaska Native	1 %
Some other race	0 %
<b>Total</b>	<b>100%</b>

#### **4.4.2. 4.4.2 HISTORICAL LAND USE**

Understanding the effects of human settlement on MWMO resources is important for understanding water quality trends and guiding water resource management. The historic landscape of the MWMO consisted of a mosaic of streams, lakes, wetlands, and plant community types as a result of areas of shallow groundwater flow, soil characteristics, hydrology, and varying sun exposure. Dramatic springs and waterfalls were common.

Urbanization of the region resulted in filled, buried, drained, or otherwise altered water resources. In order to make way for development, surface waters were converted into a series of pipes and tunnels to convey surface waters and any additional stormwater downstream. The few areas that have not been developed—such as green space within the Mississippi River gorge—are overgrown with invasive species as a result of early human activity including logging, aggregate and bedrock mining, and manmade access points. The banks and bed of the Mississippi River were altered over time by filling and dredging activities. Subwatersheds in the region that were previously defined by topography are now defined by extensive underground stormwater tunnel and pipe networks. Historic subwatersheds, as identified in the *Historic Waters of the MWMO* report (MWMO, 2011), are shown in Figure 19. In the *Historic Waters of the MWMO* report (MWMO, 2011), these historic subwatersheds were aggregated into six Historic Planning Areas based on hydrologic association (also in Figure 19). Each Historic Planning Area is described by landscape, historic water features, pre-settlement vegetation, and major landscape alterations. In some instances the historic hydrology of the Watershed still affects land use today. With the addition of portions of three new cities to the MWMO, two additional planning areas have been added (see Figure 19).

Figure 19: Historic Subwatersheds and Planning Areas of the MWMO



#### **4.4.3. PRESENT LAND USE**

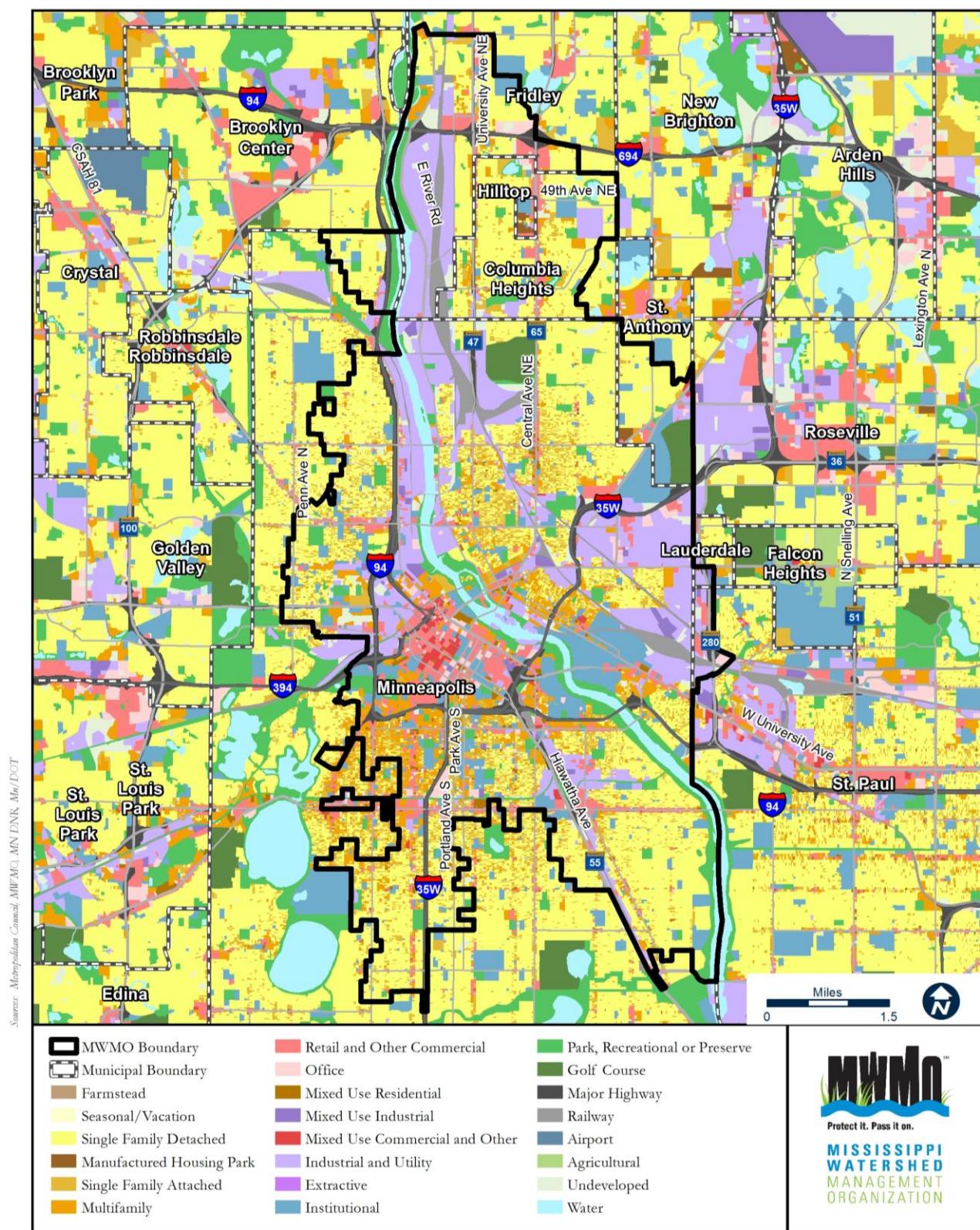
The Watershed is entirely developed and contains the central business district of Minneapolis (Figure 20). The dominant land use is single family residential, covering approximately 39.5% of the Watershed. Commercial and multi-family land uses are concentrated near downtown Minneapolis and along major roadways. Industrial land uses are generally located along major transportation routes: roadways, railways, and along the Mississippi River. Parks are distributed throughout the Watershed and range in size from small neighborhood parks to large regional parks located along the Mississippi River. Table 11 summarizes acreage of the various land uses found in the watershed. The entire Watershed is within the Metropolitan Urban Service Area. The Metropolitan Urban Service Area is the area in which the Metropolitan Council ensures that regional services and facilities, such as sewers and major highways, are planned and provided.

**Table 11: Present Land Use of the MWMO (2005)**

Land Use	Acres	% Watershed Area
Single Family Residential	10,086.4	39.5
Multi-family Residential	1,631.8	6.4
Commercial	2,044.7	8.0
Mixed Use	492.2	1.9
Industrial	3,609.7	14.1
Institutional	2,140.4	8.4
Major Vehicular Rights of Way	1,313.1	5.1
Railways	783.1	3.1
Open Water	879.6	3.4
Parks, Recreation, and Preserves	1,875.0	7.3
Vacant	687.3	2.7
<b>Totals</b>	<b>20,959.0</b>	<b>100.0</b>

*Source: Metropolitan Council, 2005 Generalized Land Use Data*

**Figure 20: Present Land Use of the MWMO**



#### **4.4.4. 2020 LAND USE**

No major changes in land use within the Watershed are expected before 2020. Table 12 summarizes acreage of the various land uses forecast for the year 2020. Future land use as reported by Metropolitan Council is shown in Figure 21.

**Table 12: Future Land Use of the MWMO (2020)**

Land Use	Acres	% Watershed Area
Single Family Residential	12,034.9	47.1
Multi-family Residential	202.2	0.8
Commercial	570.3	2.2
Mixed Use	2989.2	8.3
Industrial	3016.8	11.8
Institutional	1672.1	6.5
Major Vehicular Rights of Way	1280.9	5
Railways	726.2	2.8
Parks, Recreation, and Preserves	2158.7	8.5
Open Water	891.8	3.5
<b>Totals</b>	<b>25,543.2</b>	<b>100.0</b>

*Source: Metropolitan Council, MWMO, MN DNR, Mn/DOT*

#### **4.4.5. REDEVELOPMENT OPPORTUNITIES**

Areas slated by cities for redevelopment in the near future can represent collaboration opportunities with the MWMO with regard to corridor planning, environmentally sensitive development techniques, or communication and outreach activities. Awareness of these areas can also enable the MWMO to identify early in the planning stages any possible areas of concern due to proximity to high priority natural, hydrologic, or geologic areas. Only a few small areas within the MWMO have been identified in the Comprehensive Plans of member cities as focus redevelopment areas. All of these sites discharge to the Mississippi River and are good opportunities for the MWMO.

The City of Minneapolis Comprehensive Plan (City of Minneapolis, 2009) identifies Growth Centers in the City's future land use mapping. Growth Centers are characterized by a concentration of employment-generating development. They include four main areas: downtown Minneapolis, the University of Minnesota (east of downtown), Bassett Creek Valley (northwest corner of Hwy 94 and Hwy 394) and the Wells Fargo/Hospitals area (the area including Wells Fargo Home Mortgage, Abbott Northwestern Hospital, and Children's Hospital).

The City of Saint Paul's Draft Comprehensive Plan identifies growth opportunity areas (City of Saint Paul, 2008). Only one of the City's growth areas lies partially within the MWMO and is along University Avenue in Saint Paul. The City is considering it a future neighborhood center defined by compact, mixed use, higher density housing, as well as shopping, community amenities, and employment centers that are served by public transit.

Along New Brighton Boulevard at the south end of the City of Saint Anthony Village, multi-family housing and commercial development are planned as part of the City's Comprehensive Plan (City of Saint Anthony Village, 2007). Within the MWMO, the City of Lauderdale Comprehensive Plan identifies goals to establish a mixed-use corridor

along Larpenteur Avenue and to expand mixed-use zoning along the west side of Eustis Street and adjacent vacant land (City of Lauderdale, 2008).

The City of Columbia Heights' Comprehensive Plan identifies goals to increase medium and high density residential areas, primarily near University and Central Avenue and near lakes and parks. Redevelopment is also planned along 40<sup>th</sup> Avenue and Central Avenue (City of Columbia Heights, 2010).

The City of Fridley Comprehensive Plan identifies areas for redevelopment that include: improved access to Islands of Peace Park, the South Industrial Area along East River Road, the area north of Moore Lake, the Columbia Ice Arena, and the Automotive Area along Osborne Road and Highway 65. The City plans to create a walkable downtown area and more retail space (City of Fridley, 2009).

The City of Hilltop has created a mixed-use designation along Central Avenue for redevelopment purposes. According to their Comprehensive Plan (2009), Hilltop plans to create higher density housing and commercial property opportunities along the Central Avenue corridor.

#### **4.4.6. SURFACE AND GROUNDWATER APPROPRIATIONS**

Minnesota Department of Natural Resources Division of Waters regulates surface and groundwater appropriations based on daily and yearly withdrawal volumes. This management affects water supply for domestic, agricultural, fish and wildlife, recreational, power, navigation, and quality control purposes. A permit through the Water Appropriation Permit Program is required for all users withdrawing more than 10,000 gallons per day or 1 million gallons per year for consumptive or nonconsumptive use. A consumptive use is characterized by withdrawal of water that is not directly returned to its original source. All groundwater withdrawals are consumptive unless the water is returned directly to the aquifer from which it came. If surface water withdrawals are not directly returned to the source such that it is available for immediate further use, it is also considered consumptive. Currently there is no permitting in place for appropriations that draw less than 10,000 gallons per day or 1 million gallons per year.

Permit exemptions apply to certain domestic users, test pumping, water reuse from a permitted municipal source, and certain agricultural drainage systems. Permit exemptions may also apply to the demand from hydrofacilities. In certain cases where a hydrofacility does not take the water from its natural setting and the use is nonconsumptive, the hydrofacility does not need an appropriations permit. As a result, these appropriations would not be on record with the Minnesota Department of Natural Resources. Minnesota law also requires the Department of Natural Resources to limit appropriations during low flow conditions for the benefit of high priority downstream water users.

Figure 22 shows the locations and water source of the surface and groundwater appropriations within the MWMO. All of the five main water use categories are currently found within the MWMO: power generation, industrial processing, public supply, irrigation, and additional uses categorized as *other*. *Other* appropriations include water withdrawn for air conditioning, water level maintenance, pollution confinement, or construction dewatering. A general permit authorizing temporary water appropriations might also include dust control, landscaping, and hydrostatic testing of pipelines, tanks, and wastewater ponds.

Three power generation appropriations are within the MWMO. Power generation appropriations typically withdraw surface water sources for cooling water resulting in non-consumptive use. Industrial processing is a water use category typically applicable to mining activities, paper mill operations, and food processing. Usually withdrawals are from surface water sources. Many of the industrial processing appropriations are located along the Mississippi River as are public supply appropriations. Irrigation water can be withdrawn from either surface water or groundwater sources and is almost always a consumptive use. The *other* water use categories currently found in the MWMO include air

conditioning, water level maintenance, and pollution confinement. *Other* withdrawals found in downtown Minneapolis are mostly for air conditioning. *Other* withdrawals in industrial areas are primarily for pollution confinement.

#### **4.4.7. OPEN SPACE AND RECREATIONAL SYSTEMS**

Recreation is promoted by the MWMO through public involvement in land and water resource stewardship. Water-based recreation is an especially important part of the Minnesota lifestyle. The MWMO manages water quality to improve water-based recreation experiences and discourage water-based recreation that degrades water quality and surrounding habitat.

Multiple government entities and planning efforts have conducted open space, park, and recreational areas mapping including the following: City Local Surface Water Management Plans and Comprehensive Plans, the Minneapolis Park and Recreation Board and its Comprehensive Plan, the National Park Service, Hennepin County, the State of Minnesota, and the Minnesota Department of Transportation. To the extent that mapping is available in report-size scale and format, Figure 23 through Figure 38 identify the open space, park, and recreational areas in the MWMO.

City parks, National Recreation Areas, State and County bicycle trails, and City greenways are just a few of the many open space and recreational offerings in the MWMO. In general, parks and open space in the MWMO are either associated with the Mississippi River corridor or are designated parcels within residential neighborhoods that serve as community centers with sports fields and play equipment.

The extensive network of parks in this highly-urbanized watershed, specifically in Minneapolis, is the creation and activity of the Minneapolis Park and Recreation Board (MPRB). Established by an act of the Minnesota State Legislation and a vote of Minneapolis residents in 1883, it is an independently-elected, semi-autonomous body that governs, maintains, and develops the Minneapolis park system. While their visions and actions operate throughout the City, in 1999 they wrote down their vision with multiple stakeholders for the Mississippi River above Saint Anthony Falls in a report called *Above The Falls: A Master Plan for the Upper River in Minneapolis* (BRW et al., 1999). This plan was updated in 2013 (City of Minneapolis, 2013). The updated plan details a new implementation strategy to achieve the original vision for establishing a regional park along the Mississippi River and supporting compatible new development in the northern part of the City of Minneapolis. The plan incorporates the Minneapolis Park and Recreation Board's RiverFirst Vision for the development of parks and trails within the Above the Falls Regional Park (Tom Leader Studio et al., 2011).

Efforts were focused in North and Northeast Minneapolis for many reasons, including the increasing conflict between heavy industry and the adjacent neighborhoods striving to provide environmental quality that attracts new investment, and the fact that the Upper River is the best potential large-scale amenity awaiting development in the City of Minneapolis (and the MWMO). The Upper River Master Plan ultimately seeks to provide the following:

- 98.6 acres of new park
- 3.9 miles of bike and pedestrian trails
- 3.4 miles of restored riverbank
- 2 miles of parkway and boulevard
- Over 1,000 housing units in new riverfront neighborhoods
- Over 3,000 net additional jobs
- Over \$10 million in additional annual tax revenue

Since the original plan was written, most of the Phase I priorities have been completed:

- Upper River Development Corporation — The Minneapolis Riverfront Partnership was formed
- Grain Belt redevelopment
- Trails along both banks of the river between Plymouth Avenue and the Burlington Northern Bridge
- West River Road North extension to 26<sup>th</sup> Avenue North
- New investment in the North Washington Jobs Park

Recreational opportunities within the Watershed include activities like boating, fishing, hiking, and biking, among others. There are four public water access sites to the Mississippi River in the MWMO:

- Camden Boat Launch/Fishing Pier
- Boom Island Park
- Mississippi River Public Access, University of Minnesota
- Anoka County Riverfront Regional Park

There is an extensive network of bike trails through the Watershed, including the Mississippi River Regional Trail in Anoka County and the Grand Rounds Scenic Byway which nearly circumscribes the City of Minneapolis. Currently the Minneapolis Park and Recreation Board is working with stakeholders to complete the Grand Rounds. The study area includes that part of the MWMO east of the Mississippi River through which the final Central Rail Corridor is also planned.

Figure 21: Future Land Use of the MWMO

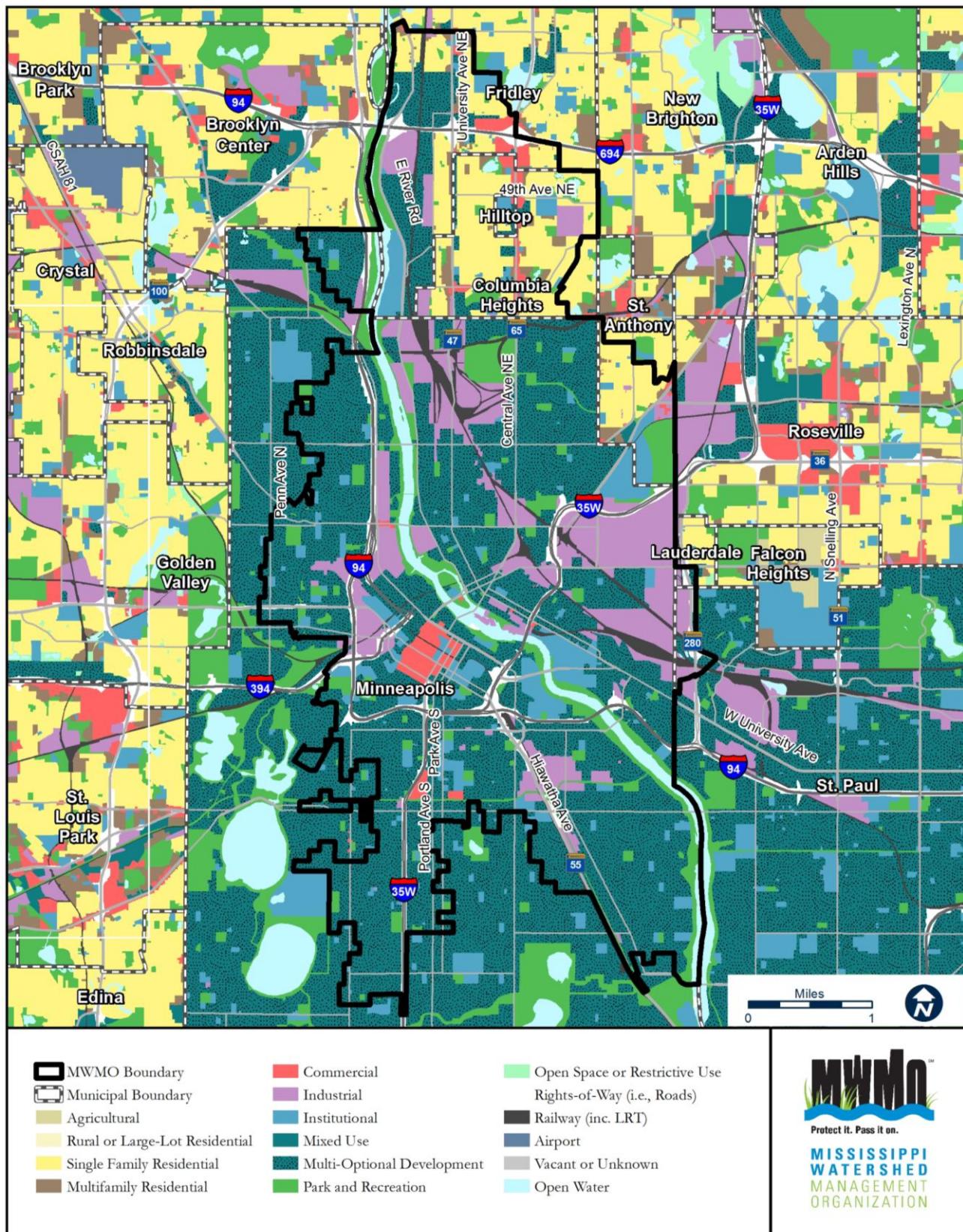


Figure 22: Surface and Ground Water Appropriations in the MWMO

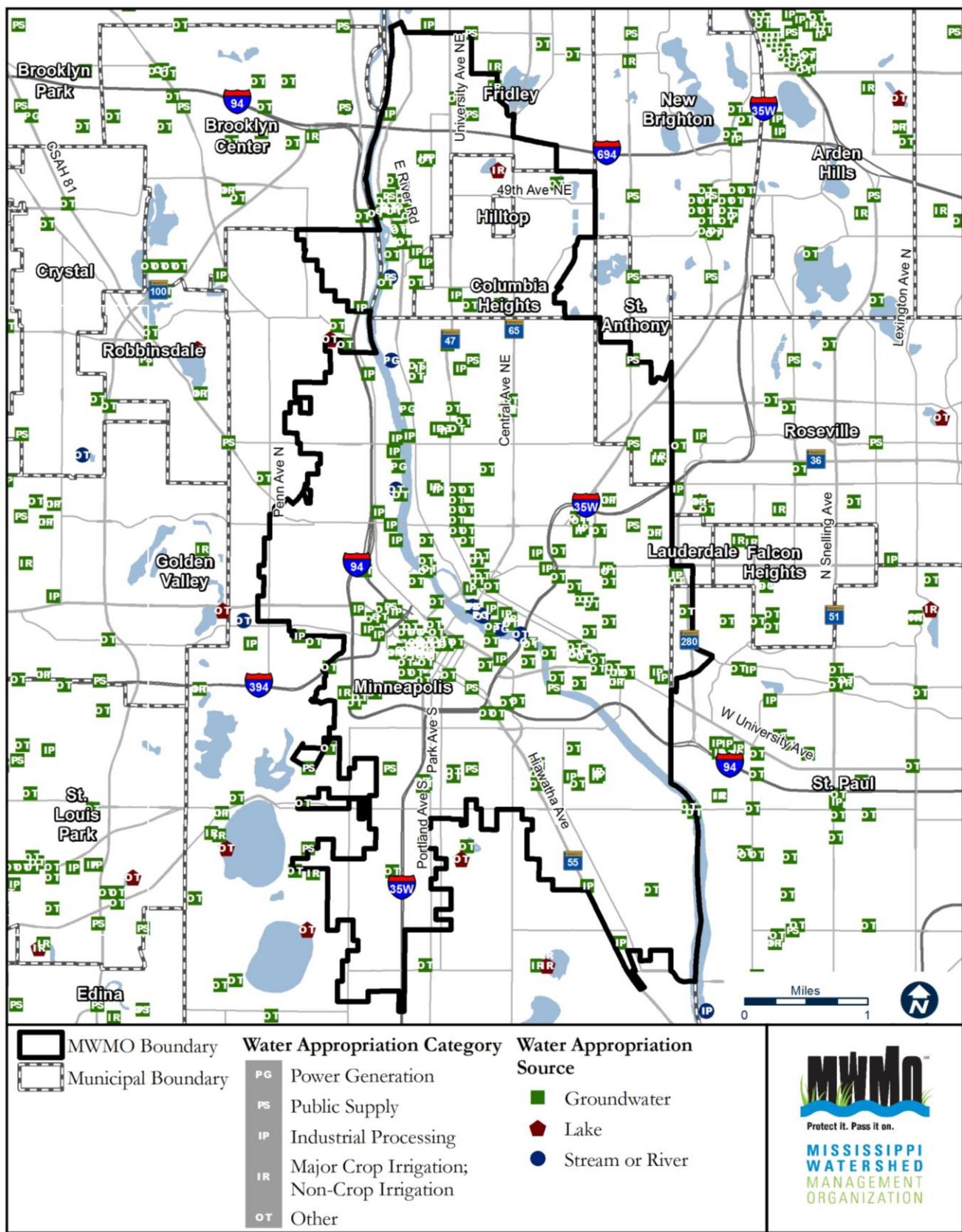


Figure 23: Parks and Open Space

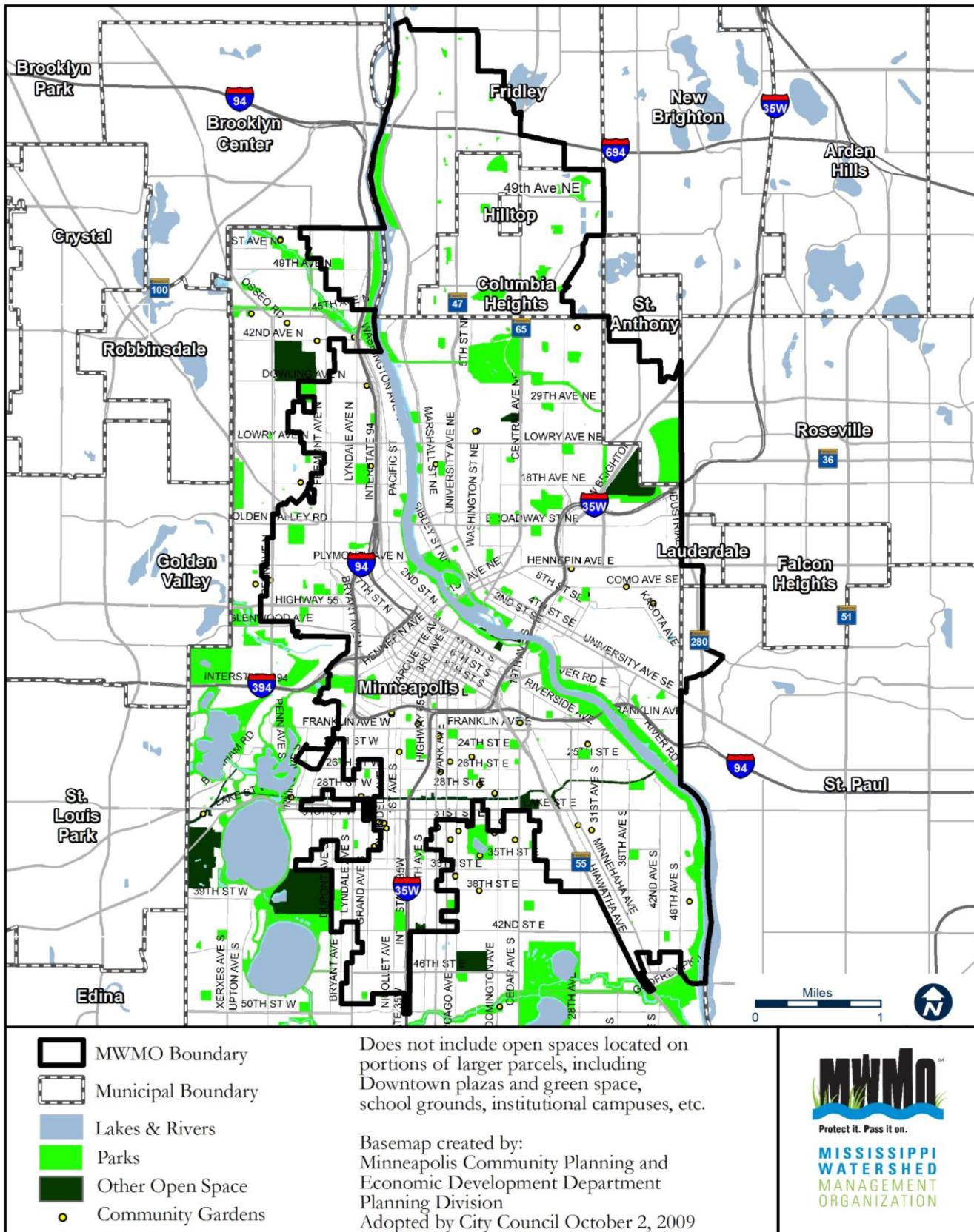
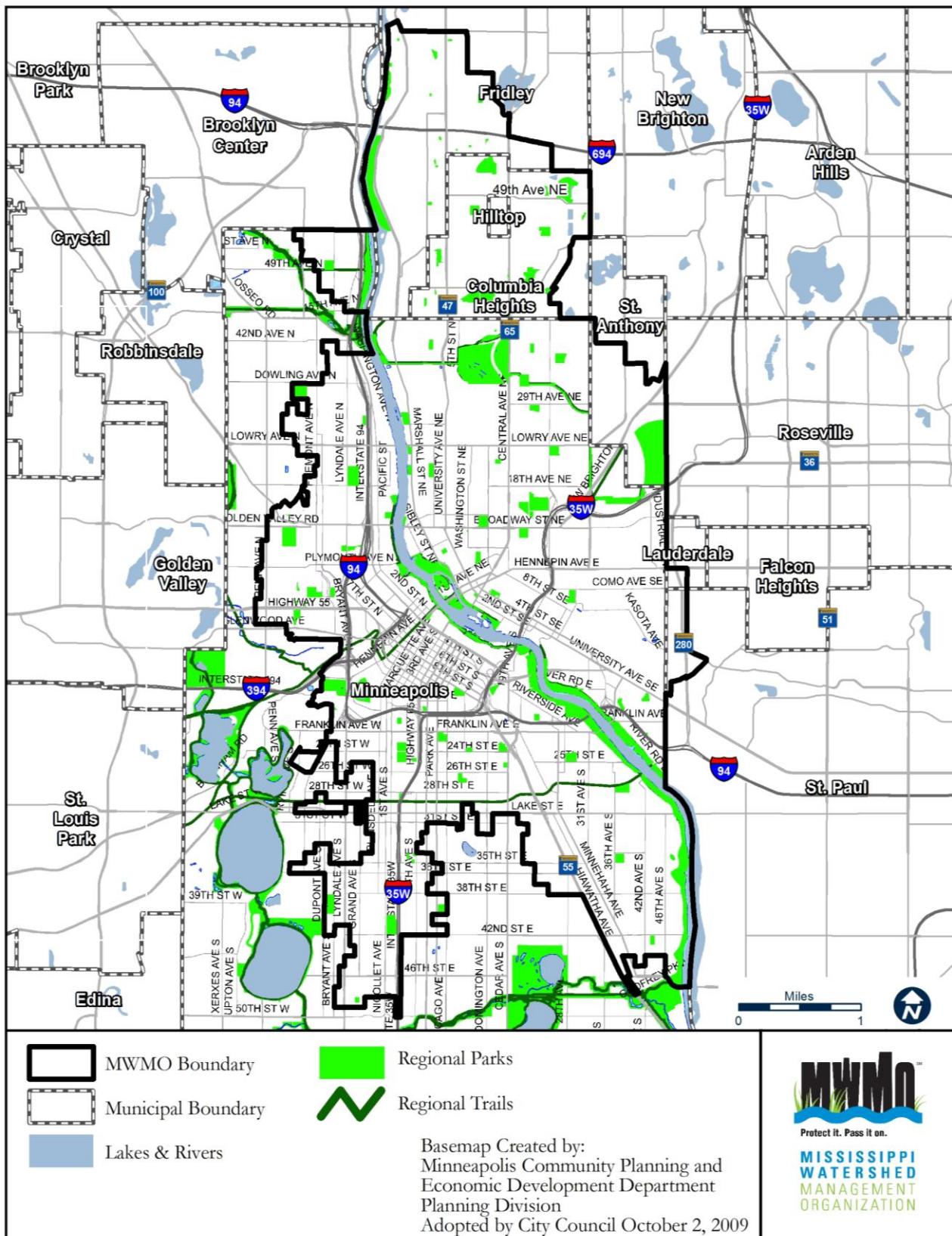


Figure 24: Regional Parks and Trails



**Figure 25: Existing Minneapolis Park System Map from Minneapolis Park and Recreation Board Comprehensive Plan (MPRB, 2007)**

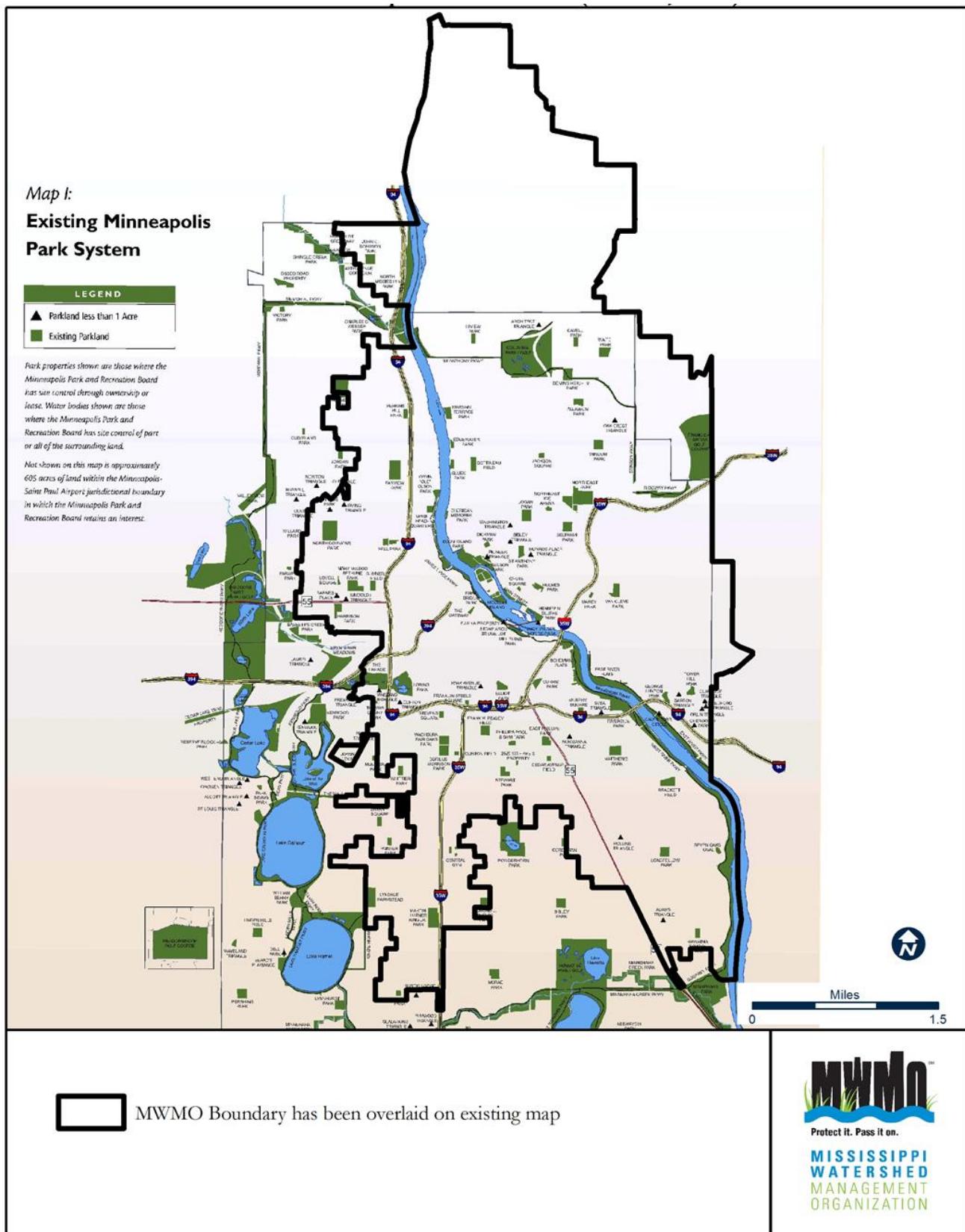


Figure 26: Minneapolis Trail System Map from Minneapolis Park and Recreation Board Comprehensive Plan (MPRB, 2007)

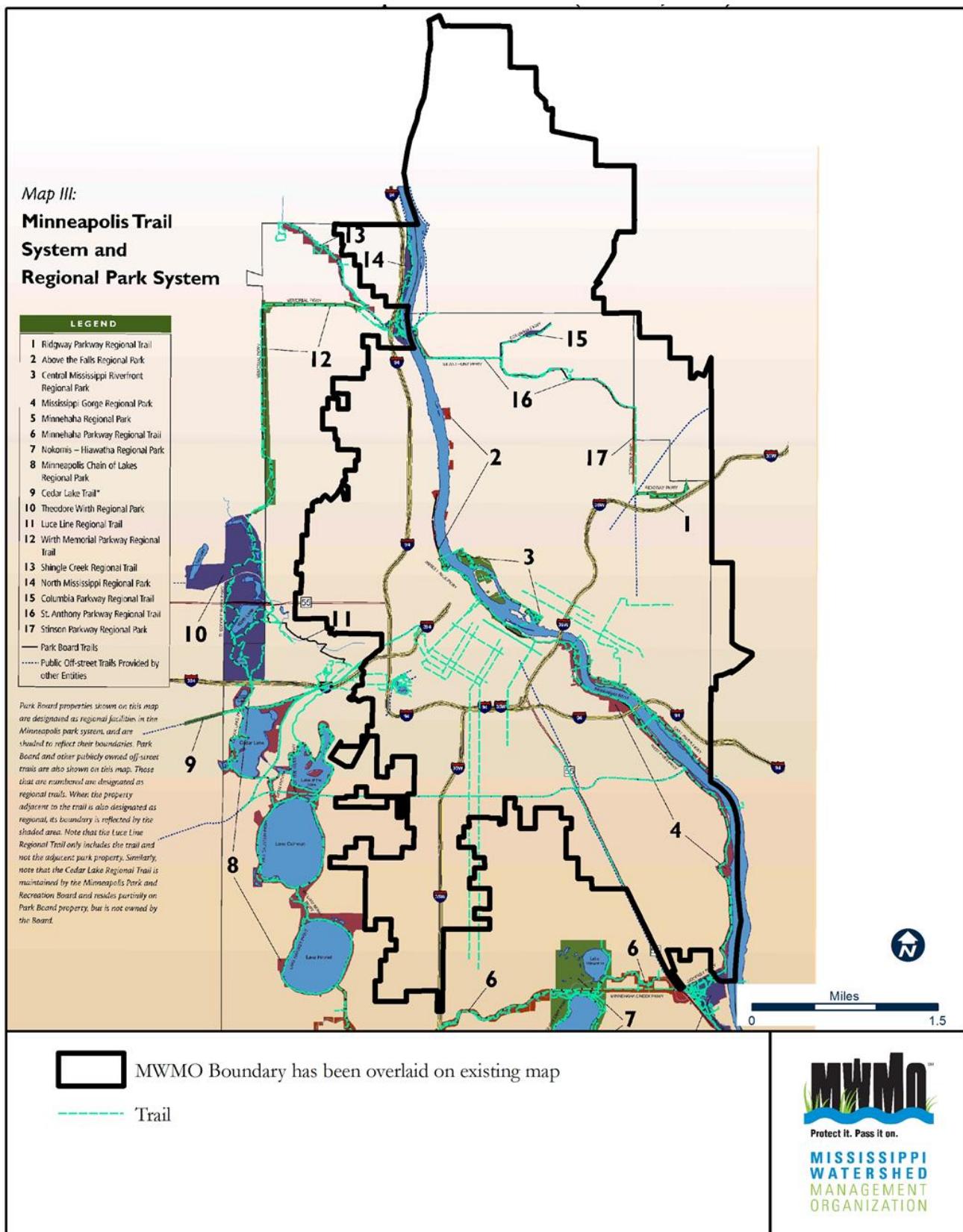


Figure 27: City of Minneapolis Existing Land Use Map from The Minneapolis Plan for Sustainable Growth (City of Minneapolis, 2009)

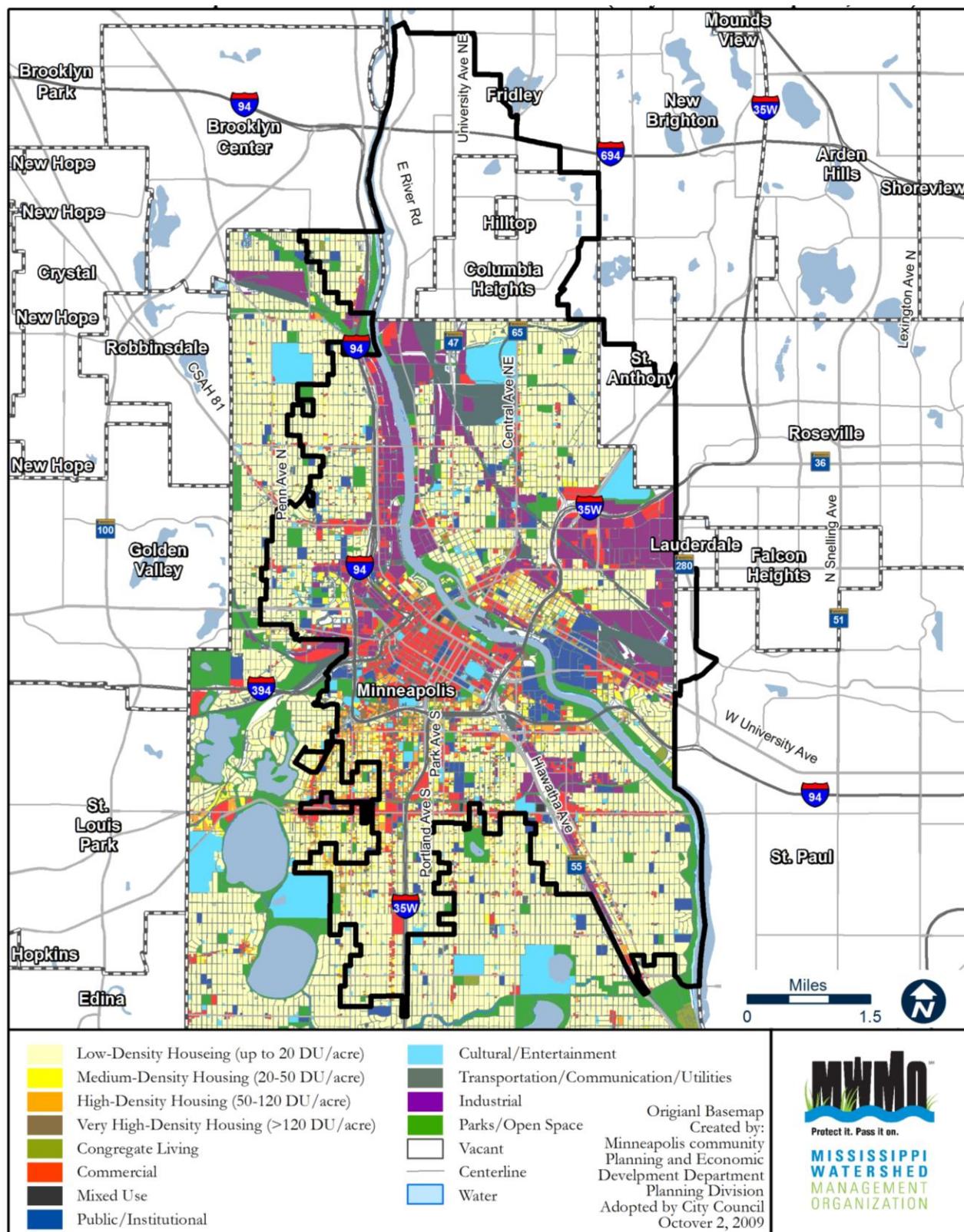
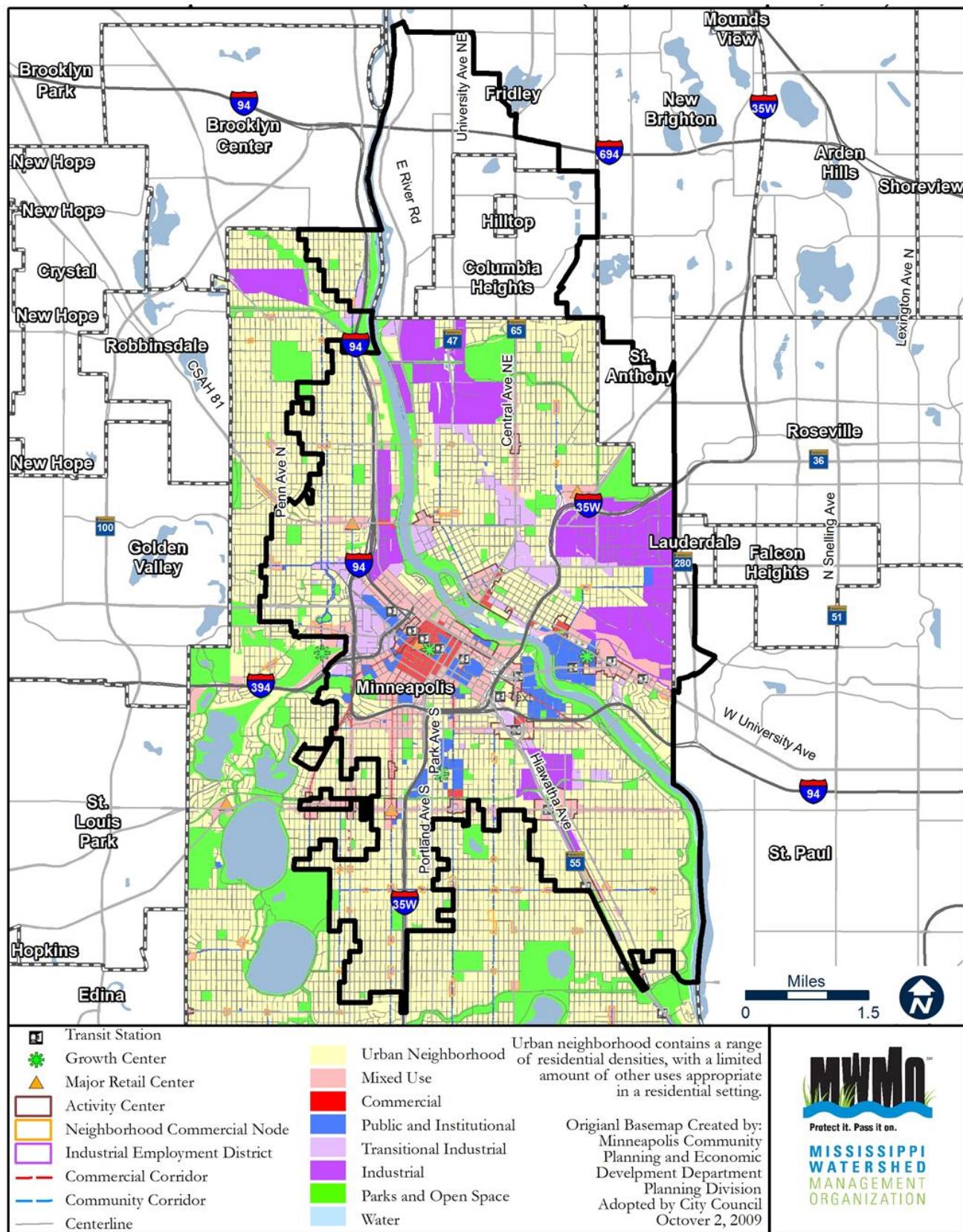


Figure 28: City of Minneapolis Future Land Use Map from The Minneapolis Plan for Sustainable Growth (City of Minneapolis, 2009)



**Figure 29: City of St. Anthony Village Existing Land Use Map from the City of St. Anthony Village Draft Local water plan (City of St. Anthony, 2008)**

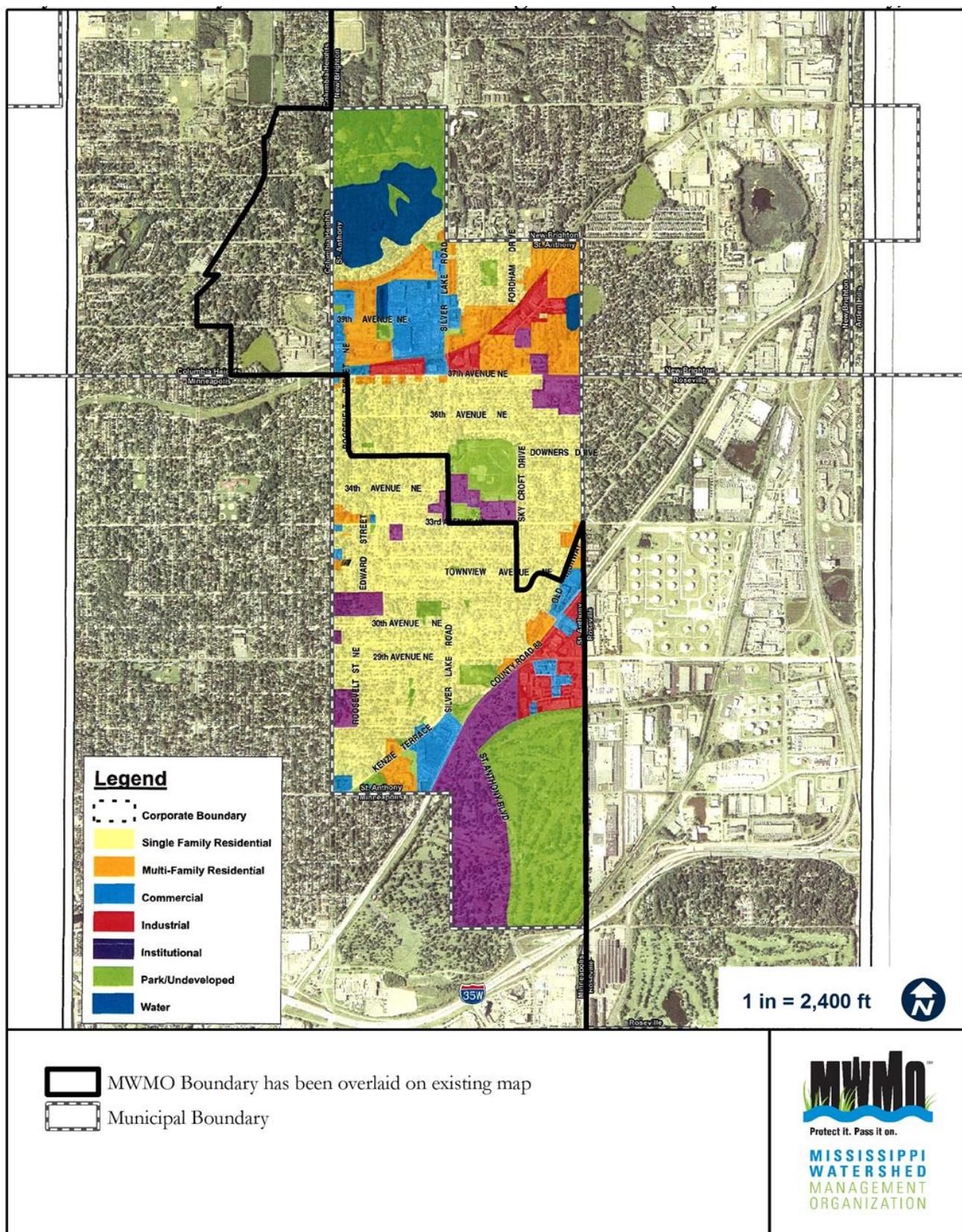


Figure 30: City of Lauderdale Existing Land Use Map from the City of Lauderdale Draft Comprehensive Plan (City of Lauderdale, 2008)

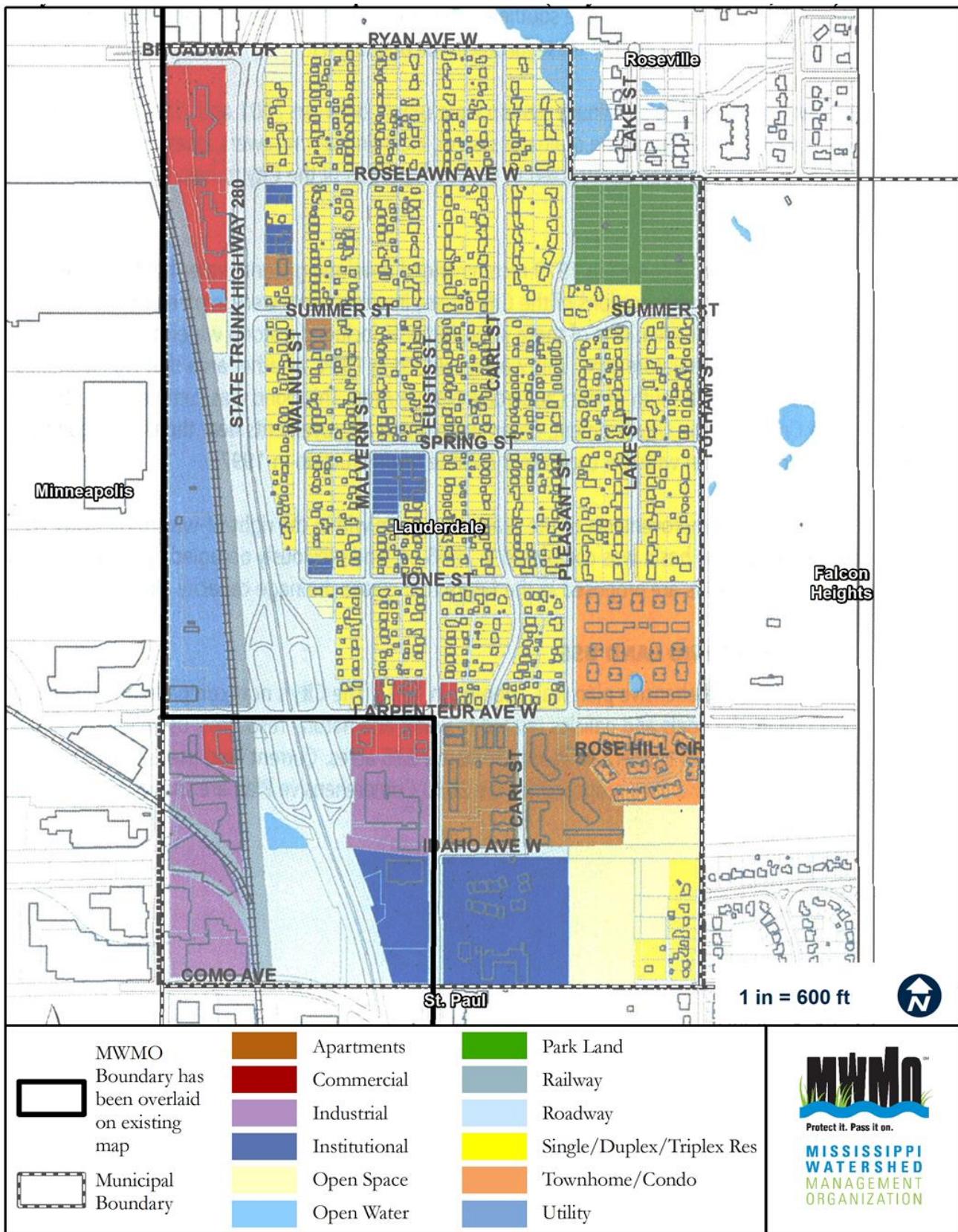


Figure 31: City of St. Paul Park System Map from the St. Paul Draft Comprehensive Plan (City of St. Paul, 2008)

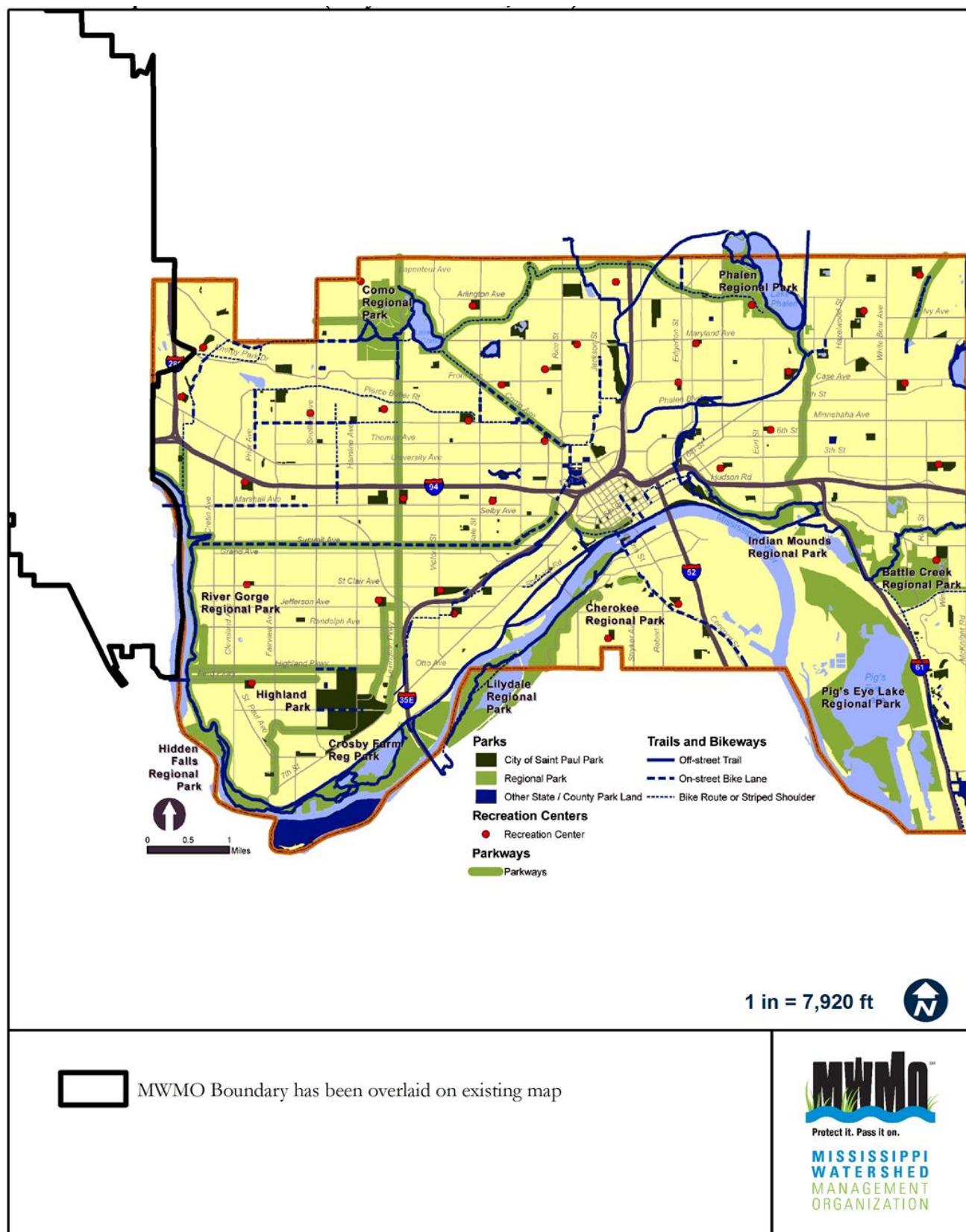


Figure 32: Columbia Heights 2008 Existing Land Use from 2030 Comprehensive Plan

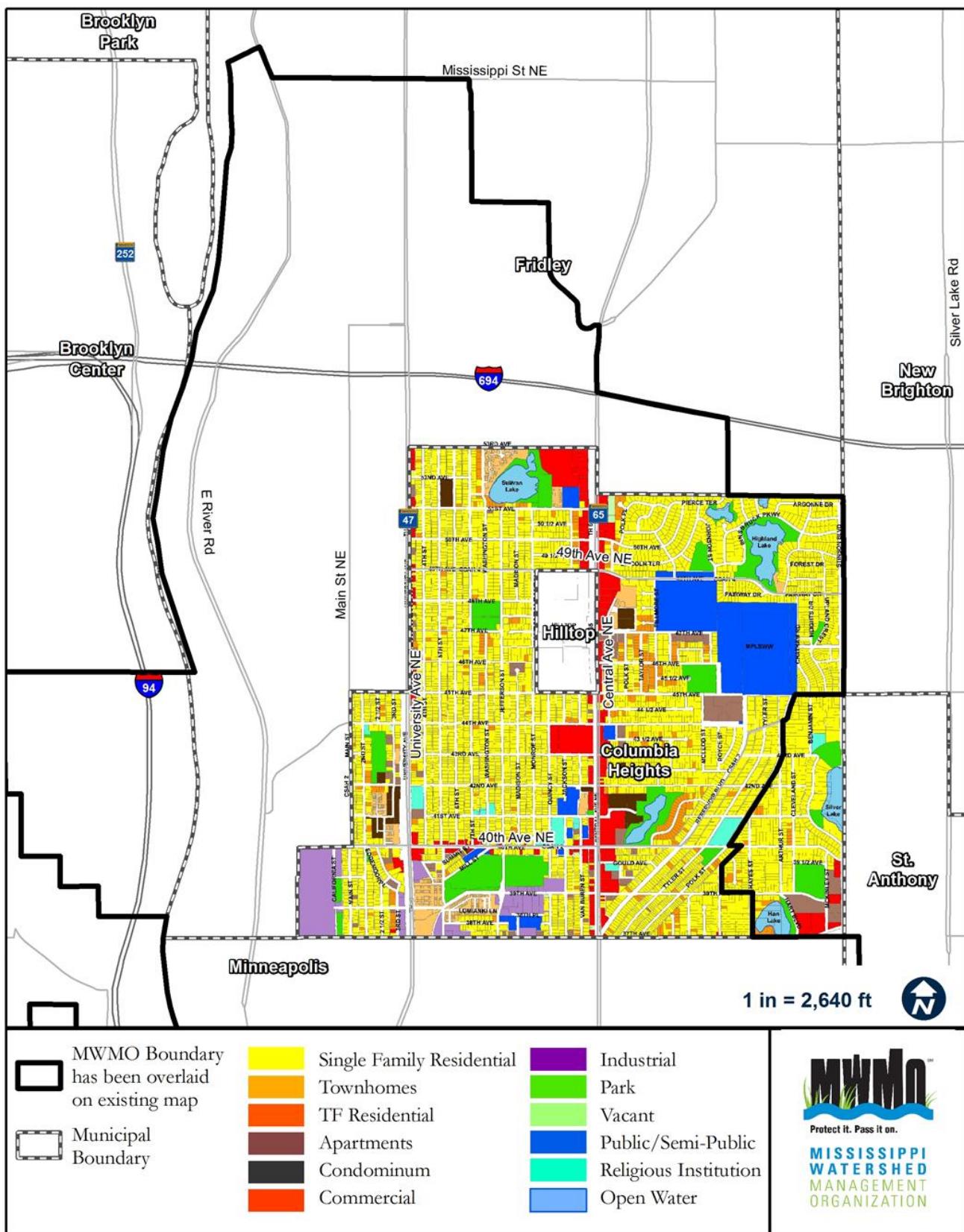


Figure 33: Columbia Heights Future Land Use from 2030 Comprehensive Plan

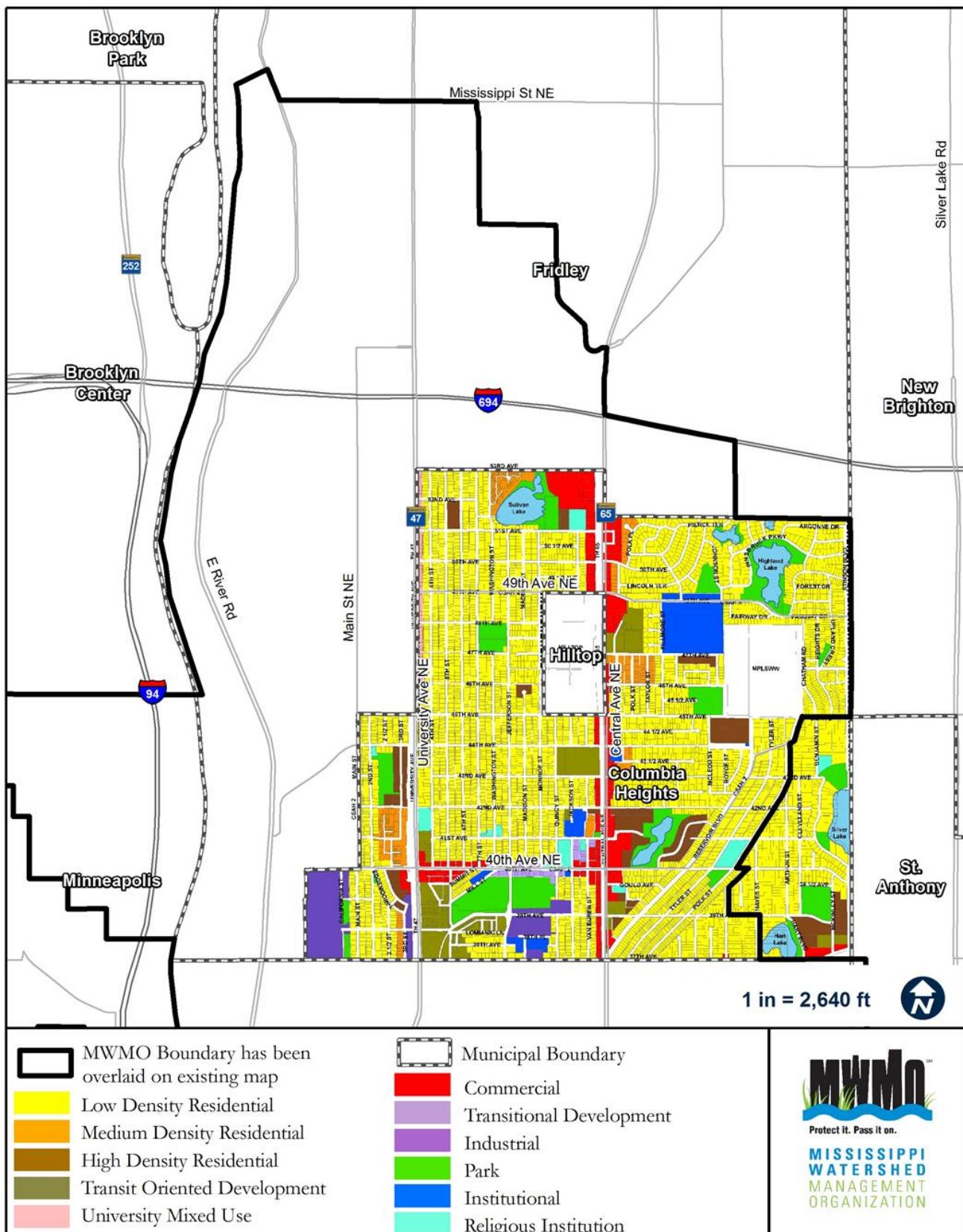


Figure 34: City of Fridley 2007 Existing Land Use from 2030 Comprehensive Plan

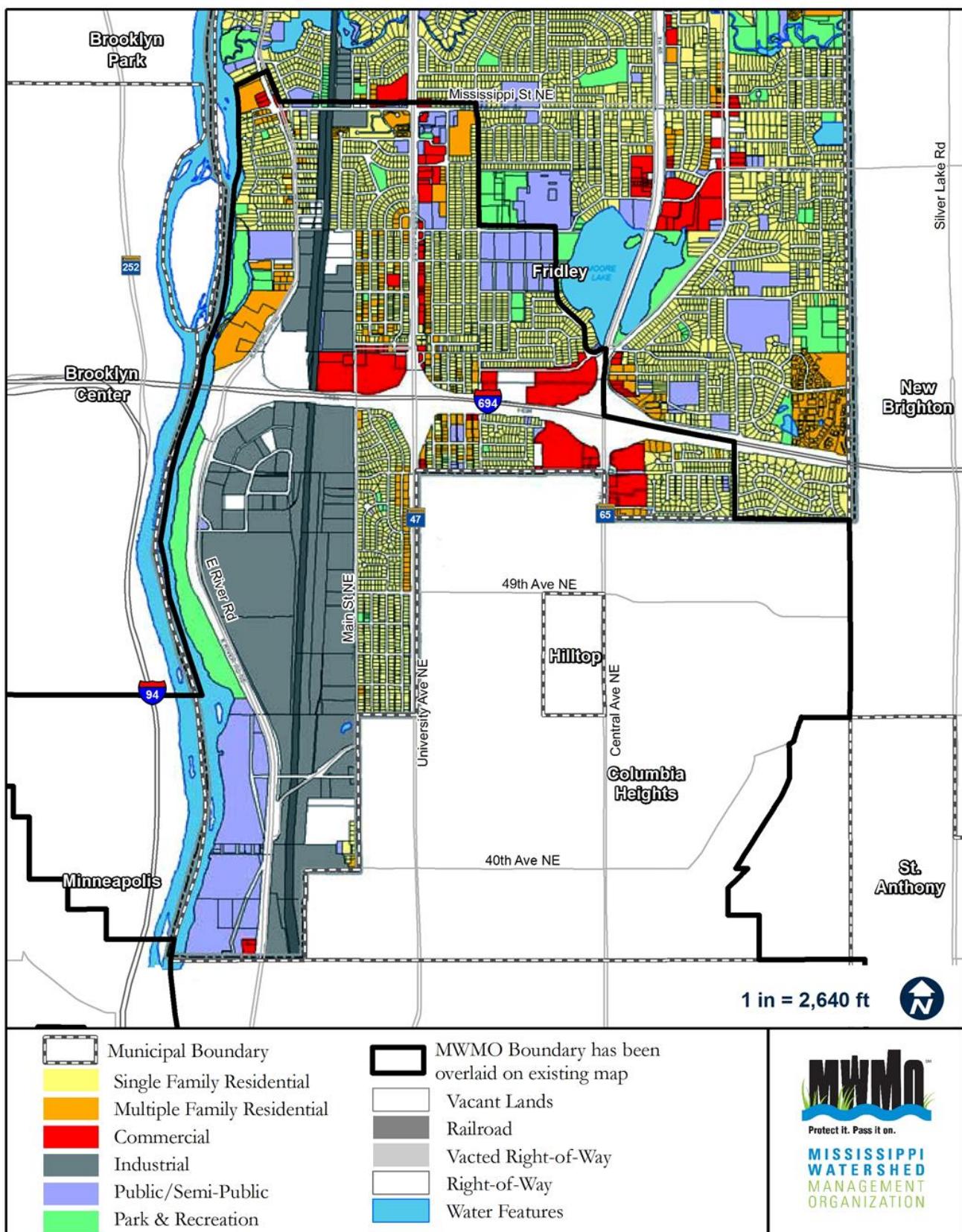


Figure 35: City of Fridley 2030 Future Land Use from 2030 Comprehensive Plan

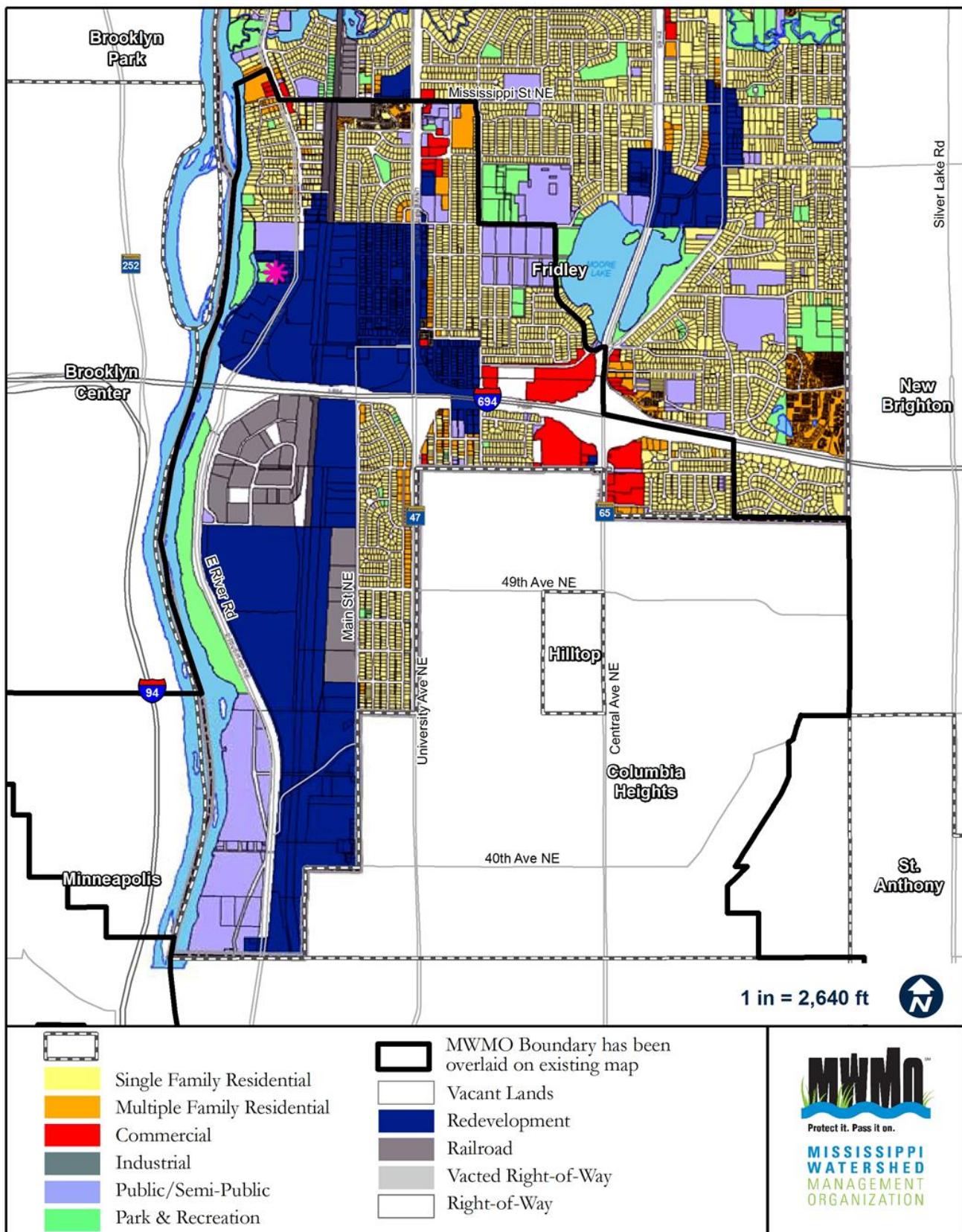


Figure 36: City of Hilltop Existing Land Use from 2030 Comprehensive Plan

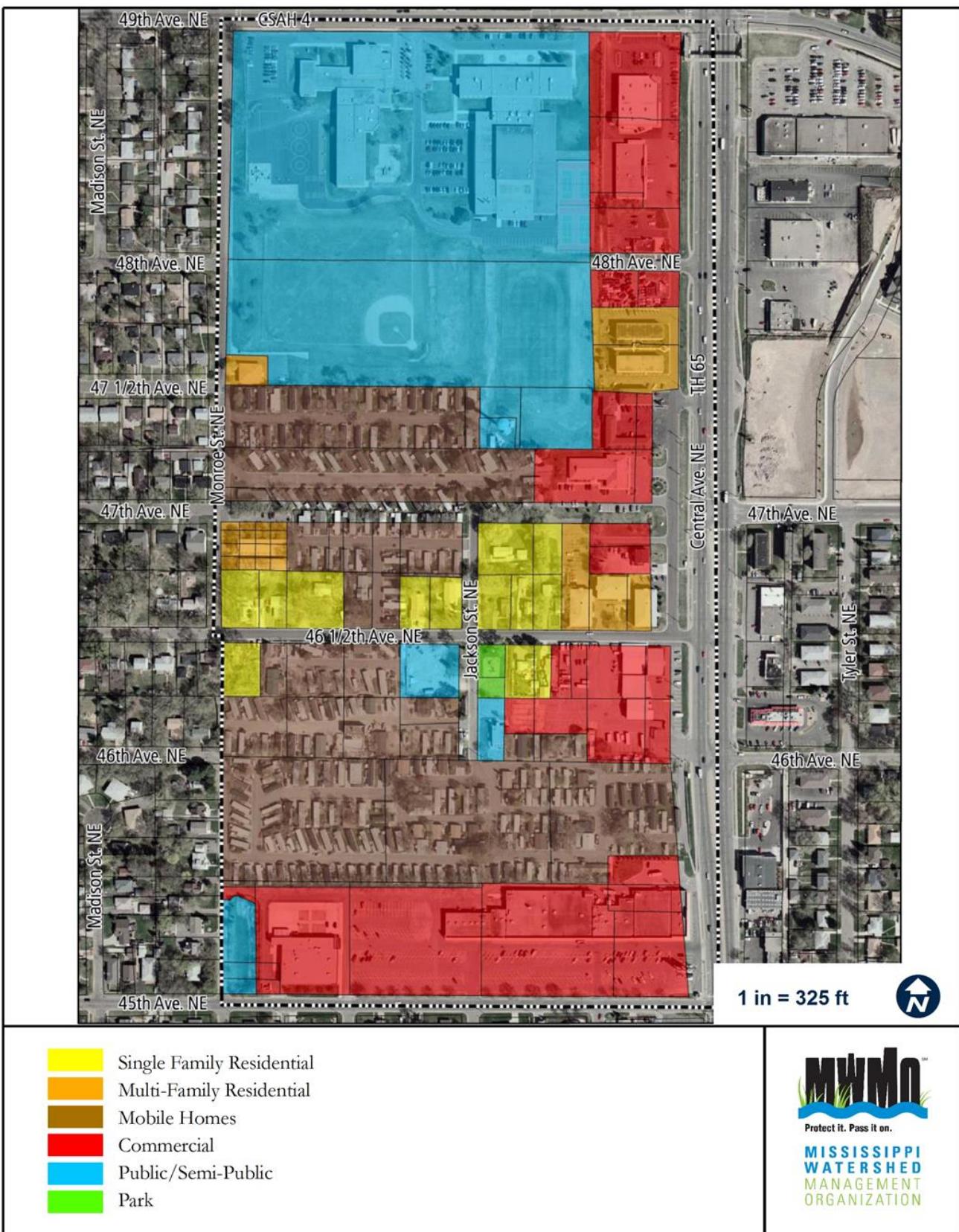


Figure 37: City of Hilltop 2030 Future Land Use from 2030 Comprehensive Plan

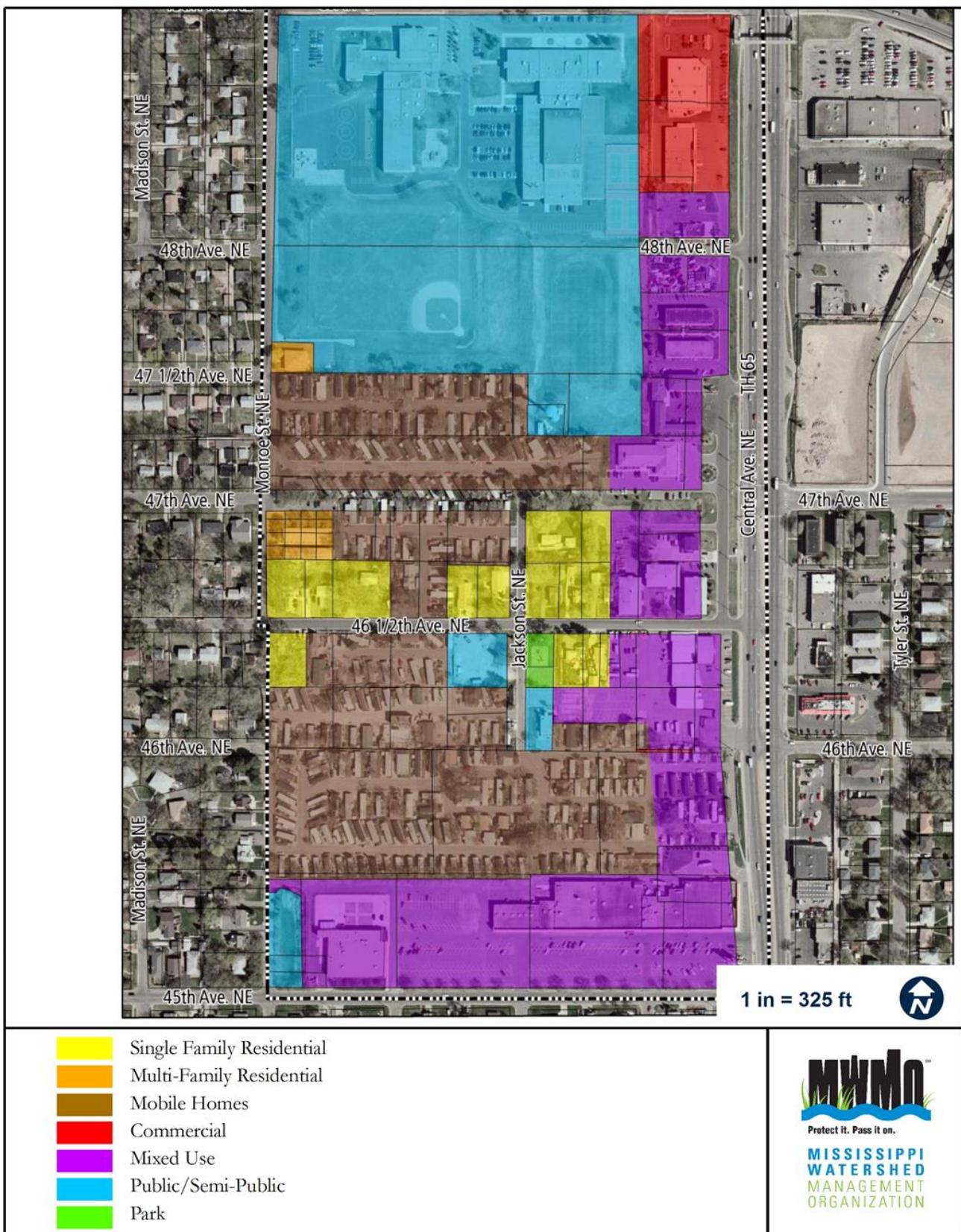
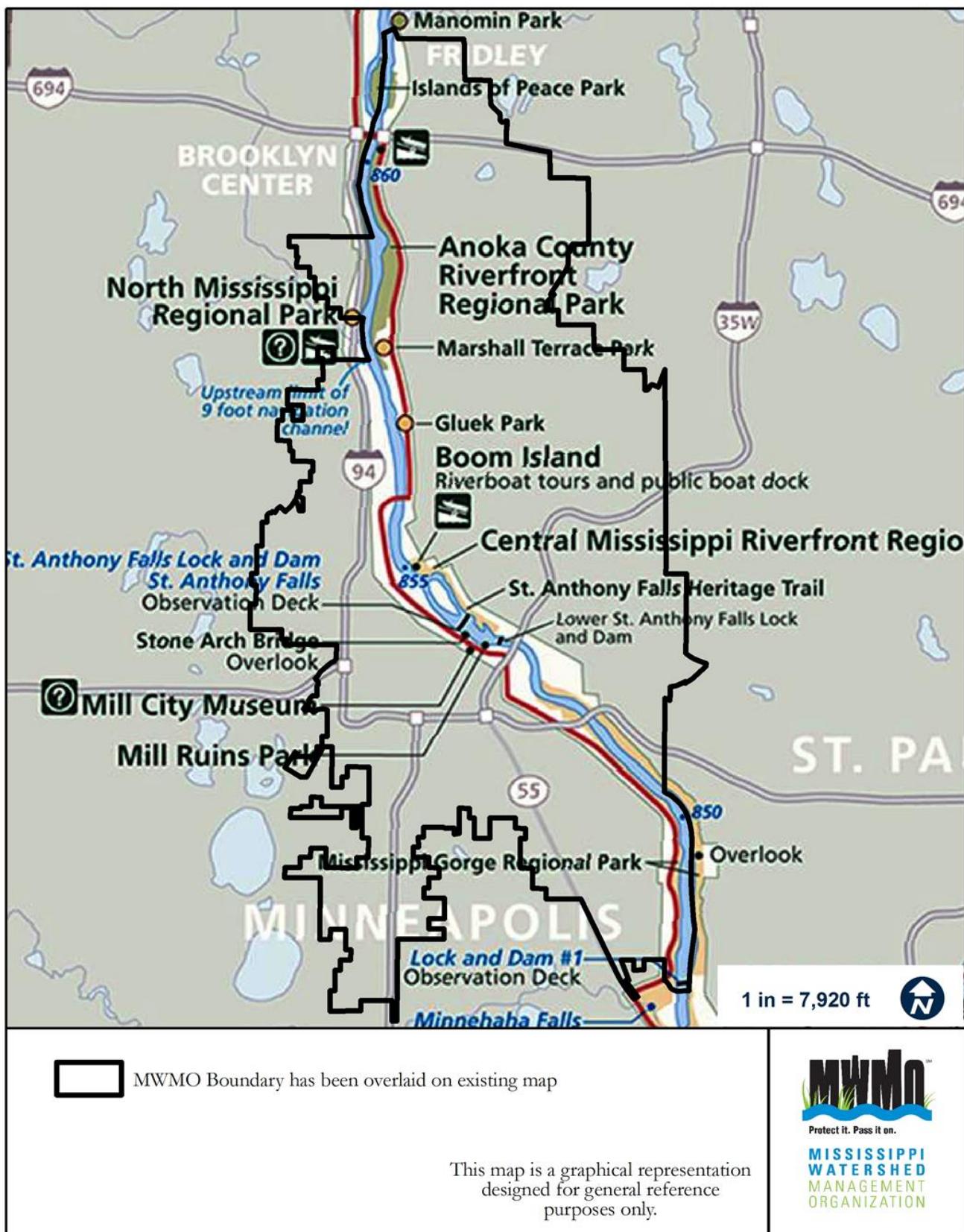


Figure 38: Mississippi National River and Recreation Map



#### **4.4.8. POTENTIAL ENVIRONMENTAL HAZARDS**

##### **PERMITTED POLLUTANT SOURCES**

###### **Municipal Separate Storm Sewer System (MS4) Stormwater**

MS4s are defined by the Minnesota Pollution Control Agency (MPCA) as conveyance systems owned or operated by an entity such as a state, city, town, county, district, or other public body having jurisdiction over disposal of stormwater or other wastes. A conveyance system includes ditches, roads, storm sewers, stormwater ponds, and so on. The goal of the MS4 Stormwater Program is to “reduce the amount of sediment and pollution that enters surface and groundwater from storm sewer systems to the maximum extent practicable.” The MS4 stormwater discharges are regulated by National Pollutant Discharge Elimination System/State Disposal System permits administered by the Minnesota Pollution Control Agency.

Phase I of the MS4 Stormwater Program identified Minneapolis and Saint Paul as large MS4s, and each city has an individual National Pollutant Discharge Elimination System/State Disposal System permit. Under Phase II of the program, MS4s outside of urbanized areas with populations greater than 10,000 (or greater than 5,000 if they are located within 0.5 mile of an outstanding value resource or impaired water) were classified as small designated MS4s. MS4s within urbanized areas and with a population of at least 50,000 and a density of 1,000 people per square mile are classified as small mandatory MS4s. As a requirement of the permit, MS4s must develop a Stormwater Pollution Prevention Plan which outlines a plan to reduce pollutant discharge, protect water quality, and satisfy water quality requirements in the Clean Water Act. A report is submitted each year by the municipality documenting the implementation of the Stormwater Pollution Prevention Plan.

Within the MWMO, there are a number of Member Organizations and road authorities that are mandatory and designated MS4s, as well as Saint Paul and Minneapolis, Phase 1 Large MS4s (Table 13).

**Table 13: Municipal Separate Stormwater Sewer Systems within MWMO**

<b>Permit Holder</b>	<b>Type of MS4</b>	<b>Preferred ID</b>
Saint Anthony Village	Mandatory Phase II	MS400051
Lauderdale	Mandatory Phase II	MS400026
Columbia Heights	Mandatory Phase II	MS400010
Hilltop	Mandatory Phase II	MS400023
Fridley	Mandatory Phase II	MS400019
Minnesota Department of Transportation	Mandatory Phase II	MS400170
Ramsey County Public Works	Mandatory Phase II	MS400191
Anoka County	Mandatory Phase II	MW400066
Hennepin County	Mandatory Phase II	MS400138
Minneapolis	Phase I Large MS4	MN0061018
Saint Paul	Phase I Large MS4	MS400054
Minneapolis Community and Technical College	Mandatory Phase II	MS400207
University of Minnesota – Twin Cities	Mandatory Phase II	MS400212

### **Construction Stormwater**

Construction sites can contribute substantial amounts of sediment to stormwater runoff. The National Pollutant Discharge Elimination System/State Disposal System Construction Stormwater Permit administered by the Minnesota Pollution Control Agency requires that all construction activity disturbing areas equal to or greater than one acre of land must obtain a permit and create a Stormwater Pollution Prevention Plan that outlines how runoff pollution from the construction site will be minimized during and after construction. Construction stormwater permits cover construction sites throughout the duration of the construction activities through final stabilization of the site. The Minnesota Pollution Control Agency Data Desk can be contacted to obtain an updated list with location information on all permitted construction sites in the MWMO.

### **Industrial Stormwater**

The National Pollutant Discharge Elimination System/State Disposal System Industrial Stormwater Multi-Sector General Permit applies to 29 sectors of industrial activity each having the risk of exposing significant materials to stormwater. Significant materials include any material handled, used, processed, or generated that contains pollutants to surface or groundwater resources. Facilities that can demonstrate that no significant materials are exposed to stormwater can apply for the No Exposure exclusion instead of the permit. Permit requirements entail development and implementation of a Stormwater Pollution Prevention Plan (SWPPP), quarterly monitoring of site stormwater runoff, and updates or revisions to the SWPPP if monitored constituent concentrations do not meet sector-specific benchmarks established in the permit. The SWPPP entails a description of both structural and non-structural stormwater management practices implemented to prevent contact of stormwater with significant materials. The Minnesota Pollution Control Agency re-issued an Industrial Stormwater Multi-Sector General Permit in April 2010, as an update to the former, expired permit. Figure 39 shows the approximate locations of the permitted industrial stormwater sites within the MWMO. The industrial stormwater discharge sites in particular are often associated with a zip code rather than an exact location.

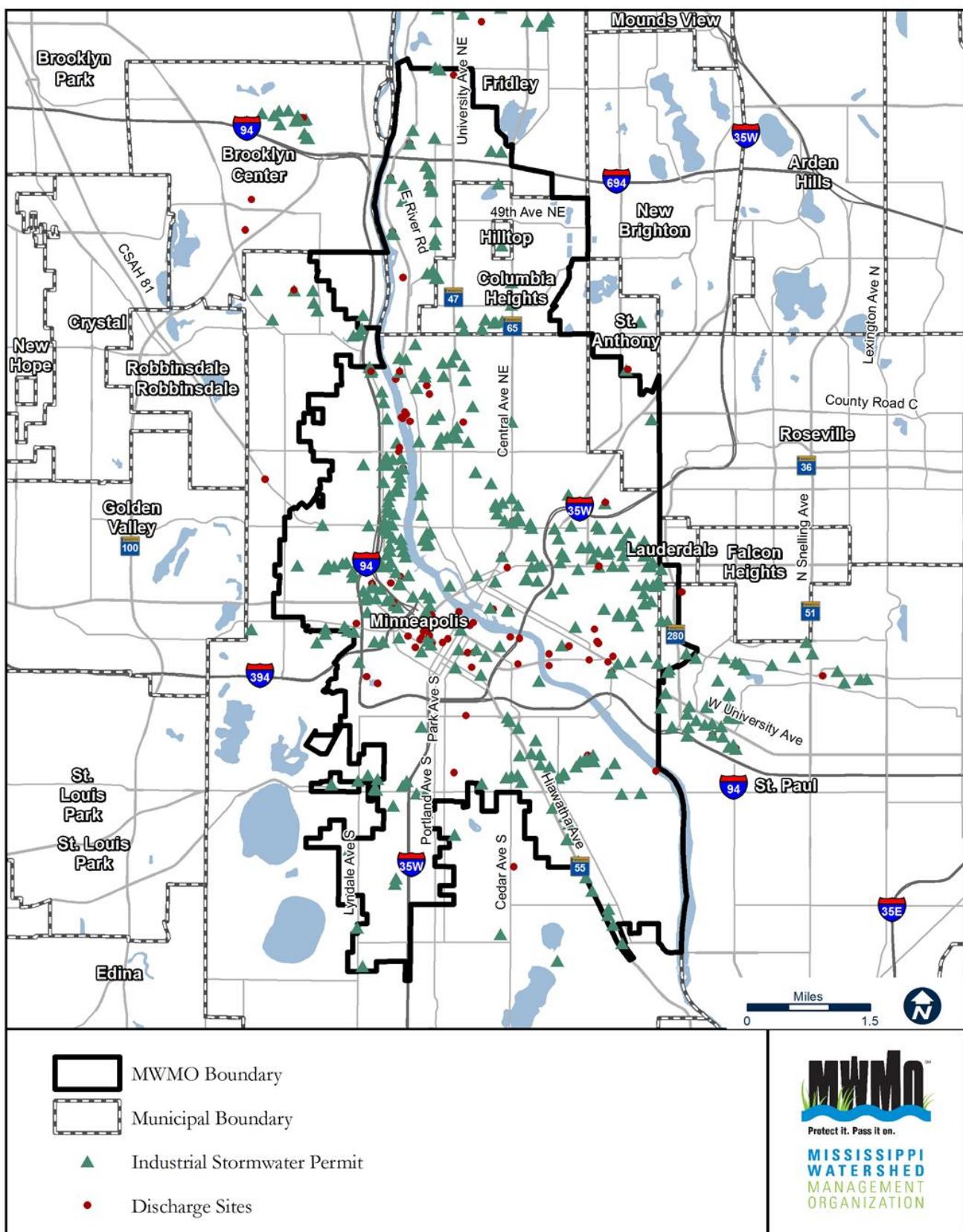
### **Feedlots**

There are no feedlot operations within the boundary of the MWMO.

### **Municipal and Industrial Wastewater**

A number of facilities within the MWMO are permitted by the Minnesota Pollution Control Agency to discharge water, such as wastewater treatment plants, commercial sites with noncontact cooling water discharge, and manufacturing facilities. For any discharge to a surface water, ground surface or subsurface, a National Pollutant Discharge Elimination System and/or a State Disposal System permit is required and administered by the Minnesota Pollution Control Agency. Figure 39 shows the approximate locations of permitted discharge sites within the MWMO.

Figure 39: Permitted Discharge and Industrial Stormwater Sites within MWMO



## POTENTIALLY CONTAMINATED SITES

Sites identified by the Minnesota Pollution Control Agency as potentially contaminated within the Watershed are shown on Figure 40. The Minnesota Pollution Control Agency has maintained a database of potentially contaminated properties since the early 1980s. The database includes properties that have already been investigated and cleaned up, properties currently enrolled in Minnesota Pollution Control Agency cleanup programs, and properties that were suspected to be contaminated but after investigation turned out to be clean. The types of potentially contaminated sites included in the database are operating and abandoned landfills, dumps, and solid waste sites, among others. Discharges at these sites may contain harmful substances that have the potential to contaminate both groundwater and surface water.

### **Leaking Above- and Below-Ground Storage Tanks**

The Minnesota Pollution Control Agency investigates and cleans up releases from petroleum tanks. Approximately 660 releases from leaking above- and below-ground storage tanks have been reported in the Watershed; their locations are shown in Figure 41.

### **Wells**

Wells from the County Well Index are shown in Figure 41. The County Well Index includes information on the location and characteristics of water wells installed in the State of Minnesota since 1974. Wells can serve as a connection between different aquifers and can serve as a pathway for groundwater contamination. Some of the wells included in the index may have been properly sealed when abandoned, but those still in use and those abandoned but not properly sealed may provide a pathway for contamination to spread between aquifers.

#### **4.4.9. DISCUSSION OF CHALLENGES, GAPS, AND NEXT STEPS**

While the MWMO provides similar services to the public as other Watersheds in Minnesota, the complex human and built environment it operates within presents unique resource management challenges. A fully built-out and urbanized area like the MWMO has a long history of population growth, redevelopment of land, changing land use patterns, and water use patterns.

Population growth resulted in a large mix of cultures and languages spoken in the MWMO. Education and knowledge transfer is most effective when it occurs within the framework of individuals' language and culture. This extensive spectrum of ethnic groups present in the Watershed means the MWMO will need to continue to develop communication networks, tools, and messaging that go beyond an English-speaking audience. With a forecasted increase in population, the MWMO will need to focus its limited education resources on key messengers and groups that have broader networks and the ability to affect change. As such, the MWMO should continue to educate and connect water resource issues to the daily activities of students, professionals, policy makers, and community leaders in the MWMO.

With more people, more land uses need to be layered on what once was a single use parcel of land. For example, a historically forested parcel may now serve multiple functions as a corridor for water treatment, buried and overhead utilities, street or rail transportation, and pedestrian pathways. In order to inform multifunctional corridor planning and management efforts, the MWMO should continue to compile and assess shared land use opportunities in all open space, park, and recreational areas maps.

Over time, as growth and redevelopment occurs, patterns of land use and water use also shift around on the landscape and waters of the MWMO. Redevelopment of individual building sites as well as transportation corridors (streets, highways, railways, and waterways) are opportunities to incorporate new water management systems into the current built-out landscape. The need to align projects with the pace of infrastructure redevelopment places some of the MWMO's goals on a twenty-five, fifty- or hundred-year timeline depending on the infrastructure being replaced. The MWMO should continue to plan for incorporating new water management systems to the Watershed as a part of ongoing redevelopment activities.

As stated prior, Minnesota Department of Natural Resources Division of Waters regulates surface and groundwater appropriations based on daily and yearly withdrawal volumes. This management affects water supply for domestic, agricultural, fish and wildlife, recreational, power, navigation, and quality control purposes. A permit through the Water Appropriation Permit Program is required for all users withdrawing more than 10,000 gallons per day or 1 million gallons per year for consumptive or nonconsumptive use. Under Minnesota Statute 103B.211, subdivision 4. Appropriations from small watercourses, states that: appropriations that draw less than 10,000 gallons per day or 1 million gallons per year are prohibited unless a permitted by the MWMO. In addition, member cities are required to enforce subdivision 4 when an appropriation occurs within their jurisdiction. To date the MWMO has not established a permitting program nor are they aware of any member city permitting or enforcement programs related to MS 103B.211, subdivision 4. To maximize efficiencies in government the MWMO should request that member cities add the development and enforcement of this permitting requirement to their current regulatory duties. In addition, the MWMO should work with the member cities to determine and approve an appropriate permit fee to be paid to the cities.

As built today, cities and industries in the Watershed rely on the surface and groundwater resources to provide a water supply for many different functions such as drinking water, irrigation, and industrial cooling water. With a primary function of surface water being the assimilation of waste streams such as stormwater runoff from streets, effluent from wastewater treatment plants, and industrial discharges. Use of the river as a final stage of treatment is straining its ecosystem, i.e. endocrine disruptors and their effect on fish populations downstream of wastewater treatment plants. The river has a finite capacity to serve in this function until its ecosystem is damaged and our society loses the basic benefits of: swimming, fishing, waterfowl, migratory riparian birds, prime adjacent real estate, and parks that a clean river ecosystem has to offer. This strain on the river can be eased if there is development of new technologies and systems that utilize today's pollutant waste streams as inputs into tomorrow's new products and services.

Wellhead and source water protection zones assure surface and groundwater quality and available volume is maintained for cities and industries in the Watershed. Permitted industrial and wastewater treatment plant discharges attempt to manage the downstream impacts on ground and surface water resources. This system works well with a first generation of development. However, in long standing urban areas natural hydrologic conditions have been altered, land use has changed, and redevelopment has occurred many times over. As a result, the likelihood of a site having water-soluble contaminated soils or groundwater contamination from one of these historic changes is high. Thus, it is critical that the MWMO evaluates historic and present day groundwater hydrology and contamination whenever it installs stormwater management practices or systems. In addition, the MWMO should stay abreast of emerging water quality, rate, and volume issues affecting the Mississippi River and in turn source water protection and waste stream discharge activities.

Figure 40: Known and Potential Sources of Soil and Groundwater Contamination in the MWMO

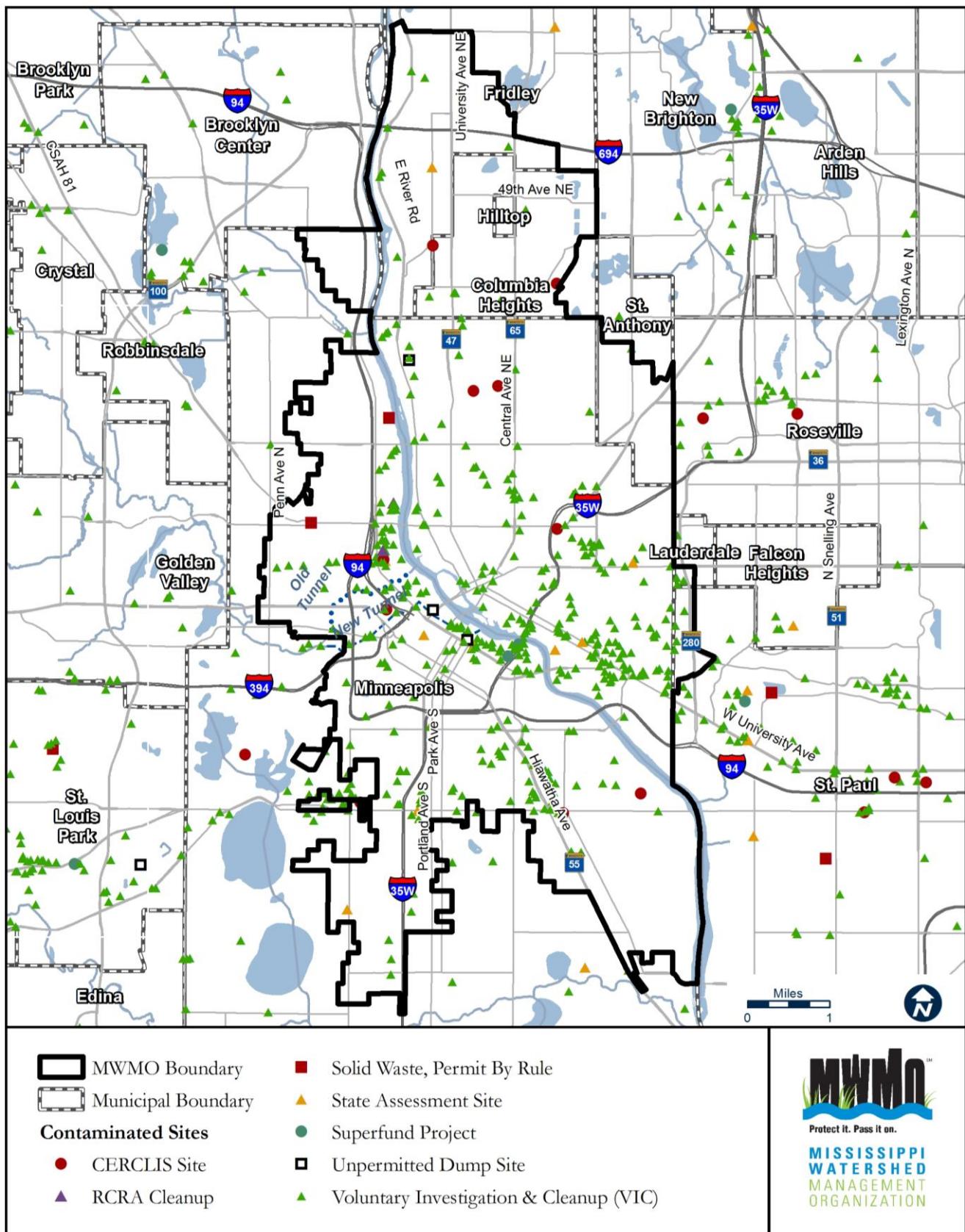
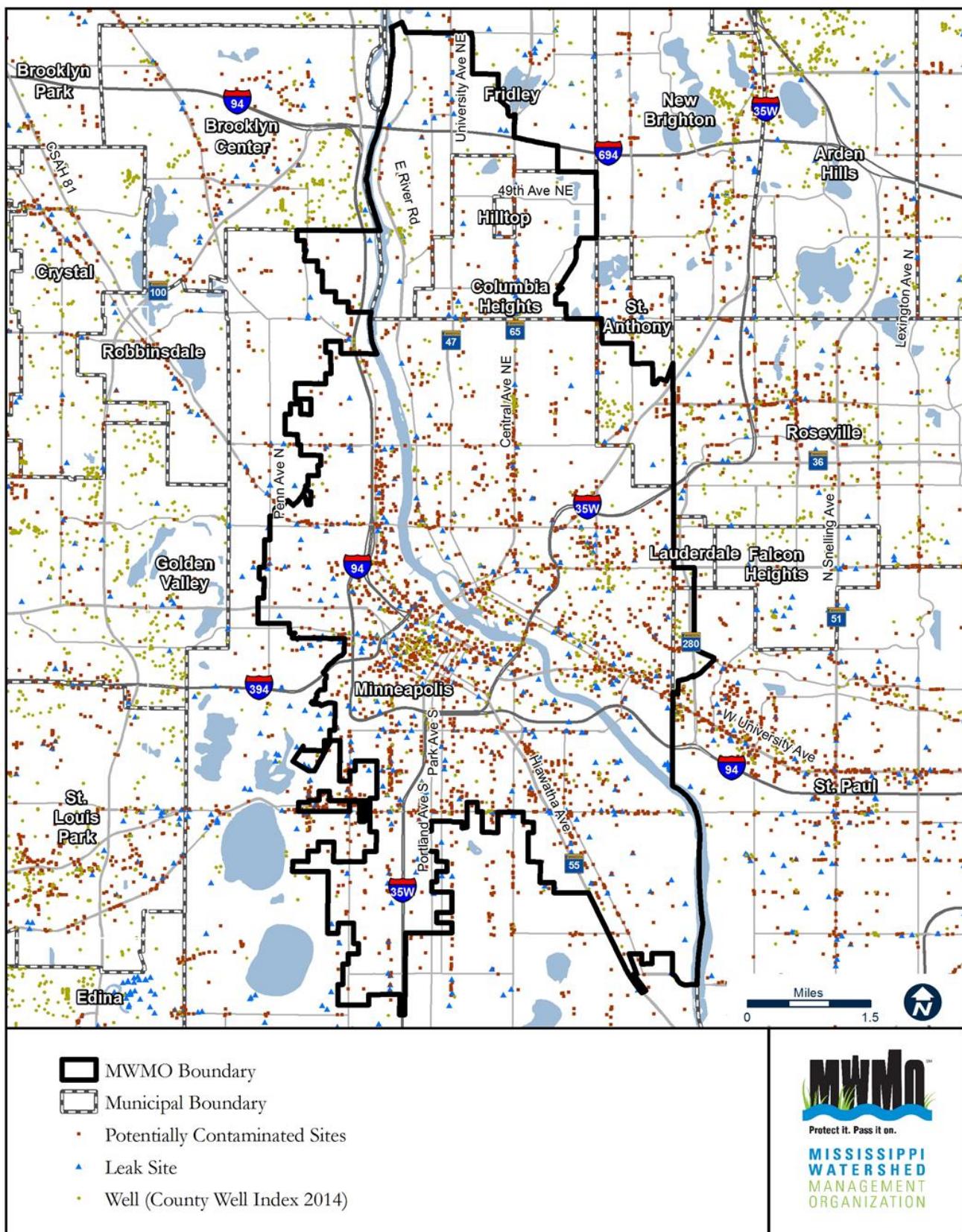


Figure 41: Environmental Hazards in the MWMO



## 4.5. Hydrologic System

### 4.5.1. CLIMATE AND PRECIPITATION

Rainfall duration, intensity, and distribution are all factors that affect the MWMO's water quality with respect to erosion sedimentation loads, pollutant runoff, and groundwater recharge. Knowledge of their effects on the Watershed help watershed managers determine hydrologic designs to mitigate water quality and quantity problems.

The climate within the MWMO is similar to the overall Seven County Metropolitan Area. The seven county metropolitan area exhibits the typical characteristics of continental climates. Areas with continental climates have winters with at least one month below 32° F and at least three months of temperatures above 50° F. Regions with continental climates are characterized by winter temperatures cold enough to support snow cover from late fall to early spring, and relatively moderate precipitation that occurs mostly in the summer months.

Monthly averages for precipitation, snowfall, and temperature for the period 1971-2000 are presented in Table 14. Data was collected by the National Weather Service Cooperative at the Minneapolis-St. Paul International Airport (Station 215435). The average annual temperature is 46.0 degrees F. Average annual precipitation is 29.41 inches, including approximately 53.7 inches of snowfall.

**Table 14: Monthly Climate Averages for the Period 1971-2000**

Mean Monthly Precipitation, 1971 - 2000													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Precipitation (inches)	1.04	0.79	1.86	2.31	3.24	4.34	4.04	4.05	2.69	2.11	1.94	1.00	<b>29.41</b>
Mean Monthly Snowfall, 1971 - 2000													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Snowfall (inches)	12.4	8.0	10.4	3.1	0.1	0.0	0.0	0.0	0.0	0.6	9.8	9.3	<b>53.7</b>
Mean Temperature, 1971 - 2000													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Max °F	21.9	28.4	40.6	57.0	70.1	79.0	83.3	80.4	71.1	58.4	40.1	26.4	<b>54.7</b>
Min °F	4.3	11.8	23.5	36.2	48.5	57.8	63.0	60.8	50.8	38.9	24.8	10.9	<b>35.9</b>
Mean °F	12.1	20.1	32.1	46.6	59.3	68.4	73.2	70.6	61.0	48.7	32.5	18.7	<b>45.4</b>

*Source: (NCDC, 2008)*

### Design Storms

Table 15 illustrates the probability of a rainfall event occurring in any given year at the centroid of the MWMO. The probability of exceedance and the return period are measures of the probability of occurrence of the storm event. For example, a 24-hour rainfall event of 7.4 inches has a 1% probability of occurring in any given year which is expressed as once in every 100 years. A 3.6 inch, 24-hour rainfall event has a 20% probability of occurring in any given year which is expressed as once in every 5 years.

The standard accepted practice is to use National Oceanographic and Atmospheric Administration's (NOAA) Atlas 14, Volume 8, Version 2 (Atlas 14), released in 2013, on which Table 15 is based. Atlas 14 supersedes NOAA's

Technical Paper No. 40 (written in 1961), which was previously the standard accepted source of precipitation depths for selected return periods. Atlas 14 data for Minnesota is available on NOAA's website at [http://hdsc.nws.noaa.gov/hdsc/pfds/pfds\\_map\\_cont.html?bkmrk=mn](http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=mn). In Table 15, red text indicates Atlas 14 precipitation depths that have increased from TP-40, green text indicates Atlas 14 precipitation depths that have decreased from TP-40, and black text indicates precipitation depths that remain unchanged.

**Table 15: Storm Event Precipitation (inches) for Minneapolis-Saint Paul, MN**

Probability of Exceedance	Return Period	Duration of Storm Event							
		24-hour	12-hour	6-hour	3-hour	2-hour	1-hour	30-min.	15-min.
100%	1-year	2.5	2.1	1.9	1.6	1.4	1.2	0.9	0.6
50%	2-year	2.9	2.5	2.2	1.9	1.7	1.4	1.1	0.7
20%	5-year	3.6	3.2	2.8	2.4	2.2	1.8	1.4	0.9
10%	10-year	4.3	3.9	3.4	2.9	2.6	2.1	1.6	1.1
4%	25-year	5.4	5	4.4	3.8	3.3	2.6	2	1.4
2%	50-year	6.4	6	5.3	4.5	3.9	3.1	2.2	1.6
1%	100-year	7.4	7	6.3	5.3	4.6	3.6	2.5	1.8

Source: National Oceanographic and Atmospheric Administration's (NOAA) *Atlas 14, Volume 8, Version 2 (Atlas 14)*, released in 2013

### Climate Change

Over the next 50 years, the approach to watershed management could shift as a result of climate change. Watershed managers are likely to go from monitoring and evaluating the effects of climate change to mitigating and finally adapting to climate change.

What impacts could climate change have on precipitation in the State of Minnesota? As the earth warms, the intensity of precipitation increases in two ways: (1) increasing the temperature of the land and oceans causes water to evaporate faster; and (2) increasing air temperature enables the atmosphere to hold more water vapor. These factors combine to make clouds richer with moisture, making heavy downpours or snowstorms more likely. The State of Minnesota is predicted to see a total increase in annual precipitation.

Seasonal precipitation could change as follows: precipitation may increase in winter by 15-50 percent and decrease in summer by up to 15 percent. While the frequency of heavy rainstorms (both the 24-hour and the multi-day) may increase, droughts are likely to be more common as the rainfall cannot compensate for the drying effects of a warmer climate. These predictions or trends have already been established: a review of approximately 3,500 National Oceanic and Atmospheric Administration (NOAA) weather stations indicates that Minnesota has already seen a 24 percent increase in the frequency of extreme precipitation events from 1948 to 2006 (Madsen and Figdor, 2007). In the Twin Cities Metropolitan Area, this increase was as large as 47 percent. Other changes we can expect to see in the State of Minnesota include a shorter winter season with less snow, more ice, winter rains, earlier ice-out dates, and more rapid spring snowmelt events. Table 16 summarizes the impacts possible in the State of Minnesota as a result of climate change.

**Table 16: Expected Impacts of Climate Change in Minnesota**

Impact to Water Resource	Description	Indicators
<b>Increases in Water Pollution Problems</b>	Warmer air temperatures results in warmer waters	<ul style="list-style-type: none"> <li>▪ Warmer waters hold less dissolved oxygen (DO) making instances of low DO and hypoxia more likely</li> <li>▪ Increased frequency of algal blooms</li> </ul>
	Increased flooding increases water-borne diseases and sediment transport	<ul style="list-style-type: none"> <li>▪ Increased stormwater runoff washes sediments (erosion) and other contaminants into waterbodies</li> <li>▪ Overloading of stormwater and stormsewer systems transports contaminants into waterbodies</li> </ul>
	Changes in snowfall patterns	<ul style="list-style-type: none"> <li>▪ More ice during the winter requires application of more chemicals</li> <li>▪ Less ice coverage results in greater evaporation of surface waters during winter and lower surface water levels, concentrating pollutant loads</li> </ul>
<b>More Extreme Water-Related Events</b>	Heavier precipitation during rainfall events	<ul style="list-style-type: none"> <li>▪ Increased risk of flooding</li> <li>▪ Increased variability of streamflows</li> <li>▪ Increased velocity of water during high flow periods</li> <li>▪ Taxes existing infrastructure systems (e.g. levees, sewer pipes, wastewater treatment plans, and so on)</li> </ul>
<b>Changes to Availability of Drinking Water Supplies</b>	Changing patterns of precipitation and snowmelt	<ul style="list-style-type: none"> <li>▪ Increased drought conditions place higher demands on drinking water supplies</li> <li>▪ Increased water loss due to higher evaporation (as a result of warmer air temperatures)</li> </ul>
	Water air temperature	<ul style="list-style-type: none"> <li>▪ Places higher demands on community water supplies</li> <li>▪ Increased water needs for agriculture and industry</li> <li>▪ Increased need for energy production (e.g. air conditioning)</li> </ul>
	Size of wetlands and lakes will change	<ul style="list-style-type: none"> <li>▪ Changing water flow to lakes/streams</li> <li>▪ Increased evaporation</li> <li>▪ Changes in precipitation impacts wetland hydrology (bounce and duration)</li> </ul>
<b>Water Boundary Movement and Displacement</b>	Increased stream channel instability	<ul style="list-style-type: none"> <li>▪ Increase in channel-forming flows (bank-full flows) leads to increased sediment transport potential and channel instability</li> </ul>
	Decreased Groundwater Recharge	<ul style="list-style-type: none"> <li>▪ Rain from extreme events falls too quickly to be absorbed into the ground</li> <li>▪ Reduced summer water levels diminish recharge of groundwater</li> <li>▪ Earlier snow melt reduces ability of snow to recharge aquifers</li> </ul>
	Increased Erosion	<ul style="list-style-type: none"> <li>▪ Due to altered buffer/shoreline areas</li> </ul>
<b>Changing Aquatic Biology</b>	Warmer water temperatures	<ul style="list-style-type: none"> <li>▪ Loss of fisheries habitats as aquatic life replaced by other species better adapted to warmer waters</li> <li>▪ Interruption of breeding cycles</li> <li>▪ Increase in invasive species</li> </ul>

#### **4.5.2. SURFACE WATER RESOURCES**

Surface waters of the MWMO are sources of drinking water, recreation, wildlife habitat, and navigation. Each serves a different function based on size, hydrologic characteristics, and location. Surface waters can also be a source of (or a control for) flooding, depending on surface water management practices. Surface waters can physically divide communities or facilitate intercommunity activity and purpose. The surface waters of the MWMO are described below and shown in Figure 42.

##### **Mississippi River**

The Mississippi River at the MWMO receives drainage from approximately 19,680 square miles (USACE, 2004). Much of this drainage area is rural woodland and agriculture with large urban communities of Saint Cloud, Minneapolis, and surrounding communities. From upstream areas down to the MWMO border, the percentage of agricultural lands, forest, and wetlands decreases, while the percentage of residential, commercial, industrial, and turf lands increases (MDH, 2001). The Mississippi River is part of the MWMO water monitoring program (see Section 2.5.8).

The headwaters of the Mississippi River above Anoka, Minnesota are designated as an Outstanding Resource Value Water and a Wild, Scenic, and Recreational River by the State of Minnesota. In addition, the MWMO reach of the river is part of the National Park Service Mississippi National River and Recreational Area. Minnesota Rules 7050.0470 lists the water use classifications for all waters of Minnesota, and the Mississippi River within the MWMO has multiple designations.

Above the Upper Saint Anthony Falls, the Mississippi River is designated Class 1C (domestic consumption), 2Bd<sup>1</sup> (aquatic life and recreation), and 3B (industrial) waters, protected for drinking water uses due to the municipal water intake for the cities of Minneapolis and Saint Paul, which is located at River Mile 862.8. This portion of the Mississippi River is additionally classified as Class 3C (industrial), 4A (irrigation), 4B (livestock), 5 (aesthetic and navigation), and 6 (upstream of another state). The lower portion of the Mississippi River within the MWMO is designated Class 2B (aquatic life and recreation), 3B (industrial), 4A (irrigation), 4B (livestock), 5 (aesthetic and navigation), and 6 (upstream of another state) waters.

As a source of public potable water, the Mississippi River has been studied through the Source Water Assessment Program, administered by the Minnesota Department of Health, as an area for protection from contamination sources. The Minnesota Department of Health develops source water assessments for all public water supplies within the state under the federal Safe Drinking Water Act. A source water assessment area is typically mapped to show the land area over which protection measures should be taken to protect the water supply from contamination. A source water protection plan has been developed by the cities of St. Cloud, Minneapolis, and St. Paul, along with other local units of government through the Upper Mississippi River Source Water Protection Project. The Source Water Protection Plans include a delineated source water protection area, an inventory of potential point and non-point contaminant sources within the area, and a description of management strategies and objectives for implementation. The plans and other information about the project can be found at the Upper Mississippi River Source Water Protection Project website: [www.umrswpp.com](http://www.umrswpp.com).

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<sup>1</sup> Class 2 waters, aquatic life and recreation. Aquatic life and recreation includes all waters of the state which do or may support fish, other aquatic life, bathing, boating, or other recreational purposes, and where quality control is or may be necessary to protect aquatic or terrestrial life or their habitats, or the public health, safety, or welfare. For further elaboration on quality and standards of Class 2B waters see Minnesota Rules Chapter 7050.0222 subpart 3.

The Mississippi River is considered one of the few federally-navigable waters in Minnesota. This means that the State of Minnesota actually owns the bed of the river, below the low water mark. The beds of most other public waters in Minnesota are either privately owned, or are held in trust for the riparian owners by the State.

The Mississippi River Corridor Critical Area includes the Mississippi corridor within the MWMO. The Mississippi River Corridor Critical Area consists of 72 miles of river and 54,000 acres of surrounding land from Anoka to the confluence of the Saint Croix River. The land was designated in 1976 under the Critical Areas Act passed by the State Legislature three years prior. The Minnesota Critical Areas Program is housed under the Environmental Quality Board, and the Minnesota Department of Natural Resources administers the Mississippi River Corridor Critical Area. The purpose is to protect and preserve the unique natural, recreational, transportation, and cultural features of the section of the Mississippi River flowing through the Minneapolis-Saint Paul Metropolitan Area. The corridor's designation gives the state oversight in local land use decisions and a tool for managing development within the corridor. Partners in the protection and preservation of this area include the Environmental Quality Board, the Metropolitan Council, and the National Park Service.

According to the Upper Mississippi River Water Quality Assessment Report (EPA, 2002), water quality of the Upper Mississippi River is most influenced by nonpoint source inputs from tributary streams, major point source discharges, and river flows. The Twin Cities Metropolitan Area has a noticeable negative effect on the river's quality.

Implementation of point source pollutant controls in the 1980s have reduced ammonia nitrogen concentrations and increased dissolved oxygen concentrations below the metropolitan area. Nitrification as a wastewater treatment technology and increased nonpoint source runoff from agricultural watersheds in the 1990s is a potential cause of increasing nitrite and nitrate nitrogen concentrations.

Overall water quality trends were assessed for the 2006-2007 water year based on data from as early as 1953 to the present in the Minnesota Pollution Control Agency's 2008 Report to Congress (MPCA, 2008b). Just above Saint Anthony Falls, data indicate an increasing trend for nitrite/nitrate and decreasing trends for biochemical oxygen demand (BOD), total phosphorus (TP), unionized ammonia and fecal coliform. Downstream of the MWMO, in Pool 2 (upstream of Lock and Dam No. 2), data indicate the same findings with the exception of no trend found for TP and an additional increasing trend for total suspended solids (TSS).

### **Combined Sewer Overflow**

To address degrading Mississippi River water quality as a result of combined sewer overflows, the cities of Minneapolis, Saint Paul, and South Saint Paul together with the Metropolitan Council were involved in a ten-year sewer separation project, the Minneapolis Combined Sewer Overflow Program - Phase I (1986-1995). The Metropolitan Council monitored results from the project and data indicated a reduction by half in fecal coliform bacteria levels. In 1986, an estimated 4651.3 acres of runoff from street inflow connections were served by combined sewers (City of Minneapolis, 2006). By 2000, 98.5% of street drainage was separated, leaving approximately 69 acres that are still served by combined sewers. Each year the City identifies additional connected acreage. For example, in 2010 additional acres have been identified through continuous flow monitoring, smoke testing, and investigation.

The City's former National Pollutant Discharge Elimination System (NPDES) permit (Permit No. MN0046744, held jointly with the Metropolitan Council) required elimination of combined sewer overflows by its expiration in 2001. Since this goal was not fully achieved, a documented approach for the elimination of combined sewer overflows was required for permit renewal. The Metropolitan Council Environmental Services and the City of Minneapolis jointly conducted a combined sewer overflow study, completed in April 2002. Based on study results, the Minneapolis Tier II Comprehensive Sewer Plan was approved by Metropolitan Council Environmental Services in January 2003 and constitutes the Minneapolis Combined Sewer Overflow Program - Phase II for the five-year period 2003-2007.

Based on the study, the Combined Sewer Overflow Program requires the removal of both public and private stormwater inflows to the sanitary sewer system. The Program's 2009 report of 2008 activities, reports zero CSO events within the city of Minneapolis in 2007 and 2008. However, eight potential CSO discharge locations still remain. The elimination of all potential CSO discharge locations may not be feasible in every case without causing a public health or safety hazard. However, additional Program activities (including rain leader inspection and infiltration and inflow reductions) are being undertaken to reduce the volume of stormwater flows to the sanitary system. The city of Minneapolis and the Metropolitan Council continue to operate under the expired permit, which includes recording and data requirements for all CSO events as well as maintaining operation and maintenance data for CSO events and elimination efforts.

In 2002, Minneapolis initiated the rain leader inspection program seeking to eliminate direct connection of roof drains to sanitary sewer. The Combined Sewer Overflow Program incorporates the rain leader inspection program. A new ordinance was approved effective Aug, 1, 2003: Chapter 56, Prohibited Discharges to Sanitary Sewer System. It prohibits property owners from discharging rooftop rain leaders and private surface drainage to sanitary sewer and requires redirection to either the public stormdrain system or to side yards.

### **Metropolitan Council Surcharge Program**

The Metropolitan Council appointed a Task Force in April 2003 to identify solutions to infiltration and inflow (I/I) to the sanitary sewer system that results in excessive sanitary flows during large storm events. Based on the Task Force findings, the Metropolitan Council implemented an I/I Surcharge Program. The program's purpose is to encourage communities to eliminate their excess peak I/I over the five-year period from 2007 through 2011. The surcharge program charges for a community's excess peak I/I. The program is to provide the Council with contingency funding to provide incentives and mechanisms for communities to mitigate excess peak I/I and/or to increase system capacity. In 2007 all 46 of the region's communities with excessive I/I took action to reduce their excess peak I/I (MCES, 2007). In 2008 a total of \$700,000 in grant money was available for communities disconnecting clean-water drains and stormwater runoff from the sanitary sewer system. In 2009, \$46 million was spent by communities on local I/I mitigation work.

### **Dams**

The Mississippi River has been molded (straightened) and maintained for navigation since 1930 such that today the River consists of 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 13 locks and dams, beginning at Upper Saint Anthony Falls in downtown Minneapolis and ending at Lock and Dam 10 in Guttenberg, Iowa. Upper Saint Anthony Falls Lock and Dam is the uppermost lock and dam along the River. The USACE is required by law to close the Upper Saint Anthony Falls Lock to all navigation traffic by June 10, 2015. After that time, the lock may only be operated for upstream flood mitigation.

There are three dams with navigation locks within the Watershed. Upper Saint Anthony Falls Lock and Dam and Lower Saint Anthony Falls Lock and Dam are owned by Xcel Energy Center. Construction was completed in 1963 and 1956, respectively. Lock and Dam No. 1, also referred to as Ford Dam, is owned and operated by Brookfield Power Company. Construction was initially completed in 1917 but it underwent reconstruction in 1929. The main lock was not completed until 1932, and the last major rehabilitation was as recent as 1978-1983. The locks of all three dams are 56 feet wide by 400 feet long. Lock and Dam No. 1 has two locks of this size making it the only twin locks in the Saint Paul District of the USACE.

### **Loring Park Pond**

Loring Park Pond (also referred to as a “lake”) is located near the 90 degree bend of Highway 94. Designated a Type 5 wetland (Cowardin et al., 1979), it is an eight-acre eutrophic lake that receives strictly urban surface runoff and ultimately discharges to the Mississippi River (see Figure 42). The pond is composed of two basins and no beaches. The north basin was originally a wetland. The Minneapolis Park and Recreation Board acquired the lake in 1883 and removed a floating bog. The pond was dredged again in 1976.

In 1997-1998 the Minneapolis Park and Recreation Board enhanced the aesthetic value of Loring Park Pond by improving both water level stability and water quality. A liner consisting of a layer of clay and several sequential soil layers was installed to minimize seepage and reduce or eliminate groundwater pumping to maintain pond levels. The pond was buffered with a vegetative strip to prevent Canadian Geese from accessing the pond and to protect shoreline from erosion, to filter pollutants, and to create wildlife habitat. In addition, an aeration system was installed to improve water quality by eliminating anoxic conditions.

In March 2007, accumulated sediments in the north basin of Loring Park Pond were dredged in order to restore deeper water levels and improve habitat. Dredging made the island a distinguishable feature by deepening water levels under the bridge. Native plantings were installed along the shoreline.

According to the 305(b) lake assessment, the south basin of Loring Park Pond has insufficient information to determine whether it supports aquatic recreation. Since 1992 the Environmental Operations Section of the Minneapolis Park and Recreation Board has monitored the Pond as part of a diagnostic study for the Chain of Lakes Clean Water Partnership. From 1992 to 1996, the Trophic Status Index (TSI) had been on an increasing trend. After stabilization of pond improvements, the TSI has been on a decreasing trend, indicating steady improvement in water quality (MPRB, 2006). The Lake Aesthetic and User Recreation Index give Loring Park Pond an *excellent* for aesthetics and aquatic plants and a *poor* for water clarity.

### **Mallard Marsh and the Kasota Ponds**

Mallard Marsh (also known as Rosie’s Swamp) is located in Saint Paul, approximately 1 mile south of Larpenteur Avenue on the south side of Kasota Avenue and to the west of Highway 280 among the Kasota Ponds. Designated a Type 4 wetland (Cowardin et al., 1979), this deep freshwater marsh is 2.5 acres in size and is not meandered. The Kasota Ponds (located along Kasota Avenue and on the west side of its intersection with Hwy 280 and including Mallard Marsh), treat stormwater runoff from the Bridal Veil Creek subwatershed during storm events and then slowly release that stormwater into the storm sewer system. Groundwater recharge and discharge occurs in the Kasota area, including Skonnard Spring, and discharges into one of the ponds. Mallard Marsh and the Kasota Ponds are a remnant of a much larger 100-acre wetland and pond complex.

Saint Anthony Park Community Council sponsors annual cleanups around Mallard Marsh to recover discarded trash and appliances from the water and shoreline areas. Volunteer turnout usually reaches 50-60. Historical volunteer efforts have included tree planting, nesting box installation, buckthorn clearing, turtle habitat creation, and pollutant removal. Saint Anthony Park Community Council volunteers have monitored Mallard Marsh, including three surrounding ponds, for at least 15 years. They have recorded water quality indicators such as observations, temperature, pH, and conductivity.

MWMO staff have been monitoring the area since 2008. Biological sampling was conducted in 2011 to develop an index of biotic integrity. The results indicated all three monitored wetlands are in poor health. A basic wetland inventory was done by Saint Anthony Park Community Council and University of Minnesota faculty and students in 1999-2000. See Section 2.3.3 for details on the inventory. Currently, Saint Anthony Park Community Council has a grant with the Minnesota Conservation Corps to remove buckthorn and to restore and stabilize shoreline areas around Mallard Marsh and three surrounding ponds.

### **Bridal Veil Creek and Bridal Wetland**

Bridal Veil Creek, Bridal Veil Pond, and the Kasota Ponds are at the eastern edge of the MWMO. Bridal Veil Creek was originally a small creek or gully draining a large swampy area in the northern part of the Watershed (Kasota Avenue area). It ran southwesterly through wooded areas to the existing falls to the Mississippi River. Beginning in the mid-1800s with the growth of railroad yards, commercial areas, and residential areas, the creek was enclosed in a piecemeal fashion within culverts. Currently, only a minute stretch of the creek is day lighted: the remainder is completely enclosed in culverts until its dramatic confluence with the Mississippi River at the Franklin Avenue Bridge in Minneapolis at Bridal Veil Falls.

During subsequent residential development, some of the stormwater runoff was diverted into sanitary sewers and discharged directly into the river. During the mid-1930s the interceptor system was built to collect the sanitary flows, but not the stormwater runoff, which was allowed to mix with the sanitary sewage and permitted to overflow into the river in large rain events. The construction of commercial buildings, paved streets, driveways, sidewalks, and homes increased the amount of stormwater conveyed by Bridal Veil Creek. The size of the stormdrain pipes increased with time, from a 27-inch to a 72-inch pipe following construction of I-94.

After the construction of Highway 280, the City of Saint Paul Public Works noted that projected developments in the Bridal Veil Creek subwatershed would eventually exceed the design capacity of the storm sewer system. In 1995, the City of Saint Paul completed the Eustis Tunnel, separating Saint Paul runoff from the Minneapolis storm sewer system to correct capacity problems and shared management issues. The Cities of Lauderdale and Falcon Heights connected to Saint Paul via the Eustis Tunnel.

The Valentine Clark Superfund Site is located to the northeast of Bridal Veil Pond. It is the only superfund site in the MWMO and was a wood treatment facility from 1908 until 1962. Much of the ground adjacent to the site, including Bridal Veil Pond and the surrounding Bridal Veil Open Space, was polluted by chemical runoff from the site as well as Hwy 280 runoff. The pond was stocked with fish by the Minnesota Department of Natural Resources from 1976 to 1991, but ducks and fish were killed when upstream dredging of Bridal Veil Creek released contaminants in December 1990. Contaminants of concern include polyaromatic hydrocarbons (PAH), pentachlorophenol (PCP), and dioxins.

Local community groups, such as Southeast Como Improvement Association and the Saint Anthony Park Community Council (SAPCC), have made the Bridal Veil Creek Watershed a high priority. In the winter of 2007-2008, Minneapolis Public Works and the Minnesota Pollution Control Agency remediated Bridal Veil Open Space and Bridal Veil Pond within it. Remediation activities included removal of four feet of contaminated soil over the entire Bridal Veil Open Space and replacement with clean soil, filling of the current Bridal Veil Pond and conversion to a wetland area reseeded with native vegetation, and creation of a shallow, rocky meandering stream within the wetland to promote natural bioremediation of contaminants. In addition, the project involved extension of the storm sewer from the railroad tracks to a new outfall by the pond, limited removal of contaminated sediment from the creek and installation of sedimentation basins to decrease the potential for contaminated sediments to migrate into the new wetland area.

### **Bassett Creek**

Bassett Creek flows through the MWMO by way of a tunnel which was built in phases and completed in 1992. The new Bassett Creek Tunnel is in an entirely different alignment than Old Bassett Creek Tunnel. Although the old tunnel no longer carries Bassett Creek flow from portions of Minneapolis and eight upstream cities, it remains in-place to convey local flows from its remaining drainage area. A boundary change between the Bassett Creek Watershed Management Commission and the MWMO transferred the area encompassing both tunnels to the MWMO.

In 2000, the Bassett Creek Watershed Management Commission, MWMO, and the City of Minneapolis entered into a joint and cooperative agreement, which resulted in a boundary change that transferred 1,002 acres from the Bassett Creek Watershed Management Commission to the MWMO. The agreement defines the responsibilities of the MWMO and the Bassett Creek Watershed Management Commission with respect to the new and old tunnel. For example, the agreement requires accommodation of a 50 cfs overflow from Bassett Creek to the Old Tunnel during a 100-year flood. The agreement also requires written approval of the Bassett Creek Watershed Management Commission for changes in the area tributary to the new tunnel, or increases in the rate of runoff to the new tunnel by either the City of Minneapolis or the MWMO. A copy of the agreement is attached as Appendix K.

### **Sullivan Lake**

Sullivan Lake is located in Columbia Heights along 51<sup>st</sup> Avenue, east of Central Avenue. According to the City of Columbia Heights' Comprehensive Plan (2010), Sullivan Lake serves as a detention area for stormwater. Its drainage basin is 0.73 square miles and the surface area is 15.3 acres at the normal water level of 880.3. A gated outlet structure controls outflow from the lake. The lake is surrounded by the largest park in Columbia Heights, with trails around the lake.

### **Highland Lake**

Highland Lake is located in Kordiak County Park in the northeast portion of Columbia Heights. The City of Columbia Heights' Comprehensive Plan (2010) states that Highland Lake has six stormwater drains discharging to it and serves as a stormwater detention area. The drainage basin is 0.32 square miles and the surface area is 15.7 acres at a water level of 996.1.

### **Public Waters and Wetlands**

The Minnesota Department of Natural Resources identifies the entire stretch of the Mississippi River, Loring Pond, Mallard Marsh, Sullivan (Sandy) Lake, and Highland (Unnamed) Lake as the only public waters within the Watershed (see Figure 42). Public waters include, but are not limited to, those where there is publicly owned and controlled access, waters of the state determined to be public waters by court jurisdiction, watercourses with a drainage area greater than two square miles, and water basins surrounded by publicly owned lands. Public waters wetlands are types 3, 4, or 5 wetlands (Cowardin et al., 1979) that are at least two and one-half acres in surface area. Minnesota's public waters and wetlands have been inventoried by the Minnesota Department of Natural Resources. Minnesota Department of Natural Resources public waters and wetlands maps for Hennepin and Ramsey Counties are adopted by reference and are available from Minnesota Department of Natural Resources.

The Minnesota Department of Natural Resources provides waterbody size, ordinary high water levels, and normal water levels for most public waters and wetlands. Current records of water levels are available from the MWMO office, the regional hydrologist of the Minnesota Department of Natural Resources, and the Hennepin and Ramsey Counties Public Works Departments.

### **National Wetlands Inventory**

The United States Fish and Wildlife Service has inventoried wetlands using the Cowardin system of wetland designation (see Cowardin et al., 1979). These maps are known as the National Wetland Inventory Maps. National Wetlands Inventory wetlands are inventoried for the United States Geological Survey (USGS) quadrangle maps: Minneapolis North, Minneapolis South, New Brighton, and Saint Paul West. The jurisdictional limit of any wetland, however, must be determined by trained wetland delineators based on field review.

Figure 42 also identifies the National Wetlands Inventory wetlands within the MWMO including three systems: riverine, lacustrine, and palustrine. Riverine systems are those wetlands or deepwater habitats contained within a channel that is not dammed nor dominated by trees or emergent vegetation. Lacustrine systems are those wetlands or deepwater habitats in a depression or in a dammed river channel that have less than 30% coverage of vegetation (e.g. trees and persistent emergents) and total at least 20 acres in surface area. Palustrine systems are all nontidal wetlands that are dominated by vegetation (e.g. trees and emergents). In those systems lacking such vegetation, palustrine includes areas less than 20 acres and with active bedrock shoreline features less than 6.6 feet (2m) deep. These systems can characterize some tidal areas, though they are not applicable here.

The majority of wetland area in the MWMO is that part of the Mississippi River affected by dams and classified as lacustrine. Those wetlands not along the Mississippi River are found in pockets throughout the urban watershed. The Mississippi River, Loring Park Pond, Bridal Veil Creek, Mallard Marsh, and the Kasota Ponds are associated with National Wetlands Inventory wetlands.

The MWMO conducted a function and value assessment of any wetlands.. The project used Version 3.3 of the Minnesota Routine Assessment Method for Evaluating Wetland Functions. In addition to traditional federal and state data sources, the MWMO identified potential wetland sites using soils data from its *Historic Waters of the MWMO* study (MWMO, 2011) and data gathered from its recent Land Cover Classification and Natural Resources Inventory (MWMO, 2008). To view Minnesota Routine Assessment Method visit the Minnesota Department of Natural Resources website or go directly to the web address: [http://www.bwsr.state.mn.us/wetlands/mnram/MNRAM\\_fulltext\\_9\\_2010.pdf](http://www.bwsr.state.mn.us/wetlands/mnram/MNRAM_fulltext_9_2010.pdf).

Results of this study will be integrated in the MWMO's planning and resource management efforts.

### **Metropolitan Mosquito Control District Wetland Map**

The Metropolitan Mosquito Control District maintains its own inventory of maps of all wet areas that provide information on habitat for larval mosquitoes in the seven-county metropolitan area. Areas as small as 400 square feet that occasionally hold water for seven days are mapped in Figure 43. In addition to lakes and ponds, the maps include cattail marshes, grassy ditches or vegetative swales, and a wide array of natural or constructed water holding areas. Each wetland is classified into wetland types using the US Fish and Wildlife Service Circular 39 system. This wetland inventory is updated every five years by field inspection. The wetland inventory maps are available for review at the offices of MWMO and Metropolitan Mosquito Control District.

### **Impaired Waters**

Previous development and redevelopment in the Watershed have placed a significant burden on the health and sustainability of the MWMO's water resources due to increasing impervious surfaces generating polluted stormwater runoff. Section 303(d) of the Federal Clean Water Act requires that states establish total maximum daily loads (TMDLs) of pollutants to waterbodies that do not meet water quality standards. The loading limits are to be calculated such that, if achieved, the waterbody would meet the applicable water quality standard. To comply with the Clean Water Act, the Minnesota Pollution Control Agency assesses the state's waters, lists those waterbodies that are impaired (i.e. do not meet water quality standards), and conducts studies to determine the pollutant loading limits for the impaired waterbodies. These studies are known as Total Maximum Daily Load studies.

The Minnesota Pollution Control Agency sets target start and completion dates for individual Total Maximum Daily Load studies. Studies are usually funded by either the Minnesota Pollution Control Agency or by local units of government. Each Total Maximum Daily Load study describes the impairment, identifies the relevant pollutant(s), inventories the pollutant sources, calculates the assimilative capacity of the waterbody, allocates the allowable loads to the different sources, and prescribes an implementation strategy to restore the waterbody to meet water quality standards. Within a year of completing the Total Maximum Daily Load study, the Minnesota Pollution Control Agency requires the completion of an implementation plan, which provides more specific management details than are provided in the initial Total Maximum Daily Load study.

Segments of the Mississippi River and Bassett Creek within the watershed, as well as Sullivan (Sandy) Lake, Highland (Unnamed Lake), Loring Park Pond, Mallard Marsh, and Kasota Ponds are listed on the 303(d) list of impaired waters. The waters are shown on Figure 44, and Table 17 summarizes impairments. The chloride impairments in Loring Park Pond, Mallard Marsh, and Kasota Ponds are listed on the Proposed 2014 Impaired Waters List that has not yet been approved by the U.S. Environmental Protection Agency.

**Table 17: Impaired Waters of the MWMO**

Waterbody	Year First Listed	Impairment	Target start /end date	Status
Mississippi River – Coon Creek to Upper Saint Anthony Falls	2006	Fecal Coliform	2020/2024	
	1998	PCB in fish tissue	■ 1998/2025	■
		Mercury in fish tissue		TMDL completed in 2007
Mississippi River – Upper Saint Anthony Falls to Lower Saint Anthony Falls	1998	PCB in fish tissue	1998/2025	
		Mercury in fish tissue		TMDL completed in 2007
Mississippi River -- Lower Saint Anthony Falls to Lock and Dam #1	2002	Fecal Coliform	2020/2024	
		Mercury in fish tissue		TMDL completed in 2007
Bassett Creek* – Medicine Lake to Mississippi River	2010	Chloride	2009/2015	TMDL work began in 2010, anticipated completion in 2015
	2008	Fecal Coliform	2008/2015	TMDL completed in 2014
	2004	Fishes Bioassessments	2012/2016	
Loring (South Bay)**	2014	Chloride	2009/2015	TMDL work began in 2010, anticipated completion in 2015
Mallard Marsh	2014	Chloride	2009/2015	TMDL work began in 2010, anticipated completion in 2015
Kasota Pond North	2014	Chloride	2009/2015	TMDL work began in 2010, anticipated completion in 2015
Kasota Pond West	2014	Chloride	2009/2015	TMDL work began in 2010, anticipated completion in 2015
Sandy (Sullivan) Lake	2002	Nutrient/Eutrophication Biological Indicators	2015/2018	
Unnamed (Highland) Lake	2004	Nutrient/Eutrophication Biological Indicators	2015/2018	

\*\* The chloride impairments are listed on the Proposed 2014 Impaired Waters List that has not yet been approved by U.S. EPA.  
Note: Table 17 (Proposed 2014 Impaired Waters List) is updated frequently by MPCA and the most recent version can be found at:  
<http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdlis/impaired-waters-list.html>  
\*Note that within the MWMO, Bassett Creek is wholly contained underground within the MWMO.

## Ditches

There are no public ditches within the Watershed as established by Minnesota Statutes chapter 103E.

Figure 42: Surface Water Resources of the MWMO

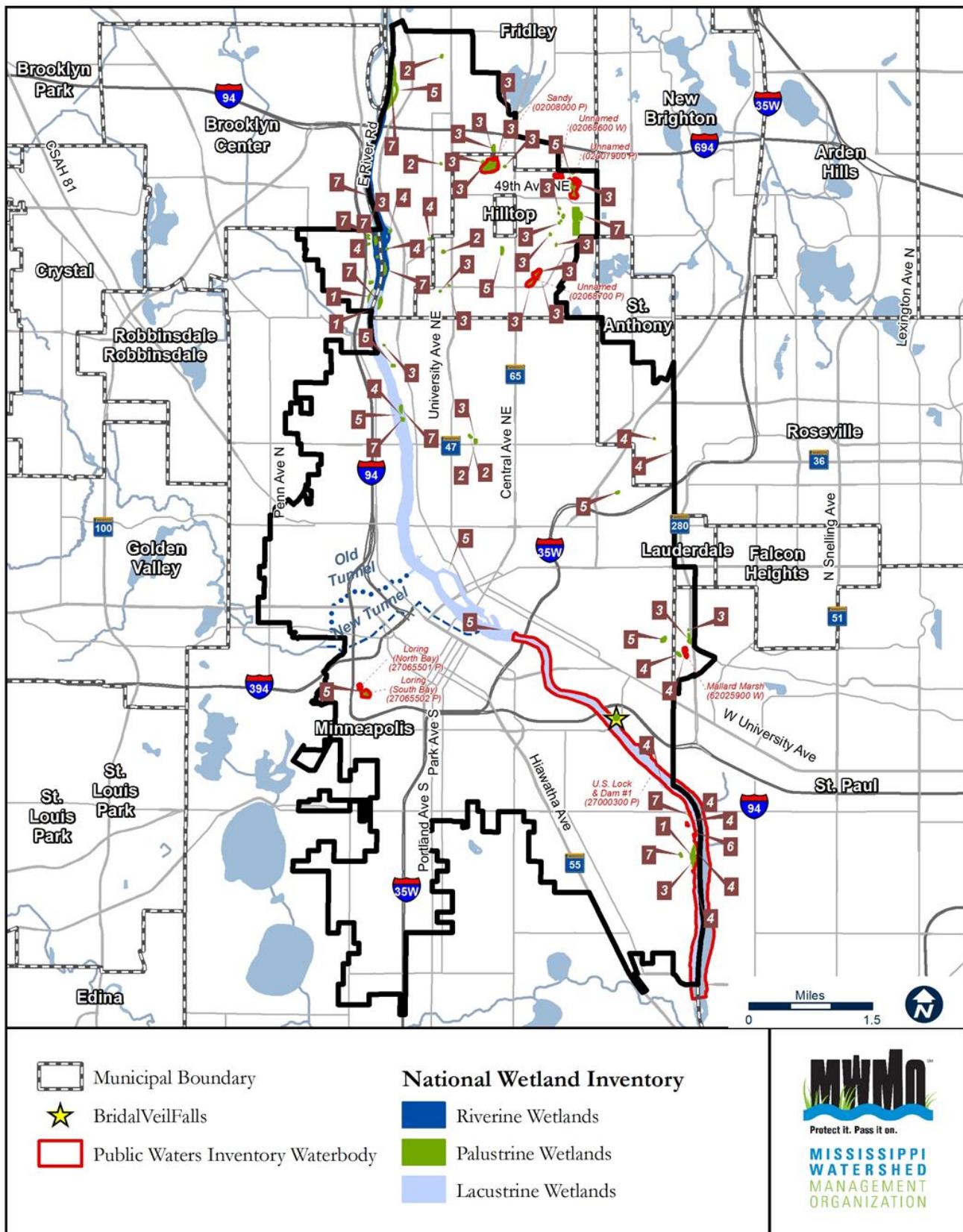


Figure 43: Metropolitan Mosquito Control District Wetland Areas in the MWMO

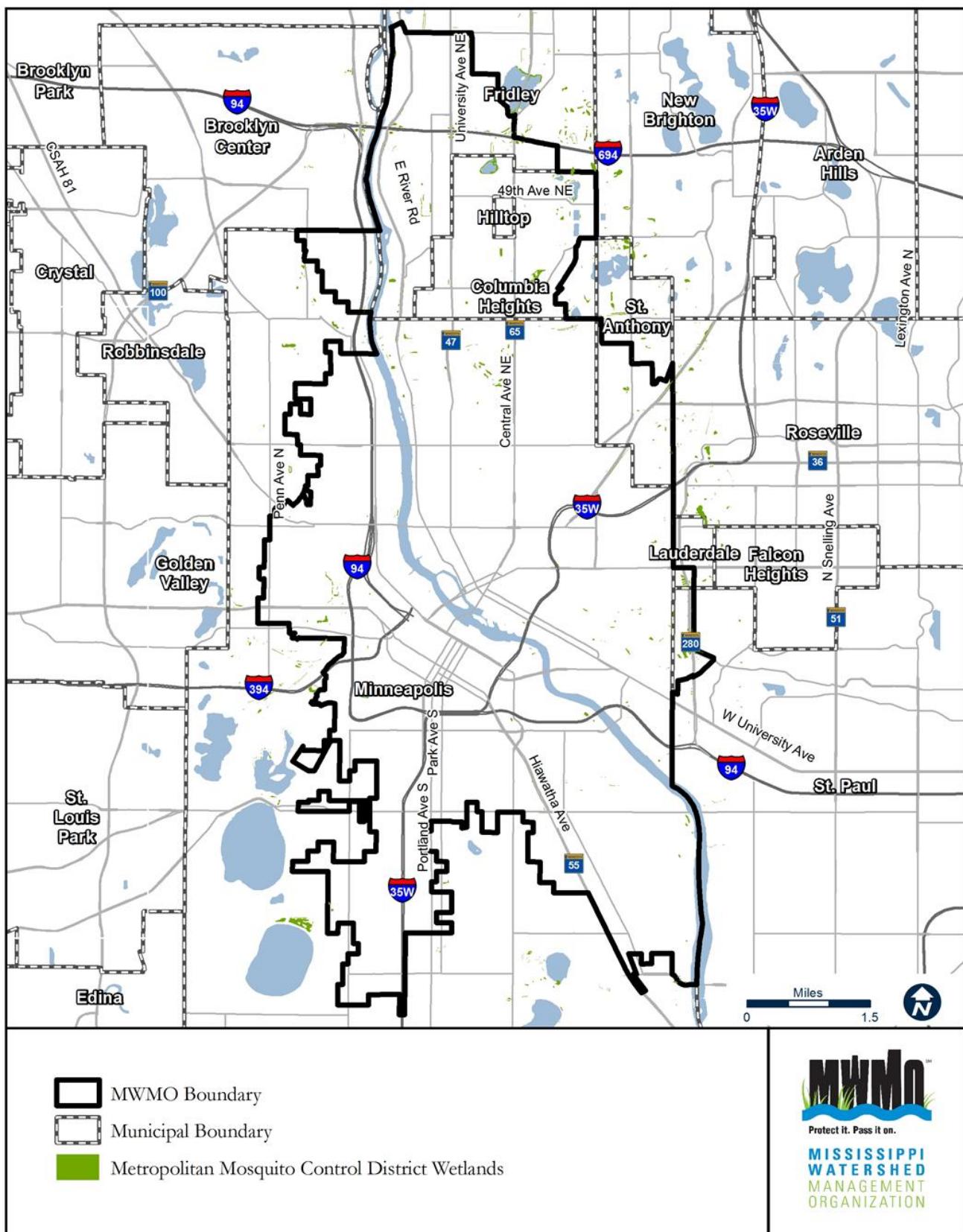
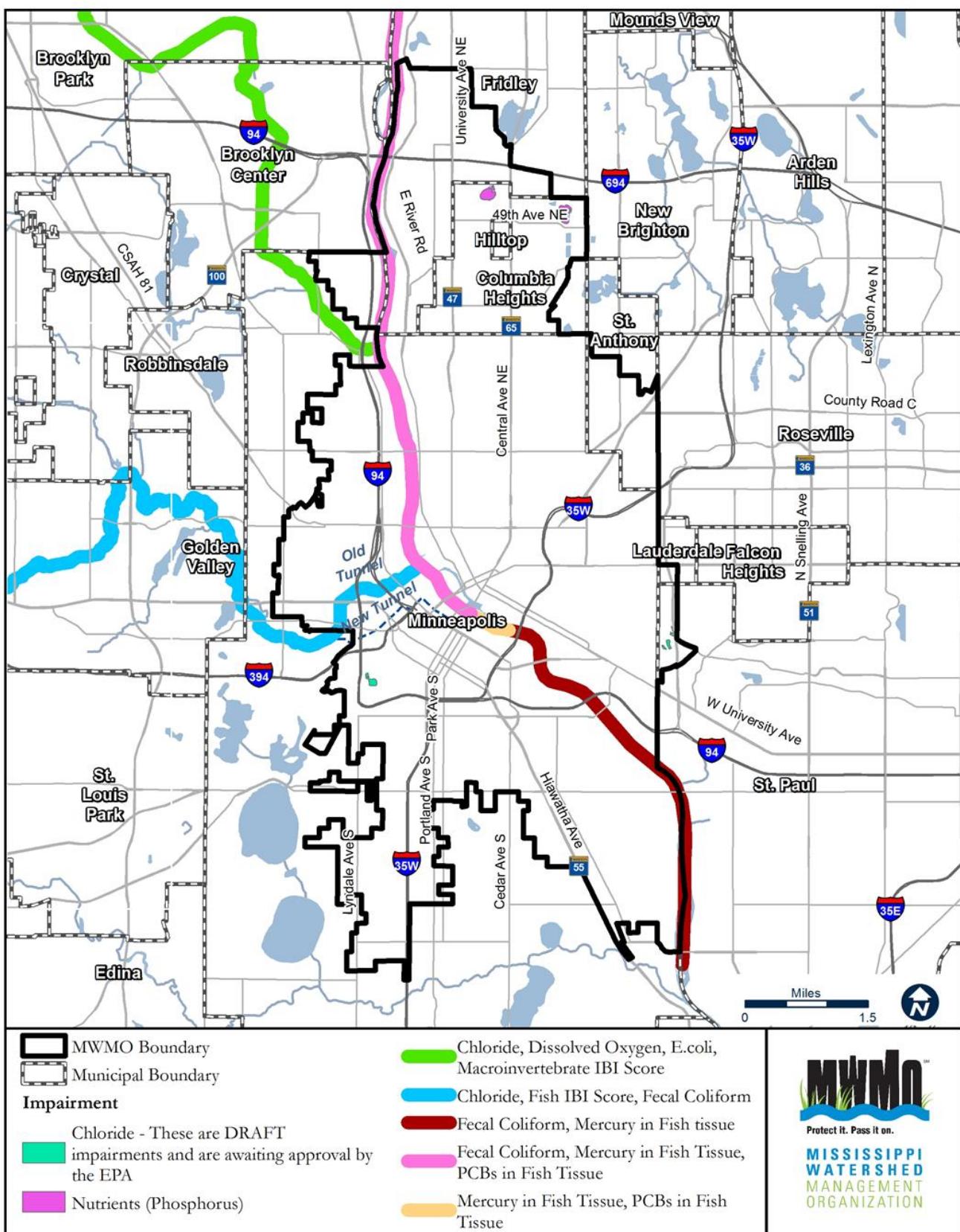


Figure 44: Impaired Waters of the MWMO



#### **4.5.3. STORMWATER SYSTEM**

The MWMO is highly urbanized. Many of the streams, lakes, and wetlands once found in the Watershed have been buried, filled, drained, or otherwise altered as the Watershed developed. As historic surface water drainageways were altered to make way for development, an extensive series of pipes and tunnels were put in place to collect and convey stormwater downstream. This conveyance system is mostly manmade—stormwater pipes and tunnels have replaced the creeks and streams that once conveyed water within the area to the Mississippi River. Understanding this extensive stormwater pipe and tunnel system is key to watershed management in the MWMO. The pipesheds of the MWMO can be found in Figure 45.

The MWMO has aggregated pipesheds shown in Figure 45 into five subwatershed management units. These subwatershed areas shown in Figure 46 will be the management units the MWMO uses when identifying projects and assessing changes (improvements/degradation) occurring in the Watershed's resources. The MWMO reserves the right to define additional areas in the future if needed. Four main criteria were used to establish the subwatershed management units: existing pipeshed boundaries, potential greenway corridors based on existing land cover, existing MWMO boundaries, and existing pervious areas.

The City of Minneapolis stormwater system receives runoff from approximately 50 square miles. The system includes main line storm pipes, deep storm tunnels (23 miles in total), catch basins, outfall control structures, pump stations, and numerous stormwater management practices including ponds, wetlands, and grit chambers (City of Minneapolis, 2008a). Cross connections between storm sewer and sanitary sewer systems still exist.

Over the past several years the City has been updating its stormdrains spatial database (GIS). Almost all of the stormdrain system has been digitized with attribute information attached. Minneapolis Park and Recreation Board stormdrain networks were incorporated into the database recently.

The major Saint Paul storm system within the MWMO is the Eustis Tunnel in the Bridal Veil Creek region. The Saint Paul storm sewer network is available from the City in computer-aided design and drafting (CADD) format. The City of Lauderdale has mapped the storm sewer system throughout the city. The maps are available in Geographic Information System (GIS) format. The City of Saint Anthony Village storm sewer system is not available electronically.

Figure 45: Pipedsheds of the MWMO

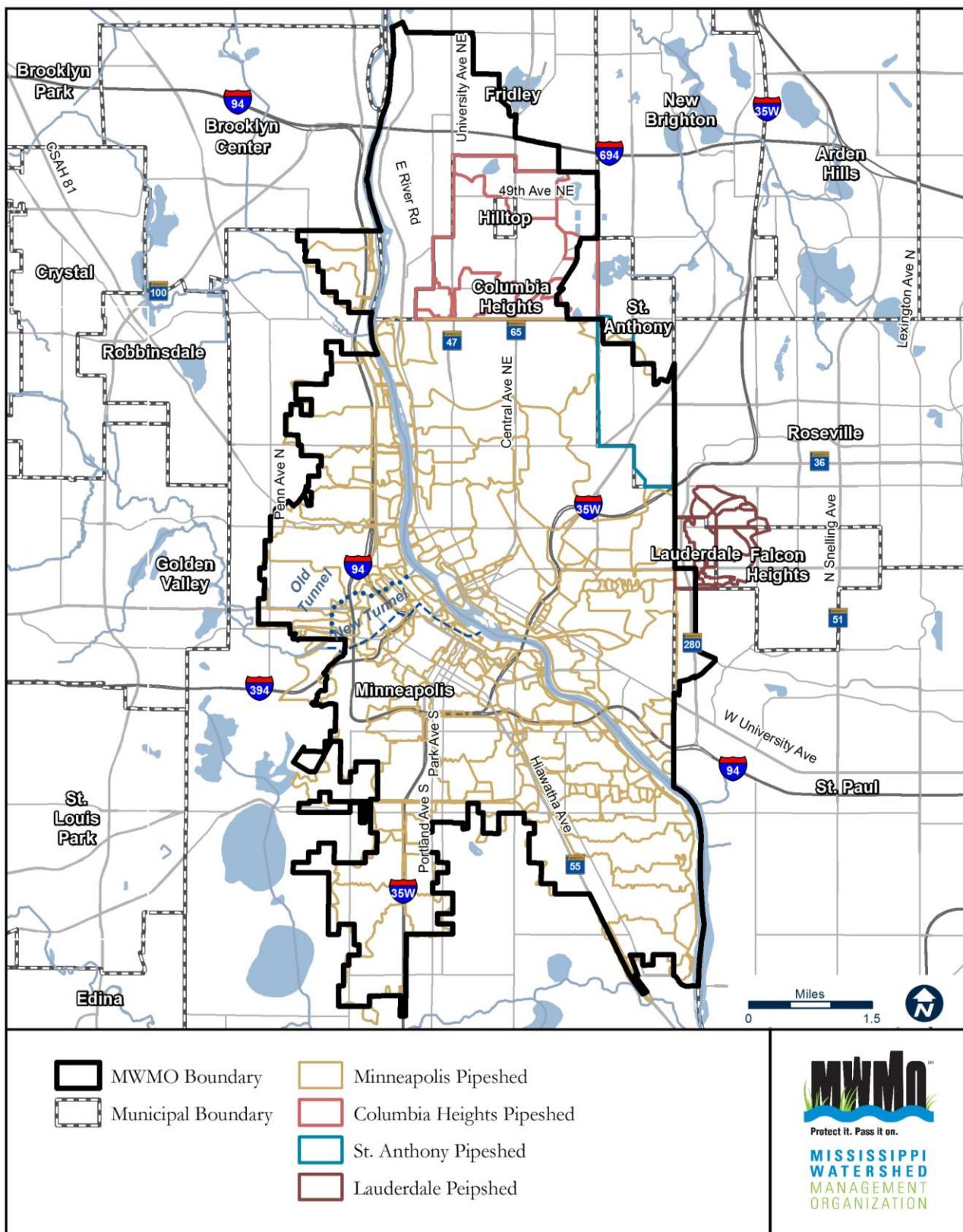
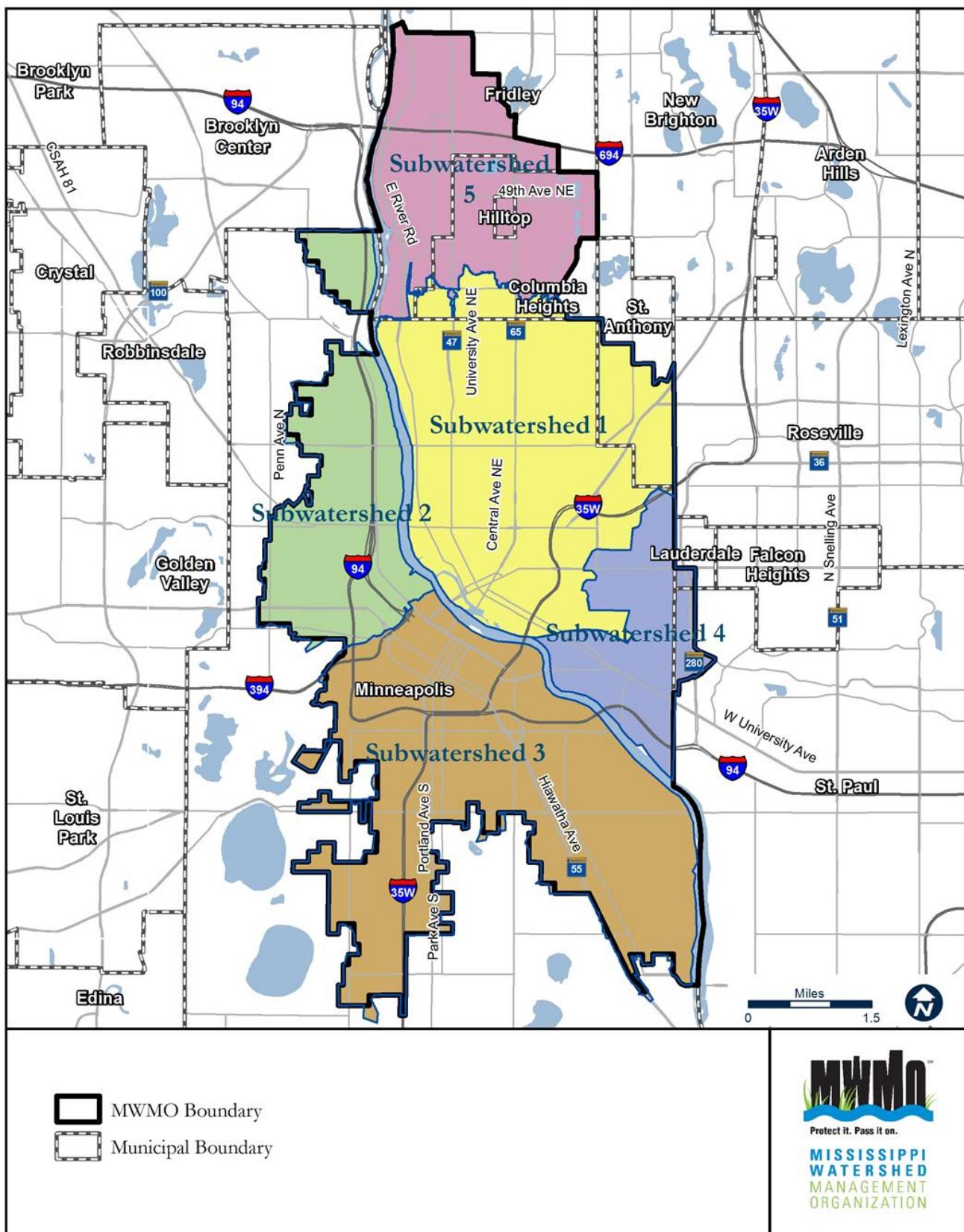


Figure 46: 2010 Subwatershed Management Areas of the MWMO



#### **4.5.4. FLOOD-PRONE AREAS**

The urbanized condition of the MWMO, coupled with a natural history that indicates this area once featured a network of streams and wetlands, now defines a landscape that is (among other things) prone to flooding. July 1997 rainfall totaled twelve inches and included five events that produced flooding complaints throughout the Watershed. These five events prompted simultaneous flood control awareness and action on the part of the cities within the MWMO.

From 1998 to 2006, the City of Saint Anthony Village completed approximately \$16 million in flood improvements based on recommendations from their 1997 analysis of problem areas (City of Saint Anthony Village, 1997); 7 of the 13 problem areas were located within the MWMO. The City has since identified an additional flooding problem area at Anthony Lane South in the Saint Anthony Village Industrial Park. The City is planning to undergo a feasibility study to investigate the causes and solutions for this problem. The site is within the New Brighton Boulevard Stormdrain (NBBS) subwatershed. The area of the Watershed that includes the Village of Saint Anthony defines the NBBS.

In response to the 1997 rainfalls, the City of Minneapolis created the Minneapolis Flood Mitigation Program. Actions of the program included construction of additional stormwater ponds, construction and upgrade of existing stormdrains, replacement of old catch basin grates, construction of additional catch basins, identification of flood-prone areas, installation of backup generators at pump stations, increased inspection and maintenance of catch basins and stormdrains, and decreased property flooding caused by sanitary sewer backups. Figure 47 shows the flooding locations identified by Minneapolis in 1997. The City of Minneapolis also has a system of storm tunnels as shown in Figure 48. Between 1998 and 2006, the City spent almost \$74 million on flood mitigation projects. The City of Minneapolis Local Surface Water Management Plan identifies in its Figure 4-6 the location and status of known flood areas (City of Minneapolis, 2006). The Local Surface Water Management Plan indicates that the following projects are completed or were under construction at that time (City of Minneapolis, 2006):

- 42<sup>nd</sup> Ave N & Russell Ave N
- 51<sup>st</sup> Ave N & Vincent Ave N
- 37<sup>th</sup> & Humboldt Ave N
- 33<sup>rd</sup> & Benjamin NE
- 30<sup>th</sup> Ave N to 33<sup>rd</sup> Ave N Dupont to Irving Aves N
- 35<sup>th</sup> Ave & Polk St NE
- Edison High School Area
- 18<sup>th</sup> & Quincy NE
- Talmage & Hoover NE
- 3700 Block of Columbus S
- 26<sup>th</sup> St W & Emerson Ave S
- 44<sup>th</sup> St. W & Aldrich Ave S
- Minnehaha Creek – Humboldt to Newton Aves S
- 43<sup>rd</sup> St W & Abbott Ave S
- E 43<sup>rd</sup> St to Minnehaha Creek Portland to Chicago Ave S
- 29<sup>th</sup> Ave S & E 44<sup>th</sup> St, 30<sup>th</sup> Ave S & E 39<sup>th</sup> St
- E 40<sup>th</sup> St & Snelling Ave
- 50<sup>th</sup> to 51<sup>st</sup> Sts W& Sheridan Ave S
- 49<sup>th</sup> St E & Stevens Ave S
- Minnehaha Creek – 34<sup>th</sup> Ave S to 38<sup>th</sup> Ave S
- 60<sup>th</sup> St E – Nicollet to Stevens Aves
- 54<sup>th</sup> St E & 28<sup>th</sup> Ave S
- Knox-Morgan Aves N 27<sup>th</sup> – 29<sup>th</sup> Aves N

In 2006, the City published an inventory in their Local Surface Water Management Plan of all their flood mitigation projects including designation of projects that are completed, under construction, or in design stages. Project areas are peppered throughout the MWMO, but many are in the upper half of the Watershed. In addition, Phase II of the Minneapolis Combined Sewer Overflow Program (2003-2007) resulted in a second major effort for elimination of combined sewer overflows as a result of heavy rainfall.

The City of Saint Paul made substantial flood mitigation efforts within the MWMO back in 1995, the year of completion of the Eustis Tunnel, and throughout the past few decades leading up to completion of combined sewer overflow work. The Tunnel resulted in major alleviation of potential flooding in the Bridal Veil Creek (BVC) subwatershed. The BVC subwatershed, as discussed earlier, is that area of the Watershed that includes the cities of Lauderdale, Saint Paul, and east Minneapolis.

In 2003 the City of Lauderdale rebuilt city streets, the utilities under those streets (natural gas, water, sanitary sewer), and used stormwater management practices to create stormwater drainage capabilities throughout the residential portion of the city which integrated with surrounding established systems.

In 2014 and 2015 the MWMO will be working with member cities Minneapolis, Columbia Heights, Hilltop and Fridley on comprehensive water quantity (Hydrology and Hydraulic: H & H) and associated water quality model studies for areas covering Northeast Minneapolis, and portions of Columbia Heights, Hilltop and Fridley. In the years following, the MWMO will continue partnering with its member cities to complete H&H and water quality models across the remainder of the MWMO. The MWMO and its member cities need to understand and analyze stormwater as it flows through the existing infrastructure system. To date, the MWMO has not conducted a rigorous model that can be used to aid in the location or selection of our capital projects.

The models generated will also assist cities with local system management and programmatic reporting. The MWMO and member cities will use the models to target locations for stormwater control measures and best practices to manage or improve water quantity and quality infrastructure. The models will aid cost/benefit analyses that determine which of these practices are the most effective and efficient. The models should be able to function as the basis for additional, probabilistic studies to understand the relative impact of changes in land use, climate and infrastructure.

Figure 47: Map of 1997 Flood Area (prepared by City of Minneapolis)

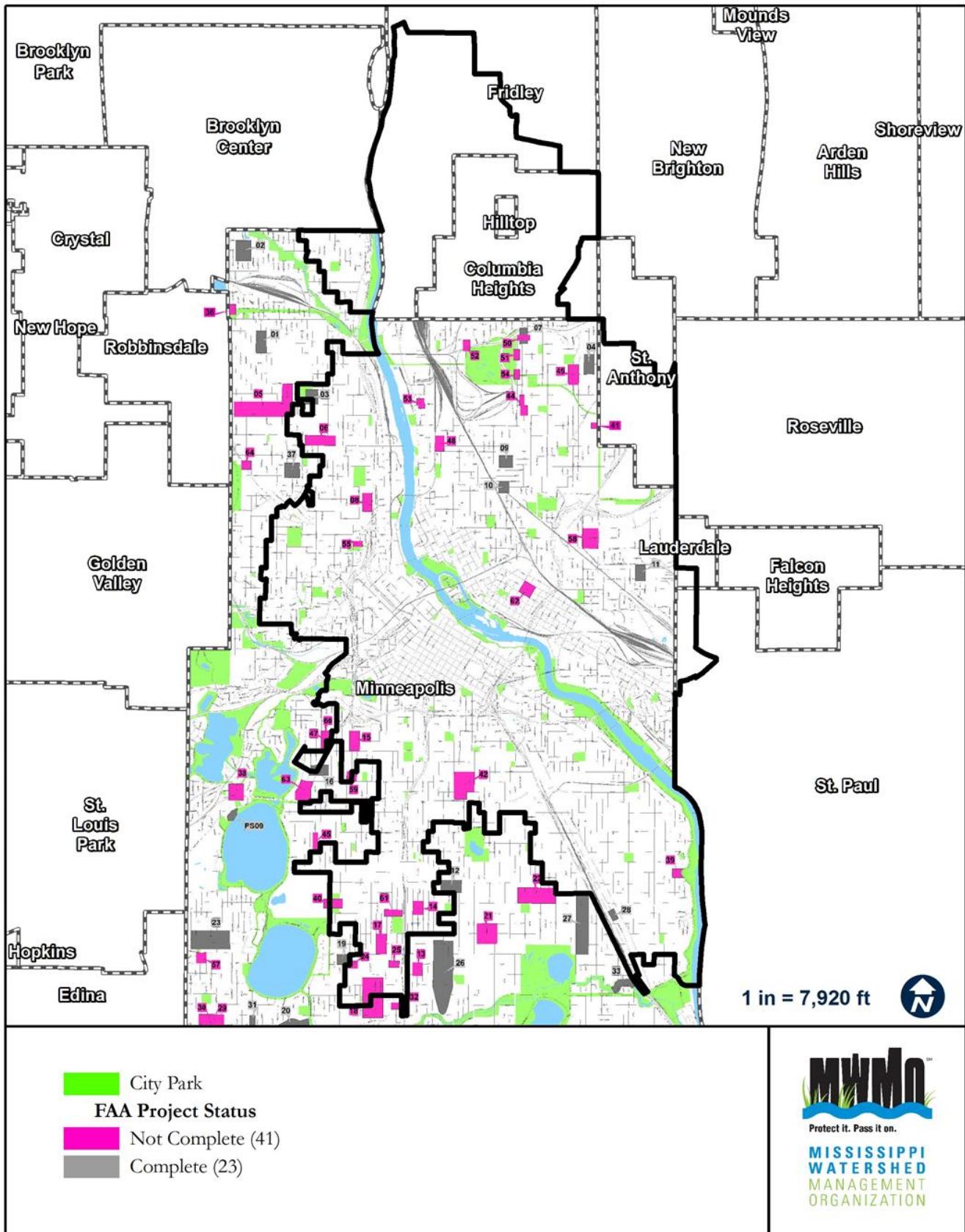
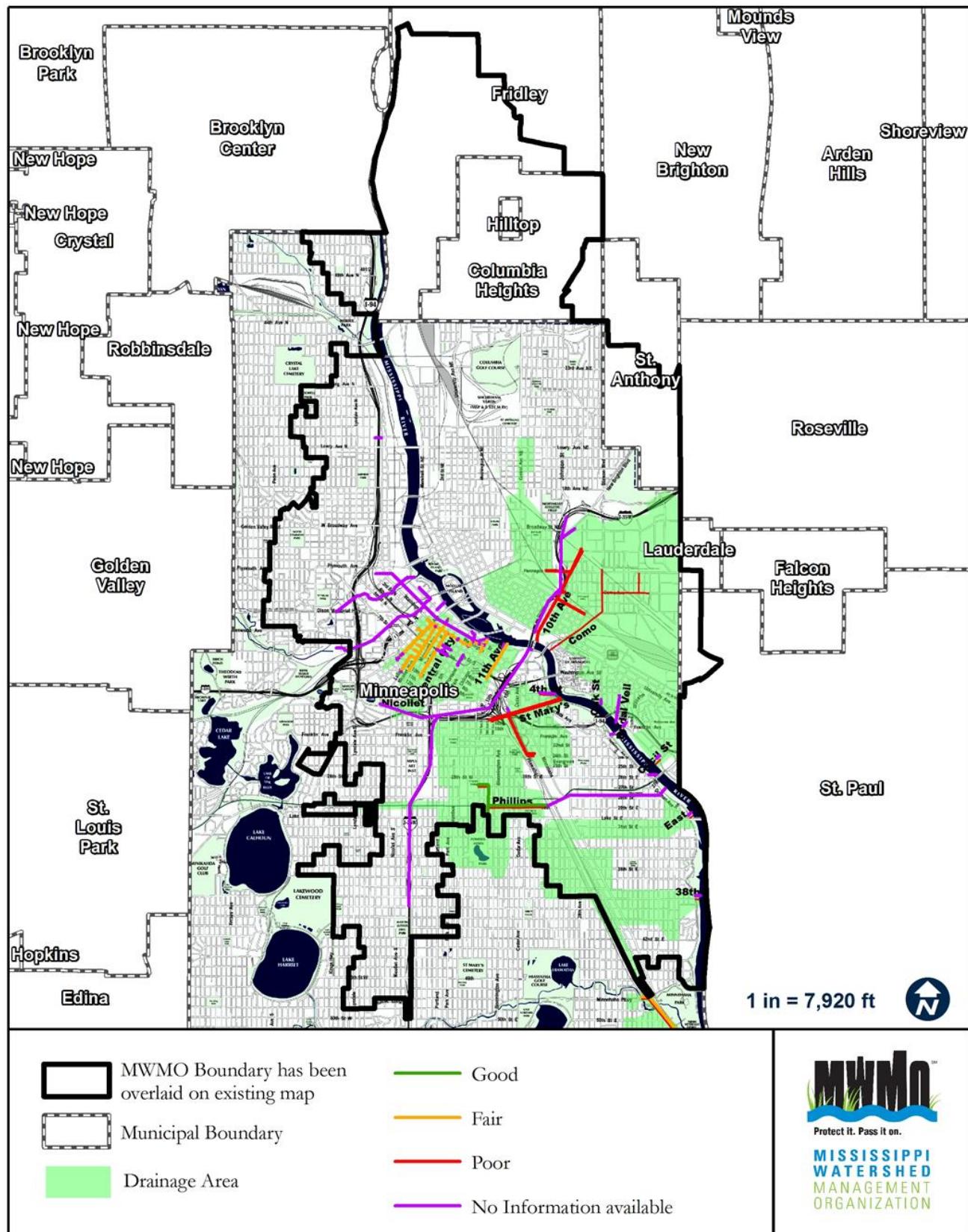


Figure 48: Minneapolis Storm Tunnel System – Tunnel Condition Ranking



#### **4.5.5. FLOODPLAIN AND SHORELAND**

##### **Floodplain**

Most floodplains in the Watershed are adjacent to the Mississippi River with the exception of a small zone affiliated with Bassett Creek on the west side and some small areas in the City of Columbia Heights. All floodplains are within the Cities of Fridley and Minneapolis. Current 100- and 500-year floodplains are illustrated in Figure 49. Flood insurance studies are completed by the Federal Emergency Management Agency in compliance with the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial National Flood Insurance Program Maps for the City of Minneapolis were completed in 1974. Initial Flood Insurance Rate Maps (FIRM) were completed in 1981. The most recent FIRM update in the Twin Cities metropolitan area was September 2, 2004.

By law, Minnesota's flood-prone communities are required to adopt floodplain management regulations when adequate technical information is available to identify floodplain areas and to participate in the National Flood Insurance Program. Participation in the National Flood Insurance Program is a commitment to administering and enforcing ordinances that are intended to keep people and structures reasonably safe from flooding and enables the people of Minnesota to insure themselves from future losses through the purchase of flood insurance.

When the FEMA maps are updated, as they were in 2004, the cities participating in the National Flood Insurance Program must adopt those new maps by the effective dates or FEMA suspends them. The maps are adopted by either adopting a new floodplain management ordinance, or amending an existing ordinance. State law requires that Department of Natural Resources approve the draft ordinance before they adopt it. All MWMO member cities participate in the National Flood Insurance Program and Columbia Heights, Fridley, Lauderdale, Minneapolis, Saint Paul, and Saint Anthony Village have approved floodplain ordinances.

##### **Shoreland Ordinances**

The Minnesota Department of Natural Resources administers the Shoreland Management Program. This program requires that local governments implement, administer, and enforce shoreland management standards through their planning and zoning controls. The shoreland rules were last revised in 1989. The Department of Natural Resources is currently developing draft rule revisions to the shoreland management standards. The current project schedule had preliminary rule revisions available in May 2009. Minneapolis is the only municipality within the MWMO with an approved shoreland ordinance.

#### **4.5.6. SURFACE WATER AND WATER QUALITY & QUANTITY MODELING**

Surface water and water quality and quantity modeling provides communities and organizations with the ability to identify flood-prone areas and test solutions, identify key areas for stormwater management practices implementation, and coordinate policy with those practices that have the most positive effect on the Watershed. In addition, models create a central database of hydrologic, hydraulic, and water quality information at many possible scales, from small subwatersheds to national drainage systems like the Mississippi River.

In 2014 and 2015, the MWMO will be working with member cities Minneapolis, Columbia Heights, Hilltop and Fridley on comprehensive water quantity (Hydrology and Hydraulic: H & H) and associated water quality model studies for areas covering Northeast Minneapolis, and portions of Columbia Heights, Hilltop and Fridley. In the years following, the MWMO will continue partnering with its member cities to complete H&H and water quality models across the remainder of the MWMO.

The MWMO has developed a hydraulic model of the Mississippi River from River Mile 860.4 (interstate 694) down to River Mile 847.7 (the Ford Dam), as a part of the MWMO's *A Guide to Bank Restoration Options for Large River Systems*

(MWMO, 2010). The study modeled shear stress and flood levels along the reach from 2yr to 500yr flood events to inform the potential for bioengineering restoration techniques along the Mississippi's riverbanks. Eventually this same modeling will be tied into stormwater discharge modeling of tunnels and pipes leading to the river.

The City of Minneapolis has initiated a citywide comprehensive modeling program that is planned for completion in 2017. The MWMO will partner with the city to develop models that can be used for a variety of purposes including flood mitigation and water quality assessments and solutions. In 2004, the City initiated a Storm Water Management Model calibration and standards study for the purpose of establishing standards for future modeling efforts in the City such that all models can ultimately be integrated. The result would be higher model accuracy and greater confidence in model results. SRF Consulting developed for the City a *Development Manual for SWMM Users* (City of Minneapolis Public Works Department, 2005). The Manual includes basic modeling standards, data sources, and processing requirements to be used by a variety of professionals for all Storm Water Management Models developed for the City. To date, the City of Minneapolis has modeled each of its deep storm tunnel systems under the 100-year, 24-hour event as an effort for the 2004 Storm Tunnel System Management Plan. The main findings were that most of the tunnels operate under surcharge conditions during this extreme event.

### **Intercommunity Flows Analysis**

79% of the MWMO's area is within Minneapolis. Roughly six square miles of drainage from Columbia Heights, Hilltop, St Anthony Village, St Paul, and Lauderdale cross over into Minneapolis and contribute to intercommunity flows. A central role for the MWMO is to understand and assist its member cities in managing the quality, rate, and volume of these intercommunity flows.

#### **4.5.7. GROUNDWATER RESOURCES**

The majority of the residents within the MWMO obtain their drinking water from the City of Minneapolis, which uses the Mississippi River as its primary water source. However, groundwater is also used to privately supply drinking water to organizations and businesses. It is also likely that there are private wells located within the MWMO supplying groundwater for drinking water or small irrigation uses that are not identified within existing databases. There are three aquifers of significance in the MWMO including the Quaternary water table, Saint Peter, and Prairie du Chien-Jordan. The proximity of the Quaternary water table aquifer to the land surface make the Quaternary water table aquifer susceptible to pollution, therefore it is not typically used for residential wells. However, many monitoring wells in the MWMO are set in the Quaternary water table aquifer.

Groundwater flow within the MWMO is locally toward lakes, springs, and wetlands and regionally toward the Mississippi River. The Metropolitan Council is in the process of updating a regional groundwater flow model for the entire Metropolitan Area (Twin Cities Metropolitan Groundwater Flow Model Version 2.00). This model is being developed in conjunction with the Metropolitan Council's Master Water Supply Plan. The model provides detailed information on current and future groundwater flow conditions in the Metro Area. This model may be relevant to understanding groundwater flow in the MWMO in the future.

Unconsolidated sediments in the MWMO can be generalized as a two-tiered system. The top tier is the unsaturated zone, sometimes referred to as the vadose zone. This zone is not continuously inundated with water. The vadose zone may become saturated after large precipitation or melting events, however the water within the zone either infiltrates to lower aquifers, moves laterally down gradient, is evaporated into the atmosphere, or is used through transpiration by plants.

The lower tier, which is fully saturated with water, is known as the saturated zone. The top of the saturated zone is the water table. Elevation of the water table fluctuates through time due to changes in climatic conditions and

groundwater withdrawal. Understanding regions where the vadose zone is seasonally greater than five feet deep aids in identifying regions where infiltration is a viable stormwater management practice.

Bedrock aquifers underlying unconsolidated deposits in the MWMO are typically used as groundwater sources. These deeper units typically offer better protection from contaminants and typically offer better water yield. The Saint Peter aquifer is the first bedrock aquifer that is sometimes used in the MWMO. It is confined in some areas by the Platteville-Glenwood Formations and unconfined in areas where these confining layers have eroded away. Flow in this unit is toward the Mississippi River. This aquifer does not provide for a significant source of water in the MWMO. It is used locally for domestic supply and other low-capacity uses.

The Prairie du Chien-Jordan aquifer system, or a combination of aquifers including the Prairie du Chien-Jordan, provides for most of the groundwater uses in the MWMO. This aquifer is somewhat confined on the top by the shaly base of the Saint Peter Sandstone and on the bottom by the Saint Lawrence confining unit. This aquifer has a total thickness between 120 and 130 feet. Flow in this unit is toward the Mississippi River. The Prairie du Chien-Jordan aquifer has been subject to large withdrawls by industrial, municipal, and commercial uses which have lowered the water level by almost 50 feet since the initial use of the aquifer in the 1880s.

### **Groundwater Sensitivity and Protection**

Groundwater analysis is important for both the quality and quantity of municipally utilized water. Groundwater uses throughout the MWMO described in Section 2.4.6 make it necessary to monitor this resource for quality and quantity.

Figure 50 shows the sensitivity of the shallow groundwater aquifers to pollution. The groundwater's susceptibility was determined by a methodology developed by the Minnesota Geological Survey. The ratings are based on the ability of the geological material to absorb contaminants, attenuate contaminants, change the contaminant to a benign substance, and the rate at which the aquifer transmits contaminated water.

Both Ramsey and Hennepin Counties have published draft county groundwater protection plans. The 2009 Draft *Ramsey County Groundwater Plan* presents a comprehensive overview of the surficial and geologic features, and it provides the county's assessment of the groundwater resources. This plan uses maps and tables to show locations of contaminated sites, wellhead protection areas, and sensitive geologic areas. Similarly, the *Draft Hennepin County Groundwater Plan* contains information on geologic features, areas of special groundwater protection needs, and strategies to protect groundwater resources that can be implemented by local government units. Anoka County has prepared a groundwater protection assessment.

### **Source Water Assessment and Wellhead Protection**

The Source Water Assessment Program administered by the Minnesota Department of Health develops source water assessments for all public water supplies within the state. A source water assessment provides basic information regarding a public water supply, including the water supply's susceptibility to contamination, and is a requirement of the 1986 amendments to the federal Safe Drinking Water Act. A source water assessment area is typically mapped to show the land area over which wellhead protection measures should be taken to protect the water supply from contamination. There are currently no mapped source water assessment area within the MWMO (Figure 51).

Some public water suppliers are required to develop a detailed wellhead protection plan; others are required to implement wellhead protection measures within a specific area surrounding their well(s). There are currently four delineated wellhead protection areas that overlap the political jurisdiction of the MWMO. These mapped areas are regions where the Cities of Fridley, New Brighton, Richfield and Saint Anthony Village's Well Head Protection Areas overlap the MWMO political jurisdiction.

Figure 49: FEMA Designated Flood Plains in the MWMO

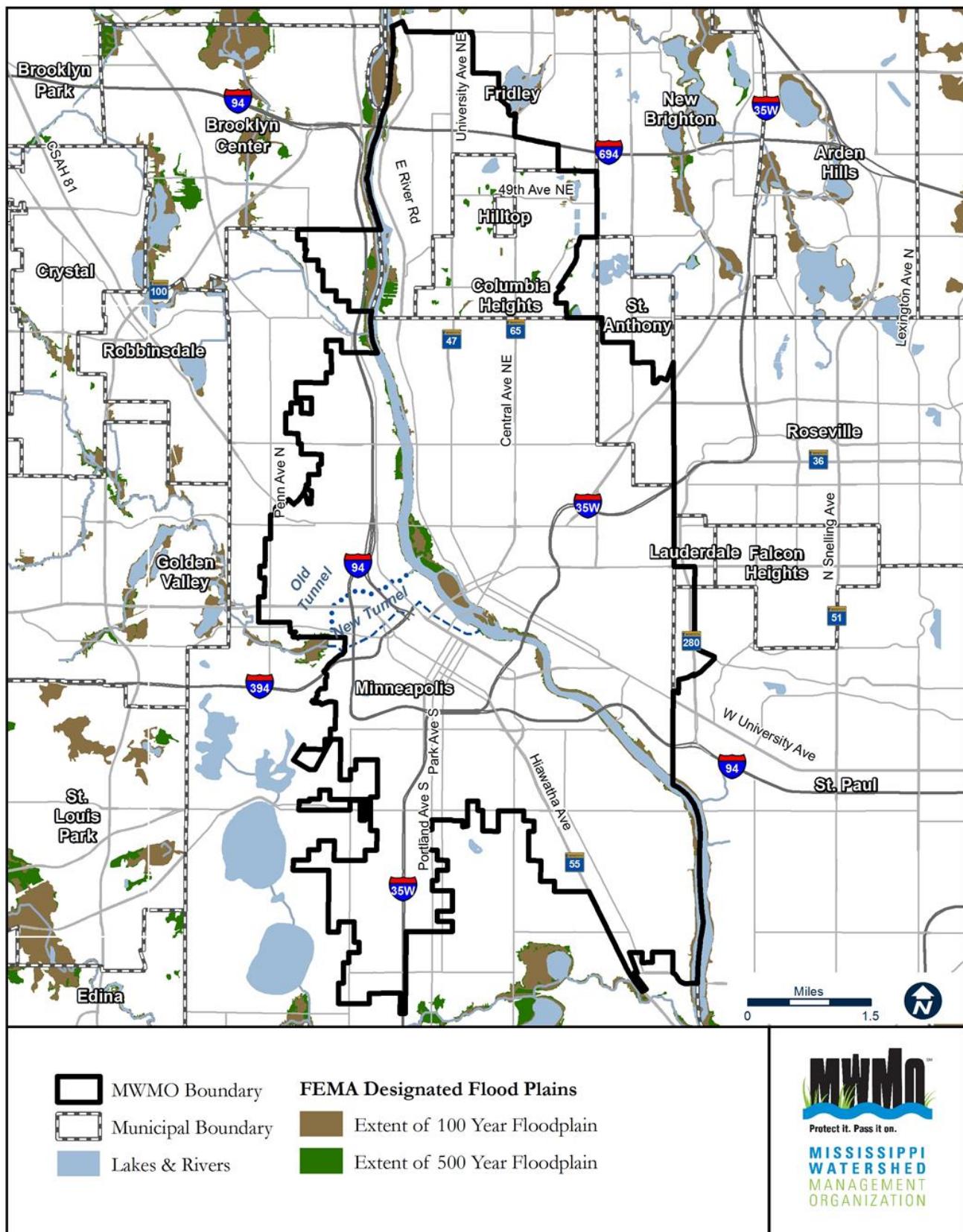


Figure 50: Groundwater Sensitivity of the MWMO

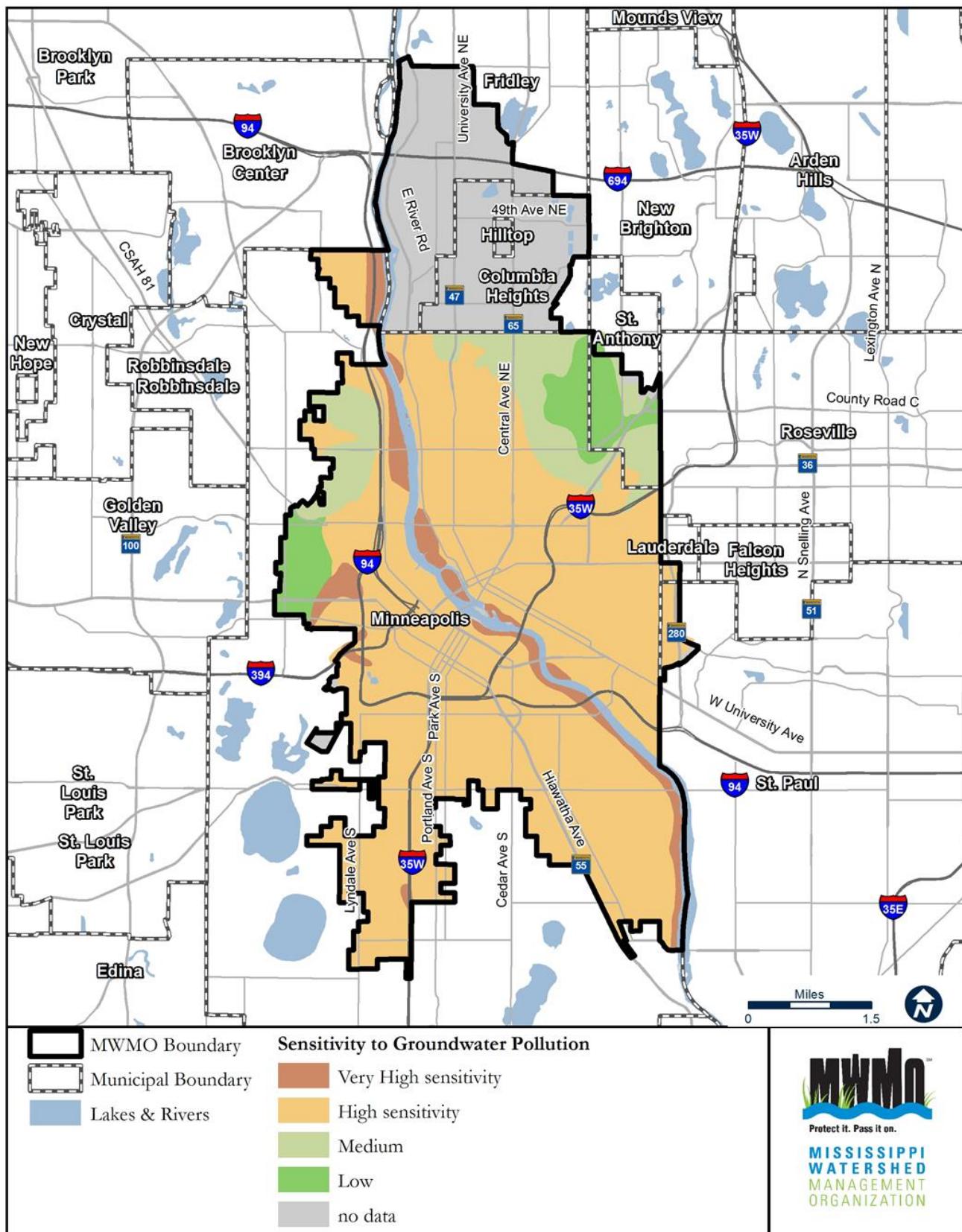
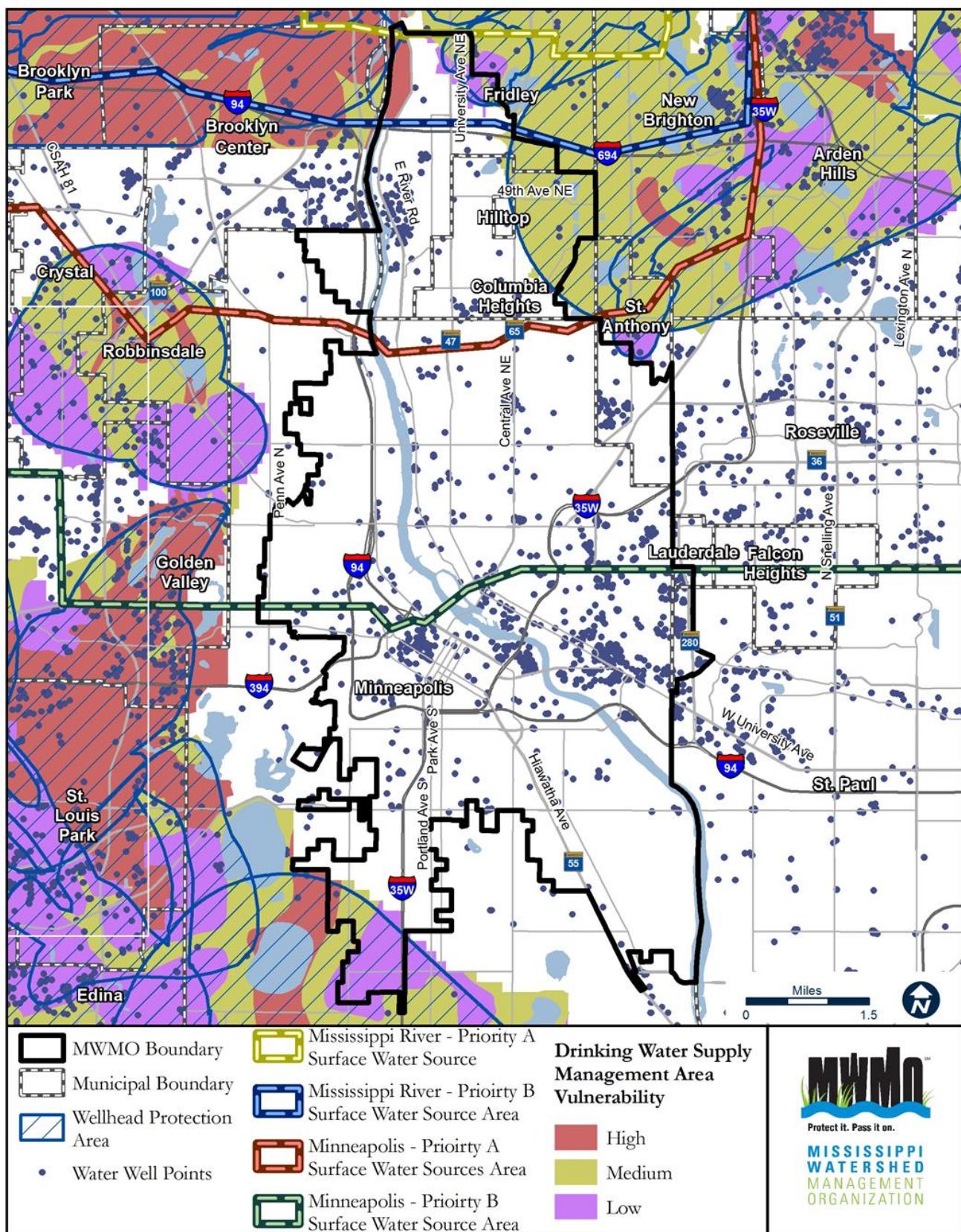


Figure 51: Groundwater Management Areas of the MWMO



#### **4.5.8. MONITORING**

Water quantity and quality monitoring is valuable for a direct analysis of the status of the Watershed. These data are also important for hydrologic and water quality modeling in order to improve the accuracy and ultimate value of the model. The MWMO is highly involved in monitoring throughout the Watershed. Due to the density of the area, the multiple layers of governance and the iconic nature of the Mississippi River, many other organizations are also monitoring the waters of the MWMO.

The MWMO is implementing a Monitoring Program that includes seven sites along its portion of the Mississippi River, five stormwater outfall sites as they discharge to the Mississippi River, , one jurisdictional boundary site between Saint Anthony Village and Minneapolis, and three sites in the Kasota Ponds (including Mallard Marsh) (Appendix N). See Figure 52 for monitoring locations.

The goal of the Monitoring Program is to establish baseline water quantity and quality data that can be used for the management of outfalls and receiving waters. Precipitation is recorded at one outfall site, at the jurisdictional boundary site between Saint Anthony Village and Minneapolis, at the MWMO headquarters, and at three other locations in Northeast Minneapolis and Columbia Heights. Water level and stage is recorded at all of the monitoring sites. At the Mississippi River sites, water quality data includes fecal coliform, *E. coli*, dissolved oxygen, pH, transparency, salinity, and specific conductivity. At the stormwater outfalls, water quality data includes the parameters previously mentioned, as well as nutrients, sediment, inorganics, organics, and metals. Flow is also measured at four of the five stormwater outfalls. Site descriptions and monitoring results can be found in Annual Monitoring Reports at [www.mwmo.org](http://www.mwmo.org).

Future monitoring will expand to additional MWMO wetlands and waterbodies, jurisdictional boundaries, and representative outfalls of each subwatershed. Figure 46 identifies the subwatershed and jurisdictional boundary framework which will be used for locating future monitoring activities.

In 2006, the MWMO developed plans to better achieve its responsibility for monitoring water quality in the Mississippi River. *The MWMO Big River Study* (MWMO, EOR and SCWRS, 2008) is a literature review on the topics of hydraulic mixing in large river systems and appropriate monitoring protocols for them. The report assessed mixing processes in big rivers and the big river characteristics that affect mixing, delineated the hydraulic mixing reaches of the Mississippi River within the MWMO, and described the big river characteristics that influence mixing in each reach. Part two of this study will develop a monitoring methodology appropriate for the Mississippi River as it passes through the MWMO.

#### **4.5.9. DISCUSSION OF CHALLENGES, GAPS, AND NEXT STEPS**

To date the MWMO has reviewed all monitoring activities occurring in the Watershed and is identifying efficient ways to address gaps in monitoring, while avoiding duplication of any existing monitoring efforts. Specific partnerships and coordinated efforts include working with MPCA on Total Maximum Daily Load studies, member cities on interjurisdictional flows, and the City of Minneapolis on system-wide illicit discharge detections. The MWMO also partners with the University of Minnesota Saint Anthony Falls Laboratory to collect real-time data from stormwater monitoring sites. The MWMO should continue to develop local and regional partnerships that coordinate and unify multi-organization monitoring goals.

Many forces come to bear on the Mississippi River as it passes through the MWMO's urban watershed. Protecting the Mississippi River Corridor Critical Area should be a part of the MWMO's strategy for maintaining the health of the Mississippi River.

The MWMO conducted a function and value assessment of wetlands. The MWMO recognizes that member communities may place differing value and priorities on each wetland function depending on their own policies, values, and goals. As such, this assessment should be followed up with a cooperative effort among its members to classify allowable uses for each wetland identified and draft a model buffer zone ordinance.

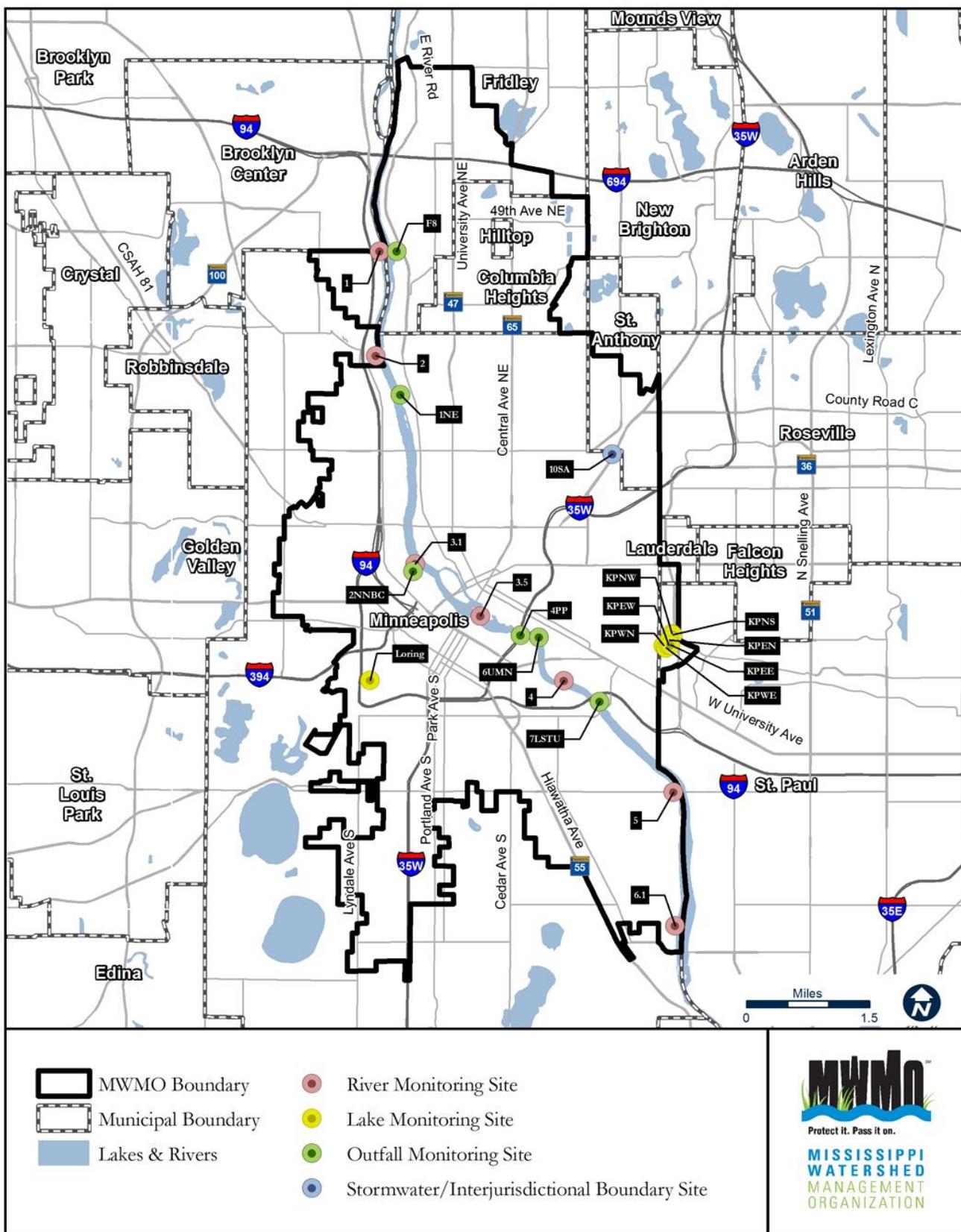
In the future MWMO capital projects and programmatic efforts will be tied to subwatershed management units identified in Figure 39. The MWMO should identify priority water resource project areas and contamination hot spots to inform future MWMO and member organizations' capital projects and programmatic activities.

The MWMO should expand its monitoring efforts to characterize loading within each subwatershed identified in Figure 39 and to gather information on interjurisdictional flows. Before expanding its monitoring efforts on the Mississippi River, the MWMO should develop Mississippi River monitoring protocols that account for pollutant mixing and result in the collection of reliable and accurate water quality data.

MWMO needs to understand pollutant mixing on two levels for the Mississippi River. First, in order to adequately address public health issues around Total Maximum Daily Loads for bacteria (*E. coli*), a big river sampling methodology that accurately measures existing pollutant loads in the river needs to be developed. Second, outfall discharges and their related zones of mixing need to be better defined in order to adequately address water security issues related to source water protection. The MWMO should seek out broader regional partnerships or funding to accomplish both of these studies. These studies exemplify the type of assessments the MWMO will need to complete to more accurately monitor and evaluate the impact specific programmatic efforts and capital improvements are having on the Mississippi River.

From its start in 2004, the MWMO's monitoring program has focused on gathering reliable flow-weighted data that can be used for long-term loading and trend analysis. Difficult site conditions and limited staffing resources have limited the growth of the program and the amount of consistent reliable data gathered. Currently, data collected is reported in the MWMO's Annual Monitoring Reports and loading analysis is underway.

Figure 52: Monitoring Locations of the MWMO



## 5.0 WATERSHED ISSUES, GOALS, STRATEGIES, AND ACTIONS

This section identifies actions that will guide MWMO activities over the next ten years. The section starts with a discussion of key partnerships the MWMO will seek out to leverage funding and other organizational resources. Next are a series of narratives that describe shared elements which affect or govern the implementation of actions within each focus area. This is followed by a description of the MWMO's financials as they relate to Figure 53, a pie chart of MWMO programmatic activities, and Table 19, MWMO's Capital Improvement Schedule. Finally, The MWMO's Ten Year Implementation Schedule (Table 20) provides detailed timeframes, relative program areas, and potential partnerships for each action listed.

The MWMO will seek out partners and leverage funding whenever possible to carry out the focus area activities or action items presented in Implementatlon Table 20. Actions in Table 20 were derived from MWMO staff, the public, government agencies, non-governmental organizations, and MWMO municipal partners via public meetings, surveys, and focus groups (see Appendices H and O for details).

Partners may be member organizations, other government agencies, organizations such as nonprofits, as well as residents and other stakeholders. Table 18 outlines key partnership opportunities the MWMO has with other governmental organizations who conduct work in support of water resource issues.

**Table 18: Potential Water Resource Project Partners**

Source	Agency/ Organization	Mission/Activities
Federal	Environmental Protection Agency	Implement Clean Water Act by requiring states to monitor waters, conduct TMDL studies, and regulate certain activities affecting wetlands, lakes, and rivers. Provides research assistance to state and federal agencies and requires state programs to meet or exceed federal standards. Provides water quality improvement project funding (319 Program).
	Natural Resources Conservation Service	Delivers soil and water conservation programs on agricultural lands. Provides financial assistance for many conservation activities and conservation technical assistance to land-users, communities, and units of state and local government. Oversees the Resource Conservation and Development Program.
	United States Army Corps of Engineers	Oversees Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. Oversees dredging, filling, and dam maintenance activities in waters of the United States.
	United States Geological Survey	Provides water information that benefits citizens, including publications, data, maps, and applications software. Oversees and conducts research and data acquisition on ground and surface water resources.
	National Park Service	Oversees the Mississippi National River and Recreation Area.

Source	Agency/ Organization	Mission/Activities
State	Minnesota Pollution Control Agency	Protects, improves, and conserves water quality. Oversees wastewater and stormwater permitting, septic systems, impaired waters (Total Maximum Daily Load) projects, surface water monitoring, groundwater monitoring, and the state administration of the Clean Water Act mandates and state and federal water funds.
	Minnesota Department of Natural Resources	Manages the conservation and use of natural resources. Oversees public waters permits, invasive species, groundwater monitoring, water resource mapping, water appropriations, dam safety, flood damage, lake and stream hydrology, and shoreland management.
	Minnesota Department of Agriculture	Regulates fertilizers, pesticides, and soil and plant amendments, Minnesota Pesticide Control Act and Agriculture Best Management Practices Loan Program. Monitors waters for pesticides.
	Minnesota Department of Health	Prevents environmentally-induced disease. Oversees the Safe Water Drinking Act, health-based standards setting and groundwater well sealing.
	Environmental Quality Board	Coordinates state water management activities and the development of broad water policy recommendations. Oversees environmental review process, conducts period water quality and quantity trends assessments and reports, coordinates overall state water policy.
	Board of Water and Soil Resources	Improves and protects Minnesota's water and soil resources. Works in partnership with local organizations on private lands. Oversees the Wetland Conservation Act. Provides watershed district and watershed management organization oversight, local water planning, erosion control and water quality cost share. Administers conservation easements. Evaluates outcomes and performance of local water management.
Regional	Minnesota Geological Survey	Conducts mapping, research, and education on wells, hydrologic properties, and groundwater monitoring. Maintains statewide database on well records. Collects geophysical logs, maps ground water, identifies recharge areas, recharge rates, and sustainable yields.
	Metropolitan Council	Monitors metro area lakes and rivers, provides funding to local park services and runs a Citizens Assisted Monitoring Program. In cooperation with local communities, oversees a comprehensive regional planning framework focusing on wastewater, transportation, and park systems that guides the efficient growth of the metropolitan area. The Council operates wastewater and transit services and administers housing and other grant programs.
	Counties: Hennepin, Anoka and Ramsey	General-purpose unit of government approach to water. Has a major funding role with Soil and Water Conservation Districts. Administers shoreland and land use regulations that guide property development. Manages the local water plan by identifying problems and providing for development. Regulates wetlands, manages large tracts of public lands.

Source	Agency/ Organization	Mission/Activities
Local	Minneapolis Parks and Recreation Board	Governs, maintains, and develops the Minneapolis park system. Preserves, protects, maintains, improves, and enhances its natural resources, parkland, and recreational opportunities. Provides places and recreational opportunities for all people to gather, celebrate, contemplate, and engage in activities that promote health, well-being, community, and the environment.
	Soil and Water Conservation Districts	Political subdivisions governed by a board of elected supervisors. Work cooperatively with the public, nonprofit organizations, and governmental entities in protecting water and land resources through the use of conservation practices. Provide local leadership for the prudent use and conservation of water, soil, and associated resources.
	Watershed Management Organizations	Prepare and implement comprehensive surface water management plans and work cooperatively with each other, the state, counties, cities, and soil and water conservation districts to achieve water quality, water quantity, and natural resource preservation and improvement.
	Watershed Districts	Local government units that work to solve and prevent water-related problems. The boundaries generally follow those of watersheds and cross multiple jurisdictions. Watershed Districts have broad authorities including adopting rules, hiring staff and contracting with consultants, levying taxes, accepting grant funds, acquiring property and drainage systems and entering upon lands. In addition, Watershed Districts can act in coordination with each other, the state, counties, cities, and soil and water conservation districts to achieve goals.
	Cities: Minneapolis, Saint Paul, Fridley Columbia Heights, Hilltop, Lauderdale, and Saint Anthony Village	Water suppliers that utilize Mississippi River as at least a partial water source; owners of storm sewer systems; plan, direct, coordinate, and evaluate all planning and zoning activities. Holders of National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System permits and usually the primary implementers of Total Maximum Daily Load wasteload allocation strategies.
	Public at Large	Individuals, University of Minnesota, other universities and colleges, non-governmental organizations, and neighborhoods work to improve their communities and to protect and improve the natural resources and human resources of the area.

Based on a thorough and comprehensive public involvement process detailed in Appendix M, the MWMO developed a set of focus statements and corresponding goals and strategies for the management of the water and natural resources in the Watershed. They sought input from the public, government agencies, non-governmental organizations, and its municipal partners via public meetings, surveys, and focus groups. Over 1,000 comments were collected during the issues identification phase of the plan development process. Appendix M includes a complete list of the comments, the source of each comment, and indicates how comments were incorporated into the plan. Comments received on the Plan during the formal review process are included in Appendix O.

Ten Watershed focus areas were identified through this process:

- Water Quality (WQ)
- Water Rate and Volume (WRV)
- Monitoring and Data Assessment (MD)
- Communication and Outreach (CO)
- Ecosystem Health (EH)
- Regulations and Enforcement (RE)
- Urban Stormwater Management (USM)
- Emergency Preparedness and Response (ER)
- Emerging Issues (EI)
- Financial Responsibilities and Strategies (FRS)

The focus statements, goals, strategies, and actions found in Implementation Table 20 are the direct result of these ten focus areas. The MWMO will develop its staff and expertise as necessary to implement activities resulting from the goals and strategies of each focus area described in this section.

## 5.1. Focus Area: Water Quality (WQ)

### Purpose

Initiatives implemented within this focus area will protect, maintain, or improve the water quality of the Mississippi River and the other water resources within the MWMO.

### Challenges

One of the primary challenges the MWMO faces in implementing water quality improvements is the regional nature of the water quality issues facing the Mississippi River, the major water resource within the MWMO. The water quality of the Mississippi River is affected by actions far beyond the boundaries of the MWMO, making coordination with upstream groups necessary to improve the water quality of the river.

Additional challenges regarding water quality include the urban and highly-developed condition of the Watershed. The extent of impervious surface and the high population density can both limit and facilitate implementation opportunities. Water resources that remain in the MWMO have more intensive and varied roles to fulfill including recreational activities, natural habitat, and open space amenities. Work done to improve water quality in the MWMO will help meet these roles.

### Target Audiences

The primary target audiences for water quality implementation initiatives are entities holding land rights, land use controls, and regulatory controls for water resources within the MWMO and their associated headwaters as well as those partaking in any use of the resources within the Watershed.

### Indicators and Measures of Performance

An indicator of successful implementation will be a long-term water quality trend that is on course to attain required pollutant reductions and notable improvements in the aquatic ecosystem. An evaluation of the trend in water quality parameters at points of discharge into the Mississippi River will be conducted every 5 years at a minimum. For all other waterbodies, resource specific evaluations will be conducted.

## **MWMO Daily Activities**

The MWMO regularly engages in funding infrastructure improvements, sharing data with stakeholders, informing citizens of water quality improvement practices, and implementing effective training programs to reduce pollution within the Watershed. The MWMO also takes a leadership position in coordinating Total Maximum Daily Loads of pollutants entering the Watershed.

### **5.2. Focus Area: Water rate and volume (WRV)**

#### **Purpose**

Implementation of Water Rate and Volume initiatives will protect downstream resources from the impacts of high stormwater runoff volumes, limit the frequency at which flood damage occurs, and reduce the severity and frequency of drought-like conditions. Volume controls promote practices such as green infrastructure, stormwater infiltration, and water harvesting for irrigation. These types of techniques collect stormwater runoff where it falls and use it (infiltrate it) where it falls tempering the effects of drought-like conditions.

#### **Challenges**

The MWMO's main challenge when addressing stormwater runoff volumes, flooding, and drought concerns is integrating structural solutions into the existing infrastructure of the MWMO member communities that address local flooding and drought issues in a manner that does not increase flooding of downstream communities.

#### **Target Audiences**

The primary target audience for Water Rate and Volume implementation initiatives is the member organizations that can implement land use controls and standards and partner on capital improvement projects in order to limit stormwater runoff volumes and reduce the occurrence of flooding and drought-related damages.

#### **Indicators and Measures of Performance**

Change the rate of stormwater discharging into the Mississippi River and reduce the number and extent of damages to habitat and infrastructure resulting from flooding or drought.

#### **MWMO Daily Activities**

Water Rate and Volume activities of the MWMO stem from a watershed wide versus a single site management perspective. The MWMO's efforts to manage flooding and drought are on a watershed wide scale, where changes in the hydrology of an upstream community improve the hydrology of downstream communities. MWMO staff will continue to review and attend agency led planning activities and water resource related, meetings, events, trainings, and conferences that address this perspective.

Two water quantity management approaches espoused by the MWMO are: identifying joint actions that complement stormwater management and water supply efforts and using our knowledge of the historical hydrology to complement flood and drought projects in the Watershed. For the latter approach, the MWMO will assist member organizations in developing policies and programs that promote structural and nonstructural practices for managing hydrology. These efforts will promote storage, reuse, or infiltration of rainfall or other forms of precipitation at its point of impact to slow down or eliminate its discharge to downstream communities and water resources.

### **5.3. Focus Area: Monitoring and data assessment (MD)**

#### **Purpose**

Implementation of Monitoring and Data Assessment initiatives continue to assemble the best scientific data to inform water resource decision making and to identify successful implementation of stormwater management practices based on water quality and quantity trends.

#### **Challenges**

Challenges include identifying monitoring methodologies and locations appropriate for the varying hydraulic and hydrologic conditions and pollutant mixing occurring within the MWMO's reach of the Mississippi River. Damaging conditions resulting from the hydraulics and size of the urban stormwater pipeshed as well as vandalism can limit available monitoring station locations and corrupt data collected. The bluff landscape along the Mississippi River also limits access to stormwater pipes, some of which are located greater than fifty feet below the land surface.

#### **Target Audiences**

The target audiences for Monitoring and Data Assessment implementation initiatives are MWMO's member communities as well as local and statewide entities already conducting monitoring initiatives. The data are publically available through the Minnesota Pollution Control Agency's "EQuIS" database.

#### **Indicators and Measures of Performance**

The measure of performance is an increasing length of accurate and usable data records. Ultimately, having sufficient data to guide water resource management indicates success.

#### **MWMO Daily Activities**

The MWMO coordinates and develops partnerships with other organizations and agencies to effectively gather and assemble the highest quality monitoring data available for the Watershed's resources. Monitoring and data assessment activities provide the MWMO with a feedback loop of information on the state of the water resources in the Watershed. Once analyzed, data results are used to assess the effectiveness of existing MWMO Standards and to inform the prioritization of future MWMO projects and activities. Monitoring and data assessment activities of the MWMO are a cornerstone of the organization for determining progress made in improving water resources as well as identifying areas within the Watershed with the greatest potential for improvement.

### **5.4. Focus Area: Communications and outreach (CO)**

#### **Purpose**

Implementation of Communication and Outreach initiatives will increase citizen awareness of water resource issues and communicate the value of resource stewardship so that citizen action positively impacts MWMO water and natural resources.

#### **Challenges**

The MWMO's main challenge when conducting communication and outreach is the urban culture and population density of the Watershed. Urban populations historically have less exposure to the role and value of water and natural resources. The diversity of communities within the MWMO also challenges communicating the value of water and natural resources across cultures.

## **Target Audiences**

The primary target audiences for Communication and Outreach initiatives are the policy and decision makers, constituents, and workers within the MWMO as well as those partaking of any use of the resources within the Watershed.

## **Indicators and Measures of Performance**

The main performance indicator is extent of citizen awareness and stewardship as measured by public opinion surveys and participation in MWMO activities.

## **MWMO Daily Activities**

The MWMO's communication and outreach efforts are both internal and external in nature and are a part of all staff's general responsibilities. Internally, communication and outreach elements are considered for all projects or activities being carried out by MWMO staff. Identification of which audiences are relevant to what projects and anticipating the need to develop supporting materials, provide language translators, and honor non mainstream communications is a norm. In addition, all staff members provide information on the MWMO's daily activities to the MWMO Board and committee members, as well as outside professional and layman audiences.

External outreach and communication occurs on a variety of levels from assuring that statements about the MWMO are clear and differentiate the MWMO from other local water-related groups to articulating the connections between resources and design standards in professional settings. The MWMO also plans for and develops materials that are able to be understood by a broad audience and is willing to respond to requests by the public for assistance in understanding data and complex issues. Finally, the MWMO has made significant inroads in developing ongoing and responsive relationships with key stakeholders and leaders from diverse communities within the Watershed.

## **5.5. Focus Area: Ecosystem Health (EH)**

### **Purpose**

Implementation of Ecosystem Health initiatives will protect, create, and enhance vegetated areas, native plant communities, habitat, open space, and public infrastructure.

### **Challenges**

The MWMO's challenge in implementing ecosystem health initiatives is the extent of development and contaminated soils within the fully urbanized Watershed. This raises the cost of land acquisition and exacerbates balancing the cost benefits of improving water and natural resource quality with existing land use and availability.

### **Target Audiences**

The target audiences for Ecosystem Health initiatives are citizens and landowners who can help protect and restore ecosystem health. This includes member organizations and public land-use authorities who have jurisdiction over public lands, as well as permitting entities, private developers, and landowners who make landform and landscaping decisions.

### **Indicators and Measures of Performance**

Increased ecosystem connectivity and an increase in key environmental health parameters (e.g. vegetation and wildlife), will indicate successful implementation.

## **MWMO Daily Activities**

The MWMO continues to encourage the integration of ecosystem health throughout land use decision making processes. Ecosystem management needs to be considered in land use and infrastructure planning, operation, and management activities.

The MWMO encourages member organizations and other entities to develop management plans for public lands within the Watershed that: use easements, buffers, land conservation, and native plantings to restore and protect natural areas and aquatic habitat; create greenway systems to provide open space, recreational opportunities, and stormwater management; and promote ecosystem benefits through existing regulatory and permitting processes.

Land conservation is another tool the MWMO utilizes to establish and maintain ecosystem health in the Watershed. The high cost of land and the optimal mix of land use within the urban core are some of the factors the MWMO considers in balancing the economic reasonableness and ecosystem health benefits associated with new land purchases. The MWMO is committed to leveraging its land acquisition funds and avoiding duplication of acquisition activities by careful evaluation of the ultimate intent of those engaged in the purchase and/or use of the acquired land and the relationship those owner(s)/purchaser(s) will have in the land in the future.

## **5.6. Focus Area: Regulations and enforcement (RE)**

### **Purpose**

Implementation of Regulations and Enforcement initiatives will promote consistency across jurisdictions in the standards, compliance and enforcement of regulations for the protection and improvement of water and natural resources.

### **Challenges**

MWMO will need to work with member organizations to be sure they have the necessary resources and controls to implement and enforce the MWMO's Standards. A variety of site conditions such as poorly drained or contaminated soils could limit the stormwater management practices available to the contractor, increasing the cost of meeting the standards.

### **Target Audiences**

The target audience for Regulations and Enforcement initiatives include member organizations and local units of government who regulate water resources and stormwater management. Stakeholders and workgroups within the MWMO who can effectively evaluate water resources standards, rules, and regulations and associated enforcement activity are also targeted.

### **Indicators and Measures of Performance**

One measure of performance is an increase in the consistency across jurisdictions in the application of standards and compliance and enforcement of regulations. A long-term reduction in pollutant loads entering and exiting MWMO waterbodies is another measure of performance.

### **MWMO Daily Activities**

The MWMO recognizes the need to establish standards in the Watershed that will maintain and improve water resources within the MWMO while at the same time limiting the new costs to those regulated.

As such, the MWMO is willing to provide some of the additional resources needed by member organizations and state agencies to improve compliance with MWMO Standards and other regulations. They also are willing to improve

water resource-related enforcement efforts in the Watershed. This includes but is not limited to assistance with Total Maximum Daily Loads, non-degradation, National Pollutant Discharge Elimination System (NPDES), general construction and industrial permits, Stormwater Pollution Prevention Plans (SWPPP), and so on. Finally, where site conditions create limitations for managing water, the MWMO Standards language (see 3.1.3 The MWMO's Standards Language and Appendix D) provides options for achieving the standards while maintaining the goals of the MWMO.

## 5.7. Focus Area: Urban Stormwater Management (USM)

### Purpose

Implementation of Urban Stormwater Management initiatives will promote unique and effective stormwater solutions to address the highly-developed urban condition of the Watershed.

### Challenges

The urban and highly-developed nature of the Watershed demands innovation in stormwater management. The MWMO has a three-pronged challenge: first to implement and encourage regulators to allow for innovative urban stormwater management practices; second, to retrofit solutions to existing infrastructure; and third, dealing with contaminated or compacted soils from historic land uses. The extent of impervious surfaces and the high population density within the Watershed are simultaneously a barrier to innovation and an opportunity for gaining support and recognition for highly visible projects.

### Target Audiences

The target audiences for Urban Stormwater Management initiatives are the member organizations who can modify existing land use regulations and building codes to allow for new stormwater management, and stakeholders and other entities that are willing to collaborate on the design and implementation of unique stormwater management solutions.

### Indicators and Measures of Performance

The installation of innovative projects by a variety of entities is the performance measure.

### MWMO Daily Activities

The MWMO will continue to advance discussions about stormwater management needs to the start of planning and development processes. Incorporating strategies that create multifunctional corridors, consider lifecycle costs, slow runoff, and increase filtration and infiltration of stormwater are all best served at the front end of the planning and development processes. This shift in process will go a long way toward maximizing stormwater treatment potential at the lowest possible cost to member cities and developers (Appendix N).

## 5.8. Focus Area: Emergency Preparedness and response (ER)

### Purpose

Implementation of Emergency Preparedness and Response initiatives will prepare the MWMO and member organizations to protect water and natural resources in the event of an emergency that threatens the health and function of these resources, and assist them in alleviating damages to resources from emergencies.

### Challenges

The MWMO's challenge in being prepared for emergencies is the inherent unpredictability of the type and timing of emergencies. There may also be challenges among the public and existing emergency response agencies given that

these emergency preparedness and response initiatives represent a change from the historical role the MWMO has played in this arena.

### **Target Audiences**

Target audiences for Emergency Preparedness and Response initiatives include MWMO staff and member organizations who can implement emergency response activities, as well as emergency response officials from local, state, and federal agencies who can effectively protect water and natural resources.

### **Indicators and Measures of Performance**

The measure of performance is the demonstrated preparedness and response to future emergencies that threaten water and natural resources in the Watershed.

### **MWMO Daily Activities**

The MWMO will take proactive steps to adopt protection strategies that protect and minimize the effects of natural disasters and emergencies on water and natural resources. Two initial steps will be (1) to identify any gaps in the protection of water and natural resources during natural disasters and emergencies and (2) assisting member organizations in understanding the stormwater drainage system within the Watershed.

To date the MWMO has identified a need for water quality monitoring in the river when disasters occur as well as working with the cities to develop a more robust model of the stormwater drainage system that has better data on the potential sources of harmful pollutants.

## **5.9. Focus Area: Emerging Issues (EI)**

### **Purpose**

Implementation of Emerging Issues initiatives will both develop awareness of and address changing conditions in order to protect water and natural resources.

### **Challenges**

The MWMO's main challenge is the inherent newness of emerging issues. This compounds the difficulty of anticipating and identifying potential impacts to water and natural resources, and possible solutions to these impacts.

### **Target Audiences**

The primary target audience for emerging issues implementation initiatives is MWMO staff and stakeholders with input on key emerging issues.

### **Indicators and Measures of Performance**

The performance measure is the retrospective evaluation of how emerging issues were handled, the identification of secondary effects avoided, and the perceived preparedness for future changes in conditions.

### **MWMO Daily Activities**

The MWMO will continue to foster a culture of proactive stormwater management, innovation, and learning within, adjacent to, and beyond the Watershed. The MWMO may take leadership roles in policy coordination, grassroots movements, technical advisory committees, steering committees, and think tanks that encourage the development and use of new and innovative infrastructure systems, communication processes, and programmatic initiatives that will address existing and emerging issues in the Watershed.

## **5.10. Focus Area: Financial Responsibilities and Strategies (FRS)**

### **Purpose**

Implementation of financial responsibilities and strategy initiatives will fund the protection and improvement of the quality and quantity of water and natural resources through effective, transparent, and responsible utilization and leveraging of funds.

### **Challenges**

In the past the MWMO had a relatively scant amount of water and natural resource information on which to base its programmatic expenditures. As such, it has taken the initiative to identify gaps in this information and fund watershed assessments to further develop this base of knowledge. New knowledge about the Watershed's resources can shift the focus of the MWMO's projects and activities on an annual basis. Thus, one of the challenges the MWMO will address is maintaining enough flexibility in funding its annual projects and activities to keep up with current science and information available on the Watershed.

### **Target Audiences**

The primary target audiences for financial responsibilities and strategies implementation initiatives are the MWMO itself, potential project partners who can provide in-kind or cash contributions, and the public and member organizations who are interested in involvement in funding processes.

### **Indicators and Measures of Performance**

The performance measures will be the amount of leveraged funds, the extent of public benefits of funds, and the number of successful activities and projects that are funded. MWMO will actively maintain a financial plan.

### **MWMO Daily Activities**

At the top of the MWMO's priorities is accountability and good stewardship of public monies. This stewardship starts with maintaining a strategic and responsible annual levy policy that is in concert with past practices and coupled with efforts to optimally leverage the MWMO's financial and human resources.

The MWMO has implemented efficiencies in its daily organizational operations, projects, and activities to meet these self-imposed limits. The MWMO is able to do more in less time by utilizing the most efficient and up-to-date equipment and technologies in the organization's daily activities. The MWMO also limits time and money spent on any would-be projects by tying explicit water resource improvement criteria to the expenditure of MWMO funds and requiring up-front feasibility studies that include a cost-benefit analysis or other type of impact assessment of the projects' outcomes. This process assures MWMO projects will meet the organization's goals and be economically viable.

All projects and activities funded by the MWMO must result in a direct connection to cleaner water, an environmentally literate public, and a healthier ecosystem. The MWMO assures these results by taking on activities that provide measurable outcomes for the Watershed's natural resources and by only funding capital projects that meet or exceed MWMO Standards.

Finally, healthy ecosystems do not conform to jurisdictional boundaries. As such, a portion of the MWMO's staff time and monies is spent on water resource management occurring on a broader scale than just within the MWMO's jurisdictional boundaries.

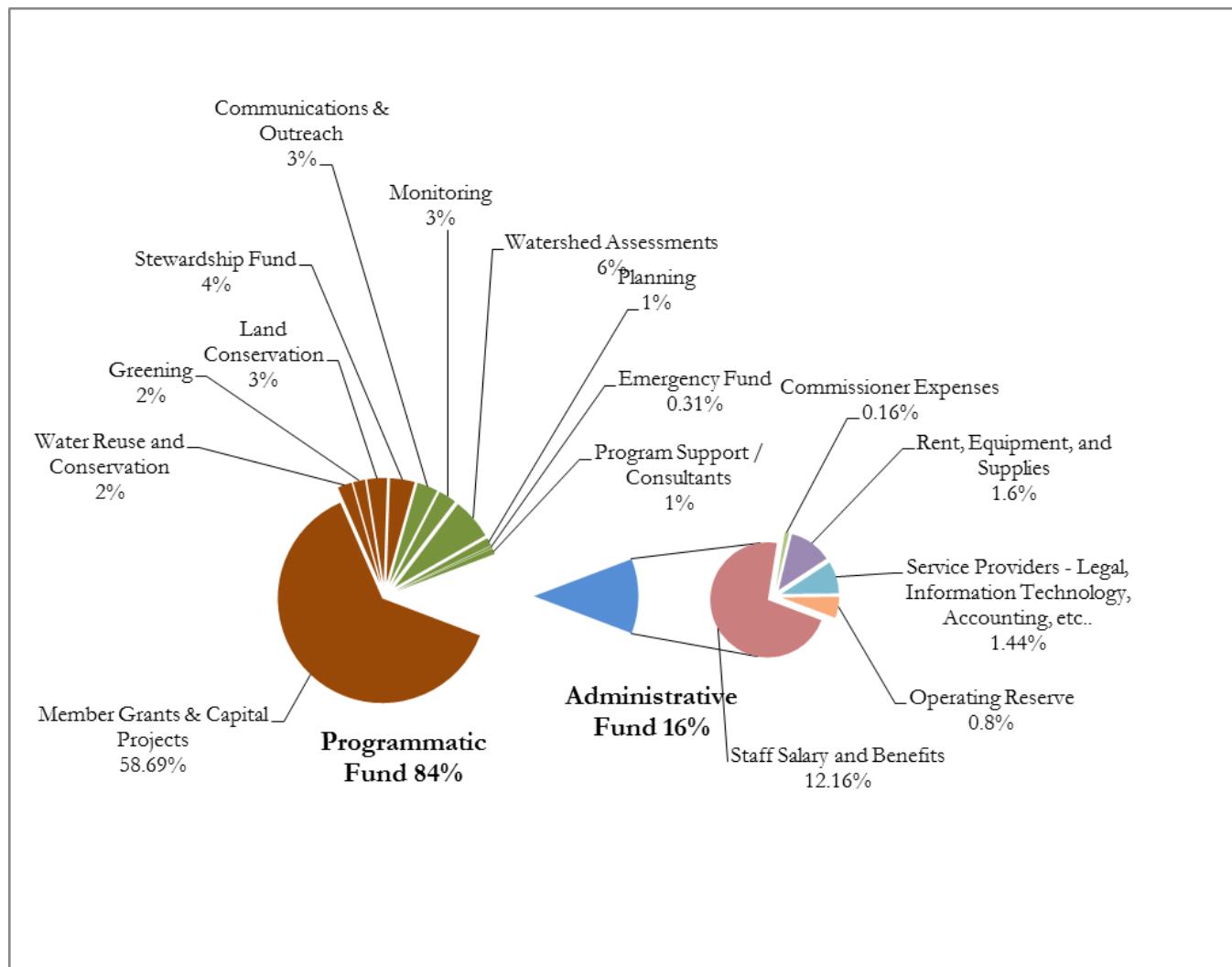
## 6.0 MWMO FINANCIALS

The MWMO is a Joint Powers Watershed Management Organization (WMO). The MWMO is listed in MS 275.066 as a “Special Taxing District” for the purposes of property taxation to complete water management under section 103B.211 and 103B.241. This annual levy is the primary source of revenue for the MWMO.

The MWMO operates two funds to complete its work, one for all programmatic efforts and one for all administrative efforts. The average annual levy between 2002 and 2009 was \$4.08 million. Figure 53 represents the average percentages allocated to MWMO administrative and programmatic areas from 2002 through 2009. Figure 54 lists the annual funding range anticipated for each program area from 2010 to 2016. Individual program areas are funded on an as needed basis. Thus, there are years where certain programs receive no funding.

Programs shaded brown in Figure 46 primarily alter the physical landscape of the Watershed. Programs shaded green are informational and educational in nature and result in behavioral changes. Over the next ten years the MWMO anticipates a slight shift of funding from the brown and green programmatic areas into the blue administrative area due to planned organizational growth.

**Figure 53: Average Percentages allocated to MWMO Administrative and Programmatic Funds 2002 – 2009**



**Figure 54: Program Budget Forecasts 2010-2016**

	2002-2009 Budget		2010	
	Average	% of Total	Base Budget <sup>1</sup>	% of Total
<b>Capital Programs</b>				
<b>Total</b>	\$ 3,613,600	100.0%	\$ 3,613,556	100.0%
Member Grant Program	2,327,444	64.4%	2,327,444	64.4%
Water Reuse and Conservation	91,111	2.5%	91,111	2.5%
Communications & Outreach				
(Nonpoint Source Pollution Program)	145,000	4.0%	145,000	4.0%
Stewardship Grant Fund	166,667	4.6%	166,667	4.6%
Planning	51,111	1.4%	51,111	1.4%
Watershed Assessments (Research, H&H Studies, etc)	253,889	7.0%	253,889	7.0%
Monitoring	128,333	3.6%	128,333	3.6%
Greening	66,667	1.8%	66,667	1.8%
Land Conservation	333,333	9.2%	333,333	9.2%
Emergency fund	11,111	0.3%	11,111	0.3%
Program Support / Consultants	38,889	1.1%	38,889	1.1%
<b>Administration</b>				
<b>Total</b>	\$ 534,556	100.0%	\$ 1,050,000	100.0%
Staff Salary and Benefits	388,889	72.7%	800,000	76.2%
Commissioner Expenses	6,667	1.2%	15,000	1.4%
Rent, Office Administration, Equipment, and Supplies	61,389	11.5%	100,000	9.5%
Service Providers - Legal, Engineering, IT, HR, Auditor, Accounting	46,111	8.6%	75,000	7.1%
Operating Reserve	31,500	5.9%	60,000	5.7%
<b>Budget</b>				
<b>Total</b>	\$ 4,148,156	100.0%	\$ 4,663,556	100.0%
Programs	\$ 3,613,600	87.1%	\$ 3,613,556	77.5%
Administration	\$ 534,556	12.9%	\$ 1,050,000	22.5%

<sup>1</sup> Base budget is a combination of historical average for Capital Program Fund and the FY2010 Administration Fund. The FY2010 Administration Fund more accurately estimates costs going forward.

<sup>2</sup>The historical average increase was calculated for FY2002 through FY2010 for each fund - Capital Program Fund increased, on average, 1.5% per year and the Administration Fund increased 25% per year, primarily because staff levels increased from 2 to 10 positions. When fully staffed the MWMO will carry 12-14 full-time employees. The MWMO expects to be fully staffed by 2016.

<sup>3</sup> The Board adopted a Financial Management Plan capping increases for the Capital Project Fund and the Administrative Fund at 6% and 3% respectively. The forecast provides the estimated top and bottom ends to future funding.

(Figure 54: Program Budget Forecasts 2010-2016 Continued)

	2002-2009 Budget		2010	
	Average	% of Total	Base Budget <sup>1</sup>	% of Total
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<sup>3</sup> The Board adopted a Financial Management Plan capping increases for the Capital Project Fund and the Administrative Fund at 6% and 3% respectively. The forecast provides the estimated top and bottom ends to future funding.

(Figure 54: Program Budget Forecasts 2010-2016 Continued)

	2013		2014	
	Historical Increase <sup>2</sup>	Financial Plan <sup>3</sup> Max Increase	Historical Increase <sup>2</sup>	Financial Plan <sup>3</sup> Max Increase
<b>Capital Programs</b>				
<b>Total</b>	\$ 3,778,617	\$ 4,303,802	\$ 3,835,296	\$ 4,562,031
Member Grant Program	2,433,758	2,772,024	2,470,265	2,938,345
Water Reuse and Conservation	95,273	108,515	96,702	115,026
Communications & Outreach (Nonpoint Source Pollution Program)	151,623	172,697	153,898	183,059
Stewardship Grant Fund	174,280	198,503	176,894	210,413
Planning	53,446	60,874	54,247	64,527
Watershed Assessments (Research, H&H Studies, etc)	265,486	302,386	269,468	320,529
Monitoring	134,195	152,847	136,208	162,018
Greening	69,712	79,401	70,758	84,165
Land Conservation	348,559	397,005	353,788	420,826
Emergency fund	11,619	13,234	11,793	14,028
Program Support / Consultants	40,665	46,317	41,275	49,096
<b>Administration</b>				
<b>Total</b>	\$ -	\$ 1,147,363	\$ -	\$ 1,181,784
Staff Salary and Benefits	-	874,182	-	900,407
Commissioner Expenses	-	16,391	-	16,883
Rent, Office Administration, Equipment, and Supplies	-	109,273	-	112,551
Service Providers - Legal, Engineering, IT, HR, Auditor, Accounting	-	81,955	-	84,413
Operating Reserve	-	65,564	-	67,531
<b>Budget</b>				
<b>Total</b>	\$ 4,925,980	\$ 5,451,166	\$ 5,017,080	\$ 5,743,815
Programs	\$ 3,778,617	\$ 4,303,802	\$ 3,835,296	\$ 4,562,031
Administration	\$ 1,147,363	\$ 1,147,363	\$ 1,181,784	\$ 1,181,784

<sup>1</sup> Base budget is a combination of historical average for Capital Program Fund and the FY2010 Administration Fund. The FY2010 Administration Fund more accurately estimates costs going forward.

<sup>2</sup> The historical average increase was calculated for FY2002 through FY2010 for each fund - Capital Program Fund increased, on average, 1.5% per year and the Administration Fund increased 25% per year, primarily because staff levels increased from 2 to 10 positions. When fully staffed the MWMO will carry 12-14 full-time employees. The MWMO expects to be fully staffed by 2016.

<sup>3</sup> The Board adopted a Financial Management Plan capping increases for the Capital Project Fund and the Administrative Fund at 6% and 3% respectively. The forecast provides the estimated top and bottom ends to future funding.

(Figure 54: Program Budget Forecasts 2010-2016 Continued)

	2015		2016	
	Historical Increase <sup>2</sup>	Financial Plan <sup>3</sup> Max Increase	Historical Increase <sup>2</sup>	Financial Plan <sup>3</sup> Max Increase
<b>Capital Programs</b>				
<b>Total</b>	\$ 3,892,826	\$ 4,835,752	\$ 3,951,218	\$ 5,125,898
Member Grant Program	2,507,319	3,114,646	2,544,928	3,301,524
Water Reuse and Conservation	98,153	121,927	99,625	129,243
Communications & Outreach (Nonpoint Source Pollution Program)	156,206	194,043	158,549	205,685
Stewardship Grant Fund	179,547	223,038	182,241	236,420
Planning	55,061	68,398	55,887	72,502
Watershed Assessments (Research, H&H Studies, etc)	273,510	339,761	277,613	360,146
Monitoring	138,251	171,739	140,325	182,043
Greening	71,819	89,215	72,896	94,568
Land Conservation	359,095	446,075	364,481	472,840
Emergency fund	11,970	14,869	12,149	15,761
Program Support / Consultants	41,894	52,042	42,523	55,165
<b>Administration</b>				
<b>Total</b>	\$ -	\$ 1,217,238	\$ -	\$ 1,253,755
Staff Salary and Benefits	-	927,419	-	955,242
Commissioner Expenses	-	17,389	-	17,911
Rent, Office Administration, Equipment, and Supplies	-	115,927	-	119,405
Service Providers - Legal, Engineering, IT, HR, Auditor, Accounting	-	86,946	-	89,554
Operating Reserve	-	69,556	-	71,643
<b>Budget</b>				
<b>Total</b>	\$ 5,110,063	\$ 6,052,990	\$ 5,204,973	\$ 6,379,653
Programs	\$ 3,892,826	\$ 4,835,752	\$ 3,951,218	\$ 5,125,898
Administration	\$ 1,217,238	\$ 1,217,238	\$ 1,253,755	\$ 1,253,755

<sup>1</sup> Base budget is a combination of historical average for Capital Program Fund and the FY2010 Administration Fund. The FY2010 Administration Fund more accurately estimates costs going forward.

<sup>2</sup>The historical average increase was calculated for FY2002 through FY2010 for each fund - Capital Program Fund increased, on average, 1.5% per year and the Administration Fund increased 25% per year, primarily because staff levels increased from 2 to 10 positions. When fully staffed the MWMO will carry 12-14 full-time employees. The MWMO expects to be fully staffed by 2016.

<sup>3</sup>The Board adopted a Financial Management Plan capping increases for the Capital Project Fund and the Administrative Fund at 6% and 3% respectively. The forecast provides the estimated top and bottom ends to future funding.

In 2002 the Board hired a full-time administrator and since then the organization has grown to a staff of nine. This plan anticipates staff growing to fourteen by 2016. As a result of this growth in staff the percentage spent on administrative costs will likely increase.

The MWMO will be able to implement more of its programmatic goals with each new staff member. As such, fluctuations in percentages spent on individual activity areas will reflect both additional staffing resources available and the MWMO shifting between activity areas to complete tasks central to planned MWMO actions. For example, with the completion of this Third Generation Plan, expenses in the programmatic areas of Planning and Watershed Assessments are likely to taper back and the Capital Project expenses will grow. Reviewing the Ten Year Implementation Schedule for the program areas in any given timeframe, e.g. 2, 4, 7, 10 years will exemplify these projected shifts over the next ten years.

## 6.1. Capital Improvement Schedule

The MWMO Capital Improvement Schedule estimates the total project costs for MWMO Capital projects over the next six years. Projects found in Table 19 and described below will not be contracted for without the completion of a feasibility study. All projects will require a maintenance plan, inspection schedule and a maintenance budget. In addition, post construction performance testing of stormwater management practices installed may also be required.

The MWMO is currently assessing priority areas within the Watershed for future capital projects and will be adding additional projects to this capital schedule as studies are completed. The MWMO will continue to review the Capital Improvement Program minimally every 2 years for potential amendments. A table of future project areas where feasibility studies and an amendment will be required for adding specific projects to the MWMO Plan can be found in Appendix P.

The MWMO recommends that its staff and its member's staff work with one another on shared reviews of capital projects and planning efforts. Sharing staff expertise between the organizations will strengthen the connectivity and synergy between MWMO and members' capital projects and planning activities.

### **The Seward Common's: Water quality improvements**

Seward Commons is a 4-acre, highly contaminated industrial site that Seward Redesign has acquired. Seward Commons is located between 22nd and 24th Streets and Snelling Avenue and the Hiawatha Light Rail line in Minneapolis. The site is currently a highly impervious area and will be redeveloped with considerably more green space than under current conditions (though still significantly impervious). The green space will be located and designed to manage stormwater, with a goal of retaining a significant portion of stormwater on-site.

The MWMO will work with the City of Minneapolis, Seward Redesign and the Neighborhoods to plan, design and install stormwater infrastructure (filtration and reuse systems) that achieve the MWMO's Standards in the Seward Commons project.

### **Northeast Green Campus: Parking lot improvements**

Minneapolis Public Schools (MPS), in partnership with MWMO, has installed significant stormwater improvements at Edison High School. The next phase of construction is to construct a parking lot, east of the athletic field, which will drain into the site's stormwater reuse system. Under this phase, MWMO will look for opportunities to bring innovative stormwater management and water quality improvements when the parking lot is installed. Opportunities for innovation may include the installation of an automated system for managing the reuse tank to function as a rate control BMP.

### **Prospect North Partnership Water quality Improvement Projects**

Prospect North Partnership activities are located within the Bridal Veil Creek sub-watershed. The MWMO completed a stormwater retrofit study in Bridal Veil Creek that identified 77 retrofit opportunities to improve water quality, reduce runoff volumes, and manage rates of discharge. Using this study and others being completed by the partnership on District Systems, the MWMO will implement stormwater projects that contribute to a greater synergistic benefit when combined with other public realm land uses and infrastructure.

One of the partnerships first projects is the reconstruction of South East 4th St (Green 4th). Green 4th Street allows for the creation of larger outdoor gathering areas and stacked function bioretention basins within the street right-of-way. Walkways weave through deep and shallow rain gardens creating a wide variety of spaces for gathering. The bioretention basins not only treat stormwater, but also define and enhance the outdoor gathering spaces by providing greenery and shade. Seat walls connected to the deep bioretention basins provide an element of pedestrian safety while also creating flexible spaces for resting. Beyond using stormwater as a resource to irrigate the landscaping and trees bioretention basins provide numerous environmental benefits such as: habitat creation, urban heat island mitigation, and air quality improvements.

Another initiative in this area is the introduction of Restorative Development and Watershed Management. The MWMO is interested in leading cost benefit analysis, research, design and implementation efforts that bring Restorative Watershed Management from concept to a reality within the watershed. An outcome the MWMO seeks from this project is to bring water resource planning in at the front end of other Restorative planning efforts. To meet this end studies completed will be designed to scale up the watershed analysis to supplement potential future studies and planning conducted at district, city, county, regional, and state wide levels.

### **Sculpture Garden Renovation: Water quality and water conservation improvements**

The Minneapolis Park and Recreation Board's sculpture garden renovation will focus on innovative stormwater parking lot and the roadway installations that utilize infiltration, filtration, storage, and reuse practices. Improving water quality and reducing the volume of stormwater discharging to the Mississippi River.

### **Scherer Park: Water quality, water conservation and habitat improvements**

Scherer Park is a proposed RiverFIRST project within the Critical Area along the east bank of the Mississippi river. This Minneapolis Park and Recreation Board project would include shoreline restoration, and the development of wetlands, biohabitats and a riverine island. The project would result in improved water quality and habitat due to a mix of bioretention, bioengineering, infiltration, filtration, storage and reuse stormwater management techniques.

### **Old Bassett Creek Tunnel: Water quality and water conservation improvements**

This is a joint Minneapolis Public Works and MWMO project. The project involves structural repairs and modifications to the Old Bassett Creek Tunnel, including the addition of access shafts to increase opportunities for removal of deposited sediments, and possibly the addition of a weir to provide stormwater treatment, storage and reuse functions. The renovations will improve water quality and may reduce the volume of stormwater discharging to the Mississippi River. It is expected that renovations will happen in phases, as opportunities for tunnel modification become available. The MWMO will coordinate the project design with staff from Bassett Creek Watershed Management Commission, and Minneapolis to assure it meets the requirements set forth in the 2000 joint and cooperative agreement (or subsequent revisions) between Bassett Creek Watershed Management Commission, MWMO, and the City of Minneapolis (see Appendix K).

### **Restoration of Eroded Riverbanks Sites: Water quality and habitat improvements**

This is a MWMO project to reduce near bank erosion. The MWMO has identified eleven riverbank restoration sites that contribute sediment to the MWMO's reach of the Mississippi River. Bioengineering techniques will be used restore these and other eroded areas, improving water quality and habitat along the Mississippi river. Who will carry out the improvements is dependent on findings of a final feasibility study / or studies on restoration needs along the Mississippi river. The MWMO will work with our member organizations to identify eroded sites where we have a shared interest in restoration along the river. Single projects that require multi-year funding would need to be amended into the CIP schedule as stand-alone projects. The \$1,000,000.00 is for implementation of projects that eliminate near bank erosion and improve habitat in the Critical Area corridor in accordance with the MWMO's Bioengineering Installation Manual.

### **City of Fridley: Street Retrofit Project – Stormwater Quality Improvement**

The City of Fridley in partnership with the MWMO will be reducing total suspended solids, reducing total phosphorus and promoting infiltration, in conjunction with a series of road reconstruction projects. Projects may utilize the public right-of-way bordering adjacent residential homes. Boulevard rain gardens and tree trenches are examples of stormwater management features to be considered for the reconstruction project. In addition, the City will look for opportunities to utilize area parks and other green spaces to install infiltration practices and address localized flooding issues. The reconstruction projects cover two general areas bound by: 1) Main Street/University Avenue and 45<sup>th</sup> Ave NE/I-694; and 2) 7<sup>th</sup> St NE/MWMO boundary and I-694/59<sup>th</sup> Ave NE.

### **Gauvitte Park Area: Water quality improvements and flood protection**

The City of Columbia Heights in partnership with the MWMO will be implementing flood control and water quality improvements in the Gauvitte Park Area. The project implemented may utilize infiltration, filtration, reuse, bioretention or bioengineering practices to reduce the amount of total phosphorus and total suspended solids reaching the Mississippi River. The project is located between 42nd Ave. and 44th Ave. NE, west of University Ave.

### **St. Anthony Lane South Industrial Park: Flood mitigation**

The City of Saint Anthony Village plans to construct a flood water storage pond on the west side of the St. Anthony Village industrial park to improve the level of flood protection to the adjacent industrial buildings. This project may include some new stormwater pipes, reconfiguration of existing stormwater pipes, and construction of a linear pond. The work may coincide with Hennepin and Ramsey counties reconstruction of County Road C.

### **1NE Watershed System-Scale / Multiple-Benefit Stormwater BMPs**

The MWMO is working with the City of Minneapolis and MPRB to design and implement system-scale stormwater BMPs within the 1NE Watershed. These BMPs will be informed through the use of recently completed watershed-scale hydrology/hydraulic and water quality models and focus on optimizing benefits to multiple project partners. Examples may include regional treatment practices that address stormwater management concerns amongst multiple partners and across jurisdictional lines. Projects may also include practices that meet or exceed MWMO's water quality standards while addressing members' flood concerns or other stormwater management goals. The Columbia Park Golf Course is being considered as a likely location for BMP implementation.

### **Water Works Park**

Water Works is an 8-acre park development project by the MPRB. It lies along the west bank of the Mississippi River, just north of the Stone Arch Bridge, and was originally envisioned as part of the RiverFirst Initiative. In addition to green infrastructure practices, the MPRB will be installing a stormwater reuse system at the site. The stormwater reuse system will collect and treat roof runoff from the existing rooftops of adjacent buildings, as well as the proposed park

pavilion rooftop. This water will be used for irrigation at the Water Works site, toilet flushing in the proposed pavilion and potentially for use in one of the three water features at the site.

### **Minneapolis: Greening within the public right-of-way**

The City of Minneapolis, in partnership with the MWMO, will look for opportunities to implement greening for stormwater management within the public right-of-way. Greening projects will be designed to reduce total suspended solids, reduce total phosphorus and promote infiltration. When site conditions limit infiltration potential, filtration practices will be considered. In some cases, increased habitat potential may also be considered. Opportunities may occur as part of a street reconstruction project or as a retrofit to existing infrastructure. For opportunities in the Downtown area, the Downtown Improvement District will likely be a stakeholder in the project planning.

### **Huset Park Area: Water reuse and water quality improvements**

The City of Columbia Heights, in partnership with the MWMO, will implement water reuse and water quality improvements in Huset Park. The project will be designed to optimize stormwater reuse to maximize the amount of water captured/reused and reduce the amount of total phosphorus and total suspended solids reaching the Mississippi River. Water quality improvements may include the addition of an iron enhanced sand filter to an existing pond in the park. The project is located south of 49<sup>th</sup> Ave, between University Ave and Central Ave NE.

### **Upper Harbor Terminal**

The Minneapolis Upper Harbor Terminal (UHT) is a 50-acre redevelopment site located along the west bank of the Mississippi River in North Minneapolis. The MWMO will seek to implement site and district-scale stormwater opportunities at the UHT. The MWMO will work with willing landowners to evaluate the opportunity for innovative stormwater practices along the roadways; railway and utility corridors; private development sites and on MPRB lands. Stormwater designs will work to: create added-value (eg stormwater reuse, improve ecosystem services etc...) from the significant volume of stormwater that passes thru the UHT area from North Minneapolis; utilize historic sites; complement existing and future land uses; improve ecosystem services; and provide bank and shoreline habitat restoration.

**Table 19: MWMO Capital Improvement Schedule 2016 to 2021**

MWMO Capital Improvement Projects	2016	2017	2018	2019	2020	2021	Total funding
Mpls CPED: Seward Common's Water Quality Improvements	X	X					\$100,000
Mpls: Northeast Green Campus Parking Lot Improvements			X	X	X		\$200,000
MWMO: Prospect North Partnership Water Quality Improvements	X	X	X	X			\$3,500,000
MPRB: Sculpture Garden Renovation Stormwater Reuse and Water Quality Improvements	X	X					\$1,500,000
MPRB: Scherer Park Stormwater Reuse and Water Quality Improvements	X	X	X	X			\$1,500,000
Mpls: Old Bassett Creek Tunnel Water Quality and Water Conservation Improvements			X	X	X		\$2,000,000
MWMO: Restoration of Eroded Riverbanks Sites. Water Quality and Habitat Improvements	X	X	X	X			\$1,000,000
Fridley: Street Retrofit Projects — Stormwater Quality Improvements	X	X	X	X			\$750,000
Columbia Heights: Gauvitte Park Area Water Quality Improvements and Flood Protection			X	X			\$500,000
St. Anthony Village: St. Anthony Lane South Industrial Park			X	X	X		\$250,000
MPRB/Mpls/MWMO: 1NE Watershed System-Scale / Multiple-Benefit Stormwater Projects			X	X	X		\$4,000,000
MPRB: Water Works Park		X	X	X			\$900,000
Mpls: Greening within the Public Right-of-Way		X	X	X			\$1,000,000
Columbia Heights: Huset Park Water Reuse & Water Quality Improvements		X	X	X			\$900,000
MPRB/Mpls/MWMO: Upper Harbor Terminal				X	X	X	\$3,500,000
<b>Grand Total</b>							<b>\$21,600,000</b>

*Note: A feasibility study of the project and the MWMO's funding guidelines will determine what aspects of the project may be funded. MWMO Board will review and approve all final project budgets and agreements.*

Funding amounts for the capital improvement projects do not include diagnostic and feasibility study costs. These costs are a part of the annual budget for the Watershed Assessments. Any significant changes (15 to 25% increase) to the estimated project costs will be reported by the MWMO in their annual report to the Board of Water and Soil Resources and included in the MWMO's annual budget meeting which is open for public comment. Projects exceeding 25% of their budgeted cost will require a minor amendment. The maximum grant amount for a CIP project not on the current CIP schedule is 25% of the MMWO's annual CIP project budget or an average annual estimated total CIP project budget over the life of the Plan.

## **6.2. Ten Year Implementation Schedule**

The MWMO's Ten Year Implementation Schedule is intended to be used as a guide, not a prescription, for MWMO activities over the next ten years. The MWMO will conduct an annual prioritization of goals, strategies, and implementation actions for each year. This annual prioritization will be based on effectiveness of actions performed in past years, progress toward meeting intended goals, changing resource conditions, and financial constraints.

A summary of recently approved TMDL Implementation Plans and MWMO's related activities will also be included in the MWMO's annual report to BWSR to ensure that MWMO activities and projects are supporting TMDL implementation as needed. Consistent with the MWMO Plan amendment policy in Section 7.2, the MWMO will incorporate needed TMDL implementation activities into the Watershed Management Plan.

Substantive content from initial public involvement formed ten focus areas which the MWMO's implementation actions are nested within. Analysis of watershed data described in the Land and Water Resource Inventory section helped to prioritize the MWMO's implementation actions for the greatest benefit to the Watershed's water and natural resources.

Actions listed in the two to four year ranges are most likely to be undertaken. Actions listed as seven to ten years may be completed or revised during the 2016 plan update of this plan. However, since this plan is based on organizational, scientific, and regulatory information currently available, the MWMO reserves the right to move actions listed up or down the timeline indicated in order to adapt to emerging issues, priorities, and organizational growth.

### **Layout and Content Guidance on Table 20**

The MWMO's ten year implementation schedule is framed by ten focus areas: Water Quality, Water Rate and Volume, Monitoring and Data Assessment, Communication and Outreach, Ecosystem Health, Regulations and Enforcement, Urban Stormwater Management, Emergency Preparedness and Response, Emerging Issues, and Financial Responsibilities and Strategies. The first column of Table 20 starts with the water quality focus area title with water quality issue statements, goals, strategies, and actions listed further down the column. This format continues for each of the focus areas. All final actions are understood within the context of the information preceding them.

Together columns two and three indicate the period of years in which an action will be completed and if an action is likely to occur more than one time. Actions only coded in column two with a 2, 4, 7, or 10 year designation are expected to be completed before or by the year shown.

If an action is coded with a number in column two and "ongoing" in column three, then the number indicates a time period the activity will initiate in. "Ongoing" indicates that there is no end date. For example, "4 and ongoing" would indicate the activity will begin between two and four years of the plan's approval and be able to repeat for the duration of the plan. The reader should not take this scheduled timeline too literally or linearly because the actions coded may occur more than one time, at different degrees of detail, and with a variety of other actions depending on the information and resources available to the MWMO at that time. For example, monitoring actions related to modeling pollutant loads within the Watershed may reoccur a number of times because the MWMO is continually gathering new data which can be used to recalibrate models and update modeled loading results.

The italicized actions designated as "ongoing" in column two represent organizational norms and expectations within the MWMO's work culture. These actions reflect the business activities, common processes, messaging, and frameworks the organization uses which are not specific to any given project, or activity area. These actions do not have an end date and are further described in the focus area narratives under the heading of "MWMO Daily

Activities” (see sections 5.1 to 5.10). They appear in the implementation table because they provide needed context for the other issue statements, goals, strategies, and actions in the table.

Column four indicates opportunities for the MWMO to partner with specific member organizations and other stakeholders when taking on a stated action in the schedule. The Plan’s framework is based on focus areas identified by the public, MWMO member organizations, agencies, MWMO Board, MWMO Citizen Advisory Committee, and MWMO staff.

Column five codes the actions identified within each focus area into MWMO activity areas which in turn, help to identify the primary staff and team expertise needed for any given activity. MWMO’s activity areas are coded as follows: Administration (Admin), Capital Improvement Projects (CIP), Communications and Outreach (CO), Monitoring (MD), Watershed Assessments (WA), Planning (PL).

The complete implementation schedule has a total of 199 actions scheduled for implementation over the next 10 years. Actions coded as “ongoing” in years 2 and 4 limit the number of new actions taken on in years 7 and 10. The ability of the MWMO to accomplish all of the actions listed is based on the anticipated growth of the MWMO organization to reach a future mix of fulltime, part-time, and intern employees, totaling out at fourteen staff members.

**Table 20: MWMO's Ten Year Implementation Schedule**

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Water Quality (WQ)				
WQ 1 Protect and improve the water resources of the MWMO.				
Goal 1 Protect and improve the Mississippi River.				
Strategy 1 Quantify MWMO’s contribution to pollutant loading in the Mississippi River.				
<i>Action 1 Provide information and participate in meetings with federal and state agencies to set state water quality standards specific to big river systems</i>	<i>ongoing</i>			
Action 2 Quantify each subwatershed contribution to pollutant loading	7	ongoing	Henn Co, Mpls	MD
Action 3 Prioritize at a subwatershed-scale loading reduction goals needed to meet state water quality standards.	7	ongoing	Mpls	PL
Action 4 Model hydrology and water quality in the MWMO.	2		Mpls, MPRB	WA
Action 5 Develop a design and planning tool to identify water quality impacts at concept stages.	7		Member Cities	WA
Strategy 2 Monitor the water quality of the river upstream and downstream of the MWMO’s reach of the Mississippi River.				

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
<i>Action 1 Collaborate with stakeholders to obtain and share data</i>	<i>ongoing</i>		<i>MCES</i>	<i>MD</i>
Strategy 3 Eliminate water quality impacts of combined sewer overflows.				
Action 1 Provide feasibility studies and services to members to reduce volume and rate of water leaving the land.	4		Mpls MCES	MG
Action 1a Provide feasibility studies and services to members to provide innovative alternatives for CSO systems	4	ongoing	All Members MCES,	PL
<i>Action 2 Fund infrastructure improvements when feasible</i>	<i>ongoing</i>		<i>Mpls</i>	<i>CIP</i>
Strategy 4 Work with appropriate agencies to limit resuspension of sediment and pollutants in the water column of the Mississippi River.				
Action 1 Model hydraulic and mixing characteristics and recommend a management strategy.	4		Mpls	MD
Strategy 5 Manage riverbanks to allow multiple uses.				
Action 1 Identify and mitigate acute erosion.	7		Mpls, MPRB	WA
Action 2 Implement practices that improve habitat structure and ecosystem function	4		Henn Co, MPRB	CIP
Action 3 Develop an ecosystems management plan	4	ongoing	MPRB	PL
Goal 2 Protect and improve the quality of lakes and wetlands in the watershed.				
Strategy 1 Quantify pollutant loading to each waterbody in the watershed.				
Action 1 Delineate lake and wetland subwatersheds	4		Mpls	MD
Action 2 Quantify pollutant loading from each subwatershed.	7	ongoing	Henn Co Mpls	MD
Action 3 Set MWMO standards for each natural waterbody in the watershed .	7		MPRB	PL

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Strategy 2 Reduce pollutants to lakes and wetlands.				
<i>Action 1 Collaborate with stakeholders to implement actives to reduce pollution.</i>	<i>ongoing</i>		<i>Mpls</i>	<i>WA</i>
Action 2 Identify and mitigate acute erosion.	7		Mpls, MPRB	WA
Action 3 Implement practices that improve habitat structure and ecosystem function	4		Henn Co, MPRB	CIP
Strategy 3 Participate in the development, implementation and compliance of regulations, ordinances, rules and standards that impact the watershed's resources				
Action 1 Develop, maintain and implement Standards in the MWMO's watershed Management Plan.	2	ongoing		PL
Action 2 Review and comment on regulations, ordinances, rules and standards that impact the watershed	2	ongoing		PL
Action 3 Provide technical expertise to planning initiatives and studies that impact water resources in the watershed	2	ongoing		PL
WQ 2 Account for water quality conditions upstream that impact the MWMO.				
Goal 1 Take a leadership role in protecting the health of the Mississippi River.				
Strategy 1 Work with stakeholders within the Mississippi River basin to establish common goals to improve the health of the river.				
Action 1 Implement riparian best management practices that limit the transport of pollutants to the Mississippi River.	7		MPRB	PL
Strategy 2 Share information on efforts and successes to demonstrate the feasibility of meeting standards in a highly urban watershed.				
Action 1 Develop and implement outreach activities	4		MPRB	CO
Action 2 Develop and implement training programs	4	ongoing		CO

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Action 3 Present information on successful protection efforts at neighborhood meetings and local civic groups to share practical ideas and to promote similar activities and the efforts of MWMO.	2	ongoing		CO
Strategy 3 Partner with watersheds that manage headwaters discharging into the MWMO to help achieve the MWMO's water quality goals for the Mississippi River.				
<i>Action 1 Coordinate with regional planning efforts to ensure that state and federal water quality standards set for upstream reaches and streams will be stringent enough to allow the Mississippi River to meet state and federal standards.</i>	ongoing			PL
WQ 3 Participate in the development and implementation of TMDLs.				
Goal 1 Take an active role in Total Maximum Daily Loads (TMDLs) affecting the Mississippi River and the resources within the MWMO				
Strategy 1 Work with Minnesota Pollution Control Agency (MPCA) on TMDLs				
<i>Action 1 Participate in a dialogue with member cities and MPCA staff on Total Maximum Daily Loads to determine the MWMO's leadership and active partner roles.</i>	ongoing		MPCA, MPRB, Mpls, U of M	PL
<i>Action 2 Lead Total Maximum Daily Load (TMDL) studies where the MWMO was identified to have a leadership role.</i>	ongoing		MPCA	WA
Strategy 2 Participate in the development and implementation of TMDLs.				
Action 1 Provide information, attend meetings and review draft state water quality standard for water entering the MWMO.	7	ongoing	MPCA, MPRB	PL
Action 2 Coordinate with agency TMDL assessment and planning.	4	ongoing	MPCA	PL
WQ 4 Identify the role the MWMO will take in addressing soil contamination and groundwater quality.				

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Goal 1 Engage in effective watershed management that does not adversely affect groundwater.				
Strategy 1 Account for the effect of contaminated soils and groundwater when setting watershed performance standards or rules.				
Action 1 Gather information on areas of contaminated soils and groundwater within the watershed.	4			WA
Action 2 Develop an incentive or cost-share program for landowners to assist with clean-up activities that enhance the overall watershed.	2			CO
Action 3 Ensure that databases that include data on location, type, pollutants of concern, and status of clean-up for contaminated sites within the WMO are complete and accurate.	7			WA
Strategy 2 Account for the effect of contaminated soils and groundwater when planning capitol and infrastructure projects				
Action 1 Incorporate contaminated soils investigation into capital improvement project planning.	4		Mpls	CIP
Strategy 3 Monitor the quality of groundwater discharging into the Mississippi River.				
Action 1 Monitor the quality of groundwater reaching the Mississippi River.	10	ongoing	Henn Co	MD
Strategy 4 Manage areas of groundwater-surface water interaction (e.g. areas of recharge and discharge) with a heightened awareness of pollution potential between the two systems.				
Action 1 Provide assistance with sealing groundwater wells.	10			CIP
Action 2 Identify areas of groundwater-surface water interaction	2		Hennepin Co, Ramsey Co, MetCouncil	WA

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Action 3 Develop a groundwater-surface water interaction management plan for the identified areas.	10		MetCouncil	PL
Goal 2 Protect, improve and conserve the groundwater resources that support surface and drinking water sources.				
Strategy 1 Work with municipalities and stakeholders to promote groundwater conservation measures that includes a cost-share program for water use audits.				
Action 1 Develop guidance and a cost-share program for water use audits.	7			WRC
Action 2 Develop and implement an communication and outreach program to promote water conservation in landscaping.	2			CO
Strategy 2 Quantify the interaction of groundwater and any associated contamination within the WMO's natural resources				
Action 1 Identify areas of groundwater and contaminated soil interaction and areas of groundwater contamination.	4		Mpls, MPCA	CIP
Action 2 Provide studies and data for a groundwater contamination management plan for the identified areas.	10		Ramsey Co Mpls	PL
Strategy 3 Minimize unintended impacts to the Mississippi River and the local groundwater system resulting from new policies or program initiatives.				
Action 1 Identify any secondary resource impacts resulting from eliminating inflow and infiltration from sanitary sewer	10		Mpls	WA
Water Quantity (WRV)				
WRV 1 Manage the causes and reduce the effects of flooding that impact the watershed.				
Goal 1 Prevent the flooding of streets and structures due to surface water runoff.				
Strategy 1 Identify vulnerable areas and appropriate flood control projects.				

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Action 1 Map the stormwater storage and conveyance total capacity, full build out demand, and existing buildout demand	7		Mpls	WA
<i>Action 2 Develop policies and programs with member organizations that encourage stormwater to be managed as close to the site as possible.</i>	<i>ongoing</i>		<i>Mpls</i>	<i>PL</i>
Action 3 Identify vulnerable areas and appropriate flood control projects that the MWMO can help implement.	7		Mpls	CIP
Strategy 2 Encourage flood control projects that include water quality treatment, habitat improvement and erosion control.				
Action 1 Provide additional funding for flood control projects that are multipurpose in function	7		Mpls	CIP
Action 2 Complete a feasibility study for a flood control project that is multipurpose in function (e.g. reduces surficial flooding, improves water quality, redevelops condemned lots etc...)	7			WA
Strategy 3 Acquire and share monitoring data to inform flood control decisions.				
Action 1 Gather data on high water levels during large storm events.	4	ongoing	Mpls	MD
Action 2 Evaluate monitoring data against predicted flood levels from regional models.	7		Mpls	MD
Action 3 Present monitoring data and predictions of large storm event flood elevations to member organizations.	7			MD
Strategy 4 Work with member organizations and other entities to manage drainageway routes.				
Action 1 Identify areas where the existing natural landscape will serve drainage and filtration needs.	4	ongoing	MPRB	PL
Action 2 Provide example policies to member organizations to set policies that protect intended functions of drainage ways.	10			PL

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
WRV 2 Manage the causes and reduce the effects of drought that impact the watershed.				
Goal 1 Minimize the impact of drought conditions on environment, economics, infrastructure, health, and aesthetics.				
Strategy 1 Monitor and engage in agency led water supply planning efforts.				
<i>Action 1 Attend water supply planning sessions.</i>	<i>ongoing</i>			PL
Action 2 Develop a drought response plan and/or assist member organizations in developing municipal drought response plans.	10			PL
Action 3 Monitor demand for water and address areas of wasteful processes through water use audits.	10			CIP
<i>Action 4 Attend water supply trainings and conferences.</i>	<i>ongoing</i>			CIP
Strategy 2 Promote and engage in policies, activities, and projects that encourage conserving water resources.				
Action 1 Partner with municipalities and stakeholders to promote groundwater conservation measures.	10			CIP
Action 2 Identify ways to conserve and reuse water for landscaping.	10		Ramsey County	PL
Action 3 Develop guidance and cost-share program for water use audits.	7			CIP
Strategy 3 Restore localized storage and infiltration into the landscape.				
Action 1 Develop volunteer participation <i>required spacer</i>	2			CO
Action 2 Implement capital improvements and projects that restore localized storage and infiltration.	4		Mpls	CIP
Monitoring & Data Assessment (MD)				
MD 1 Make decisions based on science and best available data.				
Goal 1 Assemble best scientific data.				

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Strategy 1 Collaborate with stakeholders to effectively monitor watershed resources.				
<i>Action 1 Coordinate and develop partnerships with other organizations and/or agencies.</i>	<i>ongoing</i>		MPRB	MD
Action 2 Participate in the development of and revisions to models and databases	2	ongoing		MD
Action 3 Participate in the development of monitoring protocols.	4	ongoing	MPRB	MD
Strategy 2 Monitor and compile environmental data on the watershed to make management decisions and evaluate progress.				
Action 1 Develop a comprehensive monitoring plan.	7		MPRB	MD
Action 2 Identify data gaps.	2			MD
<i>Action 3 Gather data from other organizations and agencies</i>	<i>ongoing</i>			MD
Action 4 Collect biological, physical and chemical data for the Mississippi River and key subwatersheds.	2	ongoing		MD
Action 5 Monitor stormwater management practices within the watershed.	7	ongoing	Mpls, MPRB	MD
Action 6 Collect data to support regulatory standards.	2	ongoing	Mpls	MD
Strategy 3 Compile socio-economic data to inform program activities and policy decisions.				
Action 1 Identify socioeconomic data needs	7			WA
Action 2 Collect socioeconomic data.	10			WA
Goal 2 Process data to make it usable.				
Strategy 1 Collaborate with stakeholders to analyze data.				
Action 1 Develop and apply an approach for data analysis.	4	ongoing		MD
Strategy 2 Analyze data to make and track science-based management decisions.				
Action 1 Analyze trends in local data.	7			MD
Action 2 Incorporate information from regional and statewide sources in local analyses.	4	ongoing		MD

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Action 3 Develop methods to characterize the condition of watershed resources.	4			MD
Action 4 Determine whether regulatory standards are being met.	2	ongoing		MD
<i>Action 5 Use data to support reassessment of MWMO's standards.</i>	<i>ongoing</i>			<i>PL</i>
<i>Action 6 Inform prioritization of MWMO projects.</i>	<i>ongoing</i>			<i>ALL</i>
Action 7 Understand hydraulic and mixing characteristics of the Mississippi River and major water discharges impacting the MWMO.	4	ongoing		MD
Strategy 3 Analyze socio-economic data.				
Action 1 Understand connection between socioeconomic data and water resources	10			WA
Goal 3 Share the data with other entities.				
Strategy 1 Provide access to data.				
Action 1 Make data available to the public.	2	ongoing		MD
Action 2 Share data through federal, state and regional databases.	2	ongoing		MD
Action 3 Prepare and distribute Annual Monitoring Report.	2	ongoing		MD
Strategy 2 Use data to track and evaluate the condition of water resources.				
Action 1 Develop criteria for evaluating the effectiveness of MWMO's standards.	7			PL
Action 2 Evaluate effectiveness of stormwater management practices.	10		MPCA, UofM, Mpls, MCES, Watersheds	PL
Action 3 Evaluate the long-term outcomes of projects, activities and management decisions.	10			MD
Communications and Outreach (CO)				
CO 1 Provide resources and opportunities to build capacity and leadership and promote responsible stewardship of water and natural resources.				

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Goal 1 Educate to increase the knowledge and awareness of the connections between land use and water quality				
Strategy 1 Develop and implement audience appropriate information, programs, materials and trainings for watershed constituents.				
Action 1 Connect constituents to existing environmental information and activities.	2	ongoing	MPRB	CO
Action 2 Present locally relevant water resource information at meetings and events.	2	ongoing		CO
Action 3 Support community-initiated environmental education efforts.	2	ongoing	MPRB	CO
Action 4 Draw attention to and interpret significant watershed features, landmarks and projects. <sup>2</sup>	2	ongoing	MPRB	CO
Action 5 Create and conduct presentations and workshops for policy- and decision-makers and community leaders. <sup>2</sup>	2	ongoing		CO
Action 6 Provide technical training and guidance to public and private entities who conduct routine maintenance and construction activities.	2	ongoing		CO
<i>Action 7 Articulate the connections between resources and design standards (and amongst municipal officials, developers, design professionals, etc...)</i>	<i>ongoing</i>			CO
Action 8 Integrate watershed communications into existing formal education structures.	2	ongoing		CO
Strategy 2 Build community leadership and capacity for water education.				
Action 1 Train and develop community leaders	4			CO
Goal 2 Create and support opportunities for public participation and involvement.				
Strategy 1 Provide opportunities for community initiated projects to be realized.				
Action 1 Conduct a community grant program	2	ongoing		CO

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Strategy 2 Provide opportunities for the public to be involved with MWMO projects and activities.				
Action 1 Create and convene a Citizen Advisory Committee in the MWMO process. (MWMO CAC)	2	ongoing		CO
Action 2 Connect volunteers to existing and new MWMO activities	4	ongoing		CO
Goal 3 Collaborate with agencies, partners and networks in developing communication, outreach materials and stewardship activities to increase the reach and effectiveness of watershed education.				CO
Strategy 1 Leverage MWMO expertise and funding.				CO
Action 1 Identify educational needs of different audiences.	2	ongoing	MPRB	CO
Action 2 Identify shared program activities with member communities to help meet watershed education needs.	4		MPRB	CO
Action 3 Create and promote new and existing workshops and training opportunities.	2	ongoing		CO
Action 4 Partner with local entities to hold events and implement programs.	2	ongoing	MPRB	CO
Action 5 Seek funding from outside sources.	2	ongoing		CO
Goal 4 Recognize and respond to educational needs and opportunities of the diverse communities represented in the MWMO				CO
Strategy 1 Customize communication and outreach efforts for individual communities.				CO
Action 1 Conduct assessments.	2	ongoing		CO
Action 2 Develop an education plan that customizes content, approaches, and communications.	2	ongoing		CO
Action 3 Build community capacity and leadership by implementing custom education plan.	2	ongoing		CO

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Strategy 2 Capitalize on opportunities to expand MWMOs reach into diverse communities.				CO
<i>Action 1 Develop ongoing and responsive relationships with key stakeholders and leaders.</i>	<i>ongoing</i>			CO
Action 2 Support and participate in community meetings, events and programs.	2	ongoing		CO
Action 3 Develop new and adapt existing materials, training and programs	2	ongoing		CO
CO 2 Create communications and outreach connections within MWMO activity areas				
Goal 1 Integrate communications into MWMO activity areas.				
Strategy 1 Plan and implement communications as part of MWMO projects and activities				
Action 1 Identify and prioritize communication opportunities at the planning stages.	4			CO
Action 2 Support and implement communication elements.	4	ongoing		CO/Admin
<i>Action 3 Respond to needs of MWMO staff, board and committees.</i>	<i>ongoing</i>			CO
CO 3 Enhance communications between MWMO and constituents.				
Goal 1 Increase awareness and knowledge of the MWMO				
Strategy 1 Increase the visibility of the MWMO by collaborating and partnering with others engaged in watershed management activities				
Action 1 Establish an exchange program with organizations that work on similar watershed issues and big river systems.	10			PL
Action 2 Participate in Upper Mississippi River regional working groups develop and maintain partnerships.	7			PL
Strategy 2 Create and maintain organizational identity				

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
<i>Action 1 Ensure that statements about the MWMO are clear and differentiate the MWMO from other local water-related groups.</i>	<i>ongoing</i>			<i>All</i>
Action 2 Develop a communications plan for marketing	7			CO
Strategy 3 Document and disseminate MWMO accomplishments and activities.				
Action 1 Create an interactive map of the watershed that identifies and describes activities and projects and their locations	4			CO
Goal 2 Provide water and natural resource information and data to the public.				
Strategy 1 Document and disseminate information collected by the MWMO.				
Action 1 Place assessments, reports and/or studies generated by the MWMO on MWMO web-site.	2	ongoing		CO
Action 2 Present findings and MWMO work at professional forums and conferences	2	ongoing		All
Strategy 2 Interpret and make technical data and information available to non-technical audiences				
<i>Action 1 Plan for and develop materials that are able to be understood by a broad audience.</i>	<i>ongoing</i>			CO
<i>Action 2 Respond to requests by the public for assistance in understanding data and complex issues</i>	<i>ongoing</i>			CO
Goal 3 Coordinate communication networks.				
Strategy 1 Prepare consistent guidelines to represent the MWMO outwardly.				
Action 1 Revise and update crisis communications plan	2		Mpls	CO
Action 2 Implement a branding exercise to more clearly define the mission, goals and objectives of the organization.	7			CO
Strategy 2 Plan for making MWMO information available to constituents from different backgrounds, income levels, etc				
Action 1 Identify and prioritize strategies for reaching MWMO's diverse public.	2	ongoing		CO

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Action 2 Customize development of general materials for particular audiences	2	ongoing		CO
<i>Action 3 Identify which audiences are relevant to what projects and anticipate the need to develop supporting materials, provide translators and honor non mainstream communication normsion..</i>	<i>ongoing</i>			CO
Ecosystem Health (EH)				
EH 1 Find ways to protect, create, and enhance vegetated areas,springs, native plant communities, habitat, open space, and green infrastructure				
Goal 1 Protect and restore ecosystems.				
Strategy 1 Increase, improve and connect functional ecosystems within the watershed				
Action 1 Identify, inventory and prioritize land and water ecosystems in the watershed .	2	ongoing	Mpls, MPRB	WA
Action 2 Create and restore ecosystem function and structure in MWMO priority areas.	7	ongoing	MPRB	CIP
Action 3 Identify and evaluate opportunities to integrate historic ecosystem function with urban stormwater management in MWMO.	10	ongoing	MPRB	CIP
Action 4 Create opportunities for the public to help protect and restore ecosystems.	2	ongoing	MPRB	CO
Action 5 Increase public awareness of ecosystem structure and function.	2	ongoing	MPRB	CO
Action 6 Restore and protect natural areas through easements, buffers, acquisition and native plantings.	2	ongoing	Henn Co, MPRB	CIP
Action 7 Create greenway systems that provide open space, recreational opportunities, and stormwater management.	10	ongoing	MPRB	CIP
Action 8 Reestablish connections between existing natural areas by returning converted lands to native vegetation.	4	ongoing	Henn Co, MPRB	CIP
Action 9 Partner with member organizations and other entities to identify and remove populations of invasive species.	7	ongoing	Henn Co, MPRB	CIP
Action 10 Establish operations & maintenance procedures to assure the long-term effectiveness of acquired properties.	4	ongoing		CIP

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Strategy 2 Integrate ecosystem health throughout land use decision making processes.				
<i>Action 1 Integrate ecosystem management into land use and infrastructure planning, operation and management.</i>	<i>ongoing</i>			<i>PL</i>
<i>Action 2 Provide information and request that member organizations and other entities to develop management plans for public lands within the watershed.</i>	<i>ongoing</i>		MPRB	<i>PL</i>
Action 3 Modify site development processes to consider ecosystem health at early planning stages.	4			PL
<i>Action 4 Use easements, buffers, land acquisition and native plantings to restore and protect natural areas.</i>	<i>ongoing</i>			<i>PL</i>
<i>Action 5 Provide information and request that member organizations and other entities to create greenway systems that provide open space, recreational opportunities, and stormwater management.</i>	<i>ongoing</i>		MPRB	<i>PL</i>
Action 6 Identify a network of public lands to be managed to improve ecosystem health.	7			PL
Action 7 Identify opportunities to reestablish connections between existing natural areas by returning converted lands to native vegetation.	7		MPRB	PL
Action 8 Educate local government and inform the general public about invasive species that present environmental, economic or social risks.	4	ongoing		CO
Action 9 Provide information about landscaping with native and noninvasive species.	2	ongoing		CO
<i>Action 10 Promote ecosystem benefits through existing regulatory and permitting processes.</i>	<i>ongoing</i>			<i>PL</i>
EH 2 Protect land that significantly impacts surface and groundwater resources and natural resources				

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Goal 1 Identify and respond to opportunities for protecting and acquiring land.				
Strategy 1 Establish priorities and strategies for land acquisition				
Action 1 Develop the land acquisition program.	2			CIP
Action 2 Create a uniform land-use map for all municipalities within the MWMO.	10			PL
Action 3 Develop an open space corridor map for the MWMO.	4	ongoing		CIP
<i>Action 4 Balance economic reasonableness and ecosystem health benefits.</i>	<i>ongoing</i>			CIP
Action 5 Identify and prioritize land available for acquisition, sale, trade, etc.	2	ongoing		CIP
Action 6 Define a land acquisition site evaluation methodology based on ecosystem factors.	7			CIP
Action 7 Acquire land within the MWMO.	2	ongoing	Henn Co	CIP
Strategy 2 Leverage land acquisition funds to the greatest extent possible				
<i>Action 1 Evaluate interest of other agencies/entities and feasibility of purchase.</i>	<i>ongoing</i>		Henn Co	CIP
<i>Action 2 Collaborate with member organizations and other entities and avoid duplication of activities.</i>	<i>ongoing</i>		Henn Co	CIP
Action 3 Seek grants and partnerships with government agencies and non-profits.	4	ongoing	Henn Co	CIP
Strategy 3 Encourage land owners to enter land into conservation easements.				CIP
Action 1 Provide training, outreach materials and technical assistance to land owners regarding land conservation options.	7		Henn Co	CIP
Action 2 Provide training, outreach materials and technical assistance to member organizations regarding land conservation options.	4			CIP
Regulations & Enforcement (RE)				
RE 1 Promote consistency in rules, regulations, standards and enforcement across jurisdictions.				

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Goal 1 Develop MWMO resource-based standards that maintain or improve ecosystem health for adoption by local units of government.				
Strategy 1 Work with stakeholders to reassess MWMO standards.				
Action 1 Meet with member organizations to address potential revisions in MWMO standards.	2	ongoing		PL
Action 2 Provide model ordinances to member organizations.	4	ongoing		PL
Action 3 Review existing rules and regulations.	10			PL
Action 4 Track adoption of new MWMO standards by member organizations.	7			PL
<i>Action 5 Revise alternatives to adopting MWMO standards in prohibitive cases.</i>	ongoing			PL
Action 6 Analyze cost benefit and effectiveness of MWMO standards.	7			PL
<i>Action 7 Provide “rule-ready” MWMO standards to facilitate easy incorporation by member organizations.</i>	ongoing			PL
Action 8 Develop guidelines to facilitate compliance with MWMO's resource-based standards in an ultra-urban setting.	10			WA
Action 9 Identify options for creating a banking credit system that works with MWMO standards	7			PL
RE 2 Improve compliance and enforcement of regulations related to water and natural resources.				
Goal 1 Support and empower member organizations to improve compliance with their regulations.				
Strategy 1 Evaluate level of compliance with existing regulations.				
Action 1 Convene work groups to develop a consistent framework for enforcement of local, state and federal water resource related standards within the MWMO.	10			PL

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Action 2 Reassess procedure to evaluate regulation compliance and enforcement.	7			PL
Action 3 Track and assist member organizations' compliance with their LWMP's and MWMO's resource-based standards	4	ongoing		PL
Strategy 2 Provide assistance to member organizations to improve compliance with standards.				
<i>Action 1 Support water resource related enforcement actions of member organizations and state agencies.</i>	<i>ongoing</i>		MPRB	<i>PL</i>
Action 2 May provide funding or staff to assist member organizations in the inspection and enforcement of compliance with MWMO standards.	7			PL
Action 3 Provide training for municipal officials on MWMO resource-based standards and stormwater management practices	2	ongoing		CO
Action 4 Develop a communication plan regarding the MWMO's standards and enforcement procedures.	7			CO
Goal 2 Support and empower member organizations to improve enforcement of their regulations.				
Strategy 1 Avoid duplication of existing regulatory controls.				
Action 1 Reassess information on existing regulatory controls.	7	ongoing		PL
Goal 3 Participate in the implementation and compliance of regulations associated with state and federal laws				
Strategy 1 Assist stakeholders in establishing and complying with regulations				
<i>Action 1 Provide assistance with Total Maximum Daily Load's (TMDLs), non degradation, NPDES, general construction and industrial permits, SWPPP, etc.</i>	<i>ongoing</i>		MPRB, Mpls	<i>PL</i>
Action 2 Participate in developing standards and regulations related to emerging impairments	7	ongoing	MPCA, MPRB, Mpls	PL

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Urban Stormwater Management (USM)				
USM 1 Promote unique and innovative solutions for stormwater management in highly developed urban areas.				
Goal 1 Collaborate with member organizations to incorporate stormwater management solutions			MPRB, Mpls	
Strategy 1 Maximize opportunities for stormwater management early in the planning and development process.				
Action 1 Review member's planning and development processes	7	ongoing		PL
<i>Action 2 Incorporate strategies to slow runoff, to increase filtration, and to increase infiltration of stormwater into planning and development processes</i>	<i>ongoing</i>			<i>PL</i>
<i>Action 3 Incorporate lifecycle costs of stormwater strategies into planning and development processes</i>	<i>ongoing</i>		Mpls	<i>PL</i>
Action 4 Evaluate member's revised planning and development processes	10			PL
Strategy 2 Incorporate stormwater management into multi-functional corridors.				
<i>Action 1 Raise awareness of the potential to create multi-functional corridors</i>	<i>ongoing</i>			<i>PL</i>
Action 2 Prioritize corridors that should be multi-functional	7			CIP
Action 3 Provide feasibility, planning and design services for creating new or retrofitting existing multi-functional corridors	10			PL
Strategy 3 Assess current knowledge of stormwater management				
Action 1 Identify stormwater management practices which will protect groundwater on contaminated sites	4	ongoing	Henn Co MPCA U of M	WA
Action 2 Identify stormwater management practices for abstraction, reuse, filtration and detention	7			WA
Action 3 Identify methods to restore pre-development characteristics of soils	10			WA

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Action 4 Identify successful adaptive management techniques for stormwater	10			WA
Action 5 Evaluate the pretreatment standard of 50% TSS capture.	2			WA
Strategy 4 Evaluate the installed performance of stormwater management practices.				
Action 1 Assemble a record of stormwater management practice locations within the MWMO <i>required spacer</i>	7	ongoing	Mpls	All
Action 2 Evaluate effectiveness of maintenance techniques to preserve stormwater management practice function	7		Mpls	MD
Action 3 Evaluate effectiveness of individual stormwater management practices most likely to be used in the MWMO	7		Mpls	MD
Action 4 Document, over time, the net affects of multiple stormwater management practices on a subwatershed	10	ongoing	Mpls	WA
Strategy 5 Assess if feasible and implement innovative District redevelopment and Restorative stormwater infrastructure systems				
Action 1 Provide feasibility, planning and design services for creating new District and Restorative stormwater systems	7	ongoing		PL WA CIP
Goal 2 Publicize the value and benefits that stormwater can provide.				
Strategy 1 Encourage stormwater to be thought of as a valued resource in an effort to increase local stewardship efforts.				
Action 1 Identify benefits associated with stormwater practices that create greenspace	7			WA
Emergency Preparedness & Response (ER)				
ER 1 Protect natural resources when natural disasters and emergencies occur.				

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Goal 1 Prepare for and respond to emergencies impacting the MWMO's water and natural resources.				
Strategy 1 Collaborate with emergency response officials from local, state and federal agencies.				
<i>Action 1 Provide study information to member organizations on the stormwater drainage system within the watershed</i>	<i>ongoing</i>		<i>Mpls, MPRB</i>	<i>PL</i>
Action 2 Document and share the knowledge and experience gained from preparing for and responding to emergencies.	2		Mpls	CO
Action 3 Share monitoring data and review plans for both local and regional high water (flooding, erosion) and low water (drought, water shortages).	4	ongoing		MD
Action 4 Ensure cities have an emergency response and recovery plan.	10			PL
Action 5 Develop a funding mechanism to ensure financial assistance is provided to enhance emergency response.	4			CIP
Strategy 2 Improve emergency access to Mississippi River throughout the MWMO reach.				
Action 1 Inventory and assess existing Mississippi River emergency access points.	2		Mpls	WA
Action 2 Identify need for additional or improved Mississippi River access.	7	ongoing	Mpls	PL
Action 3 Acquire access easements and routes to allow emergency access to Mississippi River.	10		Mpls, MPRB	MD
Goal 2 Implement protection strategies that protect and minimize the effects of natural disasters and emergencies on water and natural resources.				
Strategy 1 Train MWMO staff to assist in emergency response				
Action 1 Identify and implement training for employees on emergency response.	2	ongoing	Mpls	CO

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Strategy 2 Supplement water and natural resources needs in member community emergency response plans.				
<i>Action 1 Collaborate with members to identify water and natural resources gaps</i>	<i>ongoing</i>			<i>MD</i>
Action 2 Collaborate with members on monitoring activities	2	ongoing	MCES, MPRB	MD
Action 3 Collaborate with members to design and build spill response improvements to outfalls and cashes	2	ongoing	Mpls	CIP
Strategy 3 Conduct and apply research and monitoring as needed.				
Action 1 Improve response products and clean up procedures.	10		Mpls	WA
Action 2 Conduct baseline monitoring portion of emergency response plan in coordination with member organizations	10		Mpls, MPRB	MD
Emerging Issues (EI)				
EI 1 Develop new approaches that protect water and natural resources as conditions change and emerging issues arise.				
Goal 1 Identify emerging issues related to water and natural resources				
Strategy 1 Maintain and prioritize a list of emerging issues				
Action 1 Conduct assessments to identify emerging issues.	7	ongoing	MPRB	WA
Action 2 Gather stakeholder input on key emerging issues	10			WA
Action 3 Gather information (e.g. precipitation, snow, policy language etc.) that can be used to define the impact of an emerging issue	7			WA
Action 4 Develop criteria for prioritizing emerging issues	10			WA
Goal 2 Respond to emerging issues related to water and natural resources.				
Strategy 1 Fund research and development related to emerging issues and make the information available to others.				

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Action 1 Provide funding for statewide revisions to model and precipitation databases.	4			WA
Action 2 Provide funding for research on urban watershed issues.	2	ongoing	MCES MCWD	WA
Action 3 Share information on the effects of emerging issues on local water resources.	10			WA
Strategy 2 Keep Watershed Management Plan current to address emerging issues.				
Action 1 Use a minor amendment process for emerging issues.	7			PL
Action 2 Develop activity areas as necessary to address local impacts of emerging issues.	7	ongoing		PL
Goal 3 Support new policies and regulatory systems needed to manage emerging issues				
Strategy 1 Encourage the use of new and innovative infrastructure systems				
Action 1 Identify and pilot alternative systems, including energy, water supply, stormwater and wastewater treatment and reuse systems.	4			CIP
<i>Action 2 Request policies that allow for innovative infrastructure systems</i>	<i>ongoing</i>		<i>Met Council MCWD</i>	<i>CIP</i>
Action 3 Ensure effectiveness of stormwater management practices under changing conditions.	10			WA
Financial Responsibilities and Strategies (FRS)				
FRS 1 Develop a comprehensive financial framework to implement goals, strategies and actions of the plan.				
Goal 1 Utilize funds to actively protect and improve the quality and quantity of water and natural resources				
Strategy 1 Fund the evaluation, development, and use of new technologies and management practices				
Action 1 Stormwater management practices for highly urban settings.	2	ongoing	Mpls	CIP/CO

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Action 2 Retrofit sites with appropriate stormwater management practices.	2	ongoing	MCES Mpls	CIP/CO
Action 3 Create new and support training and certification programs.	2	ongoing		CO
Action 4 Support development of statewide revisions to stormwater model and precipitation databases.	4			WA
<i>Action 5 Provide economic analysis of stormwater management practice, e.g. return on investment or cost benefit</i>	<i>ongoing</i>		<i>Mpls</i>	<i>PL</i>
Action 6 Support staff attendance at water resource related trainings and certification programs.	2	ongoing		All
Strategy 2 Expend CIP funds on any project with a proven public benefit, regardless of whether it's on public or private property.				
Action 1 Select capital improvement projects based on MWMO's selection considerations.	2	ongoing	MCES, MPRB	CIP
Strategy 3 Fund community initiated stewardship activities.				
Action 1 Identify potential community projects	2			CO
Strategy 4 Fund activities outside of the watershed that impact water and natural resources of the MWMO.				
Action 1 Identify potential upstream projects	7			WA
Strategy 5 Fund capital improvement projects				
Action 1 Provide operation and maintenance funding to projects.	10			CIP
Action 2 Conduct a feasibility study of areas most suitable for regional ponding in MWMO	4		MPRB	WA
Action 3 Provide funding for diagnostic, feasibility, planning, survey, design and bid documents expertise for capital projects.	10			CIP
Action 4 Reassess and maintain a five-year capital and financial plan.	2	ongoing		Admin

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Action 5 Provide funding for new office building	2			CIP
Strategy 6 Fund land acquisition				
Action 1 Purchase land for new offices	2			CIP
Strategy 7 Grant funds to projects that surpass regulatory standards requirements				
<i>Action 1 Use MWMO standards and design guidelines as a baseline for funding.</i>	<i>ongoing</i>			<i>PL</i>
Action 2 Create financial incentives that support the MWMO minimum standards and move projects toward maximizing cost effective treatment opportunities during reconstruction and redevelopment.	10			PL
Strategy 8 Fund approaches that protect and minimize the impact of emerging issues on water and natural resources.				
FRS 2 Maintain a funding strategy that is effective, efficient and transparent.				
Goal 1 Leverage MWMO funding and staff expertise from other sources.				
Strategy 1 Function as a team that collaborates with other entities to carry out project activities.				
<i>Action 1 Seek grants and partnerships providing cash or in-kind contributions.</i>	<i>ongoing</i>			<i>All</i>
Action 2 Apply for matching grants for restoration projects along the Mississippi River	4	ongoing	MPRB	CIP
Action 3 Identify and implement stormwater management practices for highly urban settings	2	ongoing		CIP
Action 4 Provide financial incentives for creative approaches to addressing stormwater runoff quality and quantity.	2	ongoing		CIP
Action 5 Fund community initiated stewardship activities.	2	ongoing		CIP/CO
<i>Action 6 Partner with agencies whose boundaries extend beyond the MWMO whose activities will benefit the MWMO.</i>	<i>ongoing</i>			<i>All</i>
<i>required spacer</i>				

Implementation actions	Action to be completed before or by year: 2, 4, 7 or 10	Action may occur more than one time	Potential action partners	MWMO Activity Area
Goal 2 Use funds in ways that are fiscally responsible and provide public benefit.				
Strategy 1 Be accountable to the taxpayers and member organizations of the MWMO.				
Action 1 Report spending activities.	2	ongoing		Admin
Action 2 Maintain transparent project records and facilitate the redistribution of project results	2	ongoing		Admin
Strategy 2 Involve the public and member organizations in major funding processes.				
Action 1 MWMO CAC Review	2	ongoing		CO
<i>Action 2 Review and coordinate the budget process with member organizations and partners.</i>	<i>ongoing</i>			<i>PL</i>
<i>Action 3 Provide clear direction and parameters for prioritizing capital implementation funding.</i>	<i>ongoing</i>			<i>CIP</i>
<i>Action 4 Fulfill statutory reporting requirements.</i>	<i>ongoing</i>			<i>Admin</i>
Strategy 3 Evaluate cost benefit of MWMO program expenditures				
<i>Action 1 Revise evaluation metrics for program areas</i>	<i>ongoing</i>			<i>Admin</i>
Goal 3 Expend administrative funds on activities that increase the effectiveness and efficiency of personnel				
Strategy 1 Carry out annual work planning within the MWMO.				
Action 1 Develop a framework for annual work planning within the MWMO.	2			<i>Admin</i>
<i>Action 2 Efficiently and effectively manage office administrative processes to maximize people's time/productivity</i>	<i>ongoing</i>			<i>Admin</i>

## **7.0 MWMO ADMINISTRATION/INTERNAL OPERATIONS**

The internal operations of the MWMO are designed to allow the organization to efficiently and effectively accomplish its duties. The MWMO addresses the protection and restoration of water and natural resources through planning, financing and funding processes, and a variety of projects and activities. This section of the Plan outlines the administration and internal operations of the MWMO. For a discussion on MWMO financing and funding see the implementation chapter “Financial Responsibilities and Strategies” and “MWMO Financials.”

### **7.1. MWMO project expertise and services**

While the MWMO Comprehensive Watershed Management Plan lays out the general work flow for the organization, it does not provide the year-to-year specific planning and activity detail necessary to implement the goals of the plan. In addition to the Plan, the Board periodically carries out strategic planning that must be incorporated into the annual workplan of staff. Each year, MWMO staff develops an annual workplan to present to the Board of Commissioners. The annual workplan provides a schedule and details of the projects and activities to be completed in a given year. The process takes place concurrently with the MWMO budget process to ensure funds are directed to the priority projects and activities.

The MWMO conducts an annual prioritization and selection of projects and activities based on available funding for capital projects, planning initiatives, research and watershed studies, communication and outreach initiatives and monitoring. These projects and activities advance the organization’s goals, strategies, and implementation actions, while responding to changing resource conditions; and financial constraints of the MWMO.

The MWMO also continues to seek out opportunities to collaborate and develop partnerships with other organizations to expand the reach of our and their activities, to leverage additional funds, and to prevent duplication of services and project efforts within the Watershed (Table 20).

All projects undertaken and services provided will have an evaluation component. Evaluations measure the impact of MWMO’s efforts and are a critical part of improving its projects and activities. Evaluations will clearly state objectives, measure results, and serve as a valuable tool in documenting the success of the MWMO’s implementation plan. The MWMO will include results of the evaluations as part of its annual report and financial summary.

#### **MWMO brings staff and expertise to each of the following activity areas**

- Capital Projects
- Communications and Outreach
- Monitoring
- Planning
- Watershed Assessment

#### **Capital Projects**

**Purpose and Justification:** The MWMO builds structural solutions to address its water resource protection and improvement goals, because it is the most efficient and effective way to attain the water quality and quantity goals of the MWMO. Nutrient storage, volume storage, rate attenuation, and drought attenuation on a district, sub-watershed or watershed scale is where the MWMO primarily invests its capital improvement funding.

Restoration of vegetation is also an effective tool to reduce water volume, sediment, and other pollutants of stormwater in the Watershed, thereby protecting and improving surface and groundwater and natural resources. Scientific research is increasingly demonstrating the value of trees and vegetation in reducing the negative impacts of urbanization on water and air quality, habitat, energy use, public health, and quality of life. The strategic use of vegetation reduces the amount and cumulative impact of impervious surfaces. Structurally, vegetation also provides layers of opportunities (e.g. canopy, ground cover, roots in the ground) to intercept, use, and infiltrate stormwater before it becomes runoff. Moreover, using vegetation to mitigate urban effects is often less costly than structural engineering solutions. These projects utilize opportunities and incentives to retrofit sites to integrate vegetation to improve water quality, to integrate better building and landscape design into land use decisions and policies, and to pilot new approaches to solving resource problems.

The combination of water conservation (using less water) and reuse (using water more than once before discharge) are additional measures the MWMO utilizes to reduce the impact and demand on our water resources. Water is an increasingly scarce resource, both regionally and nationally, growing demands are arising from an expanding population, changing lifestyles, and industrial, commercial, and agricultural uses. Even in Minnesota, a land of many waters, water is not replenished at the same rate that it is used. Reuse of water can also provide a backup to potable water supplies creating a strategic level resilience for a community. Sustainable water management practices should be an integral part of water use and planning by individuals and large water users, even in the absence of water restrictions.

Finally, the MWMO acquires property control, through easements, purchase of land or other tools. This enables the MWMO to significantly impact surface and groundwater natural resources and other recreational, historical, and cultural resources related to water. Cooperative land conservation projects and dedicated budget enables the MWMO to participate in long-term planning and purchasing processes, and to respond to opportunities as land becomes available. Moreover, MWMO funds will be used strategically to leverage additional partnerships and purchasing power.

***Objectives:***

- Encourage the use of new and innovative water management systems for energy, water supply, and stormwater and waste water treatment and reuse
- Evaluate the effectiveness of new technologies
- Provide technical and funding assistance for projects, programs, and policy development in the Watershed that encourage conserving water resources
- Provide leadership surface and groundwater conservation and reuse whenever opportunities arise
- Pilot innovative and visible demonstrations to showcase techniques for local conditions
- Promote integration of building and landscape design
- Use plants to reduce the volume, slow the rate, and treat runoff leaving the land
- Increase capacity of the Watershed to intercept precipitation and infiltrate and store water
- Restore and protect habitat, native plant and animal communities
- Protect, enhance, and restore natural areas by planting native species
- Create and restore ecosystem function and structure
- Create recreational opportunities related to water
- Actively seek opportunities to vegetate urban landscape and link green spaces
- Develop partnerships between the MWMO and communities
- Reduce the pollutant load reaching the Mississippi River and other MWMO water resources
- Address localized flooding concerns by reducing the rate and volume of runoff reaching the flood area

- Work toward improvement in regional flooding concerns through reductions in the rate and volume of runoff that reaches the Mississippi River
- Provide technical and funding assistance for regional projects in the Watershed
- Assist member organizations in eliminating remaining combined sewer overflows
- Leverage funding from other sources to purchase property that supports watershed planning goals
- Provide financial assistance to member organizations for responding quickly to emergencies that impact water resources
- Collaborate with emergency response officials in training and implementation of emergency response practices

## **Communications and Outreach**

**Purpose:** Provide information, training and educational opportunities, and services and products to promote responsible stewardship of water and natural resources for and by the watershed community. The MWMO watershed community can better support MWMO activities and develop their own initiatives, if they have access to information, training, education, and financial support for water and natural resource projects and activities responding to local threats to water resources identified by the community.

**Justification:** The MWMO community is arguably the most densely populated and socially diverse in the State of Minnesota. It is also the most mobile, in the sense that thousands who live elsewhere work and recreate in the Watershed, use its resources, and leave at the end of the day. Identifying and engaging key stakeholders requires a variety of approaches, targeting many different audiences and evolving standalone activities to achieve ongoing constituent/user involvement.

Achieving widespread understanding about water and natural resources is at the core of a successful watershed management plan. Better land use decisions are key to protecting the natural resources, character, and long-term economic health of our communities. Greater knowledge and awareness can lead to adjustments in personal, corporate, and institutional behaviors and expectations. Ultimately, knowledge can change policy and standard ways of doing business.

The Communications and Outreach programming and activities fulfills specific statutory requirements found in Minnesota Statutes Chapter 103B and Minnesota Rules Chapter 8410. Coordinated programming and activities may also support member cities in fulfilling the demands of NPDES permit authority, and support other MWMO projects and actions to increase their impact.

### **Objectives:**

- Learn from and work with other groups and efforts
- Provide services and products to inform and educate the watershed community using a variety of methods and media
- Create and support opportunities for public participation and involvement
- Collaborate with other professionals and networks to leverage funding and increase the reach and effectiveness of watershed education
- Inform and educate land use decision makers about the relationship between land use and natural resource protection/conservation
- Develop cultural competencies to directly reach diverse communities of the MWMO
- Encourage the use of new and innovative water management systems for energy, water supply, and stormwater and waste water treatment and reuse
- Provide training and certificate programs for the evaluation, development, and use of new technologies and management practices
- Nominate exemplary projects, programs, and actions in the MWMO for awards

- Promote and host workshops and training opportunities for MWMO staff, staff of member organizations, and other entities involved in water resources management
- Supports and promotes local stewardship initiatives, community leadership, and citizen involvement
- Create demonstration sites to inform and educate the watershed community
- Build support for MWMO efforts through grassroots initiatives
- Develop partnerships between the MWMO and communities
- Provide financial assistance to member organizations for responding quickly to emergencies that impact water resources
- Advocate for improved emergency access to the Mississippi River and for improved coordination between emergency response groups for emergencies that impact water resources
- Collaborate with emergency response officials in training and implementation of emergency response practices

## **Monitoring**

**Purpose:** Provide a scientific basis for identifying and tracking water quality and quantity issues, and to provide information to aid in the selection projects and evaluating the success of those projects.

**Justification:** Minnesota Statutes Chapter 103B.201 and Minnesota Rules Chapter 8410.003 establish the principle purposes of the MWMO. Among other purposes, the MWMO is charged with protecting groundwater and surface water quality; additionally, the MWMO may address water quantity issues to correct of flooding within the watershed. Minnesota Rules Chapter 7050 requires all waterbodies comply with water quality standards.

Section 303(d) of the Federal Water Pollution Control Act (commonly known as the Clean Water Act) requires states to develop total maximum daily loads (TMDLs) for waters with impaired uses. The Mississippi River, within the MWMO's boundaries, is listed on the Environmental Protection Agency's 303(d) list of impaired waters. Water quality monitoring provides scientific data to ascertain where and how stormwater management practices can be implemented to effectively achieve TMDLs, state standards, and MWMO purposes and standards.

## **Objectives:**

- Monitor biological, chemical, and physical parameters of surface and groundwater resources in the Watershed
- Monitor water quality within the Watershed
- Develop a record of baseline data to characterize water quality and identify pollutants that exceed water quality standards
- Assess pollutants listed on the Minnesota Impaired Waters list for the TMDL process
- Collect rate and volume data for the Mississippi River and key subwatersheds
- Monitor performance of stormwater management practices
- Collaborate with stakeholders to identify and apply a standardized data collection and assessment approach
- Develop partnerships and collaborate with other organizations and/or agencies both inside and outside the Watershed boundaries to improve water quality in the Mississippi River
- Assess land use impacts on water quality
- Participate in the technical development and update of statewide monitoring databases
- Make data accessible to the public and public entities and to MWMO staff for use as an education tool (e.g. BMP performance data)
- Develop emergency monitoring plan in case of emergencies affecting water resources

## **Planning**

**Purpose:** Provide direction to the MWMO's activities. Clarify and integrate the MWMO's goals, responsibilities, and future courses of action. Coordinate implementation of MWMO Standards and goals by member organizations. Maintain involvement with Mississippi River regional working groups.

**Justification:** Planning processes led and carried out by the MWMO transform the planning requirements of Minnesota Statutes Chapter 103B from referenced laws into a vision, mission, goals, and actions that are collectively understood and implemented by the MWMO and its member organizations. Planning for projects and activities provides the MWMO with an opportunity for coordination and to create efficiencies as to how it achieves its desired outcomes.

### **Objectives**

- Develop and maintain MWMO organizational identity
- Keep the MWMO's Watershed Management Plan (WMP) current to address new circumstances and changing priorities
- Develop plans for new watershed initiatives
- Review and respond to planning related activities and project proposals within the Watershed to assure they are in concert with the MWMO's WMP
- Review and approve local management plans and amendments that impact water and natural resources
- Provide access to information about MWMO goals, priorities, projects, and activity areas
- Encourage public participation in MWMO planning activities
- Bring together information (i.e. watershed assessments and data, public comment, staff and Board reviews) to identify MWMO planning priorities
- Integrate MWMO priorities into activity areas and projects
- Develop consensus among stakeholders for managing resources in the Watershed
- Coordinate budget establishment process and financial evaluation of MWMO projects and activity areas
- Work with member organizations on the implementation of ordinances, standards, plans, and enforcement
- Participate in regional working groups for protection and improvement of the Mississippi River

### **Watershed Assessment**

**Purpose:** Develop a scientific base of knowledge that characterizes physical, chemical, cultural, historic, biological, social, economic, organizational, and political resources of the MWMO to guide planning and management decisions in the Watershed.

**Justification:** Watershed Assessment projects and activities meet the purpose of water management programs found under Minnesota Statutes Chapter 103B.201. Assessments enable a management and prioritization of water resource issues that is scientifically based, accurate, and effective. These projects and activities support both internal and external planning initiatives and the MWMO's implementation efforts by providing information on the condition of the Watershed allowing targeted planning and implementation.

### **Objectives:**

- Provide information needed to set and refine design and performance standards for the Watershed
- Conduct basic research to further knowledge on general water resource issues and emerging issues within and beyond the Watershed's boundaries
- Conduct assessments within the Watershed to define the ecological, physical, biological, cultural, social, economic, organizational, and political characteristics that comprise the MWMO
- Conduct project-based diagnostic and feasibility studies
- Provide information to support other MWMO projects and activity areas
- Provide information to inform the prioritization and use of the MWMO's natural, financial, and human resources
- Provide watershed information to organizations both inside and outside the MWMO's boundaries

## **7.2. Plan Amendments**

As a governmental entity, the MWMO levies taxes to pay for all of its activities. As such, it is essential that there is an opportunity for input by the community when the MWMO is amending or identifying new activities it will take on in the Plan. In addition, actions taken by the MWMO affect the activities of many other governmental and private entities. Thus, when making Plan amendments, coordination with these entities is an essential part of balancing the needs of all affected parties.

This plan will guide MWMO activities until BWSR's 10 year plan update approval in 2018 unless it is superseded by the adoption and approval of a subsequent plan within the ten year timeframe. Many uncertainties arise when trying to align a ten-year planning horizon with the one-year capital budget cycles of the MWMO and member organizations. Thus, changes and amendments to the plan are likely to occur prior to the next scheduled update in 2018. The MWMO will follow the most recent version of Minnesota Statutes, section 103B.231 and Minnesota Rules 8410 when amending the Watershed Management Plan.

The more routine plan changes can be implemented through a process known as "Changes not requiring an amendment" where only a notice and the distribution of changes made is required. These draft and final changes may be sent electronically and must be distributed to member cities, agencies, counties and watersheds who have received a copy of the MWMO's Plan. Distribution must include a version of changes made with deleted text as stricken and new text as underlined. Final changes need to be in the form of replacement pages for the plan with each page renumbered as appropriate and each page including the effective date of the change. Changes not requiring an amendment to the plan are as follows:

- formatting or reorganization of the plan;
- revision of a procedure meant to streamline administration of the plan;
- clarification of existing plan goals or policies;
- inclusion of additional data not requiring interpretation;
- expansion of public process; or
- adjustments to how an organization will carry out program activities within its discretion.

In 2016 the MWMO will route a copy of the Plan with changes not requiring an amendment to provide member communities with timely and current information for their mandatory comprehensive plan update cycles.

The MWMO will review, revise, or amend this plan when completion of current and future studies, regulatory changes, emerging issues or new research necessitates changes in the implementation schedule or activities of the organization. Finally, The MWMO will review, revise or amend as necessary its long range implementation program through the MWMO annual budget and work plan process.

The following is an abbreviated version of the current amendment process which describes: the type of amendment needed, procedural process to be followed, and oversight on the process:

When making amendments to the Plan the MWMO will adhere to the review process provided in Minnesota Statutes, section 103B.231, subdivision 11, except when the proposed amendments are determined to be minor amendments according to the following provisions:

- A. the Board of Water Soil Resources has either agreed that the amendments are minor or failed to act within five working days of the end of the comment period specified in item B unless an extension is mutually agreed to with the MWMO;

- B. the MWMO 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 the minor amendment procedure is being followed, and directed that comments be sent to the MWMO and the Board of Water Soil Resources;
- C. no county board has filed an objection to the amendments with the organization and the board within the comment period specified in item B unless an extension is mutually agreed upon by the county and the MWMO;
- D. the MWMO 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; and
- E. the amendments are not necessary to make the plan consistent with an approved and adopted county groundwater plan.

Draft and final amendments may be sent electronically. A receiving entity may request to receive an amendment in paper format. Draft amendments must show deleted text as stricken and new text as underlined. Unless the entire document is redone, all final amendments adopted by the organization must be in the form of replacement pages for the plan with each page renumbered as appropriate and each page including the effective date of the amendment.

The MWMO will maintain a distribution list of member organizations, state review agencies, the Metropolitan Council, Hennepin County, Ramsey County, Anoka County, and interested parties who have received a copy of the plan. The MWMO will distribute copies of amendments to all on the distribution list and post the amendments on the organization's Web site within 30 days of adoption.

Government agencies reviewing proposed amendments are encouraged to use the opportunity to balance needs and coordinate activities with the MWMO. Taxpayers of the MWMO have the opportunity to comment on proposed amendments by contacting the MWMO to request a copy of the amendment and providing written comment and/or by providing input at the public meeting.

### **7.3. Administration of Legal Boundary**

The MWMO primarily conducts activities for protection and improvement of water and natural resources within its legal boundary. Due to its urban setting, the MWMO's legal boundary encompasses an interconnected drainage network of pipes passing between the cities of Minneapolis, Saint Anthony Village, Saint Paul, and Lauderdale and between the cities of Hilltop, Columbia Heights, and Fridley and discharging directly to the Mississippi River. The legal boundary follows established property lines and typically starts in places where the upstream surficial drainages and topography are routed into this network of pipes. In cases where activities occurring outside the MWMO's legal boundary are affecting the MWMO's water resources, the MWMO will work with the adjacent watershed management organizations, watershed districts, any other local unit of government or organization to address water or natural resource protection or improvement issues.

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## FIGURES SOURCE INFORMATION

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5 Surficial Geology	Surficial Geology	Minnesota Geological Survey (M-178)	2007
6 Bedrock Geology	Bedrock Geology	MPCA Metropolitan Groundwater Model	2000
7 Bedrock units	Bedrock Units	Ojakangas and Matsh, 1982	1982
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**MISSISSIPPI  
WATERSHED  
MANAGEMENT  
ORGANIZATION**

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