Executive Summary

Introduction

This document is developed in accordance with the regulatory requirements listed below under the Purpose heading. This Water Resource Management Plan (WRMP) initiates the fifth decade of the City of Minneapolis (City) programs and practices that have modernized the sanitary sewer and stormwater drainage systems that directly impact water resources in the City.

The modern era of water resource management was initiated in the 1960s when the focus was on the water quality of the Mississippi River. Ongoing overflows of combined sewage and stormwater had resulted in a noticeable decline in the River's water quality. This approach set in the 1960s, continuing into the 1970s, aimed to reduce the occurrence of these overflows through separation of the sanitary sewer and stormwater systems in conjunction with a City-wide street paving program. In the 1980s, the City began to focus on Bassett Creek, Minnehaha Creek, and Shingle Creek water quality through partnership with watershed organizations. In the 1990s, while the sewer separation was winding down and the watershed



Sailboats on Lake Harriet

Credit: Minneapolis Public Works

management programs were growing, the City expanded its water quality focus to encompass the entire City through the initiation of activities designed to improve the quality of the stormwater runoff. Actions during that era included targeted projects such as the Chain of Lakes Water Quality Improvement Project, and initiation of City-wide activities such as increased frequency of street cleaning. Also in the 1990s, the City began a program to construct stormwater basins and other stormwater capacity improvements aimed at mitigation of areas of ongoing street and building flooding. In the 2000s, the focus shifted back to the sanitary sewers to locate and eliminate sources of clear water to the sanitary

sewer, which was identified as necessary to fully eliminate the occurrence of infrequent overflows from the sanitary sewers to the Mississippi River. Primary activities implemented included identification and elimination of rooftop drainage connections to the sanitary sewers, and identification and elimination of other sources of inflow/infiltration (I/I). By the 2010s, all of these activities initiated since the 1960s were successfully working together to improve and protect the water resources within the City.

With the development of this WRMP, the City aims to fully integrate management of the sanitary sewer and stormwater drainage systems to create a holistic approach to water resource management.



This approach is founded in the City's commitment to protect water resources in a manner that respects the needs and demands of all water-related actions, such that activities related to the management of one system are to the benefit, and not detriment, of the other system.

Purpose

The Minneapolis Vision is the foundation of the City's goals and strategic direction that guides management of the City and serves as the foundation for programs and activities implemented as part of the City's 2040 Comprehensive Plan and this Water Resource Management Plan.

Successful management of the City's water resources requires a comprehensive program that respects the needs of the water resource while concurrently The Minneapolis Vision is that the City is a growing and vibrant world-class city with a flourishing economy and a pristine environment, where all people are safe, healthy, and have equitable opportunities for success and happiness.

meeting regulatory requirements and achieving sound fiscal management. The City has prepared this WRMP as a comprehensive planning document that balances these demands as the City conserves, protects, and manages its water resources. This WRMP:

- Compiles, summarizes, and references efforts of agencies, organizations, and departments of the City and the Minneapolis Park and Recreation Board (MPRB). Links are provided to allow users of this report to access specific information that is summarized, but not fully covered, in this WRMP.
- Reviews the current state of the City's water resources in the context of sanitary sewer and stormwater drainage system goals and policies, ordinances, operations and maintenance practices, flood mitigation, and other water resource goals.

Cedar Lake Road Loch Ness Sculpture by Bruce Stillman



Credit: Minneapolis Public Works

- Establishes reasonable and affordable goals that support achievable results within the established regulatory and management structure.
- Lays out the City's approach to assessment, planning, and implementation that is used in the event that a new project or program is required to achieve water resource management goals.

This WRMP is developed in accordance with these multiple regulatory requirements:



- Local Water Plan requirements of Minnesota Statute Section 103b.235 and corresponding Rule 8410.0160.
- Water resource management plan content of the 2018 Minneapolis Comprehensive Plan, as required in Minnesota Statute Section 473.859, and as defined in Metropolitan Council's *Thrive* 2040 Water Resource Policy Plan.
- Municipal sewage collection plan content as required by Minnesota Statute 473.513, and as defined in Metropolitan Council's *Thrive 2040 Water Resource Policy Plan*.
- Supplementary Local Water Plan requirements specific to each of the four watershed management organizations with jurisdiction in the City of Minneapolis: Bassett Creek Watershed Management Commission (BCWMC), Minnehaha Creek Watershed District (MCWD), Mississippi Watershed Management Organization (MWMO), and Shingle Creek Watershed Management Commission (SCWMC).

Content

Detailed information on water resource management in the City of Minneapolis is organized into six sections in this WRMP:

Section 1 – History and Overview of Minneapolis Water Resources

Section 1 describes significant background information that is the foundation of the City of Minneapolis water resource management program. Information includes:

- The history of the City's sewer systems.
- Current trends in the City's water resource management.
- The categories of water resources, as defined by the City: surface water, sanitary collection systems, and stormwater drainage systems.
- Required content and approvals for this WRMP.
- Procedures to amend this WRMP.



Credit: Minneapolis Public Works

Quaking Bog

 The role of the City's National Pollutant Discharge Elimination System (NPDES) Integrated Permit requirements for annual water resource management reports.



ES-3

Section 2 – Regulatory Requirements, Goals, and Policies

Section 2 summarizes regulatory requirements that influence water resource management in the City. The section outlines Federal, State, and Regional requirements and associated programs, organized according to the following public agencies that establish water resource management requirements that affect the City:

- United States Environmental Protection Agency (EPA).
- United States Army Corps of Engineers (USACE).
- Minnesota Board of Water and Soil Resources (BWSR).
- Minnesota Pollution Control Agency (MPCA).
- Minnesota Department of Natural Resources (MNDNR).
- Metropolitan Council.
- Hennepin County.
- Watershed Management Organizations: BCWMC, MCWD, MWMO, and SCWMC.

Collaboration with these multiple regulatory organizations is important to successful water resource management. Section 2 also includes:

 The City and MPRB goals, strategic direction, and water resource guiding principles that direct water resource management. Section 2 outlines that the City collaborates with regulatory partners on public and private project development and on ordinances, guidance documents, and policy updates that impact water resources.

- Responsibilities for implementation of goals and policies.
- Descriptions of sanitary sewer and water resource management cooperative agreements.
- Summaries of how the City complies with major regulatory requirements.

Section 3 – Land and Surface Water Inventory and Assessment

Section 3 provides an extensive inventory and detailed characteristics of the physical environment of the City, with an emphasis on the water resources that exist within the municipal boundary of the City:

- Thirteen (13) lakes, four (4) streams, and a 12-mile segment of the Mississippi River.
- Thirty-eight (38) miles of shoreline are contained within the 6.400 acres of MPRB-owned parks.
- 30.61 inches of average precipitation falls each year in the form of rain and snow.
- Four (4) watershed management agencies oversee and guide water resource management.



Section 3 also contains detailed information of the City's population, parks, neighborhoods, soils, climate, bedrock, geology, topography, land use, zoning, wetlands, groundwater, and source water protection.

Detailed information is summarized for each of the waterbodies within the City, plus an additional 10 waterbodies outside the City's boundaries which receive stormwater runoff discharges from the City's stormwater drainage system. The information provided for each waterbody includes a summary of the physical characteristics (MNDNR ID number, MNDNR classification, MN Chapter 7050 use classification, surface area or length, downstream waterbody, watershed area, and watershed management organization), and a summary of known water quality parameters and values. The waterbody history, inventory of studies, and completed capital improvement projects are also included.

The MPRB is an important partner involved in ongoing monitoring of the water quality of many of the City's lakes and streams. Information collected by the MPRB, which is supplemented by water quality monitoring by watershed organizations, has been used by the MPCA to assess which waterbodies have water quality that is below the state standards, termed impairments. As of 2018, the MPCA has determined that the impairments listed in Table ES-1 exist in Minneapolis waterbodies:

Impairment	Waterbody
Aquatic Consumption (contaminants found in fish tissue)	 Brownie Lake
	 Cedar Lake
	 Lake Calhoun/Bde Maka Ska
	 Lake Harriet
	 Lake Nokomis
	 Lake of the Isles
	 Mississippi River
	 Powderhorn Lake
	Brownie Lake
Aquatic Life (excessive nutrients)	 Lake Hiawatha
	 Lake Nokomis
	 Mississippi River
	 Powderhorn Lake
Aquatic Life (low oxygen and/or low microorganism	 Bassett Creek
	 Minnehaha Creek
county	 Shingle Creek
Aquatic Life (excessive chlorides)	 Bassett Creek
	Brownie Lake
	 Diamond Lake
	 Loring Lake
	 Powderhorn Lake
	 Shingle Creek
	 Spring Lake
Aquatic Recreation (excessive bacteria)	 Bassett Creek
	 Minnehaha Creek
	 Mississippi River
	 Shingle Creek

able ES.1 – Existing Impairment آ	s in City of Minneap	olis Waterbodies
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Table 3.52 (page 3-94) describes the multiple activities that the City has established that are aimed at improving the water quality of all waterbodies in the City, including the above-listed impaired waters. Generally, these activities include installation and proper maintenance of structural stormwater management practices (ponds, green infrastructure, etc.), proper management of streets (street cleaning and winter salt management), stormwater management requirements for new developments, erosion and sediment control for public and private construction activities, and public education. Detailed information on these activities are contained in Section 4 and Section 5.

Section 4 – Infrastructure Inventory, Activities, and Assessment

Section 4 provides detailed information on the sanitary sewer and stormwater drainage infrastructure that work together to protect the City's water resources, including:

- Sanitary sewer inventory (age, materials, pipe, tunnels, interceptors, manholes, pump stations, and regulators).
- Stormwater drainage inventory (age, pipe, tunnels, manholes, catch basins, detention facilities, water quality controls, pump stati outfalls).



Credit: Minneapolis Public Works

Central Library Green Roof

Descriptions of public versus private systems.

- Sanitary sewer service area, capacity, and design standards.
- Stormwater drainage areas, capacity, and design standards.
- Flow projections for sanitary sewers.
- Ongoing improvement activities.
- Operation and maintenance activities.
- Condition assessments.
- Coordination with government agencies.
- Responsibilities for infrastructure management.



Credit: Minneapolis Public Works



Stone Arch Bridge

Section 5 – Regulatory Controls and Water Resource Management Programs

Section 5 recognizes that the public has responsibilities related to water resource management. Section 5 describes the following regulations and programs that require or incorporate public involvement:

- The City and MPRB ordinances that influence water resource management.
- The City's water resource regulatory programs, including stormwater management requirements for new developments, erosion and sediment control practice requirements for public and private construction activities, inflow/infiltration compliance requirements for sanitary

Shingle Creek at Lyndale Avenue North

Credit: CDM Smith

sewers on private properties, and illicit discharge compliance requirements for stormwater drainage systems on private properties.

- Inventory of water resource public education efforts by the City, MPRB, and others.
- Administrative responsibilities for the regulatory programs inventoried in Section 5.

Section 6 – Planning and Implementation

Section 6 describes the City's financial and planning processes used to manage water resource management programs. Information includes the City's revenue sources, expenditure framework, and the lifecycle management process used to identify and implement changes in water resource activities. Capital Improvement Projects that have been formally adopted by the Minneapolis City Council as part of the annual budget are identified. The prioritization approach implemented when there are multiple demands on the City's finite financial resources is also presented.

In 2018, the City budgeted \$91.1 million for sanitary sewer and stormwater management expenses, of which \$41.3 million is paid to the Metropolitan Council for sewage treatment. The remainder of the fund is used for capital improvement expenses, maintenance, street sweeping, and management/administration.

In 2018, the City budgeted \$59.4 million for sanitary sewer expenses and \$31.7 million for stormwater management expenses.

This WRMP sets a framework for the additional efforts

necessary through 2028 to ensure continued management and improvement of the City's valuable water resources.



Ongoing programs include:

- Updated to official controls, including a 2018 update of City Code of Ordinances, Chapter 54, Stormwater Management and an update to the City Stormwater and Sanitary Sewer Guide for development and redevelopment.
- Activities required in the City's NPDES Integrated Permit, including public education, illicit discharge detection and elimination, spill response program, City facility inspections, staff training, erosion and sediment control for City construction projects, street cleaning, winter snow and ice control, stormwater management practice maintenance, City good housekeeping, pilot projects, and ongoing assessments of the condition and capacity of the sanitary sewers and stormwater drainage systems. These programs are budgeted to be \$12 million to \$13.5 million per year.
- Capital improvement projects in the general categories of:
 - Sanitary Sewer and Tunnel Rehabilitation to maintain structural integrity of sanitary system.
 - **Implementation of EPA Stormwater Regulations**, which provide structural stormwater management improvements to further reduce pollutant discharge to waterbodies.
 - **Combined Sewer Overflow Improvements** involving storm drain construction as needed to eliminate stormwater connections to the sanitary sewers.
 - **Storm Drain and Tunnel Rehabilitation** to maintain structural integrity of the stormwater system and improve system capacity.
 - Flood Mitigation with Alternative Stormwater Management Improvements as needed to eliminate ongoing flooding through installation of structural stormwater management practices such as stormwater ponds, infiltration practices, and/or green infrastructure such as raingardens.

The projected cost for these capital improvements ranges from \$30 million to \$80 million per year, to be funded through City budgets, partnerships with other public agencies, state funding, and grants. A year-by-year breakdown of projects and costs is provided in Appendix K.

Annual Reporting

This WRMP is a planning level document that is intended to inventory the City's water resources and its water resource management infrastructure. It is also intended to outline solutions to identified issues, as well as to present an implementation plan that will serve to maintain and improve the water quality and infrastructure as necessary over the 10-year planning

Detailed, up-to-date information on the City's Stormwater Management Plan is found in annual reports prepared by the City and the MPRB.

period of this WRMP. Additional detail on the stormwater management activities is available in the City's Stormwater Management Plan (SWMP), which is updated on a 5-year cycle, with the most current



update planned for release in early 2019. Annual report, described in more detail in Section 1, serve to communicate specific accomplishments over the previous calendar year. The Minneapolis Water Resources Annual Report is released for public review and is the subject of an annual public hearing conducted by the Minneapolis City Council. City staff is available to meet with watershed organizations, other public agencies, and the public as requested to discuss the previous year's annual reports, proposed changes to this WRMP or to the SWMP, and upcoming capital improvement projects under development by the City.

How to Use this Report

The purpose of this WRMP is to provide a comprehensive description of the City's water resource management programs and projects at the time this report was published. Water resource management in the City continues to evolve as problems are identified or new regulations are adopted. Because of this ever-changing character of water resource management in the City, this plan has been developed with the philosophy to reference, and not duplicate, information that is available online.

Readers are encouraged to go to the original source for the most current and accurate information available. Links are provided to assist the reader in finding appropriate website(s) containing the information referenced in this WRMP. The City will review the links presented in the References and Links section on a routine basis to provide access to the most current information.

Specific information, especially information that is subject to frequent change, is contained either in an appendix to this plan, in one of the City's NPDES Annual Reports, or is identified through referral or link to another organization.



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Section 1 – History and Overview of Minneapolis Water Resources

The Minneapolis Water Resource Management Plan (WRMP) is a document that provides background and direction that the City of Minneapolis (City) utilizes to proactively manage its water resources. This document updates the 2006 Minneapolis Local Surface Water Management Plan and the 2008 Minneapolis Sanitary Sewer Plan. The purpose of this 2018 update is to describe the City's integrated approach for management of issues and activities related to the City's surface waters, stormwater drainage and treatment system, and sanitary collection system. The goal of this integrated approach is to ensure that the improvements in one system do not negatively affect operations in other systems, to ensure protection of the important water resources that define Minneapolis.

History

The City has long been defined by its water resources. The Mississippi River, in its current location, has existed since the last ice age about 12,000 years ago. Before the middle of the 19th Century, the Dakota tribe occupied the area now known as Minneapolis, with the Ojibwe as the other dominant Native American tribe in the area. Figure 1.1 shows the Dakota and Ojibwe place names for many of the significant water resources within the City.¹

The town of Minneapolis was incorporated in 1856 and the first town council organized in 1858. Saint Anthony and Minneapolis merged in 1872 under the name of Minneapolis. On February 27, 1883, the Legislature acted on a request from the citizens of Minneapolis and authorized an independent Board of Park Commissioners.

Powderhorn Park, 1905



Credit: Minneapolis Park and Recreation Board

Nearly all of the City's lakes were physically altered in the late 1800s to early 1900s. Lakes were dredged, shorelines filled, islands lost and rebuilt, springs buried, creeks rerouted, ponds built, and wetlands drained. This was done mainly for functional and aesthetic purposes. The most significant alterations include:

 Bassett Creek, near downtown, was enclosed in the mid-1880s into an underground culvert to create a railroad yard.

¹ Source: Two Pines Resource Group. *Native American Context Statement and Reconnaissance Level Survey Supplement*. Prepared for the City of Minneapolis Department of Community Planning and Economic Development. July 2016.





Figure 1.1 – Dakota and Ojibwe Place Names for Significant Water Resources in the City of Minneapolis



- Lake Harriet was extensively dredged and filled on the northwest portion to eliminate marshland and create a more beautiful landscape in the early 1900s. The northern edge of the lake was drained and turned into a meadow for picnics.
- The entire shoreline of Lake Calhoun/Bde Maka Ska received some degree of dredge fill to support parkway construction, which occurred regularly between 1910 and 1925.
- Lake of the Isles was dredged along the north arm to create a uniform depth between 1889 and 1893 and was filled along the swampy east shore to create 4.5 acres of shoreland. These actions eliminated two islands from the lake.
- Channels were created between Brownie Lake, Cedar Lake, Lake of the Isles, and Lake Calhoun/Bde Maka Ska to connect these into a continuous waterbody. A smaller channel was dredged between Lake Calhoun/Bde Maka Ska and Lake Harriet.

Between 1856 and 1927, the area of Minneapolis grew to nearly 59 square miles, as shown in Figure 1.2. In 1856, the City occupied 24 square miles; in 1889, the boundaries expanded to cover 53.5 square miles. The last major annexation of land occurred in 1927, which resulted in the total land area of 58.7 square miles. The population of the City exceeded 300,000 by 1910. To accommodate this rapid growth, the City's infrastructure grew by leaps and bounds in the last 20 years of the 19th Century. In 1889 and 1890, the City constructed 145 miles of sidewalk, and by 1908, there were approximately 125 miles of paved streets.



Figure 1.2 – Minneapolis Growth





Work began on the City's sewer system in 1870 with the construction of a 40-inch diameter brick sewer on Washington Avenue South, as shown in Figure 1.3. By the early 1900s, there were 225 miles of City sewers.





Credit: Minneapolis Public Works

Early Sewer Construction in Minneapolis, 1890



Credit: Minnesota Historical Society

Through the 1920s, most of the City was served by a combined sewer system that collected sanitary sewage plus runoff from streets and properties. This combined drainage was conveyed and discharged directly to the Mississippi River without any treatment. Combined sewers were thought to be a major public health advancement at the time of construction as they effectively washed human and animal waste to the river. It is now recognized that combined sewers simply relocated health and environmental problems from the streets to the Mississippi River.

In the early 1930s, the Legislature created the Minneapolis-St. Paul Sewer Board² to improve the welfare of the Minneapolis and St. Paul areas through installation of a centralized system of sewage treatment and disposal. The Board constructed a treatment facility in St. Paul, plus a system of interceptor sewers in Minneapolis (and elsewhere) to collect sanitary sewage and convey it to the treatment facility. Overflow regulators were installed to handle excess flows that exceeded the capacity of the interceptors, typically a result of large rain events. These overflow regulators directed the excess flows directly into the Mississippi River. At that time, there was little effort to separate the stormwater

² Historical records of the Minneapolis-St. Paul Sewer Board are available at the Minnesota Historical Society (<u>http://www2.mnhs.org/library/findaids/gr00275.xml</u>)



from the combined sewers; however, from the 1930s forward, as the City continued to develop, new areas were served with separate sanitary and storm drainage systems.

The Metropolitan Council (formerly the Metropolitan Waste Control Commission) took responsibility for

the interceptors and regulators in the mid-1960s. In 1960, the City banned rainwater drainage to the sanitary sewer (<u>City Code 1960, As Amend., § 614.010</u>) and all new sewers constructed after 1960 were dedicated to either sanitary or storm flows.

During the 1960s, the movement to separate the combined sanitary and stormwater systems gained momentum when the City began a 30-year program of residential street reconstruction. The City aimed to coordinate storm drain construction with the street reconstruction project which would separate the street runoff from the sanitary sewers. In the late-1970s, the U.S. Environmental Protection Agency (EPA) and the Minneapolis Pollution Control Agency (MPCA) worked with the City to accelerate the separation project schedule.

Analyses conducted in the 1970s and 1980s determined that adequate capacity existed in the sanitary sewers to allow private source of inflow, such as roof rain leaders and foundation drains, to remain connected to the sanitary system. By the early-2000s, however, the capacity for private source of inflow was no longer adequate. For this reason, a 2003 ordinance was enacted to require disconnection of rain leaders and other connections that delivered stormwater into the sanitary system. Currently, the City works to reduce or eliminate the sources of non-sewage that flows into the sanitary sewers, termed inflow (water that makes its way into the sewers via direct connections) and infiltration (seepage through cracks and joints). This continued reduction of inflow/infiltration (I/I) has nearly eliminated occurrence of combined sewer overflows (CSOs), reduced overall treatment costs paid by the City to the Metropolitan Council, and has provided additional capacity in the regional conveyance and treatment. Additional information on the City of Minneapolis' I/I program in contained in Section 4 -Infrastructure Inventory, Activities, and Assessment and Section 5 – Private Systems and Regulatory Controls.





Figure 1.4 – History of Minneapolis Sewer Separation

A graphic of how the City's sewer system has been separated over time is shown in Figure 1.4. As shown, sewer separation has been largely achieved in the City. Although small pockets of combined and partially separate sewers remain, there has been no CSO to the Mississippi River related to wet weather since 2010.

Current Trends in Minneapolis Water Resources Management

The City is defined by its lakes, creeks, and the Mississippi River. To protect and care for these valued resources, the City has established comprehensive programs and policies. The City must comply with federal and state regulatory mandates, and as an older, fully developed City, contends with the challenges of aging infrastructure. Management of sanitary sewers, storm drains, and surface waters as separate resources can lead to capacity and financial conflicts. For this reason, the City now manages the sanitary collection, stormwater drainage, and surface water systems as integrated systems. With this WRMP, the City has integrated activities that affect water resources by incorporation of the (previously titled) Minneapolis Sewer Plan into this WRMP. Through this integration, the operation, maintenance, and improvement of the sanitary collection system and stormwater treatment and drainage system work together to drive improvements in the quality of the water resources of the City.

In the future, the City anticipates the need to balance multiple important water resource issues and concerns. One of these is aging infrastructure, where additional resources will be required to maintain the condition and capacity of the infrastructure as the system continues to age. Another important concern is the regulatory mandates to manage stormwater runoff quality and quantity associated with Total Maximum Daily Load (TMDL) programs (see Section 3 - Land and Surface Water Inventory and Assessment), where achievement of progress toward Waste Load Allocations will require resources to focus on stormwater runoff pollutant reduction. The potential for more frequent or more intense wet weather events due to climate change is another concern that necessitates infrastructure investment, such as management of flooding. In anticipation of these numerous demands with limited resources, the City will seek to accomplish multiple water resource goals within their infrastructure improvement projects. For example, private inflow sources are identified for disconnection from the sanitary sewers as part of street reconstruction projects, and water



Credit: Minneapolis Public Works

quality improvements are included when flood mitigation projects are carried out. The City expects that this strategy will deliver projects that maintain the condition and capacity of the systems that both improves water quality and provides cost-effective solutions to multiple water resource challenges.



Sanitary Sewer Cleaning

The City is also committed to consideration of emerging techniques and technologies, as well as the anticipated weather changes related to climate change. Preservation of natural resources, disconnection of impervious surface, reduction in impervious area, and continued implementation of cost-effective Stormwater Management Practices (SMPs) are all activities that will address the overall volume, rate, and quality of stormwater that is discharged to surface waters. This will benefit both the City's infrastructure and ultimately the water as follows:

- Reduced velocity of flow in local streams.
- Reduced pollutant loads to surface waters.
- Increased recharge of groundwater.
- Reduced frequency, severity, and duration of localized street/intersection floods.
- Improved capacity of stormwater drainage system.

An important water resource tool to manage the sanitary collection system will continue to be reductions in I/I. The

Construction of Underground Stormwater Treatment



Credit: Minneapolis Public Works

overall benefit of this program is the improvement in water quality of the Mississippi River, by eliminating sewer overflows and cost savings for excess treatment at the plant and expansion of regional facilities.

Categorization of Minneapolis Water Resources Systems

The City categorizes its water resource systems into three major groups: surface waters, public infrastructure, and private systems. The public infrastructure is further divided into the sub-categories of sanitary sewer system, stormwater drainage system, and public ditches. Details of each of these systems are further described in Section 3 – Land and Surface Water Inventory and Assessment, and Section 4 – Infrastructure Inventory, Activities, and Assessment. Private systems and responsibilities are described in Section 5 – Regulatory Controls and Water Resource Management Programs.



Minnehaha Falls

Surface Waters

Surface waters include all waters of the state, termed Public Waters, that are within the Minneapolis city boundaries. <u>Public Waters</u> are defined by the Minnesota Department of Natural Resources. Although a segment of Shingle Creek through the City is a County Ditch, and regulated by Minnesota Drainage Law, it is managed as surface water for purposes of this WRMP.

All surface waters have been classified by the MPCA by its beneficial use, the highest class being for domestic water

consumption (Class 1). Each class is



Credit: Minneapolis Public Works

assigned a water quality standard, which is the basis for preservation and restoration of the quality of the waters of the State.

Infrastructure

Sanitary Sewer System

For the purposes of this WRMP, components of the sanitary system include pipes, manholes, control structures, and lift stations used primarily for the conveyance of sewage to the sanitary interceptors owned by the Metropolitan Council.

Storm Drainage System

The storm drain system includes all physical components to both convey and manage the stormwater runoff. Structural conveyance components include street gutters, catch basins, manholes, pipes, tunnels, and pumps; structural SMPs include grit chambers, detention ponds, infiltration devices, filtration devices, underground storage, and outfalls.

Public Ditches

Minnesota Statute 103E, Drainage Law

(commonly called the Minnesota Ditch Law) allows for a water management authority to construct and maintain public ditch systems. The Minnesota Board of



Cedar Meadows Stormwater Pond

Credit: Minneapolis Public Works

Water and Soil Resources (BWSR) is the state agency responsible for the oversight of Chapter 103E and



has published the Minnesota Drainage Manual (2016) and Understanding Minnesota Public Drainage Law (2002) to provide guidance for management of the public ditch system.

These public ditches are integral to the Minneapolis storm drainage system and are owned and managed by Hennepin County and Minnehaha Creek Watershed District (MCWD).

- Shingle Creek between Xerxes Avenue in Brooklyn Park and 44th Avenue North in Minneapolis is legally Hennepin County Ditch No. 13 and is the responsibility of Hennepin County under the Minnesota Ditch Law. For the purpose of this WRMP, this segment of Shingle Creek is managed as a surface water.
- At the request of the MCWD, Hennepin County transferred the administrative, operation, and maintenance responsibilities for County Ditches No. 14, No. 17, and No. 29 to the MCWD in 1971 and 1972. Each of these ditches discharge to Lake Calhoun/Bde Maka Ska and, within the municipal limits of the City, has been enclosed into a storm drain.

Private Sanitary Sewers and Treatment Systems

Generally, the proper operation and maintenance of private sanitary and stormwater systems is the responsibility of the private property owner. In Minneapolis, this private ownership includes the segment of the private connection that is within the public right-of-way, as well as the connection to the City-owned sanitary sewer. Activities detailed in this report include programs the City has implemented related to private infrastructure, as necessary to ensure compliance with City ordinances.

Private sanitary sewers that connect to the City's sanitary collection system are required to obtain a Sewer Connection Permit from the City's Utility Connections Office of the Public Works Department. Private wastewater treatment facilities are subject to additional requirements set by the MPCA and Metropolitan Council. The Metropolitan Council also requires certain industries that discharge to the sanitary sewers obtain an <u>Industrial Permit</u>, of which there are 165 issued to industries within the City. The City does not maintain a separate list of industrial permits that are managed by these agencies. A data search of the MPCA records found 35 active private industrial permitted wastewater systems in the City as of May 2016.

Private Individual Sewage Treatment Systems (ISTS), also called septic systems, are prohibited by Minneapolis Code of Ordinance Chapter 101 where public sewers are available. Chapter 511 prohibits the construction of such systems for new buildings. The City transferred authority to Hennepin County to regulate ISTS locations within the City. Hennepin County Environmental Health provides septic inspection and enforcement programs under the authority of Hennepin County Ordinance No. 19. This ordinance adopts Minnesota Rules Chapter 7080 governs ISTS and went into effect on January 1, 2000. Hennepin County has reported that there is one active ISTS within the City of Minneapolis.

Private Stormwater Drains and Industrial Stormwater

New private stormwater drains that connect to the City's stormwater system are required to obtain a Utility Connection Permit from the City. Private stormwater outfalls that discharge directly to a surface water are also subject to the City's Utility Connection Permit.



Owners of private stormwater Best Management Practices (BMPs) are required to register the BMP with the City's <u>Public Works Department</u>.

The MPCA requires certain industrial facilities to obtain an <u>Industrial Stormwater General Permit</u>. <u>MPCA</u> <u>records</u> list 160 permits issued to Minneapolis industrial facilities as of May 1, 2016. The City does not maintain an active list of private and/or industrial stormwater permits that are managed by other public agencies.

Minneapolis Water Resource Management Plan (WRMP) Purpose of Water Resource Management Plan

Successful management of the City's water resources requires a comprehensive program that respects the needs of the water resource while concurrently meeting regulatory requirements and achieving sound fiscal management. The City has prepared this WRMP as a comprehensive planning document that balances these demands as the City conserves, protects, and manages its water resources. This WRMP:

- Compiles, summarizes, and references efforts of agencies, organizations, and departments of the City and the Minneapolis Park and Recreation Board (MPRB). Links are provided to allow users of this report to access specific information that is summarized, but not fully covered, in this WRMP.
- Reviews the current state of the City's water resources in the context of sanitary sewer system and stormwater drainage system goals and policies, ordinances, operations and maintenance practices, flood mitigation, and other water resource goals.
- Establishes reasonable and affordable goals that support achievable results within the established regulatory and management structure.
- Lays out the City's approach to assessment, planning, and implementation that is used in the event that a new project or program is required to achieve water resource management goals.

Relationship to Comprehensive Plan

This WRMP is a chapter of the 2018 Minneapolis Comprehensive Plan and has been reviewed by the Metropolitan Council to ensure compliance with their Comprehensive Water Resources Management Plan.

Relationship to Minneapolis Stormwater Management Program

The Minneapolis Stormwater Management Program (SWMP) is a federally required document that has been prepared in compliance with the City's National Pollutant Discharge Elimination System (NPDES) stormwater permit which is overseen by the Minnesota Pollution Control Agency (MPCA). This WRMP is a planning document that must comply with requirements established by the State of Minnesota and overseen by the Minnesota BWSR and local watershed management organizations. These two documents have the overall goal of improvement of the quality of water resources but have different implementation approaches. The SWMP has a focus on specific SMPs as required in the City's NPDES stormwater permit. The content of the SWMP is not duplicated in this WRMP but is referenced wherever relevant. This WRMP has a broader view that includes the additional water management



activities such as management of the surface waters, monitoring, relationship with the City's goals, and management of the City's sanitary collection system, among other planning level activities.

Relationship to Minneapolis Park and Recreation Board Lands and Water Resources The MPRB owns all parkland in Minneapolis, as well as large parks outside the municipal boundaries of the City. As detailed in Section 3, most of the lakes and streams are within the boundaries of MPRB lands, resulting in the MPRB being a property owner of nearly all shoreline in the City. As a separate agency with an independent elected board, the MPRB has full zoning authority for its land and adopts ordinances that govern operations, land use, and waterbody use. The MPRB is fully responsible for maintenance of their lands, including shorelines, without oversight by the City.

As a separate agency, the MPRB is not governed by this WRMP, but is governed by the NPDES Integrated Permit, which was issued jointly to the City and the MPRB. As co-permittees, the City and the MPRB strive to work closely together to accomplish the water quality goals contained in the NPDES permit, as well as those goals described in this document. Cooperative activities include ongoing collaboration on capital improvement projects, public education, monitoring, and other program activities. As part of this ongoing collaboration, MPRB staff contributed to the development of this WRMP.

Information Contained in Water Resource Management Plan

Water resources management in the City continues to grow. Monitoring information is updated annually, improvements are constructed in the infrastructure, and watershed-based programs are implemented. Because of this ever-changing character of water resources management in the City, this plan has been developed with the philosophy to reference, and not duplicate, information developed by others. As a result, specific information, especially information that is subject to frequent change, is either contained in an appendix to this plan, is contained in one of the City's Annual Reports, or is referenced to another organization.



Heritage Park Stormwater Channel

Credit: Minneapolis Public Works

Readers are encouraged to go to the original source for the most current and accurate information available.

In 2015, the Minnesota BWSR adopted a change to Minnesota Rules, Chapter 8410 that revised the required information that must be contained in watershed management plans and local water plans. With respect to local water plans and this WRMP, the new requirements are listed in Table 1.1. A more detailed cross-reference between the Minneapolis WRMP and Local Plan requirements is contained in Appendix A.



Table 1.1 – 2016 Local Plan Requirements

8410.0160 PLAN STRUCTURE

Subpart 1. Requirement

Each local water plan must, at a minimum, meet the requirements for local water management plans in Minnesota Statutes, section 103B.235, and this part, except as provided by the watershed management organization plan under part 8410.0105, subpart 9.

Subpart 2. Local Comprehensive Plan

Each local government unit must include the local water plan as a chapter of its local comprehensive plan. All local comprehensive plans must be consistent with local water plans adopted under this part.

Subpart 3. Plan Contents

Each local water plan, in the degree of detail required in the organization plan, must contain the following:

- A. An executive summary that summarizes the highlights of the local water plan;
- B. Appropriate water resource management-related agreements that have been entered into by the local community must be summarized, including joint powers agreements related to water management that the local government unit may be party to between itself and watershed management organizations, adjoining communities, or private parties;
- C. The existing and proposed physical environment and land use must be described. Drainage areas and the volumes, rates, and paths of storm water runoff must be defined. Data may be incorporated by reference as allowed under parts 8410.0060 and 8410.0105, subpart 9, or the local comprehensive plan;
- D. An assessment of existing or potential water resource-related problems must be summarized. The problem assessment must be completed for only those areas within the corporate limits of the local government unit and similar to the process under part 8410.0045, subpart 7;
- E. A local implementation program through the year the local water plan extends must describe nonstructural, programmatic, and structural solutions to problems identified in item D. The program must not jeopardize achievement of the goals of an organization's plan. The implementation components must be prioritized consistent with the principles of part 8410.0045, subpart 1, item A. Local water plans must prioritize the implementation components of an organization plan consistent with the organization priorities set forth under part 8410.0105, only for implementation components that must be facilitated by the local government unit. Local official controls must be enacted within six months of approval of the local water plan by the organization.
 - (1) include areas and elevations for storm water storage adequate to meet performance standards or official controls established in the organization plan;
 - (2) define water quality protection methods adequate to meet performance standards or official controls in the organization plan and identify regulated areas;
 - (3) clearly define the responsibilities of the local government unit from that of an organization for carrying out the implementation components;
 - (4) describe official controls and any changes to official controls relative to requirements of the organization's plan;
 - (5) 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 tools; and
 - (6) 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, and funding source.



8410.0160 PLAN STRUCTURE

Subpart 4. Amended procedures.

A section entitled "Amendments to Plan" must establish the process by which amendments may be made. The amendment procedure shall conform with the plan amendment procedures in the organization plans that affect the community.

Subpart. 5. Submittal and review.

After consideration and before adoption, the local water plan or local water plan amendments shall be submitted for review according to Minnesota Statutes, section 103B.235.

Subpart 6. Adoption and implementation.

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. Each local government unit must notify watershed management organizations with jurisdiction over area subject to the local water plan 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.

Water Resource Management Plan Management and Adoption

The City is committed to management of its water resources in the most efficient and up-to-date manner feasible. The goal of this plan is to be in compliance with requirements of Minnesota Rule 8410.0160, which governs local water plans, including this WRMP. Once this WRMP is final, the focus will be to implement the recommended programs and to continue to update practices and policies as mandates develop or as new technologies emerge. This approach will allow the flexibility necessary to respond to the layers of regulations that affect the City. This WRMP will be used as the guide to ensure that new practices meet the



Credit: Minneapolis Public Works

stated goals and guiding principles. Approval, adoption, and revisions to this plan will follow the format detailed in the following subsections.

City Council Consideration

The City Council has accepted this draft document for review concurrent with submittal to the Metropolitan Council and watershed management organizations, as defined in Minnesota Statutes, Section 103B.235. Prior to City Council acceptance and adoption, the MPRB staff have had an opportunity to review the draft document for consistency with MPRB activities.



Fishing on Lake Harriet

Metropolitan Council, Watershed District, and Watershed Management Organization Review

After City Council acceptance of the draft document, City staff submit the WRMP for agency review, in accordance with procedures set in Minnesota Statute 103B.235 and Minnesota Rule Chapter 8410.0160. Comments from reviewing agencies will be considered for inclusion in the revised WRMP.

Public Review

Public input will be sought through formal and informal communications. City of Minneapolis staff will make the draft document available for review and will solicit comments. Public comments will be considered for inclusion in the revised WRMP. The final revised WRMP will be presented to the Transportation and Public Works Committee of the Minneapolis City Council prior to adoption by the full City Council.

City Adoption

Final adoption will be considered by the Minneapolis City Council and the Mayor after approval by the watershed management organizations, approval by the Metropolitan Council, public review, and a public hearing.

Amendment Procedures

On occasion, amendments to the WRMP may be necessary. The process for a major amendment to this WRMP will follow the steps set for adoption of the report. City staff will determine if an amendment is necessary, either based on a formal written request or based on changes to water resources management goals and objectives. The request shall outline the need for the amendment, as well as additional materials that the City will need to consider before a decision is made.

Minor changes to the WRMP do not require watershed management organization or City Council approval and can be made by City staff but must be supplied to the City Council before being submitted to the watershed organizations for their information. The City considers minor changes to be those that do not modify the goals, policies, or commitments identified in this WRMP. The most significant example of a minor change would be updating the City's Capital Improvement Program (CIP) and implementation program to align with City Council annual adoption of budgets that fund projects and programs.

Section 4 of this WRMP identifies the need to complete analysis of the runoff volumes and flow rates at the 419 stormwater outfalls owned by the City. The results of this analysis will be appended to this WRMP as a minor plan amendment when the analysis is complete.

Annual Reports

Through 2017, three annual reports were published each year that provide the most up-to-date information on water resource related actions and accomplishments. These reports are:

The <u>Combined Sewer Bypasses and Overflows</u> annual report is prepared by Metropolitan Council with information contributed by the City of Minneapolis. This report includes information on inspection activities, historic precipitation versus overflows, status of rain leader disconnections, status of catch basin disconnections, and planned activities for the future year.



The <u>NPDES Municipal Separate Storm Sewer Systems (MS4) Phase I Annual Report</u> reports on stormwater related activities governed by the City's NPDES permit. The report summarizes the accomplishments of the previous year in the general categories shown in Table 1.2.

Category	Activities
Stormwater Drainage System Maintenance	 Number of catch basins repaired Miles of storm drains cleaned Miles of storm drains televised and assessed Feet of storm tunnel repaired Number of ponds and devices maintained Number of grit chambers inspected Number of grit chambers cleaned Number of outfalls inspected Number of pump stations monitored, maintained, and rehabilitated Volume of sediment removed and disposed from storm drains, ponds, and structural controls
Erosion and Sediment Control/Inspection	 Number of erosion and sediment control cases managed Total number of inspections conducted Number of enforcement actions Number of citations for non-compliance issued
Site Plan Development	 Number of site plans reviewed Number of site plans approved Number of new BMPs approved Total acres and total impervious acres of property with new stormwater management practices
Public Works Street Maintenance	 Tons of salt applied during winter street maintenance period Tons of sand applied during winter street maintenance period Tons of material collected during spring and summer sweeping operations Tons of leaves collected for composting during fall sweeping operations Number of staff attending hazardous materials testing Number of staff attending salt management training
MPRB Snow and Ice Management	 Number of MPRB staff that hold MPCA Road Salt Applicators Training Certificate Amount of materials recovered as a percentage of materials applied Amount of salt and sand applied relative to total snowfall
Flood Mitigation	 Percentage of City-wide hydrologic/hydraulic models complete to-date
Vegetation Management – Pesticides and Fertilizer Control	 Number of MPRB staff who hold pesticide applicator licenses through the Minneapolis Department of Agriculture (MDA) Number of MPRB staff receiving training and certificates on chloride application Vegetation management at stormwater management sites, including pest management and prescribed vegetation burns
Illicit Discharge and Improper Disposal	 Number of emergency response requests and response time Number of days of outfall sampling and visual inspections Number of spill incidents where contaminant boom was utilized Training on deployment of spill response/containment boom on the Mississippi River Number of spill response overview sessions for staff

Table 1.2 – NPDES Municipal Separate Storm Sewer Systems (MS4) Phase I Annual Report Contents



Category	Activities
Illicit Discharge and Improper Disposal (continued)	 Number of water and land pollution complaints investigated Description of brownfield maintenance and monitoring Number of limited duration sanitary sewer and stormwater discharge permits approved Number of temporary water discharge permits approved Number of storage tank permits approved Number of hazardous materials facilities inspected Number of emergency response plans for hazardous materials facilities reviewed
New Sanitary Sewers and Stormwater Drains Construction	 New storm drain construction projects to eliminate CSO connections to sanitary sewer Total drainage acres removed from sanitary sewer Total miles of sanitary sewer installed with cured-in-place liners Total number of inflow/infiltration repairs completed on sanitary sewers
Public Education	 Description of MPRB public education and outreach sessions Description of Metro Blooms education workshops conducted Number of participants, catch basins stenciled, trash collected, and door hangers distributed through the Catch Basin Stenciling activities Number of MPRB parks with water quality education program events Number of sites, number of volunteers, and pounds of trash collected at Earth Day Watershed Clean-Up sites Listing of public education websites
Public Participation	 Date and location of annual public hearing on the Stormwater Management Program Number of interested parties receiving notice of annual public hearing Description of notices sent to neighborhood organizations and government agencies Summary of testimony presented at public hearing and written comments received
Coordination with Other Government Agencies	 Summary of significant activities by watershed organizations, Hennepin County, MPCA, and other agencies
Stormwater Monitoring Results and Data Analysis	 Lake water quality trends Stormwater monitoring sites description, samples collected, parameters tested, and analysis results Precipitation events greater than 0.10 inches Water quality monitoring completed Structural stormwater management sites monitored for pollutant removal effectiveness, including procedures and monitoring results

• The <u>MPRB Water Resources Report</u> summarizes monitoring and analysis for surface waters, stormwater runoff, and BMP effectiveness as completed in the previous year.

The NPDES Integrated Stormwater Permit, contained in Appendix B, will impact these annual reports such that the *Combined Sewer Bypasses and Overflows* annual report will be merged into the *NPDES MS4 Phase I* annual report. This change will be effective for the 2018 annual report, which will be published in 2019.



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Section 2 – Regulatory Requirements, Goals, and Policies

Regulatory Agencies, Requirements, Goals, and Programs

This Minneapolis Water Resource Management Plan (WRMP) is developed to meet the regulatory requirements of <u>Minnesota Statute 103B.235</u>, <u>Minnesota Statute 473.858</u>, <u>Minnesota Statute 473.513</u>, and <u>Minnesota Rule Chapter 8410.0160</u> (Local Water Management Plans). This WRMP is also designed to meet the local water plan requirements of each watershed organization with jurisdiction in Minneapolis, and the water resource comprehensive plan requirements of the Metropolitan Council. In addition to these comprehensive plan requirements, there are Federal laws and regulations and State statutes and rules that dictate water resource management in the City of Minneapolis (City).

This section describes all applicable regulatory requirements in order to provide detail on the complexity of water resource management. This section also highlights how the City's goals and objectives serve to meet these regulatory requirements.

Federal Requirements and Programs

Clean Water Act

The 1972 amendment of the 1948 Federal Pollution Control Act, known as the Federal Clean Water Act (CWA), governs the discharge of pollutants to waters of the United States. The CWA gave the **United States Environmental Protection** Agency (EPA) the authority to create federal regulations and permit programs related to Combined Sewer Overflow (CSO), Sanitary Sewer Overflow (SSO), Municipal Separate Storm Sewer Systems (MS4), and activities that alter wetlands. In Minnesota, the authority to issue National Pollution Discharge Elimination System (NPDES) permits under the authority of the CWA has been delegated



Loring Park Shoreland

Credit: Minneapolis Public Works

to the Minnesota Pollution Control Agency (MPCA). Wetland permits are issued by the United States Army Corps of Engineers (USACE). Total Maximum Daily Load (TMDL) limits for pollutants, an initiative mandated by the EPA, also stem from the EPA's role as steward of the CWA.

Environmental Protection Agency – Clean Water Act



NPDES Programs

Combined sewer systems, once a common construction practice in older cities across the country, are designed to collect rainwater runoff, domestic sewage, and industrial wastewater in a single pipe. Most of the time, combined sewer systems transport all wastewater to a sewage treatment plant, where it is treated and discharged to a surface water. However, the wastewater volume in a combined sewer system can exceed the capacity of the sanitary sewer system or treatment plant as a result of heavy rainfall or snowmelt. For this reason, combined sewer systems were designed to allow excessive stormwater/wastewater flows to overflow the sanitary sewers and

Mississippi River at Saint Anthony Falls



Credit: CDM Smith

discharge directly to nearby streams, rivers, or other waterbodies. These overflows contain not only stormwater but also untreated human and industrial waste, toxic materials, and debris. Per data collected by the United States Environmental Protection Agency (EPA) in 2004, there are 746 communities that have combined sewer systems in the United States with a combined total of 9,348 CSO outfalls and an (estimated) discharge of 850 billion gallons of combined untreated wastewater and stormwater being discharged each year.¹ As described in Section 1 – History and Overview of Minneapolis Water Resources and Section 4 – Infrastructure Inventory, Activities, and Assessment, the City has worked to eliminate major sources of clear water discharges to the sanitary sewers in an effort to minimize the occurrence of CSO events. To-date, this program has been successful with no measured CSO events since 2010. CSO controls remain in the system to prevent sewage backups into or onto streets and/or into basements during a major precipitation event, and to protect sanitary sewer infrastructure from failures caused by excessive pressure. The EPA continues to regulate CSO systems through the NPDES permit program, which is administered in Minnesota by the MPCA.

Stormwater discharges are generated by stormwater and snowmelt runoff from land and impervious areas such as paved streets, parking lots, and building rooftops. As it flows across the land and impervious surfaces, the runoff often picks up and transports pollutants in quantities that can adversely affect water quality. Most stormwater discharges to rivers, creeks, and lakes are from the storm drains at outfall structures, which are considered point sources and require coverage by an NPDES permit. The primary method to control stormwater discharge is through Stormwater Management Programs (SWMPs) as mandated in NPDES stormwater permits. In 1990, the EPA issued their initial stormwater rules which created stormwater management requirements for municipalities with populations greater than 100,000, certain industrial sites, and active construction sites. The City was designated as a Phase I

¹ EPA. Report to Congress, Impacts and Control of CSOs and SSOs. EPA 833-R-04-001. August 2004



municipality under these rules which led to the development of the stormwater programs described in this WRMP.

EPA CSO Program EPA Stormwater Program

Sanitary Sewer Overflows

Sanitary Sewer Overflows (SSOs) are occasional, unintentional discharges of raw sewage from municipal, non-combined, sanitary sewers. SSOs occur due to a variety of causes. These causes may include severe weather, clogs, improper system operation and maintenance, or vandalism. The EPA estimates that nationally, there are at least 40,000 SSOs each year. The untreated sewage from these overflows can contaminate public waters, which can result in serious water quality problems. It can also back-up into basements, which causes property damage and threatens public health. There are no documented SSO events within the City between 2014 and 2017.

EPA Sanitary Sewer Overflows

Section 208 Wastewater Treatment

Section 208 of the CWA requires local governments to identify wastewater treatment needs and to develop comprehensive programs to meet those needs. In the metro area, the 208 planning requirements are the responsibility of the Metropolitan Council.

Section 404 Wetlands

Section 404 of the CWA establishes a program that regulates the discharge of dredged or fill material into Waters of the United States, which includes wetlands. Activities regulated under this program include fill for development, water resources projects, infrastructure development, and mining projects. Section 404 requires a permit before a dredge or fill material may be discharged into Waters of the United States. Certain farming and forestry activities are exempt from Section 404 regulation.

Section 404 Fact Sheet USACE Section 404 Permits



Nokomis Knoll Wetland

Credit: Minneapolis Public Works



National Flood Insurance Programs

Since 1974, the City has participated in the National Flood Insurance Program (NFIP) to allow property owners to purchase flood insurance. In Minnesota, the Minnesota Department of Natural Resources (MNDNR) oversees the implementation of this program. To maintain enrollment in the program, the City must implement ordinances and other local controls that manage land use within designated flood zones. Floodplain overlay maps are maintained by the Minneapolis Department of Community Planning and Economic Development (CPED).

Upper Saint Anthony Falls Lock and Dam, upstream of lock



Credit: Minneapolis Public Works

FEMA NFIP Program Minneapolis Zoning Maps

USACE Navigation

The full length of the Mississippi River in the City is designated as a Navigational Water under the <u>U.S.</u> <u>River and Harbors Act</u>. Any construction along the shoreline of the Mississippi River, such as improvement of a stormwater outfall, is subject to USACE permit requirements. The USACE uses this permit process to set design requirements to protect the navigation channel of the River.

USACE Navigation Responsibilities

State Agencies

Local Surface Water Management – BWSR

The Minnesota Board of Water and Soil Resources (BWSR) oversees the state statutes and rules that govern local surface water management in the Twin Cities. The powers and duties of this Minnesota state agency with respect to this WRMP include:

- Coordination of water and soil resources plans among counties, watersheds, and local units of government.
- Facilitation of communication among state agencies in cooperation with the Environmental Quality Board.
- Approval of watershed management plans.

Minnesota Board of Water and Soil Resources/Water Management Minnesota Statute 2005 Chapter 103B Minnesota Rule Chapter 8410



Protected Waters and Wetlands – **MNDNR**

An activity within a public water requires a permit from the MNDNR, which includes appropriation of groundwater, construction of stream crossings, construction of storm drain outfalls, wetland alterations, and dredging. The MNDNR's jurisdiction is generally the area below the Ordinary High-Water level. The MNDNR area hydrologist will coordinate review among other public agencies that also have a role in permit issuance. Public Waters within the City are inventoried in Section 3 – Land and Surface Water Inventory and Assessment.



Credit: Minneapolis Public Works

Other programs managed by the MNDNR, which affect the City, include the Flood Damage Reduction Grant Program, NFIP, Floodplain Management Program, Shoreland Management Program, Mississippi River Critical Area Program, and the Mississippi River Management Navigation Program.

Minnesota Water Statutes and Rules – Division of Waters: MNDNR Floodplain Management Program – Division of Waters: MNDNR Shoreland Management Program – Division of Waters: MNDNR Water Permits: MNDNR

Wetlands – BWSR

Under the Minnesota Wetland Conservation Act (WCA), Local Government Units (LGU) may oversee that wetland management activities are in accordance with specific guidelines established by state agencies. The City is designated as the LGU for wetlands within its corporate boundaries except for those wetlands within the Minnehaha Creek Watershed District's (MCWD) boundaries, where the MCWD serves as the LGU.

WCA-protected wetlands are not administered under MNDNR's public waters permit program. The purpose of the WCA is to have LGUs oversee local wetland alteration activities to ensure that there is no net loss of Minnesota's remaining wetlands. The Minnesota BWSR administers the act statewide, and the MNDNR provides enforcement.

Minnesota Board of Water and Soil Resources/Wetland Conservation Act MN Wetland Conservation Act Rules Wetlands Conservation Program – Division of Waters: MNDNR Clean Water Act Section 401 Water Quality Certifications – MPCA



Bassett Creek

NPDES Permits – MPCA

The federal NPDES permit program is delegated by the EPA to the MPCA for administration in the State of Minnesota. Through 1990, the majority of NPDES discharge permits were issued to wastewater treatment facilities. The MPCA began to issue NPDES permits for stormwater discharges in the early 1990s after the EPA issued regulations for stormwater discharges. The MPCA created three distinct stormwater permitting programs, which align with the NPDES stormwater regulations. Stormwater permits are issued for construction activities, industrial facilities, and municipal separate stormwater sewer systems (MS4s). The MPCA has issued three General NPDES permits which are renewed on a 5-year cycle: Construction activities for sites one acre and greater; Industrial facilities as defined by EPA rules; and, MS4 stormwater systems owned by public agencies, including municipalities, universities, drainage districts, highway departments, and Indian tribes. Permittees are required to apply to be covered under each permit. The MPCA also issued individual permits to larger facilities and MS4 systems, including the issuance of an individual permit to Minneapolis for stormwater discharges.

In the past, the MPCA had issued two separate NPDES permits to the City of Minneapolis. The permit for municipal stormwater discharges permitted by NPDES/SDS Permit No. MN0061018 is held jointly by the City and the MPRB and was last issued in 2011. This permit protected water quality in accordance with Minnesota and United States statutes and rules, which includes Minnesota Statute Chapters 115 and 116, Minnesota Rule Chapters 7001 and 7050, and the CWA. The permit covers the public stormwater discharge points throughout the City operated by the City and the MPRB, which total more than 460. The second NPDES permit that regulated CSOs (NPDES/SDS Permit No. MN0046744) was held jointly by the City of Minneapolis and the Metropolitan Council as co-permittees and was last issued in 2000.

As a replacement for these two permits, the co-permittees negotiated an integrated NPDES permit, effective February 16, 2018, that recognizes the historically connected sanitary sewer and stormwater drain infrastructure, recognizes the diminished risk of CSOs and the need to continue to vigilantly direct resources to renewal of aging infrastructure to maintain service levels, and directs the City to continue to work to identify and prioritize work to minimize the risk of CSOs alongside working to meet other CWA goals. This approach is based on the EPA integrated planning approach to assist municipalities on their critical paths to achieve the human health and water quality objectives of the CWA by identifying efficiencies in implementing requirements that arise from distinct wastewater and stormwater programs, including how to best prioritize capital improvements. A cooperative agreement was developed between the City and the Metropolitan Council that will assign the NPDES Integrated Permit responsibilities between the two organizations. The NPDES Integrated Permit is contained in Appendix B.

<u>Overview – MPCA Stormwater Programs</u> <u>Stormwater Program for Construction Activity – MPCA</u> <u>Stormwater Program for Industrial Activity – MPCA</u> <u>Stormwater Program for Municipal Separate Storm Sewer System – MPCA</u> <u>Wastewater Permits – MPCA</u> <u>Watershed Based Permits – United States EPA</u>



Water Quality Standards, TMDLs, and WRAPS – MPCA

The CWA requires states to adopt water quality standards (WQS) for public waters. These standards, contained in Minnesota Rule Chapter 7050, are designed to protect waters for beneficial public uses such as fishing and swimming. A waterbody is determined to be degraded when pollutants within the waterbody are found to exceed the standards set for the beneficial use class assigned to that waterbody. Beneficial use classification for each City public water is inventoried in Section 3 - Land and Surface Water Inventory and Assessment. Assessments are prepared for the U.S. Congress under Section



Credit: Minneapolis Public Works

305(b) of the CWA to estimate the extent to which Minnesota water bodies meet the goals of the CWA. The MPCA is the public agency responsible for assessment of each waterbody on the impaired waters list. Every two years, the MPCA releases a 305(b) Report that includes information about waters of the state: healthy, threatened, and impaired. One element of the 305(b) Report is the 303(d) list which specifies waterbodies that are threatened or impaired. Once the list is approved by the EPA, a strategy needs to be developed that would lead to the attainment of the state WQS contained in Minnesota Rule Chapter 7050. Waterbodies where monitoring has shown impairment are added to the impaired waters list on a two-year cycle. Several surface waterbodies in the City are listed in the state impaired waters 303(d) list. Appendix C lists all of the City's surface waters on the State's 2018 305(b) and 303(d) lists.

Each waterbody on the approved impaired waters list will eventually be the subject of a TMDL study. The TMDL process involves four phases:

- 1. 305(b) assessment and 303(d) list development.
- 2. Development of TMDL study to determine pollutant load allocations.
- 3. Implementation plan development and implementation.
- 4. Effectiveness monitoring.

The MPCA has incorporated compliance with TMDL implementation plan recommendations into the NPDES Integrated Permit, an approach which effectively uses the CWA to mandate that stormwater permittees implement the recommendations of each TMDL study. In the City, this affects the stormwater runoff discharges to the list of waters currently on the Draft 2018 Impaired Waters List contained in Appendix C.

In 2008, the MPCA created a watershed approach for the protection and restoration of water quality called WRAPS (<u>Watershed Restoration and Protection Strategy</u>). On a 10-year cycle, the MPCA conducts



a detailed investigation of each major watershed in the State. The process involves intensive monitoring, assessment of data, development of restoration, and protection strategies and implementation of recommended solutions. Monitoring information and restoration strategies developed in TMDL studies will be incorporated into each WRAPS plan that is developed by the MPCA. To-date, there has not been any WRAPS plans that have developed strategies for restoration or protection of any water resources in the City.

Minnesota's Impaired Waters and Total Maximum Daily Loads – MPCA Water Quality Standards – MPCA Minnesota Rule Chapter 7001 Minnesota Rule Chapter 7050

Groundwater – MNDNR, MPCA, MDA, MDH, Metropolitan Council, Hennepin County

Groundwater in Minnesota is managed by multiple agencies at the federal, state, regional, and local levels. The MNDNR issues temporary and permanent groundwater use permits for wells that withdraw either more than 10,000 gallons per day or 1 million gallons per year, whereas the permit process for discharging groundwater is administered by the City. The MPCA works to clean up groundwater contamination caused by industrial activities. The Minnesota Department of Agriculture (MDA) focuses on the quality of groundwater with respect to agricultural pesticides and fertilizers. The Minnesota Department of Health (MDH) works to ensure that



Hand Pump at Cedar Lake

Credit: Minneapolis Public Works

groundwater used for public water supplies meets the requirements of the Safe Drinking Water Act. The MDH also manages the requirements for groundwater well installation and sealing. All agencies monitor the quality of the groundwater and publish results on their websites. Although it does not have a regulatory role, the Metropolitan Council studies the availability of groundwater in the Twin Cities region to evaluate the available water supply in supporting regional projected population growth in those areas that utilize groundwater as the source for drinking water.

Groundwater requirements of significance in the City include the MNDNR well permit requirements, the MPCA programs to clean up contaminated groundwater, MDH Special Well and Boring Construction Areas, North and East Metro Groundwater Management Area, MDH Drinking Water Supply Management Areas, and the MDH requirements for well installation and sealing. Areas of the City with special groundwater protection designations, including protection of the groundwater in Water Supply Management Areas for neighboring municipalities, can be found in Section 3 – Land and Surface Water Inventory and Assessment.


Hennepin County has not adopted a county groundwater management plan, therefore there are no county requirements to incorporate into this WRMP.

Minnesota Department of Natural Resources (MNDNR) Minnesota Pollution Control Agency (MPCA) Minnesota Department of Agriculture (MDA) Minnesota Department of Health (MDH) Metropolitan Council

Minimal Impact Design Standards (MIDS) In response to a 2009 statute enacted by the Minnesota Legislature, the Minnesota Pollution Control Agency (MPCA) led a multi-year process, termed Minimal Impact Design Standards (MIDS), that included representation from cities (including Minneapolis), counties, road authorities, watershed organizations, and the development community to establish guidelines that aim to manage stormwater runoff from building sites, roadway projects, and other new construction such that the volume and rate of stormwater runoff will mimic natural conditions. The overall goal is to manage stormwater onsite such that the rate and volume of pre-development stormwater discharge to receiving waters is unchanged.

Green Rooftop on Minneapolis Central Library



Credit: Minneapolis Public Works

MIDS was developed by the MPCA as an advisory program, not a specific regulatory program. To assist municipalities and developers with accomplishing MIDS goals, the following tools were developed:

- Stormwater management practice performance goals for development and redevelopment projects and linear-type projects such as roadways. Included were flexible treatment options for use in locations where achieving MIDS goals is not feasible.
- Sample ordinances that municipalities can opt to use or modify.
- A MIDS "calculator" as a simple alternative to water quality modeling software (such as P8 or WinSLAMM) to compute the approximate amount of pollutant removal that could be expected from specific infiltration-type stormwater management practices.

The MIDS efforts also provided specifications, published in the Minnesota Stormwater Manual, for designers to follow to ensure proper design, installation, and operation of the infiltration-type stormwater management practices (i.e., green infrastructure, and best management practices (BMPs)).

The City approach on the usage of MIDS guidance documents is further described in Section 5, Minimal Impact Design Standards Flexible Treatment Options.



MN MIDS Statute MPCA MIDS Page

Buffer Law

In 2015/2016, the Minnesota Legislature enacted new requirements for the management of the riparian zone of streams, lakes, wetlands, and public ditches in Minnesota called the Buffer Law. Once implemented, there will be an average 50-foot wide vegetative buffer along the shoreline of all public waters. Procedural requirements are being established by the Minnesota BWSR, and maps that highlight all public waters that require vegetative buffers have been developed by the MNDNR. The Buffer Law allows an exemption from the Buffer Law requirements for properties within municipalities that are subject to NPDES permit requirements, such as the City of Minneapolis. Guidelines for implementation of this exemption have been developed by BWSR.

MN Buffer Law BWSR Buffer Program MNDNR Buffer Maps

Anti-Degradation

The CWA requires that states adopt rules to manage surface waters in a manner that does not cause further degradation of the water quality of surface waterbodies. In Minnesota, antidegradation rules apply to all waterbodies that are not on the current MPCA Impaired Waters, 303(d) list. This rule proposes that anti-degradation procedures become a condition of municipality's NPDES wastewater and stormwater permits. An anti-degradation assessment for Minneapolis was conducted by the MPCA in 2010 as part of the reissuance of the NPDES stormwater permit. The conclusion of this assessment was that, since 1988 (the year the Minnesota Anti-Degradation Rule was adopted) there has been no expanded discharge of stormwater. The MPCA determined that the City has reduced, and continues to reduce, stormwater volume and pollutant load discharges to surface waters, as a result of these City actions:

- Since 1988, the City has not created any new or expanded stormwater discharges.
- Since 2000, the City has installed structural SMPs to reduce the discharge of pollutants.
- Since 2000, the City has initiated non-structural stormwater management practices, which are described in the City's <u>Stormwater Management Program</u>.
- Since the 1990s, developments and redevelopments have been required to comply with water quality improvement requirements set by watershed management organizations and by the City stormwater management ordinance.
- Since the 1980s, the City has aggressively worked to separate the stormwater runoff from the sanitary sewers, which has resulted in zero discharge from CSO sewers since 2010.

The City has continued to implement new SMPs and improvements to existing practices since the MPCA completed the anti-degradation assessment in 2010. The NPDES Integrated Permit requires the City submit information to update this anti-degradation determination during the term of the 5-year permit.

MN Anti-Degradation Rules



Regional Water Resource Agencies

Metropolitan Council

The Metropolitan Council works to ensure that municipal comprehensive plans and local water plans are in conformance with regional plans, are consistent with Metropolitan Council policies, and are compatible with the plans of adjacent municipalities. With respect to wastewater management, the Metropolitan Council is designated as the area-wide waste treatment management agency under Section 208 of the CWA. This responsibility divides into two broad areas: protection of the region's water resources is accomplished through urban stormwater management and management of the region's wastewater treatment and conveyance facilities.



Credit: Minneapolis Public Works

With respect to wastewater flows, the Metropolitan Council has adopted policies related to management of collection systems to ensure that the regional interceptor conveyance and wastewater facilities have sufficient capacity to manage the expected population changes in the region. The Metropolitan Council also implemented policies that require municipalities to manage the clear water that makes its way into the sanitary collection systems, termed inflow/infiltration (I/I). As owner and operator of the regional sanitary sewer interceptor system, Metropolitan Council was a co-permittee with the City of Minneapolis in the CSO NPDES permit and has worked with the City since the mid-1980s to ensure the near elimination of Minneapolis CSO overflow events.

With respect to water resources, the Metropolitan Council has adopted their Thrive 2040 Water Resources Policy Plan. The 2016 adopted version of this Plan is based on a watershed approach that encourages municipalities to develop policies, programs, and projects that integrate all aspects of municipal water resource management: surface water management, stormwater runoff, sanitary collection systems, and water supply. The goal of this approach is to ensure that decisions made with regard to one area of water resource management are beneficial to all areas of water resource management. This 2018 Minneapolis WRMP is partially based on this watershed approach through the integration of surface water management, stormwater runoff management, and sanitary collection and conveyance system management into this Plan. The water supply section of the 2018 Minneapolis Comprehensive Plan has been developed as a separate section.

Metropolitan Council is required to review this report to ensure that municipalities manage runoff in a manner that does not affect the regional disposal system and that the water resources content of the WRMP is in accordance with MN Rule Chapter 8410. A specific concern of the Metropolitan Council is



that their wastewater treatment and conveyance facilities are not negatively affected by excessive I/I in the sanitary collection system.

Appendix C of the 2040 Water Resources Policy Plan lists specific information that municipalities must include in their local water plans. Important issues and information that the City is required to assess in this WRMP include:

- Wastewater System Plan Elements:
 - Description of sanitary collection system.
 - Estimation of current wastewater flows and projections of future wastewater flows.
 - Descriptions of intercommunity interconnections and copies of intercommunity service agreements entered into with an adjoining community after December 31, 2008.
 - Description of the City's policies and activities to reduce the volume of I/I that migrates into the sanitary collection system.
- Local Surface Water Management Plans:
 - Compliance with the requirements of Minnesota Rule Chapter 8410 and Minnesota Statute 103b.235.

A cross-reference between the Metropolitan Council required plan element and this 2018 Minneapolis WRMP is contained in Appendix A. The specific policies and activities that affect this WRMP involve implementation of I/I mitigation and promotion of onsite stormwater treatment, as described in additional detail in the following subsections.

Thrive 2040 Water Resources Policy Plan

Inflow/Infiltration Requirements

The Metropolitan Council has established a policy that states "(t)he Council² will not provide additional capacity within its interceptor system to service excessive inflow and infiltration."

To accomplish this policy, the Council will establish I/I goals for all communities that discharge wastewater to the regional wastewater system. Communities that have excessive I/I in their sanitary sewer systems will be required to eliminate the excessive I/I within a reasonable period. Communities that do not meet the goals established by the Metropolitan Council may be subject to a wastewater rate demand charge that is based on the cost of wastewater improvements that would be required to provide capacity beyond the amount designated for that community. The City's approach to management of I/I is further detailed in Section 4 – Infrastructure Inventory, Activities, and Assessment and Section 5 – Regulatory Controls and Water Resource Management Programs.

Water Resource Requirements

The Metropolitan Council's policy on assessment and protection of regional water resources is to continue to monitor the water quality of lakes, rivers, streams, and groundwater to evaluate impacts

² Water Resources Policy Plan, page 42



and to measure success. To accomplish this policy, the Metropolitan Council monitors the water quality, evaluates long-term water quality trends, maintains a regional database of water data, undertakes technical studies, and conducts outreach. Monitoring conducted in the City by the Metropolitan Council is summarized in Section 3 – Land and Surface Water Inventory and Assessment.

Hennepin County

Hennepin County's primary role in water resource management is to serve as the Soil and Water Conservation District (SWCD) under Minnesota Statute 103C. Under this statute, SWCDs are established to manage natural resource programs and to work directly with landowners to establish conservation practices. To accomplish these requirements, Hennepin County has adopted the 2015-2020 Natural Resources Strategic Plan that has objectives to protect groundwater resources and to protect and restore lakes, rivers, streams, and wetlands. Specific services provided by Hennepin County include:

- Wetland Conservation Act enforcement.
- Conservation easement monitoring.
- Environmental education and outreach.
- Volunteer management.
- Technical assistance to local governments.
- Financial assistance and cost share programs.

Hennepin County does not have a regulatory role with respect to this WRMP.

BWSR SWCD

Hennepin County 2015-2020 Natural Resources Strategic Plan Wetland Health Evaluation Program

Watershed Districts and Organizations

Four watershed districts/organizations are represented within the City boundaries. Jurisdictional boundaries of each of the four watershed organizations within the City are shown in Figure 2.1. The primary difference between watershed districts and watershed management organizations relates to how the agency was organized. Watershed districts are created directly by the Minnesota Legislature, while watershed management organizations are created by joint powers agreements among the member municipalities under Minnesota Statute 103B.211. In accordance with the Minnesota Statute 103B.205 Subd. 13, all watershed management entities in the metro area are watershed management organizations regardless of whether they are watershed districts or joint powers entities. Over time, the purpose and function of these organizations have evolved such that there are only small differences between the operational functions of the two types of watershed organizations.

The power and duties of these Minnesota statutory authorities include:

- Approval authority over local water management plans.
- Ability to determine a budget and raise revenue for the purpose of administrative and capital improvement costs.



- Regulation of land use and development if one or more of the following apply:
 - The City does not have an approved local water management plan in place; and/or
 - The City is in violation of its approved local plan.

For purposes of this WRMP, the term watershed organization encompasses both watershed districts and watershed management organizations. Appendix D provides more detailed information on each of the watershed organizations that have jurisdiction within the City.

Each watershed organization has developed a watershed management plan that contains specific goals and policies that guide the overall management within its respective jurisdiction, as contained in Appendix D, and summarized briefly in the following subsections.





Figure 2.1 – Watershed Organization Jurisdictional Boundaries in the City of Minneapolis



Bassett Creek Watershed Management Commission (BCWMC)

The Bassett Creek Flood Control Commission was established in 1969 as a nine municipality joint powers agreement with the specific purpose to manage floods that previously occurred along many segments of the creek. These municipalities include the cities of Crystal, Golden Valley, Medicine Lake, Minneapolis, Minnetonka, New Hope, Plymouth, Robbinsdale, and Saint Louis Park. In 1972, the flood control commission reorganized as the Bassett Creek Water Management Commission (BCWMC) and added water quality improvement to its functions. The BCWMC area is the smallest among the four watershed organizations with jurisdiction



Credit: CDM Smith

in the City, which includes the area of the City that drains to the open channel segment of Bassett Creek. Flows that discharge to the Bassett Creek culvert and tunnel system through downtown are under the jurisdiction of the Mississippi Watershed Management Organization (MWMO).

Each member municipality appoints a commissioner and alternate commissioner to serve on the BCWMC board of commissioners. These commissioners and alternate commissioners work together to establish goals and policies to protect and manage the water resources within its member communities of Crystal, Golden Valley, Minnetonka, Medicine Lake, Minneapolis, New Hope, Plymouth, Robbinsdale, and Saint Louis Park. The most current goals for the BCWMC are contained in their third-generation Watershed Management Plan, which was adopted on September 17, 2015. There are 19 goals that are specific to water quality, habitat, aesthetics, recreation, flood control, stormwater management, shoreland integrity, wetland management, public ditches, education, outreach, and climate change. Each goal is linked to specific policies and rules.

Bassett Creek Watershed Management Commission (BCWMC)

Minnehaha Creek Watershed District (MCWD)

The Minnehaha Creek Watershed District (MCWD) is the only organization within the City that was established by the Minnesota Legislature under the Minnesota Watershed District Act. The Board of Managers who govern the MCWD are appointed by the Hennepin County and Carver County Boards of Commissioners. The MCWD hires staff to manage their programs, which include:

- Education.
- Administration and Operations.
- Permits.



Bassett Creek Watershed Sign

Projects.

Minnehaha Falls in Winter

- Maintenance and Land Management.
- Research and Monitoring.

The MCWD's most current goals, summarized in Appendix D, are based on their January 11, 2018 Watershed <u>Management Plan</u>. The goals in this plan seek to "conserve the natural resources of the Minnehaha Creek watershed principally through analysis of the causes of harmful impacts on the water resources, public information and education, regulation of land use, regulation of the use of waterbodies and



Credit: Minneapolis Public Works

Mississippi River

their beds, and capital improvement projects." A summary of the MCWD's current rules and 17 watershed management goals is contained in Appendix D.

Minnehaha Creek Watershed District (MCWD)

Mississippi Watershed Management Organization (MWMO)

The area of Minneapolis that drains to the Mississippi River has been organized by a joint powers agreement into the MWMO. Other members include the MPRB and the municipalities of Columbia Heights, Fridley, Hilltop, Lauderdale, Saint Anthony Village, and Saint Paul. Each member municipality, including the City of Minneapolis, appoints a commissioner and an alternate commissioner to serve on the MWMO governing board.

In 2001, the organization became the first joint powers watershed organization to obtain Special Taxing District designation from the Minnesota Legislature (MS 276.066). This allowed the MWMO to hire



Credit: CDM Smith

full-time staff and implement new programs. Activity areas include:

- Capital Projects.
- Communications and Outreach.
- Monitoring.



- Planning.
- Watershed Assessment.

The ten water resources management goals established by the MWMO were initially adopted and included in their 2011 Water Resources Management Plan. The stated purpose of the MWMO that resulted in these goals is to "implement measures that realize multiple objectives, respect ecosystem principles and reflect community values." The specific goals, policies, and implementation priorities of the MWMO are contained in Appendix D.

Mississippi Watershed Management Organization (MWMO)

Shingle Creek Watershed Management Commission (SCWMC)

The Shingle Creek Watershed Management Commission (SCWMC) was created by a joint powers agreement in 1984 between the municipalities of Brooklyn Center, Brooklyn Park, Crystal, Maple Grove, Minneapolis, New Hope, Osseo, Plymouth, and Robbinsdale. Each member municipality, including the City of Minneapolis, appoints a commissioner and an alternate commissioner to serve on the SCWMC governing board. The purpose of the SCWMC is to enhance the water quality of the water resources within their



Credit: Minneapolis Public Works

watershed through public education, analysis of the causes of harmful impacts, regulation of the use of water bodies, regulation of land use, and capital improvement projects.

The July, 2013 Third Generation Watershed Management Plan of the Shingle Creek Watershed Management Commission established 20 goals that are organized into six Goal Areas: Water Quantity, Water Quality, Groundwater, Wetlands, Drainage Systems, and Commission Operations and Programming. Detailed priorities and goals of the Shingle Creek Watershed Management Commission are contained in Appendix D.

Shingle Creek Watershed Management Commission (SCWMC)

Minneapolis Goals and Policies Minneapolis Goals

The current statement of the City's goals, and strategic direction, was adopted by the Minneapolis City Council on March 28, 2014. These are based on this Minneapolis Vision:

Minneapolis is a growing and vibrant world-class city with a flourishing economy and a pristine environment, where all people are safe, healthy and have equitable opportunities for success and happiness.

The goals and strategic direction related to the Minneapolis Vision are embedded in or incorporated into the management of the City in order to align these goals with the business plans and annual





Shingle Creek

budgets. The goals are also the foundation for the programs and activities implemented in the (future) Minneapolis Comprehensive Plan and in this WRMP. As part of development of the City's 2018 Comprehensive Plan, City staff have developed a set of environmental policies that will influence the planning for the next 10 years. All of these goals, directions, and policies are listed in Table 2.1. Those directly related to water resource management are identified in this table.

City Vision, Value, Goals, and Strategic Direction



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 Table 2.1 – Minneapolis Goals, Strategic Direction, Comprehensive Plan Environmental Policy, and Guiding Principles

2014 Goals, Strategic Direction, and Comprehensive Plan Environmental Policy	Water Resource Management Goal	Guiding Principle #1: Protect People Property and the Environment	Guiding Principle #2: Maintain and Enhance Infrastructure	Guiding Principle #3: Provide Cost Effective Solutions in a Sustainable Manner	Guiding Principle #4: Meet or Surpass Regulatory Requirements	Guiding Principle #5: Educate and Engage the Public	Guiding Principle #6: Enhance Livability and Safety
Living well: Minneapolis is safe and livable and has an active and connected way of life	~	~	~	~			~
 All neighborhoods are safe, healthy and uniquely inviting. 	~	~	~	~			
 High-quality, affordable housing choices exist for all ages, incomes and circumstances. 							
 Neighborhoods have amenities to meet daily needs and live a healthy life. 	~	~	~	~			~
 High-quality and convenient transportation options connect every corner of the city. 		~	~				
 Residents and visitors have ample arts, cultural, entertainment and recreational opportunities. 	~						~
The city grows with density done well.	✓	✓	✓	✓	~		
One Minneapolis: Disparities are eliminated so all Minneapolis residents can participate and prosper							~
 Racial inequities (including in housing, education, income and health) are addressed and eliminated. 							~
 All people, regardless of circumstance, have opportunities for success at every stage of life. 							~
 Equitable systems and policies lead to a high quality of life for all. 	~	~	~	~	~	~	~
 All people have access to quality essentials, such as housing, education, food, child care and transportation. 		~	~	~			~



2014 Goals, Strategic Direction, and Comprehensive Plan Environmental Policy	Water Resource Management Goal	Guiding Principle #1: Protect People Property and the Environment	Guiding Principle #2: Maintain and Enhance Infrastructure	Guiding Principle #3: Provide Cost Effective Solutions in a Sustainable Manner	Guiding Principle #4: Meet or Surpass Regulatory Requirements	Guiding Principle #5: Educate and Engage the Public	Guiding Principle #6: Enhance Livability and Safety
 Residents are informed, see themselves represented in City government and have the opportunity to influence decision-making. 						v	
A hub of economic activity and innovation: Businesses – big and small – start, move, stay and grow here	~			~	~		~
 Regulations, policies and programs are efficient and reliable while protecting the public's interests. 	~			~	~		
 The workforce is diverse, well-educated and equipped with in-demand skills. 							~
 We support entrepreneurship while building on sector (such as arts, green, tourism, health, education and high- tech) strengths. 					~		
 We focus on areas of greatest need and seize promising opportunities. 	~	~	~	~			~
 Infrastructure, public services and community assets support businesses and commerce. 	~	~	~	~	~		~
 Strategies with our City and regional partners are aligned, leading to economic success. 				~	~		
Great Places: Natural and built spaces work together and our environment is protected	~	~	~	~	~	~	~
 All Minneapolis residents, visitors and employees have a safe and healthy environment. 	~	~	~	~			~
 We sustain resources for future generations by reducing consumption, minimizing waste and using less energy. 	~		✓	~	~		~



2014 Goals, Strategic Direction, and Comprehensive Plan Environmental Policy	Water Resource Management Goal	Guiding Principle #1: Protect People Property and the Environment	Guiding Principle #2: Maintain and Enhance Infrastructure	Guiding Principle #3: Provide Cost Effective Solutions in a Sustainable Manner	Guiding Principle #4: Meet or Surpass Regulatory Requirements	Guiding Principle #5: Educate and Engage the Public	Guiding Principle #6: Enhance Livability and Safety
 The City restores and protects land, water, air and other natural resources. 	~	~		~	~		~
 We manage and improve the city's infrastructure for current and future needs. 	1	√	V	1	~	~	~
 Iconic, inviting streets, spaces and buildings create a sense of place. 	~		~	~			~
 We welcome our growing and diversifying population with thoughtful planning and design. 	V	√	√			~	~
A City that works: City government runs well and connects to the community it serves	\checkmark	\checkmark	~	~	~	~	~
 Decisions bring City values to life and put City goals into action. 	~				~	~	~
 Engaged and talented employees reflect our community, have the resources they need to succeed and are empowered to improve our efficiency and effectiveness. 	V	¥	4	~	1	V	¥
 Departments work seamlessly and strategically with each other and with the community. 	1	√	V	1	~		
 City operations are efficient, effective, results driven, and customer focused. 	~	\checkmark	~	~	~		
 Transparency, accountability and ethics establish public trust. 	\checkmark	\checkmark	~	~	~	~	~
 Responsible tax policy and sound financial management provide short- term stability and long-term fiscal health. 	~	~	~	~			



2014 Goals, Strategic Direction, and Comprehensive Plan Environmental Policy	Water Resource Management Goal	Guiding Principle #1: Protect People Property and the Environment	Guiding Principle #2: Maintain and Enhance Infrastructure	Guiding Principle #3: Provide Cost Effective Solutions in a Sustainable Manner	Guiding Principle #4: Meet or Surpass Regulatory Requirements	Guiding Principle #5: Educate and Engage the Public	Guiding Principle #6: Enhance Livability and Safety
Water Policy 1, Protect the City's lakes, creeks, and river as public assets, natural systems, and recreational assets, and manage the surface waters and groundwater, along with public infrastructure for drinking water, sanitary sewer, and stormwater systems, equitably and sustainably to meet current and future needs for those who live, work, do business, and recreate in the City.	✓	~	~	~	✓	~	V
Water Policy 2, Integrate water resource management into public and private projects to address multiple stressors, goals, and benefits and minimize adverse impacts to groundwater, or adverse impacts from groundwater to infrastructure, property, and the environment.	~	✓	✓	~	~	~	V
Water Policy 3, Value and manage natural areas in and around surface waters, as well as stormwater ponds and other stormwater treatment facilities, as areas supportive of aquatic and terrestrial ecosystems, habitat, and wildlife and as flood storage areas.	~	4	~	~	~	~	4
Water Policy 4, Respond to and work to minimize adverse impacts of climate change on surface waters, groundwater and stormwater, wastewater, and drinking water infrastructure.	√	V	V	~	√	V	√



Minneapolis Park and Recreation Board Goals

The MPRB adopted their vision statement and vision themes as a part of the development of the <u>Comprehensive Plan, Minneapolis Park and Recreation Board, 2007-2020</u>. As the primary property owner along the City of Minneapolis' lakes and streams, the MPRB has developed specific goals tied to water resource management. Those goals directly related to water resource management are listed in Table 2.2.

Lake Calhoun/Bde Maka Ska



Credit: Minneapolis Public Works MPRB Mission, Vision, and Values



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Table 2.2 – MPRB Vision, Goals, and Guiding Principles

MPRB Vision and Goals	Water Resources Goal	Guiding Principle #1: Protect People Property and the Environment	Guiding Principle #2: Maintain and Enhance Infrastructure	Guiding Principle #3: Provide Cost Effective Solutions in a Sustainable Manner	Guiding Principle #4: Meet or Surpass Regulatory Requirements	Guiding Principle #5: Educate and Engage the Public	Guiding Principle #6: Enhance Livability and Safety
Vision Theme 1: Urban forests, natural areas, and waters that endure and captivate	~	~	\checkmark	\checkmark		\checkmark	\checkmark
 Sound management techniques provide healthy, diverse, and sustainable natural resources. 	~	~		~			\checkmark
 Healthy boulevard trees connect all city residents to their park system. 	~	~	~				\checkmark
 Residents and visitors enjoy and understand the natural environment. 	~					~	~
 People and the environment benefit from the expansion and protection of natural resources. 	~	~		~			\checkmark
 Knowledgeable stewards and partners generously support the system's natural resources. 	~			~		✓	\checkmark
Vision Theme 2: Recreation that inspires personal growth, healthy lifestyles, and a sense of community	~	~				~	~
 People play, learn, and develop a greater capacity to enjoy life. 	~	~				\checkmark	\checkmark
 Residents, visitors, and workers enjoy opportunities to improve health and fitness. 	~	~					\checkmark
 People connect through parks and recreation. 	~	~				~	✓
 Volunteers make a vital difference to people, parks, and the community. 	~					✓	
 Parks provide a center for community living. 	~	~				\checkmark	~



MPRB Vision and Goals	Water Resources Goal	Guiding Principle #1: Protect People Property and the Environment	Guiding Principle #2: Maintain and Enhance Infrastructure	Guiding Principle #3: Provide Cost Effective Solutions in a Sustainable Manner	Guiding Principle #4: Meet or Surpass Regulatory Regulatory	Guiding Principle #5: Educate and Engage the Public	Guiding Principle #6: Enhance Livability and Safety
Vision Theme 3: Dynamic parks that shape city character and meet diverse community needs	~	~	~	~		~	~
 Parks shape an evolving city. 	~	~					~
 Park facility renewal and development respects history and focuses on sustainability, accessibility, flexibility, and beauty. 	~		~	~			
 Focused land management supports current and future generations. 	~	~		~			~
 Financially independent and sustainable parks prosper. 	~			~			
 Through outreach and research, park and recreation services are relevant today and tomorrow. 	~	~				~	
 Easily accessible information supports enjoyment and use of the park and recreation system. 	~					~	
Vision Theme 4: A safe place to play, celebrate, contemplate, and recreate	~	~				~	~
 Positive recreation experiences and welcoming parks prevent crime. 	~	~				~	~
 Residents, park visitors, and staff make safe choices in the parks. 	~	~				~	~
 Intervention and communication reduces safety concerns. 	~	~				~	~
 Parks are safe and welcoming by design. 	~	~				~	~
 Communities, public and private partners, and staff cooperate to promote safety. 	~	~				~	~



Minneapolis Water Resource Management Policies

Minneapolis Water Resource Guiding Principles

The City and MPRB intend to accomplish their goals and policies through careful consideration of budget limitations, changes to regulations, aging infrastructure needs, and natural resource needs. To further define and accomplish these goals, the WRMP sets up more specific guidance that fits generalized goals into actions that are of critical importance to infrastructure and water resource management, called Guiding Principles. These Guiding Principles are:

Guiding Principle #1 – Protect People, Property, and the Environment

Two significant programs implemented in the City have a common goal of protection of the health and safety of the people of Minneapolis. The CSO I/I program has resulted in elimination of the discharge of sewage into the Mississippi River since 2010. The Flood Mitigation program protects property from the damages incurred by severe and/or regular flooding. Protection of people, property, and the environment means that:

- Overflows from sanitary sewers occur only during extreme events.
- Structures are protected from flooding during the 100-year storm.
- Roadway flooding that impacts public safety and/or commerce is minimized.
- Structures, infrastructure, and surface waters are protected from the detrimental effects of soil erosion and sedimentation.

Guiding Principle #2 – Maintain and Enhance Infrastructure

The most effective stormwater BMPs are based on pollution prevention activities, such as maintenance of public infrastructure. For the purpose of this WRMP, the definition of infrastructure includes both structural components (i.e., pipes and stormwater management practice) and natural resource components (i.e., boulevard trees, native vegetation, and natural areas in parks). Critical maintenance practices undertaken by the City include street and public parking lot sweeping, sediment/debris removal from stormwater management practices, construction site erosion and sediment control, facility management, natural resource management, and



Credit: Minneapolis Public Works

vegetation management. Maintenance and enhancement of the public infrastructure requires the City to:

• Routinely assess the condition of the sanitary sewers and storm drains.



Brick Egg Sewer

- Identify and correct sanitary sewer and storm drain capacity issues.
- Inspect and maintain infrastructure and natural resources in a manner that maximizes effectiveness and longevity.
- Develop capital improvements in a manner that minimizes lifecycle costs.
- Match resources to meet needs of inspection, assessment, and implementation requirements.
- Incorporate latest projections of rainfall quantities and frequencies based on advances in modeling and climate science.

Guiding Principle #3 – Provide Cost-Effective Services in a Sustainable Manner

Whenever there are two alternatives that meet the same goal, the City and MPRB will opt for the most cost-effective solution. All lifecycle issues will be a component of cost-effective analyses that involves assessment of the planning/design, construction, operation, and maintenance phases of the infrastructure. Providing cost-effective services in a sustainable manner requires that:

- Both short-term and long-term lifecycle analyses will be conducted to adequately assess all project/program costs.
- Lifecycle analyses will include all costs.
- Multi-objective strategies for water resources management are evaluated with all projects and programs.
- The capabilities and capacities of existing water resources systems are optimized.
- Source water is protected to improve water treatment efficiency.
- Multi-functional capital projects are collaborative.

Guiding Principle #4 – Meet or Surpass Regulatory Requirements

At a minimum, all water resources management activities must meet regulatory requirements. However, Minneapolis residents have voiced the expectation that surface water quality should surpass minimum requirements. Therefore, Minneapolis activities often aim to surpass regulatory requirements, which requires that the City:

- Maintain communications with watershed organizations and adjacent municipalities to maximize cooperative activities and projects that achieve the goals of multiple organizations.
- Anticipate regulatory trends and implement projects/programs before a regulation is finalized.
- Apply standard Maximum Extent Practicable (MEP) to control pollutants in stormwater.
- Provide cross-jurisdictional support to local sewer and stormwater agencies whenever circumstances, such as major storm events, require additional services than available by the local agency.
- Collaborate with watershed organizations early during public and private project development to work towards more beneficial water quality outcomes.



Guiding Principle #5 – Educate and Engage the Public and Stakeholders

Planting for Pollinators



Credit: Minneapolis Public Works

The City and the MPRB have long involved the public in the development of public improvements and programs. A portion of the budget for all projects includes funds to engage the public stakeholders during development of a project/program and educate the public and stakeholders once the project/program is implemented. Education and engagement of the public and stakeholders requires that:

- The public's role in water resources management is established and understood.
- The stakeholders in each project/program are identified and engaged early in the project's/ program's development.
- The service needs and expectations of the public are understood and dictate education and engagement.
- The public's and stakeholder's responsibility, accountability, creativity, and innovation is promoted.
- Employee leadership of citizen engagement activities is the norm and results in effective projects and programs.
- Engagement and education processes facilitate incorporation of regional goals and strategies in water resources management projects/programs.
- Engagement and education processes recognize and respond to the various needs and abilities of a diverse public and accommodates accessibility needs, including language barriers, cultural differences, socioeconomic factors, and more.
- Collaborate with watershed organizations and other stakeholders during the development and implementation of water resource management ordiannces, policies, and guidance documents.



Guiding Principle #6 – Enhance Livability and Safety

Residents judge the quality of their neighborhood by the standards of livability and safety. The quality of Minneapolis parks, and the quality of the surface waters within each park, is directly tied to the success of livability in Minneapolis. Enhancing livability and safety require that:

- High quality water resources are integral to the fabric of the City.
- All water is valued as an asset.
- Water resources are managed to contribute to the fulfillment of quality life expectations.



Credit: Minneapolis Public Works

These water resource management guiding principles provide the direction needed to allow water resources management activities to meet multiple goals – no single principle can be tied to a single goal.

Progress Towards Goals

The City has set up internal monitoring activities that track progress towards water resource management goals. Starting in 2019, for 2018 activities, these will be described in detail in the City's annual reports:

- NPDES Annual Report Documents tracks stormwater management and CSO management activities and goals set by the NPDES Integrated Permit.
- MPRB Water Resources Report tracks water quality trends in lakes plus other MPRB water resources management activities.

The NPDES CSO and stormwater annual reports will be combined into a single annual report for 2018 activities, which will be published in 2019.

NPDES Annual Report Documents MPRB Water Resources Reports CSO Annual Reports

Responsibility for Implementation of Goals and Policies City of Minneapolis and Minneapolis Park and Recreation Board Responsibilities

Responsibility for water resources management in Minneapolis is split between the City and the MPRB. The City is responsible for the public infrastructure and land use on non-MPRB properties. Authority for lake, beach, and shoreland management is delegated to the MPRB in Minneapolis City Charter Chapter 16, Section 11:



'Whenever the title shall have been acquired for the purpose of this chapter, to the land constituting the shore or shores of any stream of water, lake or pond, said Board may regulate and control the use of such shore or shores and the water contiguous thereto, and in case such ownership should embrace the entire shore or any such lake or pond, said Board is hereby empowered to take any and have exclusive charge and control of the waters of said lake, and may in all things regulate and govern the use of such waters and may prescribe penalties for the violation of such rule and ordinances as it may adopt for that purpose; provided, that said Board shall not prohibit the use of sail or rowboats on such waters.'

Both the City and the MPRB utilize three primary tools to manage water resources within their respective jurisdictions:

- Ordinances that regulate activities on private properties.
- Structural physical infrastructure that conveys, stores, and/or treats sanitary sewage and stormwater drainage.
- Non-structural activities that serve to prevent the discharge of pollutants to water resources.

Camden Lumberman Sculpture by Roger Brodin near Webber Pond



Credit: Minneapolis Public Works

The physical infrastructure is further described in Section 4 – Infrastructure

Inventory, Activities, and Assessment, and the ordinances and other non-structural water resource protection activities are described in Section 5 – Regulatory Controls and Water Resource Management Programs.

Water Resources Related Agreements

The City is party to a number of water resources related cooperative agreements. Copies of current agreements are on file and available from Minneapolis Public Works – Division of Surface Waters and Sewers.

Water Resources Agreements

Following is a list of the water resources agreements in effect in 2018:

- Joint powers agreements for the establishment of the following watershed organizations:
 - Bassett Creek Watershed Management Commission amended Joint Cooperative Agreement for the establishment of a Bassett Creek Watershed Management Organization to plan, control, and provide for the development of Bassett Creek, showing changes effective August 29, 2014.



- Mississippi Watershed Management Organization, and Agreement No. C-28991 Joint and Cooperative Agreement for the Mississippi Watershed Management Organization, effective June 2012.
- Shingle Creek Watershed Management Commission Joint and Cooperative Agreement for the establishment of a Shingle Creek Watershed Management Commission to plan, control, and provide for the development of the Shingle Creek Watershed, June 15, 1894, amended March 21, 2006. Agreement was also amended on July 17, 2015, which extended the duration of the joint powers agreement to January 1, 2025.
- Cooperative agreement for the maintenance of County State Aid Highways, Agreement No. C-40670 Road Maintenance Agreement between the County of Hennepin and the City of Minneapolis.
- Cooperative agreement for the maintenance of State Trunk Highways, Agreement No. C-42388 (MnDOT Agreement No. 1001240) State of Minnesota Department of Transportation Routine Maintenance Agreement. Includes a provision that the maintain 50 cubic feet per second (cfs) capacity on the "old" Bassett Creek Tunnel during the 100-year storm event to accommodate the overflow of stormwater that cannot be accommodated in the "new" tunnel.
- Joint and Cooperative Agreement No. C-015730 for Boundary Change, BCWMC and MWMO, September 28, 2000. Includes requirement that the City maintain capacity in the "old" Bassett Creek Tunnel to allow for 50 cfs.
- Memorandum of Understanding (MOU) among the City, MPRB, and MCWD was approved by the Minneapolis City Council in April 2017. The MOU defines processes and commitments for integrated planning, policy, and capital project initiatives across the three organizations. Additionally, it will guide an integrated planning process that actively coordinates and aligns respective work within the Minnehaha Creek Watershed area in the City of Minneapolis.
- Local Cooperation Agreement between Department of the Army and the City for Flood Protection on Bassett Creek (new tunnel construction), June 27, 1986.
- Agreement under Section 215 of Public Law 90-483 Flood Control Project Basset Creek Watershed, Hennepin County, U.S. Army Corps of Engineers, and Golden Valley, May 11, 1979.
- Agreement entered into pursuant to provisions of the Joint Powers Agreement establishing the Bassett Creek Water Management Organization, relating to the construction of an improvement project in cooperation with the U.S. Army Corps of Engineers, Minneapolis and Minnetonka, June 16, 1986; Minneapolis and Robbinsdale, June 17, 1986; Minneapolis and Plymouth, July 7, 1986; Minneapolis and Golden Valley, June 16, 1986; Minneapolis and New Hope, June 9, 1986; Minneapolis and Medicine Lake, June 10, 1986; Minneapolis and Crystal, June 17, 1986; Minneapolis and Saint Louis Park, June 11, 1986.
- Agreement No. 58881, Cooperative Construction Agreement, RE: City cost participation of storm drain tunnel facilities construction by the State primarily along 2nd Street North between 12th Avenue North and 3rd Street North and the Middle Pool of the Mississippi River, February 2, 1978, MnDOT and the City of Minneapolis.



- Agreement No. 58881-1, Cooperative Construction Agreement, Supplement No. 1, RE: City cost participation of storm drain tunnel facilities construction by the State primarily along 2nd Street North between 12th Avenue North and 3rd Street North and the Middle Pool of the Mississippi River, January 28, 1988, MnDOT and the City of Minneapolis.
- Agreement No. 64742, Cooperative Construction Agreement, RE: State cost participation of storm drain tunnel facilities construction by the U.S. Army Corps of Engineers adjacent to T.H. 394 on 3rd Avenue North from 2nd Avenue North to the T.H. 94 ramps in Minneapolis, June 27, 1988, MnDOT and the City of Minneapolis.
- Permit #D-08-21205, MnDOT application for drainage permit, Minnesota Ballpark Authority, January 12, 2008 for stormwater runoff connection from the Twins stadium to new Bassett Creek tunnel.

Sanitary Sewer Agreements

The following agreements have been entered into by the City, which relate to the operation of the sanitary sewer system:

- Interagency agreement between the City and the Metropolitan Council detailing each entity's responsibilities under the 2018 NPDES Integrated Permit. The agreement governs the study of, investment in, and renewal of the interconnected sanitary infrastructure.
- Eleven agencies in the Fort Snelling area have agreements with the City of Minneapolis for water and sanitary sewer service, listed below:
 - Fort Snelling Park.
 - Henry Whipple Building (GSA).
 - Metropolitan Airport Commission.
 - Minnesota Air National Guard.
 - Minnesota Department of Natural Resources.
 - Minnesota Department of Transportation.
 - U.S. Naval Reserve.
 - Veterans Medical Center.
 - Veterans Administration.
 - 934th Medical Service Corps (MSC)/CERU.

Copies of these interagency agreements are available from the Water Treatment and Distribution Division of Minneapolis Public Works.

The City has not entered into any intercommunity agreements with an adjoining community after December 31, 2008.



Compliance with Regulatory Requirements

The City works to balance all regulatory requirements alongside the infrastructure management requirements that are typical of a fully developed city with systems that have been in operation for nearly 150 years. Additionally, compliance with regulatory requirements also requires that the City balance the hydraulic needs of the sanitary sewer and stormwater drainage systems. For example, stormwater disconnected from sanitary sewers for I/I compliance should not cause hydraulic capacity issues in the stormwater drainage system. Given these complexities, the City is fully compliant with the water resource regulatory requirements imposed by federal laws and regulations, state statutes and rules, and watershed organization requirements. To satisfy these requirements, the City has established goals as described in Section 2 – Regulatory Requirements, Goals, and Policies, and programs as detailed in Section 3 – Land and Surface Water Inventory and Assessment, Section 4 – Infrastructure Inventory, Activities, and Assessment, and Section 5 – Regulatory Controls and Water Resource Management Programs. The following provides a summary of how the City is compliant with the regulations cited in this section.

Federal Water Resource Compliance

NPDES Stormwater and Combined Sewer Requirements

The City has been subject to NPDES permit requirements since the initial CSO permit was issued in 1980. The permit was reissued with minor modifications in 1986, 1991, and 1997. These permits detailed the specific actions that the City and the Metropolitan Council were required to implement to reduce, and ultimately minimize, the occurrence of overflows to the Mississippi River of combined sewage/stormwater runoff. In 1990, the EPA issued the Phase I stormwater rules which required larger cities, such as Minneapolis, to develop a comprehensive stormwater management program. The City met the requirements of these rules and began to expand its stormwater management program in 1992 to incorporate water quality management structures and practices. The MPCA eventually issued the first NPDES stormwater permit to Minneapolis in 2000, which was reissued in 2011.

The City continues to manage its sanitary sewer and stormwater drainage systems in compliance with NPDES permits issued prior to the date of this WRMP. Details of the specific programs and projects established to meet these permit requirements are contained in Section 4 – Infrastructure Inventory, Activities, and Assessment and Section 5 – Regulatory Controls and Water Resource Management Programs.

Sanitary Sewer Overflow Requirements

The City is subject to the Capacity Management Operation and Maintenance (CMOM) requirements issued by the EPA. To meet these requirements, the City has opted to incorporate the specific activities into its asset management program.

National Flood Insurance Program

The City has been enrolled in the NFIP since 1974. Enrollment in the program has led to the development of the City's floodplain ordinance and maps that identify the floodplain boundaries along the major streams in the City: Mississippi River, Bassett Creek, Minnehaha Creek, and Shingle Creek. The ordinances and maps have been updated over the 44 years that this program has been in effect. The



most current ordinance went into effect on November 4, 2016 and the most current update of the flood maps went into effect on November 4, 2016.

State Water Resource Compliance

Local Surface Water Management Plans

The purpose of this WRMP is to comply with the local water plan requirements established by the BWSR. Additional information on the development, adoption, and future amendments to this WRMP is contained in Section 1 - History and Overview of Minneapolis Water Resources. Appendix A includes a list of the specific requirements for this WRMP and the section of this plan that contains the required information.

Wetland Conservation Act

The City is the LGU responsible for the review and approval of proposals to alter wetlands within the City except for those wetlands located within the Minnehaha Creek watershed, for which the MCWD is the LGU. As an LGU, Minneapolis requires that wetland delineation surveys and mitigation plans be completed for all construction projects that propose to alter a wetland. Minneapolis also coordinates with watershed organizations to ensure that both the WCA and watershed organization requirements are met. Specific program information is contained in Section 5 – Regulatory Controls and Water Resource Management Programs.

Total Maximum Daily Load

Each individual TMDL implementation plan contains specific actions that cities and others should undertake that would, over time, improve the water quality of the specific waterbody to a non-impaired status. The measurable goals of each TMDL implementation plan are set in terms of Waste Load Allocations (WLAs) for permitted discharges, including the discharges permitted in the NPDES Integrated Permit. Each plan will contain a WLA numerical maximum pollutant discharge goal for removal of pollutants from municipal stormwater runoff. The City's NPDES stormwater permit contains a requirement that Minneapolis implement projects and practices as defined as the municipal WLA for each approved TMDL implementation plan. The City's approach is contained in the City's Stormwater Management Program. Specific activities for each approved TMDL implementation plan that is in effect as of the date of this WRMP is described in Section 3 – Land and Surface Water Inventory and Assessment.

Minimal Impact Design Standards

MIDS was developed as a voluntary program. There is no specific state requirement that cities must impose MIDS standards on projects; however, some watershed districts and management organizations have adopted MIDS standards. In accordance with the NPDES Integrated Permit, the City is using the MIDS goals and MIDS Flexible Treatment Options specific to ultra-urban conditions as a foundation for developing revised regulatory controls that address volume management requirements.

Buffer Law

The Minnesota Buffer Law that was enacted in 2015 and amended in 2016 includes a provision that grants a waiver from Buffer Law requirements for cities subject to NPDES stormwater permits. Therefore, the City is not required to establish any buffer protection programs or projects.



Anti-Degradation Rules

In 2010, the MPCA determined that the City is compliant with anti-degradation requirements, and therefore, additional conditions are not required for the City's NPDES permit. If anti-degradation does become a condition of the City's NPDES stormwater permit, then the City will be required to develop anti-degradation prevention, treatment, or pollutant load offset procedures to ensure that developments in the City do not cause an increase in pollutant loads to high quality surface waters. Therefore, the City is fully compliant with anti-degradation requirements and no additional actions are necessary.

Regional Water Resource Compliance

Metropolitan Council Comprehensive Plan

This Water Resource Management Plan is developed to meet both the stormwater and sanitary sewer requirements for comprehensive plans as established by the Metropolitan Council. This Plan will be incorporated as an appendix to the 2018 Minneapolis Comprehensive Plan. Appendix A includes a list of the specific requirements set by the Metropolitan Council and the section of this plan that contains the required information.

Metropolitan Council Inflow/Infiltration Program

The City's approach to reduction in I/I contributions to the sanitary sewer is founded in the CSO approach that was established in the NPDES permit requirements. CSO program progress is described in Section 4 – Infrastructure Inventory, Activities, and Assessment. The primary source of I/I from private properties has been identified as direct connections between rooftop drainage and the sanitary sewers. The inspection and elimination of these rooftop connections is further described in Section 5 – Regulatory Controls and Water Resource Management Programs.

Downtown Smoke Testing of Sanitary Sewers



Credit: Minneapolis Public Works

Neighborhood Smoke Testing of Sanitary Sewers



Credit: Minneapolis Public Works



Local Watershed Organization Requirements

The four watershed organizations that have jurisdiction in the City have each created a set of requirements for the City to implement through this WRMP. Appendix A includes a list of the specific requirements set by each watershed organization and the section of this plan that contains the required information.



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Section 3 – Land and Water Resources Inventory and Assessment

Overview

The focus of this section of the Minneapolis Water Resource Management Plan (WRMP) is on the City's physical environment, including rivers, streams, lakes, and wetlands, as required by Minnesota Rule 8410 and by the requirements of each watershed management authority with jurisdiction within the municipal boundaries of the City. Detailed information is provided for each water resource that is listed as a <u>public water</u> (also termed Protected Water) by the Minnesota Department of Natural Resources (MNDNR). The detailed information includes Department of Natural Resources (DNR) classification, Chapter 7050 beneficial use classification¹, stream length, watershed area, and watershed management information, as well as historical information and current water quality.

Population, Land Area, Neighborhood, and Parks

The City of Minneapolis is the largest city in Minnesota and the county seat of Hennepin County. The <u>2010 census</u> population of 382,578 is spread over 87 neighborhoods, as shown in Figure 3.1. As of 2016, the City continues to grow, with an estimated population of 413,651.

The City has 151 parks that are wholly or partially within Minneapolis Park and Recreation Board (MPRB) property, which comprise a total of 10 square miles out of a total of 59 square miles of the City. The City has 645 square feet of parkland for every resident. There is a park within six blocks of every resident. In total, the Minneapolis Park System encompasses nearly 6,400 acres of land and water with approximately 24 miles of shoreline along lakes and 14 miles of shoreland along the Mississippi River. MPRB parks are listed in Table 3.1 and shown in Figure 3.2.

¹ Chapter 7050 beneficial use classification are defined in <u>Minnesota Administrative Rule 4050.0140</u> – Use Classifications for Waters of the State. Generally, Class 1 is applied to waters used for domestic consumption (such as the Mississippi River), Class 2 is applied to waters that support fish, other aquatic life, bathing, boating, or other recreational uses, Class 3 is applied to waters used for industrial consumption, Class 4 is applied to waters used for agriculture and wildlife such as waterfowl, Class 5 applies to waters used for aesthetic enjoyment and navigation, and Class 6 waters apply to all other uses.





Figure 3.1 – City of Minneapolis Neighborhoods



Map ID	Park Name
0	Shingle Creek Park
1	Humboldt Greenway Park
2	49 th Ave Corridor Park
3	Bohannon Park
4	North Mississippi Park
5	Webber Park
6	Victory Memorial Parkway
7	Victory Park
8	Folwell Park
9	Cleveland Park
10	Theodore Wirth Parkway
11	Valley View Park
12	Perkins Hill Park
13	Farview Park
14	Jordan Park
15	Newton Triangle
16	Glen Gale Park
17	Irving Triangle
18	Cottage Park
19	Russell Triangle
20	Oliver Triangle
21	North Commons Park
22	Willard Park
23	Hall Park
24	Farwell Park
25	Lovell Square Park
26	Bethune Park
27	Barnes Place Triangle
28	Humboldt Triangle
29	Sumner Field Park
30	Harrison Park
31	Bassett's Creek Park
32	Laurel Triangle
33	Bryn Mawr Park
34	Kenwood Parkway
35	Kenwood Park
36	Fremont Triangle
37	Thomas Lowry Park
38	Brownie Lake Park
39	Cedar Lake Trail – St. Louis Park
40	Cedar Lake Park
41	Lake of the Isles Park
42	Park Siding Park
43	St. Louis Triangle

Map ID	Park Name
44	Alcott Triangle
45	Chowen Triangle
46	West End Triangle
47	Levin Triangle
48	Smith Triangle
49	Mueller Park
50	Whittier Park
51	Soo Line Garden
52	Bryant Square Park
53	Painter Park
54	Dean Parkway
55	Lake Calhoun Park
56	The Mall Park
57	William Berry Park
58	Linden Hills Boulevard
59	Linden Hills Park
60	Waveland Triangle
61	Pershing Field Park
62	Dell Park
63	Reserve Block 40 Park
64	Washburn Avenue Totlot Park
65	Armatage Park
66	Penn Model Village Triangle
67	Kenny Park
68	Lynnhurst Park
69	Minnehaha Creek Parkway
70	Meadowbrook Golf
71	Windom South Park
72	Todd Park
73	Pearl Park
74	Kings Highway Park
75	Gladstone Triangle
76	Elmwood Triangle
77	Rustic Lodge Triangle
78	Fuller Park
79	Lyndale Farmstead Park
80	Rev. Dr. Martin Luther King Jr. Park
81	Stewart Park
82	Central Gym Park
83	McRae Park
84	Phelps Park
85	Sibley Park
86	Lake Hiawatha Park
87	Lake Hiawatha Park/Golf Course

Table 3.1 – Minneapolis Park and Recreation Board Parks



Map ID	Park Name
88	Lake Nokomis Park
89	Shoreview & 54 th Street East Triangle
90	Shoreview & 54-1/2 Street East Triangle
91	Shoreview & 55 th Street East Triangle
92	Bossen Field Park
93	Morris Park
94	Keewaydin Park
95	Longfellow Gardens Park
96	Minnehaha Park
97	Hiawatha School Park
98	Adams Triangle
99	Longfellow Park
100	Seven Oaks Oval Park
101	Corcoran Park
102	Brackett Park
103	Matthews Park
104	Cedar Avenue Field Park
105	East Phillips Park
106	Normanna Triangle
107	Phillips Community Center
108	Peavey Park
109	Murphy Square Park
110	28 th Street Totlot Park
111	Clinton Field Park
112	Morrison Park
113	Washburn Fair Oaks Park
114	Lake Harriet Park
115	Loring Park
116	Parade the Park
117	Stevens Square Park
118	Franklin Steele Square Park
119	Park Avenue Triangle
120	Elliot Park
121	Currie Park
122	Gateway Park
123	Vineland Triangle
124	Diamond Lake Park
125	West River Parkway
126	Orvin "Ole" Olson Park
127	Upper River West Bank Park
128	MPRB Headquarters
129	Camden Boat Launch
130	Caleb Dorr Circle
131	Chergosky Park
132	Clarence Triangle

Map ID	Park Name
133	Orlin Triangle
134	Barton Triangle
135	Tower Hill Park
136	Luxton Park
137	Van Cleve Park
138	Marcy Park
139	Holmes Park
140	Chute Square Park
141	Lucy Wilder Morris Park
142	Main Street Southeast Park
143	Nicollet Island Park
144	BF Nelson Park
145	Boom Island Park
146	Scherer Property
147	Dickman Park
148	Sibley Triangle
149	Saint Anthony Park
150	Monroe Place Triangle
151	Washington Triangle
152	Sheridan Memorial Park
153	Logan Park
154	Beltrami Park
155	Northeast Ice Arena
156	Northeast Athletic Field Park
157	Ridgway Parkway
158	Gross Golf
159	Stinson Park
160	Windom Northeast Park
161	Deming Heights Park
162	Columbia Park Golf Course
163	Waite Park
164	Cavell Park
165	Architect Triangle
166	Hi-View Park
167	Audubon Park
168	Marshall Terrace Park
169	Edgewater Park
170	2220 Marshall Street Northeast
171	2128 Marshall Street Northeast
172	Gluek Park
173	1808 Marshall Street Northeast
174	1812 Marshall Street Northeast
175	1720 Marshall Street Northeast
176	Jackson Square Park
177	Oak Crest Triangle


Map ID	Park Name
178	Bottineau Park
179	Theodore Wirth Park
180	East River Parkway
181	Powderhorn Park
182	Riverside Park
183	Bohemian Flats Park
184	Creekview Park
185	First Bridge Park
186	Mill Ruins Park
187	East River Flats
188	Beard's Plaisance Park
189	Rose/Peace Garden
190	Theodore Wirth Golf Course
191	James I. Rice West River Parkway
192	Eloise Butler Wildflower Garden
193	Bluff Street Park
194	Edward C. Solomon Park
195	Fort Snelling Sports Complex
196	Central Gym Park
197	Northwest Bell Property Park
198	Xcel Energy Field
199	Victory Prairie Dog Park
200	1828 Marshall Street Northeast
201	1415 Ramsey Street Northeast
202	1510 Water Street Northeast
203	1601 16 th Avenue Northeast
204	1326 Water Street Northeast
205	Graco Trail Easement
206	1604-½ Marshall Street Northeast
207	Father Hennepin Bluffs
208	1822 Marshall Street Northeast
209	30 31 st Avenue North
210	1500 Water Street Northeast
211	3101 Pacific Street
212	50 31 st Avenue North
213	Saint Anthony Parkway
214	Saint Anthony & Columbia Trail
215	Ramsey Parcel Park
216	Loring School Pool
217	Ryan Lake Park





Figure 3.2 – Minneapolis Park and Recreation Board Parks



Soils

The City surface soils are highly variable and altered, which is typical of urban cities. The University of Minnesota Department of Soil, Water, Climate and Land Management reports that the native soils in the City are broadly classified as two main soil types: sandy/loamy or silty. Due to the history of the development in the City, there are few areas that have undisturbed soils. Specific soil information is contained in the following watershed management plans and is incorporated into the Minneapolis WRMP by reference.

Bassett Creek Water Management Commission

Hydrologic soil groups within the Bassett Creek Water Management Commission (BCWMC) area are shown in Figure 2.5 of the Commission's <u>2015 Management Plan</u>. The soils for the area of Minneapolis are shown as "not rated or not available."

Minnehaha Creek Watershed District

The area of the Minnehaha Creek Watershed District (MCWD) that is east of Highway 169, which includes the City, is generally categorized as disturbed soils and have not been assigned a hydrologic soil group. This information is shown on Figure 3 of the 2006 <u>Minnehaha Creek Subwatershed Plan²</u>, amended June 2013. This data was not amended in the 2018 Watershed Management Plan.

Mississippi Watershed Management Organization

Soils information for the Mississippi Watershed Management Organization (MWMO) area is detailed in the <u>Watershed Management Plan 2011-2021</u>, amended May 2015. Figure 9 – Present Day Urban Soils, identifies the majority of Minneapolis as having Urban Soils. Additional soil information is contained in Figure 10 – Modern Secondary Soil Information, and Figure 11 – Combined Historic and Modern Soil Information. Figure 15 shows that all four Hydrologic Soil Groups (A, B, C, and D) are present in the City, with the highest volume of runoff generated by Hydrologic Soil Group D, and the least volume of runoff generated by Group A soils.

Shingle Creek Watershed Management Commission

The majority of the soils of the Minneapolis area within the Shingle Creek Watershed Management Commission (SCWMC) boundaries consist primarily of Hydrologic Soil Groups A (sandy) and B (loamy). This data is shown in Figure 2.3 of the Shingle Creek Watershed Management Commission <u>Third</u> <u>Generation Watershed Management Plan</u>, April 2013.

Digital Soil Maps

An additional source of soil information is available from the Minnesota Geospatial Information Office (MnGeo). MnGEO has created <u>digital datasets of soil</u> information that are based on county soil surveys published by the Natural Resources Conservation Service (NRCS), including the Hennepin County Soil

² MCWD 2017 Comprehensive Plan (draft), page 57, incorporates landforms and geology from the 2007 MCWD Comprehensive Water Resources Management Plan.



Survey. Detailed soil maps may be generated, with an example of the available data shown in Figure 3.3. The same information in printable format is available online from NRCS.



Figure 3.3 – Detailed Soil Map

Climate Precipitation

The City has a continental climate, strongly influenced in the summer months by weather systems that originate in the Gulf of Mexico and the Pacific Ocean. Average and maximum precipitation data are listed in Table 3.2. Precipitation in the form of snowfall is included in these values and is described in terms of water equivalent. Growing season (May through September) precipitation averages 19.03 inches, or approximately 62 percent of the annual precipitation, based on normal precipitation recorded at the Minneapolis-Saint Paul (MSP) International Airport for the period of 1981 through 2010.

³ Minnesota IT Services, Geospatial Information Office. Digital Soil Mapping in Minnesota. East Mississippi River and Southeast Minneapolis Detailed Soil Map. Generated by CDM Smith. October 2016.



Source: MnGEO website³

	•	•		•									
Measure ^a	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Mean Precipitation (inches) ^b	2.43	1.77	1.16	0.90	0.77	1.89	2.66	3.36	4.25	4.04	4.30	3.08	30.61
Maximum Monthly Precipitation ^c (inches)	5.68	5.29	4.27	3.63	2.14	4.75	7.00	9.34	9.82	17.90	9.32	7.53	17.90
Maximum Monthly Precipitation ^c (year)	1971	1991	1982	1937	1981	1965	2001	2012	1990	1987	2007	1942	1987
Maximum 24- Hour Precipitation ^c (inches)	4.83	2.91	2.47	1.21	1.34	1.66	2.58	3.39	3.28	10.00	7.36	3.55	10.00
Maximum 24- Hour Precipitation ^c (year)	2005	1940	1982	1967	2012	1965	2006	2012	2003	1987	1977	1942	1987

Table 3.2 – City of Minneapolis Precipitation Data

^a Snow values represent water equivalent

^b 30-year period of record (1981 through 2010)

^c 75-year period of record (1940 through 2015)

(Source: University of Minnesota, Department of Soil, Water and Climate, 1981 through 2010,

http://www.files.dnr.state.mn.us/natural_resources/climate/twin_cities/msp_normals_means_extremes_page3.pdf

Extreme Weather

In 2012 and 2013, Minneapolis Public Works participated in the innovative <u>Weather – Extreme Trends</u> (WET) study concerning response to climate change, funded through a grant from the National Oceanic & Atmospheric Administration (NOAA). The study dealt with stormwater drainage system vulnerability, capacity, and cost under climate change, and used long-term climate information and forecasts to support stakeholder-driven adaptation decisions for urban water resources. The purpose for federal funding of this project was to promote stakeholder-driven adaptation of vulnerable stormwater management systems and related water resources as a model for communities facing significant impacts from climate change. The project compared a fully developed area of the City with a developing suburban area in the City of Victoria. The project convened a broad cross-section of the community. The final project report was submitted on January 13, 2104, and the results will be of interest for the City's use in future planning for climate change adaptation.

In anticipation of weather changes related to climate change, the City is committed to continue preservation of natural resources, disconnection of impervious surfaces, reduction in impervious areas, and increased installation of green infrastructure. These actions will serve to counter-act, or potentially improve, the rate and volume of stormwater runoff generated in the future.

Atlas 14

In 2013, the NOAA released <u>Atlas 14, Precipitation-Frequency Atlas of the United States, Volume 8</u>, which contains updated precipitation prediction data for 11 Midwestern states. The data in this report creates precipitation estimates for storms that have durations that range from 5 minutes to 60 days and



for frequency intervals of 1-year through 1,000-year. The information updates and supersedes Technical Paper-40 (1961), which was the previous standard for the precipitation estimation utilized to size storm drainage structures within the City.

The Minneapolis Surface Water and Sewers Division of Public Works transitioned to Atlas 14 as the hydrologic basis for storm drainage infrastructure design, first effective for projects constructed in 2016.

Snowfall and Snowmelt

In the winter months (November through March), snow predominates in the City. Table 3.3 lists average monthly snowfalls for the City. Snowfall occurs throughout the winter in small events that do not generate runoff. The snowmelt, which occurs over a comparatively short period of time (e.g., approximately two weeks) in March or April, does not affect the hydraulic capacity of the storm drainage system. Snowmelt does, however, have a significant pollutant load, which can affect the water quality of the water resource.

Measure	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Mean Snowfall (inches)	0.6	9.3	11.5	12.1	7.8	10.2	2.5	Trace	0.0	0.0	0.0	Trace	54.0
Maximum Monthly Snowfall (inches)	8.2	46.9	33.6	46.4	19.7	36.8	21.8	0.3	0.0	0.0	0.0	0.4	98.6
Minimum Monthly Snowfall (inches)	0.0	0.1	1.8	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.4
Source: University of Minnesota, Department of Soil, Water and Climate, 1981 through 2010,													

Tahla 3 3 -	- Snowfall	Monthly	Δνοτασος	in the C	ity of N	/inneanolis
1 able 5.5 -	- Showrall	wonuny	Averages	in the c	πιν οι π	/inneapons

http://www.dnr.state.mn.us/climate/twin_cities/snowfall.html

Hydrologically, the amount of precipitation that is contributed to the groundwater as recharge is between 6 inches and 8 inches per year, as reported by the Minnesota Geologic Society⁴.

Bedrock, Surficial Geology, and Topography

The Minnesota landscape is a product of the continental glaciers. It consists of gentle and steep hills, numerous marshes and lakes, and extensive outwash plains. The City has a relatively flat topography, which is a result of outwash deposition that occurred 14,000 years ago by the Des Moines Lobe of the late Wisconsin glaciations.

In general, the bedrock geology of the City consists of undivided layers of limestone, dolostone, sandstone, and shale categorized as Paleozoic Rocks that developed between 225 million years and 600

⁴ Geologic Atlas User's Guide: Using Geologic Maps and Databases for Resource Management and Planning, MCS, Open-File Report OFR-12-1. <u>http://www.mngs.umn.edu/user_guide_v1.pdf</u>



million years ago⁵. Surficial materials typically contain various combinations of sands, gravels, and loamy sands covered by the soils, previously described in the Soils section. Detailed maps of the Surficial and Bedrock Geology have been published as the <u>Hennepin County Atlas Series</u>, Atlas C-4, Plate 3 (Surficial Geology) and Plate 4 (Bedrock Geology).

Topography of the City is divided into four main watersheds: Bassett Creek, Minnehaha Creek, Mississippi River, and Shingle Creek. As noted in Table 3.4, approximately 5 percent of the land area is within the Bassett Creek watershed, 36 percent is within the Minnehaha Creek watershed, 54 percent is within the Mississippi River watershed, and 5 percent is within the Shingle Creek watershed. Note that these values represent the physical topography within the City and not the jurisdictional area of the associated watershed organization, which differ slightly.

Topographical Watershed	Area of Watershed within the City of Minneapolis	Portion of City ^a
Bassett Creek	1,800 acres	5%
Minnehaha Creek	13,400 acres	36%
Mississippi River	19,900 acres	54%
Shingle Creek	2,000 acres	5%

Table 3.4 – Topographical Watersheds in the City of Minneapolis

^a Percentages are rounded

More specific geologic information is contained in watershed management plans and is incorporated into the Minneapolis WRMP by reference, described as follows.

Bassett Creek

A 50-foot layer of glacial drift materials covers the bedrock in the BCWMC area of the City. The bedrock consists of Platteville Limestone over Glenwood Shale. The major bedrock aquifer is within the St. Peter Sandstone, below the Glenwood Shale. Additional detailed information can be found in Section 2.5 of the <u>2015 Management Plan</u>.

Minnehaha Creek

The bedrock within the City region of the MCWD ranges from 0 feet to 100 feet below the surface. Unique features within the City include glacial drift deposits under Lake Calhoun/Bde Maka Ska and Lake Harriet, and exposed bedrock at Minnehaha Falls. Additional detailed information can be found in Section 2.2.2 of the MCWD <u>2007-2017 Comprehensive Water Resources Management Plan, Minnehaha</u> <u>Creek Subwatershed Plan</u>, amended June 2013. This data was not amended in the 2018 Watershed Management Plan.

Mississippi River

The Mississippi River has a distinct geologic stratigraphy with a layer of glacial till and river deposits that overlay oceanic limestone, shale, and sandstone bedrock. Under the City, groundwater is located in

⁵ Geologic Atlas User's Guide: Using Geologic Maps and Databases for Resource Management and Planning, MCS, Open-File Report OFR-12-1. <u>http://www.mngs.umn.edu/user_guide_v1.pdf</u>



unconsolidated deposits and bedrock formations. Bedrock, examples of which are exposed along the Mississippi River bluffs, is not continuous beneath the glacial drift.

The MWMO <u>Watershed Management Plan 2011-2021</u>, amended May 2015, described two geologic areas within the City: along the Mississippi River and the upland areas beyond the River. Within the Mississippi River corridor, the bedrock is 0 feet to 10 feet below the surface, with areas of exposed bedrock, terrace deposits, peat deposits, and a post-glacial stream. Further from the river, the bedrock ranges from 10 feet to 200 feet below the surface with the overburden consisting of glacial outwash and till. There is a deep valley that runs through the bedrock along a northeast-to-southwest alignment through the City that starts in Columbia Heights and continues through the Minneapolis Chain of Lakes. Additional detailed information can be found in Figure 5 through Figure 7 of Section 4.2.3 of the MWMO Watershed Management Plan.

Shingle Creek

The SCWMC <u>Third Generation Watershed Management Plan</u>, April 2013, describes the City as within the Mississippi Valley Outwash geomorphic region. Bedrock is primarily St. Peter Sandstone. Additional detailed information can be found in Section 2.2.5 of the SCWMC plan.

Land Use and Zoning

The Minneapolis Zoning Code is the primary tool used by the City to manage land use within five primary zoning districts: residential, office-residential, commercial, industrial, and downtown. Additionally, there are three types of overlay districts that influence water resource management as defined in Section 5 – Regulatory Controls and Water Resource Management Programs. These three overlay districts include Floodplain Overlay District, Shoreland Overlay District, and the Mississippi River Critical Area Overlay District. Each primary and overlay zoning district has clearly defined allowable and prohibited land uses. Specific land use requirements can be found in the Minneapolis Code of Ordinances, Title 20, Minneapolis Zoning Code.

The City has developed land use policies that guide those development and redevelopment projects that propose changes to land use. The most current land use policies were updated in June 2016 and will be in effect until the updated Minneapolis comprehensive plan, <u>Minneapolis 2040</u>, is in effect. The completed plan is anticipated to be completed in late 2018.

The Metropolitan Council estimates that the population of Minneapolis will grow from an estimated 2016 population of 413,651 to a projected population of 459,200 in 2040. To accommodate this growth, planners anticipate a shift to higher density land uses. This shift in land use is detailed in Minneapolis 2040.

Current City land use is shown in Figure 3.4. Future land use information will be available in the Land Use chapter of the 2018 Minneapolis Plan.

Descriptions of how land use information is utilized in sanitary sewer and stormwater capacity estimations are included in Section 4 – Infrastructure Inventory, Activities, and Assessment.



Figure 3.4 – City of Minneapolis Land Use





Minneapolis Waterbodies

The origin of the name Minneapolis is described as a combination of the Dakota *Minnehaha*, translated as falling waters, and the ancient Greek *polis*, translated as city. This name, as well as the nickname "City of Lakes" suitably describe the landscape of the City, which includes the Mississippi River, four streams, and 17 waterbodies, as listed in Table 3.5 and shown in Figure 3.5. Waterbodies included in this table are those that receive stormwater runoff from a Minneapolis owned outfall. The definition of lake, wetland, and stream is based on information obtained from the <u>MNDNR Lake Finder</u> and <u>MPCA Water</u> <u>Quality Dashboard</u>. The tributary areas for each waterbody are shown in Figure 3.6. This section provides historical information and water quality assessments for those waterbodies that are within the municipal limits of the City. Descriptions of waterbodies that are outside of the City which receive runoff generated within the City are briefly described in a separate section.



Туре	Waterbody	DNR ID	Watershed Organization
River	Mississippi River	07010206-805 ^a 07010206-814 ^b	Mississippi Watershed Management Organization
Stream	Bassett Creek	07010206-538	Bassett Creek Watershed Management Commission
Stream	Minnehaha Creek	07010206-539	Minnehaha Creek Watershed District
Stream	Ryan Creek	07010206-536	Shingle Creek Watershed Management Commission
Stream	Shingle Creek	07010206-506	Shingle Creek Watershed Management Commission
Lake	Birch Pond 27065300 Bassett Creek Watershed Manag Commission		Bassett Creek Watershed Management Commission
Lake	Brownie Lake	27003800	Minnehaha Creek Watershed District
Lake	Cedar Lake	27003900	Minnehaha Creek Watershed District
Lake	Cemetery Lake	27001700	Minnehaha Creek Watershed District
Wetland	Diamond Lake	27002200	Minnehaha Creek Watershed District
Wetland	Ewing Wetland	NA	Minnehaha Creek Watershed District
Wetland	Grass Lake	27068100	Minnehaha Creek Watershed District
Lake	Lake Calhoun/Bde Maka Ska	27003100	Minnehaha Creek Watershed District
Lake	Lake Harriet	27001600	Minnehaha Creek Watershed District
Lake	Lake Hiawatha	27001800	Minnehaha Creek Watershed District
Lake	Lake Nokomis	27001900	Minnehaha Creek Watershed District
Lake	Lake of the Isles	27004000	Minnehaha Creek Watershed District
Lake	Loring Pond	27006500	Mississippi Watershed Management Organization
Lake	Powderhorn Lake	27001400	Minnehaha Creek Watershed District
Lake	Ryan Lake	27005800	Shingle Creek Watershed Management Commission
Lake	Sanctuary Pond	27066500	Minnehaha Creek Watershed District
Shallow Lake	Spring Lake	27065400	Bassett Creek Watershed Management Commission

Table 3.5 – Waterbodies within the City of Minneapolis

^a Mississippi River ID for purposes of Impaired Waters changed from 07010206-509 by MPCA in 2016
 ^b Mississippi River ID for purposes of Impaired Water carried forward from 07010206-513, 07010206-501, 07010206-502, 07010206-503, 07010206-504, 07010206-505, and 07040001-531 to 07010206-814



Figure 3.5 – City of Minneapolis Waterbodies







Figure 3.6 – City of Minneapolis Waterbodies Drainage Areas



Mississippi River

The Mississippi River has historically been the City's source of commerce, recreation, and potable water. Approximately 12.2 miles of the Mississippi River, with a drainage area with Minneapolis of 20,300 acres, flows from northwest to southeast through the City. Hydrologically, the Mississippi River is the ultimate downstream receiving water for nearly all waterbodies in the City, with the exception of a few landlocked wetlands and ponds.

The Minnesota Department of Natural Resources (MNDNR) has segmented the Mississippi River through the City into three segments:

- Coon Creek (in Anoka) to Upper Saint Anthony Falls Dam.
- Upper Saint Anthony Falls Dam to Lower Saint Anthony Falls Lock and Dam.
- Lower Saint Anthony Falls Lock and Dam to Lock and Dam #1 (Ford Dam).

The physical characteristics for each segment of the River are summarized in Table 3.6.

Mississippi River at Lowry Avenue



Credit: CDM Smith



Table 3.6 – Mississipp	i River Characteristics
------------------------	-------------------------

River/Stream	Mississippi River, Crow River to Upper Saint Anthony Falls Dam				
DNR ID#	07010206-805 °				
DNR Classification	N/A				
Chapter 7050 Classification	1C, 2B, 3C				
Length within Minneapolis	5.2 miles				
Downstroom waterbody	Mississippi River, Upper Saint Anthony Falls Dam to Lower Saint				
	Anthony Falls Lock and Dam				
Watershed area within Minneapolis	6,309 acres				
Watershed Management Organization	Mississippi Water Management Organization				
River/Stream	Mississippi River, Upper Saint Anthony Falls Dam to Lower St. Anthony Falls Lock and Dam				
DNR ID#	07010206-814 ^b				
DNR Classification	N/A				
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5 and 6				
Length within Minneapolis	0.6 miles				
Downstream waterbody	Mississippi River, Lower Saint Anthony Falls Lock and Dam to Lock and Dam #1				
Watershed area within Minneapolis	112,969 acres				
Watershed Management Organization	Mississippi Water Management Organization				
River/Stream	Mississippi River, Lower Saint Anthony Falls Lock and Dam to Lock and Dam #1 (Ford Dam)				
DNR ID#	07010206-814 ^b				
DNR Classification	N/A				
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5 and 6				
Length within Minneapolis	6.4 miles				
Downstream waterbody	Mississippi River, Lock and Dam #1 (Ford Dam) to Lock and Dam #2				
Watershed area within Minneapolis	1,035 acres				
Watershed Management Organization	Mississippi Water Management Organization				

^a Mississippi River ID for purposes of Impaired Waters changed from 07010206-509 by MPCA in 2016

^b Mississippi River ID for purposes of Impaired Water carried forward from 07010206-513, 07010206-501, 07010206-502, 07010206-503, 07010206-504, 07010206-505, and 07040001-531 to 07010206-814

Navigation

The City is situated at the upper reaches of the United States Army Corps of Engineers (USACE) Mississippi River navigational system. The Saint Paul District of the USACE operates and maintains 12 locks and dams on the river between the Upper Saint Anthony Falls in downtown Minneapolis and Lock and Dam #10 in Guttenberg, Iowa. Each dam represents a critical step in the "stairway of water" that makes navigation possible between the City and Saint Louis. Figure 3.7 shows the locations of the locks and dams that are within the City. As of 2015, navigation on the Mississippi River is limited to the reach that is downstream of the Upper Saint Anthony Falls Lock and Dam. As described in the section below, titled United States Army Corps of Engineers Closure of Upper Saint Anthony Falls Lock, the lock permanently ended operation as mandated by the U.S. Congress.





Figure 3.7 – Locks and Dams on the Mississippi River, City of Minneapolis



The Upper Saint Anthony Falls Lock and Dam, shown in Figure 3.7 is located on the Mississippi River at river mile 854. The dam consists of a horseshoe dam with a chord dam downstream of the horseshoe and a concrete overflow spillway. The lock is 56 feet wide by 400 feet long. Lower Saint Anthony Falls Dam is located downstream of the Upper Saint Anthony Falls Lock and Dam at river mile 853.9. This lower dam consists of a 275-foot long concrete spillway with four Tainter gates. The lock is also 56 feet wide by 400 feet long.

Both the upper and lower dams were constructed by the USACE and became operational in September 1963. The upper Upper Saint Anthony Falls Dam, upstream of the Stone Arch Bridge



Credit: CDM Smith

lock was closed in 2015 and the lower lock remains open and operates on an occasional schedule. Additional information on the closure is contained in the following subsection.

Lock and Dam #1 (Ford Dam) is located on the Mississippi River at river mile 847.9 in the City. It was constructed in 1917, with major reconstruction in 1929, 1932, and between 1978 and 1983.

United States Army Corps of Engineers Closure of Upper Saint Anthony Falls Lock Due to concerns about the spread of invasive Asian carp, the 113th Congress included a provision in the *Water Resources Reform and Development Act of 2014 (WRRDA)* that permanently closed the Upper Saint Anthony Falls locks. <u>Title II: Navigation – Subtitle A, Section 2010, Upper Mississippi River</u> <u>Protection</u> contains this provision that closed the Upper Saint Anthony Falls Lock effective June 9, 2015. The Lower Saint Anthony Falls Lock remains open and operates under reduced hours. The WRRDA does allow for the lock to be operational in emergency conditions, as necessary to mitigate flood damage.

Recreational boaters are encouraged to use a <u>1.5-mile portage</u> that has been established by the MNDNR. The Mississippi River and Recreation Area Visitor Center at the Upper Saint Anthony Falls Lock and Dam remains open for visitors between May and September of each year.

Efforts are underway to assess the environmental impacts of the closure, as well as the opportunities for redevelopment. Additional research on the impacts related to water quality, and fish, mussel, and macroinvertebrate communities in the river is being conducted by Minneapolis River Partnership in a project funded by the Minnesota Environmental Trust Fund. Recreational opportunities are under consideration by the MPRB, as described in Section 3.7.1.3 of the <u>Upper River Master Plan</u>.



United States Army Corps of Engineers Environmental Pool Plans

In 2004, the USACE Fish and Wildlife Work Group, a subgroup of the USACE Saint Paul District River Resources Forum⁶, completed Environmental Pool Plans (EPP) for the Mississippi River Pools 1 through 10. The Pool Plans establish common habitat goals and objectives for the Upper Mississippi River and serve as a guide toward a sustainable ecosystem and identify a desired future habitat condition. The EPPs serve as a guide for individual agencies to carry out their respective missions and to seek funds to do so in a way that ensures environmental sustainability in a manner that maintains Congressionallymandated navigation on the river.

The entire segment of the Mississippi River in the City is within Pool #1. This 18.6-mile pool is located between the Coon Rapids Dam (river mile 866.2) and Lock and Dam #1 (Ford Dam, river mile 847.6). The Fish and Wildlife Working Group (FWWG) had determined that the only viable use of Pool #1 is commercial navigation and recreational boating and, therefore, have not established environmental sustainability goals. Maintenance of navigation is Congressionally mandated and will continue to be the primary goal of this segment.

Initial discussions on updating the EPP to consider the changes related to closure of the Upper Saint Anthony Falls Lock, began with the FWWG in early 2015. The initial EPP updates reflect habitat restoration and enhancement projects, operation and maintenance (O&M) activities, refuge projects, and other agency restoration projects. As of April 2016, Pool #8 has been completed and will be used as a template for updating the other EPPs. The FWWG also began working on a Habitat Needs Assessment II in 2016. This assessment will be incorporated into the EPP revisions. Currently, the EPP revisions are being delayed until after this assessment is complete. It has not been determined if this EPP update will include revisions to Pool #1.

Water Quality

In 2012, the Minnesota Pollution Control Agency (MPCA) published <u>Mississippi River Pools #1 through</u> <u>#8: Developing River, Pool, and Lake Pepin Eutrophication Criteria</u> to reassess each pool of the Mississippi River in an effort to refine the eutrophication status for each pool and to establish water quality criteria that is specific for each pool. The report contains general conclusions of the quality of Pool #1 based on review of long-term data collected by Metropolitan Council and MPCA, as follows:

- There is no significant overall trend in Total Phosphorus (TP) and Dissolved Ortho Phosphorus (DOP) through 2009, except that the TP and DOP for the period between 2005 and 2009 was lower than for the period between 1993 and 2009.
- DOP is high as it enters the metropolitan area and declines in Pool #1, likely due to algal uptake.

⁶ River Resources Forum consists of representatives from State and Federal agencies within the jurisdiction of the Saint Paul District of the USACE. Agencies include the USACE, U.S. Fish and Wildlife Service, U.S. Coast Guard, National Park Service, MPCA, MNDNR, Iowa DNR, Wisconsin DNR, MnDOT, Iowa DOT, and Wisconsin DOT.



 Chlorophyll-a (Chl-a) gradually increases through Pool #1. The levels of Chl-a in Pool #1 are strongly influenced by flow in the Mississippi River, which causes the levels to vary from season to season.

Concurrently, the MPCA assessed the turbidity and total suspended solids (TSS) water quality standards and published their conclusions in the May 2011 report <u>Aquatic Life Water Quality Standards Draft</u> <u>Technical Support Document for Total Suspended Solids (Turbidity</u>). This report recommended that the turbidity criteria be eliminated and replaced by TSS standards, which are defined by river nutrient regions. The water quality standards for the Mississippi River segment through the City is now categorized as the Central River Nutrient Region. For this segment, the water quality standards were revised from 25 NTU⁷ to 30 mg/l TSS.

The MPCA also published the results of intensive watershed monitoring in a report titled <u>Mississippi</u> <u>River – Twin Cities Watershed Monitoring and Assessment Report (2013)</u>. The report draws conclusions based on data collection since 2010 on the pollution of the Mississippi River. Because of increased development, the waterbodies within the watershed continue to experience stress from pollutants such as nutrients, bacteria, and suspended solids.

Site specific water quality standards developed by the MPCA for the Mississippi River became effective on August 11, 2014 and are summarized in Table 3.7.

Water Quality Indicator	Water Quality Standard	Average Water Quality Concentration ^a	Monitoring Dates
Chl-a (µg/l)	35	46	1993 to 2009
TP (µg/l)	100	97	1993 to 2009
TSS (mg/l)	30	25	unavailable

Table 3.7 – Mississippi River Water Quality Standards, Fridley to Ford Dam

^a Source: Mississippi River – Twin Cities Watershed Monitoring and Assessment Report (2013)

Many other agencies are involved in monitoring of the Mississippi River, as follows:

- Metropolitan Council collects samples at Lock and Dam #1 (Ford Dam) and analyzes on a weekly, bi-weekly, or monthly basis, based on the parameter under analysis. Information is available from the <u>Metropolitan Council</u>.
- United States Geological Survey (<u>USGS</u>) records the depth of water of the Mississippi River at the Minneapolis Water Treatment Plant, located in Fridley.
- MWMO collects grab samples one to two times each month at eight sites on the Mississippi River, all of which are in the City of Minneapolis. Results are summarized and published in the <u>MWMO</u> <u>Annual Monitoring Reports</u>.

⁷ Nephelometric turbidity units.



 <u>USACE</u> maintains data on water depth, flow rates, precipitation, temperature, wind speed, and ice depth at each of the three lock and dams in the City of Minneapolis. Instantaneous and long-term data for each site is available from the USACE, Saint Paul District Water Control Center.

Summaries of reports and monitoring dates are available at the website for each organization.

The MPCA's 2018 Draft Impaired Waters List identified impairments for the three segments of the Mississippi River (see Table 3.5), as summarized in Table 3.8.

MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Consumption/Mercury in Fish Tissue/1998 (3 of 3 segments) Aquatic Consumption/PCB in Fish Tissue/1998 (2 of 3 segments) Aquatic Life/Nutrient and Eutrophication/2016 (1 of 3 segments) ^a Aquatic Recreation/Fecal Coliform (Bacteria)/2002 (3 of 3 segments)
TMDL Status	Fecal Coliform (Bacteria): metro-wide TMDL approved in 2014 Mercury in Fish Tissue: statewide TMDL approved in 2008 Nutrient and Eutrophication: study underway PCB in Fish Tissue: not started
Minneapolis Required Implementation Actions	Fecal Coliform (Bacteria): no action for Mississippi River segments, MPCA will review after 2020 Mercury in Fish Tissue: mercury impairment is not stormwater related

Table 3.8 – Mississippi River Impaired Waters Summary

^a Crow River to Upper Saint Anthony Falls segment (07010206-805), only

The Mississippi River segment through the City is tributary to the downstream segment of the Mississippi River that has been identified with water quality impairments related to excess Total Suspended Solids (TSS). The <u>South Metro Mississippi River, Lock and Dam #1 (Ford Dam) to Lock and Dam #4</u> TSS total maximum daily load (TMDL) report was approved by the EPA on April 26, 2016. This TMDL study concludes that municipalities upstream of Lock and Dam #1, with one exception that does not include the City, are not required to implement additional actions to reduce the load of TSS related to stormwater discharges.

The City, as a municipality with a NPDES stormwater permit, could be required to comply with any identified reductions in stormwater pollutant loads to comply with future Mississippi River TMDL implementation plans that are downstream of the City. The City will continue to track the progress of these, and future, TMDL activities to identify changes in compliance requirements.

Mississippi River Water Quality Improvement Projects

The MPRB has managed a Capital Improvement Program that has included several projects along the Mississippi River that have or will improve the shoreline of the Mississippi River. Most of these projects are improvements to parklands, recreation areas, trails, and parkways.

The <u>Above the Falls Master Plan</u> was completed by the MPRB in 1999 as a master plan for the entire riverfront between Plymouth Avenue North and 42nd Avenue North. The 1999 plan includes near-term and long-term priorities that have resulted in the completion of projects that have included shoreline and other riverfront improvements:

Completed Projects



- Gluek Park improvements included soil remediation, shoreline restoration, and areas of native plantings.
- Boom Island Park trail improvements included shoreline improvements and rehabilitation of the marina.
- Orvin "Ole" Olsen Park acquisition and landscaping.
- Active Projects
 - Scherer Brothers park development and shoreline improvements includes restoration of Hall Island.
 - Upper Harbor Terminal Park improvements are under development.
- Long-Term Projects
 - Northside Wetlands Park along the riverfront between Lowry Avenue and 35th Avenue North.
 - Development of Northeast riverfront parks through land acquisition.

Other projects that include stabilization or improvements to the Mississippi River shoreline, which are downstream of the Above the Falls segment of the Mississippi River, include:

- <u>Water Works</u> is a project to improve the downtown riverfront near Portland Avenue. Specific components under development will include shoreline improvements.
- <u>West River Parkway Slope Repair</u> was an emergency project to repair a severely eroded section of the Mississippi River Bluff below Amplatz Children's Hospital, completed in 2017.

Streams

Three tributaries to the Mississippi River (Bassett Creek, Minnehaha Creek, and Shingle Creek) originate west of the City and flow through the City to the Mississippi River. A fourth stream, Ryan Creek, is tributary to Shingle Creek. These streams are shown in Figure 3.5.

Bassett Creek is a 12-mile stream that meanders eastward from Medicine Lake through Plymouth and Golden Valley and then through MPRB's Theodore Wirth Park. Near Girard Avenue North in the City of Minneapolis, Bassett Creek flows into a tunnel system that discharges to the Mississippi River downstream of Saint Anthony Falls between the upper and lower dams.

Minnehaha Creek originates at the outlet of Lake Minnetonka (Gray's Bay Dam) located in Minnetonka. The Creek flows 22 miles through the cities of Minnetonka, Hopkins, Saint Louis Park, Edina, and Minneapolis, and ends at the confluence with the Mississippi River upstream of Lock and Dam #1 (Ford Dam).

The main stem of Shingle Creek begins in Brooklyn Park in northwestern Hennepin County and flows southeast to its confluence with the Mississippi River through the far northern neighborhoods of the City of Minneapolis, immediately upstream of the Camden Bridge. The main stem is approximately 11



miles long and drops approximately 66 feet from its source to its mouth. Ryan Creek originates at Ryan Lake and discharges to Shingle Creek at approximately Humboldt Avenue North.

Over the years, these streams have been altered to improve drainage, enhance recreation, facilitate transportation, and support development, which is described in detail in the sections below.

Bassett Creek

Bassett Creek is in the mid-section of the City, as shown on Figure 3.5. Bassett Creek originates at Medicine Lake in Plymouth and enters the City of Minneapolis at TH-55. The BCWMC classifies Bassett Creek as a priority waterbody for management purposes.

Originally, Bassett Creek discharged to the Mississippi River at the mouth of the Creek located south of Plymouth Avenue. Construction in the 1980s diverted the lower section of Bassett Creek into a deep tunnel system that discharges to the Mississippi River below Saint Anthony Falls. The Old Bassett Creek Tunnel continues to take local flow which discharge to the Mississippi River at the mouth of original Bassett Creek. This tunnel is still operated and maintained by the City. The physical characteristics of Bassett Creek are summarized in Table 3.9.

Bassett Creek at Wirth Park

Credit: CDM Smith

River/Stream	Bassett Creek, Main Stem
DNR ID#	07010206-538
DNR Classification	N/A
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6
Length within Minneapolis	3.1 ^{a, b}
Downstream waterbody	Mississippi River, Coon Creek to Upper Saint Anthony Falls Dam
Watershed area within Minneapolis	1,621 acres
Watershed Management Organization	Bassett Creek Watershed Management Commission

Table 3.9 – Bassett Creek Characteristics

^a Length of open watercourse, remainder is enclosed in storm pipe

^b Includes length through MPRB Theodore Wirth Park

The property along the shoreline is owned by the MPRB between Theodore Wirth Park and Cedar Lake Road. The remainder of the shoreland is in public ownership by the Minneapolis Public Works Department, the Minneapolis School Board, and the Minneapolis Department of Community Planning and Economic Development (CPED).

Development has drastically altered Bassett Creek throughout the history of the City. Meanders were straightened, wetlands were filled, and trees were cut to accommodate development. Early development, which consisted mostly of sawmills and railroads, led to the influx of industrial and



commercial development along Bassett Creek. In the late 19th Century, Bassett Creek was channelized and the last few miles diverted into a buried culvert that discharged into the Mississippi River immediately south of the Plymouth Avenue Bridge and above Saint Anthony Falls.

Bassett Creek splits into two channels immediately upstream of Trunk Highway 55 located at the border between the City of Minneapolis and Golden Valley, as shown in Figure 3.8. What is now the main channel contains a concrete weir structure that was constructed by the USACE as a part of the larger 1990 Bassett Creek Flood Control Project. The secondary channel, which was the primary channel until rerouted for widening of Trunk Highway 55 in the 1940s, now serves as an infrequent overflow channel. This secondary channel is subject to heavy sedimentation and collection of trash and debris. Occasionally, the City has cleaned out the channel to maintain its hydraulic function, most recently in 2015. Both channels are identified as Public Waters on the MNDNR Public Waters Inventory Map.





Figure 3.8 – Bassett Creek Culverts at Trunk Highway 55



In 1969, the communities of Crystal, Golden Valley, Medicine Lake, Minnetonka, Minneapolis, New Hope, Robbinsdale, Plymouth, and Saint Louis Park formed the Bassett Creek Flood Control Commission. In 1982, in accordance with the Metropolitan Surface Water Management Act, the Bassett Creek Flood Control Commission became the Bassett Creek Watershed Management Commission (BCWMC). Its mission is to control floods and to maintain and enhance the quality of the surface and ground water resources in the 40-square-mile watershed.

In the 1970s, the original Bassett Creek tunnel required extensive maintenance, could no longer accommodate increased drainage from upstream, and was a contributing factor to upstream flooding in the City. From 1987 to 1996, the USACE, in cooperation with the Minnesota Department of Transportation (MnDOT), MNDNR, the BCWMC, and the BCWMC member cities, constructed \$40 million of flood mitigation improvements. The project effectively controlled floods in portions of Golden Valley, Plymouth, Minneapolis, and Crystal, and reduced flood elevations along the Bassett Creek corridor by up to 4.5 feet in the City of Minneapolis. The principal feature of the BCWMC Flood Control Project within the City is the 1.7-mile tunnel through downtown Minneapolis, built in three phases (1979, 1990, and 1992) for a total project cost of \$28 million. Base flow from Bassett Creek was diverted to this new culvert/tunnel. The original tunnel remained in place to convey local runoff and to provide an overflow during flood conditions. The deep tunnel ultimately discharges to the Mississippi River downstream of Saint Anthony Falls. The alignments of these culverts and tunnels are shown in Figure 3.9.





Figure 3.9 – Original and New Bassett Creek Alignment



The joint and cooperative agreements that resulted from the BCWMC Flood Control Project, include obligations for the BCWMC and the member cities in regard to developments or other modifications that affect peak flows or hydraulic capacity in both the new and old tunnels. Additionally, the BCWMC has adopted policies that details the responsibilities and procedures for inspection and maintenance of the flood control structures. This is described in greater detail in Section 4, subsection Stormwater Management Sites Inspection and Maintenance.

<u>Stream monitoring</u> to collect water quality and quantity data is performed in cooperation with the Metropolitan Council and BCWMC as part of the Watershed Outlet Monitoring Program (WOMP). The WOMP station on Bassett Creek is located at Irving Avenue, approximately ¼-mile upstream of where Bassett Creek enters the new tunnel. Data collected includes continuous measurements of stream flow, temperature, and conductivity, as well as monthly base flow grab samples and storm event composite samples. This information is used to assess current stream conditions, develop target pollutant loads, and provide continued monitoring after BMPs are completed in the watershed. BCWMC also completes biotic (invertebrate) monitoring of streams on a regular basis. Monitoring for the presence of biological indicator organisms provides evidence of the water quality of Bassett Creek. The types of organisms on the stream bottom depend on the available habitat; the habitat quality is affected by the water quality.

In 2014, the Metropolitan Council published a comprehensive assessment of the water quality of the streams it monitors⁸. Bassett Creek conclusions from this assessment include:

- Bassett Creek is vulnerable to loss of flows caused by excessive groundwater withdrawal.
 Additional evaluation is required to demonstrate whether there is an actual relationship between
 Bassett Creek flows and groundwater withdrawals.
- There is an increase in peak flows due to summer rainfall and winter snowmelt.
- TSS concentrations have decreased by 72 percent between the years of 2000 and 2013. Current concentrations are higher than in the Mississippi River, but lower than other metropolitan area highly urbanized streams.
- TP concentrations have decreased since 2000, with the greatest reduction of 17 percent in the 5year period between 2008 and 2012. The concentration of TP is slightly higher than the Mississippi River, but lower than other urbanized metropolitan area streams.
- Nitrate (NO₃) concentrations decreased by 27 percent between the years 2008 and 2012. The concentration is lower than the Mississippi River and other urbanized metropolitan area streams.
- Chloride (Cl) concentrations are among the highest of streams monitored by Metropolitan Council.

⁸ Comprehensive Water Quality Assessment of Select Metropolitan Area Streams. St. Paul: Metropolitan Council, 2014



The MPCA's 2018 Draft Impaired Waters List identified impairments for Bassett Creek, as summarized in Table 3.10.

MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Life/Chloride/2010 Aquatic Life/Fishes Bioassessments/2004 Aquatic Recreation/Fecal Coliform (Bacteria)/2008
TMDL Status	Chloride: metropolitan-wide TMDL approved in 2016 Fishes Bioassessments: not started Fecal Coliform (Bacteria): Upper Mississippi TMDL approved in 2014
Minneapolis Required Implementation Actions	Chloride: assessment of winter practices recommended Fecal Coliform (Bacteria): actions recommended

The Main Stem of Bassett Creek was included in the <u>Upper Mississippi River Bacteria TMDL and</u> <u>Protection Plan</u> completed by the MPCA in 2014. The <u>Upper Mississippi River Bacteria TMDL</u> <u>Implementation Plan</u>, March 2016, establishes that a target goal of 79 percent reduction of bacteria load is needed to meet the Waste Load Allocation (WLA) established in the 2014 report. High priority actions have been recommended; however, these actions have not been assigned to a specific organization for implementation:

- Identify and map potential bacteria hot spots, including dog parks.
- Update and enforce pet waste ordinances.
- Conduct public outreach.
- Install filtration and biofiltration, where feasible.
- Direct runoff flows to infiltration and treatment basins or away from impervious surfaces.
- Develop, implement, and enforce Illicit Discharge Detection and Elimination (IDDE).

The <u>Twin Cities Metropolitan Area Chloride Total Maximum Daily Load Study</u> was approved by the MPCA on February 26, 2016 and by the United States Environmental Protection Agency (EPA) on June 6, 2016. All waterbodies assessed in this study, including Bassett Creek, were found to have concentrations of chloride that exceed the State's water quality standards. Over a 10-year monitoring period, the chloride concentration in Bassett Creek exceeded the standard of 230 mg/L on a total of 321 days. The <u>Twin</u> <u>Cities Metropolitan Area Chloride Management Plan</u>, completed in February 2016, requires that all municipalities undertake an assessment of winter maintenance practices and create a plan to reduce winter salt use. Specific reductions in chloride loads have been calculated for each stream; however, there has not been a specific load reduction assigned to individual MS4s.

Since 2006, one stream restoration project has been completed along the Golden Valley segment of Bassett Creek located within Theodore Wirth Park. The <u>Bassett Creek Main Stem Restoration Project</u>, completed in 2015, repaired nine areas of eroded stream bank between Golden Valley Road and the location where Bassett Creek flows into Minneapolis. The 2,100 feet of stabilized stream bank is



estimated to reduce the phosphorus loads by 60 pounds per year and the TSS loads by 105,000 pounds per year. The project was funded by the BCWMC and a grant from the Clean Water Fund. Construction was managed by the MPRB.

The next planned phase of streambank stabilization along Bassett Creek within the City of Minneapolis and Theodore Wirth Park are focused on erosion repair and channel restoration. The <u>Bassett Creek Main</u> <u>Stem Erosion Repair Project</u>. is located between Fruen Mill and Dupont Avenue North. A feasibility study was completed in 2016 and construction is planned for 2018. The Restoration of Historic Bassett Creek Channel at Highway 55 is recommended to mitigate problems associated with extreme sedimentation and collection of trash and debris. Additional improvements are anticipated to be completed by the Blue Line Light Rail Transit (LRT) project. The BCWMC has included a project as a placeholder if the LRT project does not fully mitigate the problems. Improvements are planned for 2022.

Minnehaha Creek

Minnehaha Creek is in south Minneapolis, as denoted on Figure 3.5. Minnehaha Creek originates at Gray's Bay Dam on Lake Minnetonka. Near the end of the Creek in Minneapolis is Minnehaha Falls, a popular and scenic area managed by the MPRB. The physical characteristics of Minnehaha Creek are summarized in Table 3.11.

River/Stream	Minnehaha Creek
DNR ID#	0701206-539
DNR Classification	N/A
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6
Length within Minneapolis	7.7 miles
Downstream waterbody	Mississippi River, Upper Saint Anthony Falls to Lock and Dam #1 (Ford Dam)
Watershed area within Minneapolis	3,347 acres
Watershed Management Organization	Minnehaha Creek Watershed District

Table 3.11 – Minnehaha Creek Characteristics

The property along the entire shoreline of Minnehaha Creek within the City is owned and managed by the MPRB. This parkland extends to several lakes that flow into Minnehaha Creek, primarily the Chain of Lakes (Brownie, Isles, Cedar, Calhoun/Bde Maka Ska, Harriet), Lake Nokomis, and Lake Hiawatha. The MPRB and the MCWD actively manage Minnehaha Creek and its tributary lakes.

Minnehaha Creek monitoring is conducted by the Metropolitan Council, USGS, and the MCWD at multiple sites along Minnehaha Creek. Metropolitan Council monitors flow and collects water samples at a site at 32nd Avenue. MCWD monitors the Creek for dissolved oxygen, flow, water level, nutrients, suspended solids, chloride, algal abundance, and *E. coli* at three sites along the Creek in Minneapolis: 21st Avenue South (canoe landing at Lake Nokomis weir), 28th Avenue South, and Hiawatha Avenue. The MWCD and USGS cooperate to monitor the flows and water levels at Hiawatha Avenue. Real time data is available on the <u>USGS National Water Information System: Web Interface</u>. for Station 05289200.



Minnehaha Falls in Winter

Additionally, the MCWD conducted site specific studies in the City, as follows:

 Hydrologic, Hydraulic, and Pollutant Loading Study (HHPLS) began in 2001 and resulted in a report published in 2003. The study intended to understand the characteristics of the watershed, quantify water movement, incorporate public input, and form



Credit: Minneapolis Public Works

management programs. The overall goal of the study was to improve and maintain the natural resources of the MCWD.

- Minnehaha Creek Base Flow Study is a cooperative study completed by MCWD, MPRB, MWMO, and the University of Minnesota to understand the relationship between base flows in Minnehaha Creek and the groundwater. The study concluded that:
 - Surface waters are the primary source of flow in Minnehaha Creek.
 - Water from the Creek is infiltrated into the groundwater.
 - Focused stormwater infiltration can effectively augment groundwater flows.
 - Improved creek baseflow is possible by targeted infiltration of stormwater in the Creek segment below Lake Harriet.
- Zebra Mussel Monitoring. is an assessment that looks for the presence of Zebra Mussels in Minnehaha Creek. An initial conclusion is that although Zebra Mussels are present in Lake Minnetonka, those that move to Minnehaha Creek experience die-off each year. MPRB Management of Zebra Mussels in Minnehaha Creek and other waterbodies is described in this Section 3, subsection City-Wide Water Quality Monitoring and Other Efforts.
- Lake Hiawatha and Minnehaha Creek Fish Survey was conducted in 2009 in four sites along Minnehaha Creek, which included Lake Hiawatha in Minneapolis. This survey concluded that bullheads, carp, and dogfish (which are primarily low-oxygen tolerant fish) probably have an adverse effect on the water quality in Lake Hiawatha.
- Ecosystem Evaluation Program (E-Grade) is under development by the MCWD. The E-Grade Program is intended to provide a holistic view of the health of the entire watershed through the assessment of a variety of ecosystems: deep and shallow lakes, streams, wetlands, land use, groundwater, and hydrology. These ecosystems will be evaluated for their performance in flood



control, biodiversity, habitat diversity, recreation, potable water supply, and nutrient cycling to determine the overall health of the watershed. All subwatersheds will be examined on a 10-year cycle with intensive monitoring and data collection over three-year periods.

- Minnehaha Creek Visioning Partnership Final Report was jointly conducted by the USACE and the MCWD in 2005. This report created recommendations for future creek management. Erosion control and streambank stabilization were the highest priorities for the reach downstream of the Browndale Dam that includes the entire segment of Minnehaha Creek through the City. The report recommended the MCWD consider bioengineered stabilization techniques over hard armoring where possible, and that habitat improvement be focused on the management of riparian vegetation and retention of large woody debris rather than instream habitat management. The report also recommended that water quality be improved through the reduction of peak stormwater flows, pretreatment of discharges, application of Best Management Practices (BMPs), good housekeeping practices in the watershed, and repair of streambank erosion.
- Minnehaha Creek Bacterial Source Identification Study is a 2-phase project that began in 2016 to address a TMDL that has been established for the Creek due to elevated levels of *E. coli*. In response to the TMDL, the City initiated this bacterial source identification study to identify the sources of *E. coli* in the Creek and the surrounding watershed. A multiple lines of evidence approach was used to identify *E. coli* sources, which included baseline monitoring, sanitary surveys, groundwater characterization, bacterial regrowth assessments, and a series of special studies. A suite of tools was used for the studies, which included traditional culture techniques, genetic molecular markers, and microbial community analysis. The final report is expected to be completed in 2018 at which point Best Management practices to reduce *E. coli* concentrations in the Creek will be evaluated by the City.

In 2014, the Metropolitan Council published a comprehensive assessment of the water quality of the streams it monitors⁹. Minnehaha Creek conclusions from this assessment include:

- The primary source of water in Minnehaha Creek is from Lake Minnetonka, and the secondary source of water is direct stormwater runoff, which creates a sudden significant increase of flow.
- The section through Edina and Minneapolis is defined as "losing flows," meaning that water in the Creek flows into the groundwater.
- Minnehaha Creek is located at groundwater levels, which causes Creek flows to be vulnerable to groundwater pumping.
- Water quality of Minnehaha Creek is influenced by water releases from Lake Minnetonka and urban stormwater runoff.

⁹ Comprehensive Water Quality Assessment of Select Metropolitan Area Streams. St. Paul: Metropolitan Council, 2014



- TSS concentrations are lower than found in the Mississippi River.
- Nutrient concentrations are lower than found in the Mississippi River.
- Nutrient concentrations in the Creek have shown a long-term decline.
- Chloride loads and concentrations are high, as seen in highly developed urbanized watersheds.

The MPCA's 2018 Draft Impaired Waters List identified impairments for Minnehaha Creek, as summarized in Table 3.12.

MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Life/Aquatic Macroinvertebrate Bioassessments/2014 Aquatic Life/Chloride/2008 Aquatic Life/Dissolved Oxygen/2010 Aquatic Life/Fishes Bioassessments/2004 Aquatic Recreation/Fecal Coliform (Bacteria)/2008
TMDL Status	Aquatic Necreation/recarconion (Bacteria)/2008 Aquatic Macroinvertebrate Bioassessments: not started Chloride: metropolitan-wide TMDL approved in 2016 Dissolved Oxygen: not started Fishes Bioassessments: not started Fecal Coliform (Bacteria): approved in 2014
Minneapolis Required Implementation Actions	Chloride: assessment of winter practices recommended Fecal Coliform (Bacteria): actions recommended

Table 3.12 – Minnehaha Creek Impaired Waters Summary

The <u>Minnehaha Creek 5 Bacteria/Lake Hiawatha Nutrients TMDL</u> plan was approved by the EPA on February 24, 2014. With respect to Minnehaha Creek, the TMDL study established an *E. coli*¹⁰ standard of 1,260 count/mL, and a geometric mean of 126 count/mL. Monitoring data shows that the highest number of exceedances of these standards occurs in the section of Minnehaha Creek that is upstream of Lake Hiawatha with the highest frequency of exceedances found at Chicago Avenue South. The Implementation Activities section of the report generally recommends that MS4s consider these approaches:

- Pet waste management and disposal ordinances.
- Illicit discharge ordinances and IDDE programs.
- Street sweeping, storm drain/catch basin cleaning, and pipe rehabilitation.
- Installation of volume control/infiltration/filtration BMPs.

The <u>Twin Cities Metropolitan Area Chloride Total Maximum Daily Load Study</u> was approved by the MPCA on February 26, 2016 and by the EPA on June 6. 2016. All waterbodies assed in this study were found to

¹⁰ Conversion from Fecal Coliform to *E. Coli* is based on <u>Bacteria TMDL Protocols and Supplemental Requirements</u>, 2007, Minnesota Pollution Control Agency



have concentrations of chloride that exceed the State's water quality standards. Over a 10-year monitoring period, the chloride concentration in Minnehaha Creek exceeded the standard of 230 mg/L on a total of 415 days. The <u>Twin Cities Metropolitan Area Chloride Management Plan</u>, completed in February 2016, requires that all municipalities undertake an assessment of winter maintenance practices and create a plan to make reductions in winter salt use. Specific reductions in chloride loads have been calculated for each stream; however, there has not been a specific load reduction assigned to individual MS4s.

TMDL studies for Fishes Bioassessments, Dissolved Oxygen, and Aquatic Macroinvertebrate Bioassessments have not started.

Multiple streambank and in-stream projects along the segment of Minnehaha Creek within the City have been completed. The <u>Minnehaha Falls and Glen Restoration</u>, completed in 2011, stabilized the streambanks and bluffs, installed rock vanes in the Creek, managed invasive vegetation, constructed walkways and trails, protected historic and cultural resources, and added stormwater management features. The project was completed by the MCWD in cooperation with MPRB, Minneapolis Veterans Home, State of Minnesota, and the USACE. In 1997, the Standish-Ericsson Neighborhood Association (SENA) Wetland was constructed as a vegetative buffer to trap debris and nutrients prior to discharge to Minnehaha Creek. The <u>Minnehaha Creek Channel Modifications/Erosion Management Plan</u>, completed in 1998, consisted of a hydrological model of the lower basin of MCWD under severe runoff conditions. Based on this model, a channel modifications plan was produced. In 2001, the <u>Minnehaha Creek Trail</u> <u>Corridor</u> project consisted of shoreline erosion repairs, construction of channel meander and an adjacent wetland, and the placement of vortex treatment structures upstream of the wetland located at Cedar Avenue.

The wettest 6 months (January 1 through June 30) on record in the Twin Cities occurred in 2014, with June 19th being the sixth wettest day ever recorded in the area. Lake Minnetonka, at the headwaters of Minnehaha Creek, topped its previous record for high water by more than seven inches. This extreme precipitation also caused Minnehaha Creek flows to be the greatest on record, as recorded by the MCWD. The record water levels and flows led to more than \$1 million worth of damages. Damage from flooding was widespread and included slope failures, shoreline erosion, damaged culverts, and flooded homes. The City, the MPRB, and the MCWD worked with the Federal Emergency Management Agency (FEMA) to develop plans to fix 11 damaged sites along Minnehaha Creek within MPRB property.

Ryan Creek

The MNDNR considers Ryan Creek as an altered natural watercourse. Ryan Creek originates at Twin Lake in Robbinsdale. The segment within Minneapolis begins at Ryan Lake and discharges to Shingle Creek at 49th Avenue North, as shown on Figure 3.10. The full length of the Creek is approximately 1.0 miles, of which 0.75 miles is within a storm drain and 0.25 miles is an open watercourse located entirely on private property. The physical characteristics of Ryan Creek are summarized in Table 3.13.



River/Stream	Ryan Creek	
DNR ID#	07010206-536	
DNR Classification	N/A	
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6	
Length within Minneapolis	0.25 miles ^a	
Downstream waterbody	Shingle Creek at 49 th Avenue North	
Watershed area within Minneapolis	Acreage included in Shingle Creek watershed area	
Watershed Management Organization	Shingle Creek Watershed Management Commission	

Table 3.13 – Ryan Creek Characteristics

^a Length of open watercourse, remainder is enclosed in storm drain

Ryan Creek has not been monitored, therefore there is no water quality data. The Creek is not listed on the MPCA Impaired Waters List and there are no planned improvements.

Figure 3.10 – Ryan Creek



Ryan Creek

Open Channel and Piped Segments Flowing Between Ryan Lake and Shingle Creek



Shingle Creek

Shingle Creek is located in north Minneapolis, as denoted on Figure 3.5. Shingle Creek originates in Maple Grove at Eagle Lake and discharges to the Mississippi River immediately upstream of 42nd Avenue North. The physical characteristics of Shingle Creek are summarized in Table 3.14.

River/Stream	Shingle Creek
DNR ID#	07010206-506
DNR Classification	N/A
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6
Length within Minneapolis	2.2 miles
Downstream waterbody	Mississippi River, Coon Creek to Upper Saint Anthony Falls
Watershed area within Minneapolis	1,458 acres
Watershed Management Organization	Shingle Creek Watershed Management Commission

Table 3.14 – Shingle Creek Characteristics

The property along the shoreline of the entire length of Shingle Creek in the City is owned and managed by the MPRB.

There are two monitoring sites on Shingle Creek within the City:

An outlet monitoring site maintained by the SCWMC is located on Shingle Creek upstream of 45th Avenue North. Stream stage is continuously recorded. Grab samples are taken bi-weekly and analyzed for TP, ortho-phosphorus, TSS, Total Kjeldahl Nitrogen (TKN), nitrate, and chloride. Additionally, there are four composite samples taken each year. The site has been monitored since 1997, although the parameters analyzed have changed over time. Annual results are available from the SCWMC.

Webber Falls on Shingle Creek at Lyndale Avenue North



Credit: Minneapolis Public Works

The second site is on Shingle Creek at Queen Avenue near the border between Minneapolis and the Brooklyn Center. The site is maintained by the USGS as part of their National Water Quality Assessment (NAWQA) Program. Real-time data for flow, stream depth, temperature, and specific conductivity is collected and available at the USGS Water Resources web interface for site <u>USGS</u> <u>05288105</u>. The SCWMC collects and analyzes grab and composite samples at this site concurrent with the 45th Avenue North monitoring site.

The MPCA's 2018 Draft Impaired Waters List identified impairments for Shingle Creek, as summarized in Table 3.15.



Table 3	.15 –	Shingle	Creek	Impaired	Waters	Summary
Table J	.13	Jungie	CIECK	impaneu	waters	Juilliary

MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Life/Aquatic Macroinvertebrate Bioassessments/2006 Aquatic Life/Chloride/1998 Aquatic Life/Dissolved Oxygen/2004 Aquatic Recreation/Escherichia coli (Bacteria)/2014
TMDL Status	Aquatic Macroinvertebrate Bioassessments: approved in 2011 Chloride: approved in 2007 Dissolved Oxygen: approved in 2011 Escherichia coli (Bacteria): metropolitan wide TMDL approved in 2014
Minneapolis Required Implementation Actions	Aquatic Macroinvertebrate Bioassessments/Dissolved Oxygen: implement in-stream improvements Chloride: assessment of winter practices recommended Escherichia coli (Bacteria): actions recommended

The <u>Shingle Creek and Bass Creek Biota and Dissolved Oxygen TMDL</u> report was approved by the EPA on November 4, 2011. This study identified that the low oxygen of Shingle Creek is caused by a low level of oxygen discharged from the creek's headwaters, excessive uptake of oxygen by the sediment in the wider sections of the creek, and the lack of habitat along the streambanks. The subsequent <u>Shingle and Bass Creeks Biota and Dissolved Oxygen TMDL Implementation Plan</u> was completed in January 2012. Recommendations for the City segment of Shingle Creek between Queen Avenue North and the Mississippi River include:

- Stabilization of the shoreline by select tree removal, shoreline vegetation planting, and buffer establishment.
- Installation of in-stream habitat features such as root wads, tree pins, and riffles.
- Narrow the channel and installation of riffles to improve aeration.
- Evaluation of the benefits of removal of the concrete structure at Webber Park and I-94.
- Creation of a fish passage around the concrete Webber Falls structure.
- BMP retrofits.
- Increase volume of stormwater infiltration.
- Education and outreach.

The Implementation Plan assigns the responsibility for these projects jointly to the City and the SCWMC. In accordance with the 2018 NPDES Integrated Permit, local responsibilities for TMDL compliance are jointly assigned to the City and the MPRB. The MPRB has the primary responsibility to implement all capital projects recommended for Shingle Creek. The City will work cooperatively with the MPRB on all TMDL projects and will negotiate cooperative funding and project management responsibilities on a project-by-project basis.


The <u>Shingle Creek Chloride TMDL Report</u> and the <u>Shingle Creek Chloride TMDL Implementation Plan</u> were developed before the metropolitan-wide chloride TMDL that included the Bassett Creek and Minnehaha Creek watersheds. This TMDL Report estimated that a reduction of 71 percent of chloride loads is necessary to achieve water quality standards. The primary source of chloride (82 percent) is estimated to be from winter road maintenance with the remaining sources from private commercial use, salt storage facilities, groundwater, and residential use. Recommended actions include:

- Retrofit equipment to updated technology, such as temperature sensors to adjust salt application rates, pre-wetting equipment, and anti-icing capabilities.
- Cover all road salt stockpiles and store on impervious surfaces.
- Train operators.
- Stockpile cleared snow away from sensitive areas.
- Continue to research technologies and materials.

Shingle Creek was included in the <u>Upper Mississippi River Bacteria TMDL and Protection Plan</u> completed by the MPCA in 2014. The <u>Upper Mississippi River Bacteria TMDL Implementation Plan</u>, March 2016, establishes that a target goal of 69 percent reduction of bacteria load is needed to meet the WLA established in the 2014 report. High priority actions have been recommended; however, these actions have not been assigned to a specific organization for implementation:

- Identify and map potential bacteria hot spots, including dog parks.
- Update and enforce pet waste ordinances.
- Conduct public outreach.
- Install filtration and biofiltration, where feasible.
- Direct runoff flows to infiltration and treatment basins or away from impervious surfaces.
- Develop, implement, and enforce IDDE discharges.

The SCWMC has installed two <u>experimental</u> water quality projects along Shingle Creek on MPRB property. The first is an off-line filter bed at the Webber Park falls that treats Shingle Creek flows. The project was funded by a Section 319 grant and SCWMC levy; no City match was required. The filter bed was installed in the Fall of 2016. The second is an iron- and biochar-enhanced sand filter pond retrofit as part of the biochar grant project in a pond at Creekview Park, just north of 49th





Credit: Minneapolis Public Works

Shingle Creek Biochar Box

Avenue North and Humboldt Avenue North. This was installed in late Spring 2017. Next steps for both projects include monitoring inflow, outflow, and ambient water quality to assess effectiveness of the filters. The purpose of these installations is to test the efficacy of these filters at removing *E. coli* bacteria and dissolved phosphorus from stormwater runoff and from direct streamflow.

Lakes and Wetlands

Lakes and wetlands described in this WRMP are those which are listed on the MNDNR's Public Waters Inventory (PWI), as authorized by Minnesota Statutes, Section 103G.201, and/or receive discharges of Minneapolis stormwater runoff. Seventeen (17) lakes and wetlands receiving stormwater runoff from the City's drainage system exist partially or wholly within the City, as shown in Figure 3.5. Most of these lakes are integrated into the parks and are the focus of the City's park system. Table 3.16 is a complete list of Minneapolis lakes inventoried in this WRMP.

Minneapolis Lakes Inventoried in this WRMP		
Birch Pond	Brownie Lake	Cedar Lake
Cemetery Lake	Diamond Lake ^a	Ewing Wetland ^a
Grass Lake ^a	Lake Calhoun/Bde Maka Ska	Lake Harriet
Lake Hiawatha	Lake Nokomis	Lake of the Isles
Loring Pond	Powderhorn Lake	Ryan Lake
Sanctuary Pond	Spring Lake ^b	-

Table 3.16 – City of Minneapolis Lakes

^a Categorized as a wetland by MPCA, MNDNR, or other.

^b Categorized as shallow lake by MPCA.

Birch Pond

The physical characteristics of Birch Pond are summarized in Table 3.17.

Table 3.17 – Birch Pond Ch	naracteristics	

River/Stream	Birch Pond
DNR ID#	27065300
DNR Classification	N/A
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6
Downstream waterbody	Landlocked
Surface Area	2.5 acres
Depth – mean	N/A
Depth – maximum	N/A
Watershed area within Minneapolis	39 acres
Watershed Management Organization	Bassett Creek Watershed Management Commission

Birch Pond, surrounded by hills and mature trees, is a landlocked pond located in Theodore Wirth Park within the City of Minneapolis, north of Interstate 394 and south of Wirth Lake. The pond receives runoff from the southbound portion of Wirth Parkway. Birch Pond is managed by the MPRB.



The pond was acquired with the initial 1890 acquisition of 64 acres of Theodore Wirth Park. In 1893, the park board allowed the State Fish Commission to use the pond as a fish hatchery for about 25 years. In 1910, it was renamed after the birch trees that surround the pond.

Prior to the 1990s, water was pumped from the Mississippi River into Bassett Creek and then from Bassett Creek into Birch Pond to supplement water levels in the Chain of Lakes, as further described in the Brownie Lake section. This was accomplished by pumps that moved water from Birch Pond to Brownie Lake. This practice was discontinued in the 1990s to prevent the movement of invasive species into Bassett Creek and Birch Pond. Remnants of the previous conveyance system is located on the east side of the pond.

Bird watching is the main recreational activity at the pond. No public boat access or fishing docks are present.

Buckthorn, an invasive plant species, is managed around Birch Pond as part of a larger effort to prevent buckthorn infestation of the adjacent Eloise Butler Wildflower Garden. In 2014, the MPRB received an <u>Outdoor Heritage Grant</u> from the State of Minnesota to manage invasive vegetation, including buckthorn, in upland and wetland areas of Theodore Wirth Park. Purple loosestrife, an invasive wetland plant, is controlled, as needed, by biocontrol (introduction of leaf-eating beetles). Additional information on efforts to control loosestrife is contained in this Section 3, subsection City-Wide Water Quality Monitoring and Other Efforts.

The MPRB monitors the ice conditions of Birch Pond. Birch Pond has not been monitored or evaluated for impairments due to its size.

Brownie Lake

The physical characteristics of Brownie Lake are summarized in Table 3.18.

River/Stream	Brownie Lake
DNR ID#	27003800
DNR Classification	General Development
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6
Downstream waterbody	Cedar Lake
Surface Area	9 acres
Depth – mean	22 feet
Depth – maximum	47 feet
Watershed area within Minneapolis	94 acres
Watershed Management Organization	Minnehaha Creek Watershed District

Table 3.18 – Brownie Lake Characteristics

Brownie Lake is located immediately south of Interstate 394 and east of Highway 100. It is the uppermost lake in the Minneapolis Chain of Lakes, which also includes Cedar Lake, Lake of the Isles, Lake Calhoun/Bde Maka Ska, and Lake Harriet (from upstream to downstream). The majority of the drainage area is from outside of Minneapolis, which includes residential and commercial areas of Saint Louis Park. Though the Minneapolis Chain of Lakes are interconnected with channels and operate as one



waterbody, the individual lakes are considered separate by the MNDNR and MCWD. Brownie Lake is encompassed by Brownie Lake Park with trails and a canoe launch. Brownie Lake's drainage area within the City is predominantly residential.

The surface water elevation of Brownie Lake was significantly lowered after railroad tracks were constructed between it and Cedar Lake in the mid-19th Century, and again in the 1910s when the channel that links Brownie Lake and Cedar Lake was opened. These actions also resulted in a surface area of the lake that is significantly smaller than existed before the railroad lines were installed. The MPRB acquired the lake in a larger (over 100-acre) acquisition as an expansion of Theodore Wirth Park in 1908. After a period of historically low water levels, water from Bassett's Creek was pumped into Brownie Lake in 1958, which created a connection between Bassett Creek and the Minneapolis Chain of Lakes. Water pumped from the creek initially raised lake levels. A pump station on the Mississippi River was constructed in 1966 to supplement Bassett Creek flows which ultimately supplemented the Minneapolis Chain of Lakes water levels. Pump stations were shut down in the 1990s due to concerns of water quality impacts, primarily phosphorus concentrations and invasive species.

In July 1993, a group known as the Water Quality Management Citizen Advisory Committee presented Mayor Sharon Sayles Belton with the Green Report, which evaluated the Chain of Lakes and recommended measures for preservation and improvement. Funded by a Clean Water Partnership grant and made up of members of the MPRB, City Council, neighborhood groups, and community organizations, the Committee developed a report that moved quickly from an assessment of the Chain of Lakes to goals, recommendations, and implementation steps. With support from technical staff, the Committee reported on the state of the Chain of Lakes.

Improvements recommended in the 1993 report were implemented through a 391 Grant awarded by the MPCA. Efforts to improve Brownie Lake and adjacent parkland included a community-wide program that focused on removal of invasive plant species and rehabilitation of a stormwater pipe in Saint Louis Park.

Brownie Lake is included in MPRB's lake monitoring program. Monitoring results are published each year in the MPRB annual <u>Water Resources Report</u>. Additional information on MPRB water quality monitoring is contained in this Section 3, subsection City-Wide Water Quality Monitoring and Other Efforts.

The MPCA's 2018 Draft Impaired Waters List identified impairments for Brownie Lake, as summarized in Table 3.19.



MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Consumption/Mercury in Fish Tissue/1998 Aquatic Recreation/Nutrient/Eutrophication Biological Indicators/2004 (DE-LISTED 2010) Aquatic Life/Chloride/2014
TMDL Status	Mercury in Fish Tissue: statewide TMDL approved in 2007 Chloride: metro-wide TMDL approved in 2016
Minneapolis Required Implementation Actions	Mercury in Fish Tissue: no responsibilities for local municipalities Chloride: assessment of winter practices recommended

Table 3.19 – Brownie Lake Impaired Water Summary

In 1998, Brownie Lake was listed as impaired due to mercury in fish tissue. Excess mercury concentrations have been found statewide (about two-thirds of impaired lakes had excess mercury by 2006) and are largely attributed to atmospheric deposition. As such, Minnesota lakes with mercury impairments have been added to a <u>statewide mercury TMDL</u>, which was first approved by the EPA.

In 2004, Brownie Lake was listed for impairment due to excess nutrients and then de-listed in 2010 when the MPCA determined that the water quality standard was met. However, it was noted that the lake could be listed again if total phosphorus concentrations rise. A MPRB 2014 Water Quality Report (May 2015) indicates that total phosphorus in the Minnehaha Creek Subwatershed had increased in June due to heavy precipitation and floods that occurred in 2014. The increase in total phosphorus after de-listing did not result in the lake being re-listed as impaired from excess nutrients; however, the impairment status is continuing to be monitored by the MPCA.

On March 27, 2007, Brownie Lake was added to the statewide mercury TMLDL list for the southwest region with a target completion date of 2025.

Brownie Lake was listed as impaired in 2014 in a metropolitan-wide TMDL study for chloride concentration. The MPCA partnered with local and state experts to create a plan for reduction of chloride concentrations through management of salt use on driving lanes, as summarized in the Twin Cities Metropolitan Area (TCMA) <u>Chloride Management Plan</u> dated February 2016. This plan identifies salts (primarily sodium chloride) applied to paved surfaces in the winter as the major source for elevated chloride concentrations in waters and from water softeners in rural areas as a secondary source. The EPA approved the metropolitan-wide TCMA TMDL on June 9, 2016. The TCMA Chloride Management Plan indicates that Brownie Lake has been identified as being meromixis, based on MPRB monitoring, which may suggest that increase water density from chloride concentrations has impeded the lake's natural mixing and circulation. The MPRB reports that these conditions may be due to alterations to the watershed and outlet that occurred prior to the practice of winter salt application.

In 2008, the MPRB and the Minneapolis Public Works worked on restoration of an area that had eroded on the east side of the lake and replaced a stormwater outlet with a buried drop-structure and pipe. A canoe rack was installed along the north shore of the lake in 2009 and trail improvements were completed in 2014.



Cedar Lake

The physical characteristics of Cedar Lake are summarized in Table 3.20.

River/Stream	Cedar Lake
DNR ID#	27003900
DNR Classification	General Development
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6
Downstream waterbody	Lake of the Isles
Surface Area	164 acres
Depth – mean	20 feet
Depth – maximum	51 feet
Watershed area within Minneapolis	288 acres
Watershed Management Organization	Minnehaha Creek Watershed District

Table 3.20 – Cedar Lake Characteristics

Cedar Lake is in west-central Minneapolis and makes up part of the Minneapolis Chain of Lakes, which also includes Brownie Lake, Lake of the Isles, Lake Calhoun/Bde Maka Ska, and Lake Harriet. Though the Chain of Lakes are interconnected with channels and operate as one waterbody, the individual lakes are considered as separate waterbodies by the MNDNR and the MCWD. The lake is surrounded by parkland with several recreational resources available: biking and walking paths, ski trail, fish pier, picnic areas with grills, a canoe launch, and 3 public beaches. The lake receives runoff from the City and Saint Louis Park. Though Cedar Lake is typically stratified, there is evidence in

Cedar Lake Swimming Beach



Credit: Minneapolis Public Works

some years that the lake may mix during the late summer.

The MPRB acquired the western parkways to Cedar Lake in 1902. The lake was dredged between 1911 and 1917, and channels were created in 1913 and 1916 to connect to Lake of the Isles to the east and Brownie Lake to the northwest. A part of the east shore was donated to MPRB in 1933 and, by 1953, MPRB obtained legal control of Cedar Lake waters despite not owning the entire shoreline. Additional land to the east was purchased through the mid- to late-1950s.

In July of 1993, a group known as the Water Quality Management Citizen Advisory Committee presented Mayor Sharon Sayles Belton with the Green Report, which evaluated the Chain of Lakes and recommended measures for preservation and improvement. Funded by a Clean Water Partnership grant and made up of members of the MPRB, City Council, neighborhood groups, and community



organizations, the committee developed a report that moved quickly from an assessment of the Chain of Lakes to goals, recommendations, and implementation steps. With support from technical staff, the committee reported on the state of the Chain of Lakes. The technical data showed Cedar Lake to be eutrophic. Furthermore, Secchi disk Trophic State Index (TSI) values had increased rapidly through the 1960s. The water quality of Cedar Lake was found to be worse than predicted by water quality modeling, which suggested that internal loads played a significant role.

Projects by the Clean Water Partnership to improve water quality in the lake were implemented through a 319 Grant awarded by the MPCA. Projects for Cedar Lake included a 4.6-acre constructed wetland near the southwest corner of the lake to treat stormwater runoff, which was completed in 1995. An aluminum sulfate (alum) treatment project in 1996 improved phosphorus levels at the lake's surface. Secchi disk TSI values increased after the alum treatment ended in 2003 and the lake met the MPCA eutrophication standard for Secchi depth, chlorophyll-a, and total phosphorus, as reported in the MPRB's 2015 Water Resources Report issued in April of 2016.

Cedar Lake is part of the MPRB's annual lake monitoring program. Monitoring results are published each year in the MPRB annual <u>Water Resources Report</u>.

Purple loosestrife, an invasive wetland plant, has been controlled, as needed, by biocontrol (introduction of leaf-eating beetles). Eurasian water milfoil, another invasive water species, is also managed by the MPRB at Cedar Lake via mechanical harvesting. Additional information on efforts to control loosestrife and milfoil is contained in this Section 3, subsection City-Wide Water Quality Monitoring and Other Efforts.

The MPCA's 2018 Draft Impaired Waters List identified impairments for Cedar Lake, as summarized in Table 3.21.

MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Consumption/Mercury in Fish Tissue/1998
TMDL Status	Mercury in Fish Tissue: statewide TMDL approved in 2008
Minneapolis Required Implementation Actions	Mercury in Fish Tissue: no responsibilities for local municipalities

Table 3.21 – Cedar Lake Impaired Water Summary

In 1998, Cedar Lake was listed as impaired due to mercury levels in fish.

Cemetery Lake

The physical characteristics of Cemetery Lake are summarized in Table 3.22.

River/Stream	Cemetery Lake
DNR ID#	27001700
DNR Classification	N/A
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6
Downstream waterbody	Lake Harriet



Surface Area	10 acres
Depth – mean	unknown
Depth – maximum	unknown
Watershed area within Minneapolis ^a	Acreage included in Lake Calhoun/Bde Maka Ska watershed area
Watershed Management Organization	Minnehaha Creek Watershed District

^a Watershed area is privately owned and does not receive stormwater runoff from the Minneapolis stormwater drainage system.

Cemetery Lake, also known as Jo Pond, is located between Lake Calhoun/Bde Maka Ska and Lake Harriet. Cemetery Lake is situated in a garden cemetery, Lakewood Cemetery, developed in the 1870s. All stormwater runoff discharged to Cemetery Lake is from the surrounding cemetery and does not include runoff from City streets. The land is managed by Lakewood grounds crews.

Cemetery Lake has not been monitored or evaluated for impairments.

Diamond Lake

The physical characteristics of Diamond Lake are summarized in Table 3.23.

River/Stream	Diamond Lake
DNR ID#	27002200
DNR Classification	General Development
Chapter 7050 Classification	2D, 3D, 4C, 5, and 6
Downstream waterbody	Minnehaha Creek
Surface Area	51 acres
Depth – mean	3.2 feet
Depth – maximum	5.8 feet
Watershed area within Minneapolis	663 acres
Watershed Management Organization	Minnehaha Creek Watershed District

Table 3.23 – Diamond Lake Characteristics

Diamond Lake is located immediately east of Interstate 35W, to the southeast of Lake Harriet, and to the southwest of Lake Nokomis. Pearl Park borders the lake to the north and Minnehaha Creek and Minnehaha Parkway is further to the north.

Amenities offered at the park include baseball/softball fields, basketball court, football/soccer fields, outdoor hockey and ice skating rink, picnic areas, pickleball court, playground, tennis courts, volleyball courts, restrooms, a wading pool, walking paths, and a canoe launch at the north end of Diamond Lake.

The land surrounding Diamond Lake was acquired by the MPRB in 1927. The land previously contained another lake called Pearl Lake, which was listed as separate from Diamond Lake in 1942. Pearl Lake was filled over the course of a few years in the 1930s, with at least 60,000 yards of fill provided by the nearby airport. Pearl Lake was then repurposed as a park with playing fields and courts, an ice rink, and a playground. A 12-inch drain in the center of the park drains to Diamond Lake. Due to settling and flooding issues at the former Pearl Lake, refilling and re-grading the area occurred multiple times in the



park's history. A recreation center was built in 1968. In 2006, an in-ground irrigation system was also added to the playing fields.

A stormwater pond was created in 2000 near 60th Street and 1st Avenue to help alleviate flooding and to treat stormwater upstream of Diamond Lake. In 2007, construction began on a nearby highway (35W/Highway 62) that altered the Diamond Lake watershed drainage area.

Diamond Lake is included in MPRB's lake monitoring program. Monitoring results are published each year in the MPRB annual <u>Water Resources Report</u>. Additional information on MPRB water quality monitoring is contained in this Section 3, subsection City-Wide Water Quality Monitoring and Other Efforts.

The MPCA's 2018 Draft Impaired Waters List identified impairments for Diamond Lake, as summarized in Table 3.24.

MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Recreation/Nutrient/Eutrophication Biological Indicators/2006 (DE-LISTED 2010) Aquatic Life/Chloride/2014
TMDL Status	Chloride: metropolitan-wide TMDL approved in 2016
Minneapolis Required Implementation Actions	Chloride: assessment of winter practices recommended

Table 3.24 – Diamond Lake Impaired Waters Summary

Diamond Lake was reclassified as a wetland (or game lake) by the MPCA in 2008 due to its depth and percentage of lake that is littoral zone. There are no nutrient standards for wetlands at this time, therefore, there are no eutrophication standards to assess the water quality in the Diamond Lake wetland. Therefore, although Diamond Lake with its previous waterbody classification was listed as impaired for excess nutrients in 2006, it was removed from the impaired waters list in 2010 due to this reclassification to wetland.

The long-term monitoring information for Diamond Lake was used to develop the 2009 <u>Diamond Lake</u> <u>Management Plan</u>, prepared by MPRB, Friends of Diamond Lake, and Health Lakes & Rivers Partnership Committee. The report includes a detailed history of the lake and characteristics of the lake and surrounding land. It establishes long-term goals for the lake and action plans to accomplish those goals. Recommended actions include ongoing monitoring, identification of locations to install structural SMPs, survey of plants and animals, implementation of an education program, improvements to trails, and improvements for water access.

Diamond Lake was listed as impaired in 2014 in a metropolitan-wide <u>TMDL study</u> for chloride concentration with an initial target TMDL completion of 2015. The EPA approved the metropolitan-wide TCMA TMDL on June 9, 2016 in a letter that also identified Diamond Lake as a wetland. The MPCA partnered with local and state experts to create a plan for reduction of chloride concentrations in water through management of salt use on land, resulting in the <u>TCMA Chloride Management Plan</u> in February of 2016. This plan identifies salts (primarily sodium chloride) applied to paved surfaces in the winter as the major source for chloride in waters, and water softeners in rural areas as a secondary source. The



implementation for the metropolitan-wide TCMA Chloride Management Plan is further discussed in the section for Brownie Lake, which is also listed in the plan.

Between 2014 and 2016, Metro Blooms led the Diamond Lake Blooming Alleys Project. This cost-share project encouraged residents to install rain gardens, permeable pavements, and/or native plants in areas adjacent to alleys within the Lake Nokomis watershed. A total of 50 properties within 4 alleys participated in the program.

Ewing Wetland

The physical characteristics of Ewing Wetland are summarized in Table 3.25.

River/Stream	Ewing Wetland
DNR ID#	None
DNR Classification	N/A
Chapter 7050 Classification	2D, 3D, 4C, 5, and 6
Downstream waterbody	Landlocked
Surface Area	2 acres
Depth – mean	Unknown
Depth – maximum	Unknown
Watershed area within Minneapolis	Acreage include in Cedar Lake area
Watershed Management Organization	Minnehaha Creek Watershed District

Table 3.25 – Ewing Wetland Characteristics

Ewing Wetland is located to the west of Brownie Lake and Cedar Lake along France Avenue South in Saint Louis Park. The wetland receives runoff from a residential area in the City. Prior to 1995, the wetland was unnamed and privately owned. The upland portion of the property was divided into ten lots and houses were eventually constructed on all lots. Runoff from the local street, and the 10 properties, discharges to a private stormwater pond, which discharges to Ewing Wetland. The wetland area was delineated and platted as an outlot. It was deeded to the Department of Public Works and is currently managed as an undeveloped area.

Ewing Wetland has not been monitored or evaluated for impairments.

Grass Lake

The physical characteristics of Grass Lake are summarized in Table 3.26.



River/Stream	Grass Lake
DNR ID#	27068100
DNR Classification	Natural Environment
Chapter 7050 Classification	2D, 3D, 4C, 5, and 6
Downstream waterbody	Richfield Lake
Surface Area	27 acres
Depth – mean	2 feet
Depth – maximum	4.9 feet
Watershed area within Minneapolis	325 acres
Watershed Management Organization	Minnehaha Creek Watershed District

Table 3.26 – Grass Lake Characteristics

Grass Lake is located immediately northwest of the intersection of Interstate 35W and Highway 62. Despite its name, Grass Lake is officially a wetland according to the MPCA and is known for bird watching. The adjacent land is not part of the Minneapolis Park system, though Grass Lake was added to the MPRB lake sampling program in 2002.

Grass Lake was previously part of the larger Richfield Lake located to the southeast, which was divided by <u>construction of Highway 62</u>. The separated Grass Lake was dredged to help provide fill for the new highway in 1962. The two lakes were joined by a pipe to preserve their former hydrogeology. Stormwater runoff and storm sewers from the highway drain into the wetland. In 1995, grit chambers were constructed at the end of storm drain pipes to remove debris from the runoff prior to discharge to Grass Lake.

Grass Lake is included in MPRB's lake monitoring program. Monitoring results are published each year in the MPRB annual <u>Water Resources Report</u>. Additional information on MPRB water quality monitoring is contained in this Section 3, subsection City-Wide Water Quality Monitoring and Other Efforts.

Lake Calhoun/Bde Maka Ska

The physical characteristics of Lake Calhoun/Bde Maka Ska are summarized in Table 3.27.

River/Stream	Lake Calhoun/Bde Maka Ska
DNR ID#	27003100
DNR Classification	General Development
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6
Downstream waterbody	Lake Harriet
Surface Area	420 acres
Depth – mean	Unknown
Depth – maximum	82 feet
Watershed area within Minneapolis	1,250 acres
Watershed Management Organization	Minnehaha Creek Watershed District

Table 3.27 – Lake Calhoun/Bde Maka Ska Characteristics



Lake Calhoun/Bde Maka Ska is located in south Minneapolis as part of the Chain of Lakes and is situated between Lake of the Isles (to the north from West Lake Street) and Lake Harriet (to the south past Lakewood Cemetery). The Minneapolis Chain of Lakes also includes Brownie Lake and Lake of the Isles. Though the Chain of Lakes are interconnected with channels and operate as one waterbody, the individual lakes are considered separate by the MNDNR and MCWD. Lake Calhoun/Bde Maka Ska is the largest lake in Minneapolis, as well as the deepest lake monitored by the MPRB. The lake receives runoff from Minneapolis and Saint Louis Park.

The lake is part of the Grand Rounds National Scenic Byway and is primarily used for recreational activities. Recreational activities include highly used trails, sailing, canoe/kayak, restaurant, and 3 public swimming beaches.

In May 2017, the MPRB started the process for formally restore the name of Lake Calhoun to its original Dakota name of Bde Maka Ska, meaning White Earth Lake. As property owner of the entire shoreline of the Lake, the MPRB has the authority to request a name change but cannot unilaterally approve this change. As of January 2018, the <u>MPRB had formally recognized this Lake as Bde Maka Ska</u>. A formal request for approval has been approved by Hennepin County, the MNDNR, and the United States Board on Geographic Names. As of July 2018, the lake name change is officially Bde Maka Ska.

Land adjacent to the lake was acquired in pieces and coincided with the gradual purchase and donation of lands near Lake of the Isles and Lake Harriet. There was a 25-year gap between the MPRB acquisition of the eastern shores and the south and western shores. The lands around the lake were not completely owned by the MPRB until 1908. Recreational use of the lake started as early as 1887 with a skating rink, a horse racetrack (later moved to Lake of the Isles), and boat rentals. A temporary bathhouse was constructed in 1890 and by the following year, the lake was stocked with fish supplied by the Minnesota Fish Commission.

A channel was constructed to connect the Lake of the Isles to Lake Calhoun/Bde Maka Ska in 1911. Lake Calhoun/Bde Maka Ska was dredged after construction of the connection and again in 1923 through 1925, which created beaches on the south and east shores. Wetlands in the area were drained via pipeline to Lake Calhoun/Bde Maka Ska in 1923 to aid in park development. The channel between Lake of the Isles and Lake Calhoun/Bde Maka Ska was dredged in the 1950s after a period of low water levels. Fishing docks were installed at the lake in 1966. A pump station brought water from Bassett Creek to Brownie Lake and, thus, the rest of the connected Chain of Lakes, as described in the Brownie Lake section.



Lake Calhoun/Bde Maka Ska

Credit: Minneapolis Public Works



In July 1993, a group known as the Water Quality Management Citizen Advisory Committee presented Mayor Sharon Sayles Belton with the Green Report, which evaluated the Chain of Lakes and recommended measures for preservation and improvement. Funded by a Clean Water Partnership grant and made up of members of the MPRB, City Council, neighborhood groups, and community organizations, the Committee developed a report that moved quickly from an assessment of the Chain of Lakes to goals, recommendations, and implementation steps. With support from technical staff, the Committee reported on the state of the Chain of Lakes. The technical data showed Lake Calhoun/Bde Maka Ska to be eutrophic. Furthermore, Secchi disk Trophic State Index (TSI) values had increased rapidly through the 1960s. The water quality of Cedar Lake was found to be worse than predicted by water quality modeling, which suggested that internal loads played a significant role.

The projects recommended in the 1993 report were implemented through a <u>319 Grant</u> awarded by the MPCA. By 1999, a three-cell wet detention system was installed near the southwest area of Lake Calhoun/Bde Maka Ska to treat stormwater from Minneapolis and Saint Louis Park prior to discharge into the lake. A monitoring and assessment report titled <u>Southwest Lake Calhoun Wetland Ponds Project</u> (1999), documented the effect of these three ponds on pollutant removal. In addition, the MPRB performed shoreline repairs to Lake Calhoun/Bde Maka Ska in 1999 to prevent erosion and installed grit chambers to improve water quality. Grit chamber installation continued until 2004.

Lake Calhoun/Bde Maka Ska is included in MPRB's lake monitoring program. Monitoring results are published each year in the MPRB annual <u>Water Resources Report</u>. Additional information on MPRB water quality monitoring is contained in this Section 3, subsection City-Wide Water Quality Monitoring and Other Efforts.

The MPCA's 2018 Draft Impaired Waters List identified impairments for Lake Calhoun/Bde Maka Ska, as summarized in Table 3.28.

MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Consumption/Mercury in Fish Tissue/1998 Aquatic Consumption/Perfluorooctane Sulfonate (PFOS) in Fish Tissue/2008
TMDL Status	Mercury in Fish Tissue: statewide TMDL approved in 2008 PFOS in Fish Tissue: regulatory action by MPCA in lieu of a TMDL
Minneapolis Required Implementation Actions	Mercury in Fish Tissue: mercury impairment is not stormwater related PFOS in Fish Tissue: no municipal action required

Lake Calhoun/Bde Maka Ska was first identified as impaired and added to the Minnesota Statute 303(d) list for mercury content found in fish tissue in 1998. Excess mercury concentrations have been found statewide and are largely attributed to atmospheric deposition. As such, the Minnesota lakes with mercury impairments have been added to a statewide mercury TMDL, which was first approved by the EPA on March 27, 2007. The statewide TMDL is divided into two categories: the northeast and southwest regions, each with separate targets. Lake Calhoun/Bde Maka Ska is included on the statewide mercury TMDL list for the southwest region with a target completion date of 2025. The implementation for the statewide mercury TMDL is further discussed in Appendix E.



Perfluorooctane Sulfonate (PFOS) was <u>first identified</u> in Lake Calhoun/Bde Maka Ska in 2014 by researchers at the University of Minnesota, which led to a fish consumption advisory by the Minnesota Department of Health and the lake being listed as impaired for PFOS. The MPCA used stormwater sampling to trace the contamination back to a metal plating facility (the Douglas Corporation) in Saint Louis Park. The facility stopped using the PFOS-containing product as of 2010 and has implemented additional efforts to prevent PFOS-contaminated stormwater runoff. Continued monitoring is being conducted by the facility and the MPCA. In May of 2016, a Schedule of Compliance was signed by the Douglas Corporation and the MPCA that requires continuation of monitoring and either containment or treatment of the stormwater. According to a Minnesota Conservation Federation blog, "the last testing in 2013 showed PFOS concentrations in fish were decreasing. The MPCA intends to test again in 2016" (MPCA News Release, MPCA announces resolution of investigation in PFOS in Lake Calhoun, published June 14, 2016). To-date, no additional monitoring information has been published.

The <u>TCMA Chloride Management Plan</u> (February 2016) lists Lake Calhoun/Bde Maka Ska as a high-risk waterbody for potential chloride impairment, which means that the chloride concentration in at least one sample of water within the past 10 years was within 10 percent of the chronic water quality standard (207 mg/L chloride). Although the lake has not been listed as impaired for chloride, the TCMA Chloride Management Plan encourages high-risk waterbodies to follow proactive actions similar to those for impaired waters, as prevention for chloride contamination is easier than restoration.

In 2009, permeable pavers and rain gardens were installed as part of a parking lot reconstruction project. A swimming dock and diving platform were installed in 2011. A new fishing dock was constructed in 2012, and the older dock was replaced in 2013.

Vegetation management and water quality improvements for Lake Calhoun/Bde Maka Ska have involved alum treatment to limit phosphorus concentrations (2001), control of the invasive plant species loosestrife through biocontrol, and management of Eurasian water milfoil by mechanical harvesting. These efforts are described in Section 5 – Regulatory Controls and Water Resource Management Programs.

Lake Harriet

The physical characteristics of Lake Harriet are summarized in Table 3.29.

River/Stream	Lake Harriet
DNR ID#	27001600
DNR Classification	General Development
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6
Downstream waterbody	Minnehaha Creek
Surface Area	335 acres
Depth – mean	29 feet
Depth – maximum	85 feet
Watershed area within Minneapolis	1,120 acres
Watershed Management Organization	Minnehaha Creek Watershed District

Table 3.29 – Lake Harriet Characteristics



As the downstream-most lake in the Chain of Lakes, Lake Harriet is located in the southwest part of Minneapolis near Minnehaha Creek. Other lakes in the Chain of Lakes include Brownie Lake, Lake of the Isles, and Lake Calhoun/Bde Maka Ska. Though the Chain of Lakes are interconnected with channels and operate as one waterbody, the individual lakes are considered separate by the MNDNR and the MCWD.

Sailing, swimming, and fishing are the main recreational activities at the lake. Lyndale Park, along the northern shore of the lake, features gardens, a decorative fountain, a bird sanctuary, and a band shell.

Most of the lake and parkland area was donated to the MPRB in 1895 by Colonel W.S. King, a former park commissioner. Additional land to the north and northeast of the lake, currently Lyndale Park, was donated by King to the MPRB in the 1890s. A road between the park and lake was paved and trees were planted in the park in 1904. By 1910, a rose garden was installed in the park and an access road from King's Highway to the lake was created. Gardens were installed in the park from the 1900s through the 1920s. The bird sanctuary was added in 1936 and the decorative fountain was installed in 1947. A second fountain was installed in 1963 and an expansion of gardens occurred in the 1960s. The rock garden was transformed into the current Peace Garden, that includes a peace bridge flanked by stones from Hiroshima and Nagasaki, Japan in 1985. The floating docks in the lake were extended in 2006.

A gravity outlet, open channel, and pipe connection were installed to connect Lake Harriet and Lake Calhoun/Bde Maka Ska. Water from Lake Calhoun/Bde Maka Ska enters Lake Harriet through a submerged pipe near a boat launch to the northeast and Lake Harriet, in turn, discharges to Minnehaha Creek through submerged pipe located to the south.

In July 1993, a group known as the Water Quality Management Citizen Advisory Committee presented Mayor Sharon Sayles Belton with the Green Report, which evaluated the Chain of Lakes and recommended strong measures for preservation and improvement. The



Credit: Minneapolis Public Works

committee urged the City and MPRB to proceed with similar evaluations and water quality improvement projects for the other waters in the City that were not covered in the Green Report. Funded by a Clean Water Partnership grant and made up of members of the MPRB, City Council, neighborhood groups, and community organizations, the committee developed a report that moved quickly from an assessment of the Chain of Lakes to goals, recommendations, and implementation steps. With support from their technical staff, the committee reported on the state of the Chain of Lakes. They found that Lake Harriet was the only lake of the four that was mesotrophic based on a significantly lower total phosphorus concentration than the other lakes. The committee considered Lake Harriet as a model for what might be accomplished at Cedar Lake and Lake Calhoun/Bde Maka Ska. One of the key indicators of Lake



3-55

Harriet's good water quality was the persistence of daphnia, a zooplankton, throughout the year. As noted for the other lakes, the persistence of daphnia occurs when algal blooms are limited.

Improvements recommended in the 1993 report were implemented through a 319 Grant awarded by the MPCA. The Clean Water Partnership study recommended improvement of water quality by reduction of phosphorus in the lakes. For this purpose, activities affecting Lake Harriet included public education, increased frequency of street sweeping, and limited aluminum sulfate (alum) treatment to control filamentous algae. Grit chambers were installed from 1994 through 1996.

Lake Harriet is included in MPRB's lake monitoring program. Monitoring results are published each year in the MPRB annual <u>Water Resources Report</u>. Additional information on MPRB water quality monitoring is contained in this Section 3, subsection City-Wide Water Quality Monitoring and Other Efforts.

The MPCA's 2018 Draft Impaired Waters List identified impairments for Lake Harriet, as summarized in Table 3.30.

MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Consumption/Mercury in Fish Tissue/1998 Aquatic Consumption/Perfluorooctane Sulfonate in Fish Tissue/2008
TMDL Status	Mercury in Fish Tissue: statewide TMDL approved in 2008 PFOS in Fish Tissue: regulatory action underway by MPCA in lieu of TMDL
Minneapolis Required Implementation Actions	Mercury in Fish Tissue: mercury impairment is not stormwater related PFOS in Fish Tissue: no municipal action required

Table 3.30 – Lake Harriet Impaired Waters Summary

Lake Harriet has not been listed as impaired for phosphate levels. Although phosphorus levels were identified as a potential risk to the lake, it appears that peak levels occurred in the 1970s and through the implementation of best management practices, such as those listed previously, phosphorus levels have declined since that time.

Lake Harriet was found to be impaired for aquatic consumption and added to the Minnesota Statutes 303(d) list based on mercury content found in fish tissue in 1998. Excess mercury concentrations have been found statewide and are largely attributed to atmospheric deposition. As such, the Minnesota lakes with mercury impairments have been added to the statewide mercury TMDL, which was first approved by the EPA on March 27, 2007. The statewide TMDL is divided into two categories, the northeast and southwest regions, each with separate targets. Lake Harriet is included in the statewide mercury TMDL list for the southwest region with a target completion date of 2025.

According to the EPA Waterbody Quality Assessment Report online database and the MPCA's 2016 Minnesota Impaired Waters List, Lake Harriet is also listed as impaired due to the presence of Perfluorooctane Sulfonate (PFOS) in fish tissue since 2008. As Lake Harriet is connected to Lake Calhoun/Bde Maka Ska, the presence of PFOS in its waters is associated with the identified industrial contamination described in the Lake Calhoun/Bde Maka Ska section. PFOS was first identified in Lake Calhoun/Bde Maka Ska in 2014 by researchers at the University of Minnesota, which led to a fish consumption advisory by the Minnesota Department of Health and the lake being listed as impaired for



PFOS. The MPCA used stormwater sampling to trace the contamination back to a metal plating facility (the Douglas Corporation) in Saint Louis Park. The facility stopped using the PFOS-containing product as of 2010 and has implemented additional efforts to prevent PFOS-contaminated stormwater runoff. Continued monitoring is being conducted by the facility and the MPCA. In May 2016, a Schedule of Compliance was signed by the Douglas Corporation and the MPCA that requires continuation of monitoring and either containment or treatment of the stormwater. According to a Minnesota Conservation Federation blog, "the last testing in 2014 showed PFOS concentrations in fish were decreasing. The MPCA intends to test again in 2016." (MPCA News Release, MPCA announces resolution of investigation in PFOS in Lake Calhoun, published June 14, 2016). To-date, no additional monitoring information has been published.

Vegetation management and water quality improvements for Lake Harriet have involved alum treatment to limit phosphorus concentrations (2001), control of the invasive plant species loosestrife through biocontrol, and management of Eurasian water milfoil by mechanical harvesting. These efforts are described in this Section 3, subsection City-Wide Water Quality Monitoring and Other Efforts.

Lake Hiawatha

The physical characteristics of Lake Hiawatha are summarized in Table 3.31.

River/Stream	Lake Hiawatha
DNR ID#	27001800
DNR Classification	General Development
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6
Downstream waterbody	Minnehaha Creek
Surface Area	53 acres
Depth – mean	16.4 feet
Depth – maximum	28 feet
Watershed area within Minneapolis	1,243 acres
Watershed Management Organization	Minnehaha Creek Watershed District

Table 3.31 – Lake Hiawatha Characteristics

Although Lake Hiawatha has the appearance of a lake, it is actually a widened section of Minnehaha Creek, consisting of a basin north of the main channel of the Creek. As such, the water quality in the lake is greatly dependent on the large inflow from Minnehaha Creek. The lake is located in the Lake Nokomis-Lake Hiawatha Regional Park and adjacent to the Hiawatha Golf Course. The MPCA classifies Lake Hiawatha as a lake, as the average depth is (slightly) greater than 15 feet.

Before it was acquired by the MPRB in 1922, Lake Hiawatha was a shallow wetland named Rice Lake for the wild rice that grew along the shoreline. The lake was dredged and reshaped in the late 1920s. The dredged material was used to fill and create the adjacent Hiawatha Golf Course, which opened in 1934, and a beach on the eastern shore, which was created in 1931. As shores created by dredged materials are susceptible to erosion, a federal work relief project added walls along the southern and eastern shorelines to prevent erosion at Lake Hiawatha in 1939.



The Blue Water Commission was established and issued a report in 1998 on recommendations for Lake Hiawatha and Lake Nokomis. The Blue Water Commission found that Lake Hiawatha and Lake Nokomis are eutrophic. The Commission also identified bacteria contamination and fish kills as among the many other concerns associated with these lakes. The Commission organized their concerns around central themes, such as:

- Swimability interference by algae and weeds, bacteria contamination, and swimmer's itch.
- Fishability safety of fish consumption, fish kills, and weeks impeding fishing.
- Aesthetics odor, clarity, algae blooms, and shoreline aesthetics.
- Plant Diversity and Wildlife namely reduction in exotic species.
- Shoreline Environment vegetation restoration and elimination of sediment deltas.

These concerns led the Blue Water Commission to recommend implementation steps. These recommendations included a strong emphasis on reduction of phosphorus loads into both lakes. Since 1998, the City, MPRB, and MCWD have implemented several projects that follow directly from the report recommendations. Examples of these projects include a shoreline and littoral area revegetation (2001) and construction of detention basins within the major subwatersheds to Lake Hiawatha (2000-2001).

Lake Hiawatha is included in the MPRB's lake monitoring program. Monitoring results are published each year in the MPRB annual <u>Water Resources Report</u>. Additional information on MPRB water quality monitoring is contained in this Section 3, subsection City-Wide Water Quality Monitoring and Other Efforts.

The MPCA's 2018 Draft Impaired Waters List identified impairments for Lake Hiawatha, as summarized in Table 3.32.

MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Recreation/Nutrient/Eutrophication Biological Indicators/2002
TMDL Status	Excess Nutrients: TMDL approved February 2, 2014
Minneapolis Required Implementation Actions	Excess Nutrients: urban/residential nutrient reduction strategies are encouraged

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Lake Hiawatha was identified as impaired by excess nutrients, specifically phosphorus, in 2002. This impairment was documented in a MCWD study that included Lake Hiawatha and eight other lakes in the watershed identified with similar impairments. Long-term monitoring data collected by the MPRB was used to confirm the strong relationship between the water quality of Minnehaha Creek and Lake Hiawatha. For this reason, Lake Hiawatha was removed from this nine-lake study and incorporated into a separate <u>TMDL project</u> that encompassed impairments to Minnehaha Creek. Minnehaha Creek and Lake Hiawatha were added to the TMDL for bacteria impairment based on the fecal coliform indicator.



The Minnehaha Creek bacteria TMDL and the Lake Hiawatha nutrient TMDL both address aquatic recreational use impairments.

Several nonpoint sources were identified as the source of phosphorus load to Minnehaha Creek and Lake Hiawatha. These sources include upstream nonpoint source loads from Lake Minnetonka (headwaters of Minnehaha Creek), atmospheric deposition, wetland and forest sources, groundwater discharge, non-regulated stormwater runoff, and wildlife inputs. Implementation strategies for reduction of phosphorus concentrations include:

- Urban/residential nutrient reduction strategies (e.g., controlled volume runoff, increased infiltration, and vegetation buffers).
- Municipal activities (e.g., increased frequency of street sweeping and installation of stormwater BMPs).
- Protection and restoration of wetlands (especially wetlands in the floodplain of Minnehaha Creek).
- Public education.

The contribution of Minnehaha Creek flows to Lake Hiawatha results in a watershed to lake surface area ratio of 550:1, that is among the highest in Minnesota. Additionally, the lake experiences relatively short residence time (4.4 days), which reduces algae growth, allowing for a greater concentration of phosphorus. Due to these characteristics, site-specific standards for the total phosphorus load goals were developed by the MPCA. The lake is in the implementation phase for achievement of these standards.

In addition to its excess nutrients impairment, Lake Hiawatha was identified in the <u>TCMA Chloride</u> <u>Management Plan</u> (February 2016) as a high-risk waterbody for potential chloride impairment, which means that the chloride concentration in at least one sample of water within the past 10 years was within 10 percent of the chronic water quality standard (207 mg/L chloride). Although the lake has not been listed as impaired for chloride, the TCMA Chloride Management Plan encourages high-risk waterbodies to follow proactive actions similar to those for impaired waters.

After Minnehaha Creek and the Hiawatha Golf Course flooded in 2014, it was discovered that the MPRB pumps approximately 242 million gallons of groundwater annually to keep the property open as a playable, 18-hole golf course. This groundwater use was not part of the MPRB's existing MNDNR groundwater appropriations permit. As of the date of this report, the City and the MPRB are working with regulatory agencies, members of the public, and other stakeholders to develop a master plan that addresses the high groundwater levels and park use.

Lake Nokomis

The physical characteristics of Lake Nokomis are summarized in Table 3.33.



River/Stream	Lake Nokomis
DNR ID#	27001900
DNR Classification	General Development
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6
Downstream waterbody	Minnehaha Creek
Surface Area	204 acres
Depth – mean	14 feet
Depth – maximum	33 feet
Watershed area within Minneapolis	695 acres
Watershed Management Organization	Minnehaha Creek Watershed District

Table 3.33 – Lake Nokomis Characteristics

Lake Nokomis is located immediately south of Minnehaha Creek and is situated midway between the Minneapolis Chain of Lakes (to the west) and the Mississippi River (to the east). Lake Nokomis is part of the Lake Nokomis-Lake Hiawatha Regional Park, which also encompasses Lake Hiawatha to the northeast.

Lake Nokomis is the downstream lake in a series of lakes and wetlands that are outside the municipal boundary of the City. The easterly, uppermost lake is Mother Lake, located within the boundaries of the Metropolitan Airport. Mother Lake discharges to Taft Lake, which is at the southwest quadrant of the Crosstown/Cedar Avenue interchange in Richfield. Legion Lake is the uppermost westerly lake that also drains into Taft Lake. Taft Lake discharges into Solomon Park Wetland, which in turn discharges to Lake Nokomis.

The park features biking and walking paths, sports fields, basketball and tennis courts, a recreational center, fishing pier, fountains, playground, a wading pool, picnic area, and boat docks. Swimming beaches are located on the lake, and swimming, sailing, fishing, and ice fishing occur.

The lake was known as Lake Amelia at the time it was purchased by the MPRB in 1907. At the time, the area was comprised of open water, wetland, and a peat bog. A small bathhouse was installed in 1909. The lake was reshaped and dredged to connect the former Lake Amelia to the nearby creek, with water surfaces reduced from 300 acres to 200 acres in 1914. A new bathhouse was constructed by 1920 (replaced in 1967), which led to the high popularity of swimming in the lake. A WPA shore wall was installed along the lagoon and on the east and west shores in the 1930s. Also, in the 1930s, a weir was constructed to fix the water elevation in the lake. The purpose and function of the current structure is to prevent Minnehaha Creek flows from entering the lake.

The lake was treated with sodium arsenite in the 1950s to control weeds that had grown during low water conditions at the time.

The Blue Water Commission was established and issued a report in 1998 on recommendations for Lake Nokomis and the nearby Lake Hiawatha. The Blue Water Commission findings were that Lake Hiawatha and Lake Nokomis are eutrophic. The Commission also identified fecal contamination and fish kills as



primary among the many other concerns associated with the lakes. The Commission organized their concerns around central themes, such as:

- Swimability interference by algae and weeds, fecal contamination, and swimmer's itch.
- Fishability safety of fish consumption, fish kills, and weeds impeding fishing.
- Aesthetics odor, clarity, algae blooms, and shoreline aesthetics.
- Plant Diversity and Wildlife namely reduction in exotic species.



Credit: Minneapolis Public Works

Shoreline Environment – vegetation restoration and elimination of sediment deltas.

These concerns led the Blue Water Commission to recommend implementation steps. These recommendations included a strong emphasis on reduction of phosphorus inputs into both lakes. The City, MCWD, and MPRB implemented several of the recommendations, which included additional increased frequency of street sweeping starting in 1998, removal of carp in 2000, construction of three wetland settling ponds with grit chambers to the southwest in 2001, and installation of a weir in 2000 to prevent Minnehaha Creek water from flowing into the lake.

The weir separating Minnehaha Creek from the lake was reconstructed in 2000 as an inflatable weir that allows the lake to discharge to the Creek, while it prevents the Creek from overflowing into the lake. The purpose is to prevent the contribution of nutrient-rich water and invasive species (e.g., zebra mussels). This weir is operated according to requirements set in a permit from the MNDNR.

An effort to remove carp from the lake in the winter of 2001-2002 was intended to limit the internal phosphorus loads caused by the fish when they forage in lake sediments. Similar efforts were repeated in a three-year biomanipulation study from 2010 to 2013, which aimed to reduce sediment disturbance by burrowing fish. The biomanipulation study focused on internal circulation of nutrients by the fish population, primarily black bullheads and bluegill sunfish. The project targeted and removed adult bullheads and stocked the lake with walleye, which prey on the bullheads and bluegills.

The Amelia stormwater pond was dredged in 2011 to remove accumulated sediments and to remove invasive plant species. MCWD reconstructed the weir again in 2012.

Lake Nokomis included in MPRB's lake monitoring program. Monitoring results are published each year in the MPRB annual <u>Water Resources Report</u>. Additional information on MPRB water quality monitoring is contained in this Section 3, subsection City-Wide Water Quality Monitoring and Other Efforts.



East Lake Nokomis Wetlands

The MPCA's 2018 Draft Impaired Waters List identified impairments for Lake Nokomis, as summarized in Table 3.34.

MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Consumption/Mercury in Fish Tissue/1998 Aquatic Consumption/PCB in Fish Tissue/1998 Aquatic Recreation/Excess Nutrients/2002
TMDL Status	Mercury in Fish Tissue: statewide TMDL approved in 2008 PCB in Fish Tissue: study not started Excess Nutrients: TMDL study approved in 2011
Minneapolis Required Implementation Actions	Mercury in Fish Tissue: mercury impairment is not stormwater related PCB in Fish Tissue: N/A Excess Nutrients: municipal actions are encouraged

Table 3.34 – Lake Nokomis	Impaired Waters Summary
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Lake Nokomis was first identified as impaired and added to the Minnesota 303(d) list for mercury content found in fish tissue in 1998. Excess mercury concentrations have been found statewide and are largely attributed to atmospheric deposition. The lake was also determined to have another impairment with PCB found in fish tissue the same year as its mercury impairment was identified (1998). The EPA Waterbody Quality Assessment Report online database indicates that a TMDL study for this impairment is still needed. The MPCA 2016 303(d) Impaired Waters List projects a TMDL completion by 2025.

Lake Nokomis was identified as impaired by excess nutrients, specifically phosphorus, in 2002. As the TMDL study for this impairment was conducted, eight other lakes within the MCWD were identified with similar impairments and were incorporated into one metropolitan-wide study. Five of the lakes (Brownie Lake, Powderhorn Lake, Diamond Lake, Lake of the Isles, and Lake Hiawatha) were eventually removed from the study for various reasons (i.e., improved water quality criteria or changes to waterbody classification). Of the four other lakes, Lake Nokomis is the only one located in Minneapolis. A metropolitan-wide TMDL report for excess nutrients in these four lakes was approved by the EPA April 25, 2011.

The TMDL report identified phosphorus sources as stormwater runoff, internal loads, and atmospheric deposition. For Lake Nokomis, the TMDL recommended increased frequency of street sweeping, the installation of rain gardens/neighborhood water quality ponds, the installation of rain barrels, the creation of infiltration swales, the installation of curb cuts, the installation of pervious pavement, and educational programs throughout the subwatershed.

The TMDL report indicated that for state nutrient standards to be met, the lake required a reduction in overall phosphorus load. Taft Lake and Legion Lake are involved in the TMDL for Lake Nokomis into which they drain and are responsible for reduction of total phosphorus loads. A phosphorus reduction plan for the two lakes was scheduled to be completed by the Spring of 2016 and included a water reuse infiltration system, native prairie restoration and buffers, grit chambers (Legion Lake only), in-situ flocculation treatment systems (Taft Lake only), construction of the Richfield Parkway North Connection, and removal of Taft Lake Frontage Road.



Between 2015 and 2017, Metro Blooms led the Nokomis Blooming Alley Project. This cost-share project encouraged residents to install rain gardens, permeable pavements, and/or native plants in areas adjacent to alleys within the Lake Nokomis watershed. A total of 180 properties, within 15 alleys, participated in the program. The result was installation of more than 160 rain gardens and permeable pavements.

As a result of <u>University of Minnesota research</u>, it was determined that the carp population of Lake Nokomis likely has a negative effect on the water quality. In 2016, the MPRB and MCWD received a grant from the Minnesota Environment and Natural Resources Trust Fund to update the <u>carp</u> <u>management of Lake Nokomis</u>, its upstream lakes, and connecting storm drains. Currently, the MPRB is collecting data on the carp, including population and patterns of movement. The information will be used to determine the optimal time and locations for winter carp removal. The project also includes study of the viability of carp barriers and completion of a long-term carp management plan. The project is expected to be completed in late-2019.

In 2017, the MPRB initiated a <u>shoreline enhancement project</u> to improve the landscape, vegetation, habitat, and water quality of Lake Nokomis. The long-term goal of this project is to reduce invasive vegetation and increase native vegetation. The MPRB is in the process of soliciting public input. The MPRB received funds from the Minnesota Legacy Outdoor Heritage Fund for the proposed improvements to the northern and eastern shoreline of the lake.

Lake of the Isles

The physical characteristics of Lake of the Isles is summarized in Table 3.35.

River/Stream	Lake of the Isles
DNR ID#	27004000
DNR Classification	General Development
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6
Downstream waterbody	Lake Calhoun/Bde Maka Ska
Surface Area	109 acres
Depth – mean	9 feet
Depth – maximum	31 feet
Watershed area within Minneapolis	770 acres
Watershed Management Organization	Minnehaha Creek Watershed District

Table 3.35 – Lake of the Isles Characteristics

Lake of the Isles is the center of the Chain of Lakes, near uptown Minneapolis. Though the Chain of Lakes are interconnected with channels and operate as one waterbody, the individual lakes are considered separate by the MNDNR and the MCWD. Two islands are present in the middle of Lake of the Isles, which contributed to the lake's name. Lake of the Isles Park features biking and walking paths, fountains, fishing pier, hockey rink, ice skating rink, and a soccer field. Canoe racks are available on the south and northwest sides of Lake of the Isles.



The history of Lake of the Isles overlaps Lake Calhoun/Bde Maka Ska's history as parkland between the two lakes were acquired concurrently. Lake development projects often included both lakes. Historically, the lake was surrounded by wetlands and contained four islands, two of which were removed during development through fill and dredging. The parkland of the lake was acquired through a donation in 1886. The two islands in the lake were purchased by the MPRB in 1887.

The northern and eastern shores of the lake were dredged from 1889 through 1893. While piecemeal acquisitions of the Lake Calhoun/Bde Maka Ska area took place in the early 1900s, a channel connecting Lake Calhoun/Bde Maka Ska to Lake of the Isles was proposed and ultimately constructed in 1911. Dredging in Lake of the Isles restarted in 1907, around the same time that the land between the two lakes and Kenwood Park to the north were acquired. Additional land between Lake of the Isles and Cedar Lake was donated in 1909 to the MPRB for connection between those two lakes, which was completed in 1913. Paving of the parkway began in 1923.

The historically swampy area of Lake of the Isles was transformed over this time such that water area increased from 100 acres to 120 acres of water, 33 acres of dry land was more than doubled to 80 acres, and 67 acres of wetland was removed completely. However, the use of dredged wetland material as fill to create parkland resulted in settling and erosion issues.

In 1950, the channel between Lake of the Isles and Lake Calhoun/Bde Maka Ska was dredged again to deepen the channel; however, by the late 1950s, sediment had built up in the channel to the extent that canoes could not fit through. Additionally, some parts of the shore would flood during storms due to lack of wetlands.

Aquatic plants flourished during low water periods leading up to the 1950s, which led to treatments of sodium arsenite in 1959.

In July 1993, a group known as the Water Quality Management Citizen Advisory Committee presented Mayor Sharon Sayles Belton with the Green Report, which evaluated the Chain of Lakes and recommended strong measures for preserving and improving them. Funded by a Clean Water Partnership grant and made up of members of the MPRB, City Council, neighborhood groups, and community organizations, the committee developed a report that moved quickly from an assessment of the Chain of Lakes to goals, recommendations, and implementation steps. With support from their technical staff, the committee reported on the state of the Chain of Lakes. Lake of the Isles was found to be eutrophic and had the highest measured total phosphorus concentrations in the entire chain. Algal blooms were frequent. Water quality in the lake was better than predicted by models likely due to the presence of milfoil, a plant that utilizes phosphorus from the water.

The Clean Water Partnership study recommended improvements to water quality through reduction of phosphorus in the lakes. The recommended improvements were funded through a 319 Grant awarded by the MPCA. For this purpose, grit chambers were installed from 1994 to 1999 for stormwater sediment removal, and in 1997 the lake was treated with aluminum sulfate (alum). From 1998 to 1999, the MPRB completed shoreline repairs and native plantings to prevent erosion. In 2001, to improve water quality and shorelines, the MPRB started a similar project that included shoreline stabilization, wetland restoration and enhancement, path reconstruction, and upland plant restoration. Vegetation management to control the invasive species of purple loosestrife and Eurasian water milfoil continues.



Lake of the Isles is included in the MPRB's lake monitoring program. Monitoring results are published each year in the MPRB annual <u>Water Resources Report</u>. Additional information on MPRB water quality monitoring is contained in this Section 3, subsection City-Wide Water Quality Monitoring and Other Efforts.

The MPCA's 2018 Draft Impaired Waters List identified impairments for Lake of the Isles, as summarized in Table 3.36.

MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Consumption/Mercury in Fish Tissue/1998 Aquatic Consumption/Perfluorooctane Sulfonate (PFOS) in Fish Tissue/2008
TMDL Status	Mercury in Fish Tissue: statewide TMDL approved in 2007 PFOS in Fish Tissue: regulatory action underway by MPCA in lieu of TMDL
Minneapolis Required Implementation Actions	Mercury in Fish Tissue: no municipal responsibilities PFOS in Fish Tissue: no municipal responsibilities

Lake of the Isles was first identified as impaired and added to the Minnesota 303(d) list for mercury content found in fish tissue in 1998. Excess mercury concentrations have been found state-wide and are largely attributed to atmospheric deposition. As such, the Minnesota lakes with mercury impairments have been added to a statewide mercury TMDL, which was first approved by the EPA on March 27, 2007. The statewide TMDL is divided into two categories, the northeast and southwest regions, each with separate targets. Lake of the Isles is included on the statewide mercury TMDL list for the southwest region with a target completion date of 2025.

Lake of the Isles is also listed as impaired due to the presence of PFOS in fish tissue since 2008. Presence of PFOS is primarily related to industrial discharge to Lake Calhoun/Bde Maka Ska. PFOS was first identified in Lake Calhoun/Bde Maka Ska in 2014 by researchers at the University of Minnesota, which led to a fish consumption advisory by the Minnesota Department of Health and the lake being listed as impaired for PFOS. The MPCA used stormwater sampling to trace the contamination back to a metal plating facility (the Douglas Corporation) in Saint Louis Park. The facility stopped using the PFOS-contaminating product as of 2010 and has implemented additional efforts to prevent PFOS-contaminated stormwater runoff. Continued monitoring is being conducted by the facility and the MPCA. In May 2016, a Schedule of Compliance was signed by the Douglas Corporation and the MPCA that requires continuation of monitoring and either contaminant or treatment of the stormwater. According to a Minnesota Conservation Federation blog, "the last testing in 2013 showed PFOS concentrations in fish were decreasing. The MPCA intends to test again in 2016." (MPCA News Release, MPCA announces resolution of investigation in PFOS in Lake Calhoun, published June 14, 2016). To-date, no additional monitoring information has been published.

In addition to its mercury and PFOS impairments, Lake of the Isles was identified in the TCMA Chloride Management Plan from February 2016 as a high-risk waterbody for potential chloride impairment, which means that the chloride concentration in at least one sample of water within the past 10 years



was within 10 percent of the chronic water quality standard (207 mg/L chloride). Although the lake has not been listed as impaired for chloride, the TCMA Chloride Management Plan encourages high-risk waterbodies to follow proactive actions similar to those for impaired waters, as prevention for chloride contamination is easier than restoration.

The implementation for the statewide mercury TMDL and the metropolitan-wide TCMA Chloride Management Plan is further discussed in Appendix E.

As part of Arbor Day celebrations in 2008, 125 trees were planted on the north shore. In 2008, the MPRB performed extensive restoration on the wildlife refuges on the lake's two islands.

This channel under the Lake Street bridge was dredged again in 2014 as part of the Metropolitan Council project to replace a sanitary sewer force main that crosses under the channel.

An invasive aquatic plant species, Eurasian water milfoil, was identified in the lake in 1987. Current practice to control the milfoil involves mechanical harvesting of the plant. Lake of the Isles also has experienced extensive areas of purple loosestrife, which is controlled by biocontrol, the release of beetles that feed on the loosestrife. These efforts are further described in this Section 3, subsection City-Wide Water Quality Monitoring and Other Efforts.

Loring Pond

The physical characteristics of Loring Pond are summarized in Table 3.37.

River/Stream	Loring Pond
DNR ID#	2706500
DNR Classification	N/A
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6
Downstream waterbody	Mississippi River
Surface Area	8 acres
Depth – mean	5 feet
Depth – maximum	17 feet
Watershed area within Minneapolis	27 acres
Watershed Management Organization	Mississippi Watershed Management Organization

Table 3.37 – Loring Pond Characteristics

Loring Pond, which is situated within Loring Park, is divided into a smaller North Bay (DNR #27-0655-01) and a larger South Bay (DNR #27-0655-02). The lake is situated on the edge of downtown Minneapolis, east of Interstate 94 and south of Interstate 394. An augmentation well is used to maintain the water levels at Loring Pond.

Loring Park features a dog park, a bandstand, basketball and tennis courts, biking and walking paths, fishing pier, garden and picnic areas, a restroom facility, a playground, a community arts center, and a wading pool.



The parkland was originally purchased (30 acres) in 1883 and was named Loring Park after the first president of the Park Board, Charles Loring. The lake was excavated and enlarged in 1884. Additional land was purchased in stages and incorporated into Loring Park through 1902.

Several attempts were made in the 1970s to improve water quality in Loring Pond. An Olszewski tube was installed in an attempt to drain high-nutrient hypolimnetic water from the lake. The tube never functioned properly and was abandoned. The pipe was capped in 2014 in an effort to limit water losses from the pond. Dredging of the north arm from



Credit: Minneapolis Public Works

1976 to 1977 also did not improve the water quality of the lake. Augmentation of the lake level with groundwater appears to have had a positive effect on water quality and continues today in accordance with a water appropriation permit issued by the MNDNR.

Further lake restoration and park improvement projects were initiated in 1997. The lake bottom was sealed, lined, and vented. An aerator was installed to help prevent oxygen depletion during the summer months. Multiple vegetation restoration projects were completed throughout the park. In 1999, the shoreline was planted with native vegetation in cooperation with the MNDNR and the Friends of Loring Park. The native shoreline restoration provided a buffer strip for waterfowl management, protection against shoreline erosion, pollutant filtration, and improved lake aesthetics.

In 1998 and 1999, through funds provided by the MPRB and the city's Neighborhood Revitalization Program and Friends of Loring Park, the lake bottom was lined to prevent water loss and the shoreline was planted with native vegetation. In 2007, the north basin was dewatered and the water level in the southern basin was lowered in order to accommodate dredging of the north basin to remove accumulated sediment and restore original depths in the channel between the two basins.

Dewatering for the North Bay dredging project lowered water levels in Loring Pond significantly in 2007. Storm sewer backflow entered Loring Pond several times in 2010 and 2011 during high-intensity rain events and the largest of these events can be seen as peaks in the level graph. Water pressure from storm sewer backflow caused the Loring Pond outlet to deteriorate. In 2011, MPRB staff repaired the cement at the base of the outlet and reinstalled the outlet board. Water levels were manipulated throughout 2014, with water being allowed to drain down throughout the summer and then raised to the top of the outlet wall as part of a cattail removal project. Water levels were then kept near the top of the outlet from 2015 through 2017 by using the augmentation well in accordance with a water appropriate permit issued by the MNDNR.



Loring Pond was monitored by MWMO for water quality and *E. coli* in 2006 and 2007. In 2008, the MPRB took over this monitoring.

Loring Pond is included in MPRB's lake monitoring program. Monitoring results are published each year in the MPRB <u>Water Resources Report</u>. Additional information on MPRB water quality monitoring is contained in this Section 3, subsection City-Wide Water Quality Monitoring and Other Efforts.

The MPCA's 2018 Draft Impaired Waters List identified impairments for Loring Pond, as summarized in Table 3.38.

MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Life/Chloride/2014
TMDL Status	Chloride: metropolitan-wide TMDL approved in 2016
Minneapolis Required Implementation Actions	Chloride: assessment of winter practices recommended

Table 3.38 – Loring Pond Impaired Waters Summary

Loring Pond (South Bay) was listed as impaired in 2014 in a metropolitan-wide <u>TMDL study</u> for chloride concentration with an initial target TMDL completion in 2015. The U.S. EPA approved the metropolitan-wide TCMA TMDL on June 9, 2016. The MPCA partnered with local and state experts in the TCMA to create a plan for reduction of chloride concentration in water through management of salt use on land, as summarized in the <u>TCMA Chloride Management Plan</u> (February 2016). This plan identifies salts (primarily sodium chloride) applied to paved surfaces in the winter as the major source for chloride in waters and water softeners in rural areas as a secondary source.

Powderhorn Lake

The physical characteristics of Powderhorn Lake are summarized in Table 3.39.

River/Stream	Powderhorn Lake
DNR ID#	27001400
DNR Classification	General Development
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6
Downstream waterbody	Mississippi River
Surface Area	12 acres
Depth – mean	4 feet
Depth – maximum	20 feet
Watershed area within Minneapolis	323 acres
Watershed Management Organization	Minnehaha Creek Watershed District

Table 3.39 – Powderhorn Lake Characteristics

Powderhorn Lake is a relatively shallow, landlocked lake surrounded by parkland (Powderhorn Park) and is situated in Minneapolis between Interstate 35W and Hiawatha Avenue, south of East Lake Street.



Recreational activities available at the park include several sports courts, a fishing pier, gardens, picnic areas with grills, ice skating rink, playground, a wading pool, and walking path.

The lake was named after its shape, which resembled a cow horn historically used to carry gunpowder. The MPRB purchased 38 acres of parkland in 1890. Powderhorn Park was expanded the next year with the addition of 20 acres. The lake was deepened by dredging in 1895, which resulted in the creation of a half-acre island. A playground was added in 1907. In 1925, the northern arm of the lake was filled in due to the low water levels, which had dropped significantly since the early 1900s. A shore protection wall was installed along part of the lake in 1940.

Due to continued decreases in water levels, city water was pumped into the lake in 1963 to raise it by ten feet. A permanent pump station was installed to control water levels in the event that water levels are high. Pumped water is discharged to a storm drain that is tributary to the Mississippi River. Use of this pump to control the water levels in Powderhorn Lake was temporarily prohibited by the MNDNR because of the presence of Egeria densa, an evasive plant that had the potential to affect shipping in the Mississippi River. The restriction was lifted after successful eradication carried out by the MNDNR.

In 1975, an aerator was installed in the lake for summer operation to increase the lake's oxygen levels to prevent fish kills. The MNDNR has stocked the lake with fish as part of the Kid's Fishing Pond since 1980.

In 1995, a winter aeration system was installed.

In 1999, the City and MPRB implemented a restoration plan for Powderhorn Lake that continued through 2003. Actions included installation of five grit chambers near stormwater drain outfalls, native shoreline plantings, and alum treatment.

In 2004, the MPRB began annual spring installation of barley straw, used to control blue-green algal growth with mixed results.

In 2007, the MPRB began treatments to control Brazilian waterweed, an invasive aquatic plant. The treatment was successful, as documented by 5 years of MNDNR surveys.

Powderhorn Lake is included in MPRB's lake monitoring program. Monitoring results are published each year in the MPRB annual <u>Water Resources Report</u>. Additional information on MPRB water quality monitoring is contained in this Section 3, subsection City-Wide Water Quality Monitoring and Other Efforts.

The MPCA's 2018 Draft Impaired Waters List identified impairments for Powderhorn Lake, as summarized in Table 3.40.



MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Recreation/Nutrient/Eutrophication Biological Indicators/2002/2018 Aquatic Consumption/Mercury in Fish Tissue/2006 Aquatic Life/Chloride/2014
TMDL Status	Excess Nutrients: De-listed in 2012, due to improved water quality Relisted in 2018. TMDL study not started. Mercury in Fish Tissue: statewide TMDL approved in 2007 Chloride: metropolitan-wide TMDL approved 2016
Minneapolis Required Implementation Actions	Mercury in Fish Tissue: no municipal requirements Chloride: assessment of winter practices recommended

Table 3.40 – Powderhorn Lake Impaired Waters Summary

In 2002, the lake was first listed as impaired due to excess nutrients, specifically phosphorus. MPRB implemented ongoing annual barley straw treatments in 2004 to improve the water clarity. Due to an improved water quality trend caused by in-lake water quality management, the lake was de-listed for nutrient impairment in 2012. The MPCA and MPRB continued to monitor the lake for changes in lake water quality. Changes observed by the MPCA have resulted in the 2018 relisting of Powderhorn Lake for nutrient impairment.

Powderhorn Lake was identified as impaired and added to the Minnesota 303(d) list for mercury content found in fish tissue in 2006. Excess mercury concentrations have been found statewide and are largely attributed to atmospheric deposition. As such, the Minnesota lakes with mercury impairments have been added to a statewide mercury TMDL, which was first approved by the EPA on March 27, 2007. Powderhorn Lake is included on the statewide TMDL list with a target completion date of 2025.

Powderhorn Lake was listed as impaired in 2014 in a <u>metropolitan-wide TMDL</u> study for chloride concentration. The TCMA Chloride Management Plan identifies salts (primarily sodium chloride) applied to paved surfaces in the winter as the major source for chloride in waters, and water softeners in rural areas as a secondary source. The EPA approved the metropolitan-wide TCMA TMDL on June 9, 2016. The MPCA partnered with local and state experts in the TCMA to create a plan to reduce chloride concentration in water by management of salt use on land.

Native grasses were planted on the east and north hillsides in 1995. As part of a city-wide restoration plan, five continuous deflective separation grit chambers were installed in 2001, native plantings were included again in 2002, and an alum treatment was implemented in 2003. In addition, an aeration system was installed in the lake and a retaining wall was restored in 2002. Two-hundred (200) trees were planted in the park as part of the 2007 Arbor Day celebration.

The Powderhorn Lake Neighborhood of Raingardens project was a three-year community engagement project that began in 2009. Led by Metro Blooms, the project installed 125 raingardens with more than 229 community members involved and more than 70,000 square feet of impervious surface redirected to infiltration BMPs. This project engaged property owners in the Central and Powderhorn Park neighborhoods to install and maintain raingardens on their property, demonstrating that communities can directly impact local water quality by using native plants and sound landscape practices.



Ryan Lake

The physical characteristics of Ryan Lake are summarized in Table 3.41.

River/Stream	Ryan Lake
DNR ID#	27005800
DNR Classification	Recreational Development
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6
Downstream waterbody	Ryan Creek
Surface Area	15 acres
Depth – mean	Unknown
Depth – maximum	33 feet
Watershed area within Minneapolis	61 acres
Watershed Management Organization	Shingle Creek Watershed Management Commission

Table 3.41 – Ryan Lake Characteristics

Ryan Lake is a mesotrophic lake located in north Minneapolis adjacent to the boundary between Robbinsdale and Minneapolis. Highway 100 is located to the northwest, a railroad corridor (Canadian Pacific Railway) is immediately north of the lake, and Shingle Creek runs farther to the northeast. The North Twin, Middle Twin, and South Twin Lakes (collectively known as Twin Lake) are located to the west. Twin Lake and Ryan Lake are connected within Robbinsdale by Ryan Creek. Ryan Lake is the last lake in what is considered the Twin Lakes Chain of Lakes. Ryan Lake discharges to Ryan Creek and thence to Shingle Creek.

The west and south shores of the lake are owned by private residents, and the MPRB manages publicly held land on the eastern shore. In 2006, a new public dock was installed on the eastern side and a small rain garden was constructed. The MNDNR stocked fish in the lake from 2004 through 2014.

Ryan Lake is occasionally monitored by volunteers organized through the Metropolitan Council's <u>Citizen-Assisted Monitoring Program (CAMP)</u> program.

The MPCA's 2018 Draft Impaired Waters List identified impairments for Ryan Lake, as summarized in Table 3.42.

Table 3.42 – Ryan Lake Impaired Waters Summary

MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Recreation/Nutrient/Eutrophication Biological Indicators/2002 (DE-LISTED in 2014)
TMDL Status	Excess Nutrients: TMDL study approved in 2007
Minneapolis Required Implementation Actions	Excess Nutrients: ongoing monitoring

Ryan Lake was identified as impaired with excess nutrients, specifically phosphorus, along with the Twin Lakes in 2002. The TMDL study report of the Twin and Ryan Lakes was approved by the EPA on November 9, 2007, and the associated implementation plan was approved by the MPCA four days later.



Although it appears that the total phosphorus loads was least in Ryan Lake among the Twin Cities Chain of Lakes, it still exceeded the state standard concentration limit ($40 \mu g/L$) by $4 \mu g/L$ total phosphorus. The TMDL identified the primary sources of phosphorus in the lakes as stormwater runoff, a degraded wetland to the north of North Twin Lake, and sources within the lakes themselves (i.e., phosphorus released from sediment and invasive aquatic pondweed). Specific implementation plan actions include strategies for all Twin Lake chain lakes and strategies specific to Ryan Lake. Mitigation strategies includes evaluation of the adequacy of rules, additional Best Management Practices (BMPs) to decrease runoff and increase stormwater treatment, BMPs effectiveness monitoring, increased infiltration in watershed, increased frequency of street sweeping, aquatic plant surveys, and shoreline restoration.

For Ryan Lake, 15 rain gardens were installed in Minneapolis and five sump manholes were installed in Brooklyn Center in an effort to reduce external phosphorus loads. Additionally, a shoreline restoration project was completed in Ryan Lake Park in Minneapolis.

In December 2014, a Twin and Ryan Lakes Nutrient TMDL Five Year Review was provided. The report established a new goal of 19 percent reduction in Ryan Lake's phosphorus loads. Ryan Lake achieved water quality standards for nutrient levels and was de-listed by the MPCA in 2014.

According to the TCMA Chloride Management Plan from February 2016, Ryan Lake is listed as a high-risk waterbody for potential chloride impairment, which means that the chloride concentration in at least one sample of water within the past 10 years was within 10 percent of the chronic water quality standard (207 mg/L chloride). Although the lake has not been listed as impaired for chloride, the TMCA Chloride Management Plan encourages high-risk waterbodies to follow proactive actions similar to those for impaired waters, as prevention for chloride contamination is easier than restoration.

Sanctuary Pond

The physical characteristics of Sanctuary Pond are summarized in Table 3.43.

River/Stream	Sanctuary Pond
DNR ID#	27066500
DNR Classification	N/A
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6
Downstream waterbody	Lake Harriet
Surface Area	11 acres
Depth – mean	Unknown
Depth – maximum	Unknown
Watershed area within Minneapolis	Acreage included in area for Lake Calhoun/Bde Maka Ska
Watershed Management Organization	Minnehaha Creek Watershed District

Table 3.43 – Sanctuary Pond Characteristics

Sanctuary Pond, sometimes called Sanctuary Marsh, is situated between Lake Harriet and Lakewood Cemetery, separated from Lake Harriet to the southwest by Lake Harriet Parkway. Sanctuary Pond is located within the Thomas Sadler Roberts Bird Sanctuary. Catch basins in Lakewood Cemetery and along



Lake Harriet Parkway discharge into the pond. The pond and adjacent wetlands are monitored by the Hennepin County Wetland Health Evaluation Program (WHEP).

In 1958, the pond was dredged for fish spawning and a pump building was constructed with a pipeline installed under Lake Harriet Parkway to provide water from Lake Harriet to the pond. By 1987, the pond was expanded and a screen was placed on the pipe connecting to Lake Harriet to prevent fish from entering the pond from the lake. The fish hatchery and pumps are no longer in operation.

Two additional ponds were dredged to the west of Sanctuary Pond in 1991 and 1992.

In 2008, as part of the city's stormwater and rain-leader disconnect program, Lakewood Cemetery to the north disconnected its stormwater connections to the sanitary sewer system and redirected the runoff to Sanctuary Pond.

Spring Lake

The physical characteristics of Spring Lake are summarized in Table 3.44.

River/Stream	Spring Lake
DNR ID#	27065400
DNR Classification	N/A
Chapter 7050 Classification	2B, 3C, 4A, 4B, 5, and 6
Downstream waterbody	Bassett Creek
Surface Area	3 acres
Depth – mean	9.5 feet
Depth – maximum	Unknown
Watershed area within Minneapolis	50 acres
Watershed Management Organization	Bassett Creek Watershed Management Commission

Table 3.44 – Spring Lake Characteristics

Spring Lake is located west of Interstate 94 and immediately south of Interstate 394. Bryn-Mawr Meadows is located farther to the northwest from the lake. Spring Lake, the smallest lake monitored by the MPRB, has limited water quality information available. Seven floating biohavens (floating islands) were installed in Spring Lake in 2011 to act as a wildlife refuge; however, as of 2014, the biohavens are reported to be in poor condition. The lake overflows to Bassett Creek via a constructed storm drain.

Spring Lake is included in MPRB's lake monitoring program. Monitoring results are published each year in the MPRB annual <u>Water Resources Report</u>. Additional information on MPRB water quality monitoring is contained in this Section 3, subsection City-Wide Water Quality Monitoring and Other Efforts.

The MPCA's 2018 Draft Impaired Waters List identified impairments for Spring Lake, as summarized in Table 3.45.



MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Life/Chloride/2014
TMDL Status	Chloride: metropolitan-wide TCMA TMDL approved by U.S. EPA in 2016
Minneapolis Required Implementation Actions	Chloride: assessment of winter practices recommended

Table 3.45 – Spring Lake Impaired Waters Summary

Spring Lake was listed as impaired in 2014 in a <u>metropolitan-wide TMDL</u> study for chloride concentration with an initial target TMDL completion in 2015. The EPA approved the metropolitan-wide TCMA TMDL on June 9, 2016. The MPCA partnered with local and state experts in the TCMA to create a plan for reduction of chloride concentrations in water by management of salt use on land. The <u>TCMA Chloride</u> <u>Management Plan</u>, completed in February 2016, identifies salts (primarily sodium chloride) applied to paved surfaces in the winter as the major source for chloride in waters and water softeners in rural areas as a secondary source.

Non-Minneapolis Lakes and Wetlands Receiving Stormwater Runoff

There are 10 lakes located outside the municipal boundaries of the City that receive stormwater runoff discharges from the City stormwater drainage system. A full list of these lakes is contained in Table 3.46.

Name	DNR ID	Municipality	Watershed Organization
Bassett's Pond	27003600	Golden Valley	Bassett Creek Watershed Management Commission
Crystal Lake	27003400	Robbinsdale	Shingle Creek Watershed Management Commission
Hart Lake	02008100	Columbia Heights	Rice Creek Watershed District
Legion Lake	27002400	Richfield	Minnehaha Creek Watershed District
Mother Lake	27002300	MSP Airport Unincorporated Area	Minnehaha Creek Watershed District
Richfield Lake	27002100	Richfield	Minnehaha Creek Watershed District
Silver Lake	62008300	St. Anthony	Rice Creek Watershed District
Solomon Park Wetland	27068200	MSP Airport Unincorporated Area	Minnehaha Creek Watershed District
Taft Lake	27068300	MSP Airport Unincorporated Area	Minnehaha Creek Watershed District
Wirth Lake	27003700	Golden Valley	Bassett Creek Watershed Management Commission

Table 3.46 – Non-Minneapolis Lakes and Wetlands that Receive Minneapolis Stormwater Runoff

A brief summary of these lakes and their identified impairments follows.

Bassett's Pond

Bassett's Pond is located in the City of Golden Valley and is situated immediately north of Olson Memorial Highway (Highway 55) in Theodore Wirth Park. The pond is actually a series of deep pools that were dredged as part of the park plan created by Theodore Wirth, the first Minneapolis park commissioner. The pools are in-line with the main stem of Bassett Creek, which enters through the



northern end of the pond. Although it has a unique DNR ID, it is managed as a widened section of Bassett Creek rather than a separate pond and does not have a direct contribution of runoff from a Minneapolis pipeshed. As the pond is in Theodore Wirth Park, land use in the area is mostly park and recreational use, with single-family and multi-family residences to the east. The BNSF Railway and Canadian Pacific Railway run near the pond to the north and east.

The chloride, fishes bioassessments, and bacteria (fecal coliform) impairments described in the Bassett Creek section also apply to Bassett's Pond. No additional water quality information was identified with regard to the pond and additional information on the identified creek impairments is discussed further in the Bassett Creek section.

Crystal Lake

Crystal Lake is in the City of Robbinsdale and primarily receives stormwater runoff from a 1,200-acre area of Robbinsdale. However, runoff from a 421-acre area in the City of Minneapolis also drains to Crystal Lake. County Road 81 borders the lake to the west and Lakeview Terrace Park is to its south. Crystal Lake is also located to the south of Ryan Lake.

Crystal Lake does not have a natural outlet. In the mid-1990s, the City of Robbinsdale constructed a pump station to manage lake levels when the water level is high. The pumped water is discharged into the Minneapolis storm drainage system at the intersection of Xerxes Avenue and 42nd Avenue North. The storm drainage system that receives the discharge is historically under capacity, which results in frequent on-street floods of intersections and other low areas. The depth of water in the intersections is worsened whenever the Crystal Lake pump station is in operation. The City Minneapolis is working with City of Robbinsdale on an inter-jurisdictional agreement that defines a pump station operational plan that minimizes flooding in the City of Minneapolis.

The MPCA's 2018 Draft Impaired Waters List identified impairments for Crystal Lake, as summarized in Table 3.47.

MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Recreation/Excess Nutrients/2002
TMDL Status	Excess Nutrients: TMDL study approved in 2009
Minneapolis Related Implementation Actions	Excess Nutrients: urban/residential nutrient reduction strategies are to be implemented as opportunities arise.

Table 3.47 – Crystal Lake Impaired Waters Summary

Hart Lake

Hart Lake is situated immediately north of the Minneapolis municipal boundary in Anoka County, just north of the Hennepin County border. A 3-acre pipeshed area in the northeast corner of Minneapolis discharges to Hart Lake. Silver Lake is located to the northeast of Hart Lake. Hart Lake is located within and along the Rice Creek Watershed District (RCWD) southwestern boundary. A map of the RCWD impaired waters inventory from 2015 indicates that Hart Lake is not listed as impaired, but Silver Lake is, and the Silver Lake TMDL identifies Minneapolis as one of the parties in the categorical WLA. No TMDL implementation responsibilities are assigned to Minneapolis.



Legion Lake

Legion Lake is located in the City of Richfield, part of a series of lakes and wetlands that are outside the municipal boundary of the City which ultimately flow into Lake Nokomis. Legion Lake is the uppermost westerly lake that drains into Taft Lake, which is at the southwest quadrant of the Crosstown/Cedar Avenue interchange in Richfield. Mother Lake, located within the boundaries of the Metropolitan Airport, is the easterly, uppermost lake. Mother Lake also discharges to Taft Lake. Taft Lake discharges into Solomon Park Wetland, which in turn discharges to Lake Nokomis.

A 2-acre pipeshed area in Minneapolis discharges to Legion Lake. No impairments have been identified for Legion Lake, but Legion Lake is involved in the TMDL for Lake Nokomis. Legion Lake flows intermittently to the Mother-Taft-Solomon wetland complex described in the previous paragraph, which is connected to Lake Nokomis.

The City of Richfield, partnered with MCWD, has completed a Taft Lake/Legion Lake Water Quality Improvement Project in an effort to treat a large area of urban stormwater runoff that previously drained into both lakes. Although neither Taft Lake nor Legion Lake are listed as impaired, both lakes are involved in the TMDL for Lake Nokomis into which they drain. The project was completed in 2016 and includes a water reuse infiltration system, native prairie restoration and buffers, grit chambers (Legion Lake only), in-situ flocculation treatment systems (Taft Lake only), construction of the Richfield Parkway North Connection, and removal of Taft Lake Frontage Road.

Mother Lake

Mother Lake is located at the northwestern corner of the MSP International Airport, situated at the southeast corner of the intersection of Highway 62 and Cedar Avenue, east.

Mother Lake is part of a series of lakes and wetlands that are outside the municipal boundary of the City, which ultimately flow into Lake Nokomis. Mother Lake is the easterly, uppermost lake located within the boundaries of the Metropolitan Airport. Mother Lake discharges to Taft Lake, which is at the southwest quadrant of the Crosstown/Cedar Avenue interchange in Richfield. Legion Lake is the uppermost westerly lake that also drains into Taft Lake. Taft Lake discharges into Solomon Park Wetland, which in turn discharges to Lake Nokomis.

A 3-acre pipeshed area of Minneapolis discharges to Mother Lake. A few remnant wetlands are present at the airport and nearby Mother Lake. The taxiways of two runways are present in the drainage area, which would be associated with vehicular traffic and airplane movement, but no maintenance, deicing, or fueling is conducted in this area. Richfield maintenance facility and MnDOT materials storage and maintenance facility, as well as adjacent Cedar Avenue and Highway 62 roadways, also drain into the lake.

Per the EPA Waterbody Quality Assessment Report online database and the MPCA 2016 Minnesota Impaired Waters List, Mother Lake is not listed as impaired. However, it was noted that Mother Lake, though not itself listed, is involved in the TMDL study for Lake Nokomis, which is directly downstream from Mother Lake.


Richfield Lake

Richfield Lake is in the City of Richfield, immediately southeast of the intersection of I-35W and Highway 62. Minnehaha Creek is located farther north. The Lake is surrounded by Richfield Lake Park. A 58-acre pipeshed area of Minneapolis discharges to Richfield Lake.

Richfield Lake was divided by construction of Highway 62, resulting in part of the former lake being separated to the northwest. The waterbody separated from Richfield Lake is now a wetland known as Grass Lake. The two lakes are joined by a pipe to preserve their former hydrogeology. Stormwater runoff and storm sewers from the highway drain into the lake and wetlands. In 1995, grit chambers were constructed at the end of the sewer pipes to filter out debris form water discharging to the lake and wetlands.

Per the EPA Waterbody Quality Assessment Report online database and the MPCA 2016 Minnesota Impaired Waters List, Richfield Lake is not listed as impaired.

Silver Lake

Silver Lake is situated upstream of Hart Lake between the City of New Brighton and the City of Columbia Heights, south of I-694 and west of I-35W. The Silver Lake watershed is in the southwest portion of the RCWD. A 25-acre pipeshed area of Minneapolis discharges to Silver Lake.

There are two islands in the lake, one of which is accessible by bridge. Overall, the lake is shallow; however, there is a 47-foot deep hole, which is the proposed site for an in-lake alum treatment system.

The MPCA's 2018 Draft Impaired Waters List identified impairments to Silver Lake, as summarized in Table 3.48.

MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Recreation/Nutrient/Eutrophication Biological Indicators/2002 Aquatic Consumption/Mercury in Fish Tissue/2012 Aquatic Life/Chloride/2014
TMDL Status	Excess Nutrients: TMDL study approved in 2010 Mercury in Fish Tissue: statewide TMDL approved in 2008. Silver Lake retroactively added to the statewide TMDL approved study in an update in 2012 Chloride: metropolitan-wide TMDL approved in 2016
Minneapolis Related Implementation Actions	Excess Nutrients: urban/residential nutrient reduction strategies are encouraged Mercury in Fish Tissue: no responsibilities for local municipalities Chloride: assessment of winter practices recommended

Table 3.48 – Silver Lake Impaired Waters Summary

Solomon Park Wetland

Solomon Park Wetland is in the Edward C. Solomon Park south of Lake Nokomis and north of Taft Lake, across from Highway 62. The Solomon Park area was formerly located within the City of Minneapolis. Recent municipal boundary adjustments resulted in this area becoming part of the unincorporated area of the MSP International Airport. Taft Lake was formerly located within the City of Minneapolis. Recent



municipal boundary adjustments resulted in Taft Lake becoming part of the unincorporated area of the MSP International Airport. The lake is part of the larger Mother Lake, Taft Lake, Lake Nokomis complex located northwest of the MSP International Airport. The land was acquired by the MPRB in 2004 from a land swap and long-term lease with the Metropolitan Airports Commission. The Hennepin County WHEP is an ongoing wetland monitoring program that uses a MPCA-developed approach to measure vegetation and invertebrate diversity. WHEP monitored this wetland in 2005.

Taft Lake

Taft Lake was formerly located within the City of Minneapolis. Recent municipal boundary adjustments resulted in Taft Lake becoming part of the unincorporated area of the MSP International Airport. Taft Lake is bordered to the north and northwest by Highway 62, to the east by Cedar Avenue, and to the south by Taft Park. Legion Lake is near the southwest of Taft Lake and Mother Lake is located to the east, across Cedar Avenue. A 139-acre pipeshed area of Minneapolis discharges to Taft Lake.

The City of Richfield, partnered with MCWD, conducted a <u>Taft Lake/Legion Lake Water Quality</u> <u>Improvement Project</u> to treat a large area of urban stormwater runoff that previously drained into both lakes. Although neither Taft Lake nor Legion Lake are listed as impaired, both lakes are involved in the TMDL for Lake Nokomis into which they drain. Additionally, Taft Lake is listed as a high-risk waterbody for potential chloride impairment, which means that the chloride concentration in at least one sample of water within the past 10 years was within 10 percent of the chronic water quality standard (207 mg/L chloride). Although the lake has not been listed as impaired for chloride, the <u>TCMA Chloride</u> <u>Management Plan</u> encourages high risk waterbodies to follow proactive actions similar to those for impaired waters.

Wirth Lake

Wirth Lake is situated immediately south of Olson Memorial Highway (Highway 55) in Theodore Wirth Park in Golden Valley, west of downtown Minneapolis, and is managed by the MPRB. The BCWMC classifies Wirth Lake as a priority waterbody for management purposes.

A majority of the lake's approximately 400-acre watershed is located in the City of Golden Valley and a minor southern portion of the watershed area, 37 acres, is located within the City of Minneapolis.

Wirth Lake is included in MPRB's lake monitoring program. Monitoring results are published each year in the MPRB annual <u>Water Resources Report</u>. Additional information on MPRB water quality monitoring is contained in this Section 3, subsection City-Wide Water Quality Monitoring and Other Efforts.

The MPCA's 2018 Draft Impaired Waters List identified impairments for Wirth Lake, as summarized in Table 3.49.



MPCA Impaired Water Status	Impairment
Use/Impairment/Date Listed	Aquatic Recreation/Nutrient/Eutrophication Biological Indicators/2002 (DELISTED 2014) Aquatic Consumption/Mercury in Fish Tissue/1998 Aquatic Life/Chloride/2016
TMDL Status	Excess Nutrients: TMDL approved in 2010 Mercury in Fish Tissue: statewide TMDL approved in 2008 Chloride: metropolitan-wide TMDL plan approved in 2016
Minneapolis Related Implementation Actions	Mercury in Fish Tissue: no municipal action required Chloride: assessment of winter practices recommended

Table 3.49 – Wirth Lake Impaired Waters Summary

Wetland Inventories

The City of Minneapolis has several wetlands within its boundaries that are identified on the National Wetlands Inventory (NWI) established by the U.S. Fish and Wildlife Service, which do not receive stormwater runoff from the City-owned storm drain system and are not on the MNDNR protected waters list. These wetlands are shown on Figure 3.11 and Figure 3.12. These NWI wetlands consist of many smaller wetlands that are located on either public or privately-owned properties. The primary purpose of the NWI is to track the extent and status of all wetlands in the United States. A secondary purpose of this inventory is to serve as a planning tool to determine if a wetland may be affected by a proposed project.

The MCWD also manages an inventory of wetlands which are greater than one-quarter acre in area. The <u>functional assessment</u> inventory, completed in 2003, evaluated the condition of each wetland and categorized into four management categories. This inventory is incorporated into this WRMP by reference.

The City uses <u>MnRAM</u> to assess all other wetlands in the City, those not otherwise inventoried by the NWI or by a watershed organization. MnRAM is a functional wetland assessment technique developed and maintained by the Minnesota Board of Water and Soil Resources.















Groundwater

There are many agencies that manage aspects of groundwater in the City. There is no single source for groundwater data in the City; however, information is available at multiple locations:

- The City issues a Temporary Water Discharge Permit. This permit is short-term for construction purposes and does not allow permanent discharge of groundwater so projects must be designed and implemented in a manner that does not rely on permanent groundwater discharge.
- The Minneapolis Department of Health Environmental Services maintains <u>permits for</u> <u>construction or sealing of wells</u>.
- The MPRB monitors groundwater levels at 8 locations within park property. Locations of MPRB wells are contained in the <u>MPRB's annual Water Resources Report</u>.
- The <u>Minnesota Department of Natural Resources</u> issues permits to construct wells and appropriate groundwater for wells that withdraw 1 million gallons or more of groundwater per year. Permittees are required to submit annual groundwater data on the MNDNR Permitting and Reporting System (MPARS), which is available for download. Data for each permitted well is available to be downloaded.
- The MNDNR maintains the <u>Cooperative Groundwater Monitoring</u> network, which is an inventory of observational monitoring wells that tracks the static water levels over time.
- The USGS maintains a nationwide inventory of groundwater data, which can be found at the <u>National Ground Water Monitoring Network</u>. There are no sites in the City currently monitored by USGS.
- The MPCA collects information on the <u>quality of groundwater</u> in Minnesota.
- The Metropolitan Council, as the agency responsible for long-term planning in the Twin Cities, uses MNDNR data to develop a <u>regional model of the groundwater</u> that is used to assess impacts of long-term water usage caused by population growth and other changes.

Groundwater discharges into the municipal or regional storm or sanitary sewer systems are not allowed without first receiving approval from the City of Minneapolis. Temporary or one-time discharges that are anticipated to occur during construction must first receive a Minneapolis Temporary Water Discharge Permit and provide all related information and supporting documentation needed to issue the permit. If groundwater discharges are anticipated to occur long-term, then a Minneapolis Long-Term Groundwater Discharge Approval must be issued. The City's <u>Stormwater & Sanitary Sewer Guide</u> provides information on permit requirements and supporting documentation needed.

City staff actively participate in working groups and committees that are established to coordinate groundwater management between multiple agencies and organizations. Currently, staff participates in the MPCA groundwater-surface water interaction committee that discusses research, policies, and practices related to those stormwater management practices that infiltrate stormwater runoff.



Additionally, the City is working with multiple local, regional, and state jurisdictions to evaluate shallow groundwater levels in the Lake Nokomis area of Minneapolis.

Unique Features/Fish and Wildlife Habitats/Scenic Areas/Natural Resources/Key Conservation Areas/Ecological Health

There are opportunities with shifts in land use, private redevelopment, and public road reconstruction to collaborate between City departments and with external stakeholders to achieve the best water resource outcomes for the City and it's receiving waters. Two plans have been developed that anticipate these shifts and propose changes that would benefit water resources:

- The MPRB, in cooperation with the MWMO, is in the process of development of an Ecological System Plan. Once complete, the Plan will recommend how to protect the ecology of the parks and the City through park improvement projects. As of the date of this WRMP, the MPRB Ecological Plan has completed development of goals and strategies. There is no set completion date for this effort. Additional information is available at the <u>MPRB Ecological System Plan</u> website.
- Hennepin County has created a <u>natural resources interactive map</u> that can be consulted for detailed information on land cover, ecological significant areas, soils, natural resource corridors, and other natural features for all parcels in the county.

Maps that note unique features, fish habitat, wildlife habitat, and scenic areas of the City that are contained in the Watershed Management Plans of the BCWMC, MCWD, MWMO, and SCWMC are included in this WRMP by reference.

City-Wide Water Quality Monitoring and Other Efforts

City-Wide Water Quality Monitoring and Other Efforts

Minneapolis Park and Recreation Board

As property owner of the lake shoreline in the City, the MPRB is responsible for shoreline maintenance and has created an effective program of monitoring and management, which is specifically described in each affected waterbody. Scientists have analyzed water quality parameters since 1927. The current MPRB lake monitoring program, initiated in 1991, consists of an in-depth assessment of lake quality based on bi-weekly monitoring.

The extensive MPRB monitoring program includes monitoring of:

- Aquatic invasive species
- Aquatic plants
- Fish kills
- Groundwater levels
- Irrigation and augmentation wells

- Lake levels
- Phytoplankton and Zooplankton Monitoring
- Stormwater management practices
- Stormwater runoff
- Winter ice cover



Lake Monitoring

The Environmental Operations Section of the MPRB implemented a lake water quality monitoring program in 1991 as part of a diagnostic study for the Chain of Lakes Clean Water Partnership, which focused on Brownie Lake, Cedar Lake, Lake of the Isles, Lake Calhoun/Bde Maka Ska, and Lake Harriet. The monitoring program was expanded in 1992 to include Lake Hiawatha, Lake Nokomis, Diamond Lake, Powderhorn Lake, Loring Pond, and Wirth Lake. Monitoring at Spring Lake was added on a limited basis in 1993 and Grass Lake was added in 2002. Currently, only ice conditions are monitored at Birch Pond and Ryan Lake. Ryan Lake is occasionally monitored by the Metropolitan Council's CAMP program.

The objectives of the MPRB lake monitoring program are to:

- Protect public health.
- Establish a database for tracking water quality trends.
- Quantify and interpret both immediate and long-term changes in water quality.
- Provide water quality information to develop responsible water quality goals.
- Provide a basis for water quality improvement projects.
- Evaluate the effectiveness of implemented best management practices such as ponds and grit chambers.

A list of the parameters and monitoring frequency is contained in Table 3.50.

Table 3.50 – Schedule of Sampled Parameters for MPRB Monitored Lakes

Parameters	Sampling Frequency
Chloride, Chlorophyll-a, Conductivity, Dissolved Oxygen, pH, Phytoplankton, Secchi Transparency, Temperature, Total Phosphorus, Soluble Reactive Phosphorus, Total Nitrogen, Turbidity	Once per Winter Once in March or April Twice per month May through September Once in October or November
Silica	Once per Winter Once in March or April Once per month May through September Once in October or November
Zooplankton	Once in March or April Once per month May through September Once in October or November
Alkalinity, Ammonia, Hardness, Sulfate, Total Kjeldahl Nitrogen, Nitrate/Nitrite	Once per Winer Once in March or April Once per month May through September Once in October or November
Escherichia coli (<i>E. coli</i>)	Once per summer for each lake Weekly at public beaches



LAURI

The MPRB has developed a lake quality classification system termed LAURI (Lake Aesthetic and User Recreation Index) to provide a graphical snapshot of lakes in a non-scientific format. The MPRB uses the Trophic State Index (TSI) as a benchmark for comparison of water quality across all lakes in the City. TSI is calculated from a water transparency, chlorophyll-a values, and surface phosphorus values to produce a score from 0 to 100, although theoretically, the scale has no upper or lower bounds, with higher numbers relating to higher trophic status and lower water quality. In the Twin Cities metropolitan area, it is recommended that a TSI score of 59 or lower be maintained in lakes used for swimming. This recommendation is based upon the aesthetic appeal of the waterbody. Changes in lake water quality can be tracked by analyzing long-term trends in TSI scores. The MPRB uses TSI scores to assess changes in water quality and evaluate the effectiveness of restoration and management activities on the trophic statue of the lakes.

The LAURI scoring system was created in 2003, refined in 2009, and again in 2017. LAURI considers five indices of water quality:

- 1. Public Health, as measured by *E. Coli* at public swimming beaches.
- 2. Water Quality, as measured by water clarity.
- 3. Habitat Quality, as measured by plant and fish diversity.
- 4. Recreational Access, as measured by availability and ease of public access.
- 5. Aesthetic, as measured by color, odor, garbage, and debris.

Data for the LAURI analysis is collected during regular lake monitoring activities and once per month during beach monitoring trips during the growing season from May through September.

The classification system consists of values for each indicator that result in a score for each of the five measures. Currently, the MPRB reports LAURI information for:

Brownie Lake

Lake of the Isles

Lake Calhoun/Bde Maka Ska

Lake NokomisLoring Pond

- Cedar Lake
- Diamond Lake
- Lake Harriet

Wirth Lake

Powderhorn Lake

Lake Hiawatha

Further detailed information is available in the Annual Water Quality Monitoring Reports published by the <u>MPRB</u>.



Beach Monitoring

MPRB Lake Monitoring

The MPRB has 12 official beaches located on six lakes:

- Wirth Lake (1)
- Cedar Lake (3)
- Lake Calhoun/Bde Maka Ska (3)
- Lake Harriet (2)
- Lake Hiawatha (1)
- Lake Nokomis (2)



Credit: Minneapolis Park and Recreation Board

Prior to 2003, the City of Minneapolis Environmental Health Department

monitored the beaches for fecal coliform bacteria. The MPRB began beach monitoring in 2003 and tested the beaches for *E. coli*, as well as fecal coliform bacteria. From 2004 to the present, MPRB Environmental Management staff monitored the beaches for *E. coli* alone as recommended by the EPA. Epidemiological testing allowed the MPCA to develop an inland lake standard which MPRB has followed since 2006. The inland lakes standard has a single-sample limit of 1,260 organisms per 100 mL and was accepted into rule during 2008 and has been used by MRPB since that time. The MPRB will temporarily close beaches whenever *E. coli* levels exceed these levels. Up-to-date monitoring information for each MPRB beach monitoring information is available from the <u>MPRB</u>.

Zebra Mussel Action Plan

The MPRB Zebra Mussel Action Plan was prepared in response to the discovery of zebra mussels in Lake Minnetonka in 2010 and the subsequent declaration of Minnehaha Creek, Meadowbrook Lake, Lake Hiawatha, and Lake Nokomis as infested waters. Lake Harriet was designated as infested in September 2017. The purpose of the plan is to identify organization-wide best management practices to eliminate the spread of Aquatic invasive species (AIS) through operational activities. The plan is updated to include new data and findings as needed. Key actions include:

- Establishment of operational procedures and best management practices for MPRB staff that access multiple waterbodies during their work activities.
- Purchase of an aquatic plant harvester so that all harvesting is conducted by MPRB staff, eliminating the potential of a contractor inadvertently moving zebra mussels into a City lake.
- Provide education pieces and communication with watercraft owners who have permits to store boats at canoe racks and sailboat buoys.
- Partnership with sailing organizations located on Minneapolis waters to maintain AIS Prevention plans that help to guide best management practices.



- Require contractors and researches working in Minneapolis waterways to maintain AIS Prevention plans along with required MNDNR permits and certifications as part of the permitting and contract process.
- Installation of public education signs and kiosks at boat landings and launches.
- Inspection of all boats and water-related equipment accessing MPRB boat launches on Lake Nokomis, Lake Harriet, and Lake Calhoun/Bde Maka Ska.
- Early detection monitoring of all City lakes for new AIS.
- Development of a comprehensive and adaptable AIS Response Plan in partnership with the MNDNR and the MCWD.

Aquatic Invasive Species Management and Inspection

Purple loosestrife is a shoreline plant that, once established, will rapidly crowd out native shoreline plant species. It has been designated as an invasive aquatic species by the MNDNR. The MPRB works to control loosestrife through biocontrol, the release of beetles that exclusively feast on the loosestrife. This program was developed in the 1990s as part of a cooperative pilot program developed by the MPRB, Minnesota Department of Health (MDH), and the DNR. This biocontrol continues to be the primary management tool for control of purple loosestrife. The presence of this plant within MPRB properties has declined significantly since initiation of this program, although controlled areas of the loosestrife remain to perpetuate the beetle population. Purple loosestrife is controlled at Wirth Lake, Lake Calhoun/Bde Maka Ska, Birch Lake, Lake Harriet, Cedar Lake, and Lake of the Isles.

<u>Eurasian Water Milfoil</u> is a submerged aquatic plant that has been designated as an invasive species by the MNDNR. The MPRB manages the plant in certain lakes by mechanical harvesting.

The MPRB began their Aquatic Invasive Species (AIS) Inspections Program in 2010 with occasional DNR staffed inspections during prime use hours. The MPRB, understanding that prevention is the key to protecting Minneapolis waterbodies, further supported the Inspections Program in 2012 by enacting rules and allocating funding and staff for AIS protection efforts. These efforts included the 100 percent inspections requirement at boat launches on Minneapolis lakes, signage, ability to lock launches when inspectors were not on duty, and increased education efforts.

The MPRB has continued to support AIS prevention with allocated funds, enforced inspection rules at MPRB boat launches, strong partnerships with the boating community, comprehensive sampling and monitoring programs, and education campaigns. MPRB staff work closely with state and local organizations to be abreast of the most current AIS research, prevention, and management efforts.

The MPRB Inspection Program currently requires that all watercraft and water-related equipment accessing the boat launches on Lake Nokomis, Lake Harriet, and Lake Calhoun/Bde Maka Ska between May 1 and December 1 be inspected by DNR-trained staff and certified AIS Inspectors. The launches are closed when Inspectors are not on duty. Inspectors provide AIS education and customer service to the public, as well as assist with early detection monitoring efforts at the launches.

The AIS Inspection Program is conducted by the MPRB in cooperation with the following partners:



- MCWD will provide 36 percent of inspection program costs for 2018.
- Friends of Lake Nokomis monitors early detection zebra mussel samplers on Lake Nokomis.

Wetland Health Evaluation Project

The Hennepin County Wetland Health Evaluation Project (WHEP) is a volunteer wetland monitoring program that uses an MPCA-developed approach to measure vegetation and invertebrate diversity. In Minneapolis, the efforts are coordinated by Hennepin County and funded by the MPRB and the City. This program has expanded to include monitoring of 34 wetlands in Hennepin County, of which six are located within the City, as listed on Table 3.50.

WHEP utilizes teams of MPCA-trained volunteers to collect and analyze wetland data to characterize wetland health. Hennepin County Environmental Services staff then cross-check, synthesize, and report the collected data back to the partner organizations and to the public. Sampling from the wetlands includes both vegetation and invertebrate data. Monitoring results are reported annually by Hennepin County.

The MPRB has sponsored WHEP volunteer teams to monitor wetlands within the park system each year since 2002. Every summer, several wetlands are monitored depending on the needs of the MPRB. Table 3.51 lists the seven sites monitored in 2016 as part of the MPRB sponsored program, including the Roberts Bird Sanctuary wetland, which is monitored annually as a reference wetland site for the City of Minneapolis.

WHEP Wetland	2016 Invertebrate Rating	2016 Vegetation Rating
Diamond Lake	Moderate	Moderate
Robert's Bird Sanctuary	Moderate	Moderate
Heritage Park ^a	Moderate	Moderate
Wirth Beach Wetland b	Moderate	Moderate
Lower Wirth ^b	Moderate	Moderate
Webber Stormwater Pond ^a	Poor	Moderate
Webber Regeneration Pond ^c	Poor	Moderate

Table 3.51 – Hennepin County Wetland Health Evaluation Project Monitored Wetlands (2016)

^a Stormwater wetland

^b MPRB lake outside Minneapolis municipal boundary

^c Natural swimming pond managed by MPRB

According to the 2016 report, the wetlands in the City appeared to have moderate to poor invertebrate conditions and moderate vegetation conditions. A historical summary of all WHEP monitoring results is available on an <u>interactive map</u> developed by Hennepin County.

MPRB Golf Course Wetlands Monitoring

The MPRB golf course maintenance staff has received certification through the <u>Audubon International</u> <u>Cooperative Sanctuary Program</u> for golf courses. This certification is a result of the MPRB following environmental management practices that have been developed by Audubon International. A component of this management is ongoing collection and analysis of water samples and visual surveys of aquatic and wetland vegetation. Results are published in the annual <u>Water Resource Reports</u>.



The Audubon Cooperative Sanctuary Program for Golf (ACSPG) is an education and certification program that helps golf courses protect the environment, preserve natural areas, and protect wildlife through improve efficiency and minimize harmful impacts. Audubon International provides both a Site Assessment and Environmental Planning Form to provide guidance for certification. The areas used for the certification process are:

- Environmental Planning
- Wildlife and Habitat Management

Water Quality Management

Water Conservation

- Chemical Use Reduction and Safety
- Outreach and Education

MPRB collects both water and vegetation data required for their annual certification by the ACSPG. The ACSPG has a water quality and aquatic plant monitoring component as part of their final certification. Each golf course integrates these data (plant and water chemistry) into their final certification application.

Source Water Protection – Minneapolis

In 1996, amendments to the Safe Water Drinking Act required source water assessments to be prepared for public water systems. The City's own assessment, completed in 2001 and updated in 2009, provides information on:

- The area which supplies drinking water to the Minneapolis Public Works.
- An overview of why this source is susceptible to potential contamination.
- A description of the contaminants of concern.
- The sources of the contaminants of concern, if possible.

The City obtains its drinking water from the Mississippi River, and the Minneapolis Water Works intake is in Fridley. The area most directly connected to the supply and the area over which a spill or contamination could quickly reach the intake is termed the "inner emergency response area." This area includes subwatersheds immediately adjacent to the Mississippi River from the intake upstream to Elk River – a distance along the river of 26 miles. The "outer source water management area" is conceived as an area where protection against chronic sources of contamination is emphasized or where periodic low levels of contamination occur. This management area consists of those subwatersheds immediately adjacent to the Mississippi River from Elk River to Saint Cloud. Notably, the furthest extent of the City "outer source water management area" generally coincides with the downstream portion of St. Cloud's "inner emergency response area." The final assessment area is the entire Mississippi watershed, above the Twin Cities, approximately 19,000 square miles.

The Source Water Assessment document lists potential contamination sources. These sources are derived from several state and federal databases. The overall intent of the assessment is to provide public information. In the document's own words, "The assessment provides the community with a significant amount of information regarding where your drinking water comes from (the source) and



what the risks are to the quality of that source." The <u>2001 Source Water Assessment</u> is available from the Minnesota Department of Health.

Source Water Protection Plan

In 2002, the City partnered with Saint Cloud and Saint Paul to develop the <u>Upper Mississippi River</u> <u>Source Water Protection Plan</u>, a two-part document that delineates the source water protection area, assesses the susceptibility of contamination, and details the management strategy. Part 1, completed in 2005, delineates the source water protection area and analyzes its sensitivity and susceptibility. Part 2, completed in 2009, develops a specific plan to protect the City's surface water intake from potential contamination. The plan is scheduled to be updated in 2019.

A portion of the City, roughly north of Victory Memorial Parkway, Weber Parkway, and Shingle Creek, falls within the Minneapolis Water Supply Priority Area A Source Water Protection Area, as delineated under the source water assessment in 2005. The area north of the line delineated on **Figure 3.13** represents the Priority A area of the City. The Minneapolis Priority Area A includes Shingle Creek and its watershed, even though the confluence of Shingle Creek and the Mississippi River is downstream of the City water intake. Because of the pooling of the Mississippi River due to the Saint Anthony Falls dam, the possibility exists that water downstream of the intake could travel upstream under certain conditions, such as high winds, and reach the intake. More information about the delineated source water protection area is available at the <u>Upper Mississippi Source Water Protection Project MapFeeder</u>.

In 2016, the City updated the Vulnerability Assessment and found that for the area of the City downstream of this Priority Area A, the City's drinking water source (the Mississippi River) qualifies as "low" in the risk ranking scheme. The risks of source water contamination or drought would either have very low consequences or is very unlikely to occur. It was concluded that additional investment in source water mitigation measures or contingency action strategies to supplement or replace the source would have little to no risk reduction benefits.





Figure 3.13 – City of Minneapolis Source Water Protection Priority A Area

Source: Upper Mississippi River Source Water Protection Project, MapFeeder, accessed December 5, 2017



Source Water Protection – Neighboring Municipalities

Five neighboring municipalities that rely on groundwater source for their potable water supply have identified Water Supply Management Areas of Vulnerability that reach into Minneapolis. Each municipality has identified the risk of well contamination for their water supply, as follows:

- Bloomington Moderate/Low
- Edina Moderate/Low
- Richfield High/Moderate/Low
- Robbinsdale Low
- Saint Louis Park Moderate/Low

As described in Section 5 – Regulatory Controls and Water Resource Management Programs, the City will update its Development and Redevelopment regulations and practices as required in the NPDES Integrated Permit. The updates will incorporate requirements specific to these Areas of Vulnerability based on the level of risk that has been identified by each municipality.

Monitoring by Others

In addition to monitoring conducted by the City and the MPRB, there are numerous other agencies that have developed monitoring programs, surveys, and water quality improvement projects. A comprehensive list of these reports and activities is contained in Appendix E.

Compliance with Water Resource Improvement Requirements

The purpose of this section is to describe the physical environment of the City, including detailed descriptions of all surface waters. As property owner of a majority of the shoreline in the City, the MPRB and the City manage a full range of land management, shoreline management, and monitoring to ensure the health of the City's water resources. The MPRB's primary focus includes public education, lake management, monitoring, shoreline management, and property management of parklands adjacent to each water resource. The City's primary focus is on management of the stormwater drainage system: operation, maintenance, improvements, and annual reports. This management focuses on Stormwater Management Practices (SMPs), street maintenance, land management, ordinances, development and redevelopment controls, and public education.

The comprehensive projects and programs managed by the City and the MPRB as described in this section fully satisfy the surface water management requirements set by the NPDES permit, completed TMDL implementation plans, Metropolitan Council, and watershed management organizations. Requirements specific to infrastructure management are summarized in Section 4 – Infrastructure Inventory, Activities, and Assessment; those related to ordinances, education, and other non-structural activities are summarized in Section 5 – Regulatory Controls and Water Resource Management Programs. City projects and programs are fully compliant with the identified regulatory requirements, as described below.



TMDL Mitigation Plans Required Actions

The City is required, through its NPDES Integrated Permit, to comply with the MS4-designated actions contained in the approved TMDL implementation plans. In the City SWMP, Category 8, Progress Toward Waste Load Allocations for Approved Total Maximum Daily Loads, describes the City's overall requirements for compliance with TMDL WLAs. Table 3.52 summarizes the MS4 requirements for those surface waters that are either within the City municipal boundaries and/or receive stormwater runoff that is generated within the City. This table summarizes the requirements contained in TMDL Implementation plans approved as of December 2017. It does not include activities in draft TMDL plans nor information on TMDL studies have not been initiated.



Affected Surface Water(s)	Required Actions Under TMDL (for Minneapolis)	WRMP Reference	MS4 SWMP Reference	Other	Description
Aquatic Macroinverte	orate Bioassessments				
Shingle Creek	 In-stream improvements: Shoreline stabilization In-stream habitat improvements Assessment of I-94 structure Create fish passage structure 	Section 3 – Shingle Creek Section 6 – Capital Improvement Program	-	-	Cooperative CIP implementation between MPRB, SCWMC, and Minneapolis
Chloride					
Shingle Creek	 Upgrade deicing equipment Cover salt stock-piles Store cleared snow away from sensitive areas Operator training 	Section 3 – Shingle Creek Section 4 – Stormwater System Operation and Maintenance	Category 6 – Pollution Prevention and Good Housekeeping for Municipal Operations	-	Winter street maintenance practices include proper salt storage, detailed accounting of salt application, condition assessment after each snow event, calibration and maintenance of equipment, and ongoing operator training.
Bassett Creek Brownie Lake Diamond Lake Loring Pond Minnehaha Creek Powderhorn Lake Silver Lake Spring Lake Wirth Lake	 Assessment of winter street maintenance practices 	Section 4 – Stormwater System Operations and Maintenance	Category 6 – Pollution Prevention and Good Housekeeping for Municipal Operations	-	Winter street maintenance practices include proper salt storage, detailed accounting of salt application, condition assessment after each snow event, calibration and maintenance of equipment, and ongoing operator training.
Dissolved Oxygen					
Shingle Creek	 In-stream improvements: Shoreline stabilization In-stream habitat improvements Assessment of I-94 structure Create fish passage structure 	Section 3 – Shingle Creek Section 6 – Capital Improvement Program	-	-	Cooperative CIP implementation between MPRB, SCWMC, and Minneapolis

Table 3.52 – TMDL Implementation Plan Requirements and Activities for the City of Minneapolis



Affected Surface Water(s)	Required Actions Under TMDL (for Minneapolis)	WRMP Reference	MS4 SWMP Reference	Other	Description
Excess Nutrients					
Lake Hiawatha	 Infiltration BMP installation on MPRB properties 	Section 6 – Capital Improvement Program	-	-	Cooperative CIP implementation between MPRB, MCWD, and Minneapolis
Lake Nokomis/Legion Lake/Taft Lake	 Water quality ordinance for redevelopment projects BMP retrofits 	Section 5 – City of Minneapolis and Minneapolis Park and Recreation Board Code of Ordinances Section 6 – Capital Improvement Projects	Category 5 – Post- Construction Stormwater Management for Public and Private Projects Category 6 – Pollution Prevention and Good Housekeeping for Municipal Operations	-	Ongoing enforcement of stormwater management requirements for new construction projects. Cooperative CIP implementation between MPRB, MCWD, and Minneapolis.
Crystal Lake	 Provide focused education and outreach Implement BMPs as opportunities arise Perform pond maintenance Sweep streets twice annually 	Section 4 – Stormwater System Operation and Maintenance Section 5 – Public Education, Participation, and Involvement Section 6 – Capital Improvement Projects	Category 1 – Public Education and Outreach Category 6 – Pollution Prevention and Good Housekeeping for Municipal Operations	-	Ongoing maintenance of streets and stormwater SMPs. Ongoing public education. Strategic installation of new structural SMPs.
Silver Lake/Hart Lake	 Neighborhood small scale water quality retrofits P-free fertilizer lawns Education programs 	Section 5 – City of Minneapolis and Minneapolis Park and Recreation Board Code of Ordinances Section 6 – Capital Improvement Projects	Category 1 – Public Education and Outreach Category 6 – Pollution Prevention and Good Housekeeping for Municipal Operations	-	Ongoing public education. Strategic installation of new structural SMPs.
Ryan Lake	 In-lake monitoring 	Section 3 – City-Wide Water Quality Monitoring	-	MPRB Annual Report	Long-term monitoring to ensure nutrients remain within acceptable limits.



Affected Surface Water(s)	Required Actions Under TMDL (for Minneapolis)	WRMP Reference	MS4 SWMP Reference	Other	Description	
Fecal Coliform (Bacteria)						
Bassett Creek Minnehaha Creek Shingle Creek	 Pet waste ordinance IDDE inspection and enforcement Storm drain maintenance 	Section 4 – Stormwater System Operation and Maintenance Section 5 – Public Education, Participation, and Involvement	Category 1 – Public Education and Outreach Category 3 – Illicit Discharge Detection and Elimination Category 6 – Pollution Prevention and Good Housekeeping for Municipal Operations	-	Ongoing maintenance of stormwater SMPs. Ongoing inspection and enforcement of IDDE requirements. Ongoing public education.	
Mercury in Fish Tissue						
Brownie Lake Cedar Lake Lake Calhoun/Bde Maka Ska Lake Harriet Lake Nokomis/Legion Lake/Taft Lake Lake of the Isles Mississippi River (downstream of Saint Anthony Falls) Powderhorn Lake Silver Lake/Hart Lake Wirth Lake	 Statewide actions by MPCA 	NA	NA	NA	-	
PFOS in Fish Tissue						
Lake Calhoun/Bde Maka Ska Lake Harriet Lake of the Isles	 Regulatory action by MPCA 	NA	NA	NA	-	



Watershed Organization Required Actions

Two of the four watershed organizations in the City have identified specific surface water actions that will require cooperation by the City, the BCWMC, and the MCWD. The MWMO and the SCWMC have not designated specific water resource actions for implementation by the City.

<u>BCWMC</u> requires its member cities to implement capital improvement projects upon order by the BCWMC. The City projects recommended in the 2015-2025 Watershed Management Plan include:

- Bassett Creek Main Stem Channel Restoration, Cedar Lake Road to Irving Avenue.
- Water quality improvement project in Theodore Wirth Park (undefined).
- Water quality improvement project in Bryn Mawr Meadows.
- Water quality improvement project in Bassett Creek Park.
- Dredging of sediment accumulated within Theodore Wirth Park segment of Bassett Creek.
- Restoration and stabilization of historic Bassett Creek channel.

The City will continue to cooperatively work with the BCWMC towards implementation of these projects.

Additionally, the BCWMC requires that member cities assess the need for a waterbody management classification system. The City aims to be consistent with water resource management in a manner that complies with requirements of all four watershed organizations and that does not create unique systems for regions or watersheds within the City. Therefore, the City opts to not create a separate waterbody classification system.

MCWD requires that member cities assess the potential for erosion at stormwater outfalls caused by excessive runoff discharge velocities. Outfalls identified as having high potential for erosion would require further assessment to determine whether erosion control or energy dissipation could mitigate erosion. The City is in the process of developing stormwater runoff models that will, when complete, predict the discharge velocities at all City outfalls. Once this effort is complete, the City will be able to determine which outfalls have the potential for erosive flows and require additional analysis and mitigation. The MCWD is in the process of development of a 2018 project, in partnership with the MPRB and the City, that will stabilize eroded banks and other erosion areas along the Creek. This work will be funded, in part, by 2014 flood damage funds from the Federal Emergency Management Agency (FEMA).

Minneapolis will continue to work closely with all watershed management organizations towards protection and improvement of water resources in the City. These actions will include, but not be limited to, the sharing of information, review of draft reports, and reference to watershed studies when implementing local projects and programs.

Prioritized Assessment of Water Resource Problems

The City's role in water resource management is to manage its infrastructure in a manner that maintains or improves the quality of water being discharged to surface waters. Within the City of Minneapolis, the



in-lake or in-stream water resource management is the responsibility of others, primarily the MPRB as property owner of a majority of the shoreline in the City. The City is working to implement an integrated infrastructure improvement program that maximizes public investments and minimizes risk to human health and the environment. Generally, compliance with NPDES permit requirements, including TMDL required projects, are given the highest priority. Capital improvement projects and sanitary/stormwater management programs that mitigate one or more of the following risks are also given high priority: prevention of the loss of life/personal injury, prevention of severe property damage, minimization of the release of raw sewage, and/or improvement of surface water quality. Projects and programs that mitigate multiple risks are prioritized higher than those that mitigate only one risk.

Additional information on how the City management its water resource infrastructure is contained in Section 4 – Infrastructure Inventory, Activities, and Assessment, and information of water quality programs is contained in Section 5 – Regulatory Controls and Water Resource Management Programs.



Section 4 – System Infrastructure Inventory, Activities, and Assessment

Overview

The City of Minneapolis' (City) sewer and stormwater infrastructure serves to protect water resources via the management of sanitary sewage and stormwater runoff. The City, as primary steward of this infrastructure, has developed a comprehensive set of practices and programs that serve to maintain the function, integrity, and capacity of these systems. This section of the Minneapolis Water Resources Management Plan (WRMP) inventories the City's built stormwater and sewage conveyance systems. Although the City's sanitary and stormwater systems are predominantly independent systems, they were historically connected and, therefore, are managed as interrelated systems that work together to protect the City's water resources.

The major components of each system, as used in this WRMP, consist of:

- Sanitary Sewer System Sanitary sewer conveyance infrastructure includes pipes, manholes, and lift stations. This infrastructure connects to the Metropolitan Council interceptor, regulator, and treatment facilities for final treatment and discharge to the Mississippi River.
- Stormwater Drain System The stormwater drain system includes stormwater drainage and conveyance infrastructure, such as gutters, catch basins, pipes, and channels. The system also includes flood control basins and water quality treatment structures such as wet ponds, grit chambers, and infiltration features (rain gardens, infiltration trenches, and tree vaults).

Development of this WRMP involved preparation of an inventory of the sewer systems and development of maps that is based on existing current data and from the City's geographic information system (GIS) database, accessed July 12, 2017. Electronic

versions of all GIS maps contained in this section are available to the public, to public agencies, and to watershed organizations upon request.

St. Anthony Falls, 1865

History

The Minneapolis sanitary sewer and stormwater drain systems began in the 1870s as a single-sewer system where all sanitary sewage and stormwater runoff was collected into a single pipe system that discharged directly to either the Mississippi River or Bassett Creek. In the 1920s, the City adopted a two-pipe, separate sewer and stormwater infrastructure policy requiring installation of both stormwater drain and sanitary sewer systems for developing areas of the City. This policy remained in effect until the 1960s, when the City began to add stormwater drains in the pre-1920s single-



Credit: Minnesota Historical Society



sewer areas of the City. This new program allowed for redirection of the stormwater runoff from the sanitary sewers into the new stormwater drains. As of 2017, this sewer separation work is substantially complete. The success of this separation effort is evidenced by the near elimination of the risk of wet weather overflows from the sanitary sewer system. Small pockets of direct stormwater connections to the sanitary sewers remain and are described in additional detail in this section. A more detailed description of the history and evolution of the City's sanitary sewer and stormwater infrastructure is described in Section 1 – History and Overview of Minneapolis Water Resources.

Infrastructure Inventory Sanitary Sewer System

The City maintains a sanitary sewer system that is more than 140 years old. Because the City is fully developed, major additions to the system are minimal. As is typical with fully-developed cities, the City has a large inventory of older assets constructed during a period of rapid expansion. The oldest sewers in the City system are brick or non-reinforced cement pipe. In the 1880s and early 1890s, brick was used for large diameter sewers (24-inch to 96-inch) which were typically egg-shaped. The egg shape was oriented with the narrow section of the egg at the invert to efficiently convey sanitary flows. The larger section at the top of the egg-shaped sewer provided capacity for higher flows associated with stormwater runoff. These brick and cement sewers are still in

Brick Sanitary Sewer



Credit: Minneapolis Public Works

operation today. For larger sewers, brick construction was abandoned in approximately 1930 with the emergence of concrete sewer pipe. Smaller diameter (12-inch to 24-inch), oval-shaped cement sewers were installed in areas with lower sewer flow contributions until approximately 1884.

In 1896, the City abandoned the use of cement pipe and began using vitrified clay pipe. Clay remains as the preferred material for smaller diameter sanitary sewer construction throughout the City.

As of 2017, the City, MPRB, and Metropolitan Council sanitary sewer system of shallow sewers and deep tunnels totals 835 miles of trunk and local sewers, which breaks down into 757 miles of City/MPRB sewers and 78 miles of Metropolitan Council interceptors. The interceptor system was originally built by the City and operated as part of the Minneapolis and Saint Paul Sewerage District from the 1930s until 1967 when it was taken over by the Metropolitan Council subsequent to action by the Minnesota legislature. By owner, the City owns 90.6 percent of the sewers, Metropolitan Council owns 9.4 percent of the sewers. Table 4.1 and Table 4.2 present the types, ages, and total lengths of each type of the 757 miles of Minneapolis sanitary sewer system. Figure 4.1 shows the City and Metropolitan Council sanitary sewers, lift stations, and interceptors. Figure 4.2 shows the locations where the City sewers connect to the Metropolitan Council interceptor system.



Table 4.1 – Materia	l and Age of	⁻ Sanitary	System	а
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Material	Size	Year Constructed	Percent of System
Clay	6-inch to 48-inch	1882 to present	78%
Brick	18-inch to 78-inch	1870 to 1930	11%
Cement	10-inch to 18-inch	1882 to 1886	3%
Concrete/RCP	12-inch to 102-inch	1927 to present	3%
Other ^b	6-inch to 102-inch	1931 to present	5%

^a Geodatabase data accessed December 30, 2015

^b Cast Iron, Ductile Iron, High Density Polyethylene, Polyvinyl Chloride, Corrugated Metal, Polypropylene, Fiberglass Resin Cement, combined materials, and unknown materials

Table 4.2 –	Sanitary	Sewer	System	Infrastructure	Inventory
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Component	Length/Quantity
Pipes	
Tunnels	6.1 miles
Trunk and Local Sewers ^a	748 miles
Metropolitan Council Interceptors	78.3 miles
Forcemain	0.5 miles
Pipe-in-Pipe	2.4 miles
Structures	
Manholes ^a	27,499
Lift Stations	9
Regulators (Metropolitan Council owned)	7

^a Geodatabase data accessed July 12, 2017

The regulators inventoried in Table 4.2 were installed in the 1930s to allow for direct discharge of the combined sewage/stormwater into the Mississippi River. The purpose of these regulators was, and continues to be, to prevent the backflow of sewage into basements and onto streets whenever the hydraulic capacity of the sanitary sewer is exceeded during significant rainfall events and to prevent damage to the sanitary sewer as a result of over pressurization that could occur during an intense rain event. Since the 1980s, the City's efforts to reduce the volume of inflow/infiltration (I/I) has resulted in the closure of many of these regulators; as of 2016, only seven remain. The location of these seven regulators and tributary sewersheds are shown in Figure 4.3. The City and the Metropolitan Council have determined that the elimination of these overflow structures may not be feasible due to the potential for public health and safety hazards, in the event that an intense rainfall exceeds the capacity of the sanitary system.











Figure 4.2 – City of Minneapolis Sanitary Sewer Connections to Metropolitan Council Interceptors and Sanitary Service Areas









Public and Non-Public Wastewater Facilities in the City of Minneapolis

Hennepin County is responsible for tracking private wastewater facilities, and reports that there is one active septic system in the City of Minneapolis. Several privately-owned treatment facilities are located within the City and are permitted under by the Minnesota Pollution Control Agency (MPCA). These facilities maintain a National Pollutant Discharge Elimination System (NPDES) wastewater discharge permit, or a Minnesota State Disposal System (SDS) permit. A current list of privately held wastewater permits in the City is available from the MPCA on the <u>What's In My Neighborhood</u> webpage.

Service Connections

The City maintains 97,248 sanitary sewer accounts, as of December 31, 2016.

Stormwater Drain System

The City's initial use of a single-pipe sewer system resulted in minimal construction of a dedicated stormwater drain system prior to the 1920s. By 1930, four percent of the current stormwater drain system had been installed. The period of greatest expansion of the system occurred in the 1930s, associated with new development, and again between 1960 and 1990, as the City constructed stormwater drains to separate stormwater from the sanitary sewers. Table 4.3 summarizes the construction history of the stormwater drain system.

Year Built	Percent of Stormwater Drain System by Length
Pre-1900	0.3%
1901 to 1910	0.6%
1911 to 1920	0.7%
1921 to 1930	2.6%
1931 to 1940	23.8%
1941 to 1950	6.5%
1951 to 1960	7.4%
1961 to 1970	13.5%
1971 to 1980	14.1%
1981 to 1990	11.1%
1991 to 2000	8.9%
2001 to 2006	2.3%
2007 to 2016	0.9%
Construction Date Unknown	7.3%

Table 4.3 – Age of Stormwater Drain System ^a

^a Geodatabase accessed July 12, 2017

In the 1990s, the City began installation of stormwater treatment and flood control facilities to further manage the quality of runoff or to resolve capacity problems, termed Stormwater Management Practices (SMPs). As of 2018, approximately 20 percent of the City's stormwater runoff drains to a flood control or stormwater quality device.

The current stormwater drain system consists of the following major components:



- A drainage network that consists of street gutters, catch basins, manholes, pumps, stormwater drains, deep tunnels, and outfall structures.
- Water quality detention facilities consist of wet ponds, dry ponds, and inline storage, used to control localized flooding.
- Water quality treatment facilities, including stormwater ponds, wet vaults, hydrodynamic structures, sumps, grit chambers, and infiltration facilities, such as rain gardens, infiltration trenches, and tree vaults.

Table 4.4 summarizes the types and quantities the stormwater drain system owned and operated by the City. Figure 4.4 shows the stormwater drain system (note that Figure 4.4 does not include SMPs that are owned by other public agencies or are privately owned), and Figure 4.5 shows the location of City-owned SMPs. This includes the stormwater drain system that transferred to the City from the Minneapolis Park and Recreation Board (MPRB) in 2000. This inventory does not include stormwater drain infrastructure owned by other public agencies, such as the Minnesota Department of Transportation (MnDOT), Hennepin County, and the University of Minnesota.

Component	Length/Quantity
Pipes	
Pipes	501.4 miles
Stormwater Tunnels	15.9 miles
Forcemain	0.8 miles
Pipe-in-Pipe	5.7 miles
Structures	
Manholes	19,581
Catch Basins/Inlets	25,308
Detention Facilities (Public)/Storage Structures	87
Grit Chambers/Quality Controls	126
Bioretention/Infiltration/Filtration (Public)	112
Pump Stations	26
Outfalls	419
Connections to Other MS4 Permitted Systems ^b	18

Table 4.4 – Stormwater Drain System Infrastructure Inventory – City and MPRB Ov	wned ^a
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^a Geodatabase accessed July 12, 2017

^b Brooklyn Center, Columbia Heights, Edina, Falcon Heights, Golden Valley, Hennepin County, Lauderdale, MnDOT, Minneapolis/Saint Paul Airport, Richfield, Robbinsdale, Roseville, Saint Anthony Village, Saint Paul, Saint Louis Park, and University of Minnesota



Figure 4.4 – Minneapolis Stormwater Drain System







Figure 4.5 – Structural Stormwater Management Practices



Stormwater Drain System Not Owned by the City of Minneapolis

Stormwater drain networks owned and operated by other public agencies are interconnected with the City of Minneapolis stormwater drain system. Cooperative agreements that govern the construction, operation, and maintenance are discussed in Section 2 – Regulatory Requirements, Goals, and Policies, of this WRMP.

Infrastructure related to non-City systems are described below and are not included in the inventories presented in this WRMP.

Minnesota Department of Transportation

MnDOT owns surface drains and deep tunnels that serve the interstate highway system. There are areas of the Minneapolis stormwater system that drain into these storm drains adjacent to interstate highways. For stormwater drains associated with trunk highways, the reverse is generally true – the MnDOT system drains into the City stormwater system. According to Minneapolis GIS database, the MnDOT storm drainage system in the City consists of 10 miles of deep tunnel, 74 miles of storm drains, 1,580 catch basins, 3,973 manholes, 15 grit chambers, and 14 outfalls. As owner of a stormwater drain system, MnDOT is subject to the United States Environmental Protection Agency (EPA) Municipal Separate Storm Sewer System (MS4) Phase II stormwater permit requirements.

University of Minnesota

The University of Minnesota, Minneapolis campus, owns a surface drain and deep tunnel stormwater drain network that discharges directly to the Mississippi River. This system serves the original campus area of the University, an area southeast of University Avenue and 15th Street Southeast. The newer campus areas drain to the Minneapolis system. According to Minneapolis GIS database, the University of Minnesota drainage system within the City consists of 1.2 miles of deep tunnel, 8.2 miles of storm drains, 95 catch basins, 618 manholes, 1 pump station, 12 grit chambers, and 18 outfalls. As owner of a stormwater drain system, the University of Minnesota is subject to the EPA MS4 Phase II stormwater permit requirements.

Hennepin County Public Ditches

Hennepin County is responsible for County Ditch 13, which is also known as Shingle Creek. The section of Shingle Creek from the City border with Brooklyn Center to approximately Humboldt Avenue North is designated as County Ditch 13, as shown in Figure 4.6. For purposes of water quality improvements in this Water Resources Management Plan (WRMP), County Ditch 13 is considered a public water. The Minnesota Department of Natural Resources (MNDNR), however, does not have jurisdiction to issue permits or otherwise approve any improvements to this waterbody. Permission to connect to, or construct, improvements along this ditch must be obtained from Hennepin County.

As a road authority, Hennepin County owns the gutters and catch basins system within its right-of-way and the City owns the storm drains. For the most part, this storm sewer system drains into the City stormwater system. As the owner of a stormwater drain system, and owner of the Ditch, Hennepin County is subject to EPA MS4 Phase II permitting requirements.





Figure 4.6 – Public Ditches in the City of Minneapolis



Minnehaha Creek Watershed District Public Ditches

Since 1972, the Minnehaha Creek Watershed District (MCWD) serves as the authority for all county or judicial ditches that exist within the area of their jurisdiction. Ditches number 29, 14, and 17, shown in Figure 4.6, all drain from the west into Lake Calhoun. Each of these ditches has been constructed as an underground stormwater drain and is interconnected with the City system. As owner of these ditches, the MCWD is subject to EPA MS4 Phase II permitting requirements.

If the MCWD initiates the process to abandon a County Ditch, the City would consider acceptance of the stormwater drain segments provided the sewers are upgraded to be equivalent to current City standards for maintenance, condition, and capacity. City standards that would apply include:

- Maintenance standards that require manholes and other structures to be accessible and maintainable using City-owned equipment.
- Condition standards that ensure the structure has a minimum remaining service life of 50 years.
- Capacity standards that require that the structure is fully capable of conveying the runoff from a 10-year rainfall event and that any flooding occurring during a 100-year event does not impact primary structures.
- Fully established easements and access to these easements where the ditch crosses private properties.
- Abandonment of the public ditch is in accordance with procedures defined in the Minnesota Ditch Law, <u>Minnesota Statute 103E.811.</u>

Bassett Creek Watershed Management Commission

The Bassett Creek Watershed Management Commission (BCWMC) shares with the City and MnDOT the responsibility for the operation, maintenance, and repair of the Bassett Creek culvert/tunnel that was constructed to convey the main flow of Bassett Creek within the deep tunnel system associated with Interstate 394. Section 5.1.1.3 of their <u>2015 Watershed Management Plan</u> notes that BCWMC accepts responsibility for management and monitoring of their trunk culvert/tunnel system. This plan requires that the City and other tributary cities obtain approval from the BCWMC prior to altering the physical structure or altering the hydrology of the area tributary to the culvert or tunnel. Location of this tunnel is shown in Figure 3.9 in Section 3 – Land and Surface Water Inventory and Assessment.

Infrastructure Service Area, Capacity, and Design Standards Sanitary Sewer System

The City, as a fully-developed city, has an extensive sanitary sewer collection system that does not have any significant areas without access to sanitary sewers. Therefore, there is no need to extend sanitary sewers. If a unique parcel or development does require extension or alteration of a sewer, then the City will work with the property owner or developer to modify the sewers, as needed. Typically, the costs of new sanitary sewer construction where no sewer presently exists are assessed to the property owner in accordance with the City's special assessments policies and procedures.



Interceptor Service Areas

Twenty-Seven (27) Metropolitan Council Sanitary Sewer Service Areas are located within the City. These areas range in size from the smallest, area MN-305 serving 35 residents (3 acres), to the largest, area MN-344 serving 49,164 residents (5,137 acres), per the 2010 census records.

Each Sanitary Sewer Service Area was evaluated using the City's geodatabase and census data to identify service area boundaries, land use within each area, and population. Table 4.5 summarizes the area and population for each area, as shown in Figure 4.7. Appendix G contains detailed statistics on year 2010 land use, population, and households for each Metropolitan Council Sanitary Sewer Service Area. Appendix H includes population projections through 2040, also broken down by Metropolitan Council Sanitary Sewer Service Area.

Sanitary Sewer Service Area	2010 Population	Area (acres)
7026	4,708	518
8255	28,822	2,427
8754	197	67
MN-300	22,560	3,209
MN-301	3,297	521
MN-302A	558	103
MN-302N	2,935	972
MN-302S	4,288	357
MN-303	3,852	615
MN-305	35	3
MN-306	586	216
MN-310	63,650	4,373
MN-311	2,242	242
MN-312	3,221	425
MN-313	1,074	112
MN-314	907	94
MN-315	4,151	589
MN-316	7,69	754
MN-320	36,435	3,443
MN-330	41,716	2,500
MN-340	15,018 °	2,203
MN-341	65,913	4,755
MN-342	478	47
MN-343	2,287	230
MN-344	49,164 °	5,137
MN-345	7,542	744
MN-346	9,247 °	979

Table 4.5 – Population and Area for Each Metropolitan Council Sanitary Sewer Service Area

^a Population and area does not include sanitary service to properties not within the City of Minneapolis municipal boundary








Flows from Outside the City of Minneapolis

In addition to the wastewater flows from properties within the City limits, there are several connections to the sanitary sewer system from sources located outside the City. These sources are categorized into two groups:

- 1. Government-owned properties in the Fort Snelling area.
- 2. Individual properties that connect to the sanitary sewer on a border street.

Government Properties in the Fort Snelling Area

Fourteen agencies in the Fort Snelling area have agreements with the City of Minneapolis for water and sewer service. The primary contributor of wastewater is the Metropolitan Airports Commission, with 214 million gallons (MG) of wastewater discharged in 2015, which represents approximately 76 percent of wastewater flows from the entire Fort Snelling area. The second largest contributor is the Minneapolis Veterans Affairs (VA) Medical Center with 55 MG, or 20 percent, in 2015. A complete list of agencies and 2015 wastewater flow contributions is contained in Appendix I. Copies of the interagency water/sewer agreements are available from the Minneapolis Public Works Water Treatment and Distribution Division. This area is shown in Figure 4.8.

Individual Connections from Outside Minneapolis

A total of 135 properties outside the City connect to the City sanitary sewer system on border streets. These are summarized in Table 4.6. These properties receive permits from the City for these connections and receive direct monthly water/sewer bills from the City of Minneapolis Utility Billing. There are no inter-city agreements that oversee these connections.

City	Number of Sanitary Sewer Accounts
Brooklyn Center	12
Edina	71
Golden Valley	16
Robbinsdale	4
Saint Anthony	18
Saint Louis Park	11
Saint Paul	3
Total	135

Table 4.6 – Sanitary Sewer Connections from Outside the City of Minneapolis

A complete list of properties that are outside of the City but connect to the sewer system is contained in Appendix I.





Figure 4.8 – Fort Snelling Agreement Service Area



Projection of Wastewater Flows

Wastewater flows in the City's sewersheds were calculated in 2010 and projected to estimate flows through the year 2040. These flow projections are used primarily to identify capacity limitations in the sewer system.

Methodology

In 2016, a base year flow was developed for each Sanitary Sewer Service Area, based on year 2010 City water billing data. Water billing was divided into residential water use and non-residential water use; water billed to residential properties was assumed to be residential and multiple dwelling water use and water billed to non-residential properties was assumed to be commercial, industrial, and government water use.

Water use was then converted into wastewater flows by assuming:

- Water consumed in the winter quarter multiplied by 4 equals the annual residential wastewater flow.
- Non-residential water consumed over the year equals the annual commercial, industrial, and government wastewater flow.

Residential and non-residential wastewater flows were then assigned to each of the City's 27 Sanitary Sewer Service Areas. Flow was allocated to each area proportional to the area's land use. For example, if an area contains 10 percent of the City's residential population, this area is assigned 10 percent of the residential wastewater flow. Employment was used for non-residential use and population was used for residential use.

For wastewater flow projection, it was assumed that per capita water use will not change in the future. Population and employment changes in each Sanitary Sewer Service Area were identified. This projected change in population and employment was obtained from the Transportation Analysis Zone (TAZ) developed by the Metropolitan Council of the City base year 2010 and projected years of 2020, 2030, and 2040. The per capita wastewater flow was then applied to projected population for each area to identify the projected wastewater flows. An in-depth description of this approach is contained in Appendix H.

Results

Table 4.7 summarizes projected wastewater flows for each Sanitary Sewer Service Area through the year 2040. In general, flows are expected to increase the most between 2010 and 2020, and then exhibit smaller changes through 2040.



Sanitary Sewer Service Area	2010 Total Wastewater Flow (actual gallons per year)	2020 Total Wastewater Flow (projected gallons per year)	Percent Change 2010- 2020	2030 Total Wastewater Flow (projected gallons per year)	Percent Change 2020- 2030	2040 Total Wastewater Flow (projected gallons per year)	Percent Change 2030- 2040
7026	136,491,929	175,437,000	29%	188,951,000	8%	204,538,000	8%
8255	850,071,695	985,062,000	16%	1,027,382,000	4%	1,0722,475,000	5%
8754	8,594,777	9,417,000	10%	9,602,000	2%	9,833,000	2%
MN-300	841,545,263	953,210,000	13%	1,000,479,000	5%	1,055,639,000	6%
MN-301	124,186,467	126,727,000	2%	132,385,000	4%	139,188,000	5%
MN-302A	16,407,442	29,334,000	79%	34,087,000	16%	38,890,000	14%
MN-302N	267,224,048	290,080,000	9%	310,757,000	7%	330,982,000	7%
MN-302S	254,143,488	286,868,000	13%	312,134,000	9%	338,409,000	8%
MN-303	84,771,450	94,283,000	11%	93,332,000	-1%	93,581,000	0%
MN-305	737,942	821,000	11%	813,000	-1%	816,000	0%
MN-306	22,924,447	25,231,000	10%	25,218,000	0%	25,445,000	1%
MN-310	3,991,834,316	4,517,466,000	13%	4,822,333,000	7%	5,129,809,000	6%
MN-311	48,572,405	50,598,000	4%	49,912,000	-1%	50,144,000	0%
MN-312	68,544,613	74,332,000	8%	73,155,000	-2%	73,142,000	0%
MN-313	20,786,199	22,982,000	11%	22,487,000	-2%	22,254,000	-1%
MN-314	17,569,888	19,432,000	11%	19,014,000	-2%	18,818,000	-1%
MN-315	91,962,610	103,571,000	13%	102,644,000	-1%	103,06,000	0%
MN-316	153,611,717	169,658,000	10%	165,779,000	-2%	163,987,000	-1%
MN-320	1,117,081,852	1,254,908,000	12%	1,341,470,000	7%	1,437,683,000	7%
MN-330	1,294,416,457	1,457,336,000	13%	1,534,396,000	5%	1,620,415,000	6%
MN-340	350,392,715	414,714,000	18%	435,105,000	5%	458,722,000	5%
MN-341	1,460,362,781	1,515,996,000	4%	1,537,297,000	1%	1,572,909,000	2%
MN-342	9,802,359	9,998,000	2%	9,641,000	-4%	9,544,000	-1%
MN-343	50,846,946	54,496,000	7%	52,374,000	-4%	51,454,000	-2%
MN-344	1,079,983,010	1,120,847,000	4%	1,101,962,000	-2%	1,100,797,000	0%
MN-345	155,329,505	160,343,000	3%	155,557,000	-3%	153,880,000	-1%
MN-346	186,171,528	203,117,000	9%	198,961,000	-2%	197,704,000	-1%
Total	12,704,367,848	14,126,265,000	11%	14,757,227,000	4%	15,479,117,000	5%

Table 4.7 – Projected Wastewater	Flow for City of Minneapolis	Sanitary Sewer Service Areas
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It should be noted that the total flows computed for 2010, which equates to a daily average of 34 million gallons per day (MGD), represents the volume based on water billing records. The total volume recorded by the Metropolitan Council for 2010 equates to an average daily flow of 44 MGD, as reported in <u>Appendix A of the Metropolitan Council Water Resource Policy Plan</u>. This difference of 10 MGD is an aggregate of wastewater that originates from multiple sources, including:

- I/I contributions to the City sanitary sewers, as described in the following section.
- I/I contributions to the Metropolitan Council interceptors that are within the City.



- Temporary groundwater discharges from remediation sites.
- Non-metered flows from 135 individual sanitary sewer connections that are outside of the City, plus the 14 agencies in the Fort Snelling area.

Insufficient information exists to assign the portion of the 10 MGD to these four categories of wastewater contributions nor to any of the 27 individual Sanitary Sewer Service Areas. It can be assumed that the total additional flows represent an average value that will not increase between 2010 and 2040. This contribution is likely to decrease as the City continues to identify and eliminate sources of I/I from its sanitary sewer collection system, as described in additional detail in the following section.

Inflow/Infiltration Flows

Extraneous, clear water (i.e., non-sewage) continues to enter the sanitary sewer as I/I. As shown in Figure 4.9, the 2016 sources on I/I in the City system primarily consist of:

- Groundwater infiltration through damaged sewer infrastructure.
- Rooftop rain leaders with direct connections to the sanitary sewer system.
- Street runoff catch basins with direct connect to the sanitary sewer system.
- Foundation drain and sump pump connections to sanitary sewers that have been installed to prevent groundwater damage to basements.

Figure 4.9 – Typical Sources of Inflow/Infiltration



Source: CDM Smith



In 1999, the City and the Metropolitan Council executed a Memorandum of Understanding (MOU) to conduct a combined sewer overflow (CSO) evaluation study. The study concluded that removal of all public inflow sources, such as catch basin connection, would not eliminate the occurrence of CSO events. Recommendations include a combination of inflow reduction, regulator modifications, and inline storage. The City began Phase II of their CSO program in 2002 with two primary goals:

- 1. Continued identification of unidentified street catch basin connections to the sanitary sewers and prioritization for elimination.
- Identification and elimination of private sources of I/I, further described in Section 5 Regulatory Controls and Water Resource Management Program.

In 2007, Metropolitan Council established I/I goals for all communities that discharge into their treatment system to further reduce excess flow that had created capacity problems in their regional interceptor system and at the wastewater treatment plants. Communities that were identified with excess flow, which included Minneapolis, were required to develop and implement an I/I reduction program.

The City reviewed its 1999 Phase II CSO program and concluded that the actions established in 2002 were on track to meet the 2007 Metropolitan Council I/I reduction goals. Additionally, activities were implemented in 2008 to further reduce I/I and document compliance with Metropolitan Council goals. These activities, which have continued through 2018, include:

- Flow meters installed at 50 sites each year.
- Smoke testing of sanitary sewers to identify unknown catch basin connections and damaged bulkheads.
- Review of record drawings followed by field inspections to identify cross-connections between the sanitary sewer and stormwater drains.
- Repair to manholes and bulkheads that were identified as damaged or with high rates of infiltration.

As a result, significant reductions in right-of-way acreage connections to the sanitary sewers have been accomplished, as shown in Table 4.8.



Year	Acres Removed Per Year	Cumulative Acres Removed Since 2003
2003	16.8	16.8
2004	30.1	46.9
2005	8.1	55.0
2006	19.6	74.6
2007	208.7	283.3
2008	22.7	306.0
2009	37.7	343.7
2010	5.3	349.0
2011	86.2	435.2
2012	12.2	447.4
2013	32.3	479.7
2014	44.2	523.9
2015	19.2	543.1
2016	13.2	556.3

Table 4.8 – Catch Basin Drain Area Removed from Sanitary Sewers

The success of the City programs and policies aimed at elimination of catch basin and rooftop connections (described in Section 5 – Regulatory Controls and Water Resource Management Programs) to the sanitary sewer system are evident in the reduction of total annual volume of CSO discharge at the seven CSO regulators. Figure 4.10 shows that there has been no CSO discharges to the Mississippi River since 2006 that were caused by rainfall events. The event in 2010 was determined to be due to infrastructure condition, not a lack of sanitary sewer capacity.





Figure 4.10 – Combined Sewer Overflow Volume and Precipitation, 1984 to 2016

Source: Minneapolis Public Works, Division of Surface Water and Sewers

Efforts to eliminate stormwater runoff connections to the sanitary sewers will persist as the City continues to identify catch basin and other sources of clear water to the sanitary sewers.

In March 2018, the City and the Metropolitan Council executed another MOU to direct their future efforts to coordinate the study of and investment in their connected sanitary sewer infrastructure. Consistent with the MOU, the City and the Metropolitan Council are initiating a comprehensive study of the City and the Metropolitan Council sanitary systems. The goals of that study, which will be completed during multiple phases, include identifying areas in the City with high I/I that contribute to increased risk of CSO events and highlighting how these areas related to areas where the Metropolitan Council's system is capacity limited. Areas identified as having I/I that contributes to risk of CSO and limited capacity will be prioritized for future investment by the City and the Metropolitan Council. Additionally, the study will evaluate the cost/benefit of alternatives to reduce the risk of CSOs, reduce I/I, and increase capacity. Alternatives to be studies include making potential changes to the remaining regulators in the City.

Efforts by the City and Metropolitan Council through 2017 are published annually in the <u>CSO Annual</u> <u>Report</u>. Beginning in 2019 for calendar year 2018, the City will issue a single CSO/Stormwater annual report.



Trunk Sewer Design Capacity

Generally, the trunk sewers in the City are defined as those sewers that convey flow from the local sewers to the Metropolitan Council interceptors. As described in previous sections, the City's trunk sewer system was designed as a single-pipe, combined sewer system. As a result of efforts to disconnect stormwater runoff from the sanitary sewer, much of the current sanitary sewer system is oversized for sewer flows. Specific data on the capacity and flow projections for all trunk sewers are contained in Appendix H.

Stormwater Drain System Capacity

The City has a fully developed stormwater drain system that captures and conveys runoff to the surface waters, as described in Section 3 – Land and Surface Water Inventory and Assessment. The system continues to expand, as needed, based on these primary needs:

- Extension of a stormwater drain to capture the runoff from catch basins and/or roof drains formerly connected to the sanitary sewer.
- Extension of a stormwater drain to access a new stormwater service connection to accommodate changes or redevelopment of a private property.
- Installation of a relief stormwater drain or stormwater storage area to resolve ongoing street and property flooding caused by insufficient capacity of the system.

Stormwater Pipeshed Area Inventory

The 419 stormwater outfalls inventoried in Table 4.9 discharge stormwater runoff to the 22 lakes, four streams, and the Mississippi River, as described in Section 3 – Land and Surface Water Inventory and Assessment. Note that this table includes only those surface waters that receive stormwater runoff from the Minneapolis stormwater drainage system, which does not include all surface waters in the City. Figure 4.11 shows all stormwater pipeshed areas in the City. Also note that these pipeshed areas represent the area drained by the Minneapolis stormwater catch basins, pipes, and outfalls, which is not the total drainage area for the waterbodies inventoried in Section 3. The pipeshed areas for each of these stormwater outfalls was initially delineated in 1991 to comply with the EPA stormwater regulations described in Section 2 – Regulatory Requirements, Goals, and Policies. Since that time, areas and impervious surface percentages have been adjusted as necessary to reflect updated information or to accommodate changes caused by a construction project. The information contained in this WRMP is based on a comprehensive review and update of the City's delineation that was completed in 2018. Therefore, there may be some significant changes when compared to the pipesheds reported in the 2006 Local Surface Water Management Plan. Appendix J contains this detailed inventory of the updated delineated areas, including the land use and total pipeshed area for each stormwater outfall.



Surface Water	Stormwater Runoff Pipeshed Area (acres)	Pipesheds (count)
Bassett Creek	1,493	20
Birch Pond ^a	16	1
Brownie Lake	66	5
Cedar Lake	216	10
Crystal Lake ^a	421	1
Diamond Lake	635	11
Grass Lake	318	10
Lake Calhoun/Bde Maka Ska	1,188	25
Lake Harriet	1,097	21
Hart Lake ^a	3	1
Lake Hiawatha	1,217	6
Lake of the Isles	689	20
Lake Nokomis	652	13
Legion Lake ^a	2	1
Loring Lake	7	3
Minnehaha Creek	3,061	116
Mississippi River	19,736	141
Mother Lake ^a	3	1
Powderhorn Lake	278	5
Richfield Lake ^a	58	2
Ryan Lake	56	1
Shingle Creek	1,378	38
Silver Lake ^a	25	1
Spring Lake	39	3
Taft Lake ^a	139	2
Wirth Lake ^a	37	2

Table 4.9 – City of Minneapolis Stormwater Pipesheds

^a Waterbodies located outside of the City of Minneapolis





Figure 4.11 – City of Minneapolis Stormwater Runoff Pipeshed Areas



Note that nearly all stormwater pipesheds drain to surface waters that are within the City. The exceptions are for a pipeshed that drains to Crystal Lake in the City of Robbinsdale (1), Hart Lake in the City of Columbia Heights (1), Silver Lake in the Village of Saint Anthony (1), Legion Lake in the City of Richfield (1), and Richfield Lake in the City of Richfield (0). These pipesheds are inventoried in this WRMP; Section 3 does not include these lakes outside the municipal boundaries of the City of Minneapolis.

There are no significant land-locked pipeshed areas; however, very small pockets of privately-owned land-locked areas exist that are not inventoried by the City. Land-locked waterbodies, including Loring Pond and Powderhorn Lake, are inventoried in Section 3 – Land and Surface Water Inventory and Assessment.

Stormwater Drain Hydraulic Standards

The primary function of the stormwater drain system is to convey the peak flows generated by storm events is to prevent damage to infrastructure and private properties. The current stormwater drain criteria, effective for projects constructed in 2016 and later, considers:

- Rainfall depths based on Minneapolis-based Atlas 14 precipitation with MSE3 rainfall distribution.
- Pipes sized to convey the peak flows generated by a 10-year rainfall event.
- The 10-year, 24-hour rainfall event cannot result in water ponding or flooding on streets.
- A 100-year, 24-hour rainfall event may result in water ponding or flooding but cannot result in flooding of an occupied structure.

The hydraulic capacity criteria for the City's stormwater drains has changed since the 1930s, evolving from 2-year to 5-year to 10-year rainfall events, and from 1-hour to 24-hour rainfall durations. As a result, segments of the system have insufficient capacity and experience pressurization and/or surface floods during relatively small rainfall events. Over time, the City has corrected some of the most severe of these problems through the Flood Mitigation Program.

The City has developed a city-wide model of the stormwater drain system that is complete as of late 2017. The models will be used to assess capacity, discharge rates, and runoff volumes generated in each of the 406 unique stormwater pipeshed areas in 2018. This model will be used to identify capacity problems, prioritize flood improvements, and evaluate water quality improvement opportunities. Figure 4.12 shows the differentiation of the hydraulic and hydrologic (H&H) models that have been developed.

Once this assessment is complete, the City will identify the remaining areas of known flooding to determine the need for additional stormwater conveyance capacity or storage capacity.

The <u>City of Minneapolis Stormwater and Sanitary Sewer Guide</u> contains hydrologic, hydraulic, and water quality input parameters recommended for all models developed for the City.





Figure 4.12 – Hydrologic and Hydraulic Modeling Areas



Stormwater Management Practices Design Standards

The City considers the <u>Minnesota Stormwater Manual</u>, prepared by the MPCA, to be the City's approved design manual for structural stormwater management practices.

System Operation and Maintenance Activities Sanitary Sewer System Operation and Maintenance

The City's Public Works Surface Water and Sewers Division – Sewer Operations Section routinely inspects and maintains the sanitary sewer system to ensure the system functions properly. As of 2017, the City has implemented an asset management system that prioritizes sanitary sewer inspection and maintenance based on age of the system, asset criticality, and results from previous inspections. The City's sanitary sewer system has been digitized in a geodatabase and each asset includes attribute information. This geodatabase, which is updated regularly, is used for the asset management system, locating, modeling, and planning/analysis.

The City is responsible for maintenance of the sanitary sewer pipes in the public right-of-way (ROW) and ensuring access for private connections.

The following inspection and maintenance procedures are followed:

- Manhole castings are inspected, cleaned, and replaced, as necessary.
- Manhole rings are inspected and replaced, and/or re-grouted, as necessary.
- Manhole structures are inspected and are repaired or replaced, as needed. Pipe inverts, benches, steps (verifying integrity for safety), and walls are checked. Cracked, deteriorated, and spalled areas are grouted, patched, or replaced.
- Sewers with low flows and/or build-up of material in the invert are cleaned, as needed.
- Lift stations are periodically inspected and monitored to ensure efficient and reliable operation. Pumps are maintained in accordance with manufacturer requirements and are assessed annually.

Sanitary sewer pipes are targeted to be cleaned every 8 to 24 months, depending on pipe size and method of cleaning. Areas with a history of heavy root infestation or high levels of Fats, Oils, and Grease (FOG) typically require a higher level of maintenance and are scheduled for more frequent cleaning.

Routine inspections of the sanitary sewers have identified sewer segments that have defects that weaken the structural integrity of the pipe and/or allow for infiltration of groundwater which contributes to I/I flows. The City has opted to rehabilitate these pipe segments with a technique termed Cured-in-Place Pipe Lining (CIPP). CIPP is a trenchless method used to install a liner that results in a new pipe that is internally attached to the old pipe. The liner strengthens the pipe, plus joints and cracks are sealed to eliminate groundwater infiltration. A Capital Improvement Program that annually funds CIPP lining is further described in Section 6 – Planning and Implementation. Since 2010, this program has funded the lining of 53 miles of sanitary sewer, as detailed in Table 4.10.



Year	CIPP Length (miles)
2010	3.8
2011	5.3
2012	8.1
2013	7.8
2014	6.0
2015	6.3
2016	7.0
2017	6.5

Table 4.10 – Sanitary Sewer Cured-in-Place Pipe Rehabilitation Since 2010

The City is in the process of development of a FOG Control Program. The goal of the program is to aid in preventing the introduction and accumulation into the public sanitary sewer system of fats, oils, and grease from food service establishments and other industrial or commercial establishments generating wastewater that will cause or contribute to sanitary sewer blockages and obstructions.

Stormwater System Operation and Maintenance

Stormwater Drain System Operation and Maintenance

The Public Works Surface Water and Sewers Division – Sewer Operations Section periodically inspects and maintains the stormwater drain system to ensure the system properly functions, and as required after significant rain events. As of 2017, the City has implemented an asset management system that prioritizes stormwater drain and stormwater management practice inspection and maintenance based on age of the system, asset criticality, and results from previous inspections.

Generally, inspection and maintenance procedures include:

- Street maintenance staff inspect and clean basin grates on street sweeping routes during the nonsnow months.
- Catch basin and manhole castings are inspected and replaced and/or re-grouted, as necessary.
- Catch basin and manhole rings are inspected and replaced and/or re-grouted, as necessary.
- Catch basin and manhole structures are inspected and are repaired or replaced, as needed. Pipe inverts, benches, steps (verifying integrity for safety), and walls are checked. Cracked, deteriorated, and spalled areas are grouted, patched, or replaced.

Specific information on annual maintenance activities for the stormwater drain system is detailed in the City's <u>NPDES Annual Report</u>.



Catch Basins

To maximize stormwater drain capacity, catch basins (also called inlet structures) are kept operational to allow runoff to flow into underground stormwater drains. Leaf and lawn litter are the most frequent causes of inlet obstructions. The City performs routine visual inspections and cleaning of catch basins and inlets to avoid flow restrictions and localized flooding. Additionally, the City manages an Adopt-a-Drain program that has volunteers removing debris from the catch basin. This program is described in Section 5 – Regulatory Controls and Water Resource Management Programs.

Catch Basin Clogged with Debris



Credit: Minneapolis Public Works

Piping

The City's stormwater drain system has been digitized in a geodatabase and each asset includes attribute information. This geodatabase, which is updated regularly, is used for the asset management system, locating, modeling, and planning/analysis.

Pump Stations

Pump stations are periodically inspected and monitored to ensure efficient and reliable operation. Pumps are maintained in accordance with manufacturer requirements and are assessed annually.

Grit Chambers, Sump Manholes, and Sump Catch Basins

Grit chambers, sump manholes, sump catch basins wet vaults, and hydrodynamic separators are used to collect sediment before it can be transported to downstream waterbodies. Sediment originates primarily from road sanding operations, construction, and soil erosion. These features are installed in stormwater drainage systems as it is more cost-effective to vacuum sediment from a structure than it is to dredge from a waterbody.

Goals:

- Public safety.
- Prevent erosion.
- Protect and improve water quality and ecological function.

Grit Chamber During Construction



Credit: Minneapolis Public Works

 Slow water movement, hold or convert pollutants, and enhance infiltration and evapotranspiration.



- Conduct preventive maintenance for longevity of infrastructure.
- Control invasive species (non-native and selected native species) growth and prevent the production and dispersal of seeds.
- Create a wildlife habitat.
- Provide a neat and attractive appearance.

The City uses suction vacuum equipment to clean these sediment removal structures. For each cleaning, maintenance staff records:

- Quantities of sediment removed.
- Quantities of floatable materials removed.
- The presence of oil.
- The date of cleaning.

Substances removed from grit chambers are combined with debris collected by street sweepers and are properly disposed in accordance with state requirements and specific requirements set by landfill operators.

As part of ongoing work to address the bacteria impairment in Minnehaha Creek, the Public Works Department is testing new procedures in the operation and maintenance of grit chambers within the Minnehaha Creek watershed area. During routine cleaning operations, grit chambers are de-watered into the sanitary sewer system to prevent the discharge of pollutants into the creek. This decision was made after monitoring data from the Minnehaha Creek Bacteria Study indicated that there are elevated levels of bacteria found in the ponding water inside the grit chambers. These protocols will be implemented City-wide after the procedures are fully developed and tested.

Stormwater Management Sites Inspection and Maintenance

Minneapolis Stormwater Management Sites

The City has made substantial investment in stormwater flood control and water quality basins as an integral part of its drain system, which has resulted in numerous flood basins, water quality ponds, and bioretention facilities (rain gardens, infiltration trenches). Frequent and effective maintenance of these facilities helps ensure proper performance and reduces the need for major repairs. Periodic inspections are performed to identify possible problems in and around basins, basin outlets, basin inlets, and side slopes. Maintenance and removal of sediment buildup is performed based on the findings of these inspections.

Vegetation at the stormwater management sites is important to their overall functionality, and the City uses a specialty vegetation management contractor to provide high-quality management and plant materials. Native plant materials are used throughout the system, and species that support pollinators are used at select locations. The City maintains stormwater management sites by the following inspection and maintenance activities:



- Areas around outlets are kept free and clear of debris, litter, and heavy vegetation.
- Trash guards are installed and maintained over outlets to prevent clogging of the downstream stormwater drain. Trash guards are inspected at least once per year, typically in the spring, to remove collected debris.
 Problem areas are addressed more frequently, as required.
- Vegetated channel sections are inspected for signs of erosion, which is repaired by vegetation replacement.
- Emergency overflow outlets are provided for all basins, when possible. These are kept clear of debris and other materials and protected against erosion.
- Inlets are inspected for erosion. Where erosion occurs near an outlet, energy dissipaters or riprap is installed.
- Inlets are inspected for sediment deposits, which can form at the inlets due to upstream erosion. Sediment deposits are removed to ensure that design capacities of stormwater drains entering the basin are maintained.

Stormwater Infiltration Basin in Heritage Park



Credit: SRF

- Side slopes are kept well-vegetated to prevent erosion and sediment deposition into the basin.
 Severe erosion alongside slopes can reduce the quality of water discharging from the basin and increase the need for dredging of sediments from the basin.
- Noxious weeds are removed periodically from the area surrounding basins. Prescribed burns are used for this purpose at some locations.
- Some basins in highly developed areas require mowing. If mowing is performed, a buffer strip of 20 feet or more adjacent to the normal water level is typically maintained. This provides filtration of runoff and provides wildlife habitat.
- Basins are inspected to determine if sediment buildup is causing significant loss of storage capacity. Excessive sediment buildup significantly reduces the stormwater treatment efficiency of water quality ponds. Inspections occur after significant rainfalls.
- Sediment removal is performed where excessive sediment buildup has occurred. As a general guideline, ponds require dredging every 15 to 20 years or when the basin is approximately half full of sediment.

Some of the City's stormwater management sites are conducive to providing additional ecosystem services (i.e., habitat, shade, air quality improvement, places for residents to stroll, sit, and observe nature). The Public Works Department is planning additional pollinator forage at its stormwater management pond properties. "Plants for Pollinators" neighborhood events have been held at the South



43rd Street and Park Avenue site (2016) and the Shingle Creek South stormwater pond (2017). A 2018 site is yet to be selected.

MCWD Chain of Lakes and Lake Nokomis Stormwater Management Sites

Stormwater ponds and wetlands at Cedar Lake, Lake Calhoun/Bde Maka Ska, and Lake Nokomis were built as a partnership of the City, the MPRB, the MCWD, and the City of Saint Louis Park with funding assistance from the MPCA. These facilities are on the MPRB land and are managed by the MPRB in partnership with the MCWD. Specifically, the MCWD maintains the vegetation, provides sediment removal (as needed), and is responsible for major repairs at the Nokomis Ponds, Calhoun Pond, and Cedar Meadows Pond. The MPRB conducts routine inspections and provides daily maintenance services including litter removal at these ponds. Additionally, the MPRB conducts all pond inspection and management for the Hiawatha Detention Ponds, which are located within the Hiawatha Golf Course. The City maintains the storm drains associated with all of these facilities.

SCWMC Stormwater Management Sites

The Shingle Creek Watershed Management Commission is initiating a field trial application of a new technology to help reduce bacteria such as E. coli in stormwater. Biochar, a specially engineered type of ground charcoal, added to iron-enhanced sand filters has been effective in lab experiments at removing bacteria in synthetic stormwater. The SCWMC is conducting three field trials to test the effectiveness of these filters at treating real world stormwater runoff by adding the substance to stormwater pond iron-enhanced sand filter placed in storm sewer catch basins, to a filter bed to treat flow diverted from Shingle Creek. Construction occurred in 2017 and effectiveness monitoring will be conducted through 2018.

SCWMC conducted a subwatershed assessment in Minneapolis is 2017. A subwatershed assessment is an intensive study of small areas of land to identify the best locations for small BMPs such as rain gardens, tree trenches, and bioinfiltration basins. This assessment will include the entire area in the City that drains to Crystal Lake in Robbinsdale. Results are expected in 2018.

BCWMC Flood Control Structures

The BCWMC has adopted a set of policies that outline schedules, procedures, and responsibilities regarding the inspection and maintenance of the Flood Control Project (FCP) structures. These structures were installed as part of a multi-year, multi-phase project that was completed in 1992 through a partnership between the Army Corps of Engineers, MnDOT, and the nine-member cities of the BCWMC. According to those policies, the BCWMC will continue an inspection and maintenance program for the FCP structures. All non-tunnel structures are inspected annually. The double box culvert is inspected at least once every five years. The 3rd Avenue Deep Tunnel, in conjunction with the MnDOT I-94 tunnel inspection, is inspected every five years and the 2nd Avenue Deep Tunnel is inspected every 10 years. The BCWMC fully funds the FCP inspections, unless more frequent inspections or more complicated inspections beyond the currently used National Association of Sewer Services Companies (NASSCO) Assessment and Certification Program (PACP) is requested or required. Member cities, including Minneapolis, will perform initial responses to emergency situations, with the costs to be reimbursed by the BCWMC. Member cities are also responsible for the upkeep of road crossings.



The BCWMC Engineer submits inspection reports to the City regarding the condition and maintenance and repair needs for the FCP structures. The City is responsible for the work identified by the BCWMC Engineer and for the routine maintenance and repairs not otherwise identified by the BCWMC. The City formally notifies the BCWMC Engineer regarding all completed maintenance and repair actions. The inspection and reporting are essential to ensure that the Commission maintains its eligibility to receive federal funds to repair or replace flood control project features in the event of a catastrophe.

Figure 4.13 shows the location of BCWMC FCP structures located within the City.





Street Maintenance

In accordance with EPA regulations, urban street gutters are considered to be part of the stormwater drain system. Therefore, street maintenance is integral to maintenance of the stormwater drain and surface water systems.

Winter Street Maintenance Practices

The City of Minneapolis receives an average of 54 inches of snow per year (see Table 3.2 – Snowfall Monthly Average in the City of Minneapolis). Heavy snows require application of deicing chemicals (e.g., salt) on roads and sidewalks each winter for public safety. Studies indicate that an estimated 80 percent of the environmental damage caused from deicing chemicals is a result of improper storage and



handling of the material (MPCA, 1989). Improper storage and overuse of salt increases the risk of high chloride concentrations in runoff and groundwater (<u>MPCA Road Salt and Water Quality</u>). High chloride concentrations can be toxic to fish, wildlife, and vegetation.

The City manages several storage facilities that are designed to meet MnDOT specifications for runoff control. Salt stockpiles are stored under cover to minimize potential for runoff and groundwater contamination.

The primary mission of the City is to provide snow and ice control in a manner that balances the environmental concerns, Hiawatha Avenue Salt Storage



Credit: Minneapolis Public Works

public safety, and cost. The City will continue to implement and improve upon procedures it has established for efficient application of deicing materials. Improvements are constantly being made to reduce costs and minimize environmental damage. Key best management procedures used by the City include:

- Thorough accounting of materials applied to the roads each season.
- Assessment of street conditions after each snow/ice event.
 Application of additional ice control materials are adjusted accordingly to avoid over-treatment.
- Maintenance and calibration of ice control equipment to prevent excessive application.
- Training of maintenance supervisors at the Local Road Research Board (LRRB).



Application of Anti-Icing Brine to Pavement

Credit: Minneapolis Public Works

Snow and ice control is conducted in a

manner that balances the environmental concerns, public safety, and cost.



Street Sweeping

Street sweeping is an integral part of the City's surface water management system. Street sweeping greatly reduces the volume of sediment that must be cleaned from storm drainage structures and from downstream waterbodies.

The City performs two comprehensive city-wide street sweeping events in the spring and fall where approximately 1,100 miles of streets are thoroughly cleaned curb to curb. The spring sweep is intended to collect materials deposited over the winter such as accumulated debris and sand from winter maintenance activities. All 3,700 city alleys, totaling nearly 400 miles, are swept as part of the spring sweep. The fall sweeping program is a comprehensive street sweep and collection of leaves that fall in the street.

In addition to the two major city-wide sweeps, there are additional sweeping operations conducted throughout the non-winter months. The Chain of Lakes and Parkways are swept on a 15-day cycle between the major spring and fall sweeps. The downtown loop and business corridor is swept seven nights per week throughout the spring, summer, and fall, as weather permits. Other major commercial corridors around the City are swept on an approximate 15-day cycle and sweepers are also deployed on a complaint basis throughout the year.

The materials collected from street sweeping are disposed of two ways, based on the nature of the material. The predominantly inorganic materials collected year-round go to a construction demolition landfill site. The predominantly organic materials are disposed of as part of the City's yard waste disposal contract in the fall.

Practices used to optimize the impact of street sweeping include:

- The City enforces temporary parking bans to ensure complete street sweeping.
- Pressurized water is applied to the road to push sediment and leaves into the gutters. A sweeping crew then follows behind the washing crew to clean the gutters.
- A tandem sweeping process is used. Air regenerative sweepers are followed by mechanical sweepers.
- Leaves are collected into piles and sent to a composting facility for disposal.



Spring Street Cleaning



Credit: Minneapolis Public Works

Fall Leaf Collection



Credit: Minneapolis Public Works

Condition and Performance of Sanitary Sewers and Stormwater Drain Systems

Baseline Sanitary Sewer and Stormwater Drain Condition Assessments

The City began a condition assessment program in 2011 to complete closed-circuit television (CCTV) inspection of all small sanitary and stormwater pipes. The goal of this inspection is to develop a baseline assessment of existing pipe conditions throughout the City. As of late-2016, 29 percent of the sanitary system and 72 percent of the stormwater system have been televised. It is anticipated that the baseline condition assessment will be completed by 2024.

The City has budgeted \$6 million to rehabilitate or repair sanitary sewers in 2018, and \$8 million for subsequent years. CCTV inspections are used to prioritize specific areas in need of pipe lining, repairs, and rehabilitation. Rehabilitation is recommended in areas where sewers are either structurally failing, have excessive infiltration of groundwater, or have excessive root intrusion.



CCTV Inspection of Small Diameter Sanitary Sewer (left) and Visual Inspection of Como Avenue SE Storm Sewer (right)





Credit: Minneapolis Public Works

Deep Tunnel System Condition and Hydraulic Capacity Assessment

In 2004, the City developed a Stormwater Tunnel Management Plan. When the plan was developed, the City inspected approximately 15.9 miles of deep stormwater tunnels and assessed structural condition. This survey did not include the tunnels not owned by the City or assessment of the Old Bassett Creek Tunnel, which is inspected as a culvert by bridge inspectors.

To complement the inspections and evaluation of tunnel conditions, hydrologic and hydraulic modeling by the City was performed to determine the hydraulic loading to each tunnel system. The modeling used a simulated 100-year, 24-hour, 6-inch rainfall event over the area tributary to each tunnel system. The results were evaluated and correlated to structural conditions encountered in the inspections.

The hydraulic analysis showed that most tunnels are surcharged when operating. Based on this hydrologic and hydraulic analysis, it was determined that only four of the tunnel systems operate with no surcharge during the 100-year event. These four tunnel systems operate without surcharge because they are relatively short, have large cross-sections, and serve small drainage areas. The rest of the tunnel systems pressurize during the 100-year event. The effect this has on individual tunnels varies and depends on the tunnel's structural condition.

By linking hydraulic results with structural conditions and action levels, the overall condition of each of the tunnel systems is determined. A 2012 re-assessment of all City stormwater tunnel systems was completed. A long-term inspection schedule based on the 2012 inspection results was established.

Stormwater Management Practice Monitoring

In 2001, the City began contracting with the MPRB to conduct stormwater monitoring to comply with NPDES stormwater permit requirements. Between 2001 and 2005, the MPRB collected and tested stormwater runoff at sites in both the City and the City of Saint Paul. In 2006, the monitoring program was reworked to limit monitoring to four sites in Minneapolis, each one representative of a major land use type:

Site 6 – 22nd Street East at Aldrich Avenue South (Multi-Family Residential).



- Site 7 14th Street East at Park Avenue South (Commercial/Industrial/High Density Residential).
- Site 8a Pershing Park (Parkland).
- Site 9 61st Street West at Lyndale Avenue South (Commercial/Industrial).

ISCO flow recorders and automatic samplers are installed within the stormwater manholes at each site. Dataloggers record the rate of flow, and then trigger the collection of stormwater samples. Each site automatically uploads data via cell phone modem to a database server maintained by the MPRB. Each site could also be communicated with remotely using Flowlink Pro software to adjust pacing, enable or disable samplers, and to see if a sampling event has been triggered at each site. Automatic samples are collected spring through fall, limiting equipment damage due to freezing. Grab



ISCO Sampler Set-Up

Credit: Minneapolis Park and Recreation Board

samples are used for collection during winter months.

Effective 2018, each sample is analyzed for the chemical parameters that are listed in Table 4.11.



Table 4.11 – Stormwater Sample Analysis Chemical Parameters, Effective 2018

Parameter	Abbreviation	Units	Sample Type	Frequency
Chloride, Total	Cl	mg/L	 Flow-paced composite samples over non-ice time period (approx. March through Nov.) Grab samples at least two times during typical winter thaw (approx. Dec. through March) 	10 samples per year, select from events 0.10 inch or greater over range of seasons and events
Specific Conductivity	Sp. Cond	µmhos/cm		
E. coli (Escherichia Coli)	E. coli	MPN/100MI		Quarterly (spring, summer, fall, winter)
Hardness, Carbonate	Hard	mg/L	 Flow-paced composite samples over non-ice time period (approx. March through Nov.) Grab samples at least two times during typical winter thaw (approx. Dec. through March) 	10 samples per year, select from events 0.10 inch or greater over range of seasons and events
Copper, Total	Cu	μg/L	 Flow-paced composite samples over non-ice time period (approx. March through Nov.) Grab samples at least two times during typical winter thaw (approx. Dec. through March) 	10 samples per year, select from events 0.10 inch or greater over range of seasons and events
Lead, Total	Pb	μg/L	 Flow-paced composite samples over non-ice time period (approx. March through Nov.) Grab samples at least two times during typical winter thaw (approx. Dec. through March) 	10 samples per year, select from events 0.10 inch or greater over range of seasons and events
Zinc, Total	Zn	μg/L	 Flow-paced composite samples over non-ice time period (approx. March through Nov.) Grab samples at least two times during typical winter thaw (approx. Dec. through March) 	10 samples per year, select from events 0.10 inch or greater over range of seasons and events
Nitrate+Nitrate, Total (as N)	NO_3NO_2	mg/L	 Flow-paced composite samples over non-ice time period (approx. March through Nov.) Grab samples at least two times during typical winter thaw (approx. Dec. through March) 	10 samples per year, select from events 0.10 inch or greater over range of seasons and events
рН	рН	standard unit	 Field Analysis Grab, measured by multi-parameter probe 	
Phosphorus, Total Dissolved or Ortho-P	TDP Ortho-P	mg/L	 Flow-paced composite samples over non-ice time period (approx. March through Nov.) Grab samples at least two times during typical winter thaw (approx. Dec. through March) 	10 samples per year, select from events 0.10 inch or greater over range of seasons and events
Phosphorus, Total	ТР	mg/L	 Flow-paced composite samples over non-ice time period (approx. March through Nov.) Grab samples at least two times during typical winter thaw (approx. Dec. through March) 	10 samples per year, select from events 0.10 inch or greater over range of seasons and events



Parameter	Abbreviation	Units	Sample Type	Frequency
Solids, Total Dissolved	TDS	mg/L	 Flow-paced composite samples over non-ice time period (approx. March through Nov.) Grab samples at least two times during typical winter thaw (approx. Dec. through March) 	10 samples per year, select from events 0.10 inch or greater over range of seasons and events
Solids, Total Suspended	TSS	mg/L	 Flow-paced composite samples over non-ice time period (approx. March through Nov.) Grab samples at least two times during typical winter thaw (approx. Dec. through March) 	10 samples per year, select from events 0.10 inch or greater over range of seasons and events
Solids, Volatile Suspended	VSS	mg/L	 Flow-paced composite samples over non-ice time period (approx. March through Nov.) Grab samples at least two times during typical winter thaw (approx. Dec. through March) 	10 samples per year, select from events 0.10 inch or greater over range of seasons and events
Solids, Inorganic Suspended by difference	TSS-VSS=ISS		 Flow-paced composite samples over non-ice time period (approx. March through Nov.) Grab samples at least two times during typical winter thaw (approx. Dec. through March) 	10 samples per year, select from events 0.10 inch or greater over range of seasons and events
Carbon, Organic Dissolved			 Flow-paced composite samples over non-ice time period (approx. March through Nov.) Grab samples at least two times during typical winter thaw (approx. Dec. through March) 	10 samples per year, select from events 0.10 inch or greater over range of seasons and events
Chemical Oxygen Demand	COD		 Flow-paced composite samples over non-ice time period (approx. March through Nov.) Grab samples at least two times during typical winter thaw (approx. Dec. through March) 	10 samples per year, select from events 0.10 inch or greater over range of seasons and events
Flow			 Measurement 	
Precipitation			 Measurement, at 3800 Bryant Avenue South location 	Daily
Oil and Grease ^a			• Grab	Quarterly (spring, summer, fall, winter)
Nitrogen, Total			 Flow-paced composite samples over non-ice time period (approx. March through Nov.) Grab samples at least two times during typical winter thaw (approx. Dec. through March) 	10 samples per year, select from events 0.10 inch or greater over range of seasons and events

^a Pilot. If oil and grease is less than 15 mg/L in all quarterly samples for the first 2 years of the permit term, the **Permittee** may end oil and grease sampling at that/those site(s). If oil and grease is at least 15 mg/L in any quarterly sample for the first 2 years of the permit term, then oil and grease sampling must continue through the entire permit term.

mg/L = milligrams per liter

µg/L = micrograms per liter

MPN/100MI = most probable number per 100 milliliters

µmhos/cm = micro mhos

Source: NPDES Permit MN0061018



The MPRB continued to monitor each of these four sites through 2017 and has collected 12 years of continuous stormwater runoff quantity and quality data at the same sites. Long-term monitoring by the MPRB, as presented in Table 4.12, shows how the concentration of chemicals in the runoff can vary greatly in any year. A more detailed description of the monitoring results for each storm and for each site is included in the <u>MPRB Water Resources Annual Report</u>.



Parameter		Sites	1-5a							Sites	6-9					
Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
TP (mg/L)	0.470	0.337	0.474	0.332	0.354	0.548	0.472	0.486	0.583	0.341	0.355	0.368	0.369	0.313	0.337	0.297
TDP (mg/L)	0.112	0.095	0.114	0.121	0.123	0.135	0.108	0.139	0.249	0.063	0.126	0.123	0.157	0.121	0.089	0.088
Ortho-P (mg/L)	nc	0.179	0.097	0.194	0.129	0.109	0.093									
TKN (mg/L)	2.21	1.60	2.10	1.94	3.48	3.54	4.43	3.22	3.61	1.53	1.74	2.00	2.34	2.40	1.68	1.72
NH₃ (mg/L)	0.494	0.722	0.346	0.918	1.74	1.64	0.970	0.966	1.64	0.666	0.922	0.719	0.747	1.00	0.262	0.430
NO ₃ NO ₂ (mg/L)	0.398	0.423	0.496	0.382	0.448	0.638	0.496	0.582	0.755	0.414	0.498	0.397	0.402	0.937	0.396	0.290
Cl (mg/L)	37	11	587	40	18	91	412	139	803	60	213	14	72	205	229	12
Hardness (mg/L)	nc	na	nc	nc	na	nc	nc	nc	nc	na	48.0	37	41	41	30	32
TSS (mg/L)	116	83	116	70	108	156	180	148	121	107	104	101	95	123	87	90
VSS (mg/L)	nc	30	31	29	34	31	32									
TDS (mg/L)	306	85	725	130	252	183	737	507	3323	124	693	97	301	359	59	62
cBOD (mg/L)	12	8	16	20	9	9	17	25	53	7	11	13	13	10	8	7
Sulfate (mg/L)	nc	15	18	8	7	6	6									
Cd (µg/L)	0.532	0.518	2.11	2.80	2.50	nc										
Cu (µg/L)	15	31	23	15	19	29	36	16	40	23	25	16	19	13	8	9
Pb (µg/L)	23	17	22	14	41	31	34	28	23	24	18	15	22	16	8	13
Zn (µg/L)	180	76	107	76	86	94	133	132	204	100	103	90	79	68	62	58

Table 4.12 – Long-Term Average Flow-Weighted Annual Mean Concentration for Each Chemical Parameter Monitored in the City of Minneapolis

nc = data not collected

na = data not analyzed

Note: Cadmium (Cd) was discontinued from monitoring in 2006 because Cd concentrations had typically been below detection for the Minneapolis/St. Paul area



The MPRB also monitors SMPs to develop a performance baseline, as required by the NPDES stormwater permit. Different sites are selected each year for monitoring. For example, the following SMPs were monitored in 2016:

- 37th Avenue North Greenway Iron Enhanced Sand Filters.
- Webber Park Stormwater Pond.
- Lyndale Dog Park Stormwater Filter (*E. Coli* samples, only).
- 37th Avenue North at Oliver Avenue North Flood Relief Vault (Hydraulic performance, only).

Grab Sample Collection at Lyndale Dog Park



Credit: Minneapolis Park and Recreation Board

Equipment, methods, parameters, results, and analysis is detailed in each MPRB Water Resources Annual Report.

Coordination with Other Government Agencies

Hennepin County has jurisdiction over 83.5 miles of roads within the City. The City and Hennepin County work together to identify opportunities to retrofit stormwater management systems on Hennepin County road projects.

MnDOT has jurisdiction over 46.3 miles of the roadway within the City. While MnDOT and the City maintain separate stormwater drain systems, runoff water from each system flows into the other's system, necessitating a high level of coordination, including cooperative agreements for construction of new stormwater facilities – including new stormwater drains and best management practices.

The City cooperates with and coordinates efforts with neighboring cities on the management of common drainage areas. Most coordination is accomplished through watershed management organizations, though some cooperative projects have been implemented outside of this structure.

The City is willing to cooperate with the MPRB and associated watershed organization on streambank repairs that are needed in the areas near City-owned outfalls.

The City and Metropolitan Council cooperate on the CSO program to control public and private discharges to the stormwater and sanitary systems.

Responsibilities for Infrastructure Management

Responsibility for managing the infrastructure in the City is primarily the responsibility of the Minneapolis Department of Public Works. Sanitary sewer and stormwater drain systems are the responsibility of the Public Works Division of Surface Water and Sewers (PW-SWS), while street maintenance is the responsibility of the Public Works Division of Transportation Maintenance and Repair



(PW-TMR). Other departments that have a role in the sanitary sewer and stormwater drain management include Finance and Property Services (MFPS) which manage the City-owned properties, and utility billing, MPRB which manages park lands and waterbodies, and the Minneapolis Department of Health (MDH) which are involved in the emergency spill response. A detailed breakdown of these responsibilities is presented in Table 4.13.

Activity	MFPS	MHD	MPRB	MPW - SWS	MPW- TMR	Other
	Stormwa	ater Mana	gement			
Pollution Prevention and Good Housekeeping for Municipal Facilities	~	~	~	~	~	
Stormwater pond vegetation management			~	~		
Runoff management from City facilities	✓		✓	~	~	
Condition assessment				~		
Stormwater monitoring and analysis			~	~		MPCA, watershed organizations
TMDL studies and coordination			~	~		MPCA
Program assessment, modification and reporting			~	~		
Annual reporting			~	~		
Planning, design, funding for stormwater drain improvements				~		
Stormwater management practices O&M			~	~		
Street cleaning, snow, and ice removal					~	
		Misc.				
WRMP development and coordination				✓		
Coordination with watershed districts / organizations				~		
Overall coordination of NPDES requirements				~		
Integrated pest management			~	~		
	Sanitary S	ewer Mar	nagement			
I/I compliance – sanitary sewers				✓		
Planning, design, funding for sanitary collection system improvements				~		
Coordination with Metropolitan Council				✓		
Condition assessment				✓		
0&M				~		
	Water Res	ource Ma	nagement			
Lake management			\checkmark			
Natural resource management			\checkmark	✓		
Shoreline and beach management			~			
Wetland health evaluation project						Hennepin County

Table 4.13 – City of Minneapolis Infrastructure Management Responsibilities



City of Minneapolis Water Resources Infrastructure Summary and Evaluation

The City operates a robust program to continually assess and maintain the condition, capacity, and operation of its infrastructure systems, as detailed in this section. The City also improves its infrastructure as needed to meet regulatory requirements. The remainder of this section provides a summary of the City programs and practices and identifies areas that need additional effort to meet regulatory requirements.

Sanitary Sewer System

Capacity Summary and Evaluation

The City's sanitary sewers have sufficient capacity to meet current and future flows. This capacity is a direct result of the City's ongoing efforts to remove stormwater connections to sanitary sewers. Opportunities to construct new sanitary sewers exist in underdeveloped areas of the City. These opportunities are limited and will occur on a case-by-case basis when new development is proposed.

Combined Sewer Overflow and Inflow/Infiltration Summary and Evaluation

The City is committed to continual inspection and disconnection of stormwater connections to the sanitary sewer system. The City's <u>CSO Annual Reports</u> document annual activities and progress towards the I/I goals established by Metropolitan Council through 2017. Future documentation and progress towards I/I goals and guided by the March 2018 MOU will be reported in an annual report that combines both sanitary sewer and stormwater drainage system activities.

Stormwater Management and Drain System

SWMP and Conformance with NPDES Requirements Summary and Requirements The City's <u>Stormwater Management Program</u> (SWMP) details the City's most current stormwater management activities. It is written to be in compliance with current NPDES permit requirements. The initial SWMP was prepared in September 2011 to be in accordance with the requirements of the January 21, 2011 NPDES stormwater permit. The SWMP was updated in 2013 and 2015 to reflect additions and changes to the City's program. The SWMP will be reissued in late 2018 based on new requirements contained in the NPDES Integrated Permit.

A detailed summary of each year's activities is contained in the <u>City's annual report</u>. Each year through 2017, the City prepared two annual reports, one being an annual summary of stormwater management activities, construction, and monitoring as a documentation of compliance with its NPDES stormwater permit. The second was a documentation of progress towards I/I goals. Beginning in 2018, all stormwater and sanitary activities will be reported in an integrated annual report that combines both sanitary sewer and stormwater drainage system activities, in accordance with the draft NPDES Integrated Permit.

The SWMP and annual reporting requirements are subject to change to be in compliance with future NPDES permits.



Capacity Summary and Evaluation

The City will fully assess the capacity of its stormwater drain system in 2018 as part of a comprehensive analysis of the city-wide XP-SWMM (Storm Water Management Model) modeling. The model will be used to develop runoff volumes and discharge rates at each of the City's 419 outfall structures. This information will be appended to this WRMP as a minor plan amendment after the modeling and analysis is complete.

The prioritization of Capital Improvement Projects, as described in Section 6, is likely to change after the entire stormwater drainage capacity is analyzed. Project prioritization will be updated annually as the City adopts the CIP program each year.



Section 5 – Regulatory Controls and Water Resource Management Programs

Overview

Effective municipal water resource management involves proper land and activity management on both public and private properties. Flows to the sanitary sewers are regulated through permits issued by the City of Minneapolis (City) and the Metropolitan Council. Stormwater management on private property is regulated at the time of development, or redevelopment, through construction permits issued by the City. Public education is utilized to inform residents and property owners of required activities that are not triggered by new construction. This section of the Water Resource Management Plan (WRMP) details the official regulatory controls and programs adopted by the City and the Minneapolis Park and Recreation Board (MPRB) that serve to protect water resources. Official controls include ordinances, City Council resolutions, guidance documents, maps, and this WRMP.

City of Minneapolis and Minneapolis Park and Recreation Board Ordinances

Both the City and the MPRB have adopted ordinances that influence water resource management. A summarized list of the primary City ordinances that relate to water resource management is contained in Table 5.1. A summarized list of the primary MPRB ordinances that relate to water resource management is contained in Table 5.2. Full versions of all City and MPRB ordinances are available at the Minneapolis Code of Ordinances website.

CODE OF ORDINANCES							
	Title 3 – Air Pollution and Environmental Protection						
CHAPTER 48	MINNEAPOLIS WATERSHED MANAGEMENT AUTHORITY						
48.60	Provides authority to Minneapolis Health Department to regulate and control watershed pollution.						
48.80	Prohibited pollutants definitions.						
48.120 - 48.150	Permit and registration requirements for above ground and below ground storage tanks and materials.						
48.260	Permit and registration requirements for wells.						
48.270	Permit and registration requirements for oil/water separators and sediment traps.						
48.300	Storage, stockpile and permit requirements for materials contaminated with pollutants.						
CHAPTER 50	MINNEAPOLIS WASTE CONTROL AND DISCHARGE RULES						
50.50	Permit requirements for discharge industrial waste to sanitary sewers.						
50.60	Permit and annual registration requirements for discharge of runoff from process facilities. Facilities with No Exposure Exemption from MPCA exempt from registration.						
50.65	Permit requirements for connection to sanitary sewer.						
CHAPTER 52	EROSION AND SEDIMENT CONTROL FOR LAND DISTURBANCE ACTIVITIES						
52.50	Activities exempt from obtaining a permit for erosion and sediment control.						
52.60	Design requirements minimize surface runoff, erosion, and sedimentation.						

Table 5.1 – City of Minneapolis Code of Ordinances



	CODE OF ORDINANCES
52.70	Erosion and sediment control practice requirements for prevention of deposition of soil in sensitive areas.
52.100 - 52.130	Erosion and sediment control plan and associated reports content requirements.
52.140 - 52.210	Permit requirements for land disturbance or land filling activity.
52.275	Standards for conveyance and management of stormwater.
CHAPTER 54	STORMWATER MANAGEMENT FOR NEW DEVELOPMENTS
54.30	Establishes the Minneapolis Stormwater Management Design Manual authority. In events of non-conformance, a resolution is adopted by the City Council.
54.50	Stormwater management plan, registration, and annual fee requirements for all land-disturbing projects with stormwater management devices.
54.70	Stormwater Management Plan requirements and strategies to mitigate stormwater runoff required prior to construction.
CHAPTER 55	LAWN FERTILIZER
55.30	Provides authority to the Minneapolis Watershed Management Authority and the Minneapolis Health Department to regulate lawn fertilizer.
55.40	General regulations of fertilizer application.
55.60	Application rates for phosphorous-containing lawn fertilizer.
55.70	Forbids the sale of phosphorous-containing fertilizer in the City of Minneapolis as of January 1, 2002.
CHAPTER 56	PROHIBITED DISCHARGES TO SANITARY OR COMBINED SEWERS (I/I ORDINANCE)
56.60	Provides authority to the Minneapolis Health Department to regulate I/I discharges to sanitary or combined sewers.
56.70	Prohibits stormwater connections to sanitary sewers.
56.90	Requires downspouts not be directed to structures within 10 feet of downspout.
56.100	Permit requirements for disconnection of any rainwater pipe, rainleader, area drain, or other connections.
56.140	Disconnection requirements for rainwater pipes, rainleaders, area drains, or other connections conveying stormwater and/or clearwater from a property to a sanitary sewer system.
56.180 - 56.200	Establishes appeals procedures; sets up appeals panel and procedures.
CHAPTER 57	MERCURY REDUCTION
57.10	Discussion of public health in respect to mercury.
57.20	Prohibits sale and purchase of certain mercury-containing products.
57.30	Retailers required to post visible signage if product contains mercury.
CHAPTER 60	COAL TAR-BASED SEALER PRODUCTS
60.30	Prohibited use of coal tar-based sealants on driveways and other applications.
60.50	Exemption of asphalt-based sealcoat for bona fide research or purpose.
60.60	Establishes penalties.
	Title 19 – Water, Sewers, and Sewage Disposal
Chapter 510	Stormwater Management System and Operation of a Stormwater Utility.
Chapter 511	Sewers and Sewage Disposal
	Title 20 – Zoning Code
CHAPTER 530	SITE PLAN REVIEW
530.160	Requirements for landscaping and screening; establishes minimum requirement of 20 percent of site to be landscaped.
530.190	Encourages use of landscape to intercept and filter runoff.


	CODE OF ORDINANCES
CHAPTER 535	REGULATIONS OF GENERAL APPLICABILITY
535.300 - 535.315	Protection and mitigation of natural features required during development, including stormwater management and groundwater management.
535.680	Prohibits creation of water pollution by operations or occupation of a structure.
CHAPTER 551	SHORELAND OVERLAY DISTRICT
551.440	Describes the purpose of shoreland overlay districts to protect the surface waters and shoreland areas within the City of Minneapolis.
551.510	Prohibits grading and filling more than 10 cubic yards when the land slopes toward a protected water.
551.520	Prohibits removal of vegetation near steep banks sloping toward a protected water.
551.530	Requires all developments to comply with stormwater regulation and to employ best management practices to minimize negative effects of stormwater runoff.
CHAPTER 551	FLOODPLAIN OVERLAY DISTRICT
551.140	Describes purpose of floodplain overlay districts to comply with rules and regulations of the National Flood Insurance Program.
551.590	Requires that materials deposited in the floodplain overlay district be protected (riprap, vegetation, etc.) and describes floodwater protection requirements for public utilities, sewage systems, and water supply systems.
551.600 - 551.645	Establishes prohibited, permitted, and conditional uses within floodplain and flood fringe overlay districts.
551.650	Establishes standards for uses within flood fringe overlay districts.
CHAPTER 551	MISSISSIPPI RIVER CRITICAL AREA OVERLAY DISTRICT
551.660	Describes the Mississippi River Critical Overlay District as an entity that will preserve and enhance the River.
551.700	Prohibits development on bluffs and within 40 feet of top of bluffs.
	Title 22 – Land Subdivision
CHAPTER 598	LAND SUBDIVISION
598.100	Establishes requirements for the protection or mitigation of natural features in a subdivision development, including protected waters, wetlands, significant trees, significant plant communities, steep slopes, and threatened/endangered species habitats.
598.110	Establishes stormwater management requirements for developments.



CODE OF ORDINANCES					
Chapter 3 – Bathing and Beaches					
PB3-2	Forbids swimming and bathing at unauthorized beaches or water.				
PB3-3	Permit and license requirements to use floatation equipment on park lakes.				
PB3-4	Permit requirements for use of underwater breathing equipment in park waters.				
	Chapter 4 – Boating				
PB4-1	Permit requirements to have or use watercraft on a lake within the City.				
PB4-19 Provides authority to the superintendent of parks to enact additional rules and condition park waters.					
	Chapter 10 – Trees and Vegetation				
PB10-1 - PB10-5	Permit requirements and procedure for planting trees within limits of parkway or street.				
Ch	napter 12 – Environmental Protection, Shoreland, and Floodplain Preservation				
PB12-3 - PB12-4	Permit required to install structure on floodplains or protected shorelines.				
PB12-5	Restrictions on removing vegetation from floodplains and protected shoreline.				
PB12-7	Restrictions on grading or filling floodplains and protected shoreline.				
PB12-7	Provides authority for the Park Board to take action on floodplains and protected shorelines, while complying with the State and Federal laws.				

Table 5.2 – Minneapolis Park and Recreation Board Code of Ordinances

Water Resource Management Programs

The City and MPRB manage numerous programs that require actions on the part of citizens and property owners that serve to keep pollutants from being transported to water resources via the storm drainage system or the sanitary sewer system. Detailed information on stormwater programs is available in the current version of the Minneapolis Stormwater Management Program, prepared in accordance with the requirements of the City's National Pollutant Discharge Elimination System (NPDES) Integrated Permit. A description of activities and progress of the CSO and stormwater programs through 2017 is contained in the City's <u>CSO and NPDES Stormwater Annual Reports</u>, and in the <u>MPRB Annual</u> <u>Water Resources Report</u>. Starting in 2019, for calendar year 2018, all NPDES annual summaries will be contained in a single annual report. A general description of these programs is provided in the following sections.

Complaints

The City provides several techniques for the public to use to report environmental complaints:

- The <u>Minneapolis 311</u> service is a centralized location for the public to request services, communicate with City staff, seek information, or submit complaints. The public can communicate to 311 via the website, by phone, or through a mobile app. Minneapolis 311 assigns each call/complaint to the appropriate department/division, and responses and response time are tracked by the Minneapolis 311 system.
- The Minneapolis Department of Health, Environmental Management, maintains an online <u>complaint submittal form</u> to report any environmental issue such as water quality violations, illegal dumping, chemical spills, etc.



The Public Works Department maintains a "<u>Who to Call and When</u>" list of direct contact information for sanitary sewer or stormwater specific issues such as street flooding, sewer backups, odors, illegal dumping, etc. Also, included in this contact list, are links to Environmental Management and the MPRB for non-infrastructure complaints.

Emergency Preparedness

The City has established an Emergency Management Office that is responsible for the City's response in the event of an emergency, which is detailed in the City's Emergency Operation Plan.

Spill Response

The Emergency Operation Plan has written a statement of policies and procedures to be followed in the event of a spill that describe the measures taken for spill containment, source elimination, and recovery. The City's Regulatory Services section has overall responsibility for communications, development of an Incident Action Plan, and investigations. A Hazardous Materials Response Team is mobilized in the event of a large spill that has the potential to reach surface waters. After the event, street maintenance staff coordinate the final clean-up and disposal of both the streets and affected sewers/storm drains. Public Works will also collect, manage, and properly dispose of all debris collected from the spill, including sand and other materials used to sop up the spill. Fire Inspection Services staff and others continue to monitor the site and coordinate debriefings to determine the cause of the event, the City's response, and means to limit future events. Training on response procedures is conducted for staff assigned to spill response.

Both the MPCA Duty Officer and the Minnesota Department of Public Safety are informed of all spills that exceed 5 gallons.

Flood Response

In the event of a flood, the City's Emergency Operation Plan details pre-flood preparations, as well as emergency responses during the flood.

Erosion and Sediment Control

In 1996, the City adopted its Erosion and Sediment Control Ordinance (<u>Chapter 52, Minneapolis Code of</u> <u>Ordinances</u>) for the specific purpose of controlling soil erosion and sedimentation to prevent transportation of eroded soil to lakes, creeks, and the Mississippi River. The <u>City of Minneapolis</u> <u>Stormwater and Sanitary Sewer Guide</u> contains a detailed description of the Erosion and Sediment Control requirements, including permits, plan requirements, and additional regulations.

Construction Permits and Inspections

Chapter 52 requires that all land disturbing activity be conducted in a manner that prevents soil sediment from moving from the construction site onto adjacent properties and public rights-of-way. Erosion and Sediment Control Permit requirements are triggered whenever a land disturbing activity exceeds 5 cubic yards in volume or 500 square feet in area. Larger projects that exceed 500 cubic yards in volume or 5,000 square feet in area must also prepare a stormwater management plan as a condition of permit issuance. Permit application forms and fee schedules are available through the City's <u>Development Review Customer Service Center</u>.



The Public Works Department has developed tools to aid in the development of erosion and sediment control plans for projects that exceed 500 cubic yards or 5,000 square feet. Tools include standard notes that can be listed on the erosion and sediment control plan and a checklist of required plan elements. For more in-depth information, contractors and designers are encouraged to utilize information developed by the Minnesota Pollution Control Agency (MPCA), the Minnesota Erosion Control Association, and the University of Minnesota Erosion and **Stormwater Management Certification** Program.

Unmanaged Construction Site with Significant Soil Erosion on Sidewalk and Street



Credit: Minneapolis Public Works

During construction, sites are inspected and managed by the Minneapolis Department of Health Environmental Services.

Non-Construction Inspection and Enforcement

Non-construction generated erosion and sedimentation inspections and enforcement are conducted on a <u>complaint basis</u> by the Minneapolis Department of Health Environmental Services.

Illicit Discharge Detection and Elimination

<u>Illicit discharges</u> include both intentional dumping of wastes and accidental spills of chemicals/liquids in the City's storm drain system. Intentional would include dumping of oil/paint or other regulated wastes into catch basins. Accidental spills include the accidental releases caused by motor vehicle collisions or electrical transformer overloads. The result is untreated waste and hazardous materials that contribute to high levels of pollutants, which includes heavy metals, toxics, and solvents, being discharged directly into surface waters.

The Environmental Services Section of the Health Department is designated as responsible for control of Illicit Discharge Detection and Elimination (IDDE). Activities include development of baseline information, identification of problem areas, investigation and determination of sources, documentation, and corrective action. Environmental Management also provides education and regulation for unauthorized and non-stormwater discharges in the storm drains.

The City has implemented a storm drain outfall inspection program that includes inspections for flows during dry weather as an approach to identification of IDDE sources, as required by the City's NPDES Integrated Permit. If dry weather flows are detected during an inspection, then a grab sample is collected for analysis to determine if pollutants are present. Public Works Field Services and Department of Health Environmental Services work together to discover the source and ultimately to eliminate the illicit flows.



Additional efforts to eliminate illicit discharges to the storm sewers include public education, and direct response to notifications received from the community, other city departments, and government agencies. Currently, Department of Health Environmental Services addresses complaints of materials being discharged to the Minneapolis storm drainage system whether they are permitted discharges or not. The Department of Health Environmental Services also reviews compliance with NPDES, State Disposal System (SDS), and general stormwater permit requirements for businesses, as needed.

Inflow/Infiltration Compliance, Private Properties

As described in Section 4 – Infrastructure Inventory, Activities, and Assessment, the City recognized that historic building practices that allowed rooftop drainage connections to the sanitary sewer system were a factor in the continued overflow at combined sewer overflow (CSO) regulators. As part of the 2002 Phase II CSO Program, the City began to focus on the identification and elimination of these rooftop drainage connections to the sanitary sewer. To support this initiative, Minneapolis Ordinance Chapter 56 – Prohibited Discharges to Sanitary Sewer System, was updated on August 1, 2003. This updated ordinance authorized a program to inspect suspected rooftop connections and coordinate disconnections with property owners. It requires property owners to redirect rooftop rainleaders and private surface area drainage either to side yards or to the public storm drain system. Property inspections are conducted to identify illegal connections to sanitary sewer and then notifications are sent of the work needed to comply with the ordinance and other official controls.

The purpose of the Minneapolis ordinance <u>Chapter 56 – Prohibited Discharges to Sanitary Sewer System</u> is as follows:

MCO 56.10 Purpose: The City of Minneapolis has been pursuing an aggressive campaign of separating its sanitary sewer system from its stormwater drainage system to reduce the number of combined sewer overflows (CSO). However, some rainleaders and other components, which handle stormwater, are still connected to the sanitary sewer system. During rain events, infiltration and inflow from buildings and parking lots with rainleaders and area drains connected to the sanitary sewer system, cause its capacity to be exceeded resulting in overflows to adjacent storm drains. This overflow ends up discharging sewage and stormwater into the Mississippi River. Rooftop drains (rainleaders) that are connected to the sanitary sewer system are one of the major causes of combined sewer overflows.

Residential and commercial buildings, usually built before [1930], sometimes have pipes that lead underground directly into the sanitary sewer system, rather than through gutters to lawns or the stormwater drainage system. To protect the environment and prevent these overflows as well as preventing the possibility of sewage backing up into homes and businesses, rainleaders and other connections which deliver stormwater into the sanitary system rather than the stormwater drainage system or to pervious surfaces need to be disconnected. State and federal environmental mandates require us to work to eliminate combined sewer overflows.

The city and metropolitan council have conducted studies that determined the main contributor to these overflows is rainleader connections. The purpose of the City of Minneapolis Code of Ordinances Chapter 56 is to define regulations that will aid the city in



limiting inflow of rainwater to the sanitary sewer system. The ordinance will help to minimize the overflow problem resulting from the lack of capacity of the sanitary system to handle large amounts of rainwater. Rainwater runoff will be more appropriately handled through natural filtration and/or the stormwater drainage system. The net result will be a cleaner Mississippi River and a more efficient waste treatment system.

Previous City official controls and state plumbing codes were applicable to new construction only, and not to existing connections. Additional revisions to Chapter 56 were approved in 2006 to accelerate rooftop disconnections to meet the Metropolitan Council inflow/infiltration (I/I) reduction goals described in Section 4 – Infrastructure Inventory, Activities, and Assessment. These revisions included:

- Provisions to support enforcement of administrative citations.
- Providing the City with the ability to order connections to the storm drain system to be constructed as the sanitary sewer disconnection method.
- Allowing the use of assessments to recover the cost of disconnection of roof drains.

Significant progress has been made on disconnecting rainleaders from the sanitary sewer system. Table 5.3 summarizes the progress made on disconnection of rainleaders from the sanitary sewer through 2017 and Figure 5.1 identifies the location of these rainleaders. The total number of remaining rooftop connections to the sanitary sewer is estimated to be 323.

Year	Rooftop Connections Removed Per Year	Cumulative Rooftop Connections Removed
2008		4,537
2009	1,021	5,558
2010	427	5,985
2011	186	6,171
2012	133	6,304
2013	220	6,524
2014	150	6,674
2015	315	6,989
2016	105	7,094
2017	7	7,103

Table 5.3 – Rooftop Disconnections from Sanitary Sewers









Other efforts that work to reduce I/I contributions to the sanitary sewer include:

- Minnesota Code of Ordinances 56.80: Prohibited Connections (a) Connections not permitted. Rainwater pipes, rainleaders, area drains, or other connections used for conveying stormwater and clearwater from any building, structure, ground, or premises shall be not connected or reconnected with any sanitary sewer system.
- Minnesota Code of Ordinances 56.80: Previously Allowed Connections (a) Existing connections not permitted. Rainwater pipes, rainleaders, area drains, and other connections used for conveying stormwater and clearwater from any building, structure, ground, or premises which were legally connected to the sanitary sewer system prior to 1961 or those which were connected later by City permission shall be disconnected from the sanitary sewer system pursuant to 56.140 of this Code or by January 1,2005, whichever occurs first.
- Sump Pumps Chapter 56/Chapter 248: Truth in Sale of Housing Truth in Sale of Housing evaluation is required for the sale of a single-family home, duplexes, townhouses, and first-time condominium conversions. Sump pumps were added to the evaluation in 2007. Sump pumps are evaluated for conformance with Chapter 56 as part of the inspection. Truth in Sale of Housing repairs are required to be completed when a property is sold within 90 days of closing.

Public Education, Participation, and Involvement

Public Education

Successful management of the City's surface water requires positive support and action from the <u>public</u>. To engage City residents and gain their active support and participation, the City and the MPRB maintain several education efforts that aim to inform City residents about basic stormwater management, flood mitigation, water quality concepts, regulations, and policies. Many programs focus on partnering with other agencies and non-profit organizations. The City will continue to work with watershed management organizations on water resource monitoring, education events, professional training, distribution of materials, and other educational activities as opportunities arise.

Adjustments to the program are made each year to reflect changing educational needs and partnership opportunities. In 2017, MPRB Environmental Management naturalist staff participated in 30 Minneapolis community festivals and neighborhood events, as well as concerts and movies. Hands-on water quality education displays focused on neighborhood watersheds and how human activities impact local waterbodies. Education staff utilized portable mini-golf, bean bag toss, an aerial photo floor graphic of the City and its watersheds, and other hands-on learning activities. In addition, 495 people experienced water quality education while canoeing the lakes of the City. Other children's programming focused on water quality education themes in summer programs including a partnership with the Minneapolis Institute of Art that used art and water-related activities to serve 335 kids between 6 and 12 years old. Still more programs incorporated water education themes into the summer camps called Urban Adventure Camp, Outdoor Survival, and Nature Explorers serving 245 kids between 6 and 12 years old.

The following is a snapshot of additional 2017 water quality education projects that are directly supported by the City:



Water Quality Education Materials



Credit: Minneapolis Park and Recreation Board

- The Minneapolis <u>Adopt-a-Drain</u> program has volunteers cleaning debris from catch basin grates in their neighborhoods. Volunteers commit to cleaning their assigned drains for a period of two years.
- Aquatic Invasive Species Program by the MPRB focuses on inspection and signage at public boat launches between May 1 and December 1 each year. Additional detail on the Aquatic Invasive Species program is included in Section 3.
- Boulevard Bioswales is a program under development by Minneapolis Surface Water and Sewers in cooperation with the MPRB and Blooming Boulevards. The program will sponsor the creation of rain swales with native plantings to be installed along boulevards that have the ash trees removed by the MPRB. The goal of the program is to reduce stormwater runoff and allow for localized infiltration. Homeowners are presented with a choice of plant palettes, each comprised of pollinator-friendly plant species. These homeowners will be responsible for the ongoing

maintenance of the Bioswales. Approximately 900 boulevard rain swales are anticipated to be installed over this four-year period.

- Canines for Clean Water is a joint MPRB and City water quality education program initiated in 2009 that targets dog owners. In 2017, Public Service Announcements were shown that encourage pet owners to pick up pet waste and encourages all property owners to stop or reduce their use of winter salt.
- Do Not Feed the Ducks is a successful program to persuade park patrons not to feed the ducks. It utilizes an oversized buoy in the shape of a rubber duck and more than 200 tabletop ducks distributed at MPRB licensed restaurants.



Do Not Feed the Ducks Buoy



Credit: Minneapolis Park and Recreation Board

Earth Day Watershed Clean-Up was initiated in 1995 to draw attention to the water quality improvement needs of City lakes, and the effects that individual actions have on urban water quality. The goals of the Earth Day Clean-Up event are to prevent trash and debris from entering Minneapolis waterbodies and to provide a volunteer experience and environmental education to City residents and park users.

Earth Day Watershed Clean-Up



Credit: Minneapolis Public Works

- Minneapolis Surface Water and Sewers has developed education materials aimed at reducing the disposal of <u>Fats</u>, <u>Oils</u>, <u>and Grease (FOG)</u> into the sanitary sewers. Improper disposal of FOB materials tends to clog within the sewers, leading to higher levels of sanitary sewer and lateral cleaning, and/or sewer backups. The materials are primarily developed for restaurants and other food service establishments but are valuable for waste management in all kitchens.
- Greening Teen Teamworks is a summer youth employment program managed by the MPRB for 30+ years. The Greening Teen Teamworks program meets weekly with all sites supervisor and youth to provide education on stormwater runoff, water quality, and actions that should be taken to help keep our lakes, creeks, and river healthy. These site-based youth crews are charged with keeping the parks stormwater drains clear and curb lines picked up, and at parks with waterbodies, the crews remove debris from outlets and tidy up shorelines. The Greening Teen Teamworks program is funded by the MWMO.
- Metro Bloom Program conducts Rain Garden Workshops, including workshop facilitation, rainwater garden design, water quality education, and other assistance for individual property owners.
- Mississippi River Green Team is a conservation-based teen crew engaged in daily hands-on environmental work throughout the summer. There are two crews of ten youth each, which work mostly in the natural areas of the Minneapolis park system, and within the watershed of the Mississippi River. Typical work days include invasive species removal, weed wrenching, planting, watering, mulching, and citizen science work.



- Plants for Pollinators neighborhood events have been conducted by the Minneapolis Surface
- Water and Sewers staff to provide information on vegetation at stormwater management sites. To-date, events have been held at the South 43rd Street and Park Avenue site (2016) and the Shingle Creek South stormwater pond (2017). A 2018 site is yet to be selected.
- Minneapolis initiated a city-wide <u>storm drain inlet stenciling</u> <u>program</u> in 1995. Volunteers stencil "DO NOT DUMP, DRAINS TO RIVER" messages next to catch basins and distribute educational door hangers to residences and businesses in the stenciled neighborhoods. Stencils are available in English, Spanish, and Somali.

Storm Drain Stencil Volunteers



Credit: Minneapolis Public Works

Storm Drain Stencil Door Hanger



Credit: Minneapolis Public Works

The City also funds workshops on how homeowners can improve vegetation and soil conditions to promote activities that retain rainfall and reduce the volume of stormwater runoff. The following workshops are facilitated by Metro Blooms, a Minneapolis based non-profit organization:

- Resilient Yards workshops provide how-to information on rain gardens, turf alternatives, pollinator habitat, trees, and native plantings.
- Turf Alternative workshops present a variety of do-it-yourself alternatives to turf. The workshops provide information on how perennial ground covers reduce the need for irrigation and chemical inputs while maximizing ecological benefits. The two most popular turf alternatives have been Low Maintenance Lawns and Bee Lawns.

Additionally, there are multiple organizations that also provide water quality education to Minneapolis residents and businesses, including:



- Freshwater Society of Minnesota
- Friends of Mississippi River
- <u>Friends of Diamond Lake</u>
- Friends of Lake Hiawatha
- <u>Friends of Lake Nokomis</u>
- <u>Hamline University College for Global</u>
 <u>Education</u>

- Hennepin County
- Linden Hills Environmental Committee
- Minnehaha Creek Watershed District
- Metro Watershed Partners
- Mississippi Watershed Management Organization
- West Metro Water Alliance

Public Participation and Involvement

As part of the implementation of a new activity or development of a capital improvement project, the City actively seeks to engage the public in the process of decision-making. The City is committed to incorporating community engagement activities into decision-making for all activities undertaken by City departments. The City keeps its residents informed about stormwater and sanitary sewer capital improvement projects through its website and social media platforms. Information is provided on specific projects, and periodic updates on the progress of the listed projects are made available. Public meetings are conducted to invite public input on project-specific issues.

Rat and Rodent Control

In the event of a rat infestation in the sanitary sewer, maintenance staff from the Division of Surface Waters and Sewers will control the population by using poison. Raccoons and other animals commonly found in the storm drainage pipes and/or Stormwater Management Practices (SMPs) are trapped and removed only if the animal is causing damage or otherwise sick or injured.

Site Plan Review and Capital Project Task Force

For development and redevelopment projects, the Public Works Surface Water and Sewers Division (PW-SWS) carries out review for compliance of stormwater and sanitary sewer requirements, as part of the multi-department site plan review process coordinated by the Department of Community Planning and Economic Development (CPED). For projects that propose changes to the City's infrastructure (streets, lights, public utilities, etc.), the Public Works Department coordinates the Capital Projects Task Force (CPTF) process of review for compliance with the City's requirements for working within the public right-of-way.

In October 2017, the PW-SWS posted the City of Minneapolis Stormwater and Sanitary Sewer Guide (Guide) to provide information for developers and site designers to follow to ensure compliance with the City's requirements. The Guide includes a description of the City's stormwater management official controls, including the stormwater management ordinance, hydrologic/hydraulic model guidelines, groundwater permitting, project requirements, responsibilities during construction, and responsibilities following requirements. This Guide is a regulatory control that is, and will continue to be, used to ensure water resource standards are met with each development, redevelopment, and public facility constructed in the City.



Stormwater Management Standards for Development and Redevelopment/Post-Construction Stormwater Management

Shortly after the adoption of this WRMP, the Guide will be updated to change the official controls that regulate stormwater management in the City. Onsite stormwater management has been required for both private developments and new public facilities constructed since 1999 as a condition of site plan approval for developments, redevelopments, and public projects that disturb more than one acre. Chapter 54 of the Code of Ordinances established this requirement, applied pollutant reduction goals for projects that require post-construction stormwater management, and recommended that infiltration (stormwater volume reduction) be maximized to the greatest possible degree except in the cases of likely stormwater contamination (stormwater hotspots). Stormwater management plans submitted for Minneapolis Development Review must provide for stormwater controls to meet the pollution reduction goals contained in Chapter 54. The City has initiated a process to update these requirements in accordance with the NPDES Integrated Permit, the standards established by the watershed district/organizations with jurisdiction in the City, and to define requirements and the approval process for new private outfalls to surface waters. The MS4 permit requires all new and redevelopment projects that create or fully reconstruct one or more acres of impervious surface to retain onsite, to the maximum practicable extent, a stormwater volume of one-inch times the new and/or fully reconstructed impervious surfaces, except where infiltration is prohibited. Road projects are required to reduce a stormwater volume of one-inch times the net increase of impervious surfaces and reduce stormwater runoff volume for fully reconstructed surfaces, except where prohibited. The Permit requires the City's regulatory program to contain prohibitions on stormwater infiltration for sites where runoff may be contaminated, where the soils may be contaminated, in vulnerable wellhead protection areas, or where site conditions prevent effective infiltration (clay soils, sandy soils, Karst, too close to bedrock or groundwater). The Permit addresses mitigation provisions for circumstances where required conditions for stormwater management cannot be cost effectively met for construction projects.

Floodplain Management

Floodplain management is the management of developments and other activities in or near the floodplain that serve to prevent flood damages to structures. The DNR defines floodplain management as "the full range of public policy and action for ensuring wise use of the floodplains. It includes everything from collection and dissemination of flood control information to actual acquisition of floodplain lands, construction of flood control measures, and enactment and administration of codes, ordinances, and statutes regarding floodplain land use."

The National Flood Insurance Program (NFIP) was created by Congress in 1968. As stated by the <u>Federal</u> <u>Emergency Management Agency</u> (FEMA), "The National Flood Insurance Program aims to reduce the impact of flooding on private and public structures. It does so by providing affordable insurance to property owners and by encouraging communities to adopt and enforce floodplain management regulations. These efforts help mitigate the effects of flooding on new and improve structures."

FEMA periodically revises the Flood Insurance Rate Maps (FIRM) to more accurately delineate floodplain boundaries. As new maps are revised, the City adopts these new map panels and updates the provisions of the Floodplain Overlay District to continue participating in the NFIP and to reflect better



topographical data and more accurately represent the location of the determined floodway and flood fringe elevations.

The City will continue to implement its Floodplain Ordinance and to manage activities within the floodplain in accordance with State and Federal regulations. Through the ordinance, the City will maintain no net loss of floodplain storage and will not allow changes to the floodplain that will cause any increase to critical 100-year flood elevations. Where more up-to-date floodplain modeling exists, the City will use that information during the development process to provide land owners with a more accurate view of future flood risk to their property.

Anti-Degradation Requirements for Development and Redevelopment

The City is in compliance with the state anti-degradation requirements. The City has not created any new or expanded discharges as defined in 7050.0185 Subp. 2.A. and B. A non-degradation assessment was completed in 2010, with MPCA staff concluding that there had been no expanded discharge of stormwater from the jurisdiction of Minneapolis. From 1988 to 2010, the reduction in impervious cover was estimated at approximately 5 percent. The City has reduced, and is continuing to reduce, discharges through City stormwater management initiatives, City zoning requirements for developers, requirements of the municipal separate storm sewer system (MS4) permit regulations, and requirements of other local water management organizations. There has been a steady increase in the number of private plus City-owned structural best management practices (BMPs) installed in the City since 1988 to reduce runoff volume and pollutant loads, as shown in **Figure 5.2**.





The NPDES Integrated Permit requires that the City submit an application for reauthorization of this anti-degradation assessment after issuance of the final permit. No major changes to the status is anticipated.



Watershed Organization Requirements

Stormwater management requirements established by the City overlap with the standards established by the watershed district/organization with jurisdiction in the City. While the City works closely with all four of the watershed management organizations to coordinate water resource approvals, the specific review authority varies with each organization, as follows:

- BCWMC has authority to review projects to ensure compliance with their standards. BCWMC will
 review projects only after the City has completed local review and has affirmed that local
 requirements have been met.
- MCWD has authority to issue permits to projects that meet the standards set in their rules. Generally, the MCWD site plan review is independent from local review and is typically concurrent with all other permit reviews.
- MWMO does not issue permits. The MWMO does work closely with member cities to ensure that local controls meet MWMO standards.
- SCWMC has authority to review projects to ensure compliance with their standards. SCWMC will
 review projects only after the City has granted approval that the local requirements have been
 met.

MCWD allows local governments to assume sole regulatory authority to issue permits for some or all of their permits. This authority could be delegated to the local government after certain conditions set by the MCWD have been met. The City does not wish to assume sole regulatory responsibility for MCWD rules.

These watershed organization requirements overlap with stormwater management requirements set by the MPCA in their General Permit for Construction Activities. Table 5.4 compares the minimum sized site that is required to meet specific stormwater management activities for each of these organizations that are in effect in 2017.



able 5.4 – Minneapolis and Watershed Organization Permit Requirements for Redevelopments throug آلامه	ςh
2017	

Permit Category	Land Use or Activity	Minneapolis Minimum Site Area or Volume ^{a, b}	BCWMC Minimum Site Area or Volume c	MCWD Minimum Site Area or Volume d, e	MWMO Minimum Site Area or Volume f	SCWMC Minimum Site Area or Volume g	MPCA Minimum Site Area or Volume
Erosion Control	All	500 sf	10,000 sf	5,000 sf	Applies requirements to member cities	Required for all sites that require permit	1 acre
Erosion Control	Cut or Fill	5 cy	200 cy	50 су	N/A	Required for all sites that require permit	N/A
Stormwater Management	All	1 acre disturbance	1 acre new impervious surface	1 acre	1 acre	N/A	1 acre new impervious surface
Stormwater Management	Non- residential	N/A	N/A	N/A	N/A	0.5 acres	N/A
Stormwater Management	Residential	N/A	N/A	N/A	N/A	1 acre	N/A

Source:

^a Minneapolis Code of Ordinances, Chapter 52, Erosion and Sediment Control and Drainage

^b Minneapolis Code of Ordinances, Chapter 54, Stormwater Management

^c BCWMC Requirements for Improvements and Development Proposals, September 2015.

<u>http://www.bassettcreekwmo.org/application/files/9814/4430/8842/AppendixH-RevisedRequirementsDoc-Sept2015-Final.pdf</u> ^d MCWD Erosion Control Rule, April 24, 2014.

http://minnehahacreek.org/sites/minnehahacreek.org/files/attachments/6%20%20Rule%20-%20erosion%20control.pdf ^e MCWD Stormwater Management Rule, April 24, 2014.

http://minnehahacreek.org/sites/minnehahacreek.org/files/attachments/12.%20Rule%20-%20stormwater.pdf

^f MWMO Watershed Management Plan, November 15, 2016. <u>http://mwmo.org/reports/watershed-management-plan/</u> ^g SCWMC Rules and Standards, July 11, 2013.

http://www.shinglecreek.org/uploads/5/7/7/6/57762663/scwm_rules_and_standards_revised_2013.pdf

^h MPCA, NPDES General Permit for Construction Activity, August 1, 2013. <u>http://www.pca.state.mn.us/sites/default/files/wq-strm2-68a.pdf</u>

The City will look for opportunities to partner with watershed organizations to ensure that both City and watershed organization requirements for developments and redevelopments are met. In cases where current city controls are restricting the advancement of a project, the City will review and will seek to modify the controls in a manner that allows for the project to continue while also meeting the City's overall water resource goals. Revisions to official controls proposed by the City will follow an inclusive stakeholder review process that includes all watershed organizations, as well as other affected external stakeholders. Specifically, in 2018, the City will update the stormwater official controls to be in compliance with the NPDES Integrated Permit and revisions recommended in this WRMP.

Wetland Conservation Act

New construction projects that propose to alter wetlands must comply with provisions of the Minnesota Wetland Conservation Act (WCA). The City of Minneapolis, Department of Public Works, is designated as the local government unit (LGU) by the Minnesota Board of Soil and Water Resources, except for the



part of the City within the bounds of the Minnehaha Creek Watershed District (MCWD). As LGU, the City is responsible for ensuring the provisions of the WCA are implemented in Minneapolis.

Although most wetlands in the City are located on public property, there are a few small wetlands that are under private ownership. If a development or redevelopment proposes to alter a wetland that is governed by the Wetland Conservation Act, the City will require that the developer delineate the wetland and prepare a wetland mitigation plan that must be approved by the Public Works Division of Surface Water and Sewers. The City may opt to consult with the watershed management organization or a technical evaluation panel (TEP) to ensure that the mitigation plan meets all requirements.

The City's wetland review also includes review for compliance with the BCWMC buffer requirements.

Minimal Impact Design Standards Flexible Treatment Options

The Minimal Impact Design Standards (MIDS) goals are aimed at projects that add at least one acre of impervious surface. It is rare for projects in the City to add this much new pavement or building area. More commonly redeveloped projects in the City actually decrease the total amount of impervious surfaces from earlier built conditions as site designers incorporate stormwater management and green space requirements.

The low-impact approaches, inherent in MIDS, are most easily applied in areas that have not already been developed as dense urban areas. The City of Minneapolis is one of the nation's older, fully developed cities, with an extensive, underground stormwater drain network built to manage runoff from a dense urban pattern of streets and buildings. As a fully developed central city, many of the existing parcels in the City are not of sufficient size to fully implement <u>Minimal Impact Design Standards</u> performance goals. The typical small lot in the City may have insufficient separation between stormwater infiltration devices and sanitary sewer pipes, which creates the potential of the stormwater seeping into the sanitary sewer which would contribute to I/I related flows. Additionally, infiltration on Brownfield sites, those with presence of contaminated soils and/or groundwater, is not allowed by the MPCA. Other physical restrictions include poor soil conditions and utility conflicts. The City is using the MIDS goals as a foundation for developing revised regulatory controls that address volume management requirements of the NPDES Integrated Permit.

Ongoing Stormwater Management Compliance

The Division of Surface Water and Sewers maintains a database of stormwater management practices (SMPs) that have been installed in compliance with official controls established by the City. Developers or property owners are required to submit an <u>annual registration form</u> that reports on the ongoing inspection and maintenance activities for each BMP.

Inspections are conducted periodically to confirm that the stormwater practices are being maintained and that the practices are continuing to function as approved. Inspections include photo documentation of the stormwater practices and follow-up for stormwater practices that are not functioning and/or properly maintained.

The NPDES Integrated Permit requires that the City establishes a legal mechanism between the site owner and the City for structural BMPs. The program is required to contain a process that allows City



inspections of BMPs, transfer of maintenance responsibilities to future site owners/maintainers, and procedures that owners must follow to alter site features and/or structural BMPs.

Utility Billing

The Minneapolis Finance Department manages all monthly <u>utility billing</u>, including billing for sanitary sewage and stormwater runoff. For residential customers, the <u>sewage charges</u> are based on the average water consumption used during the winter months of December through March. Water consumption in the winter months is used to calculate the average sewer use for the remainder for the year to account for warm weather months when water may be used for irrigation and not end up in the sewer system. This average rate is applied for the remainder of the year.

In 2005, the City adopted a stormwater utility fee structure that applies a flat rate to residential properties and an impervious surface area rate for commercial/industrial/institutional properties. A <u>50</u> <u>percent to 100 percent credit</u> may be applied if a property contains stormwater quality and/or stormwater quantity practices. Additional information on stormwater utility fee calculations and credits are contained in the <u>City of Minneapolis Stormwater and Sanitary Sewer Guide</u>.

Utility Permits

In the City, property owners are responsible for the entire length of utility existing between a building, or other location on private property, to the point of connection to the City's main sanitary sewer, as shown in Figure 5.3. Contractors are required to obtain a connection permit from the City's Utility Connections Office prior to connecting directly to the City's sanitary sewer or storm drain. Permits are also required prior to creating an extension or change to an existing privately-owned sanitary sewer or storm drain. The Utility Connections Office will request approval from the Public Works Division of Surface Water and Sewers prior to issuance of a storm drain connection permit. Detailed descriptions of required utility permits and associated requirements are contained in the City of Minneapolis Stormwater and Sanitary Sewer Guide.





Figure 5.3 – Public vs. Private Sanitary Sewers in the City of Minneapolis

City approval of long-term discharges of groundwater to the storm drainage system will require a Long-Term Groundwater Discharge Approval, as detailed in the City of Minneapolis Stormwater and Sanitary Sewer Guide.

From time to time, a developer may propose to add an outfall directly to a waterbody in the City without connection to a City-owned storm drain. This practice is currently prohibited by the City's Code of Ordinances. Chapter 511.30 states "No person shall build or repair any ditch, or lay or repair any pipe or conduit, for the purpose of discharging storm, surface, cooling or condenser water into the Mississippi River or any stream or watercourse within or adjacent to the boundaries of the city." Rules and policies of the MPCA, the watershed organizations, and the City are being reviewed to clarify the proper process for application, review, and approval. After review of these procedures, the City will determine whether to amend Chapter 511.30.

Water Permits

The Minneapolis Health Department Environmental Services is assigned the responsibility to ensure that water utilization on private property is undertaken in accordance with the requirements of the City, Hennepin County, and the State of Minnesota. Accordingly, they have established permit and inspection procedures in the following areas of water usage:

 <u>Temporary Discharge of Water</u> permits are required for the intentional temporary discharge of any water into either the sanitary sewer or storm drain systems.



- <u>Groundwater Well</u> permits are required for temporary wells, permanent wells, and sealing of wells.
- Non-Community Public Water Systems that serve individual facilities are actively inspected to ensure that the privately withdrawn groundwater meets the requirements of the federal Safe Drinking Water Act.

Temporary and permanent groundwater discharge requirements are detailed in the <u>City of Minneapolis</u> <u>Stormwater and Sanitary Sewer Guide</u>.

Appropriations from Small Watercourses

The City and the MPRB do not allow appropriations from lakes, creeks, or wetlands in the City except when approved on a case-by-case basis for maintenance of public lands.

Zoning Code and Land Use

The <u>Minneapolis Zoning Administration Office</u> of CPED is responsible for ensuring that the land use in the City of Minneapolis is in compliance with the <u>Zoning Code</u>. All properties are within one of 23 primary zoning districts that fall into the general categories of Residential District, Office Residence Districts, Commercial Districts, Downtown Districts, and Industrial Districts. Properties may also be within an overlay zoning district which establishes additional land use requirements. Environmental protection requirements, including water resource protection measures, have been incorporated into Minneapolis Zoning Code in the following overlay districts:

- Floodplain Overlay District zoning requirements are established in accordance with the National Flood Insurance Program to maintain the City's eligibility in the National Flood Insurance Program (NFIP). Boundaries of each Floodplain Overlay District are based on the potential extent of flooding of nearby surface waters, primarily creeks and the Mississippi River.
- <u>Shoreland Overlay District</u> aims to preserve the environmental qualities of the City's surface waters and are written in accordance with the requirements of the Minnesota Department of Natural Resources (MNDNR). Boundaries of each Shoreland Overlay District extend 1,000 feet from lakes, ponds, and wetlands; and, 300 feet from rivers and streams.
- <u>Mississippi River Corridor Critical Area Overlay District</u> is a variation of the Shoreland Overlay District that specifically applies to the Mississippi River Corridor. This district's boundaries were established by Executive Order 79-19 issued by Governor Albert Quie.

It is possible that one or more of these overlay districts may apply to an individual property in the City. Figure 5.4 shows an area of Minneapolis where all three of the above overlay districts are mapped.



Figure 5.4 – Overlay Zoning Districts





The 2016 Minnesota Buffer Law could affect the riparian land use and/or zoning for a small number of privately-owned properties along Bassett Creek, Ryan Creek, and some wetlands in the City. Minnesota Statute Section 103F.48, Subd.5(4) provides an exemption to the Buffer Law for municipalities governed by a MS4 National Pollutant Discharge Elimination System (NPDES) permit. This exemption applies where municipalities have provided for riparian protection within their MS4 NPDES permit, construction stormwater permit, or industrial stormwater permit. Therefore, changes to land use to meet Minnesota Buffer Law requirements are not required in Minneapolis.

Administrative Responsibilities

The City and MPRB staff have a wide range of responsibilities and are trained to have a basic understanding of water resources management, including major stormwater management issues such as known stormwater management problem areas, stormwater management expectations for new and redevelopment projects, incorporation of stormwater mitigation into capital improvement projects, erosion and sediment control, and regulatory jurisdiction.

Staff from many City departments and MPRB work cooperatively to ensure that water resource programs are properly managed, and that official controls are enforced. Departments with the greatest involvement include CPED, Minneapolis Finance and Property Services (MFPS), Minneapolis Department of Health (MDH), Minneapolis Public Works Division of Surface Water and Sewers (PW-SWS), and Minneapolis Public Works Transportation (PW-T). Specific functions of each department are compiled into Table 5.5 and described in additional detail in the following sections.

Activity	CPED	MFPS	MHD	MPRB	MPW- SWS	MPW-T	Other
Complaints			V	V	V		
Erosion and Sediment Control			V		V		
Emergency Preparedness			V		V		
Illicit Discharge and Detection Elimination			v	v	v	v	
Individual Subsurface Sewage Treatment Systems (ISST)							Hennepin County
I/I Compliance: Private Properties			V		V		
Public Education, Participation, & Involvement				v	v		
Rat, Rodent, and Insect Control					V		
Site Plan Review	V				V	V	
Utility Billing		V			V		
Utility Permits					V	V	
Water Permits		V	V		V	V	
Wetland Conservation Act Administration					v		
Zoning Code Administration	V						

Table 5.5 – Responsibility for Regulatory Actions



Coordination with Other Government Agencies – Water Resource Programs

All staff involved in water resource management actively interact with the multiple government agencies that regulate water resources in Minnesota, including, but not limited to, agencies described in Section 1 – History and Overview of Minneapolis Water Resources. The City will continue to collaborate with these agencies to provide the most efficient and effective water resource management with minimal duplication of efforts.

Assessment of Minneapolis Water Resource Programs

The status and compliance with the following specific programs are highlighted based on requirements for this Water Resource Management Plan (WRMP) as set by Metropolitan Council and/or watershed organizations:

- MPCA Construction General Permit New BMP Requirements. The MPCA requirement to incorporate stormwater controls into projects that create one acre or more of new impervious surface is rarely triggered on development and redevelopment projects within the City. Instead, the City implemented a program that requires stormwater controls for all developments with land disturbance of one acre or greater, regardless of the increase or decrease of impervious surface. This approach has resulted in more onsite stormwater management than would have resulted if the City opted to rely solely on the MPCA Construction General Permit. Since the City requirement is more restrictive than the MPCA requirement established in the MPCA Construction General Permit, it can be concluded that the City standards are more restrictive than the MPCA requirements.
- MIDS Flexible Treatment Options. The City of Minneapolis supports the concept of stormwater volume control through site designs that minimize the generation of runoff and through onsite infiltration of the runoff that is generated. MIDS was developed as a voluntary program. There is no specific state requirement that cities must impose MIDS standards on projects; however, some watershed districts and management organizations have adopted MIDS standards. The City is using the MIDS goals and MIDS Flexible Treatment Options specific to ultra-urban conditions as a guide to determine locations where achieving MIDS goals is not feasible as a foundation for developing revised regulatory controls that address volume management requirements of the NPDES Integrated Permit. This will be incorporated in the changes to the City's stormwater management official controls that will be completed in 2018.
- Anti-Degradation Requirements. The state anti-degradation requirements are met in the City through a number of programs that reduce impervious cover, reduce discharges, and add structural BMPs to reduce runoff volume and pollutant loads.
- Wetland Conservation Act (WCA). The City complies with the requirements of the WCA by requiring wetland delineation and wetland mitigation plan for all developments that propose to alter a wetland within the City. The City will continue to coordinate with watershed organizations if a wetland is proposed to be affected to ensure that WCA and watershed organization requirements are met.



- Watershed Management Organization Requirements. An important objective of the City is to ensure that property owners and developers are not faced with conflicts in stormwater management objectives between state, watershed organization, and City requirements. If a conflict does arise, the City works closely with the affected watershed organization and developer to find a solution that is acceptable to all and not detrimental to the water resource. The City will continue to coordinate with watershed management organizations to ensure that the 2018 update to the stormwater management official controls meets the most current watershed management objectives.
- Regulatory Controls for BCWMC Flood Control Projects. The City owns, maintains, and operates two Bassett Creek tunnels. The City is required to ensure that no modifications happen that will add new tributary area, flows, connections, or outlets to the new tunnel without proper vetting and ensuring that there will be no negative impacts to the flood control projects. The City is required to maintain 50 cubic feet per second (cfs) capacity in the "old" Bassett Creek tunnel during the 100-year storm event to accommodate the overflow of stormwater that cannot be accommodated in the "new" tunnel.
- Inflow/Infiltration Program. The primary source of I/I from private properties within the City has historically been from direct connections of rooftop runoff to the sanitary sewer, also called rainleaders or roof drains. The aggressive program to locate, inspect, and disconnect the rainleaders, has been an important factor in the deterrence of CSOs since 2007. The City intends to continue to inspect private rainleaders and enforce the rainleader official controls to continue to reduce the peak flows that are discharged to Metropolitan Council interceptors.
- Private Outfalls. City ordinance prohibits the creation of new privately owned stormwater outfalls that discharge directly to surface waters. To-date, the enforcement of this prohibition has been inconsistently applied. The City will work internally to set up specific responsibilities to ensure that private stormwater outfalls are not installed as part of future private development or redevelopment projects.

Change That Would Be Adequate to Meet Performance Standards or Official Controls

This WRMP's impact will be to foster collaborative efforts, where each entity does what it does best without another entity duplicating those efforts. In this vein, the City will assume the lead in infrastructure management and construction; MPRB will assume the lead in water quality monitoring and management of park lands; and the watershed organizations will assume the lead in supporting clean water through water resource management and protection.

The WRMP envisions the City and its watershed management organizations will strive to:

 Collaborate on site plan reviews before permit issuance in cases where construction stormwater management comes under review of both the watershed organization and the City, including proposals to construct new outfalls directly to surface waters.



- Cooperate to enforce official controls, including erosion and sediment control, stormwater management, and floodplain alteration requirements.
- Participate in cost-sharing for water quality controls, modeling, and feasibility studies.
- Share modeling, monitoring, and project data and analysis.

The City will continue to seek opportunities to partner with watershed management organizations as stormwater management projects are proposed and under development. The City will involve watershed management organizations and other stakeholders in the process to amend official controls to address regulatory stormwater management, wetland buffer, and floodplain management.



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Section 6 – Planning and Implementation

Overview

The City of Minneapolis (City) has well-established programs that protect, maintain, and improve surface water quality. The intent of this section of the Minneapolis Water Resource Management Plan (WRMP) is to describe the City's structure and process for ongoing management of and changes to the City's water resource management projects and programs.

Water Resource Management Financing

The City's budget is adopted annually and establishes the finances for the year following adoption. Future budgets, such as 5-year Capital Improvement Program (CIP) plans, are presented for planning purposes, yet there is no certainty that future funding will come to fruition. The most current budget, available on the City's <u>Finance and Budget website</u>, should be referenced for information on the financial status of the sanitary sewer and stormwater programs.

Revenue

The total annual budget for the Public Works activities is funded primarily by revenue from the Sanitary Sewer Fund and the Stormwater Fund, supplemented by grants and cost-share agreements described below. Total revenue collected from the sources described in this section is not expected to increase, other than modest adjustments based on inflation. The amount budgeted towards specific activities is likely to be adjusted each year, based on changes in priorities or regulatory requirements.

These sources represent most of the revenue that supports the Sanitary Sewer Fund and the Stormwater Fund:

- Sanitary Sewer Utility Fee. The sanitary sewer utility fee is charged to customers each month through the City's utility bill. The fee is computed based on a charge per 100 cubic feet (equivalent to 748 gallons) of water used, plus a monthly fixed charge based on the size of the customer's water meter. Since there are no wastewater meters, the monthly wastewater use is based on the water used by each customer during the winter quarter. Fees are reviewed on an annual basis and adjusted as needed.
- Stormwater Utility Fee. In 2005, the City implemented a stormwater utility fee, which is charged to customers each month through the City's utility bill. Prior to that time, the sanitary sewer utility fee was used to fund both sanitary and stormwater expenditures. Stormwater utility fees are calculated using property size, impervious surface measurements, or land use category factors and a monthly rate. Single family residential properties are charged according to a three-tier monthly equivalent stormwater unit (ESU) as the base fee, with the other tiers being slightly lower or higher (25 percent lower or 25 percent higher) based on property area. The monthly rate is reviewed on an annual basis as part of the budget process.
- Sewer Bonds. Although this is not an explicit source of revenue, the City may opt to issue sewer bonds to raise money to pay for infrastructure upgrades and replacement. The sale of bonds



allows the City to spread the payment of a capital improvement project over a period, typically 10 to 20 years. The debt service on these bonds is paid through the Sanitary Sewer Fund or the Stormwater Fund, as appropriate.

- Special Assessments. Assessments against benefitting or responsible properties are used to finance improvements. This is a small revenue source that is applied to specific benefitted properties for selected capital improvement projects.
- Grants and Cost-Share Agreements. Though subject to budgetary constraints, state and other grant programs and cost-share opportunities are available for water resource management projects and programs. These revenue sources are used on a case-by-case basis, dependent on the proposed project or activity, and the limitations of the funds. In the recent past, the City has received water resource funding from the following agencies, grants, and cost-share programs:
 - Bassett Creek Watershed Management Commission.
 - Clean Water Fund of the Minnesota Clean Water and Legacy Amendment.
 - Hennepin County Natural Resource Opportunity Grant.
 - Legislative Citizen Commission on Minnesota Resources/Environment and Natural Resources Trust Fund.
 - Metropolitan Council Parks and Open Space.
 - Metropolitan Council Metro Environment Program.
 - Minnehaha Creek Watershed District.
 - Minnesota Legislature Direct Appropriation.
 - Minnesota Department of Natural Resources Flood Mitigation.
 - Minnesota Department of Natural Resources Shoreland Habitat.
 - Mississippi Watershed Management Organization.
 - Public Facilities Authority (PFA) Loans.
 - Shingle Creek Watershed Management Commission.
- Miscellaneous Revenue. Other revenue sources include fines, license fees, and permit fees. These
 revenue sources are relatively small and can vary greatly from year to year.

The MRPB and Environmental Services Department with the City also have responsibilities with regards to water resource protection. They fund their responsibilities through a combination of user fees, permit fees, and general fund.



Expenditures

The City invests in water resource management within the framework of its current capital and operating budgets, established by the City Council and approved by the Mayor on an annual basis. Prioritization is critical to ensure that the capital improvement projects and regulatory programs stay within limits of available revenue. Five-year projections of future project and program expenditures are listed in the City's annual budgets but are subject to considerable change.

The 2018 total annual budget for water resources-related activities by the City is approximately \$91 million, of which \$59.4 million is the sanitary sewer budget and \$31.6 million is the stormwater budget. In recent years, the annual budget has experienced moderate increases, as demonstrated in Table 6.1. These budget figures do not include budgets or expenditures for the drinking water treatment and distribution programs.

	2015 (actual)	2016 (actual)	2017 (actual)	2018 (adopted)
Sanitary Sewer	\$48,892,414	\$52,013,183	\$54,148,859	\$59,450,203
Stormwater	\$26,082,314	\$28,560,507	\$29,033,661	\$31,655,363
Total	\$74,974,728	\$80,573,690	\$83,182,520	\$91,105,566

Table 6.1 – City of Minnea	ipolis Sanitary Sewer an	d Stormwater Operating	g Budget, 2015 thr	ough 2018

The largest expenditure from these budgets, which represents approximately half of the total of the City water resource management budget, is the annual payment to Metropolitan Council for wastewater services, which in 2018 is projected to be \$41.3 million. The remainder is utilized by the City for capital improvement and operational (or non-capital) expenses, which are described in the following sections. A snapshot of the 2017 expenditures of the Sanitary Fund and Stormwater Fund is shown in Figure 6.1.

All the expense categories described in this section are financed through the Sanitary Sewer Fund and/or the Stormwater Fund.





Figure 6.1 – 2017 Sanitary Sewer Fund and Stormwater Fund Distribution

Capital Improvement Program

The City's 5-year Capital Improvement Project (CIP) budget is developed in an open process that starts with City department proposals, which are reviewed in detail by a citizen's committee (<u>CLIC – Capital</u> <u>Long-Range Improvement Committee</u>) and the Mayor. The City Council holds public hearings before final budget adoption, which typically occurs in December of each year. The City's <u>2018 CIP</u> identifies all



water resource-related projects programmed by the City for construction in 2017. The most current information is available on the City's Budget website.

Table 6.2 represents the 5-year Capital Improvement Program as submitted to CLIC for the 2019 to 2023 budget cycle.

Program	Program Fund Sources		2020 (\$1000)	2021 (\$1000)	2022 (\$1000)	2023 (\$1000)
Infiltration and Inflow Mitigation Program	Sanitary Bonds Sanitary Revenue	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500
Sanitary Tunnel & Sewer Rehab	Sanitary Bonds Sanitary Revenue	\$16,000	\$8,000	\$8,000	\$8,000	\$8,000
Implementation of EPA Stormwater Regulations	n of EPA gulations Stormwater Revenue		\$250	\$250	\$250	\$250
Combined Sewer Overflow Improvements	Stormwater Revenue	\$1,500	\$1,500	\$1,500	\$1,500	\$1,500
Storm Drains and TunnelsStormwater BongRehab ProgramStormwater Rever		\$6,000	\$6,000	\$6,000	\$6,000	\$6,000
I-35W Storm Tunnel Reconstruction	Stormwater Bonds	-	-	-	-	\$1,000
Flood Mitigation – Stormwater Stormwater Bonds Alternatives Stormwater Revenue		\$5,000	\$5,000	\$5,000	\$5,000	\$5,000
Central City Parallel Storm Tunnel	Stormwater Bonds Stormwater Revenue	-	\$11,000	\$11,000	\$11,000	-

Table 6.2 – Minneapolis Sanitary Sewer and Storm Sewer Capital Improvement Budget, 2019-2023

As noted in Table 6.2, sanitary sewer and stormwater drainage projects are grouped into general categories of funding. As described in Section 4 – Infrastructure Inventory, Activities, and Assessment, the City is in the process of fully evaluating the condition, capacity, and water quality needs of the sanitary sewer and stormwater systems. After these evaluations are completed in 2018, the City plans to develop an integrated infrastructure planning program to maximize public investments that minimize risk to human health and the environment, prevent loss of life, personal injury, or severe property damage, minimizes the risk of release of raw sewage to the Mississippi River, and improves water quality of all receiving waterbodies. The purpose of this evaluation will be to identify and prioritize future Capital Improvement Projects that will be funded in the categories that are described below.

Inflow/Infiltration Mitigation Program funds are used to implement projects that will reduce the amount of clear water in the sanitary system and reduce the risks for overflow of untreated sewage mixed with stormwater to the Mississippi River during severe rainstorms. The reduction of clear water in the sanitary sewer system is also required by Metropolitan Council which provides regional wastewater collection and treatment. In 2013, Metropolitan Council implemented an ongoing surcharge program to require communities to continue to make progress in removing inflow/infiltration (I/I) from the system. Reduction of I/I also reduces the total volume of wastewater sent to the treatment plant and therefore reduces the amount of money the City has to pay Metropolitan Council for wastewater treatment. Actions typically include pipe lining, bulkhead repairs, manhole repairs, and other structural rehabilitation.



Sanitary Tunnel and Sewer Rehab Program funds repair and rehabilitate tunnels, pipes, lift stations, and access structures, as prioritized by the Minneapolis Public Works Surface Water and Sewers Division. Efforts to repair and rehabilitate the sanitary sewer system have concentrated on structural failures, improved access to the deep collection tunnels, and proper maintenance of lift stations. Condition assessments have been made to comprehensively address the aging system in order to improve its reliability. The installation of a Supervisory Control and Data Acquisition (SCADA) system is a key component for efficient management of the lift stations. Ongoing work includes replacing worn out components, rehabilitation or removal of system structural flow restrictions, and manhole repairs. The City is using an asset management framework to move from emergency reaction response to a planned rehabilitation program in order to minimize repair costs and liabilities, as well as to maximize work force efficiencies. Sanitary sewers and stormwater drains that have been identified as having the greatest need of rehabilitation are identified in Figure 6.2. Pipes are evaluated using the National Association of Sewer Service Companies (NASSCO) standard condition scale of 1 to 5. Condition ratings 4 and 5 are those that have been identified as the most critical.





Figure 6.2 – Sanitary Sewers and Stormwater Drains with Maximum Condition Ratings



Implementation of United State Environmental Protection Agency (EPA) Stormwater

Regulations contains individual projects to mitigate the pollution effects of urbanization on stormwater runoff. Capital projects related to structural improvements necessary for compliance with TMDL requirements may be funded through this program. Installation of many of the future structural stormwater management practices will be prioritized based on water quality needs, as well as the ability to collaborate with other Public Works improvement projects. Coordination with street reconstruction projects will allow the City to optimize construction costs and minimize public disruption. Future street construction projects are identified in Figure 6.3.

This program will be the funding source for the local share of the following potential projects that will be led by watershed organizations:

- BCWMC: Bryn Mawr Meadows Water Quality Improvement Project (2019)
- BCWMC: Restoration and Stabilization of Historic Bassett Creek Channel (2021)



Credit: Minneapolis Public Works

- BCWMC: Bassett Creek Park Water Quality Improvement Project (2024)
- MCWD: Minnehaha Parkway Stormwater Management (2020-2021)
- MCWD: Stormwater Volume and Pollutant Load Reduction (2018-2027)
- MWMO: Greening within the Public Right-of-Way/8th Street Green Infrastructure Pilot Project (2018-2019)
- SCWMC: Flood Area #5 Water Quality Projects (2018-2022)
- Combined Sewer Overflow Improvements Program was originally established in the mid-1980s, as detailed in Section 4 Infrastructure Inventory, Activities, and Assessment to remove inflow from public sources and provide facilities for private disconnections where no storm drain currently exists in the area. The program complements the I/I Removal Program. The projects to be constructed in this CSO Improvements Program are shown in Figure 6.4.



Downtown Trees Planted within Underground Stormwater Cells

Figure 6.3 – Street Reconstruction Projects







Figure 6.4 – Combined Sewer Overflow Project Areas


Storm Drains and Tunnels Rehab

Program is similar to the Sanitary Sewer and Tunnel Rehab Program, except that the funds are used to repair and rehabilitate the condition and/or the capacity of the storm drain and tunnel systems. A 2012 study completed on the storm drain tunnels found that typical problems include voids above or below the tunnel structure, cracking due to pressurization, erosion of the tunnel floor, and infiltration of



Minneapolis Central City Tunnel Survey

Credit: CDM Smith

groundwater. Currently, the Public Works Department is conducting repairs on those considered most critical. The cost to repair these tunnels varies with the magnitude of the problem. As with the sanitary system, the City is utilizing asset management tools to move from emergency reaction response to a planned rehabilitation program in order to minimize repair costs and liabilities, as well as to maximize work force efficiencies. Sanitary sewers and stormwater drains that have been identified as having the greatest need of rehabilitation are identified in Figure 6.2. NASSCO Condition Ratings 4 and 5 are those that have been identified as the most critical.

Flood Mitigation Program –

Stormwater Alternatives addresses localized flooding and drainage problems. The programs look at volume, load, and rate controls and aim to protect homes and businesses and improve water quality. Hydraulic and hydrologic modeling is being done citywide to determine the extent of the localized problems. When modeling is completed in 2018, flood areas will be evaluated. Areas found to be a highest risk for flooding will be subject to feasibility studies. The results of the feasibility studies will inform selection and prioritization of solutions considering



Credit: Minneapolis Public Works

constructability and costs, as well as the need to leverage other opportunities and funding. Solutions for larger-scale drainage problems may include underground storage, pipes, and ponds in combination with green infrastructure such as rain gardens, bioswales, constructed wetlands, and pervious pavements. Future projects for this funding category will be informed by the Hydrologic and Hydraulic Modeling effort described in Section 4 – Infrastructure Inventory,



37th and Columbus Flood Pond

Activities, and Assessment. A preliminary indication of the likely areas in need of hydraulic improvement is shown in Figure 6.5, which shows the flood areas identified in 1999 and 2005.

This program will be the funding source for the local share of the following potential projects that will be led by watershed organizations:

- MCWD: Hiawatha Golf Course Restoration (2020-2021)
- MWMO: 1NE Flood Mitigation and Water Quality Improvements (2018-2020)





Figure 6.5 – Current Flood Mitigation Study Areas



Central City Parallel Storm Tunnel – This project includes design and construction of a new parallel tunnel in the Central City to improve system operations. The system, built from 1939 to 1940, was designed to handle the downtown drainage requirements of that time. Land development has since created a significant increase in the amount of impervious surface, and as a result, an increase in the rate and volume of stormwater directed into the Central City tunnels. The result is over-pressurization that causes degradation of the tunnel liner and erosion of the sandstone behind the tunnel liner. The goal of the project is to reduce this pressurization and ultimately reduce the risk of failure and extend the tunnel's service life. The proposed upgrade is to construct a new parallel tunnel for the Washington Avenue segment, starting at the intersection of Washington Avenue and Hennepin Avenue and ending approximately 150 feet from the outfall at the Mississippi River, as shown in Figure 6.6. Feasibility studies and design are underway and will be followed by three years of construction starting in 2020.

Figure 6.6 – Proposed Central City Parallel Tunnel Alignment



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Operational Programs

The Public Works Division of Surface Water and Sewers manages or provides funds for the following programs established to manage water resource activities in the City:

- Operation and Maintenance. Those operations and maintenance (O&M) activities described in Section 4 – Infrastructure Inventory, Activities, and Assessment are financed entirely through the Sanitary Sewer Fund and the Stormwater Fund.
- Street Cleaning. The Stormwater Fund provides funds to operate the City's street cleaning operations.



Credit: Minneapolis Public Works

Compliance with EPA Regulations. This includes non-capital activities necessary to comply with the NPDES stormwater permit and other water resource-related requirements, which are described in Section 5 – Regulatory Controls and Water Resource Management Programs. The Stormwater Fund finances these activities that include inspections, monitoring, public education, public participation, and annual reports. Activities related to TMDL compliance would be funded through this program. Stormwater Outfall Inspection

- Watershed Organization Contributions. The MCWD and MWMO have taxing authority and obtain all of their Capital Improvement and operational funds through a direct property tax levy. Capital Improvement funds for BCWMC and SCWMC are levied through Hennepin County. The City of Minneapolis, through the Stormwater Fund, directly contributes funds for the BCWMC and SCWMC operating budgets. Contributions are assessed on an annual basis and are based on a formula that takes into account the total area of each member city within the watershed and the net tax capacity of all property within the watershed. The 2016 WMO contributions from the City amounted to:
 - BCWMC \$32,885
 - SCWMC \$21,948



Credit: Minneapolis Public Works



- Metropolitan Council Contribution. The annual fee for wastewater treatment of sanitary sewage generated in the City is financed primarily by the Sanitary Sewer Fund (95 percent), with a small contribution from the Stormwater Fund (5 percent). The 2016 payments from the City amounted to \$39,190,278.
- Inflow/Infiltration Compliance. The sanitary sewer utility finances the non-capital I/I activities, which includes monitoring, metering, inspections, smoke testing, analysis, and annual reports.
- Sewer Availability Charges Program. Sewer Availability Charges (SAC) are collected by the City based on criteria established by the Metropolitan Council. All fees collected are paid directly to the Metropolitan Council. The 2016 payment from the City amounted to \$8,987,030.

Project and Program Implementation

Framework

The City promulgates programs that creates a framework for prioritization of individual projects. A specific project begins because of a specific need or regulatory requirement. Existing conditions are assessed, coordination with partners is initiated, planning occurs, and then the improvement is implemented. While the general steps are similar for program implementation, specific project considerations and coordination needs will differ. For example, some projects are born out of a need to address pipe condition and risk of infrastructure failure. Others may arise because of the need to address aging infrastructure associated with a street reconstruction project. Still others are initiated based on the need to address water quality concerns or mitigate flooding. Regardless, all projects are selected based on deliberate review of assessment data and need to coordinate and work cooperatively with partners.

The lifecycle of water resources management activities includes three principle phases: assessment, planning, and implementation, including ongoing maintenance or management costs for the life of the project or program. Components of each include:

- Assessment involves an array of techniques to validate whether water resource management practices and infrastructure meet critical City efficiency objectives, such as: structural integrity; ability to relieve impacts to health, safety, property, infrastructure, and aquatic life; and, regulatory compliance. Activities include inspection, monitoring, routine record-keeping, and emergency response readiness. Assessment involves coordination and communicaiton with potential project partners.
- Planning uses the findings from the assessment phase to identify capital, operational, regulatory, and administrative measures to cost-effectively address critical impacts. Planning activities are initiated once a problem has been identified in the assessment phase or when a new regulation is being promulgated by a public agency.
- Implementation puts plans to action by construction of capital improvements, alterations of maintenance activities, and enforcement of regulations.



Additional activities needed to meet water resource management goals are implemented when it is determined that the additional activity will add increased value to those already in place. All new activities are developed under the auspices of the implementation framework. In addition to preliminary communication and coordination during data review and assessment, for each proposed new activity, stakeholders are consulted, a detailed scope is developed, budgets are proposed, and authorization to proceed begins after approval by the City Council and Mayor.

Prioritization

The approach utilized by the City for prioritization of water resource management projects and activities is set up to balance system needs and the need to maximize investment of public dollars. Included as considerations in prioritization are asset management recommendations, capacity analysis, water quality modeling results, cost-effectiveness, and the need to leverage opportunities associated with other ongoing projects (e.g., street reconstruction).

A high/medium/low system is applied to the Implementation Program described below. Highest priority is given to action related to the health and safety of citizens, to infrastructure improvements identified as critical, and to those mandated by the City's NPDES Integrated Permit, including TMDL compliance activities. Medium priority projects and program implementation are those that are important to the integrity of the City's infrastructure and those that have City-wide significance. Low priority is given to projects that are important, but not critical, and to those that have a localized significance as opposed to a City-wide significance.

The City will continue to program water resource projects and programs based on this prioritization approach, which has proven to be both effective and flexible. Changes to prioritization of CIP projects, based on results of ongoing inspections and assessments, will occur on an annual basis as a City revises its CIP program each year.

Implementation Program

The City has created a comprehensive program that is designed to be flexible such that it can adjust to changes of needs and priorities. This iterative, robust program complies with all current regulatory responsibilities while also providing for management of the City's aging water resource infrastructure. As described previously in this section, the City works on a 5-year schedule towards implementation of capital improvements and water resource management activities. Additional projects, which are anticipated for implementation in years 6 through 10, are documented by staff, but are not developed in any significant detail until a project is added to the 5-year program.

Appendix K includes a full list of the Capital Improvement Projects and other stormwater management activities that the City intends to pursue during the 10-year planning period of this WRMP. The CIP projects and the stormwater management improvements slated for the first 5 years have been approved by the City Council and the Mayor and are actively being developed. Projects and other activities programmed for the later years of the 10-year cycle are subject to significant changes as other assessment programs identify critical deficiencies, as other priorities arise, new City Council goals are established, and as other project specific challenges are discovered.



Each year, the City will continue to adjust water resource management projects and activities to ensure that its programs are fully compliant with regulatory requirements. Once costs are identified for new projects or activities, project schedules will be developed and all projects or activities within a specific program will be revised to accommodate the new requirement. This iterative approach applies to new regulatory requirements, as well as newly identified infrastructure maintenance or rehabilitation needs.

Capital Improvement Program

The CIP section of Appendix K lists infrastructure improvement projects that have been identified as having benefits to the sanitary sewer system and to the stormwater drainage infrastructure. The list includes projects that will be led by the City, as well as those that the City will contribute funds which will be led by others (MPRB and watershed organizations).

Ongoing investigations have the potential to identify new improvements that would benefit the water resources of the City which could be given higher priority than projects in the current 5-year CIP, including:

- Development of the Asset Management Program has allowed the City to transition from a reactive, emergency response approach to infrastructure maintenance, to a proactive, planned rehabilitation program that identifies infrastructure condition issues. Newly identified issues such as risk or condition may cause an adjustment to the prioritization of rehabilitation projects.
- Completion of the XPSWMM Systemwide Storm Sewer Modeling in 2018 will allow the City to identify and prioritize improvement projects to mitigate localized flooding and provide capacity in the system. The modeling work will also help inform rehabilitation, development, and street improvement projects.
- Information developed through the Pipeshed Delineation and Water Quality Modeling project will be used to estimate load reductions from the approximately 1,000 public and private structural best management practices (BMPs) in the City, by outfall. This information will help prioritize retrofit and water quality improvements projects based on TMDLs and other water quality factors.
- Subwatershed Assessment study being conducted by the SCWMC is assessing the land area in the City that drains to Shingle Creek, Ryan Lake, and Crystal Lake. Once this assessment is completed, the City will work with the SCWMC and the MPRB to implement recommendations to improve water quality and to meet TMDL requirements in impacted waterbodies. Projects within the watershed will likely be led by the City, while projects within MPRB properties, including instream and streambank projects, will likely be led by MPRB with cooperation from the City.

Appendix K contains a comprehensive list of projects identified in Figure 6.2 (Pipes with Maximum Condition Ratings), Figure 6.3 (Street Reconstruction Projects), Figure 6.4 (CSO Project Areas), and Figure 6.5 (Current Flood Mitigation Study Areas).



Stormwater Management Program

The Stormwater Management Program is on a 5-year implementation cycle, which is driven by the City's NPDES Integrated Permit. The current permit period expires in 2022, at which time the MPCA could significantly alter the priorities and specific activities listed in Appendix K.

The highest priority project identified by the City and described in Section 5 – Regulatory Controls and Water Resource Management Programs is to revise the City's official controls, beginning with revisions to the City's stormwater management ordinance, commonly called Chapter 54. The City is committed to updating their official controls through a comprehensive stakeholder process that will involve multiple external stakeholders, including watershed organizations, builders, and developers, as well as interested citizens. The following schedule has been established that anticipates revisions to Chapter 54 within the 180-day period following City adoption of this WRMP:

October 2018

- Prepare first draft of ordinance revisions
- Complete internal reviews
- Develop a list of potential external stakeholders

November 2018

- Incorporate internal review comments into second draft
- Solicit interest from specific stakeholders

December 2018

Conduct two external stakeholder meetings

January 2019

Incorporate external review comments into third draft

February 2019

Internal review of final draft ordinance

March 2019

City Council reading and adoption

The other official controls that are anticipated to be updated in accordance with the prioritization and schedule set in Appendix K include revisions to the City's SWMP to be in compliance with the newly issued NPDES Integrated Permit, strengthening the wetland and wetland buffer mitigation procedures contained in the Minneapolis Stormwater and Sanitary Sewer Development Guide, and updates to the City's floodplain management requirements.



All other stormwater management activities listed in Appendix K are to be implemented in accordance with the current NPDES Integrated Permit, as detailed in the <u>current</u> and future revisions of the Minneapolis SWMP.



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