NPDES MS4 Phase I Permit No. MN0061018
Annual Report for 2020 Activities

City of Minneapolis and the Minneapolis Park & Recreation Board
Co-Permittees

June 30, 2021

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SIGNATURE PAGE

Minneapolis
City of Lakes

NPDES MS4 Phase I Permit
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June 30, 2021

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

Elizabeth Stout

Elizabeth Stout

Date 6/30/2021 Registration No. 46328

NPDES PERMIT NO. MN0061018
Issued February 16, 2018

Prepared by Minneapolis Public Works – Surface Water and Sewers Division

ACRONYMS

BCWMC	Bassett Creek Watershed Management Commission
BMP	Best Management Practice
BOD_5	Biochemical Oxygen Demand of wastewater during decomposition over a 5-day period
CIP	Capital Improvement Program
CSO	Combined Sewer Overflow
DNR	Department of Natural Resources
EPA	Environmental Protection Agency
ESC	Erosion and Sediment Control
GIS	Geographic Information Services
I & I	Inflow and Infiltration
IPM	Integrated Pest Management
MCES	Metropolitan Council Environmental Services
MCM	Minimal Control Measure
MCWD	Minnehaha Creek Watershed District
MDA	Minnesota Department of Agriculture
MDR	Minneapolis Development Review
MIDS	Minimal Impact Design Standards
MNDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MPRB	Minneapolis Park & Recreation Board
MS4	Municipal Separate Storm Sewer System
MWMO	Mississippi Watershed Management Organization
NPDES	National Pollutant Discharge Elimination System
PW-SWS	Public Works – Surface Water and Sewers
PW-TMR	Public Works – Transportation Maintenance and Repair
SCWMC	Shingle Creek Watershed Management Commission
SMP	Stormwater Management Practice
SOP	Standard Operating Procedure
SSO	Sanitary Sewer Overflow
SWMP	Stormwater Management Program
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TSI	Trophic State Index
TSS	Total Suspended Solids
VRS	Vehicle Related Spills
WMO	Watershed Management Organization

ACKNOWLEDGEMENTS

Minneapolis Public Works - Surface Water & Sewers
Paul Chellsen
Lane Christianson
Justin Flannery
Kevin Danen
Paul Hudalla
Stephanie Johnson
Katie Kowalczyk
Kelly MacIntyre
Shahram Missaghi
Kelly Moriarity
Sean Oberg
Isaac Prehall
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BACKGROUND

This report provides documentation and analysis of the Minneapolis Stormwater Management Program (SWMP) activities conducted during 2020. The City and Minneapolis Park & Recreation Board (MPRB) both lead the implementation of the SWMP activities and are jointly responsible for the completion of the required Permit submittals.

This Annual Report is prepared in compliance with the requirements of National Pollutant Discharge Elimination System (NPDES) Permit No. MN0061018, a Municipal Separate Storm Sewer System (MS4) Phase I permit issued to City of Minneapolis and the Minneapolis Park & Recreation Board as co-permittees. Permit No. MN0061018 was initially issued in December 2000 and reissued in January 2011. An updated NPDES permit was reissued again in February 2018. Activities completed under the new permit and approved Stormwater Management Program (SWMP) have been reported in the 2020 Annual Report and will be submitted to the MPCA (Minnesota Pollution Control Agency) by June 30, 2021.

The NPDES program was created in 1990 by the United States Environmental Protection Agency (EPA) to safeguard public waters through the regulation of the discharge of pollutants to surface waters including lakes, streams, wetlands, and rivers. The MPCA is the local authority responsible for administering this program. Under the NPDES program, specific permits are issued to regulate different types of municipal, industrial, and construction activities. This report is related specifically to municipal stormwater activities.

The SWMP is based on an adaptive management system, as outlined in Part III of the Permit, by which the Permittees continuously monitor, analyze, and adjust the SWMP to achieve pollutant reductions. Using the adaptive management approach, revisions to the SWMP are made and submitted to the MPCA as necessary. A 2013 EPA/MPCA audit helped to identify opportunities for improvement regarding comprehensive training, written procedures and documentation, and availability of staff resources that have influenced subsequent revisions to the SWMP. The Permit requires the implementation of approved Stormwater Management Activities, referred to as SMPs, also known as Best Management Practices (BMPs).

Minneapolis Public Works, Surface Water & Sewer Division provides program management and completes each Annual Report. An annual opportunity for public input into the SWMP and city priorities is required under the permit. The permit also requires the adoption of a formal resolution by the Minneapolis City Council each year, adopting the Annual Report. This resolution will be sent under separate cover.

In February 2018, the City's most recent NPDES permit was reissued by the MPCA. In response to that permit update, the City's Stormwater Management Program (SWMP) was updated to reflect any new permit requirements or changes. The updates SWMP was approved by the Minneapolis City Council in 2019 for submittal to the MPCA.

MCM ONE: PUBLIC EDUCATION AND OUTREACH

PROGRAM OBJECTIVES

The objective of this stormwater management practice is to educate the public regarding point and non-point source stormwater pollution.

Targeted pollutants include:

- All pollutants

PROGRAM OVERVIEW

A successful stormwater management program involves participation and good management from everyone in the City, including municipal staff, residents, business owners, park visitors, facility managers, contractors, developers, and all others who live, work, and recreate In Minneapolis. Public education serves to provide information on the importance of water quality, the impacts of stormwater runoff, the sources of pollutants in stormwater runoff, and the activities that the public should adopt to fulfill their collective responsibilities towards improved water quality.

Many of the components of the program can be found at the City of Minneapolis Stormwater website or on the MPRB Water Resources website.

Program activities include hosting of educational events, distribution of educational materials, regular updates of web-based information, staff training, and other activities. Some of the program activities are carried out directly by the co-permittees, the City, and the Minneapolis Park & Recreation Board (MPRB). Other activities are coordinated with and carried out by watershed management organizations, Hennepin County, and other entities.

PREVIOUS YEAR ACTIVITIES

MPRB Water Quality Education Activities

In 2020, Minneapolis Park & Recreation Board (MPRB) staff provided water quality education programs throughout the City. Water quality education programs were unique in 2020 due to the covid-19 pandemic. Environmental Management Naturalist staff were still able to offer program opportunities 31 times in neighborhood and regional parks. Additionally, educational sign prompts (offered in both Spanish and English) were placed in 9 park locations, and 8 local hardware stores were furbished with displays to educate customers about the use of salt for winter snow and ice management. All program locations can be seen in Figure 28-1. Socially distanced, in-person water quality educational displays focused on neighborhood watersheds and how human activities impact local water bodies. 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 about stormwater.

Minnehaha Park

A moveable water quality education exhibit was deployed at Minnehaha Park near the pavilion that houses the popular restaurant, Sea Salt Eatery. The spinning cubes provide information about watersheds, stormwater runoff, and actions people can take to positively impact water quality. This location was chosen because of the consistent captive audience of people standing in line waiting to

order food. Intermittent staff observations throughout the season confirmed that many of the people waiting in line were reading from the exhibit.

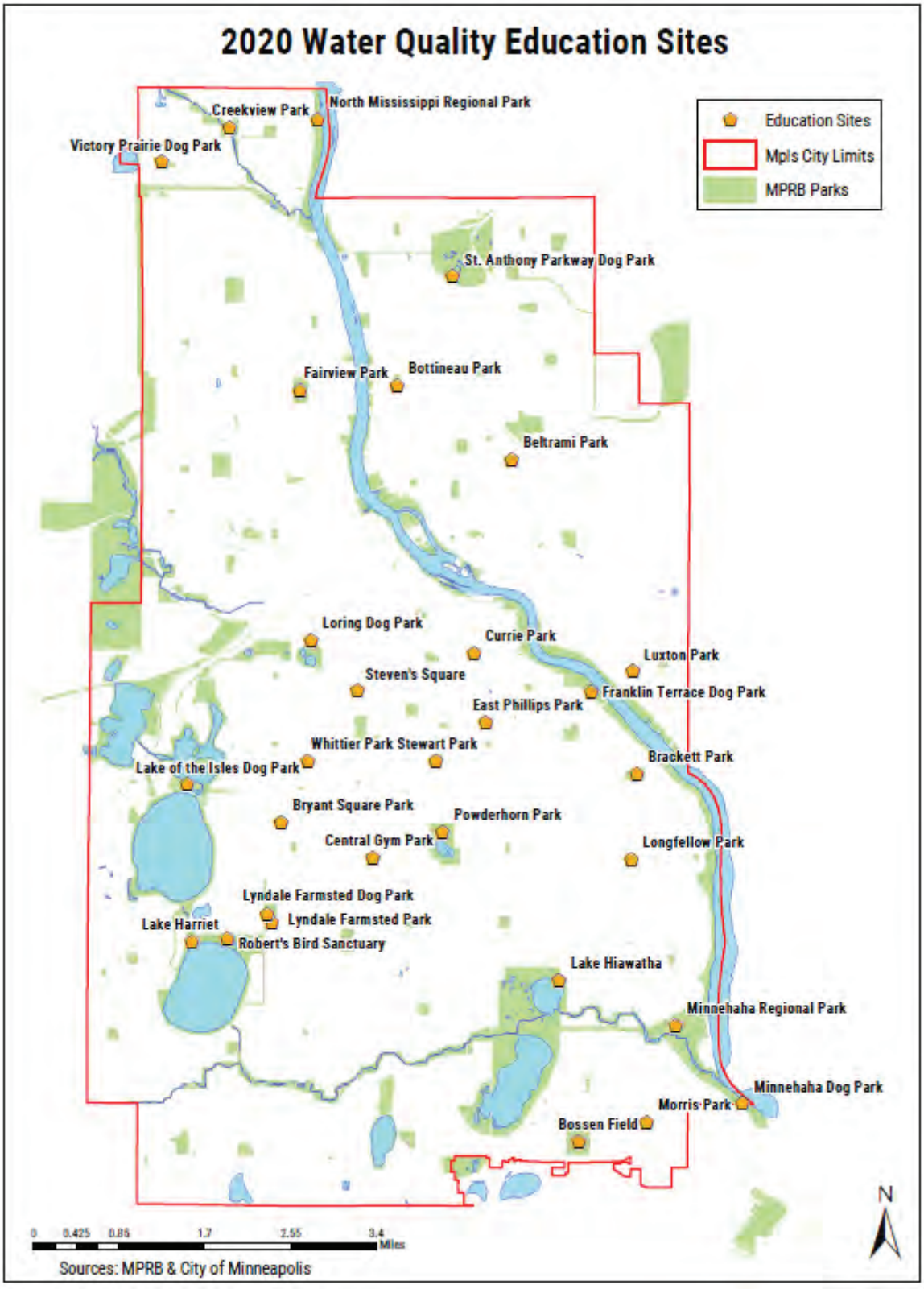


Figure 28-1. Map and list of water quality education sites in 2020.

Water Quality Water Trail

A Water Trail, a designed series of buoys to follow like a trail on the water, for Lake Nokomis is planned to include water quality education materials. A set of 10 Stand Up Paddleboard (SUP) yoga poses were designed to be added to the buoys holding water quality messages, see **Figure 28-2** for one example. These Water Trail marking buoys will be deployed in the summer of 2021 for SUP paddlers (or other boaters) to explore the lake and learn more about protecting the water quality of Lake Nokomis.

Figure 28-2. White buoy with yoga illustration on top and water quality message about the impacts of litter below.

Spanish Language Publications

A series of weekly newsletter articles were published in La Matraca News, as seen in **Figure 28-3**. This newsletter featured topics on how storm drains work, raking fall leaves, picking up litter, reducing salt

use in winter, picking up dog waste, and not feeding waterfowl. These articles appeared in Spanish and were accompanied with a photo and a list of park sites for readers to visit and learn more about water quality.

"NO SE PUEDE CHIFLAR Y COMER PINOLE" EDICIÓN 560 — DICIEMBRE 11, 2020 11

Locales

¿Qué es mejor que la sal para limpiar el hielo? ¡Muchas cosas!

Por James A. Emery
Educador en Calidad del Agua en Minneapolis Park and Recreation Board

Toda la sal que depositamos en nuestros caminos de entrada y aceras llega a los desagües pluviales y tiene un impacto terrible en nuestros lagos y arroyos. Esa es una buena razón para usar menos sal, pero otra buena razón es que la sal no hace un buen trabajo limpiando los pasillos de nieve y hielo.

La sal derrite el hielo al reducir el punto de congelación del agua, pero ese proceso deja de funcionar a temperaturas por debajo de los 15 grados Fahrenheit. Si compra y usa más sal, no servirá de nada; simplemente estará tirando su dinero por el desagüe pluvial y pagando para envenenar nuestras aguas. Se acerca el invierno y hay formas de limpiar la nieve y el hielo que son tan o más efectivas que usar sal.

¡PALEAR!

Es el deporte de invierno no oficial del estado de Minnesota. Palear nieve es un gran ejercicio, una forma divertida de estar al aire libre en un día de invierno y es una forma mucho más eficiente de quitar la nieve que rociando sal.

Vierta chocolate caliente para terminar el trabajo, en su taza, es decir, no en la acera.

ARENA

Además de proporcionar una gran tracción para zapatos y neumáticos, la arena absorbe la luz solar que ayuda a derretir el hielo y la nieve.

ARENA PARA GATOS

La arena para gatos está diseñada para ser absorbente, por lo que es muy eficaz para absorber el agua que hace que la superficie del hielo sea resbaladiza. Es mucho más amigable para las patas de sus mascotas que la sal, y no matará su césped en la primavera.

Si debe usar sal para superficies potencialmente peligrosas, como escalones, recuerde que solo un poco de sal hará el trabajo y que usar más sal no será más efectivo.

Piense en formas de reducir, si no eliminar, la sal. Hacer tu parte para cuidar nuestras aguas durante todo el año te ayudará a disfrutar de estos largos meses de invierno. ■

Figure 28-3. A screenshot of the La Matraca online News feature about using salt responsibly.

Aquatic Invasive Species Education

The MPRB continued its extensive Aquatic Invasive Species (AIS) Inspection Program at the public boat launches located at Bde Maka Ska, Lake Harriet, and Lake Nokomis. The boat launches are staffed seven days a week from May 1 to December 1, and all boats entering and leaving the lakes are inspected for AIS. In addition to providing boat inspections, staff are an information source for the park visitors. Staff directly interacted with 12,391 park visitors in 2020. Adjacent to the AIS booths are sandwich boards, **Figure 28-4**, with action steps people can take to be a good water steward. The sandwich board

messages can be changed out daily based on weather, time of year, etc. Annually, more than seven million people visit the Chain of Lakes, and more than one million visit Lake Nokomis.

Figure 28-4. Aquatic Invasive Species and water quality education at boat launches.

Canines for Clean Water Campaign

According to US Census data, there were 188,017 households in Minneapolis in 2020. Using American Veterinary Medical Association ownership rates, an estimated 115,500 dogs live within Minneapolis city limits. The US Environmental Protection Agency has calculated the average dog produces 0.75 pounds of waste each day. That means Minneapolis dogs are generating an estimated 87,000 pounds of solid waste each day. Initiated in 2009, Canines for Clean Water is a water quality education program targeting dog owners to build awareness of the impacts of this waste when it is not properly disposed of and empowering people to take action and make a difference.

In 2020, MPRB's seven dog parks were sites that received a series of six educational sign prompts about the importance of picking up dog droppings to protect our water quality. **Figure 28-5** shows an example of one of these signs, all of which were offered in both Spanish and English:

Figure 28-5. An example of the signs posted in Minneapolis Dog Parks.

Do Not Feed the Ducks Campaign

Based on a successful pilot program in 2016 that focused on persuading park patrons to not feed the ducks, the MPRB moved forward with fabrication of permanent education pieces in 2017. In 2020, our yellow duck ambassadors continued their focus on persuading park patrons to not feed the ducks. An oversized buoy in the shape of a rubber duck floated along the Lake Harriet shoreline, adjacent to the seasonal restaurant Bread & Pickle. 60 rubber duck table-toppers with ' please do not feed the ducks' messaging were installed in the following locations: picnic tables at Bread & Pickle at Lake Harriet, Sea Salt Eatery in Minnehaha Regional Park, the former Refectory site at Bde Maka Ska, Sand Castle at Lake Nokomis, and along the fishing rail at Powderhorn Lake, where ducks were provided in both English and Spanish. See **Figure 28-6** for examples of our rubber duck ambassadors.

Figure 28-6. Tabletop duck and the Lake Harriet rubber duck buoy of the Don't Feed the Ducks Campaign

Earth Day Watershed Clean-up

Since 2008, The MPRB Earth Day Clean-up event has inspired more than 20,000 residents to remove more than 160,000 pounds of garbage from Minneapolis Parks. In the spirit of continuing to create a positive impact in our parks, the 2020 Clean-Up was modified to a 'Do-It-Yourself' mode. More than 4,400 people were reached by MPRB Facebook posts, and more than 600 people participated with the hashtag #MplsDIYEarthDay. This support of so many people throughout the City of Minneapolis showed us all what we can do #AloneTogether, and created a way for us to share photos of folks picking up in our parks! Two of such photos are included in **Figure 28-7**.

Figure 28-7. 2020 Earth Day Watershed Clean-up

Mississippi River Green Team

For 2020, the Mississippi River Green Team, a conservation-based teen crew, was unable to engage in their typical environmental work throughout the summer. Instead, a crew of 8 returning, second-year youth staff and one supervisor, spent the fall working in the natural areas of North Mississippi Regional Park. See four of our youth staff mustering trail side to receive instructions for the day in **Figure 28-8.** Typical workdays included invasive species removal, weed wrenching, planting, watering, and mulching. The Mississippi River Green Team is made possible through a partnership between the Minneapolis Park & Recreation Board and the Mississippi Watershed Management Organization.

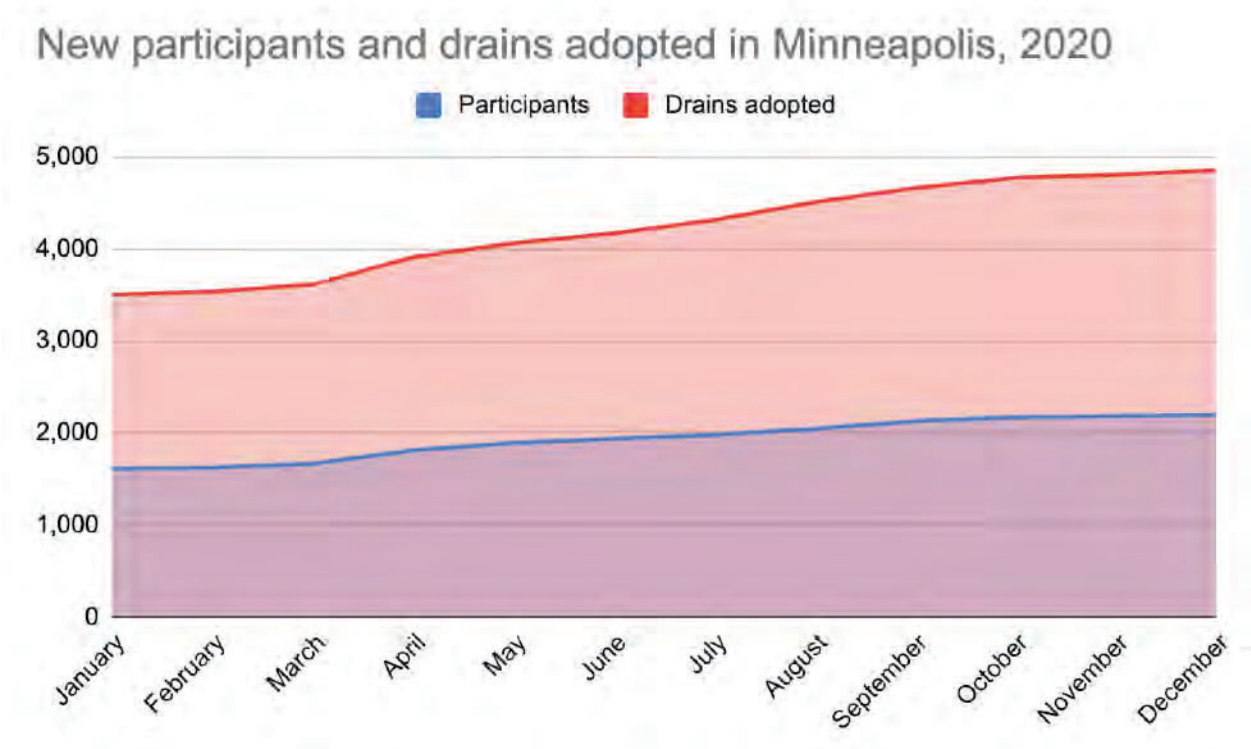
Figure 28-8. Mississippi River Green Team youth staff at North Mississippi Regional Park

Minneapolis Adopt-a-Drain Program

Since 2016, the Minneapolis Adopt-a-Drain program has empowered Minneapolis residents to take responsibility for storm drains and gutters in their neighborhoods by adopting and keeping them clean. In March 2019, the arrival of a metro-wide website (www.adopt-a-drain.org) was launched to serve all cities in the Twin Cities 7 county area.

Despite the COVID-19 pandemic, the Minneapolis Program posted significant numbers in 2020:

- Minneapolis led all cities in the Twin Cities with 2,194 total program participants (598 joined in 2020)
- 4,851 total storm drains adopted (1,376 were added in 2020)
- 962 participants in Minneapolis reported cleanings in 2020 (535 reported cleanings in 2019)
- Collected 54,712 pounds of debris in 2020 (28,083 pounds of debris was collected in 2019)
- 1,349 volunteer hours logged in 2020 (530 hours logged in 2019)
- 65 pounds of Total Phosphorus removed from the waters of Minneapolis (the amount of TP removed is higher with only 43.8% of participants reported cleanings)



Geographic breakdown by watershed and sub-watershed:

Watershed	Drains adopted	Debris collected (lbs)	Time spent (hours)
Mississippi	2,296	25,443.75	637.9
Minnehaha Creek	2,220	27,068.05	576.1
Shingle Creek	192	1,445.7	35.6
Bassett Creek	142	572.2	11.0
West Mississippi	1	0	0.0

Subwatershed	Drains adopted	Debris collected (lbs)	Time spent (hours)
Mississippi River	2,586	26,900.7	700.0
Minnehaha Creek	843	12,925.9	271.1
Lake Hiawatha	283	2,677.1	66.3
Lake Nokomis	181	1,043.6	23.1
Lake Calhoun	166	2,616.9	35.5
Lake Harriet	152	3,294.8	65.3
Diamond Lake	120	1,433.2	28.1
Shingle Creek	118	929.1	19.5
Lake of the Isles	97	793.0	10.5
Powderhorn Lake	68	196.2	5.3
Crystal Lake	66	441.6	11.8
Grass Lake	65	783.1	12.0
Bassett Creek Main Stem (Downstream)	62	316.2	7.1
Cedar Lake	16	137.9	3.5
Richfield Lake	9	5.5	0.4
Silver Lake (MWMO)	6	35.0	1.3
Brownie Lake	5	0.0	0.0
Spring Lake	5	0.0	0.0
Grimes Lake	2	0.0	0.0

Drains adopted: Cumulative total
Debris collected: 2020 data only

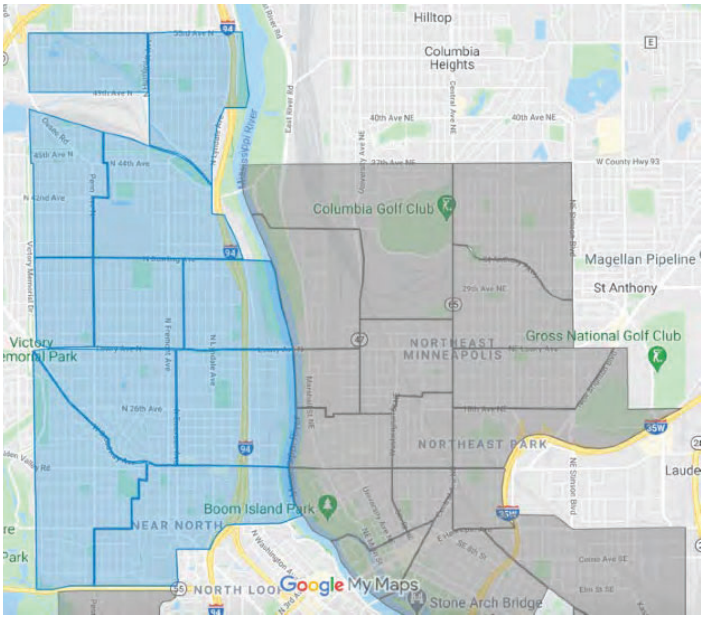
ADOPT-A-DRAIN DOOR HANGING

Because of the COVID-19 pandemic, no educational door hangers were distributed in 2020 (14,250 door hangers were distributed in 2019). Door hanging is a strong tool to encourage people to join the Adopt-

a-Drain Program, as adoption rates in door hangered neighborhoods are consistently higher than non-door hangered neighborhoods. Door hanging will resume in 2021.

In September 2020, postcards were sent to more than 16,000 residences in north Minneapolis, including these neighborhoods: Shingle Creek, Lind-Bohanon, Victory, Webber-Camden, Cleveland, Folwell, McKinley, Jordan, Hawthorne, Near-North and Willard-Hay.

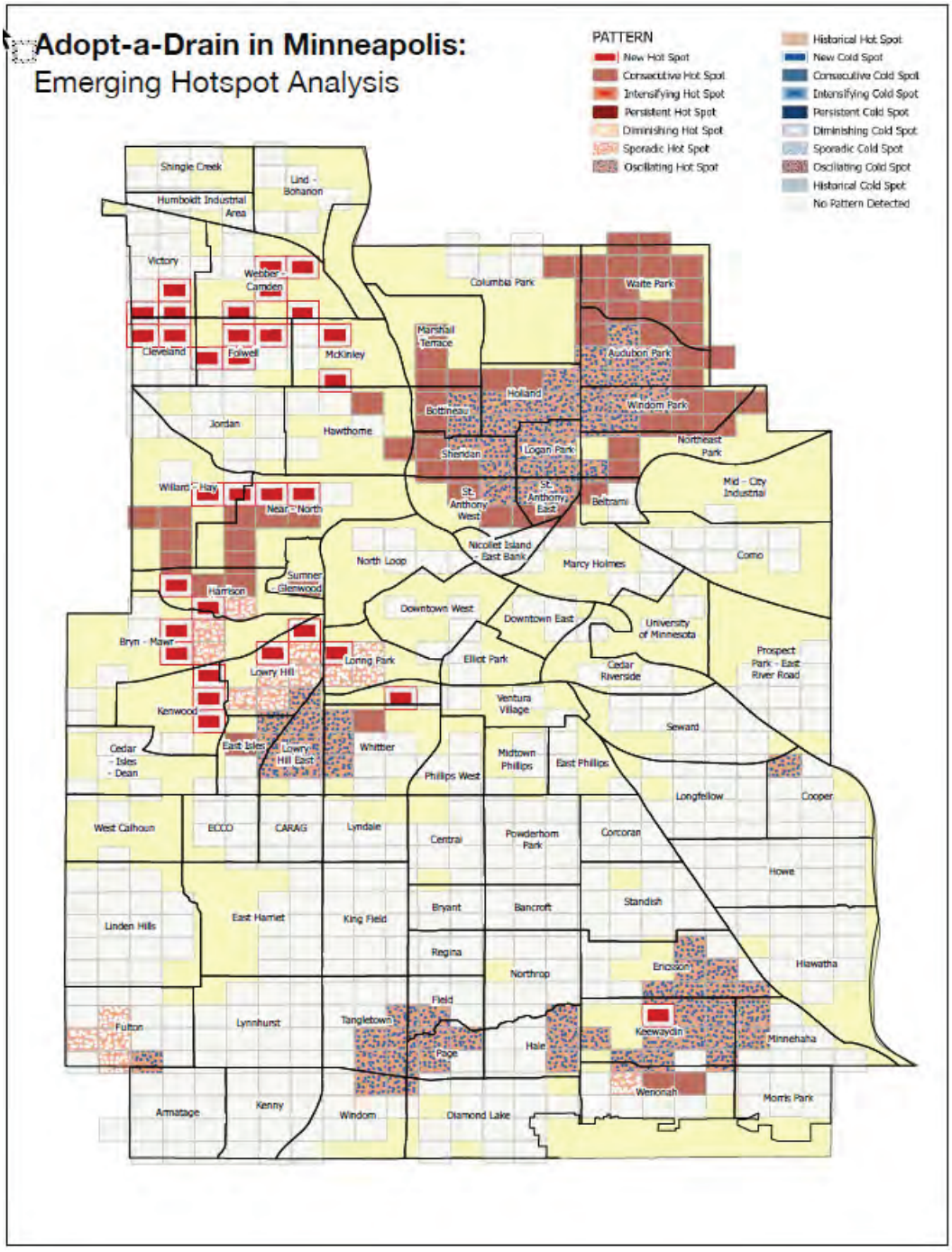
Neighborhood	New Adopters	New Adoptions
Shingle Creek	4	7
Lind-Bohanon	8	13
Victory	8	12
Webber-Camden	10	15
Cleveland	13	28
Folwell	8	14
McKinley	3	11
Jordan	7	9
Hawthorne	1	1
Near-North	4	39
Whillard-Hay	4	7
Total	70	156



There were new hot spots in many of the neighborhoods receiving the mailers including: Victory, Webber-Camden, Cleveland, Folwell, McKinley, Willard Hay, and Near North.

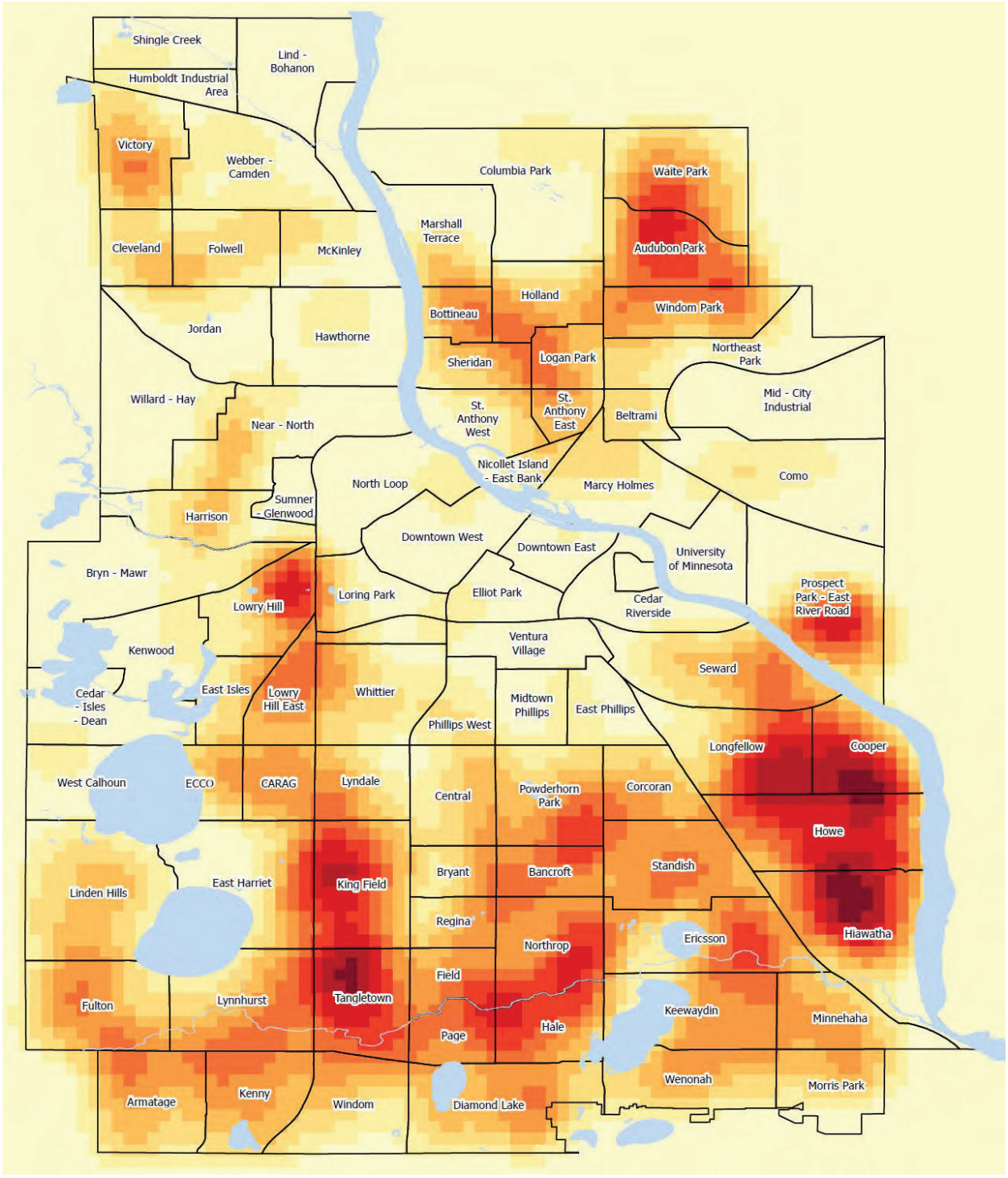
NE ADOPT-A-DRAIN CHALLENGE

A Master Water Steward stepped up to organize a challenge involving all 13 Northeast Minneapolis neighborhoods to raise awareness and increase storm drain adoption rates. It involved multi-level competitions where neighborhood organizations recognized monthly "winners", posted data throughout the 6-month challenge, and a celebration and recognition of neighborhood winners at the end of the season.



Emerging hotspot analysis

There is also a large hotspot covering much of Northeast Minneapolis, including the neighborhoods that were involved in the Northeast Drain Adoption Competition, that started in the spring 2020 and continued through the beginning of fall.

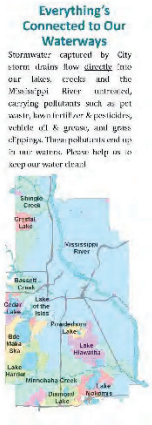


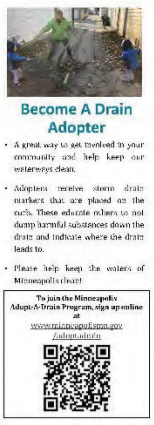
Density of adopted storm drains in Minneapolis

In 2020, 594 welcome packets mailed to program participants, including waterbody specific yard signs for adopter's yards, storm drain decals and adhesives, welcome card with safety tips and instructions, and a customized Minneapolis welcome letter. The yard signs provide a secondary touchpoint away from the storm drain, helping to raise awareness and to encourage people to keep storm drains near their homes clean.

Despite the COVID-19 pandemic, the Minneapolis Adopt-a-Drain Program again supplied brochures to many organizations, including:

- All 47 MPRB Recreation Centers
- All MPRB lake kiosks
- Hennepin County libraries
- Neighborhood organizations
- Various recipients in Minneapolis





These brochures include a QR code to allow program access from a smartphone or tablet.

Minneapolis Storm Drain Stenciling Program

Storm drain stenciling not only educates volunteers who paint environmentally friendly messages like "FLOWS TO RIVER/LAKE/CREEK – KEEP DRAIN CLEAN" on the storm drains, but also engages residents and people passing by. It is a great team-building exercise that helps people learn actions they can do to improve the quality of the lakes, creeks, and the Mississippi River in Minneapolis. The program provides stencils in English, as well as Spanish and Somali languages for certain neighborhoods.

While the COVID-19 pandemic certainly affected engagement and program numbers, a "Take & Paint" option was introduced where volunteers took supplies and didn't have to return a storm drain stenciling kit. For this version, and the standard check out version, all supplies were thoroughly cleaned and sanitized. Safety protocols were followed by City staff engaging with residents during kit exchange.

2020 STORM DRAIN STENCILING PROGRAM RESULTS:

- 22 volunteers participating
- 120 storm drains stenciled
- 200 doorhangers hung on residential homes
- 29 bags of trash and debris collected
- 2,500 pounds of trash, leaves, and debris removed from storm drain system
- Over 3 pounds of phosphorus removed from lakes, creeks, and the Mississippi River

Organizations who participated in storm drain stenciling in 2020 included schools, higher learning institutes, neighborhood organizations, block clubs, and individual residents and houses of worship.

Despite the COVID-19 pandemic, the Stenciling Program again supplied brochures to many organizations, including:

- All 47 MPRB Recreation Centers
- All MPRB lake kiosks
- Hennepin County libraries
- Neighborhood organizations
- Various recipients in Minneapolis

These brochures include a QR code to allow program access from a smartphone or tablet.

Metro Blooms Training and Engagement Programs

In 2020, the City of Minneapolis funded and provided project management and oversight for the non-profit Metro Blooms Resilient Yards Workshops and the Boulevard Bioswale Program.

Metro Blooms works with public and private partners to address long-term sustainability of constructed BMPs by regular maintenance, inspections, reporting for raingardens, bioswales, stormwater planters, wet and dry ponds, permeable pavers, and underground infiltration chambers.
Staff from Metro Blooms uses sustainable landscape management practices, prioritizing non-chemical methods and battery-operated landscaping equipment to maintain these practices. Metro Blooms provides maintenance and inspections for approximately 50 private BMPs in Minneapolis. This support helps the property owners maintain BMPs, to stay in compliance with Chapter 54 requirements and preserve their stormwater utility credit.

2020 RESILIENT YARD WORKSHOPS

- 17 workshops (9 Resilient workshops; 5 Turf Alternative workshops; and 3 Train-the-Trainer workshops)
- 571 Minneapolis residents participated
- 236 Minneapolis residents received on site consultations
- 25 residents installed neighborhood-based raingardens

In 2020, The City of Minneapolis, through working with Metro Blooms, partnered with Conservation Corps of MN and 10 Minneapolis neighborhoods (Armatage, Audubon, Holland, Kenny, Logan Park, Longfellow, Lynnhurst, Tangletown, Waite Park, Windom Park) to install raingardens:

- 121 raingardens
- 16,500 square feet of native habitat
- Estimated 2 million gallons runoff captured, 910 lbs solids and 5 lbs phosphorus in 2020

CREATING YOUR RESILIENT YARD

Nine of these workshops focused on the creation of water-friendly sustainable landscapes. Year-end survey results including program evaluation and participant survey showed that:

- 95% of respondents rated the workshops as “excellent”
- 80% plan to install a rain garden in the future
- 39% indicated that they are likely or very likely to install a raingarden

TURF ALTERNATIVES

Five workshops focused on turf alternatives that minimize irrigation and maximize pollinator habitat.

LAWNS TO LEGUMES (L2L) DEMONSTRATION NEIGHBORHOODS

The Minneapolis Public Works contract with Metro Blooms also provided matching funds for BWSR's (Minnesota Board of Water and Soil Resources) LCCMR (Legislative-Citizen Commission on Minnesota Resources) funded Lawns to Legumes Program (winner of the 2021 Environmental Initiative Awards). In 2020, North Minneapolis and Corcoran + Phillips communities were also awarded funds to install native plantings.

In the Near North Neighborhood in Minneapolis, the Northside pollinator project utilized a targeted engagement approach, where Metro Blooms leveraged their relationships with local neighborhood groups and community leaders to connect with residents that are representative of the community, including:

- 25 native planting projects installed
- 21 pollinator gardens installed
- 56 pollinator-friendly trees and shrubs planted
- Four native plant containers designed specifically for renters

The Corcoran + Phillips Pollinator Project was another Lawns to Legumes demonstration project in partnership with the Corcoran Neighborhood and Pollinator Project. Focus was on engaging the extensive Latinx community and Native American residents. Project was led by Metro Blooms' GreenCorps member, partnering with Native American community leaders to engage elders, to incorporate traditional ecological knowledge and traditional medicinal natives into project activities. 29 pollinator projects were installed.

Lessons learned: The pandemic was a good incentive to test virtual workshops, and according to their year-end surveys, MetroBlooms indicated that:

- The City of Minneapolis plans to continue to conduct workshops in person, but for flexibility reasons and to reach a wider audience, workshops will also be offered online.
- Virtual format offered more resources for 1:1 portion of workshops by easily accessing resources online. People could listen to other conversations or come back for their time.
- There was a higher percentage of the White demographic in workshops in 2020, which might have been related to online accessibility for BIPOC folks, as well as time and mental bandwidth during a pandemic and civil unrest that was present
- In 2021, the City of Minneapolis is considering changes to make workshops more accessible, such as pre-recorded workshops followed by meeting in person with a designer

Talmage Diverter

The South East Como Improvement Association SECIA working with Community Partners:

- MWMO
- Minneapolis Public Works
- MPRB
- Metro Blooms

Converted the traffic diverter on 15th Ave SE & Talmage Ave SE to a rain garden. This project was planned by local community members working with Minneapolis Surface Waters Staff worked to secure a funding grant from the MWMO and in-kind work from the City of Minneapolis.

The completed garden is a beautiful amenity for the neighborhood as well as a stormwater management feature diverting untreated stormwater that used to flow into the storm drain to the garden where it will filter into the soil sustaining the native plants at the same time. The garden is filled with native flowering plants and shrubs chosen to highlight Minnesota's natural biodiversity, as well as attracting pollinating insects.

Staff Training

City Snow and Ice Management

City maintenance supervisors and equipment operators are trained in appropriate winter maintenance practices and procedures. Specific topics covered include guidelines for sand and salt application rates that are based on weather conditions, application techniques, and spreader calibration. All Public Works staff who perform snow and ice control typically attend a pre-winter season, annual review of procedures and best practices. However, COVID prevented that training in 2020. Annual HAZWOPER refresher training covers the recognition and response to hazardous materials or situations. The Division Director is active with the APWA Winter Maintenance Subcommittee and was a contributor and a trainer for the APWA's Supervisor's Winter Maintenance Certificate course.

- 31 staff members attended eight-hour refresher for 40-hour hazardous materials training class
- 3 staff members attended training on the use of salt as presented by watershed organizations

MPRB Snow and Ice Management Training

The MPRB has 48 staff that hold the MPCA's Road Salt Applicators Training Certificate. Individuals who hold this certificate have attended a voluntary training, completed and passed an associated test, and agreed to voluntarily apply best management practices to reduce chloride impacts. Attendees chose trainings that focused on the type of work they do at MPRB, either application to roads or to small sites (parking lots and sidewalks).

MPRB Integrated Pest Management Training

Golf course foremen, most horticulture staff as well as other MPRB staff, attend the annual Northern Green Expo each January, where they receive updated information on the newest turf and other related research as it applies to fertilizers, pesticides, bio-controls, and other topics. This annual industry event

focuses on professional development and networking of outdoor professionals. Topics range from turf management to invasive species updates to landscape design.

All new hires for full-time positions of park keeper, mobile equipment operator (MEO), gardener, golf course park keeper, arborist, service area crew leaders, arborist crew leaders, park operations managers and forestry foreman are required to obtain their Minnesota Non-Commercial Pesticide Applicator license within 6 months of being hired. Every two years, as mandated by the Minnesota Department of Agriculture, staff attends re-certification training, that is offered and coordinated by the University of Minnesota. This effort is in conjunction with the Minnesota Department of Agriculture.

Other Education Partners

The City of Minneapolis has an official arrangement, through joint power agreements, with the BCWMC and SCWMC to provide financial contributions to the watersheds through an annual assessment. This assessment provides funding for the commissions' administrative operations and their public education programs.

Education-related activities of the BCWMC are guided by their 2015 Watershed Management Plan, specifically its education and outreach policies (Section 4.2.9), and education and outreach plan. The specific activities of the BCWMC public outreach and education program are set annually by the Commission after recommendations are forwarded by the BCWMC Education and Outreach Committee. The 2020 BCWMC water education activities report can be found in Appendix A1.

The SCWMC also conducts education and public outreach activities on behalf of its member cities. The 2020 SCWMC education activities report can be found in Appendix A2.

MCM TWO: PUBLIC PARTICIPATION AND INVOLVEMENT

PROGRAM OBJECTIVE

The objective of this stormwater management program is to maximize the effectiveness of the City's NPDES program by seeking input from the public.

Targeted pollutants include:

- All pollutants

PROGRAM OVERVIEW

The City of Minneapolis and the MPRB are the joint holders of the NPDES MS4 Permit, and this Annual Report is a coordinated effort by various City departments and the MPRB. The Permit requires an opportunity for public input in the development of the priorities and programs necessary for compliance.

The Permit requires the implementation of approved stormwater management activities, referred to as Best Management Practices (BMPs). The Stormwater Management Program (SWMP) is based on an adaptive management system by which the Permittees continuously monitor, analyze, and adjust the Program to achieve pollutant reductions. Using the adaptive management approach, revisions to the SWMP are submitted along with the Annual Report.

Each year, the City holds a public hearing at a meeting, prior to submission of the Annual Report. The hearing provides an opportunity for public testimony regarding the Program and Annual Report prior to report submittal to the Minnesota Pollution Control Agency. The hearing is officially noticed in the Finance and Commerce publication and publicized through public service announcements on the City cable television channel. This year's public hearing date was at the TP&W Committee meeting on June 23, 2021.

Due to the COVID-19 pandemic, all council meetings were held electronically. However, the public can still comment at the meeting and submit comments in written form. A copy of the presentation, a list of public notice recipients, public comment received, and the staff letter can be found in the City's Legislation Management System (LIMS).

All testimony presented at the public hearing, and all written comments received, are recorded, and given consideration. The comments are included with the Annual Report as Appendix A3. A copy of the City Council resolution adopting the Stormwater Management Program and Annual Report Activities is included each year with the submission to the Minnesota Pollution Control Agency. The Stormwater Management Program and the Annual Reports are available for viewing or downloading.

PREVIOUS YEAR ACTIVITIES

The Public Hearing was noticed 30 days in advance and the public was offered the opportunity to speak and provide comments on the SWMP and Annual Report. The City received comment from the Sierra Club, Friends of Lake Hiawatha, Friends of Cedar Lake, and Sean Connaughty. All comments will be fully evaluated and assessed. Changes to the SWMP based on these comments will be drafted over the upcoming year for review and approval by the City Council.

MCM THREE: ILLICIT DISCHARGE DETECTION AND ELIMINATION

PROGRAM OBJECTIVE

The objective of this program is to minimize the discharge of pollutants to lakes, creeks, wetlands, and the Mississippi River by appropriately responding to spills and to detect, investigate and resolve illegal dumping, and disposal of unpermitted, non-stormwater flows in the City's stormwater drainage system including pavement, gutters, storm drains, catch basins, swales, permitted connections to the storm drain, and other conveyance infrastructure. Illicit discharges may be random, frequent, infrequent, accidental, or other, and may occur anywhere along the stormwater drainage pathways.

Targeted pollutants include:

- All pollutants

PROGRAM OVERVIEW

Dry Weather Flow Screening

Due to the COVID-19 pandemic, there was no dry weather flow screening in 2020, but it is planned to resume in the future.

Typical Hazardous Spill Response

The immediate goals of hazardous spill response are safety, containment of the spill, recovery of hazardous materials, and collection of data for use in assessment of site impacts. Motor vehicle collisions and electrical transformer overloads are examples of accidental releases, and results can include untreated waste and hazardous materials including heavy metals, toxics and solvents.

The life cycle of an event requires personnel from within the City and outside agencies to work as a team, utilizing resources to protect people, the environment, and property. Training and response procedures are coordinated by Regulatory Services, Public Works, and the Fire Department. The Regulatory Services Fire Inspection Specialist III is responsible for coordinating recovery efforts. Events are followed by post-action debriefings to determine the causes of the events, to identify measures to improve the City's response, and to determine the means to limit future occurrences. As the assessment of the event progresses, other departments and/or outside agencies or contractors may become involved. Full procedures are documented in the City of Minneapolis Emergency Action Plan.

For small spills of petroleum products or other vehicle fluids, personnel are dispatched with appropriate equipment to apply sand or floor-dry. Once the spill has been absorbed, it is removed and deposited in a leak-proof container. For large or extremely hazardous spills, a Hazardous Materials Response Team is mobilized and augmented with staff from additional departments, outside agencies and/or contractors if warranted as the event progresses. For spills that reach the Mississippi River or Minneapolis lakes, boats are available for spill response and personnel are trained in boom deployment.

Spills are reported to the MPCA Public Safety Duty Officer, 911 Emergency Communications and, for qualified spills, to the State Duty Officer as required by law.

The protocol used by the Street Maintenance section for handling spills is documented in Appendix A4: Standard Operating Procedure for Vehicle Related Spills.

Emergency Response Program

Minneapolis Regulatory Services utilizes a boat to respond to spills that could impact water resources. A properly equipped boat facilitates addressing these events on the Mississippi River as well as on City lakes. Regulatory Services and Public Works staff are trained in the river deployment of booms, have field experience in placement of both containment and absorbent types of booms, and years of experience on the water. These skills, coupled with an extensive level of knowledge of the Mississippi River, City lakes, landings, and outfalls, provide a high level of protection for our precious natural resources.

Boom Deployment Drill

Additionally, the boat is used for placement of monitoring and sampling equipment for tracking water quality, identifying points of illegal discharges, outfall assessment, and investigation of complaints that are inaccessible from shore. The City assists the Mississippi Watershed Management Organization (MWMO) in conducting a sampling program of the storm drainage system that drains to the Mississippi River to detect illegal discharges, and establish a baseline of chemical, physical, and biological parameters.

Unauthorized Discharges

City Environmental personnel carry out pollution prevention and control activities. Results are achieved through educational efforts, inspections, and coordinated outreach events. These activities include enforcement pursuant to applicable City codes, and coordination with other regulatory agencies at county, state and federal levels. Enforcement yields identification of the responsible party, documentation of clean-up activities, and endeavors to reduce the flow of pollutants from illegal dumping and disposal. Response is made to reports of unauthorized discharges and illicit connections.

Complaints are received from various sources, including Minneapolis residents, private contractors, City staff, the State Duty Officer and other government agencies. People with environmental concerns within Minneapolis are directed to contact 311 directly.

Minneapolis Public Works also provides site investigation and mapping assistance for MPCA permit enforcement and compliance programs for other types of discharges.

Illicit Discharge Detection and Elimination Screening & Outfall Inspection

The field screening program to detect and investigate contaminated flows in the storm drain system is part of daily operations for staff in Surface Water & Sewer Operations, Environmental Services, and Regulatory Services. Maintenance crews routinely inspect and clean storm drain structures in Minneapolis. In addition, inspections of flows that generate unusual odors, stains, and deposits are included in the annual tunnel inspection, outfall inspection, and grit chamber inspection and cleaning programs. Any suspect flows are reported to Environmental Services inspectors for further investigation. Environmental Services personnel also receive reports of alleged illicit discharges to the storm drain system from the public, other City departments, and various agencies. In 2020, city staff inspected 27 outfall structures. For more detailed information, see Appendix A7.

Facility Inspection Program - Stormwater Pollution Prevention Plans (SWPPP)

The City of Minneapolis has developed a strong facility inspection program for private, City owned, and other public facilities that store large quantities of both regulated and hazardous materials. Inspectors perform site visits of these facilities to review handling, storage, and transfer procedures as they relate to the site, spill response plans and equipment on site, employee training on spill response procedures, and identification of the required spill response contractor. Minneapolis Fire Inspection Services participates in most of the inspections, reviewing spill response strategies. In addition, site plan inspections also look at drainage patterns from the site to the nearest storm sewer inlet or water body and the watershed destination and outlet location.

As per Fire Inspection Manager, 14 facilities were inspected in 2020. 302 facilities are self-reporting, which are reviewed, filed, and maintained by Fire Inspection Services. Based on latest information from Minnesota Homeland Security, 302 hazardous material facilities are inclusive to the City's Fire Commercial (FCOM) building permit. Hazmat registrations and inspections are based on FCOM cyclical rotations. 178 Emergency Response plans for TIER II Hazardous Materials Facilities were reviewed, including hazardous materials storage and spill response plans.

Lake Hiawatha Trash reduction work

In recent years there has been in increase in the visibility of trash and litter within waterbodies in the City of Minneapolis, especially within Lake Hiawatha. Trash and litter impair the recreational function of a waterbody, is a visual impairment, and can contribute microplastics and chemicals to the environment that can be detrimental to aquatic life.

Drainage to Lake Hiawatha includes parts of Minneapolis and parts of cities upstream that drain to Minnehaha Creek. 7.5 million acres and 340,000 people are upstream and drain to Minnehaha Creek and ultimately into the lake and can contribute to accumulated trash and impact lake water quality. On average, 77% of the water that enters Lake Hiawatha comes from Lake Minnetonka, and 23% comes from stormwater runoff.

Besides Minnehaha Creek, there are also storm sewer pipes that carry stormwater that discharges into Lake Hiawatha at six locations. The city, the Minnehaha Creek Watershed District, and the Minneapolis Park and Recreation Board have implemented practices and programs that help deal with the pollutants, including trash and litter, from the neighborhoods. These include three holding pond projects:

- Bloomington Ave and E 42nd St (constructed in 1989)
- Sibley Field Park (constructed in 2000)
- E 37th St and Columbus Ave (constructed in 2003)

There are also a series of stormwater ponds in the Hiawatha golf course and a rain garden in the corner north of the golf course.

In addition to these existing structural BMPs the city has implemented several pilot projects to look at additional ways to remove trash from the storm sewer system or from the lake. In 2016 the City installed an end-of-pipe BMP for trash collection and removal. This BMP was a floating curtain in Lake Hiawatha just downstream of the stormwater outfall on the north side of the lake. The floating trash curtain was installed on August 8 and removed on September 10 in 2016. There were only three bags of trash collected during the six-week long pilot installation, with city crews spending approximately 19 hours installing and maintaining the curtain. Pilot results included a determination that with limited crews and hours in the day, the most efficient use of City resources related to trash and water quality must be a top priority.

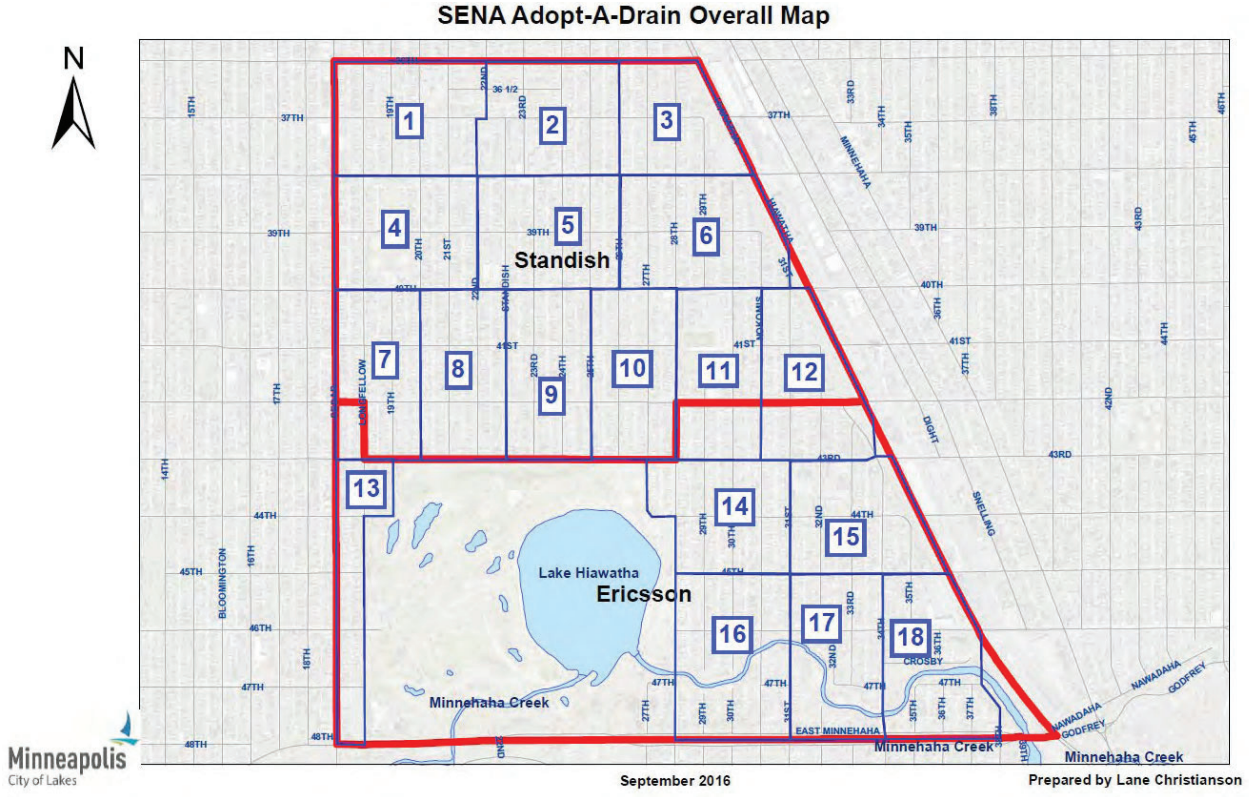
In February 2018, City staff retrofitted three manholes upstream of Lake Hiawatha with trash screens that were fabricated and designed to capture floatable trash and debris that could wash through the City's storm sewer system. City crews accessed and maintained the manholes by vactoring out all the debris and trash before it entered Lake Hiawatha. Crews tracked debris removed to assess the success of the pilot project and inform future water quality improvement efforts. The trash screens were moved to several locations during the summer of 2018. There were no locations where significant trash and litter were collected.

The City has also sponsored several studies to investigate solutions to the trash issue in Lake Hiawatha. In 2017, City staff mentored a team of civil engineering students to complete a capstone project addressing the issue of trash entering the late through the stormwater conveyance system. In 2019 and 2020, Minneapolis Public Works – Surface Water & Sewer Division sponsored an Urban Scholar to implement an exploratory study on the trash in Lake Hiawatha to quantify the amount of trash in Lake Hiawatha and identify potential sources. The study was specifically focused on developing a methodology to identify the amount, types of trash, and potential sources to Lake Hiawatha.

Education and engagement efforts within the community have been determined to be the most cost-effective way to manage trash and litter. In 2016, the Standish-Ericsson Neighborhood Association (SENA), the Minnehaha Creek Watershed District (MCWD), and the City of Minneapolis implemented an Adopt-a-Drain pilot program in the SENA neighborhood to try to remove trash and other debris from storm drains entering Lake Hiawatha.

In that pilot year, all the homes within the Lake Hiawatha watershed area (~4,500 homes) within SENA were doorhangered by student workers from Hamline University and volunteers. In addition, Master Water Stewards were engaged to go door-to-door in the area with a goal of talking to about 1,000 people at homes on randomly assigned blocks. Master Water Stewards utilized iPads allowing people to

sign up for the Adopt-a-Drain program on the spot. These Master Water Stewards gathered data on the added efficacy of going door-to-door as compared to just doorhangering homes.



In that first year, 153 people signed up to adopt over 300 storm drains, collecting over 2,380 pounds of trash and debris. The pilot program that was concentrated in the Standish-Ericsson Neighborhoods included 70 people signing up, adopting 120 storm drains. As of 2020 there are 283 storm drains adopted within the Lake Hiawatha watershed and there was an estimated 2,667 lbs. of trash and debris collected this past year.

In 2017, the Adopt-a-Drain program continued doorhangering all of the homes within the Lake Hiawatha watershed, including an additional 5,800 homes within the Bancroft, Bryant, Central, Corcoran, East Phillips, Northrop, and Powderhorn neighborhoods.
The City sponsors additional Clean City programs beyond the Adopt-a-Drain program that help with the control of trash and litter. These include Adopt-a-Litter Container, Adopt-a-Recycling Container, Adopt-a-Block, Adopt-a-Street, Adopt-a-Median, and the Storm Drain Stenciling Program.

The City's Solid Waste & Recycling Division (SW&R) picks up garbage, recycling, and more from 107,000 residential dwellings, approximately 200 larger residential and commercial properties, and neighborhood parks. In 2017/2018 they piloted a Clean City Classroom program and in 2018, a citywide litter cleanup program called **Litter Be Gone** was implemented, both programs being part of the Clean City initiatives. Details on the work being done to look for litter solutions were presented to Minneapolis City Council on January 30, 2018.

The City and MPRB sponsor annual clean-up events as part of Earth Day celebrations. Lake Hiawatha Park is one of the clean-up sites annually. The 2019 Earth Day event had 1,897 volunteers that collected an impressive 7,760 pounds of trash, and 1,200 pounds of metal. Hands-on learning activities were provided and focused on water quality, recycling, composting, and organic gardening, and lawn care.

The City and MPRB will continue to look for ways to understand the impacts of trash on the community and environment. Community engagement and education are cost-effective ways to manage this issue and the City will continue to sponsor programs to encourage community clean-up and responsible trash disposal.

PREVIOUS YEAR ACTIVITIES

Spill Response

City of Minneapolis Fire Inspection Services responded to 52 Emergency Response requests. In addition, the Minneapolis Fire Department also responds to a number of these requests. Response time varies between 5 to 20 minutes depending on Fire Department response and type of Emergency Response request. The City responded to 4 spill incidents on the Mississippi River and lakes where a containment boom was deployed. Minneapolis Fire Inspection Services, Minneapolis Public Works (Surface Water & Sewers Division) and MPCA participated in these efforts.

Outfall Inspection

Four days of Mississippi River outfall sampling were conducted, including visual inspections of outfalls, and developing spill response strategies by boat. Participating agencies included Minneapolis Fire, Minneapolis Public Works, MPCA and Mississippi Watershed Management Organization.

SPILL RESPONSE/CONTAINMENT BOOM DEPLOYMENT TRAINING

Waterworks Drill/Training

Due to the COVID-19 pandemic, a Waterworks Drill/Training meeting took place with Minneapolis Public Works, Minneapolis Fire, and Minneapolis Fire Inspections Services. Existing Standard Operation Procedures to respond to a Spill Response/Boom deployment scenario at Minneapolis Waterworks were reviewed. A hands-on Spill Response/Boom deployment training will be scheduled in 2021, conditions permitting.

Facility Inspection Program - SWPPP

As per Fire Inspection Manager, 14 facilities were inspected in 2020. 302 facilities are self-reporting, which are reviewed, filed, and maintained by Fire Inspection Services. Based on latest information from Minnesota Homeland Security, 302 hazardous material facilities are inclusive to the City's Fire Commercial (FCOM) building permit. Hazmat registrations and inspections are based on FCOM cyclical rotations. 178 Emergency Response plans for TIER II Hazardous Materials Facilities were reviewed. Reviews include hazardous materials storage and spill response plans.

MCM FOUR: CONSTRUCTION RELATED EROSION & SEDIMENT CONTROL

PROGRAM OBJECTIVE

The objective of this stormwater management program is to minimize the discharge of pollutants through the regulation of construction projects. Regulation addresses erosion and sediment control for private development and redevelopment projects and for public projects completed by the City and the MPRB. Minneapolis Code of Ordinances Air Pollution and Environmental Protection, Chapter 52 Erosion and Sediment Control and Drainage contains erosion and sediment control requirements and other pollution control requirements related to construction site management.

Targeted pollutants include:

- Phosphorus
- Total Suspended Solids (TSS)

PROGRAM OVERVIEW

Ordinance

In 1996, the Minneapolis City Council amended Title 3 of the Minneapolis Code of Ordinances relating to Air Pollution and Environmental Protection by adding Chapter 52, entitled *Erosion and Sediment Control for Land* Disturbance Activities (now Erosion and Sediment Control and Drainage).

Requirements

The City's Erosion and Sediment Control ordinance addresses development sites, demolition projects, and other land disturbing activities. Sites disturbing more than five cubic yards, or 500 sq ft, are required to have an erosion control permit. Erosion and Sedimentation Control (ESC) Permits must be acquired prior to commencement of work and must be obtained before a building permit will be issued for the site.

For all disturbances greater than 5,000 sq ft, an approved erosion control plan is also required for demolition and construction projects before the ESC Permit can be issued.

Enforcement

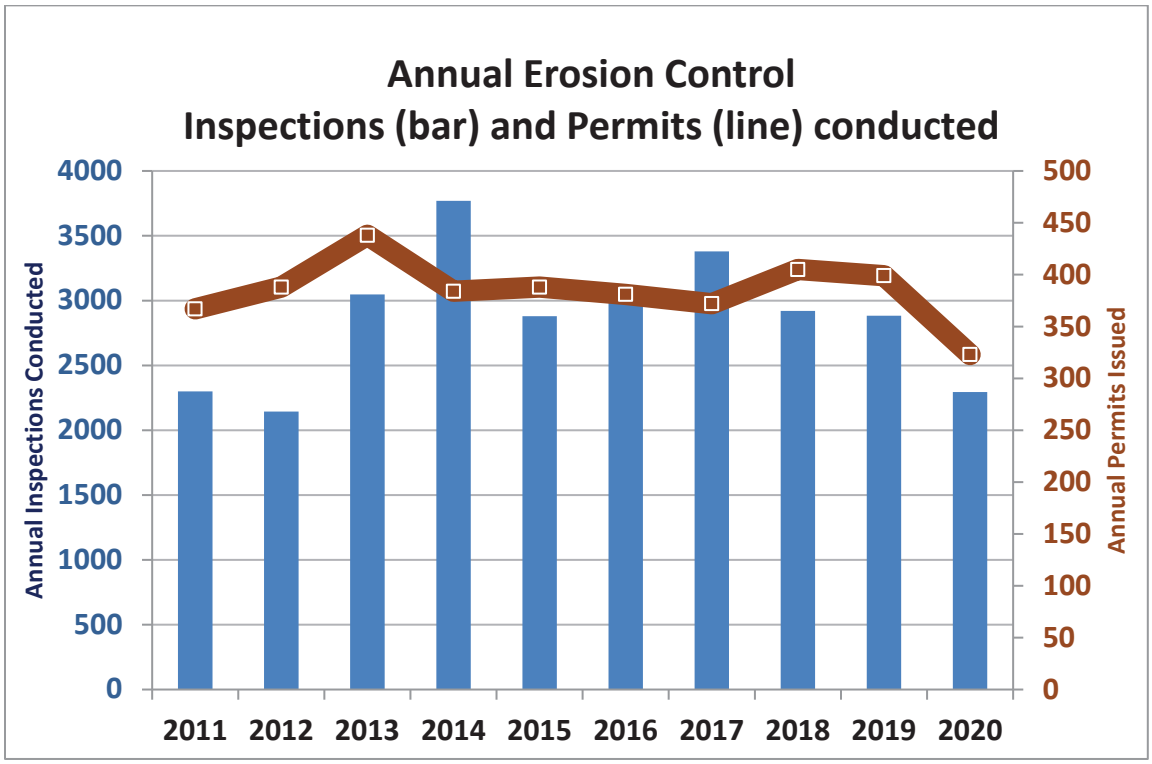
Ongoing site inspections are performed by City Environmental Services inspectors. Inspectors may issue citations and fines. Failure by the permittee to comply with the ordinance will constitute a violation pursuant to Section 52.300. If there is a demonstrated failure to comply, the City reserves the right to terminate an ESC permit at any time. The City then has the option of proceeding with the necessary restoration of the site. This restoration would be done at the expense of the owner/permittee.

PREVIOUS YEAR ACTIVITIES

Generally, since 2011 the number of sediment and erosion control permits issue has remained relatively consistent. While the number of permits issued by the City has been consistent, the number of inspections increased. Minneapolis normally employs four environmental inspectors that address sediment and erosion control enforcement and the City hires four additional seasonal technicians to help increase inspection frequency during the busy summer months. However, in 2020 due to financial constraints from COVID-19 and civil unrest, Minneapolis employed three environmental inspectors and

two additional seasonal technicians. Staffing levels are expected to return to normal in 2021. Additionally, emergency COVID-19 response duties reduced time available for inspections. Those additional responsibilities are reducing with increased public vaccination levels.

Year	Permits Issued	Inspections	Citations
2018	405	2,921	74
2019	399	2,884	40
2020	323	2,295	12



MCM FIVE: POST-CONSTRUCTION STORMWATER MANAGEMENT

PROGRAM OBJECTIVE

The objective of this stormwater management program is to reduce the discharge of pollutants and stormwater runoff from public and private development and redevelopment projects, as compared to conditions prior to construction. Redevelopment of existing sites can lessen the impacts of urbanization of the waters of Minneapolis, since most present land uses were created prior to regulation under the Clean Water Act.

Regulation includes approval of stormwater management including ongoing operation and maintenance commitments. Minneapolis Code of Ordinances Title 3 Air Pollution and Environmental Protection, Chapter 54 - Stormwater Management, contains stormwater management requirements for developments and other land-disturbing construction activities.

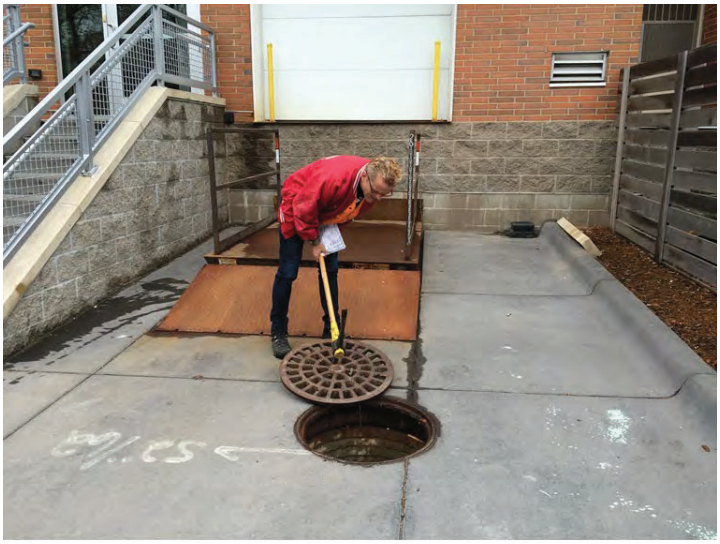
Targeted pollutants include:

- Phosphorus
- TSS

PROGRAM OVERVIEW

Stormwater Management Ordinance

In 1999, the Minneapolis City Council amended Title 3 of the Minneapolis Code of Ordinances (relating to Air Pollution and Environmental Protection) by adding the Chapter 54 Ordinance Stormwater Management Ordinance, which required stormwater management plans utilizing permanent stormwater practices for all construction projects disturbing sites greater than 1 acre in size.



Inspecting Private Stormwater BMPs

These plans are reviewed through the Minneapolis Development Review process and approved by the Surface Water & Sewers Division. Operation and Maintenance Plans for BMPs are also required as part of the approval process. Inspections of constructed BMPs are required and performed by the property owner or manager. These annual inspections are reviewed and approved by city staff, before being registered with Environmental Services, which includes a Pollution Control Annual Registration fee.

In 2018, City staff began updating Chapter 54 to be in compliance with the current NPDES MS4 permit and watershed management organization requirements. The ordinance was approved by Council on March 3, 2021 and will go into effect on January 1, 2022.

The ordinance update integrated all the new NPDES and WMO requirements and best practices while maintaining the flexibility developers and project advocates appreciated about the previous ordinance. To facilitate a robust stakeholder engagement process, city staff implemented a stakeholder engagement and outreach plan (SE&O Plan) and was managed as a living document and updated as new engagement opportunities surfaced.

The new Chapter 54 included many modifications such as:

- **Applicability**: This section highlights the change from regulating 1.0-acre or greater of land disturbing activities to **0.5-acre or greater**. Given the City Engineer authority to impose special conditions on any project within the City that may degrade the performance of the City's storm sewer system or create nuisance or unreasonable hazards to people or to public or private property.

- **Exemptions**: This section eliminates the exemption of reconstruction projects of an existing roadway, bridge, pathway, or walkway where the increase in impervious surface area is one (1) acre or less, regulating these projects in the future. Mill and overlay, underground utility, and disconnected sidewalk and trail projects will continue to be exempt.

- **Stormwater Management Plan (Plan) requirements**: This section included the following provisions:

    1) The Plan allows for the creation of a stormwater banking program for approved governmental entities and use of stormwater credits to meet the City's stormwater requirements, and

    2) The Plan requirement presents specific volume control requirements for new development, redevelopment, and linear projects without site restrictions.

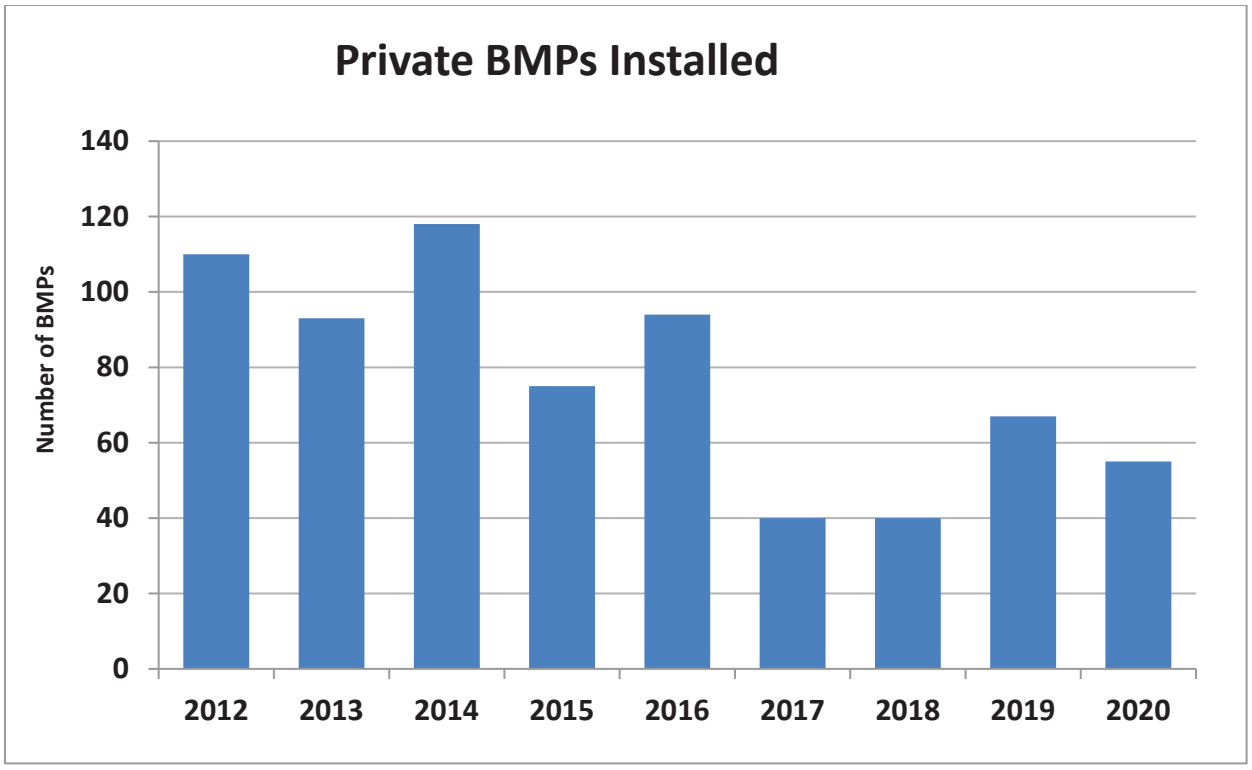
- **Inspection, remedial actions, and compliance**: This new section provides four tiers for escalating violations of compliance with Chapter 54.

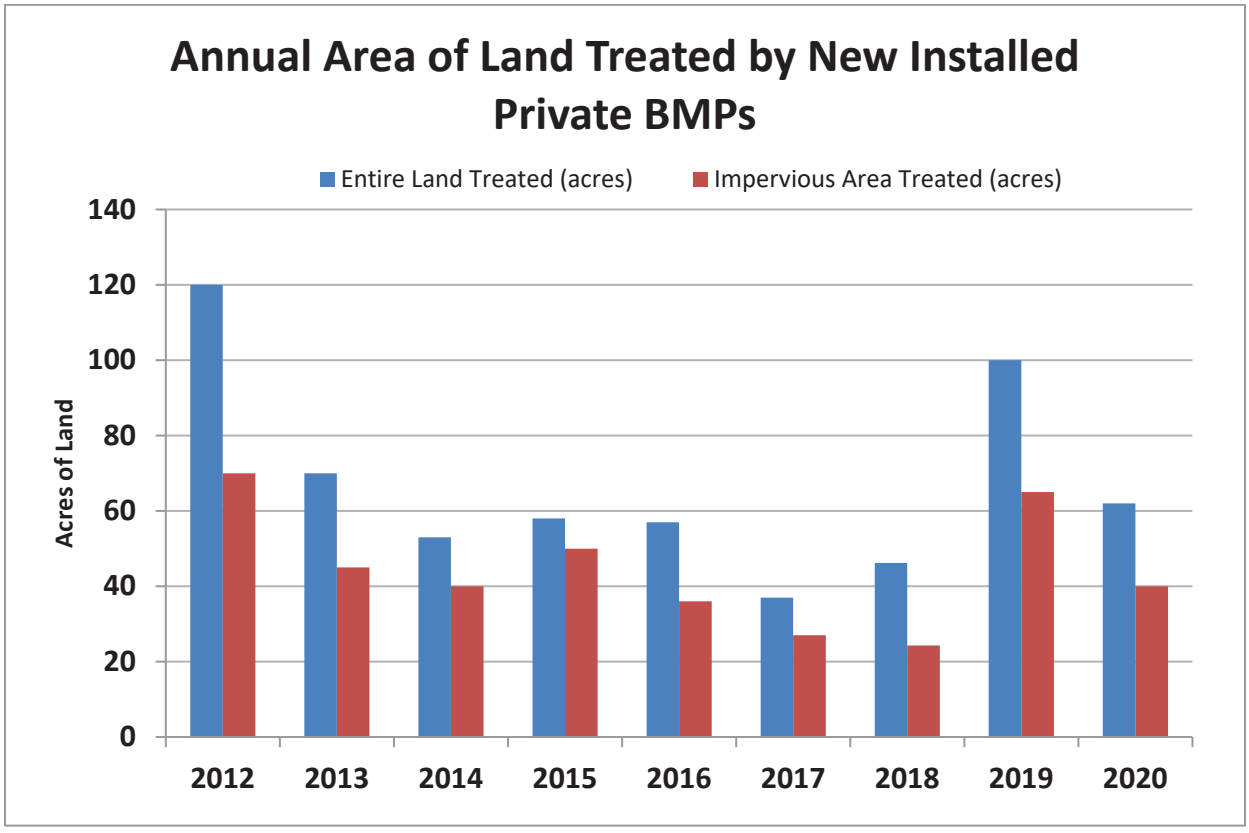
- **Prohibited discharge to storm sewer system**: This new section specifically highlights prohibited discharges to the City's storm sewer system and prohibitions on areas where infiltration can be implemented.

PREVIOUS YEAR ACTIVITIES

As of January 1, 2021, The City of Minneapolis had over 1,500 BMPs registered to nearly 700 properties under Chapter 54 of the Minneapolis Code of Ordinances. The implementation of Chapter 54 has been very effective at seeing BMPs installed as properties develop in Minneapolis, with the numbers of the total BMPs installed with the City expected to grow in 2022.

During 2020, Minneapolis Public Works reviewed 184 projects, approving 138 of these projects, with 23 projects requiring 55 BMPs constructed. These BMPs will provide rate control and water quality for approximately 62 acres of land, including 40 acres of impervious area. See following 2 charts for more information.


Private BMPs Installed
Number of BMPs
140
120
100
80
60
40
20
0
2012
2013
2014
2015
2016
2017
2018
2019
2020


Annual Area of Land Treated by New Installed Private BMPs
Entire Land Treated (acres)
Impervious Area Treated (acres)
Acres of Land
140
120
100
80
60
40
20
0
2012
2013
2014
2015
2016
2017
2018
2019
2020

MCM SIX: POLLUTION PREVENTION AND GOOD HOUSEKEEPING FOR MUNICIPAL OPERATIONS

PROGRAM OBJECTIVE

The City of Minneapolis operates its public works systems in a manner that maintains efficient and effective operability, ensures structural integrity, complies with regulatory requirements, and safeguards the ability to prevent impacts to health, safety, property infrastructure, and the environment. This is accomplished through the proper operation and maintenance of structural stormwater management practices, public streets, bridges, and alleys, parks and golf courses, municipal properties, municipal parking lots, and municipal equipment yards.

STORM DRAIN SYSTEM OPERATIONAL MANAGEMENT AND MAINTENANCE

PROGRAM OBJECTIVE

The objective of this NPDES stormwater management program is to minimize the discharge of pollutants through the proper operational management and maintenance of the City's storm drain system, streets, alleys, and municipal property. The City of Minneapolis contributes stormwater runoff to various receiving waters inside and outside of City boundaries, including Minnehaha Creek, Bassett Creek, Shingle Creek, several lakes, and the Mississippi River. Maps of the drainage areas that have been delineated according to topographic contours and the storm drain system are included in Appendix B. The 2010 population, size of drainage area, and land use percentages by body of receiving water are listed in Appendix A5.

Targeted pollutants include:

- TSS
- Nutrients
- Floatable Trash

PROGRAM OVERVIEW

The City's storm drain system is managed and maintained by the Operations section of the Public Works Department Surface Water & Sewers (PW-SWS) Division. Design engineering and regulatory issues are managed by the division's Capital and Regulatory sections, respectively.

Brick Egg-type Sewer

The City utilizes Maximo™ for asset management to compile assets, track work orders, and assist in work scheduling and purchasing.

The City's goals in implementing an asset management program include identifying the current state of assets and asset attributes (e.g., age, condition, etc.) and utilizing a standardized rating process for assets and asset attributes (e.g., National Association of Sewer

Services Companies (NASSCO) Pipeline Assessment and Certification Program (PACP)).

PW-SWS Operations Section identifies risk areas, criticality of system, and life-cycle costs. This will improve future decision making as a result of data and analysis (e.g., succession planning, level of maintenance response, Capital Improvement Project prioritization), improve documentation and recordkeeping of assets (e.g., Maximo software), improve coordination and communication, lower long-term operation and maintenance costs, improve regulatory compliance, and be used as a communication tool for staff and regulators for effective information transfer and knowledge retention.

Staffing levels are key components for achieving the City's overall management goals. The current staffing level of the PW-SWS Operations section is approximately 113 full-time employees, up from 75 in 2013. This increase is anticipated to bring about a more proactive approach, including pollution prevention that the City is striving for. In the PW-SWS Operations section, there are currently 61 permanent, full-time employees working directly within Sewer Maintenance (which includes both storm and sanitary personnel), and the remainder work within rehabilitation. General maintenance efforts include checking hours at pump stations, performing pump station maintenance, pipe inspections, pipe cleaning, system repairs, rehabilitation or reconstruction of existing infrastructure, inspection and operation of control structures, operation of pump stations, cleaning of water quality structures, and operational management of stormwater detention ponds.

The table below shows the base operational functions along with the corresponding staffing:

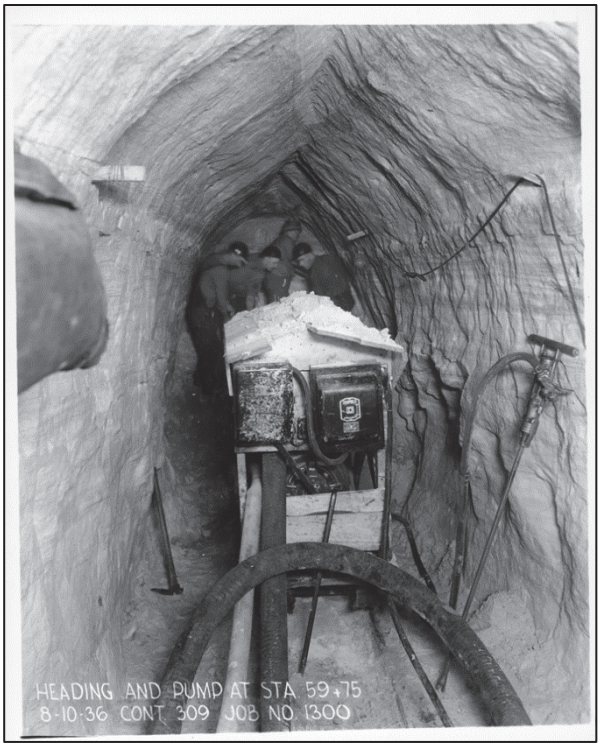
Crews	Staff/crew	Type	Tasks
4	2	Route Truck	Daily pipeline system inspections, complaint response, and resolution to minor system operational problems
5	2	Jet Truck	"As-requested" cleaning of storm system components, routine cleaning of sanitary system pipes, and "as-requested" cleaning of pump/lift stations. Hydro jet-wash technique.
3	2	Jet-Vac Truck	Routine cleaning of storm system infrastructure. Hydro jet-wash technique. Storm sewer cleaning by vacuum removal of sludge and debris build-up.
3	2	TV Truck	Televise and inspect storm drain and sanitary sewer system components. Log and assess condition of televised lines to determine and prioritize rehabilitation and/or repair needs to storm drain and sanitary sewer system components.
2	2	Repairs	Perform medium-sized repairs, requiring minimum excavation, to storm drain and sanitary sewer system pipeline components. May assist in the repair or reconstruction of larger repair/ reconstruction jobs.

2	2	Vac Truck	Vacuum-cleaning of water quality structures, manholes, and catch basins within the storm drain system. Assist in sanitary sewer cleaning by vacuum removal of sludge and debris build-up. Assist in repair/ construction activities using vacuum excavation process. Assist in erosion control compliance using vacuum cleanup of eroded soils and/or cleaning of erosion control structures.
1	2	Rod Truck	Remove roots and foreign objects from sanitary sewer system. Remove large debris from storm drain-pipes and free ice from frozen catch basin leads.
6	2	Pond & Pump	Operate, maintain, and repair sanitary lift station and stormwater pump stations. Operate and maintain stormwater detention basins.
1	1	Shop	Perform general maintenance and repair to specialty use vehicles and emergency response equipment. Fabricate, as needed, custom metal and wood objects for sewer and storm drain operations. Provide field deliveries of materials, tools, and equipment. Maintain material inventory and fleet management data.

PREVIOUS YEAR ACTIVITIES

2020 Storm Drain Infrastructure cleaning and repair information data:

- Completed repairs on 160 catch basins
- Cleaned 5.6 miles of storm drain utilizing hydro-jet washing
- Televised and condition assessed 11.5 miles of storm drain-pipes
- Continued repairs of 1,400 feet of storm tunnel
- Continued work on the Central City tunnel, which is rehabilitating the condition of the structures and reducing erosion/transfer of the sandstone outside of the tunnel. This is decreasing transport of sand particles/solids to the Mississippi River
- Tracked 160 repairs for catch basins via Maximo asset management system



WATER RESOURCE FACILITIES OPERATIONAL MANAGEMENT AND MAINTENANCE

PROGRAM OBJECTIVE

The objective of this NPDES stormwater management program is to minimize the discharge of pollutants through the proper operational management and maintenance of water resource facilities (stormwater practices) within the City's storm drain system that affect system flow, rates, quantity, and water quality discharges.

Maintenance

Minneapolis Surface Water & Sewers maintains approximately 342 public BMP systems.

Targeted pollutants include:

- TSS
- Nutrients
- Floatable Trash

PROGRAM OVERVIEW

Water resource facilities that are part of the City's overall storm drainage system are operationally managed and maintained by Surface Water & Sewers Operations. These components are routinely inspected and maintained to ensure proper operation and reliability. Frequency of inspections and assigned maintenance efforts are based on both operational experience and incurred environmental events.

By agreement with the City of Minneapolis and the MPRB, the Minnehaha Creek Watershed District monitors the design capacity of several stormwater ponds in Minneapolis and performs dredging and restoration as needed including testing for proper disposal. The MPRB also maintains small scale Park Board stormwater devices including ponds, rain gardens, and pervious pavement.

Vegetated Swale at 25th Ave. SE

Water resource facilities for water quality improvement are separated into five separate categories:

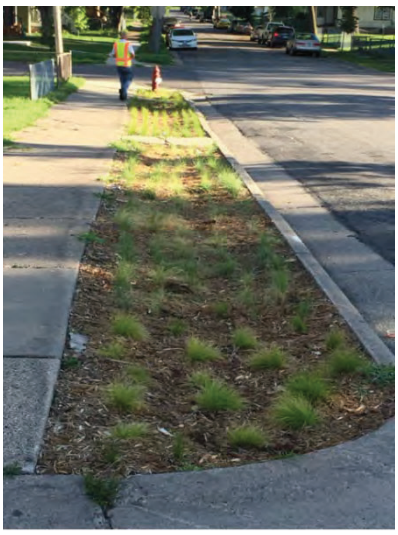
Pre-treatment Practices

Pretreatment is an integral part of BMP application. In many applications (infiltration and stormwater ponds) the practice would not function properly if pre-treatment is ignored. Pre-treatment techniques are used to keep a BMP from being overloaded, primarily by sediment. Pre-treatment can also be used to dampen the effects of high or rapid inflow, dissipate energy, and provide additional storage. These benefits help overall BMP performance. Types of pre-treatment practices include:

- Settling devices (grit chambers)
- Sump manholes
- Storm Drains – sometimes enhanced with SAFL baffles, forebays, oil / water separators, and vegetated filter strips

Filtration Practices

Filtration BMPs treat urban stormwater runoff as it flows through a filtering medium, such as sand or an organic material. They are generally used on small drainage areas and are primarily designed for pollutant removal. They are effective at removing TSS, particulate phosphorus, metals, and most organics. They are less effective for soluble pollutants such as dissolved phosphorus, chloride, and nitrate. Most filtration BMPs will achieve some volume reduction, depending on the design and the use of vegetation to promote evapotranspiration. Filtration practices used in the City include rain gardens with underdrains and iron enhanced sand filters.



Vegetated Swale at Redeemer Church

Infiltration Practices

Infiltration BMPS treat urban stormwater runoff as it flows through a filtering medium and into underlying soil, where water percolates down into groundwater. This process removes pollutants from the runoff, either by being trapped within the practice, or broken down by chemical processes within the first few feet of soil (natural attenuation). The filtering media is typically coarse-textured and may contain organic material, as in the case of bio-infiltration BMPs. These practices are primarily designed for removal of stormwater runoff volume and pollutants in that runoff. They are effective at removing TSS, particulate phosphorus, metals, bacteria, nitrogen, and most organics. Soluble pollutants such as chloride and nitrate typically percolate through these BMPs and into underlying groundwater. These BMPs, when designed with no underdrain, include rain gardens, tree trenches (including Silva Cell systems), underground infiltration, and infiltration trenches including dry wells.

12x10 Infiltration Box Culvert Installation

Sedimentation Practices

Sedimentation is the process by which solids are removed from the water column by settling. Sedimentation BMPs include:

- Dry ponds
- Wet ponds
- Wet vaults
- Proprietary devices

Proprietary hydrodynamic devices are limited to treating small tributary areas while constructed ponds and constructed wetlands can be designed to treat the runoff from a much larger tributary area. These BMPs provide temporary storage of stormwater runoff and allow suspended solids to settle and be retained by the BMP. These BMPs are effective at removing TSS and any pollutants adsorbed to the solids but that are not effective in removing soluble pollutants or in providing any volume reduction.

Infiltration Box Culvert – inside view

Chemical Practices

Stormwater BMPs that employ chemical treatment are typically designed for treatment of a specific pollutant. Phosphorus is the most common pollutant of concern, but chemical treatment may also be employed for nitrogen, metals, and organic pollutants. The City has installed iron-enhanced sand filters and the MPRB has historically used alum as an in-lake treatment to enhance settling of suspended sediment and phosphorus by encouraging flocculation.

Structural Controls

The City also employs structural controls to manage stormwater runoff that are not directly related to water quality, including:

Storm Drain Outfalls

These are the structural ends of system pipelines where conveyance of stormwater runoff is discharged into receiving water bodies. Outfalls are inspected on a 5-year schedule. Site inspections evaluate the general condition of structures, determine if any significant erosion has occurred and observe any contaminant discharges. If indications of illicit or contaminated discharges are present, they are reported to Minneapolis Environmental Services for reporting to the Minnesota State Duty Officer for further investigation and resolution. Any identified structural repair or maintenance work is prioritized and scheduled considering available personnel, budget funding, and coordination with other essential operations.

Grit Chamber Construction at Dean Pkwy

Pumps & Weirs

These are structural devices that mechanically affect the flow of stormwater runoff through the storm drain system. Pump stations are inspected regularly for routine operational checks and are annually for detailed condition assessment. Maintenance and/or repairs are performed with routine items being completed as needed and larger items being coordinated into a budgeted pump station operation program. Weirs and outlet structures are inspected and repaired as needed to facilitate their proper operational working order.

Storm Drains

These are structural devices located along the City's street system that provide entrance of stormwater runoff into the storm drainage system. Public Works crews routinely look for plugged or damaged structures. Reported damages and/ or plugs are given a priority for repair and / or cleaning. Cleaning storm drains, while ensuring proper runoff conveyance from City streets, also removes accumulated sediments, trash, and debris. Augmenting this effort is the street sweeping program that targets the pick-up of street sands, leaves, and debris prior to their reaching storm drains. Repair of damaged storm drains is also a priority, given their location in City streets and ultimate impact to the traveling public.

Residents or business owners can also adopt storm drains near their home or businesses through the Adopt-a-Drain Program. This helps to keep leaves, sediment and garbage out of these adopted storm drains and our local waters.

PREVIOUS YEAR ACTIVITIES

- Monitored and maintained 25 pump stations

DISPOSAL OF REMOVED SUBSTANCES

PROGRAM OBJECTIVE

A key component of the MS4 stormwater management program is collection and disposal of materials removed from the storm drain system and structural controls in a manner that will prevent pollution and that will comply with applicable regulations.

Targeted pollutants include:

- Sediment
- Nutrients
- Floatable Trash
- Additional pollutants analyzed for stormwater pond sediment dredging are Copper, Arsenic, and Polycyclic Aromatic Hydrocarbons

PROGRAM OVERVIEW

Accumulated materials are removed from grit removal structures, storm drains, system piping, and deep drainage tunnels during the process of inspection and cleaning. Removed substances are screened for visual or olfactory indications of contamination. If contamination of the material is suspected, the City's Engineering Laboratory will select representative samples for an environmental analysis. Contaminated substances are disposed of in a landfill or another site that is approved by the MPCA. Non-contaminated targeted pollutants are disposed of the same way as street sweepings. During cleaning and disposal operations, erosion control measures are applied when needed to prevent removed material from re-entering the storm drain system.

The process for accumulated materials dredged from stormwater ponds is similar. The materials to be dredged from stormwater ponds are tested in advance and disposed of properly according to MPCA guidance.

PREVIOUS YEAR ACTIVITIES

In 2020, Minneapolis Public Works crews removed accumulated sediment and debris from grit chambers, and approximately 513 cubic yards from storm drains during hydro-jet washing operations.

FACILITY MANAGEMENT

PROGRAM OBJECTIVE

The stormwater management objective of these activities is to prevent or reduce the discharge of pollutants generated at City and MPRB owned facilities. Facilities include but are not limited to composting sites, equipment storage and maintenance, hazardous waste disposal, hazardous waste handling and transfer, landfills, solid waste handling and transfer, parks, pesticide storage public parking lots and ramps, public golf courses, public swimming pools, public works yards, recycling sites, salt storage yards, vehicle storage at maintenance yards, and materials storage yards.

Targeted pollutants include:

- TSS
- BOD_5
- COD
- Phosphorus
- Chlorides

PROGRAM OVERVIEW

Pollutant control is managed through proper storage of materials, routine maintenance, effective application of winter salt and deicers, and, where necessary, installation of structural stormwater management practices. Operations are performed to address public safety while balancing those needs with environmental and cost considerations.

PREVIOUS YEARS ACTIVITIES

In 2016, the City began developing Stormwater Pollution Prevention Plans (SWPPPs) for City and MPRB owned facilities to reduce the discharge of pollutants into the storm sewer system from municipal and Park Board operations An inventory of municipal operations facilities has been created which includes over 70 facilities; examples include Vehicle and Equipment Maintenance Facilities, Fleet Services, Parking Lots and Ramps, Fire Stations, Police Stations, Water Services Facilities, Stockyards, MPRB Service Centers, and MPRB Dog Parks. Site specific plans have been developed for each facility which include site maps, operations specific Best Management Practices, and inspection and reporting requirements.

These facility plans will be used to facilitate regular site inspections that will document and correct potential sources of pollution or illicit discharge to the storm sewer system from City or MPRB owned properties. Inspection frequency will be evaluated based on site specific needs such as continuing or ongoing issues, seasonal site usage, or change in property use. Implementation of the facility management plans will be prioritized based on the highest pollutant potential.

ROADWAYS

PROGRAM OBJECTIVE

The objective of this stormwater management program is to minimize the discharge of pollutants through the proper operation and maintenance of public streets and alleys.

Targeted pollutants include:

- TSS
- BOD_5
- COD
- Phosphorus
- Chlorides

PROGRAM OVERVIEW

Street Sweeping

Minneapolis Public Works employs several street sweeping approaches. Some are citywide, and some vary by area or land use. Curb-to-curb sweeping operations occur citywide twice a year in the spring and fall. At those times, all city streets are swept systematically (alleys are also included in the spring), and temporary parking bans are enforced to aid with sweeping operations and to ensure that curb-to-curb sweeping is accomplished. Operational routines and special methods are employed to address seasonal conditions, and to optimize cleaning. Flusher trucks apply pressurized water to the streets to push sediment and debris to the gutters. Street sweepers follow behind the flusher trucks and clean the gutters. During the fall, leaves are first bunched into piles, and then the leaves are picked up before flushing and sweeping occurs. During the summer, between the spring and fall sweep events, sweepers are assigned to maintenance districts for periodic area sweeping. Downtown and other high traffic commercial areas are swept at night on a weekly basis. In addition, summer sweeping in the Chain of Lakes drainage areas has occurred since 1995 as part of the Clean Water Partnership project. Two sweepers are dedicated to cleaning drainage areas around the Chain of Lakes, and one sweeper is devoted to the Minneapolis Parkway System.

The materials collected from street sweeping are received at two different locations, based on time of the year and nature of the material. The inorganic materials go to a construction demolition landfill site in Becker, Minnesota, to be used as daily cover. The Mulch Store, based in Chaska, MN, receives the City's organics in the fall of each year. The Mulch Store features four retail locations, but their main mulch operation originates in Chaska.

Special Service Districts

Special service districts are defined areas within the City where increased levels of service are provided and paid for by charges to the commercial or industrial property owners in the district. One of these special service districts, the Downtown Improvement District (DID) is a business-led non-profit organization with "a mission to make downtown Minneapolis a vibrant and attractive place for recruiting and retaining businesses, employees, residents, shoppers, students, and visitors. This is accomplished by providing services that make the 120-block district cleaner, greener, and safer." The organization is an important partner to the City, carrying out maintenance activities in the downtown public realm that minimize the discharge of pollutants through the proper maintenance of public right-of-way areas. The DID removes trash from sidewalks and operates sweepers for gutters and sidewalks throughout the 120-block district.

Snow and Ice Control

The Minneapolis Public Works Transportation, Maintenance, & Repair Division applies salt and sand to City roadways every winter for snow and ice control. Efficient application of de-icing materials is sought to appropriately balance three primary concerns: public safety, cost control, and environmental protection.

Reduced material amounts not only provide a cost savings but are also the best practice available for reducing harmful impacts on the environment. Sand harms lakes and streams by disturbing the ecosystems, and in depositing pollutants that bind to sand particles in lake bottoms and streambeds. An accumulation of sand calls for more frequent cleaning of catch basins and grit chambers. Salt (chloride) is harmful to aquatic life, groundwater, and to most plant and tree species. Salt causes corrosive damage to bridges, reinforcement rods in concrete streets, metal structures and pipes in the street, and vehicles.

Within Minneapolis, the following lakes and creeks do not meet standards for concentrations of chlorides set by the MPCA and are considered impaired:

- Bassett Creek
- Brownie Lake
- Diamond Lake
- Loring Lake
- Minnehaha Creek
- Powderhorn Lake
- Shingle Creek
- Spring Lake

Reducing usage of salt was the focus of the Shingle Creek Chloride TMDL Report, which was approved by the EPA in 2007. It placed limits on chlorides (salt) discharged to Shingle Creek. Consequently, the City developed improved snow and ice control practices, and they are being implemented not only in the Shingle Creek drainage area but also citywide. These practices are in line with the 2016 Twin Cities Metropolitan Area Chloride Management Plan completed by the MPCA.

Material spreaders are calibrated annually before the winter season. Maintenance yard housekeeping practices are designed to minimize salt/sand runoff. The materials that are used are tallied daily. Salt stockpiles are stored under cover to minimize potential groundwater contamination and runoff to surface waters.

PREVIOUS YEAR ACTIVITIES

The 2020-2021 winter season was an early year starting with a record snow fall in October and ending in April with several freeze-thaw cycles which required more granular material usage along with December snowfalls that did not melt off completely and formed ice in the alleys and side streets especially with the cold December through February range. There were 27 notable events with 48.6 inches for the season, as compared to an average of 48 inches. The most snowfall was observed in December. There were two declared snow emergencies, compared to the annual average of four, and there were 152 days of temperatures at or below freezing by late of April. There were four notable freezing rain events in 2020-2021. The quantities of salt and sand used in snow and ice control are tracked by recording amounts that are delivered by suppliers, and by estimating the quantities that are on-hand daily. Street sweepings are scaled at the disposal site and reported to the City for record purposes only. Leaves picked up are weighed at the contractor's transfer facility in Minneapolis. The statistics for last year's program are as follows:

- 9.807 tons of salt applied to roadways
- 7,115 tons of sand applied to roadways

- 13.732 tons of materials reclaimed during spring and summer street sweeping operations
- 5,956 tons of leaves collected for composting during the fall Citywide sweeping

The City has been tracking the amount of salt applied within the City since 2001. Figure 6-1 shows the tons of salt applied annually. Figure 6-2 shows the amount of sand and salt applied in the City relative to the days below freezing. Figure 6-3 shows the amount of sand and salt applied in the City relative to the total amount of snowfall. These figures show that there has been an overall reduction in the amount of salt applied in the City. There has also been a reduction in the amount of salt applied relative to both the days below freezing and the inches of snowfall in the City.

Figure 6-1

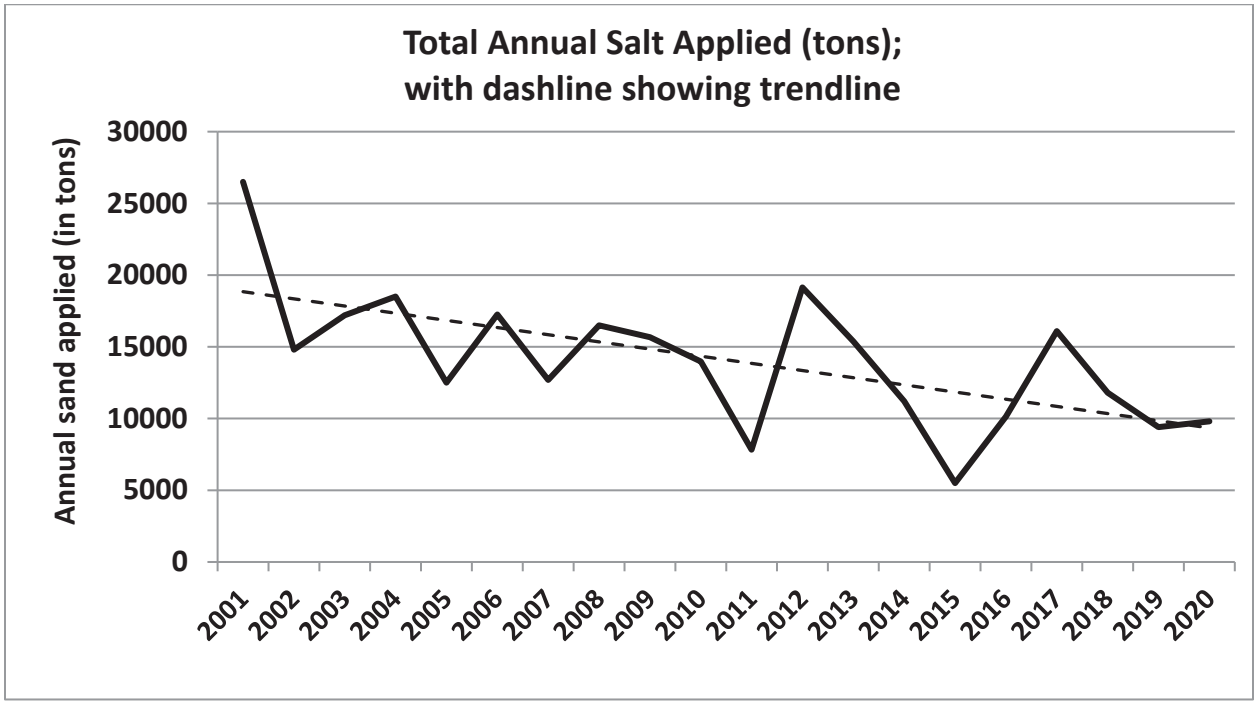


Figure 6-2

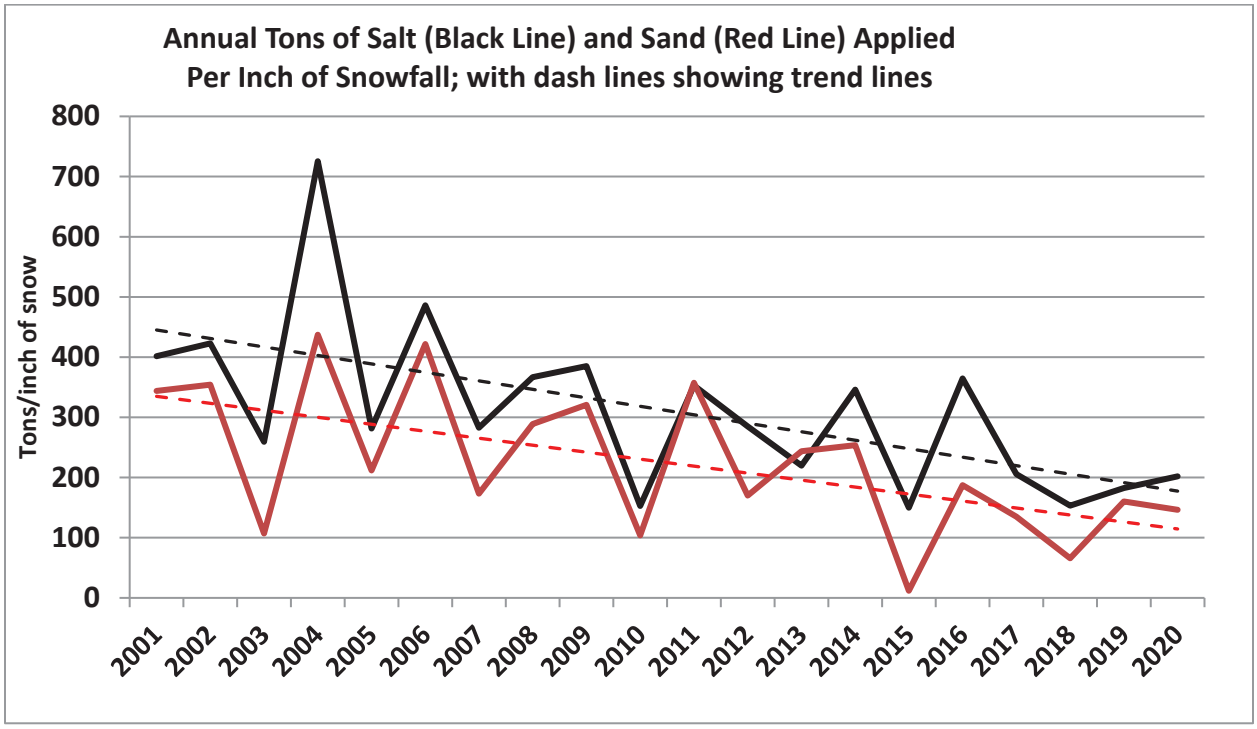
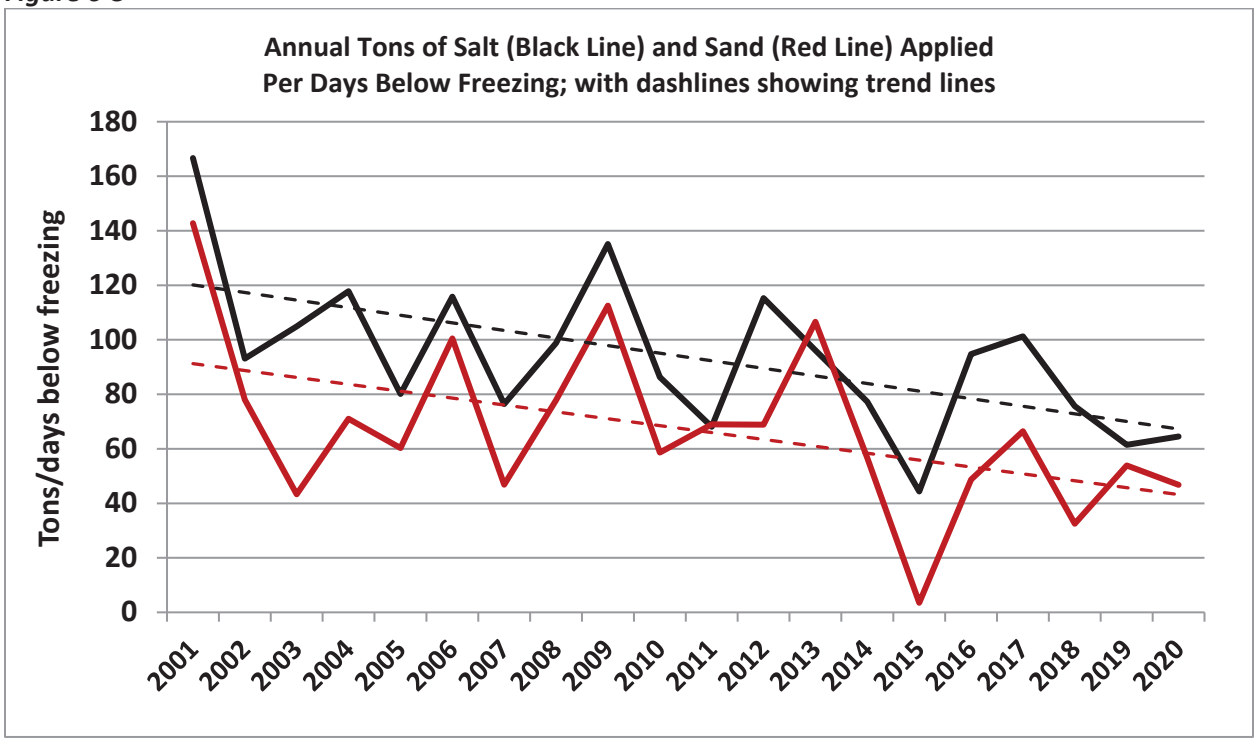


Figure 6-3



Performance Measures

- Amount of materials recovered as a percentage of materials applied: 116 %
- Amount of salt and sand applied relative to total snowfall: 348 tons/inch

VEGETATION MANAGEMENT: PESTICIDES AND FERTILIZER CONTROL

PROGRAM OBJECTIVE

The objective of this stormwater management program is to minimize the discharge of pollutants by utilizing appropriate vegetation management techniques and by controlling the application of pesticides and fertilizers.

Targeted pollutants include:

- Pesticides (insecticides, herbicides, fungicides, etc.)
- Nutrients (phosphorus, nitrogen, etc.)

PROGRAM OVERVIEW – MPRB PROPERTIES

Integrated Pest Management (IPM) Policy and Procedures

The Minneapolis Park and Recreation Board's Integrated Pest Management policy for golf courses and general park areas is included in the MPRB's General Operating Procedures. Specific areas where IPM is intensely used are the major display gardens at Lyndale Park, Loring Park, Minneapolis Sculpture Garden, Minnehaha Falls Park, premiere athletic fields, and golf courses. Gardener, golf, and maintenance staff use an established IPM policy to determine the appropriate course of corrective action.

Pesticides Use on Park Lands

The MPRB manages 6,400 acres of park land and water in the City of Minneapolis (approximately 18% of the City's 35,244 total land acres).

The use of pesticide products on general park lands is not a regular maintenance practice. Landscape pesticide products may be used during park renovations, to maintain premier athletic complexes and golf courses, to control invasive species, or to ensure plant health within formal gardens. No cosmetic use of pesticide products is performed on general parkland. In 2016, MPRB banned the use of glyphosate in neighborhood parks. In 2018, the Board of Commissioners placed a moratorium on the use of glyphosate on all MPRB lands.

Invasive Species Control

Conservation Corp working in Wirth Park.

MPRB Environmental Management (Natural Resources) staff use a variety of management techniques to control invasive plants in park natural areas. These techniques include mowing, weed whipping, hand pulling, and the use of biological controls. Biological control agents have been used in the park system to control purple loosestrife, spotted knapweed, and leafy spurge. Biological control agents are insects or pathogens that are native to the invasive plant's country of origin. They are introduced after extensive research has been done by the scientific community. The MPRB partners with Minnesota Department of Agriculture (MDA) and Minnesota Department of Natural Resources (MnDNR), to control invasive plants with biological control agents.

Purple Loosestrife is a major invasive species problem in Minnesota wetlands. Working with the MnDNR the MPRB began a biocontrol program in the early 1990s. Leaf feeding beetles were reared and released into several sites throughout the City. Currently these populations are self-sustaining.

Partnering with MDA, spotted knapweed and leafy spurge biological controls were released into the prairie planting along the Cedar Lake bike trail in 2003. Insects that specifically feed on these plants are successfully controlling spotted knapweed and leafy spurge in the planted prairie.

SCUBA hand harvesting at Wirth Lake

Eurasian watermilfoil, an invasive aquatic plant, is harvested mechanically at Cedar Lake, Lake of the Isles, Bde Maka Ska, and Lake Harriet and harvested by hand via SCUBA at Lake Nokomis and Wirth Lake. Permits for managing Eurasian watermilfoil are obtained annually from the Minnesota Department of Natural Resources. The Environmental Stewardship Division coordinates the Eurasian watermilfoil control program.

The MPRB General Operating Procedures state no chemical application will be used to control aquatic weeds. When a noxious weed species is newly introduced, whether to our region or to a specific area, MPRB staff evaluate management solutions using an integrated pest management approach.

Fertilizer Use

In September 2001, the Minneapolis City Council amended Title 3 of the Minneapolis Code of Ordinances (relating to Air Pollution and Environmental Protection) by adding Chapter 55 regarding Lawn Fertilizer in January 1, 2002. The retail sale of fertilizer containing any amount of phosphorus or other compound containing phosphorus, such as phosphates, is prohibited in Minneapolis, as of January 1, 2002. The Minnesota Statute allows the use of phosphorus turf fertilizer if an approved and recent test indicates that the level of available phosphorus in the soil is insufficient or if the fertilizer is being applied to newly established turf, and only during the first growing season.

Under certain conditions specified in the Statute, fertilizer use is allowed on golf courses. Fertilization of turf on Minneapolis Park & Recreation Board Property is performed for golf courses, around athletic fields, and in areas of heavy traffic. MPRB staff are required to complete a report for every turf fertilizer application. These records are maintained for a period of 5 years, per state law.

Recordkeeping

MPRB staff who apply pesticides and fertilizers keep records of their applications, as required by the Minnesota Department of Agriculture. Since the 1980s, golf course foremen and park maintenance staff have documented the type, amount, and locations of the chemicals that are stored at park storage facilities. These chemical inventories provide detailed information to emergency responders in the event of a compromised storage facility. The plans identify how the fires are best extinguished and how to protect surface water in the surrounding area. The plans were put into place in the early 1980s, following a chemical company fire in north Minneapolis that resulted in the contamination of Shingle Creek.

Audubon Cooperative Sanctuary Program (ACSP) for Golf Courses

Audubon International provides comprehensive conservation and environmental education assistance to golf course superintendents and industry professionals through collaborative efforts with the United States Golf Association. The ACSP for golf courses seeks to provide open space benefits by addressing environmental concerns while maximizing golf course opportunities.

Participation in the program requires that golf course staff address environmental concerns related to the potential impacts of water consumption, and chemical use on local water sources, wildlife species, and native habitats. The program also aids in comprehensive environmental management, enhancement and protection of existing wildlife habitats, and recognition for those who are engaged in environmentally responsible projects.

Audubon International provides information to help golf courses with:

- Site Assessment and Environmental Planning
- Outreach and Education
- Water Quality and Conservation
- Resource Management
- Wildlife and Habitat Management

By completing projects in each of the above, the golf course receives national recognition as a Certified Audubon Cooperative Sanctuary. MPRB Golf Course foremen are expected to maintain the ACSP certification for courses. MPRB water resources staff conduct yearly water quality and wetland vegetation monitoring at the courses. All MPRB golf courses except for Columbia, Hiawatha and Fort Snelling have current Audubon Certification. The MPRB is currently in the process of obtaining certification for Columbia and Hiawatha Golf Courses.

Rain Garden at Riverside and 8th St. S

PREVIOUS YEAR ACTIVITIES

Currently 206 MPRB employees hold pesticide applicator licenses, through the Minnesota Department of Agriculture (MDA). MPRB staff continues to reduce the use of pesticides through a variety of initiatives including improved design, plant selection, increased use of mechanical techniques and biological controls.

Zero phosphorus turf fertilizers were specified for purchasing bids beginning with the 2002 fertilizer bid. This was done in response to the 2002 City and State regulation changes regarding phosphorus turf fertilizers. A wide range of zero phosphorous fertilizers are available to park maintenance and golf course foremen if fertilizer is needed.

PROGRAM OVERVIEW – CITY OF MINNEAPOLIS PROPERTIES

The City of Minneapolis maintains vegetation on its properties, including on stormwater management sites for a variety of reasons. These include public safety, preventing erosion, protecting, and improving water quality and ecological function, and creating wildlife habitat. Proper vegetation management will slow water movement, hold or convert pollutants, and enhance infiltration and evapotranspiration within stormwater management facilities like rain gardens and grass swales.

Integrated Pest Management (IPM)

The City uses integrated pest management when addressing pest management on the sites that the City maintains. IPM is a pest management strategy that focuses on long-term prevention or suppression of pest problems with minimum impact on human health, the environment and non-target organisms. In most cases, IPM is directed at controlling pests that have an economic impact on commercial crops. However, in the instance of mosquito control, IPM is used to control nuisance and potentially dangerous

mosquito populations. The guiding principles, management techniques and desired outcomes are similar in all cases.

The City complies with the Minneapolis Code of Ordinances Title 11 - Health and Sanitation, Chapter 230 - Pesticide Control and Minnesota Department of Agriculture rules regarding pesticide application by posting plant protectant applications and maintaining the necessary records of all pest management activities completed by the City. The City's specific IPM goals, procedures, and guidelines can be found in Appendix A.

MCM SEVEN: STORMWATER RUNOFF MONITORING AND ANALYSIS

PROGRAM OBJECTIVES

The purposes of monitoring and analysis under the MS4 permit are to understand and improve stormwater management program effectiveness, characterize pollutant event mean concentrations, estimate effectiveness of devices and practices, and calibrate and verify stormwater models.

Targeted pollutants include:

- Phosphorus
- TSS
- Chlorides
- Bacteria

PROGRAM OVERVIEW

In addition to stormwater monitoring, the Minneapolis Park & Recreation Board carries out an extensive lake monitoring program which is sometimes illustrative of the effects of stormwater on natural water bodies. For example, Escherichia coli (E. coli) monitoring per the MPCA's standard is carried out at the MPRB's 12 official beaches located on six lakes. This monitoring is important for public health and provides indications of elevated bacteria issues (see Section 18, Public Beach Monitoring, of the MPRB's Water Resources Report referenced in the next paragraph). E. coli is a bacterium used to indicate the potential presence of waterborne pathogens that can be harmful to human health. Elevated bacteria levels generally occur in aquatic environments after rain events, when bacteria from various sources are washed into the lakes in stormwater runoff.

PREVIOUS YEARS ACTIVITIES

Lake Monitoring

In 2020, MPRB scientists monitored 12 of the city's most heavily used lakes. The data collected were used to calculate a Trophic State Index (TSI) score for each of the lakes. Lower TSI scores indicate high water clarity, low levels of algae in the water column, and/or low phosphorus concentrations. Changes in lake water quality can be tracked by looking for trends in TSI scores over time. A negative slope indicates improving water quality, while a positive slope indicates declining water quality. These values are especially important for monitoring long-term trends (10+ years). Historical trends in TSI scores are used by lake managers to assess improvement or degradation in water quality. Trends are also used by the Minnesota Pollution Control Agency to assess non-degradation goals.

Lake Sampling on Bde Maka Ska

Most of the lakes in Minneapolis fall into either the mesotrophic or eutrophic category. Bde Maka Ska, Harriet, and Wirth are mesotrophic with moderately clear water and some algae. Brownie, Cedar, Hiawatha, Isles, Loring, and Nokomis are eutrophic with higher amounts of algae. Powderhorn is hypereutrophic with high nutrient concentrations and the potential for severe algal blooms. Spring Lake was also classified as hypereutrophic in 2019 but was not sampled in 2020. Scores for Diamond and Grass Lake are not included since these lakes are too shallow to calculate the Secchi portion of the TSI index.

Trends in lake water quality can be seen by using the annual average TSI since the early 1990s.

Long term trends in lake water quality can be seen by using the annual average TSI since the early 1990s, **Table 7-1**. Restoration activities have improved water quality indicators at Bde Maka Ska and Wirth Lake. When data from the last 10 years is looked at for Minneapolis lakes, shown in **Table 7-2**, Cedar Lake has an increasing trend, signifying declining water quality indicators for that lake. The decline in water quality indicators at Cedar Lake may be related to high water levels, or the end of the effective life of the previous alum treatment.

Table 7-1. Water quality trends in Minneapolis lakes from 1991-2020.

Lakes with Improving Water Quality Indicators	Lakes with Stable Trends	Lakes with Declining Water Quality Indicators
Bde Maka Ska	Brownie Lake	No lakes with declining trend
Wirth Lake	Cedar Lake	
	Lake Harriet	
	Lake Hiawatha	
	Lake of the Isles	
	Lake Nokomis	
	Loring Pond	
	Powderhorn Lake	
	Spring Lake	

Table 7-2. Water quality trends in Minneapolis lakes from 2011-2020.

Lakes with Improving Water Quality Indicators	Lakes with Stable Trends	Lakes with Declining Water Quality Indicators
No Lakes with improving trend	Bde Maka Ska	Cedar Lake
	Brownie Lake	
	Cedar Lake	
	Lake Harriet	
	Lake Hiawatha	
	Lake of the Isles	
	Lake Nokomis	
	Loring Pond	
	Powderhorn Lake	
	Spring Lake	
	Wirth Lake	

Pond Screening and Monitoring

In 2020, the COVID-19 pandemic disrupted the ability to carry out field-based work and equipment installations. Due to social distancing guidelines, a pond screening study was designed for the NPDES stormwater monitoring program. In 2020 the City of Minneapolis conducted a stormwater pond study that included chemical monitoring, bathymetric surveys, and oxygen/temperature water column profiles. A Minneapolis Park and Recreation Board (MPRB) pond screening study was carried out to augment the data collected for the Minneapolis screening study.

The purpose of the MPRB screening study was to determine if any of a group of 16 existing ponds should be prioritized for retrofit projects that would increase their nutrient removal benefit. Most of the 16 ponds were designed originally for flood control. Ponds could be prioritized for projects if they had a high potential of Harmful Algal Blooms (HABs), evidence of high phosphorus return from the sediment, or evidence of sediment resuspension. For screening purposes, Chl-a was considered an indicator of moderate or greater likelihood for HABs presence when the Chl-*a* concentration was greater than 30 ug/L (Heiskary and Lindon, 2009). HABs in neighborhood ponds could be a potential health hazard. High total phosphorus values in pond water could be caused by anoxic conditions due to sediment-bound phosphorus being released to the water column. Ponds with high phosphorus may prioritized for dredging or other retrofit to gain a water quality benefit for downstream water bodies. Sediment resuspension or bioturbation in a pond could be potentially determined by high TSS, VSS, or metals values. Resuspension of sediment may indicate that the pond could be retrofit or maintained differently for increased water quality benefit.

There is also a desire in the City of Minneapolis for ponds to be greenspace or habitat. Chloride content above the Minnesota Pollution Control Agency (MPCA) 5-day chronic threshold of 230 mg/L can impair aquatic life and is an indication that a pond would be poor habitat. The Canadian Environmental Quality Guidelines have a stricter chronic chloride concentration threshold of 120 mg/L which is used to protect sensitive species (Canadian Environmental Quality Guidelines, Canadian Council of Minister of the Environment, 2011). If pond chloride concentrations were below the MPCA chronic threshold, the pond could be considered as potentially suitable aquatic habitat. If chloride values were measured below the Canadian standard, pond habitat could be considered good for aquatic life.

The MPRB study screened stormwater ponds during dry conditions, that is not directly after a rain event. Data could then be used to decide which watersheds and ponds to maintain, retrofit to improve their pollutant removal performance, and potentially prioritize as wildlife habitat.

The MPRB collected grab samples at 16 ponds. All ponds had a grab sample taken once a month and samples were analyzed for Chl-a, chloride (Cl), and total phosphorus (TP). Six of the ponds had grab samples taken every two weeks and were analyzed for the NPDES chemistry suite analyzed along with Chl-a, Cl, and TP.

Detailed monitoring methods and results are listed in **Appendix A-12**

Fat, Oil, and Grease (FOG) and Quarterly Grab Monitoring

In 2020, Fat, Oil, and Grease (FOG) monitoring was carried out at six sites:

- Powderhorn Southeast
- Powderhorn South

- Powderhorn West
- 24th Ave SE and Elm St SE - North
- 24th Ave SE and Elm St SE - South
- W 61st St and Lyndale Ave S

A full set of FOG samples could not be collected at W 61st St and Lyndale Ave S. A full set of samples will be collected at this site in 2021.

Over three years, 59 FOG samples were collected at 4-8 sites in Minneapolis, and 23 had detectable FOG. Four of those 23 samples were over the 15 mg/L threshold noted in the permit. All samples that have exceeded the 15/mg/L threshold were collected from snowmelt. In 2020, Powderhorn South had 31 mg/L FOG and Powderhorn West had 109 mg/L FOG in the samples captured from snowmelt. The Powderhorn sites are residential/mixed use. Detailed monitoring methods and results are listed in **Appendix A-12**.

Powderhorn Lake Inlet Monitoring

The City of Minneapolis and Minneapolis Park and Recreation Board undertook a restoration plan for Powderhorn Lake in 1999, due to poor lake conditions. Part of the restoration plan included the installation of Continuous Deflective Separators (CDS) to remove trash and solids from the stormwater to Powderhorn Lake. In 2001, five CDS grit chambers were installed at the outlets to the larger watersheds flowing to Powderhorn Lake to remove solids from stormwater inflow.

Despite this and other restoration work, the lake was listed as impaired and placed on the Environmental Protection Agency (EPA) 303d list based on eutrophication and biological indicators in 2001. Powderhorn Lake later trended towards better water quality and was subsequently delisted in 2012 after meeting state standards for several years. Powderhorn was relisted on the EPA 303d list as impaired for nutrients in 2018 after relapsing to poor water quality.

The purpose of monitoring the stormwater inlets into Powderhorn Lake is to measure the external nutrient load of the main tributaries to the lake. Information collected will help create a plan to decrease the amount of external nutrients impacting Powderhorn Lake. In 2020, the COVID-19 pandemic disrupted the ability to carry out equipment installations and only grab samples were collected at the Powderhorn inlets

Detailed monitoring methods and results are listed in **Appendix A-12**.

MCM EIGHT: PROGRESS TOWARD WASTE LOAD ALLOCATION FOR APPROVED TOTAL MAXIMUM DAILY LOADS

PROGRAM OBJECTIVES

Total maximum daily loads (TMDLs) are one of the many tools Congress authorized in the Clean Water Act to "restore and maintain the chemical, physical, and biological integrity of the nation's water." The goal of the City's TMDL program is to work closely with the MPCA and other water resource agencies during the study and implementation phases of each TMDL Study which is being conducted for a waterbody that receives stormwater runoff from the Minneapolis MS4 system. Additionally, this program aims to develop and maintain a tracking system to assess and report on the progress towards compliance with TMDL established maximum pollutant discharges.

Targeted pollutants include:

- Phosphorus
- TSS
- Chlorides
- Bacteria

PROGRAM OVERVIEW

The City of Minneapolis is subject to the following TMDLs:

TMDL project name	Waste Load Allocation type	Percent reduction	Pollutant of concern
Shingle Creek and Bass Creek Biota and Dissolved Oxygen TMDL	Categorical		Nitrogenous biochemical oxygen demand
Minnehaha Creek Watershed District Lakes TMDL – Lake Nokomis	Individual	38%	Phosphorus
Wirth Lake: Excess Nutrients TMDL	Categorical		Phosphorus
Silver Lake TMDL	Categorical	17%	Phosphorus
Crystal Lake Nutrient TMDL	Categorical		Phosphorus
Twin and Ryan Lakes Nutrient TMDL - Ryan Lake	Categorical		Phosphorus
Shingle Creek Chloride TMDL	Categorical	67%	Chloride
Minnehaha Creek Lake Hiawatha TMDL	Individual	31%	Phosphorus
Minnehaha Creek Lake Hiawatha TMDL	Categorical	N/A	E. coli
TCMA Chloride TMDL Study	Categorical	N/A	Chloride
Upper Mississippi River: Bacteria	Categorical		E. coli
South Metro Mississippi River TMDL (Metro)	Categorical	0%	TSS

SHINGLE CREEK AND BASS CREEK TMDL: BIOTA AND DISSOLVED OXYGEN

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- XPSWMM Systemwide Storm Sewer Model completed
- Water Quality Model completed

MINNEHAHA CREEK WATERSHED DISTRICT LAKES – LAKE NOKOMIS TMDL: PHOSPHORUS

- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- XPSWMM Systemwide Storm Sewer Model completed
- Water Quality Model completed
- Implementation of Green Stormwater Infrastructure Program
- Implementation of Chapter 54: Stormwater Management Ordinance for development and redevelopment
- Public Works Storm Sewer Maintenance and Repair Program

WIRTH LAKE TMDL: NUTRIENTS

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- XPSWMM Systemwide Storm Sewer Model completed
- Water Quality Model completed
- Implementation of Green Stormwater Infrastructure Program
- Implementation of Chapter 54: Stormwater Management Ordinance for development and redevelopment
- Public Works Storm Sewer Maintenance and Repair Program

SILVER LAKE TMDL: PHOSPHORUS

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program

- Monitoring Program with MPRB
- XPSWMM Systemwide Storm Sewer Model completed
- Water Quality Model completed
- Implementation of Green Stormwater Infrastructure Program
- Implementation of Chapter 54: Stormwater Management Ordinance for development and redevelopment
- Public Works Storm Sewer Maintenance and Repair Program

CRYSTAL LAKE TMDL: NUTRIENTS

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- XPSWMM Systemwide Storm Sewer Model Completed
- Water Quality Model completed
- Implementation of Green Stormwater Infrastructure Program
- Implementation of Chapter 54: Stormwater Management Ordinance for development and redevelopment
- Public Works Storm Sewer Maintenance and Repair Program

TWIN AND RYAN LAKES TMDL: NUTRIENTS

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- XPSWMM Systemwide Storm Sewer Model completed
- Water Quality Model completed
- Implementation of Green Stormwater Infrastructure Program
- Implementation of Chapter 54: Stormwater Management Ordinance for development and redevelopment
- Public Works Storm Sewer Maintenance and Repair Program

SHINGLE CREEK TMDL: CHLORIDE

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works equipment upgrades, advancements in de-icing technologies, and staff training
- Public Works Street Sweeping program
- Monitoring Program with MPRB

MINNEHAHA CREEK LAKE - HIAWATHA TMDL: NUTRIENTS

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- XPSWMM Systemwide Storm Sewer Model completed
- Water Quality Model completed
- Implementation of Green Stormwater Infrastructure Program
- Implementation of Chapter 54: Stormwater Management Ordinance for development and redevelopment
- Public Works Storm Sewer Maintenance and Repair Program

MINNEHAHA CREEK - LAKE HIAWATHA TMDL: BACTERIA

- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- Public Works Storm Sewer Maintenance and Repair Program
- Leadership, membership, and participation in Minnesota pathogen Task force
- Development of Stormwater Pathogen Investigation and Prevention Toolbox to identify, prevent, and remediate pathogens in stormwater runoff

TWIN CITIES METRO AREA (TCMA) TMDL: CHLORIDE

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works equipment upgrades, advancements in de-icing technologies, and staff training
- Public Works Street Sweeping program
- Monitoring Program with MPRB

UPPER MISSISSIPPI RIVER TMDL: BACTERIA

- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- Implementations of the 2019 Minnehaha Creek Bacterial Source Identification Study
- Leadership, membership, and participation in the MN Pathogen Task Force

- Developing a guide for identification, prevention, and remediation of pathogens in stormwater runoff
- Public Works Storm Sewer Maintenance and Repair Program

SOUTH METRO MISSISSIPPI RIVER TMDL (METRO): TSS

- Membership and Participation in the West Metro Watershed Alliance education campaigns
- Participation in the Adopt-a-Drain Program
- Participation in Storm Drain Stenciling Program
- Membership and Participation in Watershed Partners and Clean Water MN Public Education Programs
- Public Works Street Sweeping program
- Monitoring Program with MPRB
- Public Works Storm Sewer Maintenance and Repair Program

COORDINATION WITH OTHER ENTITIES

PROGRAM OBJECTIVE

The objective of this Stormwater Management Program is to maximize stormwater management efforts through coordination and partnerships with other governmental entities.

PROGRAM OVERVIEW

Coordination and partnerships of the City and the MPRB with other governmental entities include the four watershed organizations in Minneapolis: BCWMC, MWMO, MCWD and SCWMC. Coordination activities and partnerships with other governmental entities also include MnDOT, Hennepin County, MPCA, Minnesota Board of Water and Soil Resources (BWSR), MnDNR, neighboring cities, the Metropolitan Council, the University of Minnesota and various other entities.

The coordination and partnership activities can include the joint review of projects, joint studies, joint water quality projects, stormwater monitoring, water quality education, and investigation or enforcement activities.

Coordination with the Bassett Creek Water Management Commission (BCWMC)

In 2015, the BCWMC adopted its Third Generation Watershed Management Plan, with Minneapolis and the other eight-member cities as active partners. Minneapolis provides yearly financial contributions to the BCWMC annual operations budget. The City and the MPRB are also stakeholders with other BCWMC joint power cities in development of several Total Maximum Daily Load (TMDL) studies and implementation plans.

Coordination with the Minnehaha Creek Watershed District (MCWD)

The MCWD receives revenue through direct taxation against properties within its jurisdiction. MCWD's fourth Generation Watershed Management Plan was adopted on January 11, 2018 and sets priorities for the organization for the period from 2018-2027. The City of Minneapolis and the MPRB are stakeholders in development of TMDL studies and implementation plans, in collaboration with the MCWD and other stakeholders.

Coordination with the Mississippi Watershed Management Organization (MWMO)

In 2011, the MWMO adopted its Third Generation Watershed Management Plan (2011-2021). The City and MPRB participated in its planning committees. In 2020, the MWMO began a plan update. The City and the MPRB participated in the plan development process. MWMO expects the next generation plan to be approved in 2021. The MWMO delegates stormwater management requirements for new developments and redevelopments to its member cities and does not provide separate project review and approval. The MWMO receives revenue through direct taxation against properties within its jurisdiction. The City and the MPRB partner with the MWMO on many studies and projects. Additionally, MWMO conducted 35 educational events with a total of 853 participants.

Coordination with the Shingle Creek Watershed Management Commission (SCWMC)

In April 2013, the SCWMC adopted its Third Generation Watershed Management Plan, with Minneapolis and the other member cities as active partners. Minneapolis provides yearly financial contributions to

the SCWMC annual operations budget. The City of Minneapolis and the MPRB are stakeholders with other SCWMC joint power cities in development of TMDL studies and implementation plans.

Coordination with Hennepin County

In 2016, Hennepin County adopted the Natural Resources Strategic Plan (2015-2020). This plan is intended to guide the county and its partners, including the City, in responding to natural resource issues and developing internal and external policies, programs, and partnerships that improve, protect, and preserve natural resources. City staff and residents provided feedback on this plan through a series of meetings and survey.

Coordination with the Minnesota Pollution Control Agency (MPCA)

Minneapolis Fire Inspection Services coordinates with the MPCA on Spill Response incidents and investigations and enforcement for incidents of illegal dumping or illicit discharges to the storm drain system.

Minneapolis Public Works coordinates with the MPCA on the various work groups, including the Minnesota Stormwater Manual and surface water/groundwater interactions.

Coordination with the US Coast Guard and WAKOTA CARE

Minneapolis Fire Inspection Services coordinates with these agencies on spill response issues, training, and spill response drills.

PREVIOUS YEAR ACTIVITIES AND ONGOING COORDINATION EFFORTS

MPRB and the City of Minneapolis coordinate stormwater management efforts and coordinate with the watershed management organizations, the watershed district, and other governmental agencies on several water quality projects. Minneapolis Public Works maintains communications with all watershed management organizations and the watershed district within the City boundaries.

Interactions take several forms to facilitate communication and provide support:

- Attend selected local board and special issues meetings
- Attend selected education and public outreach committee meetings
- Take part in Technical Advisory Committee meetings
- Inform organizations of upcoming City capital projects to identify projects that may benefit from partnerships
- Provide developers who submit projects for site plan review with information and contacts to meet watershed requirements
- Share information and data regarding storm drainage system infrastructure, watershed characteristics, flooding problems, modeling data, etc.
- The MPRB and the City coordinate and partner with watershed organizations and state agencies on capital projects and water quality programs. For example:
- A feasibility study began in 2019 for a proposed project that will improve water quality and habitat and increase flood storage in Bassett Creek by dredging accumulated sediment that has

collected in the “lagoons” created within the creek in Theodore Wirth Park between Golden Valley Road and Trunk Highway 55. The City of Minneapolis and the MPRB are cooperating with BCWMC on the study. The feasibility study was completed in the spring of 2020 and the BCWMC approved the implementation of the project to dredge 3 of the lagoons to a 6-foot depth. Project design is expected to be completed in late 2021. Implementation is expected to occur in the winter of 2022/23. Clean Water Funding was awarded from the MN Board of Soil and Water Resources in 2020.

- MPRB and City of Minneapolis along with BCWMC are working towards implementation of a stormwater project in Bryn Mawr Meadows. The project will be designed and constructed in conjunction with the MPRB's master planning process for this area. The project includes diverting runoff from a 45.1-acre residential area west of the park and low flows from MnDOT’s Penn Pond discharge into new stormwater ponds within the park for a total phosphorus reduction of 30 pounds per year. Additional funding for this project has been contributed by Hennepin County and BWSR. Design of the project is expected to be in 2021 and construction in 2022.
- MPRB and City of Minneapolis along with MWMO are collaborating on common water quality, flood control and habitat improvement goals in MWMO’s 1NE project area. The overall goal of the project is to reduce flooding and reduce pollution to the Mississippi River. Projects are planned on the MPRB’s Colombia Golf Course, MPRB Parkland, and integrated with City of Minneapolis street projects. Preferred projects have been chosen, and construction started in 2020 and is expected to be completed in 2021.
- A phase of the overall project, the Northern Colombia Golf Course and Park BMP project began construction in 2020 with funding from MWMO, BWSR, City of Minneapolis, and Hennepin County.
- Collaboration between MPRB, MCWD, and Minneapolis continued via the master planning process for the Minnehaha Regional Trail corridor along Minnehaha Creek. If preliminary plans are fully implemented, 1.7 miles would be added to the length of the creek, runoff from 1,400 acres of land would be treated, 22 acre-feet of flood storage would be created, and over 400 pounds of phosphorus would be removed from the creek annually. The plan was adopted by the MPRB Board in 2020 laying out priorities for the Minnehaha Creek Corridor within Minneapolis and how the three entities can collaborate to meet common goals of managing stormwater, flooding, streambank stability, and ecology in a heavily used recreation corridor. Community engagement and design for the first project focus area is expected in 2021 with construction predicted in 2022.
- The City’s Environmental Services section coordinates with the MPCA regarding investigations and enforcement for incidents of illegal dumping or illicit discharges to the storm drain system.
- The MPRB works with the DNR and surrounding suburbs on projects like the Lake Nokomis Carp management study and other state regulatory programs.
- Public Works and MPRB staff coordinate with the MPCA, the watershed management organizations and other stakeholders for Total Maximum Daily Load (TMDL) studies and implementation plans.
- Public Works engages with MPRB, MnDOT, Hennepin County, Metropolitan Council, and watershed management organizations on those entities’ capital projects and infrastructure maintenance within the City regarding compliance with NPDES issues.

- Finally, other sections of this NPDES Annual Report provide additional information about other projects or issues on which the permittees have cooperated with other governmental entities.

INTEGRATED INFRASTRUCTURE MANAGEMENT

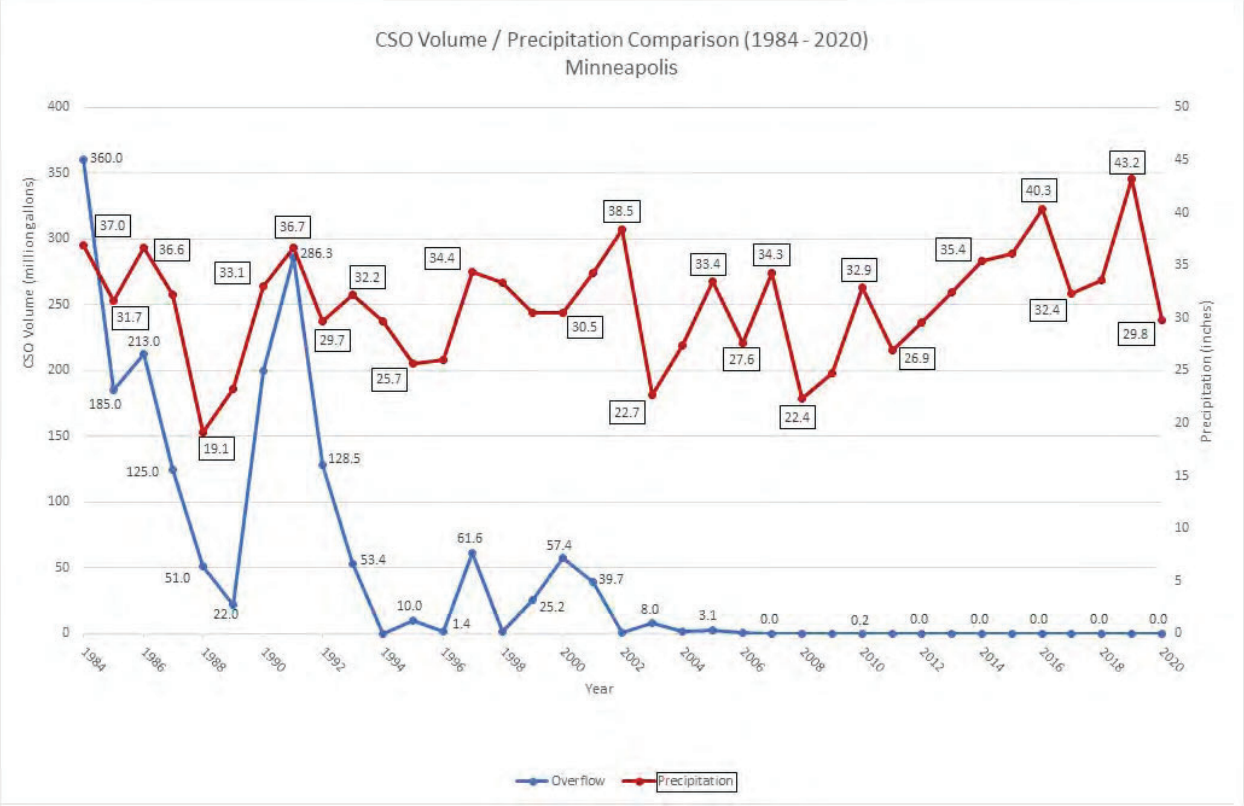
PROGRAM OBJECTIVE

The objective of this program is to prevent the unintentional discharge of untreated sewage from the Minneapolis sanitary sewer system at the regulators located on Metropolitan Council Environmental Services (MCES) Interceptors.

BACKGROUND

Transition to Integrated Infrastructure Management

In 2019**,** Minneapolis transitioned from a Combined Sewer Overflow (CSO) permit to an Integrated MS4 permit. This transition is possible because of the success of the efforts of the City of Minneapolis and MCES to reduce the risk of CSO events through storm drain separation, improvements to hydraulic performance and programs to reduce Inflow & Infiltration (I & I). The chart below shows a dramatic decrease in overflow volume from 1984-2020.



Storm drain separation can add significant flow to the stormwater system where capacity might be limited. Minneapolis is working to address stormwater capacity through the Flood Mitigation and Storm Tunnel Programs mentioned in this report. The addition of stormwater from separation projects has contributed to capacity problems in these systems. The integrated permit allows the City to prioritize

work and investment in projects to improve water quality and meet the requirements of the Clean Water Act.

Cooperation with Metropolitan Council Environmental Services (MCES)

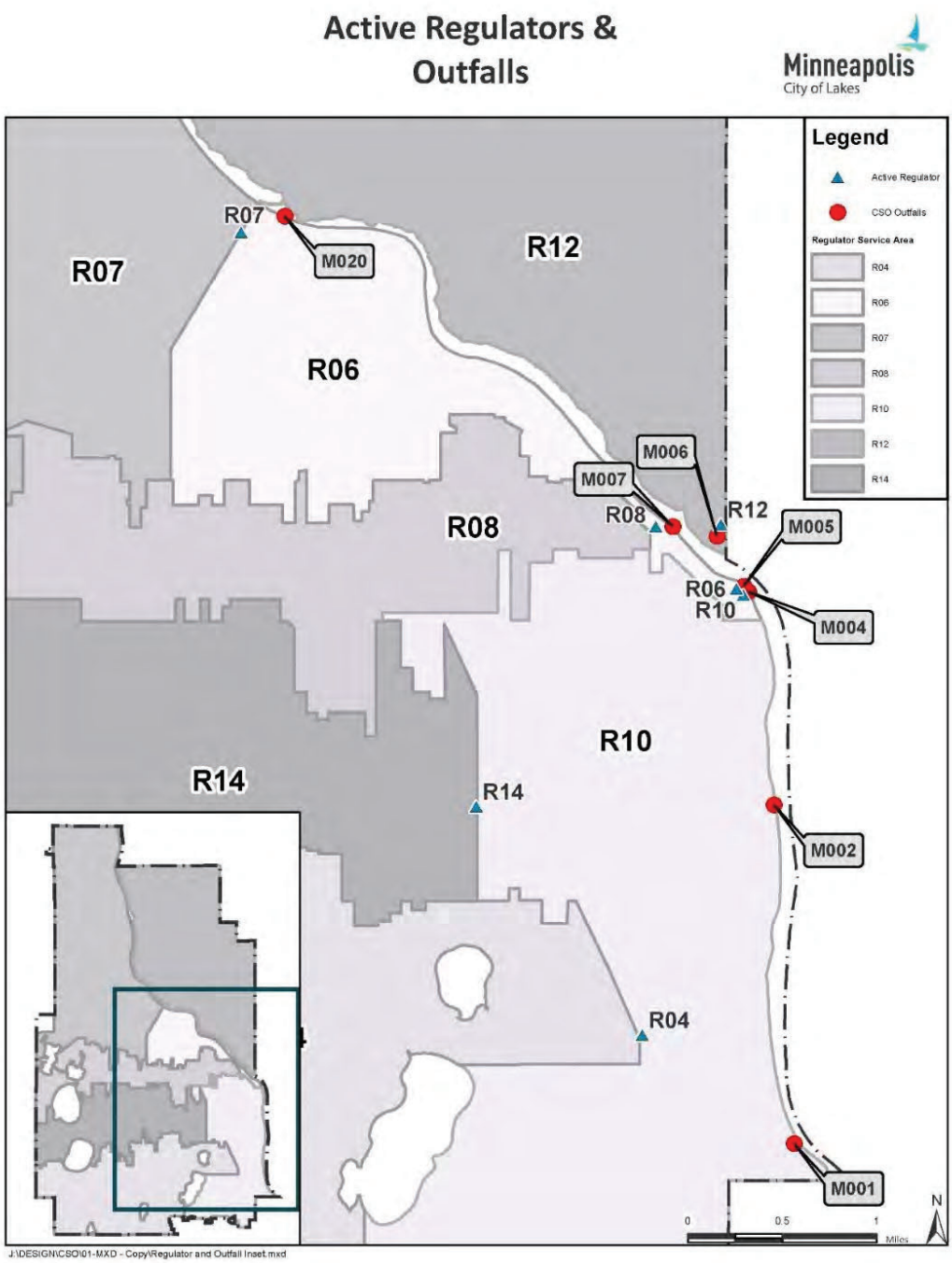
The sanitary sewer system from Minneapolis discharges to the Metropolitan Wastewater Plant, which is owned by the Metropolitan Council. Release events from the sanitary or combined sewer system can occur during periods of hydraulic overload caused by extraordinary rainfall or snowmelt events. Release events of this type occur at regulator structures owned by the Metropolitan Council. Each regulator has an associated stormwater outfall to the Mississippi River. Most of these stormwater outfalls are part of a larger storm water network owned and maintained by the City of Minneapolis. Outfalls that bypass directly from the interceptor system are owned by Metropolitan Council.

MCES and the City of Minneapolis entered into a cooperative agreement to coordinate ongoing responsibilities for release events with the termination of the joint CSO permit. The cooperative agreement was executed on March 27, 2018. It provides an inventory of regulators and outfalls and clarifies the commitments of each party to invest in, operate and maintain, and reduce Inflow & Infiltration (I & I) in each system. The following tables and map include the locations of active regulators and outfalls.

REGULATOR (Historic CSO Permit)	NAME AND LOCATION	X COORDINATE	Y COORDINATE
R04	Minnehaha Pkwy and 39th Ave S	543110.618	145799.774
R14	East 38th St and 26th Ave S	538476.110	152176.124
R10	Southwest Meters Diversion	545947.525	158095.063
R06	Northwest Meters Diversion	545745.715	158269.413
R12	East Meters Diversion	545309.317	160067.832
R08	East 26th St and Seabury Ave	543494.387	160010.412
R07	Portland Ave S and Washington Ave	531898.897	168232.605

MINNEAPOLIS NPDES OUTFALL	OUTFALL (Historic CSO Permit)	NAME AND LOCATION	X COORDINATE	Y COORDINATE
10-720	M001 (R04)	Minnehaha Tunnel	547368.436	142760.471
10-680	M002 (R14)	East 38th St	546801.334	152225.749
*	M004 (R10)	Southwest Interceptor	546085.529	158191.394
*	M005 (R06)	Northwest Interceptor	545955.556	158342.521
*	M006 (R12)	Eastside Interceptor	545208.244	159734.115
10-610	M007 (R08)	East 26th St	543969.672	160010.388
10-410	M020 (R07)	Chicago Ave S	533124.589	168689.291

**Owned by Metropolitan Council*



PROGRAM OVERVIEW

Studies, Investigations and Monitoring Activities

Studies, investigations, and monitoring activities provide information about inflow and infiltration in the sanitary sewer system. These efforts are accomplished through the I & I Program and Operation & Maintenance of the sanitary sewer system. Studies include flow monitoring, smoke testing of cross connection, manhole and sewer assessments. Since 2007, 785 miles of sewer smoke testing (96% of the

sewer system) have been completed. No smoke testing was performed in 2020 due the COVID-19 pandemic.

Capital Improvement Projects

Inflow from the public sewer system is addressed through projects included in the City of Minneapolis Capital Improvement Program, which includes:

- Combined Sewer Overflow Program – projects to reduce inflow by separating storm drains from the sanitary sewer system
- Inflow & Infiltration Removal Program – rehabilitation and repair projects to reduce I & I
- Sanitary Tunnel & Sewer Rehab Program – projects to repair and rehabilitate sanitary sewers, lift stations, tunnels and access structures.

Since 2002, 198 storm drain separations projects have been identified for the Combined Sewer Overflow Program. Of the identified projects, 153 were completed, separating 624.4 acres of drainage from the sanitary sewer system. The Combined Sewer Overflow Program is a continuation of the 1980s program that separated 4,600 acres of drainage from the sewer system.

Inflow from the private sewer system is addressed through the Rainleader Disconnection Program. Since 2003, 7,316 of 7,679 rainleader violations have been resolved.

PREVIOUS YEAR ACTIVITIES AND ONGOING COORDINATION EFFORTS

Release Events from the Sanitary or Combined Sewer System

MCES continues to monitor overflow duration and volume at each of the regulators. In 2020, there were zero reported releases to the Mississippi River from the monitored regulators.

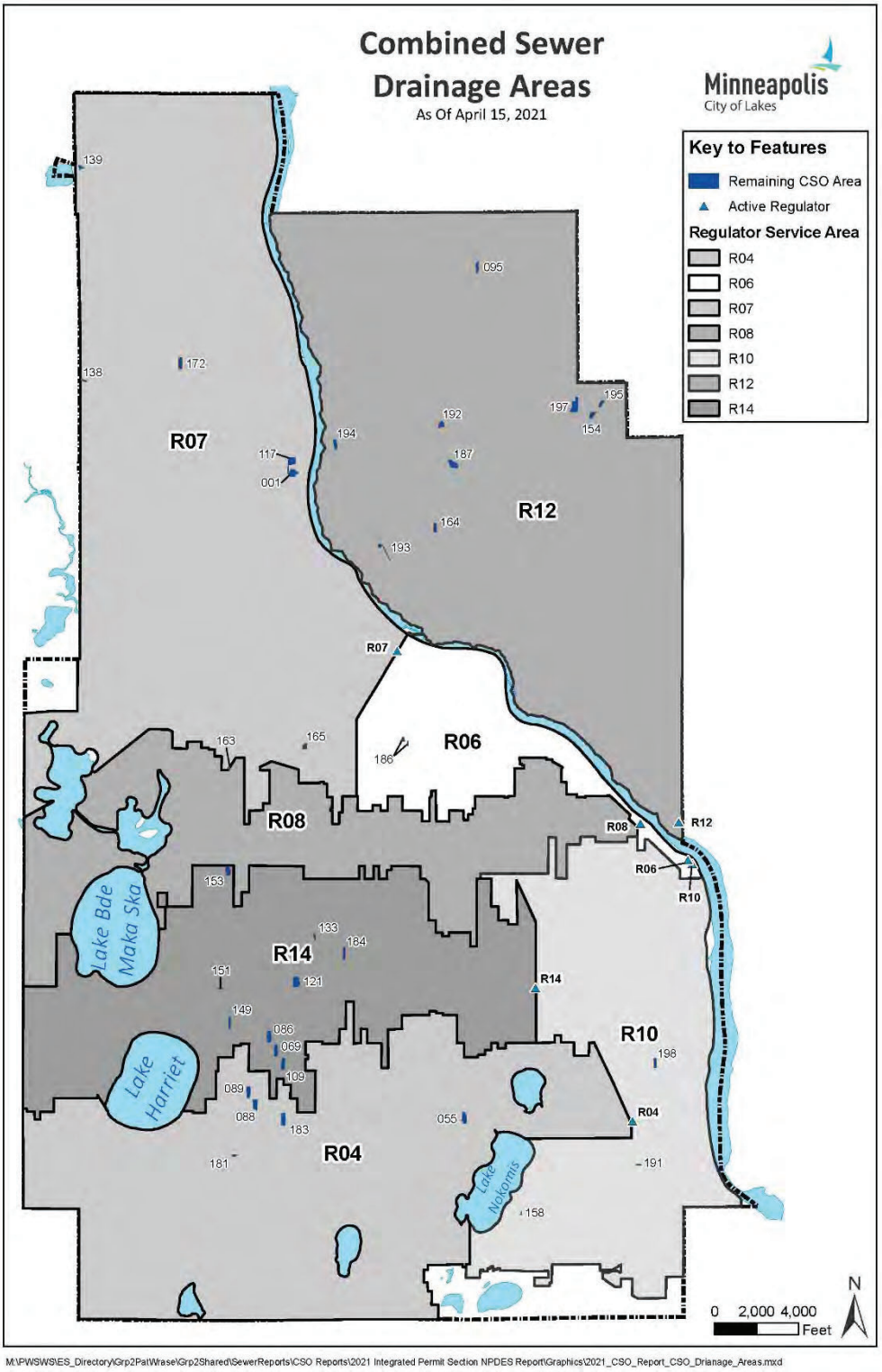
Studies, Investigations and Monitoring Activities

In 2020**,** Minneapolis continued to invest in studies, investigations, and monitoring activities aimed at identifying sources of inflow and infiltration. These efforts included the following:

- Flow Monitoring: 55 sanitary sewers and five rain gages were monitored in 2020. Sewer metering data was reviewed for rainfall dependent inflow and infiltration.
- Smoke Testing: There was no smoke testing in 2020. Smoke testing was not feasible in 2020 due to the COVID-19 pandemic.
- Suspected Cross Connection Investigations: two investigations were completed in 2020. These include suspected connections identified from record drawings, GIS work and routine maintenance of the sewer system.
- Manhole Condition Assessments: Panoramic inspections and Level 2 NASSCO condition assessments were completed on 1,011 manholes in 2020, for a total for 27,559 since 2016.
- Sewer Condition assessments: Televising and NASSCO condition assessments were completed on 15.84 miles of sanitary sewer.

Identified Inflow to the Sanitary Sewer System

An inventory of the drainage areas and sewersheds of the remaining 34 combined sewer areas is provided in the following map and table.



CSO AREA ID	SEWER SHED	AREA [acres]	LOCATION
1	R07	2.77	22nd Ave N & 2nd St N
55	R04	2.45	Alley west of Cedar Ave & south of 47th St E
69	R14	2.29	Alley west of Pillsbury Ave & north of 43rd St W
86	R14	2.49	Alley east of Grand Ave & north of 42nd St W
88	R04	2.14	Alley west of Harriet Ave & south of 46th St W
89	R04	2.23	Alley west of Garfield Ave & north of 46th St W
95	R12	1.50	Alley north of 33rd Av NE & east of Tyler St NE
109	R14	2.17	Alley east of Pillsbury Ave & south of 43rd St W
117	R07	3.30	2nd St N & 23rd Ave N
121	R14	3.43	Alley north of W 38th St & east of Blaisdell Ave S
133	R14	0.76	Stevens Ave S & 35th St E
138	R07	0.47	Xerxes Ave N & Lowry Ave N
139	R07	0.76	Washburn Ave N & Osseo Rd
149	R14	1.25	Bryant Ave S & 40th St W
151	R14	0.30	38th St W & Dupont Ave S
153	R14	2.00	Alley south of 29th St W, east of Colfax Ave S
154	R12	1.51	Coolidge St NE & 19th Ave NE
158	R10	0.21	24th Ave S & 54½ St E
163	R08	0.23	Hennepin Ave & Franklin Ave W
164	R12	1.35	Alley south of Spring St NE east of Madison St NE
165	R07	1.23	South of I-94 & 1st Ave S
172	R07	2.32	33rd Ave N & Irving Ave N
181	R04	0.51	50th St W & Aldrich Ave S
183	R04	2.66	Alley south of 47th St W, west of Wentworth Ave S
184	R14	1.47	4th Ave S & 36th St E
186	R06	1.13	17th St E & 11th Ave S
187	R12	2.69	14th Ave NE & Van Buren St NE
191	R10	0.40	51st St E and 40th Ave S
192	R12	1.67	Monroe St NE & 19th Ave NE
193	R12	1.41	Main St NE & 4th Ave NE
194	R12	1.72	Marshall St NE & 16th Ave NE
195	R12	1.11	Coolidge St NE & 22nd Ave NE
197	R12	4.11	Stinson BLVD & 22nd Ave NE

198	R10	1.6	4300 block of 42nd Av S

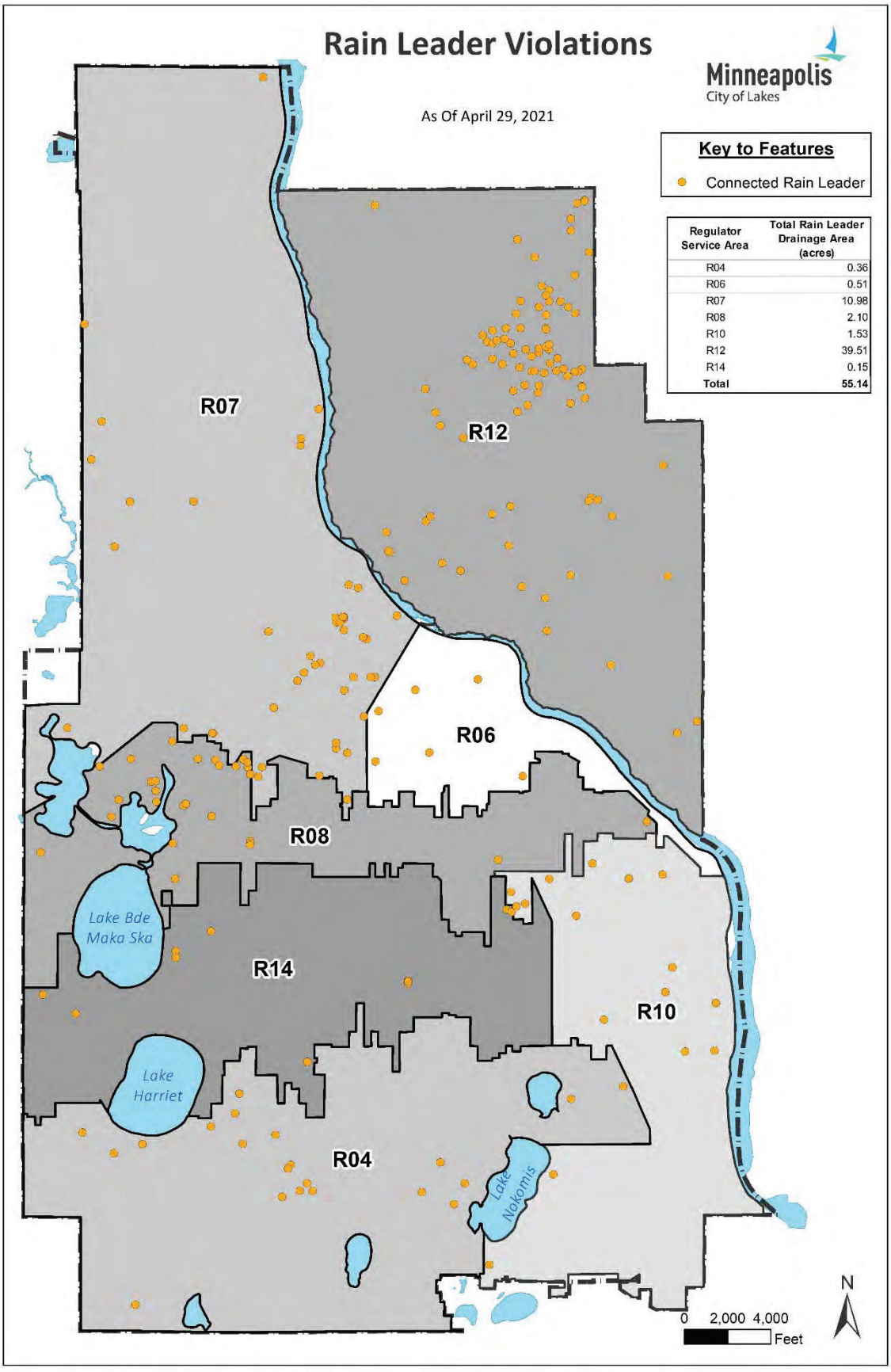
Combined Sewer Overflow / I & I Reduction Projects

Two storm drain separation projects were completed in 2020, eliminating 4.62 acres of direct drainage. *Note: CSO 42 was previously reported at removing 3.13 acres in 2007 when storm infrastructure was constructed for the project. The final separation was completed in 2020 as part of the I-35W project.*

PROJECT NAME	PROJECT LOCATION	DRAINAGE AREA [acres]
CSO 42	Stevens Ave & E Lake St	3.69
CSO 150	Stevens Ave & E 32nd St	0.93
	Total:	**4.62**

Rainleader Disconnection Program

Inflow from private property through roof drains, area drains, sump pumps, and open standpipes are tracked by parcel. The following map and table summarize parcels with open rainleader violations by sewershed. In 2020, 21 rainleaders were disconnected.


Rain Leader Violations
Minneapolis
City of Lakes
As Of April 29, 2021
Key to Features
Connected Rain Leader
Regulator Service Area | Total Rain Leader Drainage Area (acres)
R04 0.36
R06 0.51
R07 10.98
R08 2.10
R10 1.53
R12 39.51
R14 0.15
Total 55.14
R07
R12
R06
R08
R14
R10
R04
Lake Bde Maka Ska
Lake Harriet
Lake Nokomis
N
0 2,000 4,000
Feet
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Combined Sewer Drainage Area Percentage

The drainage areas for the storm drain connections to sanitary sewer system and total sewershed areas are compared in the table below. The comparison shows these areas are a small fraction of the tributary areas to each regulator and associated outfall.

OUTFALL NUMBER	REGULATOR NUMBER	TOTAL SEWER SHED AREA [acres]	COMBINED SEWER DRAINAGE AREA [acres]	PERCENT COMBINED SEWER AREA [%]
1	R04	5,881.04	10.35	0.18
2	R14	3,973.96	16.31	0.41
4	R10	4,239.58	3.74	0.09
5	R06	1,459.49	1.64	0.11
6	R12	8,322.38	56.58	0.68
7	R08	3,019.47	2.33	0.08
20	R07	8,571.93	21.83	0.25
	Total	**35,467.85**	**112.78**	**0.32**

Sanitary Tunnel & Sewer Rehabilitation Program

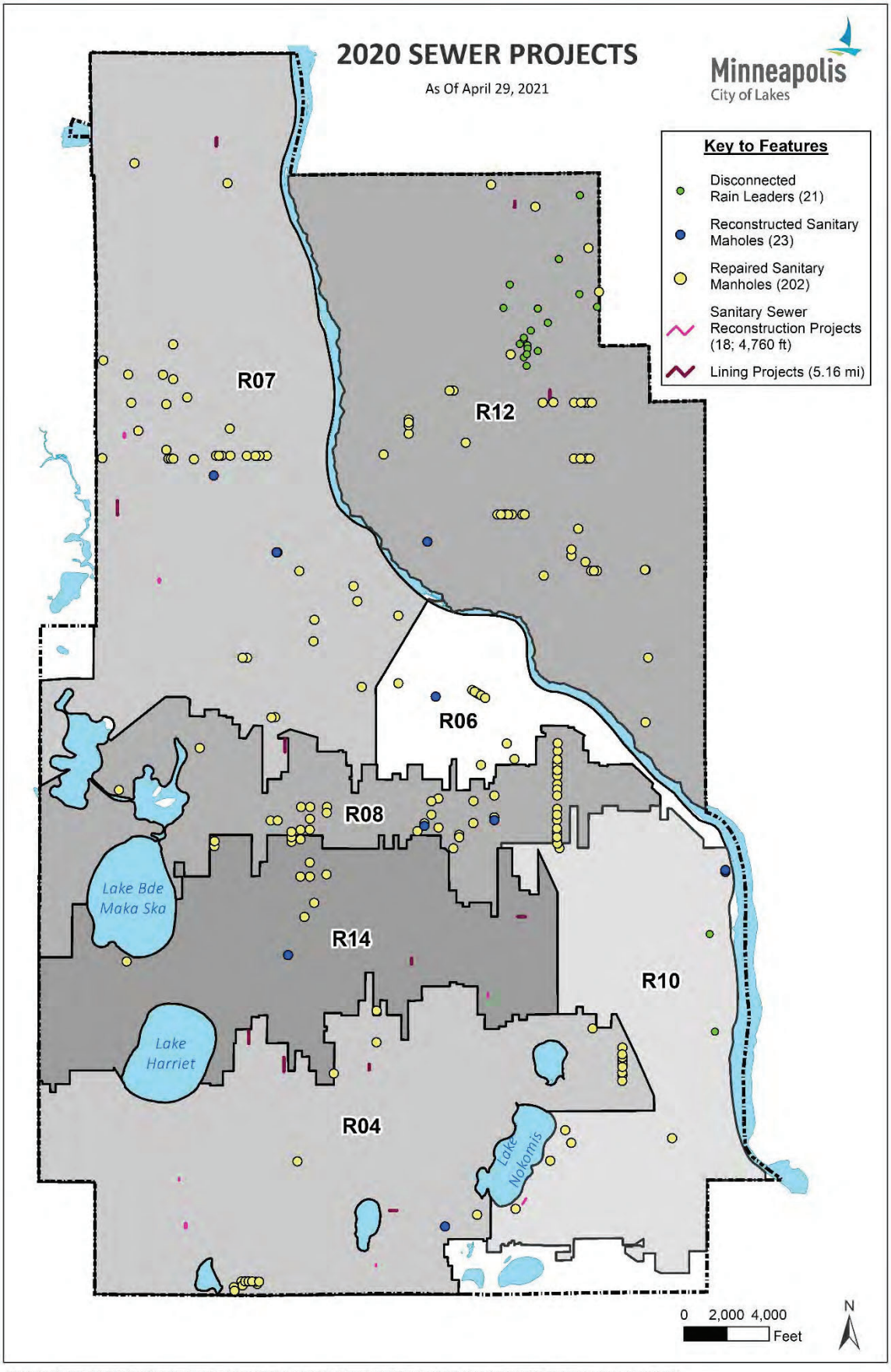
Sewer condition assessment data is used to develop this program. Repairs are prioritized based on structural and maintenance scores, paired with the likelihood and consequence of failure of each sewer. This condition assessment also determines if a sewer should be lined or reconstructed. Reconstruction is needed when sewers have collapsed or are deformed.

- Sewer Lining: Cured-In-Place-Pipe lining (CIPP) is a process to rehabilitate existing sewer pipes, due to age, cracks or leaks. Sewers are lined by inserting a fiberglass sock that is inverted and cured to an outer pipe with steam. In 2020, 5.16 miles of sanitary sewer were lined.
- Sewer Reconstruction: Full replacement of a sewer through an open excavation or tunneling for mainline is utilized when that sewer can no longer be rehabilitated. In 2020, 18 sewer construction projects were completed, replacing 4,760 feet of sewer and 23 manholes.
- Manhole Repairs: Includes a range of repairs from mortar work, to partial or full reconstruction of manholes. In 2020, 202 repairs to sanitary manholes were completed.

Summary of Annual Expenditures for Program Activities

Sanitary Rehab Projects – Repair and Replacement	$8,951,644
CIPP Lining Projects	$2,762,613
Sewer Separation Projects *	$279,046
Rainleader Disconnect Work	$698,851
Flow Metering	$610,177
Smoke Testing**	$77,308
Other I & I Studies	$176,238
Total	**$13,555,888**

*Two sewer separation projects were funded out of a paving project not tracked here
**Prep work only, delayed testing during pandemic


2020 SEWER PROJECTS
As Of April 29, 2021
Minneapolis
City of Lakes
Key to Features
Disconnected Rain Leaders (21)
Reconstructed Sanitary Maholes (23)
Repaired Sanitary Manholes (202)
Sanitary Sewer Reconstruction Projects (18; 4,760 ft)
Lining Projects (5.16 mi)
R07
R12
R06
R08
R14
R10
R04
Lake Bde Maka Ska
Lake Harriet
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Collaboration with External Partners

MCES and the City of Minneapolis share a commitment to minimize the risk of overflows. A 5-year joint study of the regional wastewater system within Minneapolis was initiated in 2018. The purpose of the study, which is being led by MCES, is to develop a work plan to address hydraulic capacity and provide for continued system reliability and reduced risk of system overflow. The goals of the study include:

- Identify areas within Minneapolis with high rates of I & I
- Identify areas of the MCES system with highest risk of sanitary sewer overflow
- Identify areas where hydraulic capacity is limited in the MCES system
- Identify projects that could lower risks of sewer overflow and increase needed capacity, including consideration of regulator closures
- Reduce I & I contributions to wastewater flows to recover interceptor capacity
- Maximize conveyance and storage capacity in the existing interceptor system
- Identify areas of the City where insufficient storm sewer capacity affects MCES system capacity and reliability
- Develop feasible alternatives to reduce risk of sewer overflows, including evaluation of cost-effectiveness, for capital projects that address the hydraulic capacity, risk of sewer overflow, and sources of I & I identified in the study

Minneapolis also participates in the Metropolitan Councils I & I Surcharge Program. The Surcharge Program is aimed at reducing peak flows from I & I that would require the MCES to construct additional capacity.

APPENDIX A

APPENDIX A1	2020 BCWMC WATER EDUCATION ACTIVITIES REPORT
APPENDIX A2	2020 SCWMC EDUCATION & PUBLIC OUTREACH PROGRAM GOALS
APPENDIX A3	NPDES PUBLIC COMMENTS
APPENDIX A4	VEHICLE RELATED SPILLS SOP
APPENDIX A5	STORM DRAINAGE AREAS BY RECEIVING WATER BODY
APPENDIX A6	STORMWATER RETROFIT PLAN PROJECTS REPORT
APPENDIX A8	INTEGRATED PEST MANAGEMENT POLICY
APPENDIX A9	2019 UTILITY RATE RESOLUTION
APPENDIX A10	STORMWATER UTILITY FEE FAQ
APPENDIX A11	2020 GRIT CHAMBER REPORT
APPENDIX A12	MPRB 2020 STORMWATER MONITORING RESULTS & DATA ANALYSIS
APPENDIX A13	FROG & TOAD REPORT

APPENDIX B

Appendix A

Minneapolis

City of Lakes

Bassett Creek Watershed Management

March 15, 2021

Liz Stout
City of Minneapolis, City of Lakes Bldg
309 Second Ave. South
Minneapolis MN 55401

RE: 2020 Water Education Activities – Letter of Understanding

Dear Liz,

This letter is to serve as an official arrangement between the Bassett Creek Watershed Management Commission (BCWMC) and the City of Minneapolis. The City of Minneapolis provides financial contributions to the BCWMC through an annual assessment based on area within the watershed and tax valuation of property in the watershed. In 2019 this assessment was $37,361. Further, watershed commissioners representing Minneapolis and Minneapolis city staff participate in, guide, and help implement the programs of the BWCMC, including its public education program. In 2020, approximately 8% of BCWMC budget was spent on education activities.

Education-related activities of the BCWMC are guided by its 2015 Watershed Management Plan, specifically its education and outreach policies (Section 4.2.9), and its overall Education and Outreach Plan found in Appendix B. http://www.bassettcreekwmo.org/document/wmp-plans. The specific activities of the BCWMC public outreach and education program are set annually by the Commission after recommendations are forwarded by the BCWMC Education and Outreach Committee.

After early March, education and outreach was impacted by the COIVD-19 pandemic which made in-person educational events impossible. The BCWMC supported virtual and online education, continued with some traditional activities such as writing educational columns and social media posts, and produced a series of educational videos for You Tube. The BCWMC contracts with Dawn Pape, (DBA Lawn Chair Gardener) an educational consultant who creates and writes much of the Commission's educational content. Activities and partners in 2020 included:

BCWMC Website - The BCWMC maintained its new user-friendly website in 2020 and maintained the information including latest news, contact list, meeting calendar, meeting materials, watershed plan, data, and projects. In 2020, there were approximately 7,288 unique users and 10,179 sessions, up nearly 50% from 2019.

West Metro Water Alliance (WMWA) Membership – The BCWMC continued its participation in WMWA along with several watershed management and other water-related organizations in the west Metro area. Through WMWA, these organizations collaborated on educational campaigns including the Watershed PREP program aimed at educating 4th grade students about water resources and the impacts of stormwater. Watershed PREP has three individual lessons meeting State education standards. **Lesson 1***, What is a Watershed and Why do We Care?* provides an overview of the watershed concept and is specific to each school's watershed. It describes threats to the watershed. **Lesson 2,** *Water Cycle - More than 2-dimensional,* describes the movement and status of water as it travels through the water cycle. **Lesson 3,** *Stormwater Walk,* investigates movement of surface water on school grounds.

Due to the COVID-19 pandemic in 2020, schools were forced to provide instruction primarily through online platforms, significantly hampering WMWA's ability to deliver the Watershed PREP curriculum.

A video of the Watershed PREP class was produced and distributed to schools for their use in the fall. Although it's been viewed 177 times, there is no analytic information on viewership. https://youtu.be/bq4zKMfc-pQ.

Despite restrictions, there were some in-person Watershed PREP lessons in 2020. Twenty classes totaling 572 students participated in Lesson 1, and 10 classes with 256 students also participated in Lesson 2. Of these, 370 students in the Bassett Creek Watershed participated in these lessons in 2020.

Also in 2020 WMWA worked with a designer and fabricator to build a "Native Roots Display" for use at future in-person events. This table-top, interactive display encourages people to pull the roots of different native plants to compare root lengths and to note the huge difference between turf grass and native plant root length. The display is available for events, libraries, schools, city halls, and nature centers.

River Watch Virtual Field Trip – In November, I participated in a "virtual fieldtrip" to Bassett Creek with a science class at Blake School in Minneapolis. Although we couldn't visit the creek in person, I presented information on the watershed, its projects, the Bassett Creek Tunnel, sources of pollution, of actions students and their parents can take to reduce water pollution.

Metro WaterShed Partners Membership —The BCWMC participated as a member of the Metro WaterShed Partners as a general supporter of the program and a financial supporter of the Metro Clean Water Minnesota Media Campaign. Metro Watershed Partners maintains a listserve and a website as forums for information sharing, holds monthly meetings for members to collaborate, and coordinates the Adopt-a-Drain program. In 2020, the Clean Water Minnesota Media Campaign provided its members with regular, seasonally appropriate stories about metro area residents taking action at home and in their lives to keep water clean. These professionally produced stories and photos are used by partners across a variety of media platforms. The BCWMC used these stories in social media and its website homepage. Find more information at www.cleanwatermn.org.

Chloride Education – The BCWMC continued its focus on education surrounding chloride and over salting in 2020 including working with other partners in the Metro area who are concerned about over salting. The BCWMC's Education Consultant continued developing and maintaining the "saltsmart.info" website, developed materials, and distributed hundreds salt smart information cards for residents to hand out at businesses that are applying too much salt.

In early March, BCWMC and the city of Plymouth hosted a free "Smart Salting Level I for Parking Lots and Sidewalks" certification training course. Approximately 50 people attended the course including private contractors and city and park district staff.

During the holidays, BCWMC produced a video with local musicians singing about salting smart to the tune of Jingle Bells that had 310 views.

Partnership with Metro Blooms for Harrison Neighborhood Project – Since 2016, the BCWMC has partnered with and supported the Metro Blooms on outreach, engagement, and project installation in Near North neighborhoods in Minneapolis. The projects aim to engage residents and commercial businesses, train youth, and install water quality practices in Minneapolis' Near North neighborhoods. The BCWMC collaborates on grant-funded projects and offers its own financial support. Since 2016, these programs have resulted in engagement with and bioswale installations on 37 residential properties; participation by neighborhood residents at multiple community block parties; engagement with 14 commercial/institutional property owners with 6 completed projects, and 20 landcare stewards trained. In 2020, the BCWMC began a partnership with Metro Blooms on a Lawns to Legumes "Northside Pollinator Project." So far, 52 residents and 3 neighborhood associations have participated and 2,000 sq. ft. of pollinator habitat has been installed.

Westwood Hills Nature Center – In 2020, the BCWMC partnered with the City of St. Louis Park to design and install educational signage and interactive displays at the newly reconstructed Westwood Hills Nature Center. A large sign indoors (see photo) defines a watershed and describes best practices to reduce water pollution. Outdoors, visitors can use hand pumps to move water through a constructed stream and into a created bog. Signs in these areas include "Managing Water Like a Forest," and "What is a Bog?" The nature center hosts tens of thousands of visitors each year (36,000 in 2017) including school groups, scouts, and residents.

Volunteer Monitoring Programs – The BCWMC entered an agreement with the Metropolitan Council to participate in the Citizen Assisted Monitoring Program (CAMP). Although the start of the program was delayed in 2020, volunteers collected data from 10 locations on 8 lakes in the watershed.

Commissioner Training Sponsorship – The BCWMC sponsored Plymouth Alternate Commissioner Catherine Cesnik's attendance at the Annual Salt Symposium in 2020.

Educational Guest Columns in Local Papers – Each month, the BCWMC education consultant, on the Commission's behalf, submitted an article related to water resources to the Sun Post local newspaper. Many articles were published in the online newspaper and some appeared in print in the Post and/or the Sun Sailor.

January: It's time to stop treating our soil like dirt
February: Getting to Know Your Local Government: BCWMC
April: Nature Not Cancelled - Spring Arriving on Time
May: The Hidden Power in Our Yards
June: When it rains, it pollutes? Rain gardens offer a pollution solution
July: We're All in This Together: Clean, Drain, DRY!
August: "Bee Kind"
September: Precipitation Whiplash
October: A little birdy told us to "leaf a little litter" in the garden—but not in the streets
November: Will our "hibernation" offer respite to our waters?
December: 2020 Takeaway

Educational Videos – BCWMC YouTube Channel - In 2020, BCWMC started a YouTube channel and created a series of educational videos on a variety of topics. Collectively, these videos have been viewed 754 times. See them all at: https://www.youtube.com/channel/UCKrsWkEW8Dl5FZbl93Fb_hg

April: What's Your Water Footprint
May: Alternative Lawns
June: Pay it Forward: Build a Raingarden
July: Boaters to the Rescue! Clean, Drain, Dry
September: Bee Kind
October: CAMP Video
October: Why Wetlands?
December: Please Salt Smart Jingle

Social Media – The BCWMC continued with weekly posts on its Facebook page. The BCWMC made 94 Facebook posts reaching 45,867 people and had 5,771 engagements. The page currently has 359 followers, which is a 19% increase from the previous year.

Financial Sponsorship for Organizations – The BCWMC financially sponsored the Children's Water Festival.

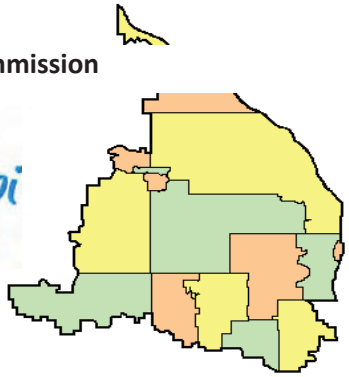
Due to the City of Minneapolis' financial contributions and close involvement and participation with the BCWMC's activities, the BCWMC's education activities can and should be considered part of the city's implementation of Minimal Control Measures (MCM) 1 and 2 in the MS4 stormwater permit. Please let me know if you have any questions or require further information.

Sincerely,
Laura Jester, Administrator

Shingle Creek Watershed Management Commission

West Mississippi Watershed Management Commission

3235 Fernbrook Lane N • Plymouth, MN 55447
Tel: 763.553.1144 • Fax: 763.553.9326
Email: judie@jass.biz • Website: www.shinglecreek.org



National Pollutant Discharge Elimination System (NPDES) Phase II Education and Public Outreach Program 2020 Annual Report

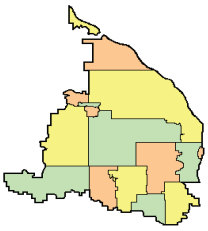
The Shingle Creek and West Mississippi Watershed Management Commissions conducted education and public outreach activities in 2020 in fulfillment of their Third Generation Watershed Management Plan Watershed Education and Public Outreach Program goals. However, due to the COVID-19 pandemic, many of these activities were modified to meet in-person guidelines, conducted virtually, or curtailed altogether.

EDUCATION AND PUBLIC OUTREACH PROGRAM GOALS

1. All members of the community become knowledgeable about the water resources in the watersheds and take positive action to protect and improve them.
2. All members of the community have a general understanding of watersheds and water resources and the organizations that manage them.
3. All members of the community have a general understanding of the Impaired Waters in the watersheds and take positive actions to implement TMDL requirements.

The Commissions identified the following general education and outreach strategies in the Third Generation Watershed Management Plan. More detailed educational goals by stakeholder groups may be found in Appendix E of that Plan.

- Maintain an active Education and Outreach Committee (EPOC) with representatives from all member cities to advise the Commissions and to assist in program development and implementation
- Participate in the West Metro Water Alliance (WMWA) to promote interagency cooperation and collaboration, pool resources to undertake activities in a cost-effective manner, and promote consistency of messages
- Use the Commissions', member cities', and educational partners' websites and newsletters, and local newspapers and cable TV to share useful information to stakeholders on ways to improve water quality
- Prominently display the Commissions' logos on information and outreach items, project and interpretive signs, and other locations to increase visibility
- Provide opportunities for the public to learn about and participate in water quality activities
- Provide cost-share funding to assist in the installation of small BMPs and demonstration projects
- Educate elected and appointed officials and other decision-makers
- Enhance education opportunities for youth
- Each year review and modify or develop and prioritize education and outreach activities and strategies for the coming two years



PROGRAM: WATERSHED PREP (PROTECTION, RESTORATION, EDUCATION, AND PREVENTION)

Audience: Fourth grade students, educators, families, the general public

Program Goals:

a. Engage elementary students in hands-on learning about the water cycle and how the built environment influences stormwater runoff and downstream water quality.
b. Provide general watershed and water quality education to citizens, lake associations, other civic organizations, youth groups, etc.

Educational Goals:

a. Have a general understanding of watersheds, water resources and the organizations that manage them.
b. Understand the connection between actions and water quality and water quantity.

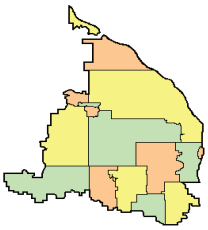
Specific Activities to Reach Goals:

Watershed PREP is a program of the West Metro Water Alliance (WMWA), a consortium of four WMOs including the Shingle Creek and West Mississippi WMOs, and stands for **P**rotection, **R**estoration, **E**ducation, and **P**revention. 2020 was the seventh year of the program. Individuals with science education backgrounds serve as contract educators to be shared between the member WMOs. The focus of the program is two-fold - to present water resource-based classes to fourth grade students and to provide education and outreach to citizens, lake associations, civic organizations, youth groups, etc.

Table 1. Watershed PREP Program participation.

Year	# Classrooms	# Students	# and Type of Schools
Lesson 1			
2013	63	1,679	13 in six districts; one charter school; one parochial school
2014	116	3,469	30 in seven districts; one magnet school; one parochial school
2015	122	3,183	36 in nine districts; two charter schools; five parochial schools
2016	107	2,850	29 in seven districts, one charter school, 5 parochial schools
2017	121	3,249	12 in seven districts, one charter school, one parochial school
2018	143	3,593	32 in seven districts, one charter school, 2 parochial schools
2019	103	2,681	27 in six districts, two magnet schools; one parochial school
2020*	20	572	6 in four districts, two magnet schools
Lesson 2			
2013	14	390	Three in three districts; one charter school; one parochial school
2014	22	645	Five in three districts
2015	27	859	Six in five districts
2016	20	524	Five in three districts, one parochial school
2017	38	1,072	Seven in three districts, one parochial school
2018	69	1,755	16 in five districts, one parochial school
2019	58	1,516	16 in five districts, one magnet school
2020*	7	172	2 in two districts

*In 2020, Watershed PREP classes were limited by the constraints of the COVID-19 pandemic that closed schools. In some cases, Watershed PREP classes were conducted virtually.



Fourth Grade Program. Three individual classes meeting State of Minnesota education standards have been developed. **Lesson 1*, What is a Watershed and Why do we care?,*** provides an overview of the watershed concept and is specific to each school's watershed. It describes threats to the watershed. **Lesson 2, *The Incredible Journey,*** describes the movement and status of water as it travels through the water cycle. **Lesson 3, *Stormwater Walk,*** investigates movement of surface water on school grounds.

Table 2. 2020 schools and students participating in Lesson 1: What is a Watershed?

Date	School	School District	City	Watershed	Classes	Students
1/9	Neill Elementary	Robbinsdale	Crystal	Bassett	3	60
3/4	Hassan	Elk River	Rogers	Elm	4	112
3/13	Sunset Hill	Wayzata	Plymouth	Bassett	4	110
10/4-5	Weaver Lake	Osseo	Maple Grove	Elm	6	90
12/8	SEA Magnet	Robbinsdale	Golden Valley	Bassett	3	80
12/9	Immersion	Robbinsdale	New Hope	Bassett		120
				Total	**20**	**572**

Table 3. 2020 schools and students participating in Lesson 2: The Incredible Journey

Date	School	School District		Watershed	Classes	Students
1/8	Neill Elementary	Robbinsdale	Crystal	Bassett	3	61
3/3	Hassan	Elk River	Rogers	Elm	4	111
				Total	**7**	**172**

One of the WMWA educators, has converted classroom Lesson #1 into a virtual, on-line learning experience. The lesson is posted to the WMWA website and to YouTube where it is available to educators, students, and the general public. She also sent out a link to the video to the teachers that she and the other educators have worked with in the classroom. The video can be viewed at westmetrowateralliance.org/.

The ultimate goal is to make this program available to all fourth graders in the four WMWA watersheds (Shingle Creek, West Mississippi, Bassett Creek, and Elm Creek), and to other schools as contracted. The program is offered to public, private, parochial, magnet and charter schools.

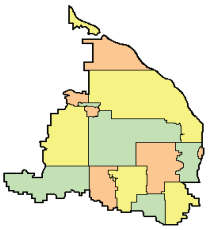
Community Education and Outreach. The PREP educators provide outreach at community and school events. Because of the nature of these events, it is usually difficult to keep a tally of the number of contacts made and citizens engaged. Scheduled events were cancelled in 2020.

Evaluation:
The educators evaluate the success of the Fourth Grade Program by surveying students and teachers about the quality of the program, the learning that was observed, and the performance of the educators. Much of the feedback occurs during and right after the presentations in spontaneous comments.

PROGRAM: DISTRIBUTE EDUCATIONAL MATERIALS

Audience: Multiple

NPDES Phase II
Education and Public Outreach
2020 Annual Report



Program Goals:

a. Inform various stakeholders about the watershed organizations and their programs.
b. Provide useful information to a variety of stakeholders on priority topics.
c. Engage stakeholders and encourage positive, water-friendly behaviors.

Educational Goals:

a. Property owners maintain properties and best management practices (BMPs) to protect water resources.
b. Property owners adopt practices that protect water resources.
c. Stakeholders support and engage in protection and restoration efforts.

Specific Activities to Reach Goals:

Maintain Your Property the Watershed Friendly Way

This handbook is targeted to small businesses, multi-family housing properties, and common ownership communities such as homeowners' associations. It contains tips for specifying and hiring turf and snow maintenance contractors and includes checklists for BMP inspections. Electronic copies have been provided to Shingle Creek and West Mississippi cities for their use and to be displayed on their websites. The handbook also appears on the WMWA website. Print copies are available for distribution.

10 Things You Can Do

In 2019 the Commissions partnered with WMWA to revise and refresh the popular brochure *10 Things You Can Do to protect Minnesota's lakes, rivers, and streams.* New emphasis was placed on salting sparingly and on conserving water.

Roots Displays

In 2020 WMWA partnered with other groups to design and commission fabrication of a new, lighter-weight version of a popular interactive display highlighting native plants, comparing their long roots to the shorter-rooted turf grasses. The new displays have been completed and delivered to the various groups that joined in on WMWA's order.

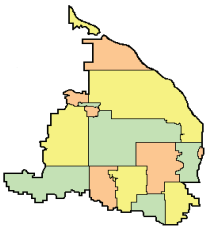
Press Releases and Newspaper Articles

Northwest Community Television currently provides services as CCX Media. CCX Media provides a Connected Community Experience for the northwest Hennepin County suburbs, offering daily televised news, and coverage of city council meetings, local events, and high school sports. CCX News aired televised coverage of the following stories:

- Announcement about Crystal Lake Management Plan grant award
- Initiation of carp management on Crystal Lake
- Curly-leaf pondweed treatment on Bass Lake
- New Hope approves Meadow Lake drawdown project

Web Site

The Commissions maintained a joint web site, shinglecreek.org, which includes information about the watersheds, the Commissions, and the water resources in the watersheds. From January 1 – December



7, 2020, there were 9,233 page views, of which 7,383 were unique views. The difference between the two is this: if a user lands on the home page, then jumps to a content page, then back to the home page, that would count as three page views, but only two unique page views. The behavior flow chart shows the most common landing page was the home page, followed by the meeting minutes, where the notice of availability includes a direct link to the page. Other popular landing pages were the Twin Lake Carp and the Biochar Filters projects, both of which were promoted on social media. The TAC meeting page with 115 direct clicks as well as clicks on other pages are lumped together in the grouping (57 more pages). So, while the website is used mainly to access meeting and application materials, it is a good forum for sharing specific project information and gets decent traffic on other more general interest pages.

Social Media

The Commission established a Facebook page in 2016. *Facebook Impressions* is the number of times a post came up in a person's feed; *reach* is the number of times a post was viewed in a feed; and *engagement* is an action – a click, comment, share, or reaction. The site gained 56 new followers in 2020. The most engaging post was a repost of a CCX news story on the upcoming Crystal Lake improvements. This post was shared to the Birdtown Club page, an interest group focused on happenings in Robbinsdale.

Evaluation:

Evaluation measures are as noted above: number of brochures and handbooks distributed; number of website hits; social media engagement. The new website uses Google Analytics to better track page views and unique visitors.

Program: Public Outreach

Audience: Residents, youth

Program Goals:

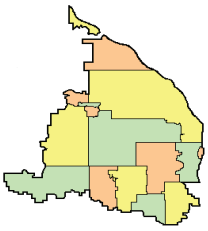
a. Provide opportunities for people of all ages to participate in hands-on activities to protect and improve waters.
b. Provide opportunities for people to learn about ways they can protect and improve waters.

Educational Goals:

a. Maintain their properties and best management practices (BMPs) to protect water resources.
b. Adopt practices that protect water resources.
c. Support and engage in protection and restoration efforts.
d. Participate in volunteer activities.

Specific Activities to Reach Goals:

The *Pledge to Plant Campaign* was developed by Metro Blooms/Blue Thumb to encourage residents to replace impervious surface and turf grass with native plantings to benefit clean water by reducing stormwater runoff. The project includes the additional benefit of creating habitat for pollinators. In past years, the project was promoted in the Blue Thumb space at the State Fair where the public voted to name the campaign, *Pledge to Plant for Clean Water and Pollinators.*



Phase two of the project included a roll out of the Pledge campaign on the Metro Blooms and WMWA websites where citizens entered the square footage of their new plantings, creation of a *Pledge to Plant* banner to be displayed at events, and a social media campaign that began in 2016. In 2020, COVID-19 limited in-person engagement, cancelling the State Fair and other area events.

At year-end 2018, over 630 people had submitted the Pledge online covering over 417 acres. The total includes a handful of larger prairie restoration projects; the median pledge covers 250 square feet. Most of the Pledges came from the metro area, but Pledges have been received from more than 20 states. The *Pledge to Plant* campaign was also promoted during the Watershed PREP classes. Pledges were not tallied in 2019 or 2020.

Rain Garden Workshops

The Commissions partnered with WMWA to sponsor one Rain Garden workshop through Metro Blooms in 2020. Metro Blooms is a non-profit organization whose mission is to promote and celebrate gardening, to beautify our communities and help heal and protect our environment.

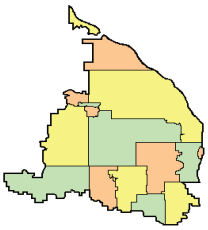
The City of Champlin hosted a Resilient Yard/Turf Alternatives Workshop on April 14, 2020. The workshop introduced the audience to the four planting types promoted through the Lawns to Legumes Program. Due to the pandemic, content was presented through an online platform. While only five Champlin residents participated in this virtual workshop, 32 residents from across the metro area also participated. It is the City's intention to continue replaying the workshop on QCTV for Champlin residents. Attendees rated this new format as "above-average" or "excellent." Eighty percent indicated they are likely to install pollinator habitat within a year; 39% responded that they are likely/very likely to install a raingarden within two years; and 93% indicated they were likely/very likely to install native plants in their yards this year.

Hennepin County Chloride Initiative (HCCI)

The eleven WMOs in Hennepin County elected to set aside 10 percent ($101,800) of the BWSR Watershed-Based Funding from the 2018 Pilot Program specifically for joint, countywide chloride reduction initiatives. The HCCI is comprised of one representative designated by each WMO. Ben Scharenbroich from the City of Plymouth represents Shingle Creek and Andrew Hogg from the City of Brooklyn Center represents West Mississippi.

The HCCI has been primarily engaged in better understanding barriers to chloride reduction BMPs and assessing training needs. The group has been partnering with the Minnesota Pollution Control Agency (MPCA) on one of the identified training needs – outreach and training opportunities for property managers. A training workshop has been developed and an accompanying handbook has been made available on the MPCA's website at: https://www.pca.state.mn.us/water/salt-applicators. The handbook is intended to accompany the workshop, not replace it. The MPCA will be translating manuals and training materials into Spanish and may make other languages available if there is demand.

One potential demonstration project, currently in the initial stages of discussion, is the Parkers Lake Chloride Reduction Project, a partnership with Bassett Creek and the City of Plymouth. That project would take a commercial/industrial area and search for willing partners to implement chloride reduction BMPs to see what it would take to make a measurable reduction in chloride in runoff.



Shingle Creek Cleanup

The 20th Annual Great Shingle Creek Cleanup was scheduled to be held the week of April 19-25. Each city sponsors its own cleanup. While some cities cancelled the event in 2020, others held abbreviated versions to limit in-person contact.

Volunteer Monitoring

The Commissions provide opportunities for high school students and adults to gain hands-on experience monitoring lakes, streams, and wetlands.

Lakes. Volunteer lake monitoring is performed through the Met Council's Citizen Assisted Lake Monitoring Program (CAMP). The Met Council provides the monitoring equipment and the laboratory work and data analysis while the Shingle Creek Commission staff recruit and train volunteers to perform sampling, collect the volunteers' water quality samples, and get them to the Met Council. Twin, Ryan, Meadow, and Success lakes were monitored by volunteers in 2020.

Streams. Routine stream macroinvertebrate monitoring in both watersheds is conducted by volunteers through Hennepin County's RiverWatch program. This program was initiated in 1995 to provide hands-on environmental education for high school and college students, promote river stewardship, and obtain water quality information on the streams in Hennepin County. Hennepin County coordinates student and adult volunteers who use the RiverWatch protocols to collect physical, chemical, and biological data to help determine the health of streams in the watershed. No sites on Shingle Creek were monitored as part of RiverWatch in 2020 due to COVID-19.

Wetlands. Two sites in the Shingle Creek watershed and two sites in the West Mississippi watershed were monitored through the Hennepin County Environmental Services' Wetland Health Evaluation Program (WHEP). WHEP uses trained adult volunteers to monitor and assess wetland plant and animal communities in order to score monitored wetlands on an Index of Biological Integrity for macro-invertebrates and vegetation. No sites were monitored in 2020 due to COVID-19.

Evaluation:

Evaluation of these programs is based on participation.

Program: Collaborative Efforts

Audience: Multiple

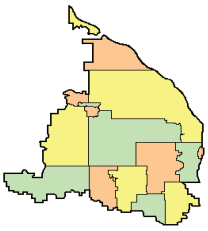
Program Goals:

a. Promote interagency cooperation and collaboration, pool resources to undertake activities in a cost-effective manner, and promote consistency of messages.
b. Share information and ideas with other partners.

Educational Goals:

a. All people have a general understanding of watersheds, water resources and the organizations that manage them.
b. All people understand the connection between actions and water quality and water quantity.

Specific Activities to Reach Goals:



WMWA

The Commissions partner with the Bassett Creek WMO and the Elm Creek WMO and other interested parties as the West Metro Water Alliance (WMWA). Other participating parties have included the Freshwater Society, Hennepin County Environment and Energy, and Three Rivers Park District. The Mississippi WMO also participates but is not a formal member. Each member watershed organization contributes funds to WMWA, which sponsors programs such as Watershed PREP, standardized brochures and booklets, and the *Planting for Clean Water Program.* WMWA publishes an annual report on its activities.

The very popular *10 things you can do to protect Minnesota's lakes, rivers, and streams* brochure was revised and updated in 2019 and was printed at no cost to WMWA members by the Hennepin County Department of Environment and Energy. It can also be downloaded from the WMWA website.

Other Partnerships

The Commissions are also members of:

- WaterShed Partners, a coalition of agencies, educational institutions, WMOs, Watershed Districts, and Soil and Water Conservation Districts that coordinate water resources education and public outreach planning in the Metro area;
- BlueThumb, a consortium of agencies and vendors partnering to increase outreach and awareness; and
- NEMO (Nonpoint Education for Municipal Officials), a program that provides educational and skill-building programming to elected and appointed officials and community leaders to increase their knowledge of the connection of land use and management decisions to water quality and natural resources. NEMO was inactive in 2020.

Evaluation:

No specific evaluation of this programing has been completed.

Program: Continuing Education

Audience: Commissioners, Technical Advisory Committee (TAC)

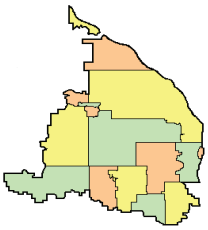
Program Goals:

a. Effectively and efficiently manage the water resources in the watershed.
b. Increase awareness and knowledge of broader water resources issues and trends.

Educational Goals:

a. Commissioners and TAC understand watershed management, water quality and quantity conditions and issues in the watershed, regulatory requirements and the current standards and practices.
b. Commissioners and TAC aware of broader water management issues and trends in Minnesota and elsewhere.

Specific Activities to Reach Goals:



Staff Presentations
All of the Staff presentations were project-related, none were for "Commissioner education."

Guest Speakers
ReNae Bowman, Master Water Steward Appointee, presented her **Capstone Project**. Her project includes evaluating and revitalizing Crystal's current 125 raingardens and offering alternative runoff abatement methods to those without raingardens.

Dr. Richard Kiesling from the United States Geological Survey (USGS) spoke about ***Advanced BMPs for Emerging Contaminants.*** He provided information on the effectiveness of iron/sand filters on the removal of PFA's, bacteria, caffeine and other surface water pollutants associated with urban runoff.

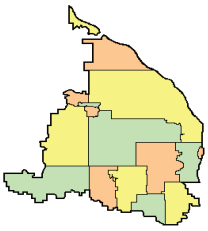
Professor John Chapman presented, **"What can we learn from urban stormwater manhole sumps?"** Using inspection and clean-out records for 150 structures in the Twin Cities and 19 structures in St. Cloud from 2009 to 2019, his team was able to determine that inspection and clean-out twice/year allowed for a greater chance of full sediment capture. When modeling, a PSD coarser than NURP50 may be needed to represent an urban site. A sediment concentration of 400 mg/l may also better represent urban sites. Chapman is an Assistant Research Professor for the University of Minnesota Department of Bioproducts and Biosystems Engineering and the Director of the Erosion and Stormwater Management Certification Program.

Other Presentations
The City of Brooklyn Park submitted a Partnership Cost Share Program application on behalf of Boisclair Corporation and Metro Blooms for improvements at **Brooks Landing Senior Apartments.** Improvements include replacing the parking lot, adding two raingardens to treat runoff from the parking lot and sidewalk, and adding amenities such as benches and landscaping. The Shingle Creek Commission approved funding of $30,000 for this project. This site was awarded a Lawns to Legumes demonstration site and funding from that grant will also be applied to the raingardens. Representatives from Metro Blooms returned in late fall to provide an update of the progress of this project.

The City of Brooklyn Park submitted a Cost Share Program application in the amount of $50,000 to assist in the cost of designing the upcoming **River Park Stormwater Improvements**. This project will provide treatment for 250 acres of land that currently discharge untreated into the Mississippi River. $35,422 from Watershed Based Funding was approved by the West Mississippi Commission for this project.

The City of Crystal submitted a City Cost Share Program application for its **West Broadway Stormwater Infiltration Project** at 5747 West Broadway. This project was initially identified in the Crystal Shopping Center Subwatershed Assessment (SWA) and will infiltrate runoff that is currently discharged untreated into the Bass Lake Road trunk system that flows to Upper Twin Lake. Based on modeling completed for the SWA, the system will infiltrate an estimated 4.8 acre-feet of runoff per year and reduce TP load by 4.3 pounds per year. Funding of $50,000 was approved by the Shingle Creek Commission for this project.

Stephen Mastey, Landscape Architecture, Inc., presented the **Twin Lake North Condominium parking lot BMP project** which was paid in part with Shingle Creek Commission cost-share funds. The project moved the existing parking lot, which drained untreated directly into Twin Creek, out of the floodplain and restored the area with a diverse native plant community. The project featured a Tire Derived Aggregate (TDA) infiltration system and reduced the amount of impervious on-site by .39 acres.



Mastey applied for a $50,000 cost-share grant to create a play area at the **Crescent Cove Children's Hospice Facility** that is mostly within the 100-year floodplain and convert the adjacent existing non-native landscape to a diverse native plant community that creates an ecologically appropriate wetland buffer. Under a portion of the play area, additional storage beyond the watershed requirements will be created by using a TDA Infiltration System similar to the product used across the street at the Twin Lake North Townhomes Parking Lot Renovation Project. Work was scheduled to begin in late summer of 2020 with completion projected for early spring 2021. Funding of $50,000 was approved by the Shingle Creek Commission for this project.

Richard McCoy, Robbinsdale TAC representative, presented on the topic of **Ryan Lake and Supplemental Pumping from Crystal Lake.** He related the needs for remedial action to reduce/better control high water levels in Crystal Lake. Crystal Lake has no natural outlet and increasing pumping into Minneapolis using the existing discharge pipe is limited by downstream capacity. During extended periods of very high water in Crystal Lake groundwater/lake water inundates the low- lying areas and infiltrates residents' basements. McCoy identified the two apparent options: 1) reduce the water coming into the lake and/or 2) increase the water going out of the lake. In addressing the first option, the City of Robbinsdale has been building raingardens and underground storage as opportunities arise and is looking to the City of Minneapolis to assist with infrastructure in their jurisdiction. With the second option, the City cannot increase pumping using the existing discharge point. The Twin Lake/Ryan Lake system is the only viable short-term option. McCoy's presentation showed the "temporary" route used in 2019 to re-direct the water into Twin Lake, avoiding disruption to local traffic. It also showed the "permanent" route employed in 2020. With the more direct route, this alternative reduced the high water issues on Twin Lake by discharging the water to Ryan Lake directly. It is the intention to maintain this route for 2021 and beyond.

A Staff presentation described the significant flood mitigation benefits realized from the **Becker Park and Kentucky Avenue underground infiltration projects** undertaken in the City of Crystal. The analysis used a two-dimensional computer model to predict street flooding depth surrounding the Bass Lake Road and Broadway Ave intersection. The model was calibrated to monitoring data recorded in the Becker Park system. Improving water quality within Twin Lake was the primary motivation for both projects, but modeling shows the two projects also reduce street flooding.

<u>Other</u>

- The Commissions made contributions to fund the 2020 Annual Road Salt Symposium presented by Fortin Consulting.
- Commission Staff created a two-page informational flier on filamentous algae for the public. It is posted to the Commission's website.
- Included an Enhanced Street Sweeper as a capital project on the Shingle Creek CIP.

Evaluation:

No specific evaluation of this programming has been completed

6/18/2021
Comments by Friends of Lake Hiawatha on Minneapolis' Stormwater Management Program SWMP
To: Elizabeth Stout, PE
Water Resources Manager
City of Minneapolis Public Works – Surface Water & Sewers Division
Phone: 612-673-5284
Email: Elizabeth.Stout@minneapolismn.gov
Cc'd Members, Minneapolis City Council, Commissioners - Minneapolis Park and Recreation Board,
Mayor Jacob Frey, Duane Duncason - MPCA via duane.duncanson@state.mn.us
Krista McKim - USEPA Region 5 via mckim.krista@epa.gov

Dear Elizabeth Stout,

First I want to thank you and City Public Works SWS for your responsiveness and willingness to engage in productive conversations about Lake Hiawatha over these past six years.. The upstream strategies employed by SWS are vital and necessary. Compliments to Director Johnson for meeting with us regularly.

As you revise the SWMP based on input from the SWMP Annual Meeting and public comment, We ask the City of Minneapolis Public Works SWS to modify the SWMP to include trash and plastics. We request that trash and plastics should be added to the list of targeted pollutants.

The Stormwater Management Program as a document includes little to no remedy or consideration of trash and plastics. Even though, in Minneapolis, the most recognizable and obvious pollutant in our waters is trash. Especially at Lake Hiawatha and the Mississippi River.

Minneapolis needs to take trash/plastics seriously as a pollutant. The cost of ignoring trash is evident at Lake Hiawatha where the accumulated trash of decades has now broken down into microplastics that contaminate the soil and water and are now an irreversible part of the food web. Had we regarded trash and plastic as the pollutant that it is earlier on we would not have this problem. The problem is only getting worse. As more trash accumulates and breaks down, wildlife are eating the plastic and styrofoam. New evidence is emerging that shows the impact microplastics accumulation in our bodies has on human health.

We have made a similar plea in previous SWMP comment periods and have not seen improvement despite the good efforts of City of Minneapolis Public Works SWS on upstream measures in the pipeshed. In fact the situation has worsened. Our latest

EarthDay cleanup in April 2021 had the largest collection tally on record for FOLH. 400 lbs of plastic and styrofoam trash removed in just 3 hours. (25,340 pieces of trash) It becomes increasingly conspicuous that the SWMP has no serious consideration of trash pollution. Our Lake Hiawatha trash total stands at 8,700 lbs of mostly plastic and styrofoam.

We cannot afford to continue to ignore 'end of pipe' conditions and the City of Minneapolis should immediately install a trash capture device at the end of the north pipe / 43rd street pipe on the north side of Lake Hiawatha until comprehensive stormwater treatment can be implemented. FOLH has asked the City and MPRB for stormwater treatment there for 6 years. The MPRB says that if the Hiawatha Golf Course Area Masterplan were to pass it would require seven more years to implement comprehensive stormwater treatment. There is a concerning lack of urgency here. In another seven years 11,200 lbs. of plastic and styrofoam trash (709,520 pieces) will be added to Lake Hiawatha and downstream waters. The MPRB's TP loading figures estimate more than two tons (*4,690 lbs.) of phosphorus will enter Lake Hiawatha from the north pipe and MPRB groundwater pumping combined over seven years.

The City needs to lead the way in expediting and implementing updates to our aging stormwater infrastructure. The City requires a program to monitor, measure and mitigate trash and plastics in our waters.
FOLH has participated in the MPCA's Triennial Standards Review, In our comment submission We recommended that new water quality standards and TMDLs for trash and plastics be developed and implemented by the MPCA, as other States have done recently. We hope the data we have collected can be helpful in your trash and plastics pollution remediation practices. As the MPRB and City of Minneapolis SWS share a permit for the north pipe. It is necessary that there be accountability for "end of pipe" trash and plastic conditions at the receiving waters of Lake Hiawatha and downstream in the Mississippi River. It is no longer possible to ignore trash pollution.

ASKS

1. Revise SWMP per input from SWMP Annual Meeting and public comments received. Include trash and plastics as a pollutant to be addressed in the SWMP. Methods to mitigate trash pollution and its impacts (on habitat, biota and humans) are needed.

2. Install temporary trash capture device at north pipe/43rd street outfall at Lake Hiawatha, until comprehensive stormwater treatment can be implemented as laid out in the Hiawatha Golf Course Area Masterplan.

3. Hire staff to assist in trash cleanup at Lake Hiawatha.

Why should trash be added to the pollutants that are measured and monitored?
The lack of enforceable water quality standards for trash and plastics has resulted in a lack of accountability and inaction regarding cleanup of the trash pollution at Lake Hiawatha and downstream water bodies. Decades of trash accumulation in Lake Hiawatha has now broken down into massive accumulations of microplastics and styrofoam beads in the water and soil at Lake Hiawatha and downstream waters.

TRASH IS MOSTLY PLASTIC
Our world has seen an exponential increase in plastic production since the north pipe was first installed in 1935. Plastic production became cheap when plastic was subsidized and now nearly every product we purchase is packaged in plastic. “Globally, 300 million tons of plastic waste is produced every year. Demand for plastics is a growing source of greenhouse gases as it increasingly drives the world’s consumption of oil and gas. Plastic pollution has reached crisis levels, with a dump truck’s worth of plastic pouring into our oceans every minute.“ Green America.org .

ECOLOGICAL CONSEQUENCES
Lake Hiawatha is home to at least 249 species of animals, including otters, mink, Great Horned Owls, spiny soft shelled turtles and many other species of interest. The Lake is also a key migratory stop for numerous avian species because it is one of the few springtime open water locations along the Mississippi River Flyway. Plastics and trash have caused wildlife mortality and pose a continuing threat to the region's biodiversity. We often find trash items that show evidence of being partially eaten by wildlife. We also see waterfowl eating trash and plastic pieces. We have also witnessed wildlife mortality directly caused by trash. It is also known that microplastics are in the food web. Emerging science indicates that microplastics pose an alarming threat to wildlife and human health.

METHODOLOGIES
Friends of Lake Hiawatha would be happy to assist in the development of a methodology for the measurement of trash and/or plastics. The extensive data we have collected on trash at Lake Hiawatha may be helpful in this work. The purpose of our 2019 Lake Hiawatha Trash Survey is to gather data and show possible methodologies for measuring trash and plastics.
Soil and water sampling for microplastics is something we have not yet done at Lake Hiawatha and would be a wise addition to a regimen of pollutant monitoring.
Folks from Sierra Club North Chapter, The University of Minnesota and Friends of Lake Hiawatha have been reviewing how other places have been able to regulate trash in water and this is what we have found:

The Minnesota Water Quality Standards contain a regulation for nuisances that are not allowed in waters of the state, including floating solids as follows:
7050.0210 Subpart 2. .Nuisance conditions prohibited.
No sewage, industrial waste, or other wastes shall be discharged from either point or nonpoint sources into any waters of the state so as to cause any nuisance conditions, such as the presence of significant amounts of floating solids, scum, visible oil film, excessive suspended solids, material discoloration, obnoxious odors, gas ebullition, deleterious sludge deposits, undesirable slimes or fungus growths, aquatic habitat degradation, excessive growths of aquatic plants, or other offensive or harmful effects.

From Sierra Club NC:
"MS4 permits are developed with conditions based on standards such as this but there is no requirement to meet this water quality standard in the current permit, nor is trash listed as a regulated pollutant. The standards clearly prohibit the presence of floating solids, and this standard along with other potential nuisance conditions should be addressed in the permit and SWMP. This has been done in a number of places in the country: Los Angeles, Baltimore, San Francisco, New York, and Honolulu. We understand that the US Environmental Protection Agency does not require a water quality standard for trash but allows jurisdictions to establish their own approaches to trash free waters. The MPCA could write detailed enforceable trash provisions in stormwater permits to require measurable trash discharge reductions. This approach could significantly reduce the amount of trash reaching streams, rivers, lakes and wetlands. The City/MPRB storm water permits should be modified to include the mitigation and prevention of trash contamination to lakes and rivers via stormwater." Sierra Club NC.

We recognize that creation of mitigation systems for trash will present challenges for Public Works SWS and the MPRB. We support additional funding allocations and staffing for the City to undertake this work. It is inevitable that trash/plastic pollution will need to be addressed as a pollutant. A lack of initiative on this problem results in increased risk to water quality, biodiversity and habitat integrity.

Thank you for everything you do and thank you for your consideration,
Sincerely, Sean Connaughty, Friends of Lake Hiawatha
www.friendsoflakehiawatha.org
Contact: friendsoflakehiawatha@gmail.com, sean.connaughty@gmail.com,

Resources:
2019 FOLH Lake Hiawatha Trash Survey

http://forums.e-democracy.org/groups/mpls-staneric/files/f/ocyQEnQ1FB98iyXYZlGcIO49TX6-1LUxT-2Mi2tr8/PICTURES%20LAKE%20HIAWATHA%20COMPREHENSIVE%20TRASH%20%20SURVEY%202019%20.pdf

Herzog, Megan M., n.d., Zero Trash: Using Clean Water Act to Control Marine Debris in California.
https://vjel.vermontlaw.edu/zero-trash-using-clean-water-act-control-marine-debris-california

Maryland Department of Environment & District Department of Environment, 2010. Anacostia River Trash TMDL.
http://pgcdoe.net/pgcountyfactsheet/Areas/Factsheet/Documents/Anacostia_Trash_TMDLFactSheet.pdf

Office of the Revisor of Statues. Minnesota Administrative Rules.
https://www.revisor.mn.gov/rules/7050.0210/

USEPA., n.d. The Clean Water Act and Trash-Free Waters.
https://www.epa.gov/trash-free-waters/clean-water-act-and-trash-free-waters

https://www.epa.gov/trash-free-waters/trash-capture-technologies#pipe
from the EPA:
Trash Capture technologies
Litter Booms

- Booms have been widely used to capture floatable trash in waterways. Booms use floatation structures with suspended curtains designed to capture buoyant materials and can also be designed to absorb oils and grease. They are typically anchored to a shoreline and the bottom downstream of one or more outfalls.
- Booms are custom-sized based upon the expected volume of floatables that can be released during a storm event. After a storm, material captured in the boom can be removed **manually**, with an excavator, or by a skimmer vessel

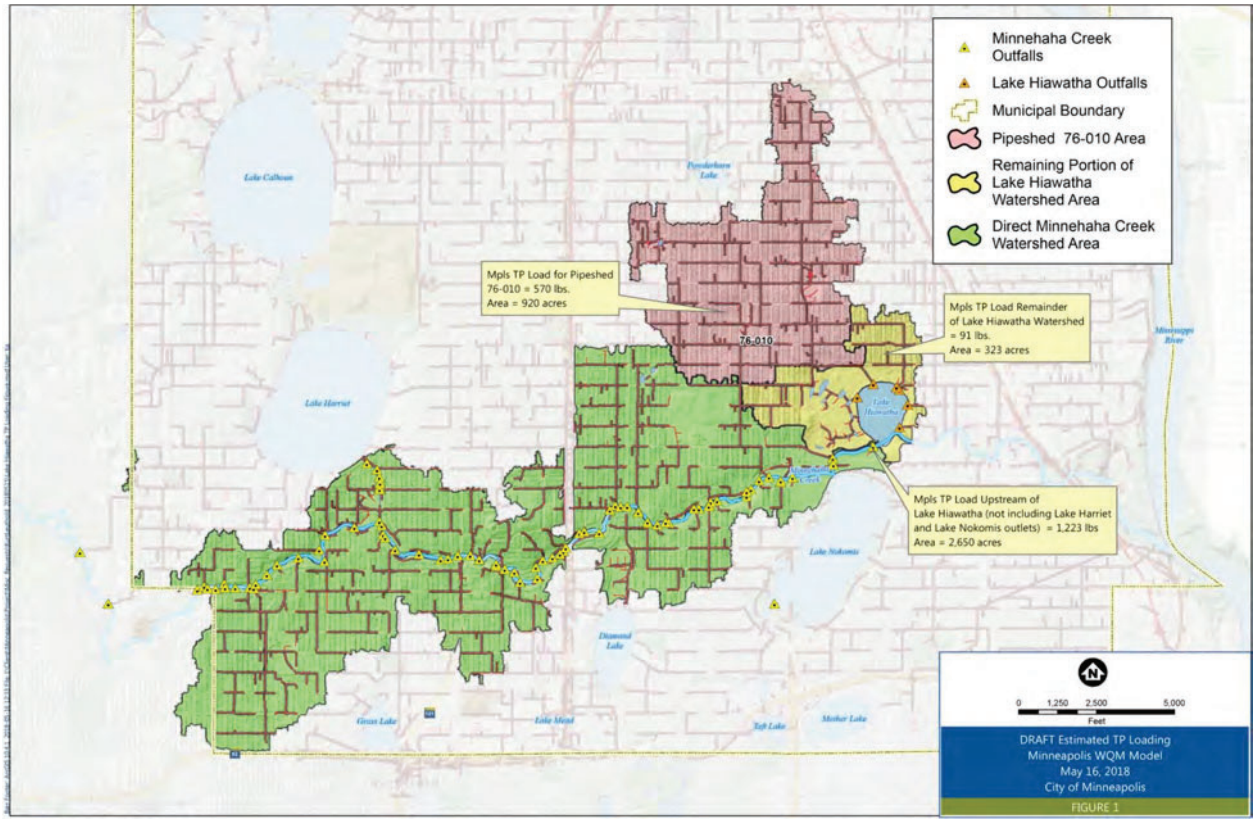
https://stormwatersystems.com/stormx-netting-trash-trap/

https://stormwatersystems.com/bandalong-litter-trap-installations/
https://stormwatersystems.com/bandalong-boom-systems/

Below is a collection of photos taken over the years that document trash accumulations at Lake Hiawatha. These conditions repeat every time we have significant rain events. Some of the photos highlight microplastic accumulations, some show the trash

accumulations in front of the north pipe in springtime melt which repeats every year. Other photos show accumulations along the shoreline.

The above photo shows a collection of selected trash items that show evidence of being eaten by wildlife. All photos by Sean Connaughty and Friends of Lake Hiawatha



*TP Loading for Lake Hiawatha. Barr, MPRB City of Minneapolis.

SIERRA CLUB
NORTH STAR CHAPTER

Sierra Club North Star Chapter
2300 Myrtle Avenue, Suite 260
Saint Paul, MN 55114

June 17, 2021

Elizabeth Stout
Water Resources Manager
City of Minneapolis Department of Public Works
Surface Waters and Sewers Division
Via email Elizabeth.Stout@minneapolis.mn.gov

Dear Ms. Stout:

This letter is to provide comments on the July 19, 2019 Storm Water Management Program (SWMP) proposed by the City of Minneapolis and the Minneapolis Parks and Recreation Board (City/MPRB). Our concerns are focused on the trash carried by storm water to MS4 permitted waters in the City of Minneapolis and Lake Hiawatha in particular. Some specific concerns that we ask you to consider:

1. In reviewing the SWMP, we find no reference to trash as a concern.

The Friends of Lake Hiawatha (FOLH) have quantified the amount of trash and provided human-powered trash cleanup in Lake Hiawatha for over 5 years. The efforts include a weekly lake cleaning during most of the year, collecting data on the amounts and types of trash found, reporting concerns on the condition of the Lake (to the City, MPRB and MPCA), commenting on permits and regulations such as Water Quality Standards (March 2021), proposing potential storm water treatment systems, and acting as a delegate to the Community Action Committee for the recent Lake Hiawatha Master Plan Development (Plan).

FOLH has collected trash from and near the Lake since 2015 and continues to do this on a regular basis. The total amount collected is 8160 lbs, with 514,402 items being mostly plastic and styrofoam (an average of 1600 lbs annually). There is evidence that animals in the area consume some of this trash and die from it. Microplastics in environmental food webs is a major concern that is being addressed as a proposed Water Quality Standard in California.

Storm water collected from streets and parking lots is a significant source of litter and trash in water bodies. Litter from cars and trucks, illegal dumping, homeless encampment refuse, litter from garbage and recycling bins, pedestrian litter and outdoor event garbage all contribute trash to stormwater. Studies have found that 80% of trash is generated on land and then transported to a receiving water body.

2. Trash must be viewed as a pollutant and methods to mitigate trash pollution and its impacts (on habitat, biota and humans) are needed.

The Plan calls for replacing the limited capacity storm water pipe at the north side of the Lake with a free flowing channel to reduce flooding in the watershed to the North, management of trash removal from the watershed, treatment of runoff to reduce pollutant loads to the Lake (which is impaired for excess nutrients and bacteria) and incorporation of storm water best management practices as required to manage site runoff (MPRB, 2020). This plan is not yet approved.

Trash in waters likely impacts other lakes, streams and rivers requiring storm water management covered under the SWMP. When debris accumulates, light levels are reduced, oxygen levels are depleted, and the habitat's ability to support aquatic life is impaired. Chemical impacts are related to plastic debris which accumulates contaminants at concentrations that are orders of magnitude greater than the surrounding environment. This serves as a potential mechanism for transporting contaminants of concern (such as persistent, bioaccumulative, and toxic contaminants (PBTs) including PCBs and pesticides) to the food chain and humans. Contaminants are on the surface and within plastic particles that break into smaller particles due to ultraviolet radiation, mechanical forces, and weathering. Potential threats to wildlife include ingestion, entanglement and the toxicological effects of contaminant ingestion. Medical waste, especially hypodermic needles, can result in the transfer of infections and disease. Additionally, trash in and near water reduces the aesthetic and recreational value of our rivers, lakes and beaches.

The SWMP is developed as a requirement of the MS4 permit for the City/MPRB, but the permit does not list trash as a pollutant of concern (as noted in Table A.4, pollutants of concern present in storm water). On the other hand, the SWMP refers to the goals of street sweeping to remove debris (p. 87) and one task (p. 90) to be implemented is developing a program to improve sweeping of City and MPRB parking lots with priorities based on land use and the trash and storm water pollutants generated. Both of these items indicate that storm water trash transport to water bodies is of concern.

The Minnesota Water Quality Standards contain a regulation for nuisances that are not allowed in waters of the state, including floating solids as follows:

> ***7050.0210 Subpart 2. .Nuisance conditions prohibited.***
> *No sewage, industrial waste, or other wastes shall be discharged from either point or nonpoint sources into any waters of the state so as to cause any nuisance conditions, such as the presence of significant amounts of floating solids, scum, visible oil film, excessive suspended solids, material discoloration, obnoxious odors, gas ebullition, deleterious sludge deposits, undesirable slimes or fungus growths, aquatic habitat degradation, excessive growths of aquatic plants, or other offensive or harmful effects.*

MS4 permits are developed with conditions based on standards such as this but there is no requirement to meet this water quality standard in the current permit, nor is trash listed as a regulated pollutant. The standards clearly prohibit the presence of floating solids, and this standard along with other potential nuisance conditions should be addressed in the permit and SWMP. This has been done in a number of places in the country: Los Angeles, Baltimore, San Francisco, New York, and Honolulu. We understand that the US Environmental Protection Agency does not require a water quality standard for trash but allows jurisdictions to establish their own approaches to trash free waters. The MPCA could write detailed enforceable trash provisions in stormwater permits to require measurable trash discharge reductions. This approach could significantly reduce the amount of trash reaching streams,

rivers, lakes and wetlands. The City/MPRB storm water permits should be modified to include the mitigation and prevention of trash contamination to lakes and rivers via storm water.

We greatly appreciate the opportunity to submit these comments as well as your attention to our concerns for developing requirements and best management practices for managing trash in storm water and improving water quality and aquatic habitat in our lakes and streams. Please do not hesitate to contact us for questions.

Sincerely,

Mathews Hollinshead
Conservation Chair
Sierra Club North Star Chapter

Cc:
Members, Minneapolis City Council
Mayor Jacob Frey
Commissioners, Minneapolis Park and Recreation Board
Duane Duncason, MPCA via duane.duncanson@state.mn.us
Krista McKim, USEPA Region 5 via mckim.krista@epa.gov
Sean Connaughty, Friends of Lake Hiawatha via conna004@umn.edu

References:

Herzog, Megan M., n.d., Zero Trash: Using Clean Water Act to Control Marine Debris in California. https://vjel.vermontlaw.edu/zero-trash-using-clean-water-act-control-marine-debris-california

Maryland Department of Environment & District Department of Environment, 2010. Anacostia River Trash TMDL. http://pgcdoe.net/pgcountyfactsheet/Areas/Factsheet/Documents/Anacostia_Trash_TMDLFactSheet.pdf

Office of the Revisor of Statues. Minnesota Administrative Rules. https://www.revisor.mn.gov/rules/7050.0210/

USEPA., n.d. The Clean Water Act and Trash-Free Waters. https://www.epa.gov/trash-free-waters/clean-water-act-and-trash-free-waters

TRASH and PLASTIC WQS + TMDL

Letter to MPCA Triennial Standards Review committee
From Friends of Lake Hiawatha
(Lake ID 27-0018-00) Lake Hiawatha, Minneapolis, MN, MCWD watershed.
Lake Hiawatha is a Mississippi River tributary via Minnehaha Creek.

Dear MPCA Triennial Standards Review Committee,
We are asking the MPCA to develop an enforceable water quality standard for trash in the state of Minnesota and/or The City of Minneapolis. Trash pollution at Lake Hiawatha is exceptionally problematic. The North Pipe or 43rd street pipe is a massive 920 acre pipeshed that ends in two 60" pipes on Lake Hiawatha's northern shore. emptying the unfiltered pollution of South Minneapolis streets directly into Lake Hiawatha. Friends of Lake Hiawatha have removed 8,160 lbs. of mostly plastic and styrofoam trash from the Lake since 2015. (avg. 1600 lbs. annually.) For more information see our *2019 Lake Hiawatha Trash Survey*. That's more than half a million individual trash pieces removed by hand. The MPRB states that if the Hiawatha Masterplan is approved, it may be another 7 years until stormwater treatment can be implemented. In that time we expect an additional 9,000 lbs of trash to accumulate in Lake Hiawatha. This is why it is important that Lake Hiawatha be listed as impaired by trash pollution. And that enforcement actions be undertaken by the MPCA to ensure accountability for end of pipe conditions and trash cleanup.

Why should trash be added to the pollutants that are measured and monitored by the MPCA?
The lack of enforceable water quality standards for trash and plastics has resulted in a lack of accountability and inaction regarding cleanup of the trash pollution at Lake Hiawatha and downstream water bodies. Decades of trash accumulation in Lake Hiawatha has now broken down into massive accumulations of microplastics and styrofoam beads in the water and soil at Lake Hiawatha and downstream waters.

TRASH IS MOSTLY PLASTIC
Our world has seen an exponential increase in plastic production since the north pipe was first installed in 1935. Plastic production became cheap when plastic was subsidized and now nearly every product we purchase is packaged in plastic. "Globally, 300 million tons of plastic waste is produced every year. Demand for plastics is a growing source of greenhouse gases as it increasingly drives the world's consumption of oil and gas. Plastic pollution has reached crisis levels, with a dump truck's worth of plastic pouring into our oceans every minute." Green America.org .

ECOLOGICAL CONSEQUENCES
Lake Hiawatha is home to at least 249 species of animals, including otters, mink, Great Horned Owls, spiny soft shelled turtles and many other species of interest. The Lake is also a key migratory stop for numerous avian species because it is one of the few springtime open water locations along the Mississippi River Flyway. Plastics and trash have caused wildlife mortality

Photos of trash at Lake Hiawatha by Sean Connaughty and Friends of Lake Hiawatha

and pose a continuing threat to the region's biodiversity. We often find trash items that show evidence of being partially eaten by wildlife. We also see waterfowl eating trash and plastic pieces. We have also witnessed wildlife mortality directly caused by trash. It is also known that microplastics are in the food web. Emerging science indicates that microplastics pose an alarming threat to wildlife and human health.

METHODOLOGIES

Friends of Lake Hiawatha would be happy to assist in the development of a methodology for the measurement of trash and/or plastics for a TMDL. The extensive data we have collected on trash at Lake Hiawatha may be helpful in this work. The purpose of our 2019 Lake Hiawatha Trash Survey is to gather data and show several possible methodologies for measuring trash and plastics.

Soil and water sampling for microplastics is something we have not yet done at Lake Hiawatha and would probably be a wise addition to a regimen of pollutant monitoring.

Folks from Sierra Club North Chapter, The University of Minnesota and Friends of Lake Hiawatha have been reviewing how other places have been able to regulate trash in water and this is what we have found:

“Trash as a water quality standard has been regulated as a narrative rather than numerical standard... The narrative standard for trash in Minnesota can be used to develop trash TMDLs for water bodies and watersheds. This has been done in a number of areas. The TMDL that has been used is a negative standard--allowing no trash, 0 trash and this is regulated and measured via lbs removed from the water body. First the water body must be designated by the state as not meeting water quality standards and placed on the “303(d) list of impaired waters for the state” which then triggers studies needed to establish the TMDL. The TMDL determines how much waste or a pollutant can be generated from each source, point source like a sewage treatment plant or via stormwater sewers and all nonpoint sources. The studies are then published and each TMDL or amount of the pollutant per source is determined and placed out for public review. The TMDL then is implemented via the permits that govern pollutants. This would include the stormwater permit for the City of Minneapolis and the Minneapolis Park Board issued by the MPCA and would tell them to install traps and other technology to remove the trash, holding them accountable for the water quality standard that is already in existence.“ S. Wiegman

We recognize that creation of a WQS and TMDL for trash will present challenges for Public Works SWS and the MPRB. We support additional funding allocations and staffing for the City to undertake this work. It is inevitable that trash/plastic pollution will need to be addressed as a pollutant. A lack of initiative on this problem results in increased risk to water quality, biodiversity and habitat integrity.

Thank you for everything you do and thank you for your consideration,
Friends of Lake Hiawatha
www.friendsoflakehiawatha.org

Photos of trash at Lake Hiawatha by Sean Connaughty and Friends of Lake Hiawatha

Contact: friendsoflakehiawatha@gmail.com,

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Photos of trash at Lake Hiawatha by Sean Connaughty and Friends of Lake Hiawatha

The above photo shows a collection of trash items that show evidence of being eaten by wildlife. All photos by Sean Connaughty and Friends of Lake Hiawatha

Photos of trash at Lake Hiawatha by Sean Connaughty and Friends of Lake Hiawatha

Date: June 23th, 2021

To: Elizabeth Stout, Water Resources Manager
City of Minneapolis Public Works – Surface Water and Sewer Division

From: Friends of Cedar Lake

Re: Comments on the Minneapolis Stormwater Management Program July 2019

Thank you for the opportunity to comment on the City of Minneapolis Stormwater Management Program July 2019 (MSMP19). The MSMP19 document (https://www2.minneapolismn.gov/media/content-assets/www2-documents/government/stormwater-management-program.pdf) is comprehensive and reflects the robust knowledge base of staff at the City and MPRB. The care in developing the program, along with collaboration with other agencies is appreciated. The MSMP relies upon data from the 2019 Minneapolis Park and Recreation Board (MPRB) Annual Water Resources Report which was published November 2020 (https://www.minneapolisparks.org/wp-content/uploads/2020/12/2019_water_resources_report.pdf).

Friends of Cedar Lake (FOCL) is a grassroots, all volunteer group concerned with the health and water quality of the city lakes with a focus on the Minneapolis Chain of Lakes and a particular interest in the wellbeing of Cedar Lake.

Cedar Lake provides important ecological habitat to insects, frogs, toads, fish, turtles, and a broad array of birds including Bald Eagles, Herons, Wood Ducks, Loons, Baltimore Orioles, Mergansers, and Forsters' Terns. The area around Cedar Lake contributes substantially to the City's tree-canopy, which is important to reduce urban heat island effect, support wildlife habitat, and enhance nature based recreation. Local and regional community members of all ages, along with other visitors, enjoy Cedar Lake. Year-round recreational amenities include:

* Swimming * Fishing * Canoeing * Kayaking * Paddle Boarding * Bird Watching * Nature Based Quietude * Walking * Running * Polar Swimming * Biking * Nordic Skiing * Skate Skiing * Snowshoeing * Ice Skating * Ice Fishing * Running *

As part of the Minneapolis Chain of Lakes, Cedar Lake is ranked 5th in the MPRB equity index rating (https://minneapolisparks.maps.arcgis.com/apps/MapSeries/index.html?appid=4bf83201e604494c8587e7832898ae42).

Generally stormwater run-off is being managed and has been separated from the sanitary sewer to prevent release of untreated sewage in to the Mississippi River. As a result the City lakes including Cedar Lake have become integral to the regional stormwater management system, which puts immense stress on the water quality and health of the City lakes. Cedar Lake takes on flow from the west and the north. Micro-plastics from trash are a factor along with salts, feces, fertilizer, toxin generating cyanobacteria, etc. Water quality throughout Minneapolis is important and engaging community can help advance improvements.

Please address the following matters in the MSMP19:

I. **Friends of Cedar Lake Issues List (Exhibit I) -** Following a series of harmful algal blooms at Cedar Lake in 2019 and 2020, FOCL met with MPRB in October and December of 2020 to better understand the components and locations of the associated stormwater infrastructure (e.g., intakes, grit chambers, filtration ponds, outflows, etc.) for Cedar Lake and municipal jurisdictions. While the information was not readily available, FOCL worked with

MPRB to identify issues and priorities, which are summarized in Exhibit I. Community feedback has identified the following additional priorities:

a. Develop a comprehensive, online Water Quality Coordination Document. Contents to include infrastructure maps, run-off and water flow maps, responsible entities and contact info, and maintenance and treatment schedules.
b. Evaluate the frequency of filtration pond(s) testing and maintenance. FOCL has observed that every 5 years may not be adequate.
c. Create data driven rapid response strategies to prevent and mitigate contaminations.
d. Collaborate with Neighborhood Organizations and other community groups to further public education initiatives.
e. Increase the length of time to retain records from 3 years to 7 years. Given the lag time of issuance of the annual report and noted analysis errors, maintaining the records beyond 3 years is important.
f. Establish adequate funding to complete the ongoing and timely maintenance stormwater infrastructure. Delays in necessary maintenance should not be the norm and reliance on volunteers to accomplish time sensitive and time intensive tasks should not be the cornerstone of keeping the waters healthy.
g. Ensure public notifications are posted at recreational lakes in the case of contaminated water. Signs should be multilingual, posted immediately, and indicate the problem and safety warning. Information related to the risks of eating contaminated fish should be included.

II. Corrected Data Analysis for Trophic State Index in Cedar Lake (Exhibit II)

a. Cedar Lake water quality is deteriorating, the situation is worse than the annual reports reveal because the statistical regression analysis has been done incorrectly (See Exhibit II). In the 2019 Annual Water Resources report, Cedar Lake is the only lake in MPRB system with declining water quality indicators but the report is understating the magnitude of the problem because of faulty statistical techniques. The 2019 Annual Water Resources report should be corrected to reflect:

- **i.** Appropriate, rigorous statistical analysis that does not include data prior to the previous alum sulfate treatment (see Mia Divecha, PhD's report for an illustration of appropriate statistical methods). This is an issue of scientific integrity.
- **ii.** Appropriately reporting Cedar Lake's water quality crisis as an impairment and environmental crisis that threatens human and animal life based on complete data and accurate statistical methods.

b. ***Based on the corrected data analysis, Cedar Lake is impaired and presents a health hazard and qualifies as an environmental crisis. Please update the MSMP19 accordingly, including a plan and funding for mitigation to include:***

i. Accelerating the review and disclosure of available 2020 Cedar Lake water quality data particularly in light of the shocking bloom that happened last year. Data from 2019 was not released until 2021, which is an unacceptable delay since time is of the essence in such matters. When modeled correctly, the data show with statistical significance that the water quality is impaired and has degraded quickly and systematically over the last few years.
ii. Enlisting a third party to evaluate alum sulfate treatment and formulate and complete a dosing plan for Cedar Lake. This should be budgeted and funded.
iii. Executing the alum sulfate treatment plan over multiple years while also pursuing other approaches that have been documented and discussed at multiple levels, including with agencies beyond the City and MPRB. The degradation has reached a point where there needs to be alum sulfate treatment planned and

administered while other strategies are put in motion in parallel to create enduring ecological stability.

c. The MPRB Master Planning exercise for Cedar Lake is underway now; the Community Advisory Board and staff need the whole data set, and this is the right moment for expanded transparency. Landscaping changes and other initiatives that will likely come through this master planning process are necessary but insufficient. Without Alum Sulfate treatment, the water quality in Cedar Lake will continue to degrade and blunt the utility of other modifications and efforts. The alum treatment and other infrastructure maintenance should be included in the MSMP19 and not deferred to be part of a capital improvement project resulting from the MPRB master planning for Cedar Lake – Lake of the Isles.

III. **Multiple Occurrences of Cyanobacteria in Cedar Lake** (See Exhibit III) - Since 2019 there have been numerous citizen observations and reports of the red bloom associated with toxin producing cyanobacteria. The nutrients in the lake (bed) feed cyanobacteria, especially when disturbed. These toxins are harmful to people and pets if ingested or inhaled. Concurrently, there have been reports of a fish kill in several lakes in the chain of lakes. This information does not appear to be reflected in the 2019 MPRB Annual Water Resources Report or the MSMP19. In a press release dated May 2020 (https://m.startribune.com/mpls-park-officials-warn-of-harmful-algae-in-cedar-lake/570577322/) MPRB confirmed the public health hazard.

a. Using corrected data analysis (See Exhibit II), Cedar Lake likely should be classified as impaired in the 2019 MPRB Annual Water Resources Report.
b. Immediate, decisive intervention and treatment is needed to protect human, animal, and environment health. Alum sulfate is a proven solution that can be operationalized in parallel with all the other activities listed in MSWP19. According to MPRB, the alum sulfate treatment that was done in the mid-90s was under-dosed by modern standards, which further underscores the need for a new, robust alum sulfate treatment that will last for years and help realize the benefits of other approaches and awareness efforts being taken in parallel.

IV. **Targeted Pollutants**

a. **Cyanobacteria**
   i. Specifically list cyanobacteria as a targeted pollutant as it is harmful to animals and humans if and ingested or inhaled. (Science Alert, "Meet Very Fast Death Factor - The Algal Toxin Scientists Are Finding in Our Air" by Jacinta Bowler, April 6th, 2021 https://www.sciencealert.com/scientists-have-found-that-a-dangerous-algal-bloom-toxin-can-be-found-in-the-air).
   ii. Develop real-time response and funding to mitigate the occurrence of cyanobacteria in City lakes. Strategic and sophisticated deployment of aluminum sulfate is efficacious and has a multi-year positive impact (https://www.nationalgeographic.com/environment/article/aluminum-sulfate-clears-polluted-lakes-algae-blooms).
   iii. Address human consumption of fish exposed to cyanobacteria.

b. **Trash and Plastic**
   i. Add trash and plastics to the targeted pollutants list. The magnitude of the problem is evidenced by volunteer clean-up efforts:
      1. Volunteers at Lake of the Isles have collected 34 bags of trash in a single clean-up effort. Trash is migrating via the storm drains. Syringes were

found on the east side of the lake – it is unclear if this is medical waste or the byproduct of public drug use.

2. The volunteer group Friends of Lake Hiawatha has substantial experience and knowledge related to trash impacts on the City lakes. FOCL supports FOLH's call for trash accountability – "the triad of responsibility for trash lies with three major groups: The Consumer, The Producer, and our Municipalities. If we are to successfully address the pollution problem, each group will need to accept their role in the problem and make changes. We have sought assistance from the top four corporations (Producer) identified in the trash at Lake Hiawatha. We are asking for support for the MPRB and City to complete this work. Consumers, or community members, need to make different choices and dispose of trash and recycling properly. Community has already borne a large portion of responsibility with hundreds of community volunteers who have removed more than three tons of plastic and styrofoam trash from Hiawatha since 2015. Our Municipalities, include the MPRB and The City, do not remove any trash from Lake Hiawatha. We are asking for this to change." (Letter from Letter to MPCA Triennial Standards Review Committee From Friends of Lake Hiawatha, http://forums.e-democracy.org/groups/mpls-staneric/files/f/c5fZvHTBWXogBdklkd6qwi76VZl-BUXU-2QDcmki/Letter%20to%20MPCA%20-%20an%20enforceable%20WQS%20for%20%20trash-3.pdf)

ii. It is our understanding that the City and MPRB do not remove any trash from the lakes. The system is relaying on volunteers to do this work. This is not sustainable therefore staffing resources should be funded to address trash in the City lakes.

V. **Evaluate and address Southwest LRT Construction and Operation impacts on Cedar Lake – primary concerns include changes pumping disturbances of lake bed nutrients that feed harmful algal blooms and changes in Cedar Lake water temperature due to storm water pumping.**

a. Construction - there is concern that the Southwest LRT project has had a negative influence on lake water quality by disturbing nutrients and feeding bacteria. Please include analysis and conclusion performed by the coordinating agencies in the Annual Water Resources Report and the MWSP.

b. Operations - The following overview has been shared by the Southwest LRT project office:

i. Water Discharge related to the Kenilworth Tunnel during operations - water at the tunnel portals is pre-treated and sent to infiltration areas. Overflow water is pre-treated and routed to storm sewer. This water is anticipated to be mostly rain and snowfall. Water in the interior of the tunnel is captured and pumped to sanitary sewer. This water is anticipated to be mostly precipitation brought in on the light rail vehicles and minor seepage over time. This information is based on discussion with design staff and culled from the Southwest LRT Final Environmental Impact Statement: FEIS Section 3 – Environmental Analysis and Effects Kenilworth Shallow LRT Tunnel Basis of Design Technical Report, specifically Sections 3.4 and 3.5 Tunnel Water Discharge Systems: The Design of the Kenilworth LRT Tunnel has accounted for two main types of water infiltration; stormwater that enters from the portal areas, and potential seepage from tunnel walls. To account for stormwater, the Tunnel Portal Water Control

System is designed to handle a 100-year storm event. Water collected in the system drains near the portals and will be routed by pumps to underground infiltration chambers, equipped with a pretreatment system to capture debris and sediments. The infiltration chambers will be located below the seasonal frost line to allow for infiltration during the winter months. The amount of stormwater from the 100-year design storm is anticipated to be on the order of 85,000 gallons and the infiltration system will be designed to handle a flow rate on the order of 4 gallons per minute (gpm). Excess stormwater that passes through the infiltration chambers will overflow into the existing storm sewer system. It is expected that the infiltration systems will be able to handle all but the most extreme storm events. For reference, the Minnesota DNR equates a 100-year storm event to about 6-7 inches of rainfall. The highest recorded daily rainfall in the last decade is about 4.2 inches (the next highest daily totals are all under 3.5 inches). Stormwater from the LRT that may eventually reach surface waters will not affect the water quality or the ability to swim in the lakes. The operation of the light rail system is not expected to affect the quality of shallow groundwater because the trains will be electric, and, generally, there are no activities associated with train operation that generate pollutants. (SWLRT EIS 3.8.3.2) The Kenilworth LRT Tunnel will be constructed to prevent the infiltration of water through its interior walls, floors and ceilings. However, to account for any potential seepage through tunnel walls, the Internal Tunnel Water Control System is designed to discharge water at a rate of 500 gpm if needed. The system is designed to accommodate an allowable seepage rate of 0.002 gallon per square foot per day is used, which is a recommended rate from the Federal Highway Administration for constructing roadway tunnels.

EXHIBIT I

Issue Categorization
Cedar/Isles Water Quality and Environment Discussion
2/18/2021

PURPOSE:
To identify activities, roles, and pathways...
for MPRB and the community...
to enhance water quality, habitat, and the ability to recreate...
in the upper Chain of Lakes

CONTACTS:
Planning: Emma Pachuta, Senior Planner
Env. Management: Rachael Crabb, Water Resources Manager
Env. Stewardship: Jeremy Barrick, Asst. Superintendent VERIFY
Superintendent's Office: Pamela Gokemeijer, Intergovernmental Affairs

#	Main Identified Issue/Idea	Secondary Ideas and Details (Community Comments)	Implementation Pathway	Community Role Community Role to be determined	MPRB Role (Department) MPRB Priority Effort	Ecological System Plan Recommendations	Notes on MPRB Processes/Realities
1	**Focus on Chain of Lakes Watershed**	Lakes are connected: Brownie/Cedar/Isles/Bde Maka Ska. Historic pumping into the Chain from Bassett/Chain. Connection to Minnehaha/Mississippi is relevant to current work. This work will benefit other lakes, in the Chain and elsewhere. Consider non-human beings at the lake (animals, dragonflies, etc.) and the bodies of water themselves	Planning	Participate in Cedar/Isles Master Plan process and advocate for inclusion of these ideas.	Consider watershed scale during master planning efforts; disseminate larger watershed information through master plan **(Planning)**		Most pollution comes to the lakes from land that MPRB does not own. MPRB coordinates closely with Minneapolis, St Louis Park, and Minnehaha Creek Watershed District (MCWD) to advocate for water quality improvements and rule changes that benefit the water resources of Minneapolis. MPRB has a Memorandum of Understanding with MCWD on coordination around water quality improvements.
2	**Understanding Infrastructure Affecting Water Quality**	Create a list of infrastructure (pipes, roads, outfalls). Create pipeshed and outfall map OF ENTIRE UPPER CHAIN. Somewhere to go to learn what runs into the lake and from where.	Planning	None	Prepare maps as part of Cedar/Isles Master Plan, then make publicly available. **(Planning)**	8.1	MPRB will need to coordinate with the City and Minnehaha Creek Watershed on this task.
3	**Increasing Infiltration Around Cedar Lake**	Minimize direct runoff from streets. Consider small filtration ponds/wetlands/marsh areas. Restore and enhance natural shoreline.	Planning and Capital Investment	Participate in Cedar/Isles Master Plan process and advocate for inclusion of these ideas.	Consider and discuss inclusion of these ideas in the Cedar/Isles Master Plan, as part of the normal planning process. Implement projects identified in the Master Plan when funding becomes available. **(Planning)**	1.1, 1.4, 1.5, 2.2, 2.5	Capital funding for this and other regional parks are determined through MPRB's regional equity metrics. The Chain of Lakes currently has a ranking of 5 and will receive funding in 2022 and 2024. Community engagement determines exactly what improvements will be constructed, guided in part by prioritizations in the adopted master plans. Although good practice to reduce impervious surfaces generally, parkways and hard surface in the parks generate a small fraction of the runoff that the lakes receive. There may be other projects that are more beneficial to lake water quality.
4	**Pavement Erosion**		Planning and Capital Investment	Participate in Cedar/Isles Master Plan process and advocate for trail location changes and shoreline stabilization. Advocacy for state to meet its maintenance funding obligations to the Regional Park System.	Consider and discuss inclusion of these ideas in the Cedar/Isles Master Plan, as part of the normal planning process. Implement projects identified in the Master Plan when funding becomes available. Utilize ongoing State O&M funding to replace pavement. **(Planning)**	1.10	State O&M Funding, the most viable source for infrastructure rehabilitation, is consistently below state statutory levels. Trails throughout the MPRB system are in poor condition and prioritization of funds must consider the entire system.
5	**Re-invigorate the Clean Water Partnership**	CWP was able to get all jurisdictions communicating together; created actionable multi-agency items. Need to understand what are multi-jurisdictional functions now. Why is water quality failing? In what ways is water quality declining?	Research		Communicate how former role of CWP is being met through other processes. Continue coordination with MCWD under the Memorandum of Understanding to advance water quality improvements watershed-wide. **(Env. Management)**		The current Federal "Total Maximum Daily Load" (TMDL) program requires analysis of lakes every three years and updates an "impaired waters" list, with an expectation that agencies gradually work to improve water bodies. This program did not exist when the CWP was initiated. Cedar Lake is not considered impaired, though it is necessary to ensure non-degradation.
6	**Water Quality Communication**	Transparently communicate testing results. Neighborhood associations can support but not lead. Dashboard for water quality. Consistent and clear communication around algae blooms. How does redevelopment affect water quality? Develop communications template about what MPRB is doing, and what members of the public can do (lawns, etc.). Include other agencies in this water quality discussion.	Procedures	Assist with information dissemination	Clarify which information is already available and where it lives. Develop and improve procedures for water quality communication. **(Env. Management)**	6.1, 6.2, 6.3	Some data is updated in "real time" (beach data, algae blooms, temperature, water clarity) at https://minneapolisparks.maps.arcgis.com/apps/webappviewer/index.html?id=8B319f73c7904adcbabccacdff38bbf1 Other data must be analyzed by laboratories and cannot be disseminated immediately.

EXHIBIT I Continued

#	Main Identified Issue/Idea	Secondary Ideas and Details (Community Comments)	Implementation Pathway	Community Role Community Role to be determined	MPRB Role (Department) MPRB Priority Effort	Ecological System Plan Recommendations	Notes on MPRB Processes/Realities
7	**Maintenance of existing water quality improvements**	Cedar Meadows. Community notification/education. City underground infrastructure around Isles/Cedar	Procedures		Work with partner agencies to ensure regular maintenance is performed; disseminate information on maintenance schedules **(Env. Management)**		The maintenance procedure is straightforward: ponds are dredged by the City when they fill up. Ponds are dredged on a schedule. If they are filling up, that indicates they are working. Cedar Meadows is owned by MCWD. Underground infrastructure may need more maintenance than expected (general schedule is twice per year)--City would need to increase crews/equipment.
8	**In-lake water quality improvements**	Aeration: Cedar Meadows, the lakes themselves. Alum treatment	Research		Study and provide clear detailed description of pros/cons/ benefits/drawbacks of aeration and alum treatment **(Env. Management)**		**Aeration:** MPRB is currently working with the City of Minneapolis to screen various ponds around the city for the potential to increase their water quality benefit. MPRB has summer aeration at Loring Pond and at Powderhorn Lake and winter aeration at Wirth and Powderhorn. Aeration is complex, and does not always decrease phosphorus levels. **Alum:** Alum treatments can be a good way to control "internal loading" of phosphorous. A chemical placed in the lake, and it takes out particulates, phosphorous, algae, and zooplankton. It forms a barrier so less phosphorous loading can happen. Alum treatments are common in MN. Ponds and stormwater can potentially be "microdosed" with alum to help treat external loading. Space and cost for this type of system makes it uncommon.
9	**Chlorides**	Strengthen partnerships regarding salt	Advocacy	Work for passage of state legislation, work for modification of city policies.	Implement Ecological System Plan Recommendations city-wide. **(Env. Stewardship, Superintendent's Office)**	1.6, 1.7, 1.8, 1.9	MPRB maintenance staff recieve "smart salting training." MPRB's goal is to be a "smart salting certified organization" but this will take time and resources to make organizational changes. MPRB strongly encourages any homeowner or commercial property owner to hire firms that are "smart salting certified." MPRB has no regulatory authority to require these actions. MPRB, Minneapolis, St Louis Park are all parties in the Twin Cities Area Chloride TMDL. https://www.pca.state.mn.us/water/statewide-chloride-resources https://www.pca.state.mn.us/water/salt-applicators
10	**Chemical Use by MPRB**	Pesticide Advisory Committee. Private homeowner lawn treatment	Procedures		Disseminate chemical use findings; notifications of any policy/procedure changes from pesticide work **(Env. Stewardship)**	36.1	Advisory committee and internal groups were actively meeting in 2019; work was paused during COVID.
11	**Dog Feces Mitigation**	Educational campaign. Provide plastic bags in strategic locations	Procedures and Advocacy	Assist with education campaign.	Continue existing dog feces education that happens city-wide and and connect community to these initiatives. **(Env. Management)**	4.3	This has been a 20-year ongoing education and communication project for MPRB. A City of Minneapolis study did not find dog feces to be a major source of e coli in Minnehaha Creek, possibly because of MPRB's long running education program.
12	**Trash in water bodies**	Lake of the Isles outfall near the Mall	Capital Investment, Education, Partnership		Implement Ecological System Plan Recommendations city-wide. Work with City on trash capture at outfalls. **(Env. Stewardship)**	3.1, 3.2, 3.3, 3.4	Specific engineering requirements exist on installing trash capture elements. Trash flowing to the lakes via stormwater outfalls is generated in the watershed, and MPRB has no control over this area. Most trash found in the lakes is litter generated by the public.
13	**Southwest LRT Impacts**	What water quality studies have been done, and should be done? What is actual water quality impact of project. Consider soil compaction, run-off, and water filtration.	External to MPRB	Request desired information from Metropolitan Council and leverage elected official relationships if necessary.	MPRB staff report issues if they arise during regular monitoring **(Env. Management)**		MPRB does not have jurisdiction over water quality standards for the SWLRT project, nor is MPRB the determining agency around compliance.
14	**Southwest LRT De-watering**		Procedures	None	Water quality staff is currently working to review SWLRT de-watering practices and will continue to do so. **(Env. Management)**		There are limitations on how much affect MPRB can have on de-watering practices.
15	**Historical De-watering**	I-394 / Bassett's Creek	Research	Perform research into historical de-watering practices.	None		

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EXHIBIT II

Mia Divecha
Mia.divecha@gmail.com
March 9, 2021

Corrected Data Analysis for Trophic State Index in Cedar Lake

Executive summary

The statistical analysis of the Tropic State Index (TSI) in Cedar Lake in the 2019 Water Resources Report[1] is inaccurate and misleading. The current analysis shows a statistically insignificant ($p > 0.05$) relationship between time and the TSI, indicating that this value is not statistically increasing. This is an inaccurate approach primarily because there was a significant mitigation event that occurred in 1996 that warrants the restriction of data analysis to a "post-mitigation time period" analysis. When this analysis is performed again using data from 1997-2019 (instead of 1991-2019), the results drastically change with a higher correlation and significant p value of < 0.00001, indicating that indeed the water levels are in fact increasing.

Original analysis

A screenshot of the original analysis is shown below in Figure 1, and an identical analysis was reproduced below in Figure 2. Consistent results are shown. The R^2 of the trendline in both cases is ~0.01, which indicates the line does not fit the data well.[2] I calculated the p-value by first calculating the correlation of the data using Excel's CORREL function, which shows the relationship between the x variable (time) predicts the y variable (TSI).[3] This value was calculated to be $r = 0.13$, showing a low correlation. To actually evaluate whether or not this means the data is "correlated" *enough*, a statistical test is performed: The null hypothesis is posited to be that there is no relationship, i.e. the correlation $r = 0$; and the alternate hypothesis is that there *is* a relationship, i.e. correlation $r \neq 0$. To evaluate this, I used a simple online tool[4] that inputs the correlation (r) value and the number of data points and outputs the p value. A p-value of <0.05 indicates that we reject the null hypothesis and accept the alternate hypothesis, and state that the data are correlated with each other. For the original case, $p = 0.52$ is calculated, indicating that we must accept the null hypothesis that there is no correlation. This is quite close to the $p = 0.56$ shown in the report. Alone, this would mean that the TSI levels are not actually increasing over time.

This analysis, being consistent with the report, should hopefully provide confidence that the approach taken here is valid and robust.

[1] https://www.minneapolisparks.org/wp-content/uploads/2020/12/2019_water_resources_report.pdf
[2] Typically, $R^2>0.6$ is an indicator that the line fits the data reasonably well.
[3] A correlation of 1 means the data are perfectly correlated; a value of -1 means the data are perfectly inversely correlated; and a value of 0 means no correlation at all.
[4] https://www.socscistatistics.com/pvalues/pearsondistribution.aspx

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March 9, 2021

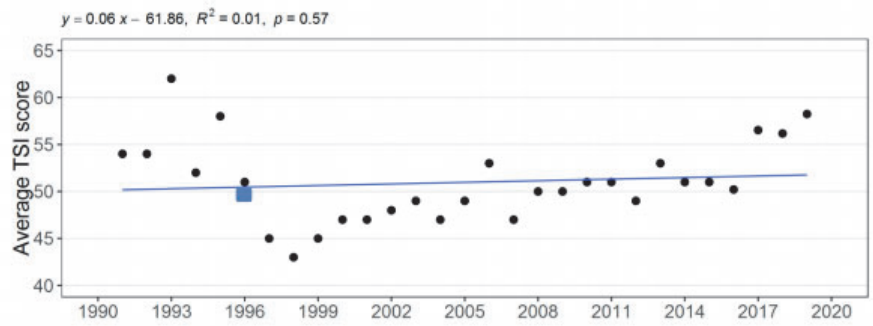

Figure 1: Original Analysis

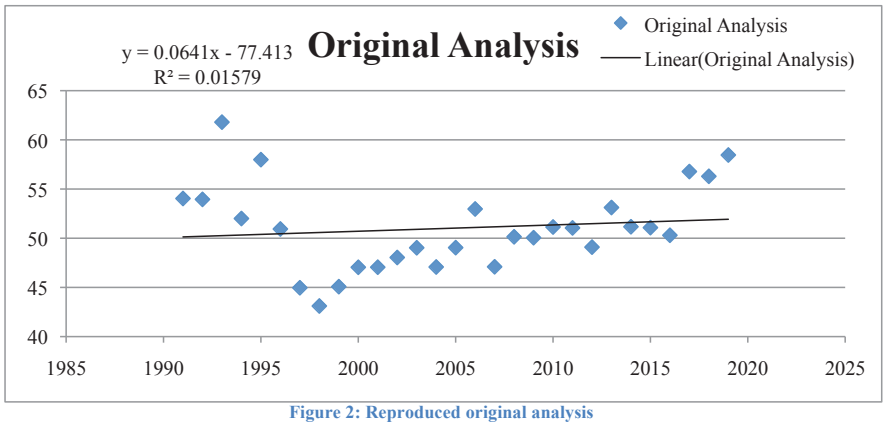

Figure 2: Reproduced original analysis

Corrected approach

The report indicates that in 1996, the alum treatment was performed. This represents a known change in the circumstances (obvious by the reduction in TSI after that) that warrants evaluating the data since that change. This is a typical approach taken all across all science disciplines: when you have a known change, you want to compare data before and after that change; not combine the data. If you had a cancer treatment in 1996 and wanted to look at how your T-cells are evolving, you wouldn't evaluate at T-cells from 1990 through today; you'd look at them from your last treatment onwards. We need to take the same approach here.

An identical analysis was performed for the same data, only truncating the data from 1997-2019. The plot in Figure 3 shows the line of regression, which has a much higher R^2 = 0.75, which indicates that the line does in fact represent the data well. The correlation

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value is also higher, at r = 0.87 (recall a correlation of 1 means perfectly correlated). The p-value, calculated similarly as above, is calculated to be $p < 0.00001$. Because $p < 0.05$, this indicates that we reject the null hypothesis and accept the alternate hypothesis, which is that the data are indeed correlated with each other. This means that we can confidently state that the TSI levels are increasing over time.

The numbers described in these paragraphs are summarized in Table 1 below.

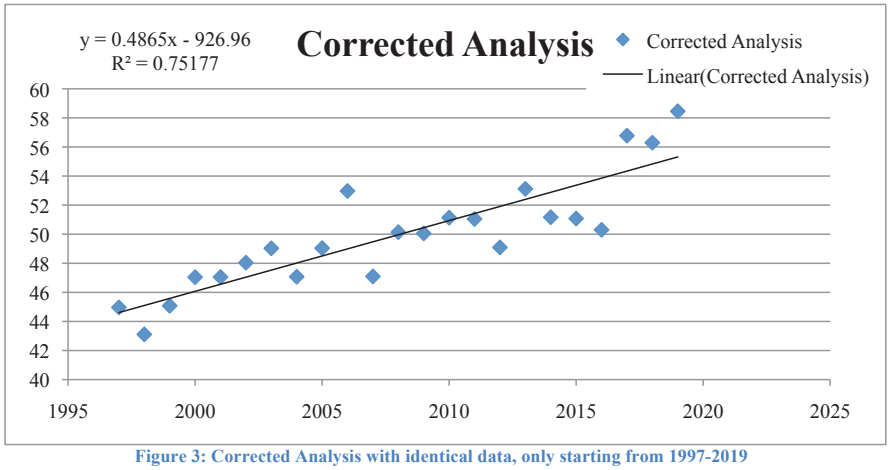

Figure 3: Corrected Analysis with identical data, only starting from 1997-2019

Table 1: Summary of statistical values from analysis

	Original Analysis	**Corrected Analysis**
Number of data points	29	23
R2 Linear Regression	0.52	0.75
Correlation value (r)	0.13	0.87
p-value	0.52	<0.00001

Discussion and Conclusion

Why does this matter? This is really important because if the MPLS Park Board is leveraging a science-based approach, the original analysis would indicate that there is *no statistical proof that the TSI levels are increasing over time*. This is not only patently wrong simply from looking at the plot with a naked eye, but statistically incorrect. If you were to follow the trendline and extrapolate (a dangerous thing to do with an R^2 of 0.01), it would predict a TSI level of 52.7 in 2030, which some may think is a non-threatening issue that does not deserve prioritization or resources.

EXHIBIT II Continued

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March 9, 2021

When using the corrected approach, I show statistical proof that indeed, the levels are increasing over time, and at an alarming rate. By showing a p value of < 0.05, we show that there is indeed correlation. This gives us the ability to trust our line of best fit, which also has a high value of R^2. This allows us then to extrapolate with confidence. This line would predict a 2030 TSI value of 60.6, which is alarmingly high. I hope this analysis shows that this is in fact a problem that deserves to be prioritized and should have resources allocated soon, before someone becomes ill or worse from the effects of these levels.

Exhibit III

Red colored algae bloom in Cedar Lake 2020: Description, comparison with previously collected data, and potential causes: Preliminary Assessment prepared by Minneapolis Park Recreation Board Water Quality Staff

In Spring of 2020 a red colored algae bloom occurred on Cedar Lake. A citizen first reported a red substance on the south side of the lake on March 30th; however, the substance was not present by the time a MPRB Water Quality staff member was able to get to the site. On April 11th, a significant amount of red material was seen on the north side of Cedar Lake and in Brownie Lake. Water Quality staff investigated the site and found no sign of spill and no unusual discharge from stormsewers. The red substance appeared to be an algal bloom. Photos of the red substance are shown in **Figure 1a-b**.

Figure 1. Red substance along north shoreline of Cedar Lake (a and b).

A sample of the red substance was collected on April 14th and was brought to the MPRB lab to view under a microscope. The microscope slide, seen in **Figure 2**, confirmed that the red substance was algae. MPRB staff then reached out to our contract lab that analyzes plankton. Our lab suspects the algae is from the genus Planktothrix based on the photo, but they need to examine a sample to confirm the species. MPRB Staff went lake sampling on April 29th to conduct our regular sampling. As a part of the sampling, staff measured water clarity and collected a plankton sample, which was prepared and sent to the lab for detailed analysis.

Red colored algae bloom in Cedar Lake 2020: Description, comparison with previously collected data, and potential causes: Preliminary Assessment prepared by Minneapolis Park Recreation Board Water Quality Staff

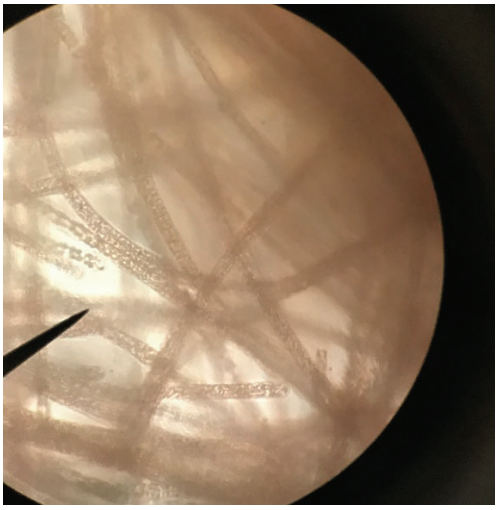


Figure 2. Microscope slide of red substance found in Cedar Lake.

Spring phytoplankton data collected on Cedar Lake over the past 10 years were reviewed and are shown in **Table 1**. Over the past 10 years, Planktothrix were present in three of the Spring samples: 2016, 2017 and are assumed to be present in 2020. Although this type of algae was present in previous years, there is no record of a bloom this severe. A brief literature review

Table 1. Most prevalent phytoplankton species in Cedar Lake Spring samples between 2011 and 2020.

Date	Genus	Species	Relative Concentration Percent	Secchi Reading (feet)
4/18/2011	Stephanodiscus	parvus	70	3.4
4/17/2012	Erkenia	subaequiciliata	67	13.9
5/6/2013	Erkenia	subaequiciliata	52	3.4
5/5/2014	Rhodomonas	minuta	19	4.6
4/16/2015	Cryptomonas	erosa	15	3.8
4/20/2016	Planktothrix	agardhii	35	NA
4/13/2017	Planktothrix	agardhii	41	4.0
5/14/2018	Chrysochromulina	parva	35	2.7
4/16/2019	Stephanodiscus	parvus	42	2.7
4/29/2020	Planktothrix (assumed)	-	ND	1.5

ND = no data

Red colored algae bloom in Cedar Lake 2020: Description, comparison with previously collected data, and potential causes: Preliminary Assessment prepared by Minneapolis Park Recreation Board Water Quality Staff

Secchi depths over the past 10 years on Cedar Lake were also reviewed and shown in **Figure 3**. The current Secchi depth of 1.5 feet is very shallow indicating low clarity. Over the past 10 years there is a trend of Secchi measurements getting shallower. The deep Secchi readings are also getting shallower over time and there are fewer readings indicating clear water in recent years.

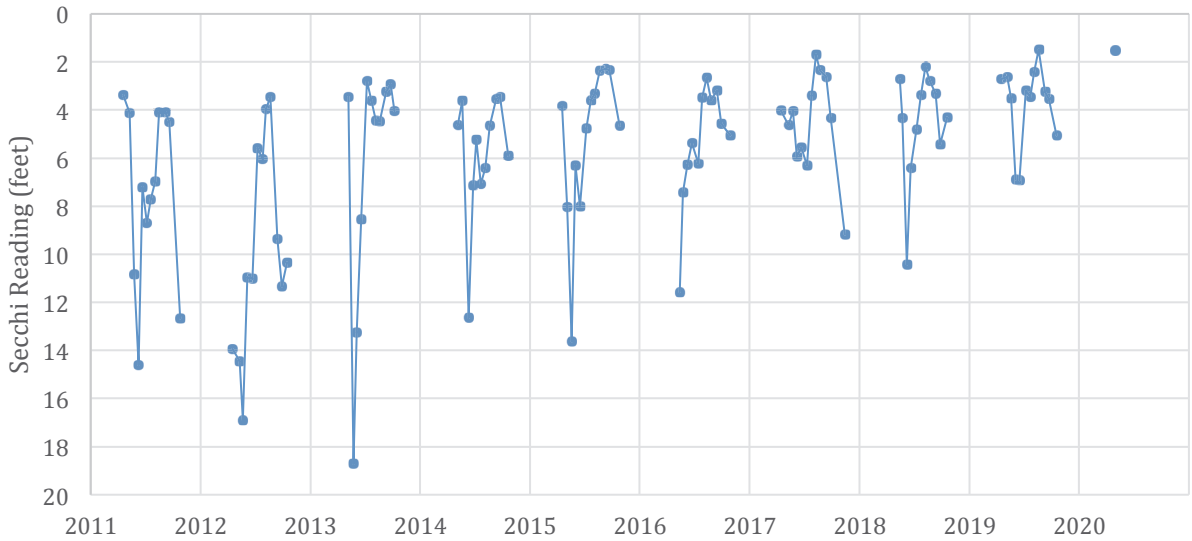


Figure 3. Secchi readings (feet) in Cedar Lake between 2011 and 2020.

Exhibit III Continued

Red colored algae bloom in Cedar Lake 2020: Description, comparison with previously collected data, and potential causes: Preliminary Assessment prepared by Minneapolis Park Recreation Board Water Quality Staff

Trophic State Index (TSI) scores and other water quality indicators were also reviewed. TSI scores are calculated using three nutrient related water quality parameters collected from surface water: water transparency (Secchi depth), chlorophyll-*a* (chl-*a*), and total phosphorus (TP). **Figure 4** shows a positive slope and increasing TSI scores over time, which indicates worsening water quality. There was an initial decrease in TSI after the alum treatment was done in 1996; however, the TSI scores started increasing again in the early 2000s. Clearly there is poorer water quality over the last several years, particularly between 2017 and 2019.

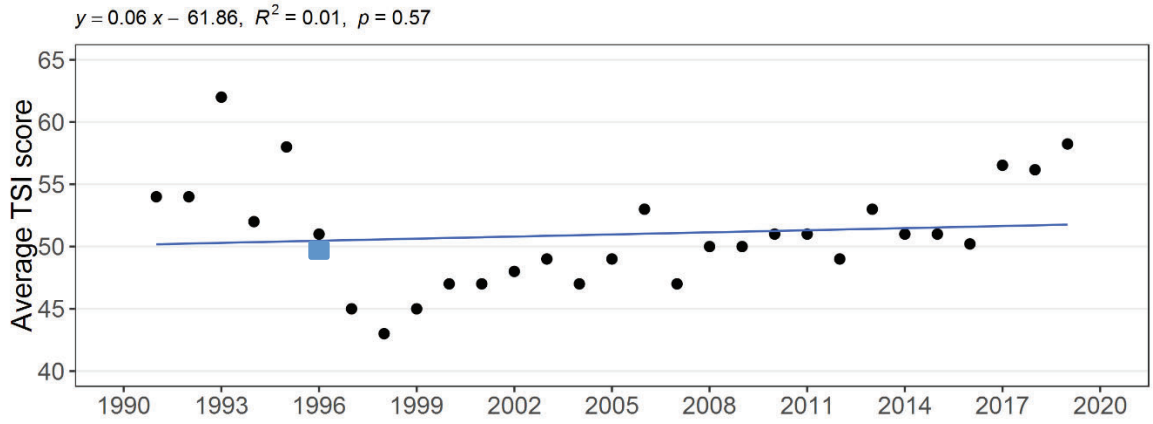


Figure 4. Cedar Lake TSI scores and linear regression from 1991-2019. The blue square highlights the 1996 alum treatment

There is no obvious reason for the decline in water quality in Cedar Lake between 2017-2019, and the presumed poor quality in spring 2020. Best Management Practices (BMPs) treating the watershed runoff were implemented for Cedar Lake after the Clean Water Partnership diagnostic study conducted in 1991. BMPs included the construction of Cedar Meadow wetlands in 1995 and an aluminum (alum) sulfate treatment in 1996. The alum treatment was done 24 years ago and was predicted to have a treatment life span of approximately seven years. The BMPs are old and may not be functioning properly or in need of maintenance. Also, the past few years have been the wettest period on record with 2019 having an annual recorded precipitation total of 43.17 inches. Increasing precipitation has led to years of unprecedented high water levels, which may be negatively impacting the water quality on Cedar Lake due to increased stormwater runoff and erosion.

Addendum by Friends of Cedar Lake based on status update provided by MPRB staff (May 2020): There is a significant algae bloom on Cedar, it has been ongoing since ice-out. MPRB is investigating the bloom, including sending phytoplankton samples to our lab. It is likely a blue green algae in the genus Planktothrix. Concurrently, there are reports of a fish kill in several lakes in the chain of lakes. MPRB is coordinating with researchers. Subsequently a harmful algal bloom of cyanobacteria was confirmed. Star Tribune, Mpls Park Officials Warn of Harmful Algae in Cedar Lake, May 18th 2020 https://m.startribune.com/mpls-park-officials-warn-of-harmful-algae-in-cedar-lake/570577322/)

CITY OF MINNEAPOLIS

Public Works - Street Maintenance Division

Standard Operating Procedure for Vehicle Related Spills (VRS)

May 13, 2020

The purpose of this document is to provide detailed standard operating procedures for the clean-up of VRS sites and the management/disposal of the impacted spill debris.

DEFINITION OF TERMS

9-1-1: Minneapolis 9-1-1 Dispatch Center for Minneapolis Fire Department

FIS/MES: Fire Inspection Service / Minneapolis Environmental Service

MDO: Minnesota Duty Officer: The MDO Program provides a single answering point for local and state agencies to request state-level assistance for emergencies, serious accidents or incidents, or for reporting hazardous materials and petroleum spills. The MDO is available 24 hours per day, seven days per week.

MPCA: Minnesota Pollution Control Agency

MSMD: Minneapolis Street Maintenance Division (Minneapolis Public Works)

NRC: The National Response Center provided for assistance for non-vehicle related spills when a federal notification is required as directed by FIS/MES / MDO

SWLRT: Southwest Light Rail Transit

VRM: Vehicle Related Material: Petroleum products or other vehicle fluids that are inherently related to vehicular operations. This does not include materials that are being transported by a vehicle, unless the material is clearly labeled as being one of the aforementioned products.

VT: Volumetric Threshold: Minnesota has a 5-gallon minimum quantity for reporting petroleum spills. Spill of all other chemicals or materials in any quantity is reportable.

Spill debris: Sand that has been placed to absorb VRM and subsequently recovered for disposal.

Scenario 1: MPCA informs FIS/MES of VRM spill

The driver of a vehicle involved in a VRM spill is responsible for notifying the MDO at 651-649-5451. If the VT is exceeded, 9-1-1 should also be contacted. The MDO will notify the MPCA Emergency Response Unit and other agencies as required. If the spill is of the size and nature that the Emergency Response Unit determines should be handled by FIS/MES, then the MPCA will notify FIS/MES and provide them with incident details. The FIS/MES representative will decide based on the information how to proceed, and if appropriate (typically VRM in manageable quantities), they would contact MSMD.

The MSMD will dispatch personnel with appropriate equipment to apply sand to the spill site. The sand will be given time to absorb the sand and spill debris (VRM), and then will then be removed by a street sweeper. The VRM will then be deposited at the established disposal site in a designated VRM spill debris pile.

If a secondary sand application is required, the procedure would remain the same. Since the volume of the spill is greater than 5 gallons, a Hazardous Material Spill Data form (see below) must be completed as soon as possible (i.e. within 24 hours or the next business day). The completed form will be sent to the FIS/MES as soon as possible. A final report on the actions taken will be sent to the MPCA from FIS/MES.

Spill Debris Pile Management

Arrangements for disposal of the spill debris pile will be a collaborative effort by the MSMD and the City of Minneapolis Engineering Laboratory. After the spill debris pile reaches a size that becomes difficult to manage within the disposal container, the Engineering Laboratory will be contacted. The spill debris pile will be mechanically blended, and the Engineering Laboratory will select representative samples for laboratory analysis, as per MPCA regulations. The sampling and testing will require approximately one week to complete. After receiving the laboratory analysis data, the spill debris will be disposed of in a manner pre-approved by the MPCA and the Minneapolis Procurement Division.

Scenario II: The MSMD discovers a VRM spill

MSMD personnel discover a spill or are informed of a potential VRM spill from sources other than FIS/MES or MPCA. After arriving at the scene, they determine if the incident is a VRM spill, (possibly from a vehicle collision, a spill from a labeled container, etc.) and determine if the volume of the spill:

- **Less than 5 gallons**: If the spill quantity is judged to be less than 5 gallons, no contact with FIS/MES is necessary. Sand is applied and the procedure will continue as described in Scenario I (i.e. subsequent sanding/sweeping and stockpiling into the spill debris pile). A Hazardous Materials Spill Data form must be completed for record and documentation purposes and retained at MSMD, but is not to be sent to FIS/MES.

- **5 gallons or more**: If the MSMD representative determines that the spill volume is more than 5 gallons of VRM, MSMD must contact FIS/MES, the MDO and 9-1-1. The same procedures for clean up and reporting (using the Hazardous Material Spill Data form) as in Scenario I will be followed. This form must be sent to FIS/MES.

For both cases, the disposal of the VRM spill debris pile is as detailed in Scenario I.

Possible Modifications to Scenario I and II

Regulatory officials may require separate stockpiling of spill debris from specific spill incidents. Separate sampling and laboratory analysis will be required in these cases. This may also be requested to create a distinct tracking mechanism of a given spill of significant quantities and/or from a billable source. This scenario will be determined on a case-by-case basis. The process for disposal will be the same as previous scenarios.

Scenario III: The MSMD becomes aware of a spill of unknown material or composition, non-VRM Spill or material labeled as required reporting to the NRC for spill/release.

The MSMD shall contact 9-1-1, the MDO and FIS/MES before taking any action to clean up a spill of unknown composition. FIS/MES will manage these spills through their contracts with private entities specializing in these activities, or manage and coordinate the cleanup with the MSMD. If FIS/MES cannot be contacted, the MDO should be contacted immediately. FIS/MES and/or the MDO will determine if NRC is to be called.

ADDITIONAL INFORMATION

1. Currently the disposal site for spill debris is behind 198 Aldrich Ave N, Minneapolis MN 55405 during SWLRT construction. The material shall be placed in two 20 cubic-yard leak-proof roll-off containers with a counter-balanced lockable lids at the City site.

2. List of Potential Contacts:
   - **MN Duty Officer - Minnesota Department of Public Safety, Bureau of Criminal Apprehension (BCA):** 651-649-5451 (24 hours a day, 7 days a week)
   - **Fire Inspection Service / Minneapolis Environmental Service (FIS/MES)**

     Steve Kennedy: 612-685-8528 (work)
     Tom Frame: 612-685-8501 (work cell - call, leave a message or text)
     Emergency after-hours contacts:
     Tom Frame: 612-685-8501 (work-cell - call, leave a message or text)
   - **City of Minneapolis Engineering Laboratory**

     Paul Ogren: 612-673-2456
     Chris DeDene: 612-673-2823
   - **Minneapolis Street Maintenance Division (MSMD)**

     Steve Collin: 612-673-5720 (work)
     Rick Jorgensen: 612-673-5720 (work)
     After hours: 612-673-5720 (24 hours a day, 7 days a week)
   - **National Response Center** 800-424-8802

3. MSMD will be responsible for any billing of outside parties for services rendered for the clean-up and disposal of a spill event. The MSMD, FIS/MES and the Engineering Laboratory will develop a system for tracking costs associated with these operations. This information will be distributed as it becomes available.

4. This is a statement of policies and procedures, which will be revised and updated as new information becomes available.

CITY OF MINNEAPOLIS - STREET DEPARTMENT - OIL AND HAZARDOUS MATERIAL SPILL DATA FORM

DATE OF REPORT:	TIME OF REPORT:	NAME & ADDRESS OF RESPONSIBLE PARTY:
DATE OF INCIDENT:	TIME OF INCIDENT:	
POLLUTANT TYPE:	QUANTITY (Units):	CAUSE OF SPILL:
LOCATION:		NAME & NUMBER PERSON OF MAKING REPORT:
AREAS AFFECTED:		
PROBABLE FLOW DIRECTION:		PARTY REPORTING SPILL TO STREET DEPARMENT:
SOIL TYPE:		
WATERS POTENTIALLY AFFECTED:		**CONTACTED: Check and list name/number**
EFFECTS OF SPILL, WAS THERE IMMEDIATE DANGER TO HUMAN LIFE OR PROPERTY:		☐ MN Duty Officer 651-649-5451 ☐ 911 ☐ FIS ☐ MPCA ☐ FIRE ☐ POLICE ☐ OTHER
ACTION TAKEN:		PROXIMITY OF WELLS, SEWERS, BASEMENTS:
CONTAINMENT OF SPILL:		IS THIS FIRST NOTICE REGARDING SPILL?
CONTACT NAME & NUMBER FOR MORE INFORMATION:		

	CLEAN-UP TO DATE	**COMMENTS:**
USED	MATERIALS:	
	LOADERS:	
	TRUCKS:	
	PICK-UP TRUCKS:	
	MACHINE SWEEPERS:	
LABOR	FOREMAN HOURS:	
	MAINTENANCE CREW LEADER:	
	CONSTRUCTION LABORER:	
	OTHER:	

ORIGINAL TO: When job is completed, send original to Street Accounting with daily time when labor/equipment first used.

COPY TO: MPCA NOTIFICATION COPY - send (interoffice or email) to Steve Kennedy (Stephen.kennedy@minneapolismn.gov), FIS, PSC Room 401 and Environmental Services (envservicesinfo@minneapolismn.gov), PSC Room 414

STREET JOB #:	LABOR COST $	
	EQUIPMENT COST $	
	MATERIAL COST $	
	TOTAL COST $	

MINNESOTA DUTY OFFICER

BCA Operations Center

651-649-5451 **1-800-422-0798**

TDD: 1-800-627-3529 **Satellite Phone: 1-254-543-6490**

About the Duty Officer

The Minnesota Duty Officer Program provides a single answering point for local and state agencies to request state-level assistance for emergencies, serious accidents or incidents, or for reporting hazardous materials and petroleum spills. The duty officer is available 24 hours per day, seven days per week.
If there is an immediate threat to life or property, call 911 first.

When to Call the Duty Officer

Examples of incidents the duty officer can assist with include (but are not limited to):

- Natural disasters (tornado, fire, flood etc)
- Requests for National Guard
- Hazardous materials incidents
- Search and rescue assistance
- AMBER Alerts
- Requests for Civil Air Patrol
- Radiological incidents
- Aircraft accidents/incidents
- Pipeline leaks or breaks
- Substances released into the air

Agency Resources Available

State Agencies

- Department of Agriculture
- Department of Commerce
- Department of Education
- Department of Health
- Department of Human Services
- Department of Military Affairs
- Department of Natural Resources
- Department of Transportation
- Minnesota Office of Enterprise Technology
- Minnesota Pollution Control Agency
- Department of Public Safety
  - Bureau of Criminal Apprehension
  - Homeland Security and Emergency Management
  - Minnesota Joint Analysis Center
  - Minnesota State Patrol
  - Office of Pipeline Safety
  - State Fire Marshal
- Other state agencies not listed

Other Resources

- Minnesota Arson Hotline
- Local bomb squads
- Chemical assessment teams
- Emergency response teams
- Fire and rescue mutual aid
- Amateur radio (ARES/RACES)
- Minnesota voluntary organizations
- Fire chiefs assistance teams
- Search-and-rescue dogs
- Interagency Fire Center
- U.S. Air Force Search and Rescue Center

MINNESOTA DUTY OFFICER

BCA Operations Center

1-800-422-0798 **FAX: (651) 296-2300** **(651) 649-5451**

Satellite Phone: 1-254-543-6490

Emergency Notification

If there is a spill of a hazardous material or a petroleum product in Minnesota, you must call:

Local Authorities	**Call 9-1-1 FIRST,** *when there is a threat to life or property*
Minnesota Duty Officer	*If there is a public safety or environmental threat and/or if state agency notification for reportable spills is required*
The National Response Center 1-800-424-8802	*When a federal notification is required*

The following information (if available) will be requested by the Minnesota Duty Officer:

- Name of caller
- Date, time and location of the incident
- Telephone number for call-backs at the scene or facility
- Whether local officials (fire, police, sheriff) have been notified of incident

Additional information will be requested in the following special circumstances:

Making Notification of Spills/Incidents

- Materials and quantity involved in incident
- Incident location (physical address, intersection, etc.)
- Responsible party of incident (property/business owner)
- Telephone number of responsible party
- Any surface waters or sewers impacted
- What has happened and present situation

Requesting State Assistance for Incidents

- Type of assistance requested (informational, specialized team assets, etc).
- Name of requesting agency/facility
- Materials, quantity and personnel involved in the incident
- Whether all local, county, mutual aid resources been utilized

STORM DRAINAGE AREAS BY RECEIVING WATER BODY
(within Minneapolis City Limits)

Surface Water	Area (acres)	Impervious %	Population 2010	Single Family / Duplex %	Multi Family %	Inst. %	Comm. %	Ind. %	R.O.W. %	Golf Course %	Park, Rec., or Preserve %	Rail %	Airport %	Open Water %
Bassett Creek	1,621.2	40.6%	15,766	43.1%	1.2%	3.5%	2.1%	3.9%	24.2%	0.0%	20.4%	1.6%	0.0%	0.0%
Bde Maka Ska	1,250.2	45.3%	14,482	34.9%	8.7%	1.7%	5.9%	0.1%	20.6%	4.7%	15.6%	0.0%	0.0%	0.0%
Birch Pond	38.8	10.3%	4	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	99.9%	0.0%	0.0%	0.0%
Brownie Lake	93.9	40.3%	321	30.9%	0.0%	0.0%	28.6%	0.0%	18.6%	0.0%	18.2%	3.1%	0.0%	0.6%
Cedar Lake	287.8	31.5%	1,853	38.0%	1.1%	2.2%	0.4%	0.0%	18.6%	0.1%	37.8%	0.7%	0.0%	1.3%
Crystal Lake	420.9	41.7%	5,728	62.0%	1.7%	2.6%	0.7%	0.0%	30.3%	0.0%	2.7%	0.0%	0.0%	0.0%
Diamond Lake	663.7	47.8%	6,291	45.6%	4.0%	2.2%	3.6%	7.9%	27.8%	0.0%	8.9%	0.0%	0.0%	0.0%
Grass Lake	324.7	43.3%	2,707	59.0%	0.1%	3.2%	2.3%	0.0%	29.9%	0.0%	4.9%	0.0%	0.0%	0.6%
Hart Lake	3.3	51.2%	21	24.8%	0.0%	0.0%	19.2%	0.0%	52.7%	0.0%	0.0%	3.3%	0.0%	0.0%
Lake Harriet	1,120.5	38.6%	9,867	46.6%	1.8%	2.8%	1.5%	0.0%	20.2%	0.0%	26.1%	0.0%	0.0%	1.1%
Lake Hiawatha	1,243.4	42.9%	16,515	49.8%	2.9%	2.9%	2.0%	0.0%	26.9%	10.4%	5.1%	0.0%	0.0%	0.0%
Lake Nokomis	695.8	35.1%	5,776	47.7%	0.1%	2.1%	0.4%	0.0%	22.9%	0.0%	26.6%	0.0%	0.0%	0.2%
Lake of the Isles	769.8	44.5%	11,516	42.6%	10.0%	2.3%	3.2%	0.3%	23.8%	0.0%	17.5%	0.0%	0.0%	0.3%
Legion Lake	2.1	43.0%	23	60.5%	0.0%	0.0%	0.0%	0.0%	39.5%	0.0%	0.0%	0.0%	0.0%	0.0%
Loring Pond	27.2	16.2%	36	0.0%	3.1%	3.5%	0.1%	0.0%	1.3%	0.0%	91.5%	0.0%	0.0%	0.5%
Minnehaha Creek	3,347.4	38.6%	32,559	53.0%	0.8%	3.2%	1.5%	0.2%	24.2%	0.7%	15.9%	0.0%	0.0%	0.0%
Mississippi River	20,313.0	57.7%	237,734	29.2%	6.0%	6.5%	6.1%	12.0%	28.8%	1.5%	7.8%	2.5%	0.1%	0.1%
Mother Lake	30.5	45.4%	112	25.3%	0.0%	1.5%	0.1%	0.0%	63.9%	0.0%	0.0%	0.0%	9.2%	0.0%
Powderhorn Lake	322.7	43.5%	6,483	44.3%	5.7%	3.7%	1.6%	0.0%	27.1%	0.0%	17.5%	0.0%	0.0%	0.1%
Richfield Lake	57.6	65.0%	356	27.2%	3.4%	1.0%	27.7%	0.1%	40.6%	0.0%	0.0%	0.0%	0.0%	0.0%
Ryan Lake	60.6	42.3%	506	50.3%	0.0%	0.0%	0.0%	10.0%	28.3%	0.0%	2.2%	8.8%	0.0%	0.5%
Shingle Creek	1,457.7	44.7%	11,571	40.5%	1.2%	2.3%	1.1%	8.8%	19.9%	1.2%	22.2%	3.8%	0.0%	0.3%
Silver Lake	25.0	41.2%	206	66.1%	3.4%	0.0%	2.2%	0.0%	28.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Spring Lake	50.0	32.6%	208	40.2%	0.3%	6.4%	0.0%	0.0%	15.7%	0.0%	37.1%	0.0%	0.0%	0.2%
Taft Lake	138.9	45.1%	1,228	57.6%	0.0%	0.0%	0.0%	0.0%	42.1%	0.0%	0.2%	0.0%	0.0%	0.0%
Wirth Lake	40.6	6.1%	25	0.2%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	99.6%	0.0%	0.0%	0.0%
Grand Total	**34,407.3**	**50.9%**	**381,894**	**36.2%**	**4.6%**	**4.9%**	**4.5%**	**7.8%**	**26.7%**	**1.6%**	**11.7%**	**1.7%**	**0.0%**	**0.2%**

Stormwater Retrofit Projects

2020 Projects

The city constructed voluntary water quality improvements in 2020 through road projects and a retrofit of an existing surge pond. The city also continued to work on assessment of the remainder of the stormwater ponds.

GSI Projects

The city passed a new stormwater ordinance in 2021 that requires linear projects to meet stormwater management. This ordinance is expected to affect linear projects built after 2021. The ordinance requires 0.55" of stormwater management (infiltration) as well as water quality treatment. GSI built on projects in 2021 or earlier will be considered voluntary. Summaries of the voluntary GSI built on road projects in 2020 and designed for construction in 2021 are provided below.

The city has adopted the term Green Stormwater Infrastructure (GSI) for stormwater management on road projects, as defined in the Transportation Action Plan Design Guide: https://sdg.minneapolismn.gov/design-guidance/boulevards-and-furnishings/green-stormwater-infrastructure. This section of the guide is intended to assist with the new stormwater ordinance adopted in 2021.

Voluntary GSI completed

The city completed GSI in conjunction with road projects in 2020 that are summarized in the following table:

Project	Location	Description	SW Treatment
S 8th Street	One block: 5th to Portland	Infiltration planter basins	29,200 sf 200 lbs TSS 1lb TP
Hoyer Heights	3 streets: Buchanan, Lincoln, and Fillmore	Tree Trenches with underdrains	4.89 ac impervious 2.9 lbs TP 566 lbs TSS
Girard Ave	One block: Lake to Lagoon	Curbless street bioretention swale	0.57 ac impervious 414 cf treatment
SW Windom	61st and 62nd	Bioretention cells and swale	28,712 sf impervious 2,233 cf treatment
29th and Bloomington	Intersection	Bumpout depressed boulevards	420 sf impervious
Talmage Diverter	Talmage Ave SE and 14th Ave SE	Traffic diverter bioretention	0.6 ac impervious 61,800 cf 928 lbs TSS 3 lbs TP

GSI projects in design

Projects expected to be built in 2021 were designed in 2020 and summarized below.

Project	Location	Description
Grand Ave S	Lake St W to 48th St W	Bioretention cells and underground infiltration
4th St N and S	2nd Ave N to 4th Ave S	Bioretention cells on three blocks, one cell with underdrain
Downtown East	3rd St S; 10th Ave S; 12th Ave S	Bioretention cells on 2 blocks, one larger infiltration basin
42nd Ave E	46th Ave S to Edmund Blvd.	Bioretention cells throughout corridor
Whittier/Lyndale Bikeway	Blaisdell Ave S (from 40th St W to 28th St W) and 1st Ave S (from 28th St W to 15th St E)	Bioswales within linear protected bikeway feature
Whittier SRTS	Grand Ave S and 26th St W	Bumpout depressed boulevards

Pond Retrofits

The Holland Basin is located southeast of the intersection of Quincy St and 22nd. This basin was originally constructed as a surge basin. The retrofit diverted low flow from 20.6 acres to the pond for infiltration. This results in annual volumes between 13.2 ac and 15.3 acres, or 53%-61% of the annual volume and removal of 14 pounds of phosphorus and 5,000 pounds of total suspended solids. The pond will be planted with native plants through a youth employment and training contract in 2021.

New Stormwater Management

The city completed stormwater management for flood control that also provides water quality treatment.

The city started construction in 2020 on a series of stormwater management facilities in the Columbia Golf Course and upstream neighborhoods in partnership with the MPRB and MWMO. The project goals are increasing flood resiliency in the upstream neighborhoods and in the park, reducing pollutant loading to the Mississippi River, and improving ecological function within the 1NE Watershed. Construction in the golf course includes three stormwater basins, more than 4200 feet of storm sewer, three hydrodynamic separators for pretreatment, and 19 acres of habitat restoration. The new stormwater infrastructure in the Columbia Golf Course allowed the construction 3800 feet of larger storm sewer on 35th Ave. NE and Tyler St. NE to address localized flooding in the Waite Park neighborhood. A new structure on Central Ave will also divert low flows from the neighborhood through the new pipes and basins constructed in the golf course. The project will be completed in August 2021 and is expected to remove more than 170 pounds of total phosphorus and 37 tons of total sediment annually.

Prioritization Tool Progress

The City passed the revised stormwater ordinance to take effect on January 1, 2022. The requirement for linear projects to manage stormwater eliminates then need to use the prioritization tool to evaluate which road projects to focus voluntary stormwater improvements on. The tool will remain in use for the other items listed in the retrofit plan; however, its use on transportation projects will shift to help determine where higher levels of treatment or treatment offsets may be most feasible. In addition, we are developing a process to prioritize addition or enhancement of landscaping on transportation projects, which we refer to as 'Sustainable Landscaping'.

Transportation Action Plan

The city released its street design guide (SDG). The SDG includes green infrastructure, which is categorized into Sustainable Landscaping (Greening) and Green Stormwater Infrastructure (GSI). Links to the documents are here:

https://sdg.minneapolismn.gov/design-guidance/boulevards-and-furnishings/green-stormwater-infrastructure

Planning Updates

Flood Mitigation and Comprehensive Stormwater Improvement Studies

A four-step process is being used to reduce flooding and improve surface water quality in a cost-effective manner.

1. **Hydrologic / Hydraulic Models**
   The first step in the process is developing hydrologic / hydraulic models for the entire city. These models are used to identify flood-prone areas and to quantify impacts that can be caused by flooding. The models can also be used to develop solutions that reduce flood impacts.

2. **Comprehensive Stormwater Improvement Study Prioritization**
   The next step of the process is to prioritize areas where a comprehensive stormwater improvement studies should occur. The process accounts for flood impacts, water quality deficiencies, and condition of sewer infrastructure. Areas with racially concentrated areas of poverty are prioritized higher than other areas. This process is evaluated annually, with the most recent prioritization completed in June 2019.

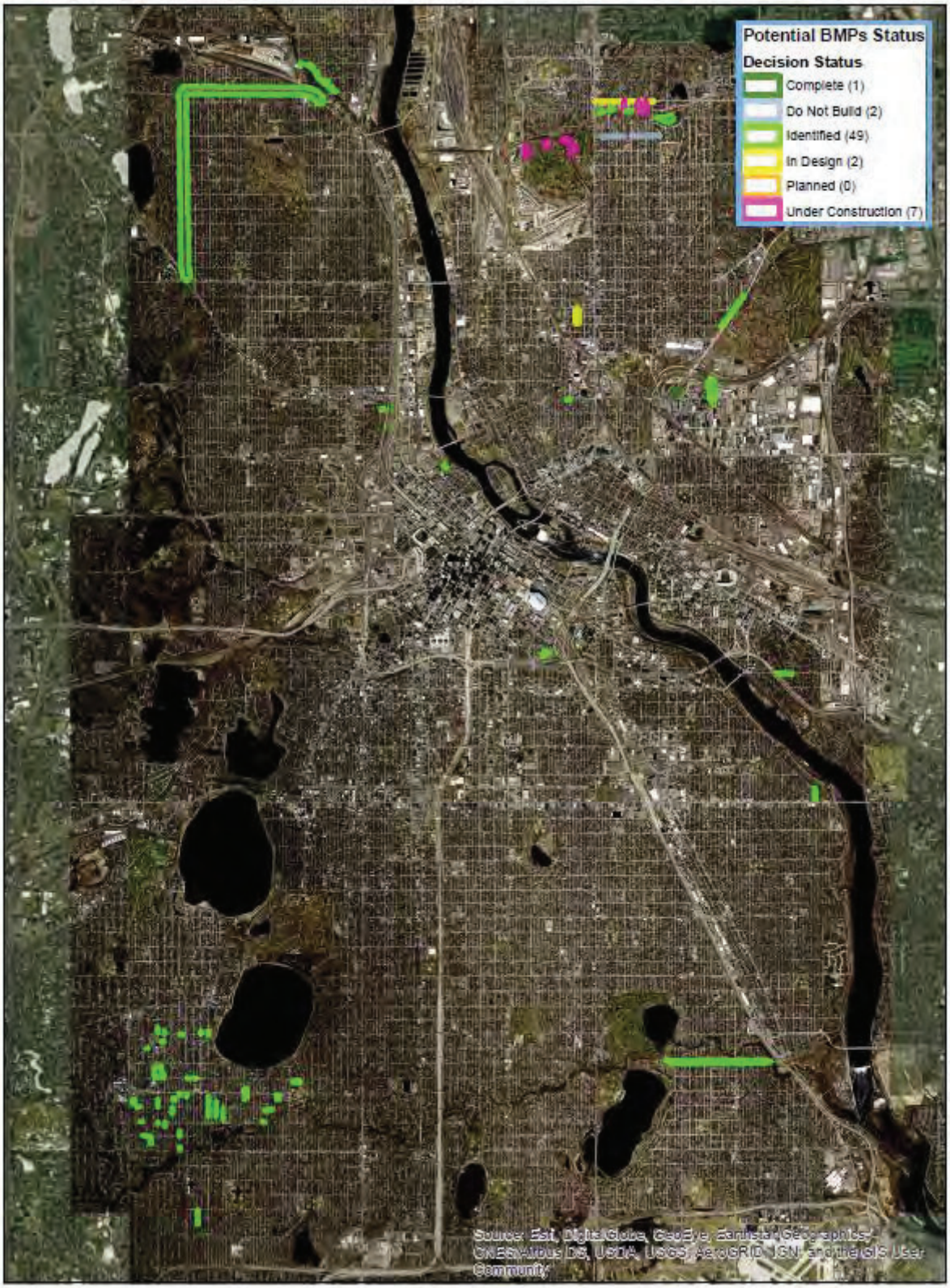
3. **Comprehensive Stormwater Improvement Study**
   Studies are conducted for priority areas to identify feasible stormwater improvement projects. These projects aim to reduce flooding and improve the quality of discharges to surface waters. Studies also consider the condition of existing drainage infrastructure and upcoming street improvement projects.

4. **Stormwater Improvement Projects**
   Favorable projects identified under comprehensive stormwater improvement studies are developed and built. Partnership and funding opportunities with watershed organizations, MPRB, and others will be considered as a part of project development.

Progress maps of Storm system modeling and flood mitigation study areas are available in Appendix B7 and B8.

Planning Tool Map Progress

The city developed a GIS map that compiles the potential stormwater facility opportunities. These opportunities are identified through a variety of sources, most comprehensively through stormwater studies. The GIS tool includes several sets of data including stormwater conveyance system, transportation projects, and the status of pipeshed study areas. The map below shows the status of potential stormwater opportunities.


Potential BMPs Status
Decision Status
Complete (1)
Do Not Build (2)
Identified (49)
In Design (2)
Planned (0)
Under Construction (7)
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

2020 Outfall Inspection Report					
Facility ID	Outfall ID	Location	Date Inspected	Notes	Drains to
441667	70-015	54th St W & Zenith Ave S	10/6/2020	Outfall ok. Concrete outfall slightly scoured at invert. This outfall extends off of 2021 54th St W Resurfacing project.	Minnehaha Creek
441740	70-020	York Ave S Sluiceway	10/6/2020	Facility ID 441740 (Sluice 568809). Outfall ID 70-020. 24"RCP outfall & sluiceway built 1932. Storm drain spills onto spillway to Minnehaha Creek see detail SD-Y-7, repaired by Swr Maint June 1986, foremans bk 263 p.44. Replace 24" outfall & sluiceway. In poor condition, breaking and sinking. There are pits and voids. Residents stopped to tell us how dangerous the sluiceway is and told us to do something about it.	Minnehaha Creek
564316	None	54th St W (btwn York & Xerxes)	10/6/2020	OUTFALL REMOVED. Edina recently reconstructed 54th, and this outfall is no longer there.	Minnehaha Creek
441303	70-025	Xerxes Ave S	10/6/2020	Replace CMP outfall and 15" RCP main. CMP invert is completely worn away for much of the pipe. CMP is offset 13ft upstream.	Minnehaha Creek
441027	70-030	Washburn Ave S (N sluiceway)	10/6/2020	CMP ok, some rust at invert. Replace when replacing sluice. Residents complained about this sluiceway one as well. Not nearly as bad as York, but still needs replacement.	Minnehaha Creek
441304	70-035	Washburn Ave S (S Outfall)	10/6/2020	Actually, 15"PVC. Looks ok. Bank eroding slightly. Rip rap over top of pipe, end broken.	Minnehaha Creek
441081	70-040	Vincent Ave S	10/6/2020	GIS outdated. Pipe is 12"PVC. 4.7ft of PVC is exposed. Looks ok though.	Minnehaha Creek
441305	70-050	99 Forest Dale	10/6/2020	Replace outfall. Bank eroded around RCP. Last stick falling into creek.	Minnehaha Creek
441306	70-055	2707 W 54th St	10/6/2020	Low profile concrete outfall with baffles and "sea wall" built 1982. Good condition.	Minnehaha Creek
441307	70-060	91 Forest Dale	10/6/2020	Low profile flared end, looks good.	Minnehaha Creek
441082	70-065	69 Forest Dale	10/6/2020	Flared end ok. MH is scoured and CFM just upstream is corroding. Replace CFM & MH, will probably have to replace flared end with those.	Minnehaha Creek
441033	70-075	5304 Russell Ave S	10/6/2020	Outfall is PVC. Pipe is in ok condition but is protruding into creek. Could cut back PVC and stabilize bank.	Minnehaha Creek
441308	70-080	Penn Ave S	10/6/2020	Flared end section with sheet piling built 1996. 21"RCP looks good, no need to replace. But not perfect. Flared end fractured, the outlet is far from creek edge. Upstream main looks good. Minnehaha Creek Watershed is planning to enhance this area and replace this with BMP.	Minnehaha Creek

441028	70-085	5225 Morgan Ave S	10/6/2020	Low profile concrete outfall with poured decorative cobbles. Outlet was under water.	Minnehaha Creek
441025	70-090	52nd St W (W Sluiceway)	10/6/2020	18"RCP built 1934 drains to sluiceway. Sluiceway is in terrible shape, voiding at the creek. Voiding concrete at footpath crossing.	Minnehaha Creek
441309	70-100	Morgan Ave S & 51st St W (NW Outfall)	10/6/2020	Looks ok from across creek.	Minnehaha Creek
591254	None	Morgan Ave S & 51st St W (SE Outfall)	10/6/2020	Arch pipe RCP half filled with dirt. Looks ok.	Minnehaha Creek
441310	70-130	James Ave S & 51st St W (N Outfall)	10/6/2020	Cobble concrete low profile outfall. Looks really good.	Minnehaha Creek
559405	Classified "inlet ID"	E Minnehaha Pkwy btwn 16th & 17th Ave S (W Sensor MH)	10/3/2021	Both PVC pipes are filled with dirt. Will that affect performance of the sensor MH?	Minnehaha Creek
441217	70-415	E Minnehaha Pkwy btwn 16th & 17th Ave S (E Sensor MH)	10/3/2020	This outfall and its upstream structures look good. Not double PVC, as recorded in outfall report. Low profile outlet with concrete post baffles.	Minnehaha Creek
None	None	224 W Minnehaha Pkwy	4/28/2020	Remove abandoned outfall in tandem with any adjacent project in the future. Mistakenly identified as FID 441414 in 2018 report. Corroding and crushed CMP, bulkheaded with mortar.	Minnehaha Creek
441414	70-265 (A)	307 W Minnehaha Pkwy	4/28/2020	Looks ok	Minnehaha Creek
441415	70-265 (B)	131 W Minnehaha Pkwy	4/28/2020	Pipes upstream of MH were replaced around 2016. Bank eroding around concrete and cobblestone pad. Flared outfall structure is submerged, but appears to be in working condition. The 36"HDPE (PVC?) transitions to a flared-end at the MH.	Minnehaha Creek
441283	10-560A	E River Pkwy & Huron St SE	10/29/2020		Mississippi River
441706	10-600	Cecil St & E River Pkwy	10/29/2020		Mississippi River
441715	10-640	Lake St E & W River Pkwy	10/30/2020		Mississippi River
441029	10-530	Oak St SE & E River Pkwy	10/30/2020		

Integrated Pest Management (IPM)
Vegetation Management Policy

Goals

- Public safety
- Prevent erosion
- Protect and improve water quality and ecological function
- 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 seed
- Create wildlife habitat
- Provide a neat appearance

Herbicide Policy

Public Works – Surface Water & Sewers Division (PW-SWS) has adopted the Integrated Pest Management (IPM) Policy formulated by the Minneapolis Park and Recreation Board (MPRB) to guide the use of herbicides on public lands under their charge. Herbicide use shall be limited as directed in this document.

Management Guidelines

- Perpetuate the original intent of the species planted. On many sites the original intent was to establish a simplified native grassland community. Plant species were selected for their resilience, habitat value and beauty. These plants shall be managed for their proliferation.

- Control [1] all species listed on the MN Noxious Weed List and comply with the MN Noxious Weed Law.

- Control invasive species in order to prevent Public Works sites from becoming sources of invasive weed seed that can disperse and establish on neighboring properties. An example is Canada thistle, which produces copious amounts of wind-blown seed that can easily become a problem on nearby public and private lands.

- Control aggressive species that if allowed to exist on a site will quickly spread and overwhelm the site. Aggressive native species include but are not limited to Canada goldenrod, sandbar willow and cottonwood. Non-native species include but are not limited to Canada thistle,

[1] **Control means manage or prevent the maturation and spread of propagating parts of noxious weeds from one area to another by a lawful method that does not cause unreasonable adverse effects on the environment.** *MN Noxious Weed Law 2013 MS 18.75-18.91*

crown vetch, bird's-foot trefoil, reed canary grass, *Phragmites australis*, spotted knapweed, smooth brome, sweet clover, purple loosestrife, Siberian elm, buckthorn, and Tartarian honeysuckle.

- Control non-native cattails (hybrid and narrow-leaf). They are common weeds in stormwater treatment facilities that may clog inlet and outlet structures, and they reduce habitat function. They are to be controlled when a threat to structures occurs, primarily by cutting the plant below the water surface. Where this is not feasible, as a last resort wick application of an aquatic-safe herbicide may be warranted, however herbicide application over water shall be avoided where practicable.

- Control fast growing, rank, woody species such as willow, Siberian elm and box elder that can quickly establish and form a thicket around stormwater treatment facilities or can cause a public safety issue.

- Control species that are allelopathic [2]. These include but are not limited to spotted knapweed, garlic mustard, and leafy spurge.

Invasive Plant Management Tools (where feasible, use mechanical means such as pulling and mowing, in order to minimize chemical usage)

- Herbaceous Plantings
    - Pulling (preferred)
    - Mowing (preferred)
        - Flail mowing
        - Spot mowing
    - Herbicide application
        - Spot spraying
        - Wick application
- Woody Plants
    - Pulling (preferred)
    - Cutting with stump application of herbicide

[2] **Allelopathic means to produce a chemical in plant tissue that releases into the soil and prevents the growth of most other species**

INTEGRATED PEST MANAGEMENT – ADAPTED FROM MINNEAPOLIS PARK AND RECREATION BOARD POLICY (Revised July 24, 2008)

Integrated Pest Management (IPM) is a pest management strategy that focuses on long-term prevention or suppression of pest problems with minimum impact on human health, the environment and non-target organisms. In most cases, IPM is directed at controlling pests that have an economic impact on commercial crops; however, in the instance of mosquito control, IPM is used to control nuisance and potentially dangerous mosquito populations. The guiding principles, management techniques and desired outcomes are similar in all cases.

A number of concepts are vital to the development of a specific IPM policy goal:

1. Integrated pest management is not a predetermined set of practices, but a gradual stepwise process for improving pest management.
2. Integrated pest management programs use a combination of approaches, incorporating the judicious application of ecological principles, management techniques, cultural and biological controls, and chemical methods to keep pests below levels where they cause economic damage. (Laws of MN, 1989)
3. Implementing an integrated pest management program requires a thorough understanding of pests, their life histories, their environmental requirements and natural enemies, as well as establishment of a regular, systematic program for surveying pests, their damage and/or other evidence of their presence. When treatments are necessary, the least toxic and most target-specific plant protectants are chosen.

The four basic principles of IPM used in designing a specific program are:

1. Know your key pests
2. Plan ahead
3. Scout regularly
4. Implement management practices

Selection of Management Strategies

Selection of Management Strategies pest management techniques include:

- Encouraging naturally occurring biological control
- Adoption of cultural practices that include cultivating, pruning, fertilizing, maintenance and irrigation practices that reduce pest problems
- Changing the habitat to make it incompatible with pest development
- Using alternate plant species or varieties that resist pests
- Limiting monoculture plantings where possible
- Selecting plant protectants with a lower toxicity to humans or non-target organisms

The criteria used for selecting management options include:

- Minimization of health risk to employees and users
- Minimization of environmental impacts (e.g. water quality, non-target organisms)
- Risk reduction (losses to pests, or nuisance/threshold level)
- Ease with which the technique can be incorporated into existing management approaches
- Cost-effectiveness of the management technique

Posting of Plant Protectant Applications

Comply with the City of Minneapolis ordinance regarding pesticide application (Minneapolis Code of Ordinances Title 11 [Health and Sanitation] Chapter 230 [Pesticide Control])

Recordkeeping

Produce and maintain the necessary records of all pest management activities as required by the Minnesota Department of Agriculture.

Weed Control in Upland Plantings, Shrub Beds and Around Trees

Plants are selected and/or replaced in order to provide disease and insect resistant plantings, thereby reducing plant protectant applications. Weeds listed on the State of Minnesota's Noxious Weed List must be controlled as per state statute, and species will be controlled as listed in Management Guidelines above. Mechanical or manual means of weed control will be tried first when feasible. However, due to global climate change, increasing populations of tap-rooted and other perennial weeds are being transported by birds and other means. Pulling or digging of these weeds is usually not successful. Spot spraying of these tap-rooted weeds with a low toxicity herbicide will help prevent flowering, seeding and further dispersal of these pest weeds. Appropriate mulching of upland plantings, shrub beds and around trees will help decrease the number of pest weeds. If control of annual weeds in pathway or mulched areas is required, the proper pre- or post-emergent low toxicity herbicide will be applied on a spot spray basis. Posting of any plant protectant applications will be carried out according to City ordinance.

Turf Areas

PW-SWS follows the Minneapolis Park and Recreation Board's General Parks and Parkways threshold of 50% for broadleaf and/or grassy weeds in turf areas. When it has been determined that this percentage has been reached or exceeded, the appropriate post emergent or pre-emergent herbicide may be applied, preferably on a spot spray basis. Selection of the appropriate herbicide of choice will be determined by trained staff after evaluating the site, the hazard rating of the product and the specific location.

Future Pest Control Issues

With changes in climate, the environment will be subject to many changes, including the arrival of additional pests within open space areas. Following IPM principles, the City will refer to updates in MPRB policy and practice and will work with the appropriate local, state or national agencies to determine the best control approach for these new pests.

Resolution No. 2019R-400 **City of Minneapolis** **File No. 2019-00899**

Author: Palmisano Committee: Budget Public Hearing: Nov 7, 2019; Dec 4, 2019; Dec 11, 2019

Passage: Dec 11, 2019 Publication: DEC 21 2019

RECORD OF COUNCIL VOTE				
COUNCIL MEMBER	AYE	NAY	ABSTAIN	ABSENT
Bender	X			
Jenkins	X			
Johnson	X			
Gordon	X			
Reich	X			
Fletcher	X			
Cunningham	X			
Ellison	X			
Warsame	X			
Goodman	X			
Cano	X			
Schroeder	X			
Palmisano	X			

MAYOR ACTION

☑ APPROVED ☐ VETOED

MAYOR

DEC 14 2019

DATE

Certified an official action of the City Council

ATTEST:

CITY CLERK

Presented to Mayor: DEC 12 2019 Received from Mayor: DEC 16 2019

Designating the utility rates for water, sewer, stormwater, and solid waste services effective with water meters read on and after January 1, 2020.

Resolved by The City Council of The City of Minneapolis:

Water Rate

Effective with utility billings for water meters read from and after January 1, 2020, and commencing whenever the street valve is turned on for water service, the meter rates for water are hereby fixed and shall be collected as follows:

1. Three dollars and sixty-eight cents ($3.68) per one hundred (100) cubic feet for customers not otherwise mentioned.

2. Three dollars and eighty-three cents ($3.83) per one hundred (100) cubic feet to municipalities, municipal corporations, villages and customers outside the corporate limits of the city where service is furnished through individual customer meters.

3. Rates for municipalities, municipal corporations and villages, which are established by contract, shall continue on the existing contract basis.

4. In addition to the above rates a fixed charge based on meter size will be billed each billing period or fraction thereof as follows:

Meter Size	Fixed Charge
5/8-inch	$5.50
3/4-inch	$8.25
1-inch	$13.75
1 1/2-inch	$27.50
2-inch	$44.00
3-inch	$88.00
4-inch	$137.50
6-inch	$275.00
8-inch	$440.00
10-inch	$632.50
12-inch	$1,815.00

5. The fixed charge for a property serviced by a combined fire/general service line shall be based on the small side register of the combined meter, provided the volume of water used on the large side register does not exceed 45,000 gallons per year. The volume of water used on the large side register in the previous year will be used to establish the fixed rate in the current year.

   The fixed charge for a property serviced by a combined fire/general service line shall be based on the large side register of the combined meter, when volume of water used on the large side register exceeds 45,000 gallons per year. The volume of water used on the large side register in the previous year will be used to establish the fixed rate in the current year.

   The fixed charge for a combined fire/general service line shall remain in place for the entire year.

6. All fire standpipes, supply pipes and automatic sprinkler pipes with detector meters, direct meters or non-metered, shall be assessed according to size of connection at the following rates each per annum for the service and inspection of the fire protection pipes and meters installed, as follows:

Fire Line Pipe Size	Annual Charge
1½ inch pipe connection	$30.00
2-inch pipe connection	$30.00
3-inch pipe connection	$40.00
4-inch pipe connection	$60.00
6-inch pipe connection	$120.00

Fire Line Pipe Size	Annual Charge
8-inch pipe connection	$190.00
10-inch pipe connection	$275.00
12-inch pipe connection	$790.00

When the seal of any of the valves connecting with such fire protection pipes shall be broken, it shall be resealed by authority of the director of the Minneapolis Water Treatment and Distribution Services Division. All connections for fire systems must have a post indicator valve installed at the curb if ordered by the director of the Minneapolis Water Treatment and Distribution Services Division.

Sanitary Sewer Rate

The sanitary sewer rates to be charged for properties within and outside the City of Minneapolis that are served directly by the City of Minneapolis sewer system and that are all served either directly or indirectly by the sewage disposal system constructed, maintained and operated by the Metropolitan Council Environmental Services under and pursuant to Minnesota Statutes Sections 473.517, 473.519 and 473.521, Sub. 2, from and after January 1, 2020, are hereby set as follows:

1. The sanitary sewer rate applicable inside the City of Minneapolis is four dollars and fifty-four cents ($4.54) per one hundred (100) cubic feet.

2. In addition, a fixed charge based on water meter size will be billed each billing period or fraction thereof as follows:

Meter Size	Fixed Charge
5/8-inch	$6.30
3/4-inch	$9.45
1-inch	$15.75
1 1/2-inch	$31.50
2-inch	$50.40
3-inch	$100.80
4-inch	$157.50
6-inch	$315.00
8-inch	$504.00
10-inch	$724.50
12-inch	$2,079.00

3. The sanitary sewer rate applicable outside the City of Minneapolis for all sewage flow generated is four dollars and fifty-four cents ($4.54) per one hundred (100) cubic feet when the City of Minneapolis also provides water. In addition, the fixed charge sanitary sewer rate shall be based on meter size per section (b).

4. Sanitary sewer only service outside the City of Minneapolis shall be thirty-three dollars and fifty-four cents ($33.54) per month.

5. The sanitary sewer charge for residential property not exceeding three (3) residential units shall be based on the volume of water used during the winter season which is defined as a four (4) month period between November 1 and March 31.

6. The sanitary sewer charge for residential property exceeding three (3) residential units and all other commercial and industrial property shall be based on measured sewage volume or the total water volume used during the billing period as is appropriate.

Stormwater Rate

The stormwater rate, subject to the provisions in Chapter 510, of the Minneapolis Code of Ordinances, is imposed on each and every Single-Family Residential Developed Property, Other Residential Developed Property, Non-Residential Developed Property, and Vacant Property, other than Exempt Property, and the owner and non-owner users, from and after January 1, 2020, and is hereby set as follows:

1. The Equivalent Stormwater Unit (ESU) rate is thirteen dollars and forty-two cents ($13.42). The ESU measurement is 1,530 square feet of impervious area.

2. The stormwater rate imposed on Single-Family Residential Developed Properties shall be categorized into three tiers based on the estimated amount of impervious area as follows:

   High – Single-Family Residential Developed Property – greater than one thousand five hundred and seventy-eight (1,578) square feet of estimated impervious area. The ESU shall be 1.25 and the stormwater rate set at sixteen dollars and seventy-eight cents ($16.78).

   Medium – Single-Family Residential Developed Property – equal to or greater than one thousand four hundred and eighty-five (1,485) square feet and less than or equal to one thousand five hundred and seventy-eight (1,578) square feet of estimated impervious area. The ESU shall be 1.00 and the stormwater rate set thirteen dollars and forty-two cents ($13.42).

   Low – Single-Family Residential Developed Property – less than one thousand four hundred and eighty-five (1,485) square feet of estimated impervious area. The ESU shall be .75 and the stormwater rate set at ten dollars and seven cents ($10.07).

3. Stormwater charges for all other properties will be based on the following calculation:

   (Gross Lot Size in sq.ft. X Runoff Coefficient) ÷ 1,530 sq. ft.= # of ESU

   # of ESU X $ 13.42 = Monthly Fee

The runoff coefficient assumed for each land use category is shown below.

Land Use	Coefficient Applied
Bar-Restaurant-Entertainment	.75
Car Sales Lot	.95
Cemetery w/Monuments	.20
Central Business District	1.00
Common Area	.20
Garage or Misc. Res.	.55
Group Residence	.75

Land Use	Coefficient Applied
Ind. Warehouse-Factory	.90
Industrial railway	.85
Institution-Sch.-Church	.90
Misc. Commercial	.90
Mixed Comm.-Res-Apt	.75
Multi-Family Apartment	.75
Multi-Family Residential	.40
Office	.91
Parks & Playgrounds	.20
Public Accommodations	.91
Retail	.91
Single Family Attached	.75
Single Family Detached	ESU
Sport or Rec. Facility	.60
Utility	.90
Vacant Land Use	.20
Vehicle Related Use	.90

Solid Waste Rate

The solid waste and recycling charges associated with water meter read dates from and after January 1, 2020, shall be as follows:

1. The base unit charge shall be twenty-five dollars and eight cents ($25.08) per dwelling unit per month.

2. The cart disposal charge shall be two dollars ($2.00) per month for each small cart.

3. The cart disposal charge shall be five dollars ($5.00) per month for each large cart assigned to a dwelling unit.

Minneapolis Stormwater Utility Fee FAQ

What is Stormwater?

Stormwater is runoff from a rainstorm or melting snow. City landscapes - unlike forests, wetlands, and grasslands that trap water and allow it to filter slowly into the ground - contain great areas of impermeable asphalt and concrete surfaces that prevent water from seeping into the ground. Because of this, large amounts of water accumulate above the surface. This water will run off before eventually entering into our lakes, rivers and streams.

Why is it important to manage stormwater?

Minneapolis, like other communities, needs to manage stormwater to protect people's homes and properties, the environment, lakes, streams & rivers. If this is not done, stormwater will cause flooding, erosion and pollution. Heavy rains that flood streets and yards can result in property damage. Stormwater runoff also picks up pollutants and debris from streets, parking lots & yards, carrying them into our lakes, rivers and streams.

What is the stormwater utility fee on my bill?

The stormwater utility fee pays for the City's current stormwater system and annual maintenance costs. This helps to prevent and correct stormwater runoff problems in Minneapolis. All properties within City limits (with very limited exceptions) are charged a monthly stormwater utility fee. This fee had existed prior to 2005, but was included as part of the combined sanitary sewer/stormwater fee.

Because the stormwater utility fee is a user fee and not a tax, all properties regardless of ownership are required to pay for the services provided by the Minneapolis stormwater management system. This includes non-profit entities such as churches, schools and institutions, as well as properties owned by the City of Minneapolis, the State of Minnesota, and the federal government.

How is the stormwater fee calculated?

The stormwater utility fee is based on impervious area and is charged on a per unit basis. Each ESU (**E**quivalent **S**tormwater **U**nit) is 1,530 square feet of impervious area on a property. The impervious area is calculated based on the size of the property, as well as the current use. Single family properties are billed using one of the following rates:

High	1.25 ESU	$17.03
Medium	1.00 ESU	$13.62
Low	.75 ESU	$10.22

All other properties are billed as follows: Gross Lot Size in square ft. X Runoff Coefficient (based on Land Use class) divided by 1,530 square ft = # of ESU's.

What is impervious area?

Surfaces where water can not flow through freely. Examples of impervious surfaces include, but are not limited to the following:

- House footprints
- Driveways
- Parking Lots
- Sidewalks
- Patios
- Decks
- Detached garages
- Sheds
- Concrete air conditioner pads
- Brick pavers

It also includes all non-improved (vegetated or grass cover) areas that are used for parking storage or are driven upon. In an urban environment such as Minneapolis, a property's impervious area is the most significant factor affecting both stormwater quality and quantity.

Is there a way to reduce my stormwater fee?

Yes. Stormwater fees can be reduced through the City of Minneapolis Stormwater Credits Program. The credits program offers a reduction in fees to property owners who use approved methods to manage stormwater runoff on their property. Fees can also be reduced through the replacement of excess impervious area (such as unused parking lots) with landscaped green space.

How does the City's Stormwater Credits Program encourage helpful environmental practices?

The stormwater fee incorporates opportunities for property owners to reduce their stormwater bill by taking environmentally friendly steps. Stormwater utility fee reductions, also called credits, are available to those who are using or installing stormwater management tools/practices on their properties. Installing rain gardens or other materials, such as impervious pavers, allows stormwater to soak into the ground, rather than run into storm sewers.

How can I get a stormwater credit on my utility bill?

Credit guidelines and application forms can be found on the on the City of Minneapolis Stormwater Fee website . If you need additional information, please contact (612) 673-2965.

Last updated Mar 3, 2015

2020 CU YDs removed from Grit Chambers			
Grit Chamber ID	Location	Volume Of Sediment Removed	Date Maintained / Inspected
GC 1	UPTON AVE N & 53RD AVE N	1	3/18/2020
GC 2	RUSSELL AVE N & 53RD AVE N	1	4/21/2020
GC 3	SHERIDAN AVE N, N OF 52ND AVE N	2	4/21/2020
GC 4	RUSSELL AVE N NORTH OF 52ND AVE N	1	3/18/2020
GC 5	PENN AVE N & 52ND AVE SO OF CREEK IN STREET	1	3/18/2020
GC 6	PENN AVE N & 52ND AVE NO OF CREEK IN GRASS	1	4/22/2020
GC 7	OLIVER AVE N & 52ND AVE N	1	4/22/2020
GC 8	NEWTON AVE N & SHINGLE CREEK	1	4/22/2020
GC 9	OLIVER AVE N & 51ST AVE N	1	4/22/2020
GC 10	MORGAN AVE N & 51ST AVE N	1	4/24/2020
GC 11	KNOX AVE N & 51ST AVE N	5	9/17/2020
GC 12	IRVING AVE N & 50TH AVE N	3	8/14/2020
GC 13	IRVING AVE N & 50TH AVE N	1	5/6/2020
GC 14	JAMES AVE N NORTH OF 49TH AVE N	1	4/24/2020
GC 15	21ST AVE N & 1ST ST N	NA	3/17/2021
GC 16	XERXES AVE N & 14TH AVE N	14	7/28/2020
GC 16	XERXES AVE N & 14TH AVE N	20	7/31/2020
GC 16	XERXES AVE N & 14TH AVE N	25	7/29/2020
GC 16	XERXES AVE N & 14TH AVE N	10	7/27/2020
GC 16	XERXES AVE N & 14TH AVE N	18	7/30/2020
GC 17	XERXES AVE N & GLENWOOD AVE	4	6/2/2020
GC 18	MORGAN AVE N & CHESTNUT AVE	4	5/6/2020
GC 19	GIRARD AVE N & CURRIE AVE N	3	7/2/2020
GC 19	GIRARD AVE N & CURRIE AVE N	2	7/2/2020
GC 19	GIRARD AVE N & CURRIE AVE N	8	8/25/2020
GC 21	LAKE OF THE ISLES PKWY & LOGAN AVE	12	6/17/2020
GC 22	W 22ND ST & JAMES AVE S	5	4/8/2020
GC 24	DREW AVE S & W LAKE ST	6	5/20/2020
GC 26	W LAKE ST & ALDRICH AVE S	3	8/6/2020
GC 27	W 32ND ST & BRYANT AVE S	5	7/28/2020
GC 28	W 33RD ST & HOLMES AVE S	6	6/18/2020
GC 29	W 33RD ST & GIRARD AVE S	8	6/18/2020
GC 30	YORK AVE S & W LAKE CALHOUN PKWY	1	5/11/2020
GC 31	CHOWEN AVE S & W 41ST ST	11	7/30/2020
GC 32	E 42ND ST & BLOOMINGTON AVE S (south)	2	11/12/2020
GC 32	E 42ND ST & BLOOMINGTON AVE S (North)	0.5	11/12/2020
GC 32	E 42ND ST & BLOOMINGTON AVE S (south)	4	12/2/2020
GC 33	43RD ST & PARK AVE S	NA	3/17/2020

GC 35	E 44TH ST & OAKLAND AVE S	2	4/20/2020
GC 36	E 46TH ST. & 31ST AVE S	3	6/4/2020
GC 38	W 47TH ST & YORK AVE S	1.5	6/1/2020
GC 38	W 47TH ST & YORK AVE S	0.25	4/29/2020
GC 39	W 47TH ST & WASHBURN AVE S	NA	3/17/2020
GC 42	QUEEN AVE S & LAKE HARRIET PKWY	6	9/2/2020
GC 42	QUEEN AVE S & LAKE HARRIET PKWY	8	9/1/2020
GC 42	QUEEN AVE S & LAKE HARRIET PKWY	6	9/1/2020
GC 42	QUEEN AVE S & LAKE HARRIET PKWY	6	9/1/2020
GC 43	16TH AVE S & E MINNEHAHA PKWY	6	6/23/2020
GC 44	SHERIDAN AVE S & W 50TH ST	4	6/12/2020
GC 45	JAMES AVE S & MINNEHAHA CREEK	8	8/5/2020
GC 46	MORGAN AVE S & W 53RD ST	17	7/23/2020
GC 47	E 55TH ST & PORTLAND AVE S	2	5/12/2020
GC 48	E 56TH ST & PORTLAND AVE S	3	5/12/2020
GC 49	E 57TH ST & PORTLAND AVE S	2	5/13/2020
GC 50	E 58TH ST & PORTLAND AVE S	4	6/15/2020
GC 51	GIRARD AVE S BETWEEN W 59TH ST & W 60TH ST	3	4/6/2020
GC 52	E 59TH ST & 12TH AVE S	4	6/3/2020
GC 52	E 59TH ST & 12TH AVE S	4	6/4/2020
GC 53	GIRARD AVE S & W 60TH ST	NA	3/17/2020
GC 55	GRASS LAKE TERRACE BETWEEN GIRARD & JAMES	5	9/28/2020
GC 56	GRASS LAKE SERVICE ROAD BEHIND #6035 JAMES AVE S		3/17/2020
GC 57	GRASS LAKE SERVICE ROAD BEHIND #6077 JAMES AVE S	0.5	4/1/2020
GC 58	GRASS LAKE SERVICE ROAD BEHIND #1416 W 61ST ST	0.5	3/31/2020
GC 59	W 61ST ST & GRASS LAKE SERVICE ROAD	0.5	3/31/2020
GC 61	E RIVER ROAD & CECIL ST	15.5	6/18/2020
GC 62	HIAWATHA PARK REFECTORY TURN-A-ROUND	1.5	5/27/2020
GC 63	33RD AVE N & 1ST ST N/RAILROAD TRACKS	1	6/4/2020
GC 64	NORTH TRANSFER STATION	1.5	6/5/2020
GC 65	SOUTH TRANSFER STATION	3	6/16/2020
GC 66	MAPLE PLACE & EAST ISLAND	1	6/8/2020
GC 67	DELASALLE DRIVE & EAST ISLAND	2	6/8/2020
GC 68	W ISLAND - 300' S OF MAPLE PLACE	NA	5/13/2020
GC 69	EASTMAN AVE & W ISLAND	2	6/8/2020
GC 70	ROYALSTON & 5TH AVE N	1	6/3/2020
GC 73	4552 KNOX AVE N (IN ALLEY BEHIND)	NA	3/17/2020
GC 76	MARKET PLAZA & EXCELSIOR BLVD	20	7/16/2020
GC 78	SHINGLE CREEK WETLAND - WEST SIDE	3	4/28/2020
GC 79	SHINGLE CREEK WETLAND - EAST SIDE	3	5/15/2020
GC 80	WOODLAWN BLVD & E 50TH ST	4	6/5/2020
GC 81	WOODLAWN BLVD & E 53RD ST	6	1/10/2020
GC 82	12TH AVE S & POWDERHORN TERRACE	NA	1/3/2020
GC 83	13TH AVE S & POWDERHORN TERRACE	3	1/3/2020
GC 84	3421 15TH AVE S (180' W OF CL)	4	1/7/2020
GC 85	3329 14TH AVE S	1	1/9/2020
GC 86	13TH AVE S & E 35TH ST	NA	1/3/2020
GC 87	3318 10TH AVE S	2	1/10/2020
GC 88	ACROSS THE STREET FROM 702, NO. BD. VAN WHITE BLVD.	0.5	5/19/2020
GC 89	ACROSS THE STREET FROM 706, NO. BD. VAN WHITE BLVD.	0.5	5/19/2020
GC 90	10TH AVE. NO. & ALDRICH AVE. NO. (S.W.C.)	0.13	4/14/2020
GC 91	SO. BD. VAN WHITE BLVD., 200' SO. OF 8TH AVE. NO	1	4/14/2020

GC 92	ACROSS THE STREET FROM 701, SO. BD. VAN WHITE BLVD	0.13	4/14/2020
GC 93	SO. BD. VAN WHITE BLVD, 250' SO. OF 10TH AVE. NO.	2	4/14/2020
GC 94	10TH AVE. NO. & NO. BD. VAN WHITE BLVD. (S.W.C.)	0.13	4/14/2020
GC 95	WEST SIDE OF ALDRICH AVE. NO. & 9TH AVE. NO.	3	5/1/2020
GC 96	8TH AVE. NO. & NO. BD. VAN WHITE BLVD. (N.E.C.)	0.13	4/14/2020
GC 96	8TH AVE. NO. & NO. BD. VAN WHITE BLVD. (N.E.C.)	3	1/16/2020
GC 97	29TH AVE. & LOGAN AVE. - NO. STORM WATER DET. POND (E & W)	4	5/12/2020
GC 97	29TH AVE. & LOGAN AVE. - NO. STORM WATER DET. POND (E & W)	5	5/8/2020
GC 97	29TH AVE. & LOGAN AVE. - NO. STORM WATER DET. POND (E & W)	3	5/8/2020
GC 98	MALMQUIST LANE & HUMBOLDT NO.	1	6/11/2020
GC 99	SHINGLE CREEK DR. & HUMBOLDT NO.	2	8/4/2020
GC 100	SO. OF 49TH AVE. NO. & HUMBOLDT NO.	2	5/19/2020
GC 101	NO. OF 49TH AVE. NO. & HUMBOLDT NO.	2	6/25/2020
GC 108	COLUMBUS AVE POND (3708 IN ALLEY)	1	5/13/2020
GC 109	22ND AVE. NO. & W. RIVER RD.	1.5	5/11/2020
GC 110	W. CALHOUN PARKWAY (approx. 100' no. of richfield rd./e. blvd)	3	4/23/2020
GC 111	RICHFIELD RD. (near w. corner of pkg. lot no. of wm berry pkwy)	1.25	4/21/2020
GC 112	W. 36TH ST. (30' w. of e. calhoun pkwy.	4	4/22/2020
GC 113	20' EAST OF VAN WHITE MEM. BLVD (N.B.) AND 5TH AVE N	3	4/17/2020
GC 114	DUPONT AVE N AND 4TH AVE N	3	4/14/2020
GC 115	VAN WHITE MEM. BLVD (S.B.) AND 4TH AVE N	3	4/23/2020
GC 115	VAN WHITE MEM. BLVD (S.B.) AND 4TH AVE N	1	4/15/2020
GC 116	400' NORTH VAN WHITE MEM. BLVD (S.B.) AND 4TH AVE N	NA	3/17/2020
GC 117	(W SIDE) OF VAN WHITE MEM. BLVD (S.B.) AND 5TH AVE N	NA	3/17/2020
GC 118	VAN WHITE MEM. BLVD (S.B.) AND 10TH AVE N	2	4/20/2020
GC 119	11TH AVE N AND VAN WHITE MEM. BLVD (N.B.)	1	4/20/2020
GC 120	VAN WHITE MEM. BLVD (S.B.)	1	4/17/2020
GC 121	VAN WHITE MEM. BLVD (S.B.) AND FREMONT AVE N	3	4/15/2020
GC 128	W. 27TH ST AND LAKE OF THE ISLES PKWY - no as-builts	2	5/14/2020
GC 134	W 22ND ST @ E LAKE OF THE ISLES BLVD, no as-builts	10	5/19/2020
GC 134	W 22ND ST @ E LAKE OF THE ISLES BLVD, no as-builts	15	5/15/2020
GC 137	W 44TH ST & W LAKE HARRIET PKWY EAST	10	6/2/2020
GC 138	EWING AVE S BETWEEN W. FRANKLIN AVE AND W 22ND ST	0.25	6/16/2020
GC 139	EWING AVE S @ W FRANKLIN AVE	2	8/11/2020
GC 140	E LAKE ST WEST OF 14TH AVE S	3.5	8/26/2020
GC 141	E LAKE ST EAST OF 14TH AVE S	2.5	10/1/2020
GC 142	18TH AVE S SOUTH OF E LAKE ST	2.5	8/25/2020
GC 143	LONGFELLOW AVE S SOUTH OF E LAKE ST	2	8/21/2020
GC 144	31ST AVE S NORTH OF E LAKE ST	2	9/16/2020
GC 145	CEDAR AVE S AND E MINNEHAHA PARKWAY	6	6/25/2020
GC 146	4522 LAKE ST. (HENN CO)	NA	8/19/2020
GC 147	4610 LAKE ST. (HENN CO)	1.5	9/17/2020
GC 148	42ND LAKE ST. (HENN CO)	2.5	8/27/2020
GC 149	W 44TH ST AND ALDRICH AVE S (SWC)	3	4/14/2020
GC 150	W. RIVER ROAD & 23RD AVE. N., no as-builts	1.5	5/11/2020
GC 151	DIAMOND LAKE ROAD & CLINTON AVE SO.	0	7/20/2020
GC 152	3RD AVE S & 2ND ST S	2	4/15/2020
GC 154	W LAKE ST AND DUPONT AVE S (east of east curbline)	3	3/18/2020
GC 155	PLEASANT AVE S AND LAKE ST (south of south curbline)	0.5	4/1/2020
GC 156	W. 43RD ST & EAST LAKE HARRIET PARKWAY	4.5	5/21/2020
GC 158	E. 61ST ST. & COLUMBUS AVE. S.	5	4/9/2020
GC 160	2nd AVE N & 6th ST N (target Center Private)	NA	3/17/2020

GC 161	3rd Ave N & Washington Ave N.	0.5	4/14/2020
GC 162	DOWLING AVE N & OLIVER AVE N	NA	3/17/2020
GC 163	PLYMOUTH AVE N (westside of River)	1	4/13/2020
GC 164	PLYMOUTH AVE N (eastside of River)	1	4/13/2020
GC 165	WASHINGTON AVE N & 14TH AVE N	1	4/10/2020
GC 166	THOMAS AVE S & DEAN PARKWAY (to Kenilworth lagoon)	4	4/24/2020
GC 168	Dowling ave N between Newton ave and Morgan Ave N	4	12/29/2020
GC 169	DOWLING AVE N & between Oliver ave and Newton Ave N	3	12/22/2020
GC 170	170 DOWLING AVE N @ Oliver Ave N	4	12/23/2020
GC 170	170 DOWLING AVE N @ Oliver Ave N	1	4/10/2020
GC 171	NEWTON AVE N @ DOWLING AVE N sump MH	NA	3/17/2020
GC 172	25TH AVE SE between U of M TRANSIT WAY AND 6TH ST	1.5	9/25/2020
GC 172	25TH AVE SE between U of M TRANSIT WAY AND 6TH ST	3	9/28/2020
GC 175	2707 W. 54TH St. S. CDS Unit	2	6/11/2020
GC 176	16th Ave S and 6th St S (North Side @ 6th St.)	0.25	6/15/2020
GC 177	16th Ave S and 6th St S (North Side Midblock)	0.25	6/15/2020
GC 178	16th Ave S and 6th St S (North Side @ RR Tracks)	0.25	6/15/2020
GC 179	16th Ave S and 6th St S (South Side @ 6th St.)	0.25	6/15/2020
GC 180	16th Ave S and 6th St S (South Side Midblock)	0.25	6/15/2020
GC 181	16th Ave S and 6th St S (South Side @ RR Tracks)	0.25	6/15/2020
GC 185	Van White Bridge @ Bassett Creek	2	5/14/2020
	Total volume removed (CU. YDs)	**531**	

NPDES Report - Appendix A12

Stormwater Monitoring Results and Data Analysis

Lake Monitoring

In 2020, MPRB scientists monitored 12 of the city's most heavily used lakes. The data collected were used to calculate a Trophic State Index (TSI) score for each of the lakes. Lower TSI scores indicate high water clarity, low levels of algae in the water column, and/or low phosphorus concentrations. Changes in lake water quality can be tracked by looking for trends in TSI scores over time. In **Table 1** and **Figure 1** TSI trends for Minneapolis lakes from 1991 to 2020 are shown, and in **Table 2** the trend in TSI is shown for Minneapolis lakes for the most recent ten years. A negative slope indicates improving water quality, while a positive slope indicates declining water quality.

These values are especially important for monitoring long-term trends (10+ years). Historical trends in TSI scores are used by lake managers to assess improvement or degradation in water quality. Trends are also used by the Minnesota Pollution Control Agency to assess non-degradation goals.

Most of the lakes in Minneapolis fall into either the mesotrophic or eutrophic category. Bde Maka Ska, Harriet, and Wirth are mesotrophic with moderately clear water and some algae. Brownie, Cedar, Hiawatha, Isles, Loring, and Nokomis are eutrophic with higher amounts of algae. Powderhorn Lake is hypereutrophic with high nutrient concentrations and the potential for severe algal blooms. Spring Lake was also classified as hypereutrophic in 2019 but was not sampled in 2020. Scores for Diamond and Grass Lake are not included since these lakes are too shallow to calculate the Secchi portion of the TSI index.

Table 1. Water quality trends in Minneapolis lakes from 1991-2020.

Lakes with Improving Water Quality Indicators	Lakes with Stable Trends	Lakes with Declining Water Quality Indicators
Bde Maka Ska	Brownie Lake	No lakes with declining trend
Wirth Lake	Cedar Lake	
	Lake Harriet	
	Lake Hiawatha	
	Lake of the Isles	
	Loring Pond	
	Lake Nokomis	
	Powderhorn Lake	
	Spring Lake	

Table 2. Water quality trends in Minneapolis lakes from 2011-2020.

Lakes with Improving Water Quality Indicators	Lakes with Stable Trends	Lakes with Declining Water Quality Indicators
No lakes with improving trend	Bde Maka Ska	Cedar Lake
	Brownie Lake	
	Cedar Lake	
	Lake Harriet	
	Lake Hiawatha	
	Lake of the Isles	
	Loring Pond	
	Lake Nokomis	
	Powderhorn Lake	
	Spring Lake	
	Wirth Lake	

Most of the Minneapolis lakes have no directional trend in water quality indicators when all years of data are taken into consideration, as shown in **Table 1**. Most of the major water quality improvement projects done in the lake's watersheds were completed by the early 2000's. Chemical treatments, like alum, have a life span after which water quality and TSI reflects the new internal and external loading regime of the watershed.

There was significant improvement in water quality indicators in Bde Maka Ska after watershed projects were built and the lake was treated with alum (linear regression, $p < 0.05$). TSI scores after 2006 have stabilized. TSI scores at Bde Maka Ska between 2017 and 2020 were higher than the previous few years due to higher chlorophyll-*a* and total phosphorus concentrations but were still below the early 1990s scores.

The water quality in Brownie Lake has been relatively stable, with no significant trend since 1993. Brownie Lake is monitored every other year and was monitored in 2020. There were no Clean Water Partnership projects in the Brownie Lake watershed. Significant amounts of redevelopment projects have reduced the external load to this lake. The lake is meromictic and highly enriched bottom waters may control water quality at this lake.

Cedar Lake showed improvement following restoration efforts through the late 1990s, particularly after chemical treatment with alum. Since the end of alum effectiveness, estimated as 7-10 years post-treatment, TSI scores gradually increased. When looking at the last ten years of TSI scores for Cedar Lake there is an increasing trend in TSI. Cedar Lake TSI scores between 2017 and 2020 have been the highest they have been since the early 1990s due to higher chlorophyll-*a* concentrations and lower Secchi depths. Increased frequency in algae blooms potentially connected to increased external loading due to high rainfall may partially explain this change.

Diamond Lake and Grass Lake are not included in this analysis, since TSI scores are only appropriate for deeper lake systems and these lakes are too shallow to measure Secchi depth. Except right after storms, the Secchi disk is clearly visible when sitting on the bottom of these two wetlands.

Lake Harriet experienced a few years with very clear water and low TSI scores following a littoral alum treatment in the mid-2000s. TSI scores remained relatively stable for several years since that time. Low TSI scores and very clear water occurred again in 2016 and 2020. The recent TSI trend in Lake Harriet was not significant in 2020 (linear regression, $p > 0.05$).

Water quality at Lake Hiawatha is heavily influenced by the inflow from Minnehaha Creek. The lake has poorer water quality during drought years, and better water quality in years with high flow from Minnehaha Creek. Several years of very high precipitation have led to low TSI scores recently compared to drier years in the 2000's.

The water quality in Lake of the Isles fluctuates with no time dependent trend. Higher TSI scores occurred between 2017 and 2020 compared to the previous few years due to increased chlorophyll-*a* concentrations. Even after an alum treatment and watershed intervention, there was no significant water quality trend in any direction since 1991 (linear regression, $p > 0.05$). External loading in this waterbody likely exceeded any benefit of internal load reduction.

Water quality in Loring Pond fluctuates. The TSI scores at Loring Pond in 2019 and 2020 were higher than previous years due to higher chlorophyll-*a* concentrations. Extensive duckweed growth, and augmentation with groundwater effect clarity and nutrient concentrations at this shallow lake.

Immediately following a biomanipulation project in 2010, Lake Nokomis had improvement in water quality; however, with higher algal concentrations in recent years, TSI scores have stabilized and there is no statistically significant trend (linear regression, $p > 0.05$).

Powderhorn Lake has experienced a wide variation in water quality. The lake was placed on the 303d list for exceeding nutrient standards, was removed, and then re-listed after water quality declined. The worst measured TSI scores at this lake occurred in the late 1990s and the best scores in the late 2000s when the lake met standards for several years. Powderhorn had poor water quality again from 2013 -2017, and again in 2020, with blue green algae blooms leading to low water clarity. TSI scores were lower in 2018 and 2019 because severe algal blooms did not occur, and chlorophyll-*a* concentrations were lower.

Water quality in Spring Lake is variable, but there is no significant trend in any direction since 1994. Spring Lake is monitored every other year and was not monitored in 2020. The TSI score increased in 2019 due to higher chlorophyll-*a* and total phosphorus concentrations. Spring Lake is a highly nutrient-enriched and chemically stratified lake that is unlikely to respond to nutrient load reduction.

Water quality improvement at Wirth Lake has been occurring since 1992, going from a eutrophic system dominated by algal growth to a moderately clear mesotrophic system (linear regression, $p < 0.05$). The lake was delisted from the 303d list based on meeting standards for secchi, chlorophyll, and phosphorus. TSI scores at Wirth Lake between 2017 and 2019 were slightly above the previous few years due to increased chlorophyll-*a* and total phosphorus concentrations but improved again in 2020.

There are no lakes in Minneapolis with water quality indicators worse than conditions in the early 1990s. Recent higher TSI scores in some lakes may be connected to several years of record precipitation leading to increases in external nutrient.

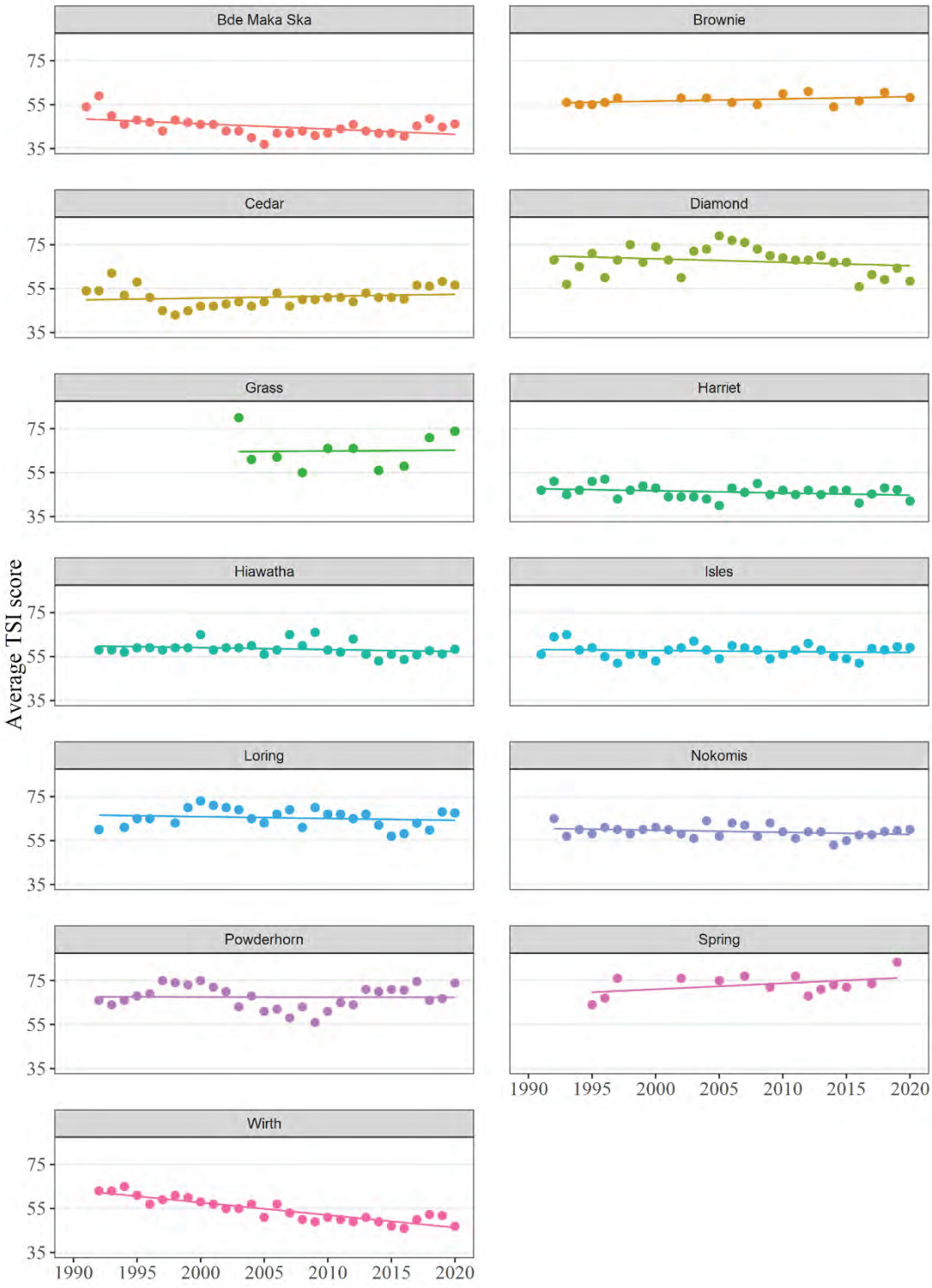

Bde Maka Ska
Brownie
Cedar
Diamond
Grass
Harriet
Hiawatha
Isles
Loring
Nokomis
Powderhorn
Spring
Wirth
Average TSI score
75
55
35
1990
1995
2000
2005
2010
2015
2020

Figure 1. TSI scores and regression analysis for selected Minneapolis lakes 1991–2020. Lower TSI scores indicate high water clarity, low levels of algae in the water column, and/or low phosphorus concentrations. A negative slope indicates improving water quality, while a positive slope indicates declining water quality. Only Bde Maka Ska and Wirth have statistically significant trends (p <0.05)

Pond Screening and Monitoring

BACKGROUND

In 2020, the COVID-19 pandemic disrupted the ability to carry out field-based work and equipment installations. Due to social distancing guidelines, a pond screening study was designed for the NPDES stormwater monitoring program. In 2020 the City of Minneapolis conducted a stormwater pond study that included chemical monitoring, bathymetric surveys, and oxygen/temperature water column profiles. A Minneapolis Park and Recreation Board (MPRB) pond screening study was carried out to augment the data collected for the Minneapolis screening study.

The purpose of the screening study was to determine if any of a group of 16 existing ponds should be prioritized for retrofit projects that would increase their nutrient removal benefit. Most of the 16 ponds were designed originally for flood control. Ponds could be prioritized for projects if they had a high potential of Harmful Algal Blooms (HABs), evidence of high phosphorus return from the sediment, or evidence of sediment resuspension. For screening purposes, Chl-a was considered an indicator of moderate or greater likelihood for HABs presence when the Chl-*a* concentration was greater than 30 ug/L (Heiskary and Lindon, 2009). HABs in neighborhood ponds could be a potential health hazard. High total phosphorus values in pond water could be caused by anoxic conditions due to sediment-bound phosphorus being released to the water column. Ponds with high phosphorus may prioritized for dredging or other retrofit to gain a water quality benefit for downstream water bodies. Sediment resuspension or bioturbation in a pond could be potentially determined by high TSS, VSS, or metals values. Resuspension of sediment may indicate that the pond could be retrofit or maintained differently for increased water quality benefit.

There is also a desire in the City of Minneapolis for ponds to be greenspace or habitat. Chloride content above the Minnesota Pollution Control Agency (MPCA) 5-day chronic threshold of 230 mg/L can impair aquatic life and is an indication that a pond would be poor habitat. The Canadian Environmental Quality Guidelines have a stricter chronic chloride concentration threshold of 120 mg/L which is used to protect sensitive species (Canadian Environmental Quality Guidelines, Canadian Council of Minister of the Environment, 2011). If pond chloride concentrations were below the MPCA chronic threshold, the pond could be considered as potentially suitable aquatic habitat. If chloride values were measured below the Canadian standard, pond habitat could be considered good for aquatic life.

The MPRB study screened stormwater ponds during dry conditions, that is not directly after a rain event. Data could then be used to decide which watersheds and ponds to maintain, retrofit to improve their pollutant removal performance, and potentially prioritize as wildlife habitat.

The MPRB monitored a total of 16 ponds, **Table 23-1**. The ponds are listed in the order that they were sampled. All the ponds had a grab sample taken once a month and samples were analyzed for

Chl-*a*, chloride (Cl), and total phosphorus (TP). Six of the ponds had grab samples taken every two weeks and had the NPDES chemistry suite analyzed along with Chl-*a*, Cl, and TP. **Figure 23-1** shows the location of each pond in the City of Minneapolis. The NPDES chemical methods, reporting limits, and holding times are presented in **Table 23-2**.

Table 23-1. Pond names, construction date, watershed area, majority land use, and year last dredged.

Pond Number	Pond Name	Construction Date	Watershed Area (acres)	Predominant Land Use	Last Dredged
1	Mead Pond*	2000	223	Right of Way/Industrial	Never
2	MPRB Hiawatha Outlet Pond E*	NA	206	Golf Course	2012-2013
3	West, Park & 44th*	2002	109	Parkland	Never
4	Columbus Wet*	2004	56	Singe Family/Duplex	2014
5	Logan Pond*	2003	103	Singe Family/Duplex	2017
6	Camden Pond*	NA	235	Parkland	Never
7	East, Park Ave & 43rd	2002	14	Singe Family/Duplex	Never
8	25th Ave NE	2011	4	Parkland	Never
9	Winter St Basin	2012	17	Industrial	Rebuilt 2016
10	Currie	1999	2	Industrial	2017
11	Heritage Park #1	2004	16	Multifamily	2014
12 & 13	Heritage Park #2 & #3	2004	86	Singe Family/Duplex	2014
14	Heritage Park #4	2004	106	Singe Family/Duplex	2014
15	Heritage Park #5	2004	116	Singe Family/Duplex	2014
16	Central	2003	28	Golf Course	Never

*Pond samples included full NPDES water chemistry analysis.

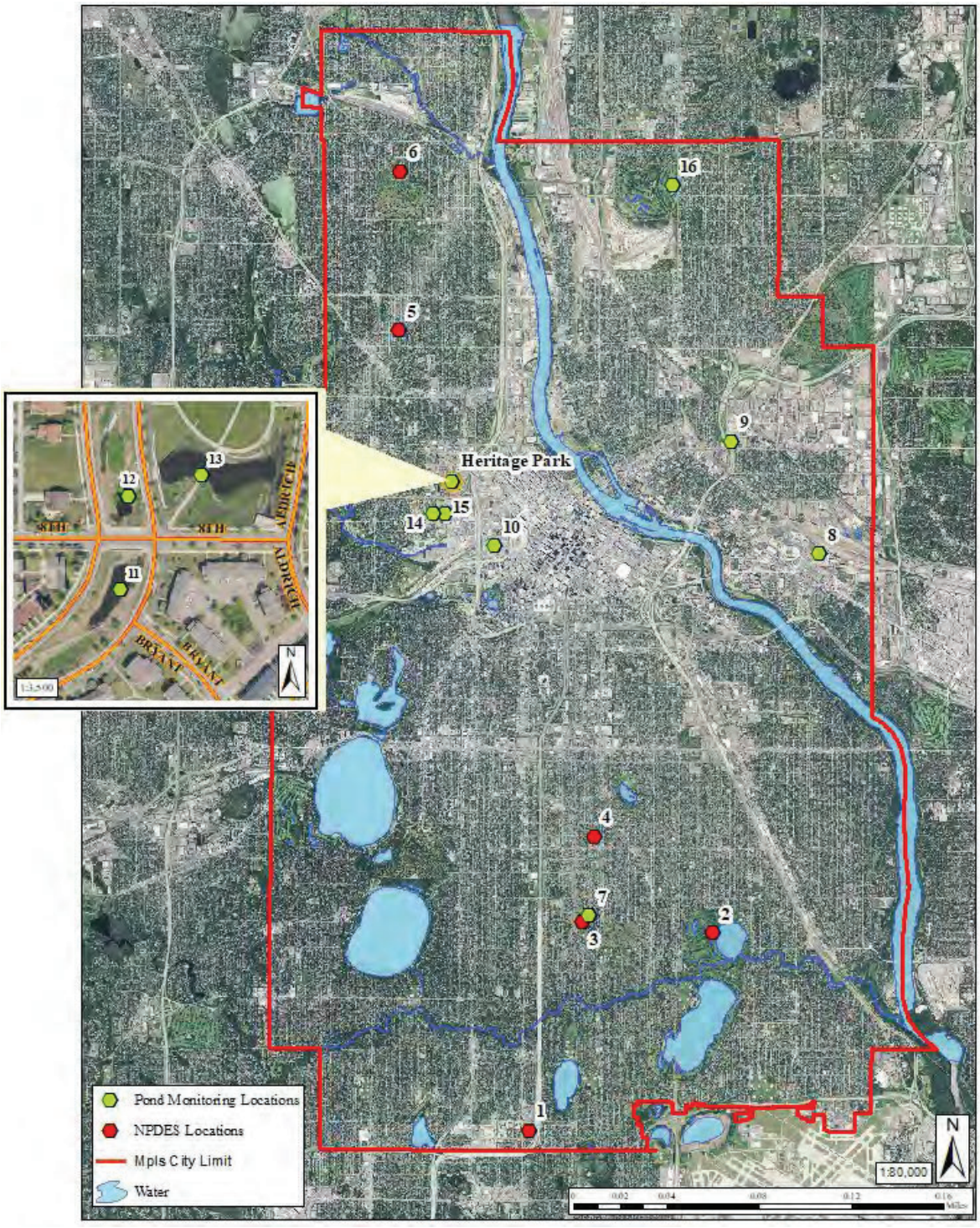


Figure 23-1. Map of the ponds and sampling locations in the City of Minneapolis. The numbers correspond with the ponds listed in Table 23-1.

Table 23-2. Analysis method, reporting limit, and holding times for parameters used by Instrumental Research, Inc. and Pace Laboratories.

Parameter	Method	Reporting Limit	Holding Times
Chlorophyll-*a*	SM 10200 H	0.5 µg/L	24-48 hrs. unfiltered, 28 days filtered in dark
COD	SM 5220-D	20 mg/L	28 days
DOC‡	SM 5310-C-00	1.5 mg/L	28 days
Chloride, Total	SM 4500-Cl^- B	2.0 mg/L	28 days
Hardness	SM 2350 C	5.0 mg/L	6 months
Copper, Total‡	EPA 200.8	1 µg/L	6 months
Lead, Total‡	EPA 200.8	0.10 µg/L	6 months
Zinc, Total‡	EPA 200.7	20 µg/L	6 months
Nitrite+Nitrate, Total as N	SM 4500-NO_3 E	0.030 mg/L	28 days
Total Nitrogen	Alk Persulfate Oxidation method	0.050 mg/L	28 days
Phosphorus, Total Dissolved	SM 4500-PE	0.010 mg/L	48 hours
Phosphorus, Total	SM 4500-PE	0.010 mg/L	48 hours
Solids, Total Dissolved	SM 2540 C	5.0 mg/L	7 days
Solids, Total Suspended	SM 2540 D	1.0 mg/L	7 days
Solids, Volatile Suspended	EPA 160.4	2.0 mg/L	7 days

‡Metals and DOC were analyzed by Pace Laboratories.

Figure 23-2 through **Figure 23-13** show an aerial picture of each pond with a yellow diamond at the sampling location. The corresponding pond name and number is in the figure description. The ponds in the study were largely constructed for flood control and were chosen for study if Minneapolis staff believed that the ponds had potential to be retrofit for additional water quality benefit.

Figure 23-2. - Mead Pond (Pond #1) and sampling location.

Figure 23-3. MPRB Hiawatha Outlet Pond (Pond #2) and sampling location.

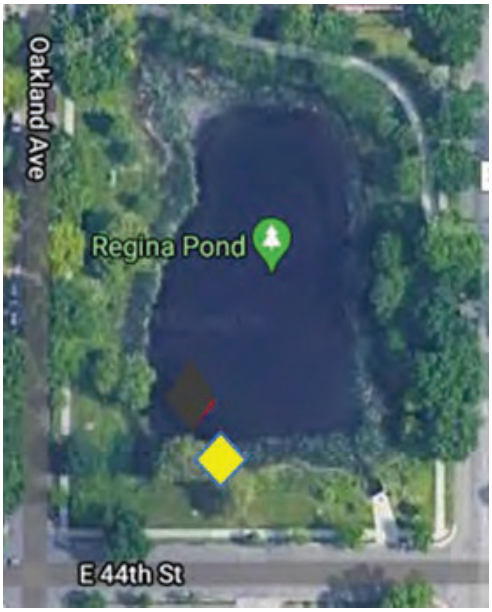


Figure 23-4. West, Park Ave & 44th Pond (Pond #3) and the sampling location.

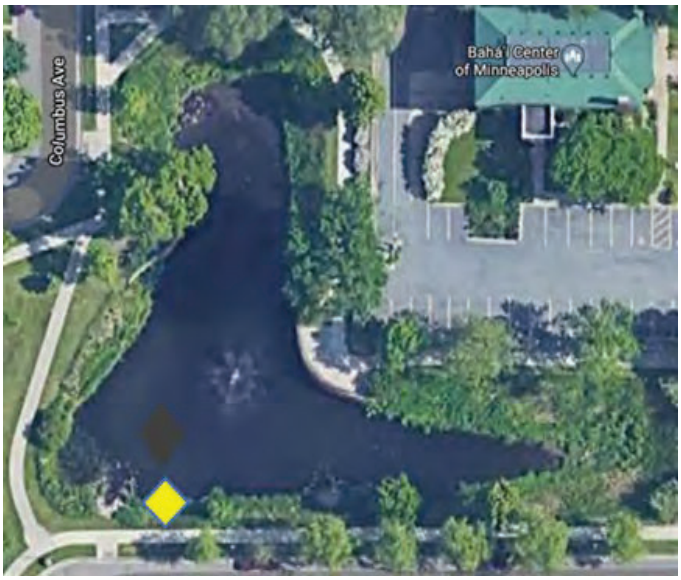


Figure 23-5. Columbus Wet Pond (Pond #4) and sampling location. Note the aerator in the middle of the pond.

Figure 23-6. Logan Pond (Pond #5) and sampling location.

Figure 23-7. Camden Pond (Pond #6) and sampling location.

Figure 23-8. East, Park Avenue & 43rd Pond (Pond #7) sampling location.

Figure 23-9. 25th Avenue NE Pond (Pond #8) and sampling location.

Figure 23-10. Winter Street Pretreatment Basin Pond (Pond #9) and sampling location.

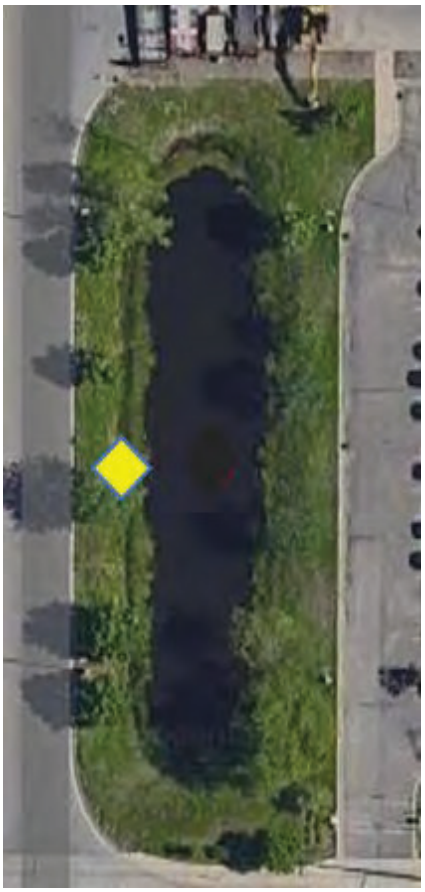


Figure 23-11. Currie Pond (Pond #10) and sampling location.

Figure 23-12. Heritage Park 1 Pond (Pond #11), Heritage Park 2 Pond (Pond #12), Heritage Park 3 Pond (Pond #13), Heritage Park 4 Pond (Pond #14), Heritage Park 5 Pond (Pond #15) and their sampling locations. Water flow in the northern ponds is from 11 to 13. In the south, water in Pond 14 flows to Pond 15.

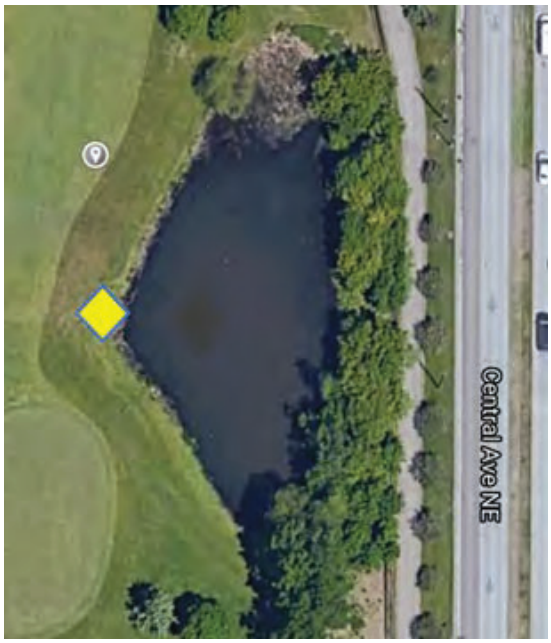


Figure 23-13. Central Pond (Pond #16) and sampling location.

METHODS

Sample Collection

Samples were collected from all ponds by MPRB personnel and followed recommended COVID-19 social distancing practices. A modified pool skimmer pole with a water clamp was used to secure the sample bottle. The sample was collected with the pool skimmer pole extended out 15-20 feet from the shore where the sample was collected, **Figure 23-14**. One person rinsed the bottle and took the sample with the pool skimmer and one person uncapped/capped the sample bottle. All sample bottles were rinsed with the pond water one time prior to collecting submitted samples. Samples were collected sub-surface with the bottle initially facing down, plunged into the water and inverted 6-inches subsurface to fill the sample bottle so as to not collect surface material. The sample bottle was then given to the other person via the pool skimmer pole to cap.

Samples were only collected from ponds at least 8 hours, or more, after any precipitation. Analysis of the ponds were to represent steady state non-storm conditions.

From May through October, monthly grab samples were collected at sixteen ponds for Chl-*a*, TP, and Cl, as shown in **Table 23-3**. Six of the ponds had Chl-a, TP, Cl, and the additional NPDES chemical parameters collected every two weeks **Table 23-4**. Pheophytin data were disregarded since the Chl-*a* data are Pheophytin corrected. The NPDES parameters are COD, DOC, Chloride, Hardness, Total Copper, Total Lead, Total Zinc, Nitrate/Nitrite, Total Nitrogen Total Phosphorus, Total Dissolved Phosphorus, Total Dissolved Solids, Total Suspended Solids, and Volatile Suspended Solids.

Field blanks accompanied all sampling trips. All Chl-*a* samples were collected in opaque 2-L bottles, chemistry samples were collected in 2-L Nalgene bottles and *Escherichia coli* (*E. coli*) were collected in 100 mL sterile vials. All samples were immediately stored and transported on ice in a cooler prior

to delivery to the laboratory for analysis.

Field notes included air temperature, wind and weather conditions, water color, smell/odors, duckweed, algae presence, pond conditions, trash, percent algae, percent duckweed, and any waterfowl present.

Figure 23-14. Grab sample being collected with a pool skimmer at Mead Pond.

RESULTS & DISCUSSION

Chl-*a*, TP, and Cl

Table 23-3 shows the chlorophyll-a, total phosphorus, and chloride data for all grab samples taken at each of the ponds. Chl-*a* data are pheophytin corrected. **Table 23-4** shows comparison statistics for these parameters.

Table 23-5 shows the geometric mean, arithmetic mean and maximum values for the ponds, as compared to average 2001-2017 FLUX event mean for NPDES representative land use stormwater sites and the Minneapolis lakes Diamond and Grass 2020 data.

Table 23-3. Chlorophyll-a, total phosphorus, and chloride data for all grab samples taken at each of the ponds. Underlined red data failed the laboratory blind monthly performance standard.

Pond #	Site Location	Date Sampled	Time	Sample Type	Chl-*a* ug/L	TP mg/L	Cl mg/L
1	Mead Pond	5/21/2020	9:25	Grab	15	0.052	110
1	Mead Pond	6/16/2020	8:45	Grab	20	0.083	160
1	Mead Pond	7/1/2020	8:50	Grab	10	0.095	65
1	Mead Pond	7/13/2020	12:30	Grab	21	0.069	57
1	Mead Pond	7/29/2020	8:30	Grab	16	0.078	50
1	Mead Pond	8/11/2020	9:55	Grab	7	0.087	37
1	Mead Pond	8/25/2020	11:00	Grab	29	0.058	37
1	Mead Pond	9/11/2020	9:00	Grab	21	0.078	28
1	Mead Pond	9/22/2020	8:30	Grab	7	0.105	40
1	Mead Pond	10/2/2020	8:20	Grab	9	0.082	53
1	Mead Pond	10/29/2020	9:35	Grab	6	0.095	87
2	Hiawatha Outlet Pond E	5/21/2020	9:50	Grab	12	0.104	85
2	Hiawatha Outlet Pond E	6/16/2020	9:10	Grab	9	0.108	115
2	Hiawatha Outlet Pond E	7/1/2020	9:15	Grab	29	0.187	80
2	Hiawatha Outlet Pond E	7/13/2020	12:55	Grab	13	0.187	102
2	Hiawatha Outlet Pond E	7/29/2020	8:55	Grab	4	0.122	102
2	Hiawatha Outlet Pond E	8/11/2020	10:15	Grab	11	0.126	92
2	Hiawatha Outlet Pond E	8/25/2020	11:20	Grab	7	0.149	105
2	Hiawatha Outlet Pond E	9/11/2020	9:25	Grab	6	0.138	102
2	Hiawatha Outlet Pond E	9/22/2020	8:50	Grab	4	0.099	105
2	Hiawatha Outlet Pond E	10/2/2020	8:45	Grab	2	0.106	100
2	Hiawatha Outlet Pond E	10/29/2020	10:00	Grab	2	0.120	102
3	West, Park & 44th	5/21/2020	9:05	Grab	17	0.087	70
3	West, Park & 44th	6/16/2020	8:25	Grab	8	0.126	40
3	West, Park & 44th	7/1/2020	8:30	Grab	5	0.170	24
3	West, Park & 44th	7/13/2020	13:15	Grab	50	0.245	24
3	West, Park & 44th	7/29/2020	9:10	Grab	31	0.269	18
3	West, Park & 44th	8/11/2020	10:35	Grab	17	0.176	13
3	West, Park & 44th	8/25/2020	11:40	Grab	21	0.104	12
3	West, Park & 44th	9/11/2020	8:45	Grab	23	0.140	10
3	West, Park & 44th	9/22/2020	9:10	Grab	7	0.105	11
3	West, Park & 44th	10/2/2020	9:00	Grab	74	0.106	11
3	West, Park & 44th	10/29/2020	10:15	Grab	22	0.125	20
4	Columbus Wet	5/21/2020	10:10	Grab	4	0.161	15
4	Columbus Wet	6/16/2020	9:35	Grab	28	0.334	20
4	Columbus Wet	7/1/2020	9:35	Grab	9	0.200	2
4	Columbus Wet	7/13/2020	13:35	Grab	19	0.467	9
4	Columbus Wet	7/29/2020	9:30	Grab	27	0.292	5
4	Columbus Wet	8/11/2020	10:45	Grab	6	0.179	1
4	Columbus Wet	8/25/2020	11:50	Grab	16	0.260	10
4	Columbus Wet	9/11/2020	9:45	Grab	7	0.149	10
4	Columbus Wet	9/22/2020	9:20	Grab	4	0.082	11
4	Columbus Wet	10/2/2020	9:05	Grab	3	0.153	19
4	Columbus Wet	10/29/2020	10:20	Grab	31	0.370	25

Table 23-3. (continued) The 2020 pond chemistry results are presented. Underlined red data failed the laboratory blind monthly performance standard.

Pond #	Site Location	Date Sampled	Time	Sample Type	Chl-*a* ug/L	TP mg/L	Cl mg/L
5	Logan Pond	5/21/2020	10:50	Grab	3	0.109	155
5	Logan Pond	6/16/2020	10:15	Grab	5	0.266	115
5	Logan Pond	7/1/2020	10:15	Grab	27	0.210	45
5	Logan Pond	7/13/2020	14:15	Grab	48	0.159	43
5	Logan Pond	7/29/2020	10:20	Grab	13	0.238	27
5	Logan Pond	8/11/2020	11:15	Grab	25	0.303	15
5	Logan Pond	8/25/2020	12:30	Grab	16	0.223	13
5	Logan Pond	9/11/2020	10:20	Grab	35	0.242	14
5	Logan Pond	9/22/2020	9:50	Grab	8	0.126	20
5	Logan Pond	10/2/2020	9:40	Grab	16	0.259	23
5	Logan Pond	10/29/2020	10:55	Grab	31	0.249	26
6	Camden Pond	5/21/2020	11:20	Grab	73	0.096	70
6	Camden Pond	6/16/2020	10:45	Grab	47	0.176	60
6	Camden Pond	7/1/2020	10:35	Grab	75	0.200	45
6	Camden Pond	7/13/2020	14:45	Grab	62	0.121	50
6	Camden Pond	7/29/2020	10:35	Grab	146	0.260	66
6	Camden Pond	8/11/2020	11:30	Grab	159	0.262	32
6	Camden Pond	8/25/2020	12:50	Grab	175	0.209	22
6	Camden Pond	9/11/2020	13:00	Grab	83	0.253	20
6	Camden Pond	9/22/2020	10:05	Grab	70	0.255	22
6	Camden Pond	10/2/2020	9:50	Grab	135	0.229	20
6	Camden Pond	10/29/2020	11:10	Grab	59	0.261	20
7	East, Park Ave & 43rd	5/22/2020	9:25	Grab	4	0.137	55
7	East, Park Ave & 43rd	6/17/2020	8:55	Grab	3	0.060	50
7	East, Park Ave & 43rd	7/8/2020	8:00	Grab	5	0.055	27
7	East, Park Ave & 43rd	8/19/2020	8:55	Grab	30	0.079	11
7	East, Park Ave & 43rd	9/9/2020	9:25	Grab	18	0.070	11
7	East, Park Ave & 43rd	10/13/2020	9:50	Grab	7	0.228	10
8	25th Ave NE	5/22/2020	9:55	Grab	4	0.028	340
8	25th Ave NE	6/17/2020	9:25	Grab	1	0.020	405
8	25th Ave NE	7/8/2020	8:40	Grab	37	0.059	390
8	25th Ave NE	8/19/2020	9:30	Grab	12	0.045	390
8	25th Ave NE	9/9/2020	9:50	Grab	145	0.284	410
8	25th Ave NE	10/13/2020	10:25	Grab	13	0.038	430
9	Winter St Basin	5/22/2020	10:15	Grab	31	0.200	70
9	Winter St Basin	6/17/2020	9:45	Grab	373	0.905	280
9	Winter St Basin	7/8/2020	9:00	Grab	6	0.121	4
9	Winter St Basin	8/19/2020	9:45	Grab	8	0.216	11
9	Winter St Basin	9/9/2020	10:05	Grab	15	0.059	3
9	Winter St Basin	10/13/2020	10:40	Grab	1	0.054	5

Table 23-3. (continued) The 2020 chemistry results are presented. Underlined red data failed the laboratory blind monthly performance standard.

Pond #	Site Location	Date Sampled	Time	Sample Type	Chl-*a* ug/L	TP mg/L	Cl mg/L
10	**Currie**	5/22/2020	13:15	Grab	6	0.031	300
10	**Currie**	6/17/2020	10:50	Grab	6	0.156	450
10	**Currie**	7/8/2020	10:10	Grab	37	0.146	260
10	**Currie**	8/19/2020	11:20	Grab	52	0.287	160
10	**Currie**	9/9/2020	11:10	Grab	148	0.898	145
10	**Currie**	10/13/2020	11:35	Grab	5	0.106	115
11	**Heritage Park #1**	5/22/2020	10:35	Grab	5	0.149	50
11	**Heritage Park #1**	6/17/2020	10:00	Grab	19	0.132	50
11	**Heritage Park #1**	7/8/2020	9:20	Grab	196	0.438	24
11	**Heritage Park #1**	8/19/2020	10:05	Grab	36	0.231	13
11	**Heritage Park #1**	9/9/2020	10:20	Grab	5	0.110	25
11	**Heritage Park #1**	10/13/2020	10:55	Grab	6	0.135	32
12	**Heritage Park #2**	5/22/2020	10:45	Grab	9	0.140	65
12	**Heritage Park #2**	6/17/2020	10:10	Grab	29	0.284	65
12	**Heritage Park #2**	7/8/2020	9:25	Grab	15	0.237	34
12	**Heritage Park #2**	8/19/2020	10:10	Grab	18	0.175	18
12	**Heritage Park #2**	9/9/2020	10:30	Grab	2	0.125	21
12	**Heritage Park #2**	10/13/2020	11:00	Grab	3	0.149	25
13	**Heritage Park #3**	5/22/2020	10:50	Grab	29	0.115	40
13	**Heritage Park #3**	6/17/2020	10:15	Grab	25	0.256	65
13	**Heritage Park #3**	7/8/2020	9:30	Grab	31	0.322	17
13	**Heritage Park #3**	8/19/2020	10:20	Grab	22	0.164	16
13	**Heritage Park #3**	9/9/2020	10:35	Grab	11	0.208	21
13	**Heritage Park #3**	10/13/2020	11:05	Grab	4	0.189	19
14	**Heritage Park #4**	5/22/2020	11:00	Grab	3	0.357	165
14	**Heritage Park #4**	6/17/2020	10:25	Grab	68	0.456	155
14	**Heritage Park #4**	7/8/2020	9:40	Grab	10	0.416	33
14	**Heritage Park #4**	8/19/2020	10:55	Grab	8	0.250	36
14	**Heritage Park #4**	9/9/2020	10:45	Grab	60	0.377	29
14	**Heritage Park #4**	10/13/2020	11:15	Grab	4	0.301	17
15	**Heritage Park #5**	5/22/2020	11:15	Grab	51	0.133	155
15	**Heritage Park #5**	6/17/2020	10:35	Grab	22	0.192	110
15	**Heritage Park #5**	7/8/2020	9:50	Grab	60	0.145	68
15	**Heritage Park #5**	8/19/2020	11:05	Grab	25	0.113	46
15	**Heritage Park #5**	9/9/2020	10:50	Grab	87	0.464	50
15	**Heritage Park #5**	10/13/2020	11:20	Grab	47	0.277	50
16	**Central**	5/22/2020	13:50	Grab	2	0.221	205
16	**Central**	6/17/2020	13:30	Grab	2	0.342	320
16	**Central**	7/8/2020	10:30	Grab	17	0.405	120
16	**Central**	8/19/2020	11:45	Grab	11	0.197	25
16	**Central**	9/9/2020	11:40	Grab	14	0.287	50
16	**Central**	10/13/2020	12:00	Grab	129	0.262	54

Table 23-4. 2020 comparison statistics of Chl-*a*, TP, and Cl. When statistical analysis was performed on the data sets and values below the reporting limit were present, half of the reporting limit was used in the calculations.

Pond #	Site Location	Statistical Function	Chl-a ug/L	TP mg/L	Cl mg/L
1	Mead Pond	MEAN (geometric)	13	0.079	58
1	Mead Pond	MEAN (arithmetic)	14	0.080	66
1	Mead Pond	MAX	29	0.105	160
1	Mead Pond	MIN	6	0.052	28
1	Mead Pond	MEDIAN	15	0.082	53
1	Mead Pond	STDEV	7	0.016	39
1	Mead Pond	NUMBER	11	11	11
1	Mead Pond	COV	0.513	0.199	0.598
2	Hiawatha Outlet Pond E	MEAN (geometric)	7	0.129	99
2	Hiawatha Outlet Pond E	MEAN (arithmetic)	9	0.132	99
2	Hiawatha Outlet Pond E	MAX	29	0.187	115
2	Hiawatha Outlet Pond E	MIN	2	0.099	80
2	Hiawatha Outlet Pond E	MEDIAN	7	0.122	102
2	Hiawatha Outlet Pond E	STDEV	8	0.031	10
2	Hiawatha Outlet Pond E	NUMBER	11	11	11
2	Hiawatha Outlet Pond E	COV	0.872	0.238	0.099
3	West, Park & 44th	MEAN (geometric)	19	0.141	19
3	West, Park & 44th	MEAN (arithmetic)	25	0.150	23
3	West, Park & 44th	MAX	74	0.269	70
3	West, Park & 44th	MIN	5	0.087	10
3	West, Park & 44th	MEDIAN	21	0.126	18
3	West, Park & 44th	STDEV	21	0.060	18
3	West, Park & 44th	NUMBER	11	11	11
3	West, Park & 44th	COV	0.830	0.398	0.781
4	Columbus Wet	MEAN (geometric)	10	0.216	8
4	Columbus Wet	MEAN (arithmetic)	14	0.241	12
4	Columbus Wet	MAX	31	0.467	25
4	Columbus Wet	MIN	3	0.082	1
4	Columbus Wet	MEDIAN	9	0.200	10
4	Columbus Wet	STDEV	11	0.115	8
4	Columbus Wet	NUMBER	11	11	11
4	Columbus Wet	COV	0.758	0.478	0.658
5	Logan Pond	MEAN (geometric)	16	0.207	32
5	Logan Pond	MEAN (arithmetic)	21	0.217	45
5	Logan Pond	MAX	48	0.303	155
5	Logan Pond	MIN	3	0.109	13
5	Logan Pond	MEDIAN	16	0.238	26
5	Logan Pond	STDEV	14	0.061	47
5	Logan Pond	NUMBER	11	11	11
5	Logan Pond	COV	0.681	0.281	1.03
	NPDES 2001-2017*	Ave. Event Mean	NA	0.433	299
	Diamond, 2020	MEAN (geometric)	9	0.063	123
	Grass, 2020	MEAN (geometric)	30	0.185	44

*Average FLUX Event Mean Stormwater Concentration 2001-2017 for four land use categories. NA=not available.

Table 23-4. (continued) The 2020 pond data showing comparison statistics. When statistical analysis was performed on the data sets and values below the reporting limit were present, half of the reporting limit was used in the calculations.

Pond #	Site Location	Statistical Function	Chl-a ug/L	TP mg/L	Cl mg/L
6	**Camden Pond**	MEAN (geometric)	89	0.202	34
6	**Camden Pond**	MEAN (arithmetic)	98	0.211	39
6	**Camden Pond**	MAX	175	0.262	70
6	**Camden Pond**	MIN	47	0.096	20
6	**Camden Pond**	MEDIAN	75	0.229	32
6	**Camden Pond**	STDEV	46	0.058	20
6	**Camden Pond**	NUMBER	11	11	11
6	**Camden Pond**	COV	0.465	0.277	1
7	**East, Park Ave & 43rd**	MEAN (geometric)	8	0.091	21
7	**East, Park Ave & 43rd**	MEAN (arithmetic)	11	0.105	27
7	**East, Park Ave & 43rd**	MAX	30	0.228	55
7	**East, Park Ave & 43rd**	MIN	3	0.055	10
7	**East, Park Ave & 43rd**	MEDIAN	6	0.075	19
7	**East, Park Ave & 43rd**	STDEV	11	0.067	21
7	**East, Park Ave & 43rd**	NUMBER	6	6	6
7	**East, Park Ave & 43rd**	COV	0.964	0.640	0.757
8	**25th Ave NE**	MEAN (geometric)	12	0.050	393
8	**25th Ave NE**	MEAN (arithmetic)	35	0.079	394
8	**25th Ave NE**	MAX	145	0.284	430
8	**25th Ave NE**	MIN	1	0.020	340
8	**25th Ave NE**	MEDIAN	13	0.042	397
8	**25th Ave NE**	STDEV	55	0.101	30
8	**25th Ave NE**	NUMBER	8	8	8
8	**25th Ave NE**	COV	1.57	1.28	0.077
9	**Winter St Basin**	MEAN (geometric)	15	0.157	16
9	**Winter St Basin**	MEAN (arithmetic)	72	0.259	62
9	**Winter St Basin**	MAX	373	0.905	280
9	**Winter St Basin**	MIN	1	0.054	3
9	**Winter St Basin**	MEDIAN	12	0.160	8
9	**Winter St Basin**	STDEV	148	0.324	110
9	**Winter St Basin**	NUMBER	6	6	6
9	**Winter St Basin**	COV	2.04	1.25	1.77
10	**Currie**	MEAN (geometric)	20	0.163	213
10	**Currie**	MEAN (arithmetic)	42	0.270	238
10	**Currie**	MAX	148	0.898	450
10	**Currie**	MIN	5	0.031	115
10	**Currie**	MEDIAN	22	0.151	210
10	**Currie**	STDEV	55	0.319	126
10	**Currie**	NUMBER	6	6	6
10	**Currie**	COV	1.31	1.18	0.528
	NPDES 2001-2017*	Ave. Event Mean	NA	0.433	299
	Diamond, 2020	MEAN (geometric)	9	0.063	123
	Grass, 2020	MEAN (geometric)	30	0.185	44

*Average FLUX Event Mean Stormwater Concentration 2001-2017 for four land use categories. NA=not available.

Table 23-4. (continued) The 2020 pond data showing comparison statistics. When statistical analysis was performed on the data sets and values below the reporting limit were present, half of the reporting limit was used in the calculations.

Pond #	Site Location	Statistical Function	Chl-a ug/L	TP mg/L	Cl mg/L
11	Heritage Park #1	MEAN (geometric)	17	0.176	29
11	Heritage Park #1	MEAN (arithmetic)	45	0.199	32
11	Heritage Park #1	MAX	196	0.438	50
11	Heritage Park #1	MIN	5	0.110	13
11	Heritage Park #1	MEDIAN	13	0.142	28
11	Heritage Park #1	STDEV	75	0.124	15
11	Heritage Park #1	NUMBER	6	6	6
11	Heritage Park #1	COV	1.68	0.623	0.466
12	Heritage Park #2	MEAN (geometric)	9	0.177	33
12	Heritage Park #2	MEAN (arithmetic)	13	0.185	38
12	Heritage Park #2	MAX	29	0.284	65
12	Heritage Park #2	MIN	2	0.125	18
12	Heritage Park #2	MEDIAN	12	0.162	29
12	Heritage Park #2	STDEV	10	0.062	22
12	Heritage Park #2	NUMBER	6	6	6
12	Heritage Park #2	COV	0.792	0.338	0.568
13	Heritage Park #3	MEAN (geometric)	17	0.198	26
13	Heritage Park #3	MEAN (arithmetic)	20	0.209	30
13	Heritage Park #3	MAX	31	0.322	65
13	Heritage Park #3	MIN	4	0.115	16
13	Heritage Park #3	MEDIAN	23	0.199	20
13	Heritage Park #3	STDEV	11	0.073	19
13	Heritage Park #3	NUMBER	6	6	6
13	Heritage Park #3	COV	0.530	0.347	0.655
14	Heritage Park #4	MEAN (geometric)	44	0.194	71
14	Heritage Park #4	MEAN (arithmetic)	49	0.221	80
14	Heritage Park #4	MAX	87	0.464	155
14	Heritage Park #4	MIN	22	0.113	46
14	Heritage Park #4	MEDIAN	49	0.169	59
14	Heritage Park #4	STDEV	24	0.133	44
14	Heritage Park #4	NUMBER	6	6	6
14	Heritage Park #4	COV	0.493	0.602	0.549
15	Heritage Park #5	MEAN (geometric)	13	0.353	50
15	Heritage Park #5	MEAN (arithmetic)	26	0.360	72
15	Heritage Park #5	MAX	68	0.456	165
15	Heritage Park #5	MIN	3	0.250	17
15	Heritage Park #5	MEDIAN	9	0.367	34
15	Heritage Park #5	STDEV	30	0.075	68
15	Heritage Park #5	NUMBER	6	6	6
15	Heritage Park #5	COV	1.21	0.209	0.940
16	Central	MEAN (geometric)	5	0.277	90
16	Central	MEAN (arithmetic)	12	0.286	129
16	Central	MAX	48	0.405	320
16	Central	MIN	1	0.197	25
16	Central	MEDIAN	6	0.275	87
16	Central	STDEV	18	0.078	114
16	Central	NUMBER	6	6	6
16	Central	COV	1.50	0.272	0.884
	NPDES 2001-2017*	Ave. Event Mean	NA	0.433	299
	Diamond, 2020	MEAN (geometric)	9	0.063	123
	Grass, 2020	MEAN (geometric)	30	0.185	44

*Average FLUX Event Mean Stormwater Concentration 2001-2017 for four land use categories. NA=not available.

Table 23-4 shows comparison statistics for each pond for Chl-*a*, TP, and Cl. Similar data from NPDES representative land use average event mean FLUX stormwater data as well as smaller Minneapolis Lakes Diamond and Grass are also shown for comparison purposes. Chl-*a* data are not collected for NPDES stormwater. All of the ponds TP and Cl geometric means are significantly lower than the NPDES stormwater geometric means. The exception was at Heritage Park #5 Pond where the geometric mean of 0.353 mg/L TP at this pond was comparable to levels measured in stormwater (0.433 mg/L TP).

Most of the ponds had similar or lower Chl-*a* than found in stormwater-influenced Grass Lake (30 mg/L). Exceptions were Camden Pond, at 89 ug/L Chl-*a* and Heritage Park #4 Pond, 44 ug/L Chl-*a* which were higher. The geometric mean of TP in the ponds was generally similar or lower than at Grass Lake (0.185 mg/ TP). Heritage Park #5, where the geometric mean of TP was 0.353 mg/L was an exception. The geometric mean of Cl at the ponds was generally lower than chloride levels at Diamond Lake (123 mg/L Cl). Two ponds, 25th Ave NE (393 mg/L Cl) and Currie (213 mg/L Cl) had higher Cl than at Diamond Lake, which is listed as impaired for chloride.

Table 23-5. The 2020 pond data showing limited comparison statistics for Chl-*a*, TP, and Cl. When statistical analysis was performed on the data sets and values below the reporting limit were present, half of the reporting limit was used in the calculations.

Pond #	Site Location	Statistical Function	Chl-a ug/L	TP mg/L	Cl mg/L
1	Mead Pond	MEAN (geometric)	13	0.079	58
1	Mead Pond	MEAN (arithmetic)	14	0.080	66
1	Mead Pond	MAX	29	0.105	160
2	Hiawatha Outlet Pond E	MEAN (geometric)	7	0.129	99
2	Hiawatha Outlet Pond E	MEAN (arithmetic)	9	0.132	99
2	Hiawatha Outlet Pond E	MAX	29	0.187	115
3	West, Park & 44th	MEAN (geometric)	19	0.141	19
3	West, Park & 44th	MEAN (arithmetic)	25	0.150	23
3	West, Park & 44th	MAX	74	0.269	70
4	Columbus Wet	MEAN (geometric)	10	0.216	8
4	Columbus Wet	MEAN (arithmetic)	14	0.241	12
4	Columbus Wet	MAX	31	0.467	25
5	Logan Pond	MEAN (geometric)	16	0.207	32
5	Logan Pond	MEAN (arithmetic)	21	0.217	45
5	Logan Pond	MAX	48	0.303	155
6	Camden Pond	MEAN (geometric)	89	0.202	34
6	Camden Pond	MEAN (arithmetic)	98	0.211	39
6	Camden Pond	MAX	175	0.262	70
7	East, Park Ave & 43rd	MEAN (geometric)	8	0.091	21
7	East, Park Ave & 43rd	MEAN (arithmetic)	11	0.105	27
7	East, Park Ave & 43rd	MAX	30	0.228	55
8	25th Ave NE	MEAN (geometric)	12	0.050	393
8	25th Ave NE	MEAN (arithmetic)	35	0.079	394
8	25th Ave NE	MAX	145	0.284	430
	NPDES 2001-2017*	Ave. Event Mean	NA	0.433	299
	Diamond, 2020	MEAN (geometric)	9	0.063	123
	Grass, 2020	MEAN (geometric)	30	0.185	44

*Average FLUX Event Mean Stormwater Concentration 2001-2017 for four land use categories.
NA=not available.

Table 23-5. (continued) The 2020 pond data showing limited comparison statistics. When statistical analysis was performed on the data sets and values below the reporting limit were present, half of the reporting limit was used in the calculations.

Pond #	Site Location	Statistical Function	Chl-a ug/L	TP mg/L	Cl mg/L
9	Winter St Basin	MEAN (geometric)	15	0.157	16
9	Winter St Basin	MEAN (arithmetic)	72	0.259	62
9	Winter St Basin	MAX	373	0.905	280
10	Currie	MEAN (geometric)	20	0.163	213
10	Currie	MEAN (arithmetic)	42	0.270	238
10	Currie	MAX	148	0.898	450
11	Heritage Park #1	MEAN (geometric)	17	0.176	29
11	Heritage Park #1	MEAN (arithmetic)	45	0.199	32
11	Heritage Park #1	MAX	196	0.438	50
12	Heritage Park #2	MEAN (geometric)	9	0.177	33
12	Heritage Park #2	MEAN (arithmetic)	13	0.185	38
12	Heritage Park #2	MAX	29	0.284	65
13	Heritage Park #3	MEAN (geometric)	17	0.198	26
13	Heritage Park #3	MEAN (arithmetic)	20	0.209	30
13	Heritage Park #3	MAX	31	0.322	65
14	Heritage Park #4	MEAN (geometric)	44	0.194	71
14	Heritage Park #4	MEAN (arithmetic)	49	0.221	80
14	Heritage Park #4	MAX	87	0.464	155
15	Heritage Park #5	MEAN (geometric)	13	0.353	50
15	Heritage Park #5	MEAN (arithmetic)	26	0.360	72
15	Heritage Park #5	MAX	68	0.456	165
16	Central	MEAN (geometric)	11	0.277	90
16	Central	MEAN (arithmetic)	29	0.286	129
16	Central	MAX	129	0.405	320
	NPDES 2001-2017*	Ave. Event Mean	NA	0.433	299
	Diamond, 2020	MEAN (geometric)	9	0.063	123
	Grass, 2020	MEAN (geometric)	30	0.185	44

*Average FLUX Event Mean Stormwater Concentration 2001-2017 for four land use categories.
NA=not available.

Table 23-5 shows the geometric and arithmetic means and the maximum values for Chl-*a*, TP and Cl, as well as showing for comparison the NPDES representative land use average event mean FLUX stormwater data and smaller Minneapolis lakes: Diamond and Grass. The highest pond values of Chl-*a* were found at Camden, Winter St. Basin, Currie, Heritage Park #1, Heritage Park #4, Heritage Park #5, and Central Ponds. The maximum TP values were all over 0.200 mg/L, except at Mead (0.105 mg/L TP), and Hiawatha Outlet (0.187 mg/L TP). The maximum Cl values were all below the MPCA 5-day chronic standard of 230 mg/L, except at 25th Ave NE (430 mg/L Cl), Winter St. Basin (280 mg/L Cl), Currie (450 mg/L Cl), and Central (320 mg/L Cl).

Table 23-6 shows the NPDES chemistry data for all of the samples. TSS values were generally low with a few samples as high as 60 mg/L at Columbus and Logan Ponds. Some of the COD values were high at 50-100 mg/L. Camden Pond had a higher COD of around 70-100 mg/L. All metals samples were generally low.

Table 23-7 shows the NPDES comparison statistics along with data from the NPDES representative land sites and several Minneapolis lakes. TSS geometric mean in the ponds is much lower than what is found in stormwater. In the ponds, most of the suspended solids are volatile and organic. DOC in the ponds is comparable to what is found in Minneapolis lakes. All metals measured in the ponds were half or less than what was found in stormwater.

Table 23-6. The NPDES chemistry results are presented. Underlined red data failed the laboratory blind monthly performance standard.

Site Location	Date Sampled	Time	Sample Type	TP mg/L	TDP mg/L	TN mg/L	NO3NO2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	Chl-*a* ug/L	Pheo ug/L	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
Columbus Wet	5/21/2020	10:10	Grab	0.161	0.102	0.933	0.031	15	26	3	3	85	<20.0	4	2	10	1	<20.0	5
Columbus Wet	6/16/2020	9:35	Grab	0.334	0.062	1.63	<0.030	20	54	12	8	140	62	28	13	6	3	<20.0	15
Columbus Wet	7/1/2020	9:35	Grab	0.200	0.104	1.16	0.095	2	26	5	3	50	9	9	6	7	2	<20.0	5
Columbus Wet	7/13/2020	13:35	Grab	0.467	0.073	2.02	<0.030	9	44	69	42	108	99	19	8	7	5	<20.0	12
Columbus Wet	7/29/2020	9:30	Grab	0.292	0.020	1.60	0.214	5	32	17	14	80	42	27	19	8	2	<20.0	8
Columbus Wet	8/11/2020	10:45	Grab	0.179	0.113	1.21	0.067	1	18	11	6	60	22	6	4	8	2	<20.0	4
Columbus Wet	8/25/2020	11:50	Grab	0.260	0.045	1.84	<0.030	10	66	65	23	127	61	16	11	11	13	46	9
Columbus Wet	9/11/2020	9:45	Grab	0.149	0.058	1.30	0.065	10	60	6	4	105	32	7	2	6	1	<20.0	9
Columbus Wet	9/22/2020	9:20	Grab	0.082	0.055	1.29	0.035	11	60	2	<2.00	115	32	4	1	6	1	<20.0	9
Columbus Wet	10/2/2020	9:05	Grab	0.153	0.092	3.02	0.686	19	72	2	2	158	32	3	3	5	2	<20.0	10
Columbus Wet	10/29/2020	10:20	Grab	0.370	0.144	1.42	0.035	25	60	17	12	170	49	31	39	9	2	<20.0	11
Camden Pond	5/21/2020	11:20	Grab	0.096	0.021	1.32	<0.030	70	106	14	13	248	35	73	2	6	1	<20.0	7
Camden Pond	6/16/2020	10:45	Grab	0.176	0.026	1.48	<0.030	60	94	31	20	237	19	47	4	6	1	<20.0	10
Camden Pond	7/1/2020	10:35	Grab	0.200	0.021	1.59	0.005	45	74	23	21	195	45	75	4	7	0.4	<20.0	10
Camden Pond	7/13/2020	14:45	Grab	0.121	0.025	1.80	<0.030	50	76	30	27	220	71	62	7	4	0.3	<20.0	12
Camden Pond	7/29/2020	10:35	Grab	0.260	0.024	3.15	<0.030	66	66	48	42	385	84	146	7	3	0.4	<20.0	10
Camden Pond	8/11/2020	11:30	Grab	0.262	0.033	3.43	<0.030	32	54	31	28	170	92	159	4	3	1	<20.0	10
Camden Pond	8/25/2020	12:50	Grab	0.209	0.033	2.49	<0.030	22	62	28	24	160	93	175	6	4	0.5	<20.0	11
Camden Pond	9/11/2020	13:00	Grab	0.253	0.033	3.17	<0.030	20	75	21	20	160	89	83	57	7	0.3	<20.0	12
Camden Pond	9/22/2020	10:05	Grab	0.255	0.026	4.22	<0.030	22	80	42	40	153	98	70	21	3	0.3	<20.0	12
Camden Pond	10/2/2020	9:50	Grab	0.229	0.023	3.48	<0.030	20	82	37	36	170	100	135	16	8	0.4	<20.0	13
Camden Pond	10/29/2020	11:10	Grab	0.261	0.027	3.07	<0.030	20	90	31	28	188	93	59	13	6	0.3	<20.0	12
Logan Pond	5/21/2020	10:50	Grab	0.109	0.043	0.982	0.055	155	96	2	2	395	22	3	<0.500	5	1	<20.0	8
Logan Pond	6/16/2020	10:15	Grab	0.266	0.063	0.922	<0.030	115	106	20	8	352	48	5	3	5	2	<20.0	13
Logan Pond	7/1/2020	10:15	Grab	0.210	0.093	1.10	0.005	45	60	10	7	197	25	27	8	7	1	<20.0	9
Logan Pond	7/13/2020	14:15	Grab	0.159	0.088	2.50	0.316	43	68	59	29	215	79	48	12	7	3	<20.0	15
Logan Pond	7/29/2020	10:20	Grab	0.238	0.031	1.60	0.211	27	56	26	14	153	52	13	11	4	1	<20.0	10
Logan Pond	8/11/2020	11:15	Grab	0.303	0.083	1.83	0.107	15	42	7	4	115	72	25	19	6	4	<20.0	8
Logan Pond	8/25/2020	12:30	Grab	0.223	0.102	1.02	<0.030	13	58	13	7	125	35	16	11	4	2	<20.0	11
Logan Pond	9/11/2020	10:20	Grab	0.242	0.065	1.46	<0.030	14	58	12	9	120	46	35	22	3	1	<20.0	9
Logan Pond	9/22/2020	9:50	Grab	0.126	0.030	0.901	<0.030	20	70	9	7	122	29	8	6	5	1	<20.0	8
Logan Pond	10/2/2020	9:40	Grab	0.259	0.038	1.38	<0.030	23	74	23	14	157	56	16	6	6	2	<20.0	9
Logan Pond	10/29/2020	10:55	Grab	0.249	0.110	1.12	<0.030	26	70	10	7	180	46	31	10	7	1	<20.0	11

Table 23-6. (continued) The 2020 NPDES chemistry results are presented. Underlined red data failed the laboratory blind monthly performance standard.

Site Location	Date Sampled	Time	Sample Type	TP mg/L	TDP mg/L	TN mg/L	NO3NO2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	Chl-*a* ug/L	Pheo ug/L	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
Mead Pond	5/21/2020	9:25	Grab	0.052	0.015	<0.500	0.038	110	32	5	3	222	<20.0	15	3	6	0.4	<20.0	4
Mead Pond	6/16/2020	8:45	Grab	0.083	0.015	0.726	<0.030	160	64	9	7	363	45	20	6	7	1	<20.0	7
Mead Pond	7/1/2020	8:50	Grab	0.095	0.039	0.859	0.162	65	34	5	3	175	9	10	5	4	0.1	<20.0	4
Mead Pond	7/13/2020	12:30	Grab	0.069	0.014	0.685	0.115	57	38	6	5	178	25	21	6	5	0.3	<20.0	NA
Mead Pond	7/29/2020	8:30	Grab	0.078	0.015	0.811	0.051	50	46	7	6	158	35	16	6	5	0.3	<20.0	7
Mead Pond	8/11/2020	9:55	Grab	0.087	0.028	0.860	0.123	37	32	9	5	125	29	7	4	4	1	<20.0	4
Mead Pond	8/25/2020	11:00	Grab	0.058	0.009	0.554	<0.030	37	50	8	5	157	12	29	7	5	0.4	<20.0	5
Mead Pond	9/11/2020	9:00	Grab	0.078	0.018	0.530	<0.030	28	56	7	5	133	25	21	8	4	0.4	<20.0	7
Mead Pond	9/22/2020	8:30	Grab	0.105	0.026	0.548	<0.030	40	68	6	4	164	29	7	3	5	0.4	<20.0	8
Mead Pond	10/2/2020	8:20	Grab	0.082	0.020	0.586	<0.030	53	78	7	5	188	29	9	4	6	0.5	<20.0	8
Mead Pond	10/29/2020	9:35	Grab	0.095	0.034	0.697	0.070	87	66	7	3	260	42	6	3	9	1	<20.0	7
Hiawatha Outlet Pond	5/21/2020	9:50	Grab	0.104	0.011	2.98	0.584	85	332	10	5	512	<20.0	12	2	5	<0.10	<20.0	7
Hiawatha Outlet Pond	6/16/2020	9:10	Grab	0.108	0.016	2.36	0.346	115	352	8	3	637	25	9	4	5	<0.10	<20.0	6
Hiawatha Outlet Pond	7/1/2020	9:15	Grab	0.187	0.022	1.82	0.271	80	292	14	8	470	25	29	13	6	2	<20.0	7
Hiawatha Outlet Pond	7/13/2020	12:55	Grab	0.187	0.010	1.98	0.299	102	348	14	6	552	15	13	4	4	0.3	<20.0	6
Hiawatha Outlet Pond	7/29/2020	8:55	Grab	0.122	0.007	2.00	1.189	102	340	13	6	595	19	4	4	3	<0.10	<20.0	6
Hiawatha Outlet Pond	8/11/2020	10:15	Grab	0.126	0.025	1.76	0.380	92	320	10	5	528	18	11	8	7	0.1	<20.0	6
Hiawatha Outlet Pond	8/25/2020	11:20	Grab	0.149	0.025	1.68	0.232	105	308	10	3	523	12	7	4	3	<0.10	<20.0	6
Hiawatha Outlet Pond	9/11/2020	9:25	Grab	0.138	0.023	2.11	0.105	102	320	8	3	518	22	6	3	4	<0.10	<20.0	6
Hiawatha Outlet Pond	9/22/2020	8:50	Grab	0.099	0.016	1.85	0.703	105	356	8	3	565	15	4	2	5	0.1	<20.0	6
Hiawatha Outlet Pond	10/2/2020	8:45	Grab	0.106	0.024	1.92	0.192	100	296	5	3	493	12	2	1	5	0.4	<20.0	6
Hiawatha Outlet Pond	10/29/2020	10:00	Grab	0.120	0.012	2.20	0.160	102	304	5	2	535	19	2	2	5	<0.10	<20.0	5
West, Park & 44th	5/21/2020	9:05	Grab	0.087	0.022	0.681	<0.030	70	30	5	3	165	22	17	3	7	0.3	<20.0	6
West, Park & 44th	6/16/2020	8:25	Grab	0.126	0.060	0.726	<0.030	40	42	3	3	149	42	8	3	6	1	<20.0	8
West, Park & 44th	7/1/2020	8:30	Grab	0.170	0.111	0.945	0.067	24	36	4	3	85	12	5	2	9	1	<20.0	6
West, Park & 44th	7/13/2020	13:15	Grab	0.245	0.045	1.99	<0.030	24	42	29	24	121	54	50	5	5	1	<20.0	7
West, Park & 44th	7/29/2020	9:10	Grab	0.269	0.015	1.41	0.254	18	36	29	22	98	55	31	6	5	0.5	<20.0	7
West, Park & 44th	8/11/2020	10:35	Grab	0.176	0.065	1.03	0.030	13	32	9	6	95	32	17	12	6	2	<20.0	6
West, Park & 44th	8/25/2020	11:40	Grab	0.104	0.029	0.799	<0.030	12	42	12	8	93	28	21	8	5	1	<20.0	7
West, Park & 44th	9/11/2020	8:45	Grab	0.140	0.042	1.02	<0.030	10	50	8	7	100	39	23	5	6	4	<20.0	8
West, Park & 44th	9/22/2020	9:10	Grab	0.105	0.036	1.29	0.077	11	54	10	6	90	29	7	3	6	1	<20.0	8
West, Park & 44th	10/2/2020	9:00	Grab	0.106	0.028	1.31	<0.030	11	62	13	8	108	32	74	33	6	1	<20.0	8
West, Park & 44th	10/29/2020	10:15	Grab	0.125	0.055	0.725	0.031	20	64	4	3	135	35	22	6	7	0.4	<20.0	9

Table 23-7. The 2020 NPDES data showing comparison statistics. When statistical analysis was performed on the data sets and values below the reporting limit were present, half of the reporting limit was used in the calculations.

Site Location	Statistical Function	TP mg/L	TDP mg/L	TN mg/L	NO3NO2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	Chl-*a* ug/L	Pheo ug/L	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
Columbus Wet	MEAN (geometric)	0.216	0.071	1.51	0.052	8	43	10	6	102	33	10	6	7	2	11	8
Columbus Wet	MEAN (arithmetic)	0.241	0.079	1.58	0.116	12	47	19	11	109	41	14	10	8	3	13	9
Columbus Wet	MAX	0.467	0.144	3.02	0.686	25	72	69	42	170	99	31	39	11	13	46	15
Columbus Wet	MIN	0.082	0.020	0.933	0.015	1	18	2	1	50	9	3	1	5	1	10	4
Columbus Wet	MEDIAN	0.200	0.073	1.42	0.035	10	54	11	6	108	32	9	6	7	2	10	9
Columbus Wet	STDEV	0.115	0.036	0.571	0.198	8	19	24	12	38	26	11	11	2	3	11	3
Columbus Wet	NUMBER	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Columbus Wet	COV	0.478	0.449	0.361	1.71	0.658	0.397	1.28	1.13	0.353	0.641	0.758	1.13	0.248	1.18	0.811	0.371
Camden Pond	MEAN (geometric)	0.202	0.026	2.48	0.014	34	77	29	26	200	67	89	8	5	0.4	10	11
Camden Pond	MEAN (arithmetic)	0.211	0.027	2.65	0.014	39	78	30	27	208	74	98	13	5	0.5	10	11
Camden Pond	MAX	0.262	0.033	4.22	0.015	70	106	48	42	385	100	175	57	8	1	10	13
Camden Pond	MIN	0.096	0.021	1.32	0.005	20	54	14	13	153	19	47	2	3	0.3	10	7
Camden Pond	MEDIAN	0.229	0.026	3.07	0.015	32	76	31	27	188	89	75	7	6	0.4	10	11
Camden Pond	STDEV	0.058	0.005	0.973	0.003	20	15	9	9	67	28	46	16	2	0.2	0.00	2
Camden Pond	NUMBER	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Camden Pond	COV	0.277	0.172	0.367	0.214	1	0.190	0.309	0.335	0.323	0.382	0.465	1	0.323	0.470	0.000	0.159
Logan Pond	MEAN (geometric)	0.207	0.061	1.28	0.031	32	67	13	8	177	43	16	7	5	1	10	10
Logan Pond	MEAN (arithmetic)	0.217	0.068	1.35	0.071	45	69	17	10	194	46	21	10	5	2	10	10
Logan Pond	MAX	0.303	0.110	2.50	0.316	155	106	59	29	395	79	48	22	7	4	10	15
Logan Pond	MIN	0.109	0.030	0.901	0.005	13	42	2	2	115	22	3	0.250	3	1	10	8
Logan Pond	MEDIAN	0.238	0.065	1.12	0.015	26	68	12	7	157	46	16	10	5	1	10	9
Logan Pond	STDEV	0.061	0.029	0.487	0.102	47	18	16	7	95	18	14	6	1	1	0.000	2
Logan Pond	NUMBER	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Logan Pond	COV	0.281	0.432	0.361	1.43	1.03	0.265	0.892	0.739	0.492	0.398	0.681	0.651	0.248	0.653	0.000	0.220
NPDES 2001-2017*	MEAN (arithmetic) Event Mean	0.433	0.140	NA	0.570	299	49	118	37	568	NA	NA	NA	23	22	114	NA
Diamond, 2020	MEAN (arithmetic)	0.074	NA	0.560	0.060	163	74	NA	NA	NA	NA	17	4	NA	NA	NA	NA
Grass, 2020	MEAN (arithmetic)	0.251	NA	1.45	0.060	52	100	NA	NA	NA	NA	57	12	NA	NA	NA	NA
Powderhorn, 2018-2020	MEAN (geometric)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7
Chain (Bde, Harriet, Isles, Cedar) 2016-2017	MEAN (geometric)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6

*Average Event Mean Stormwater Concentration 2001-2017 for four land use categories. NA=data not available.

Table 23-7. (continued) The 2020 pond NPDES data showing comparison statistics. When statistical analysis was performed on the data sets and values below the reporting limit were present, half of the reporting limit was used in the calculations.

Site Location	Statistical Function	TP mg/L	TDP mg/L	TN mg/L	NO3NO2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	Chl-*a* ug/L	Pheo ug/L	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
Mead Pond	MEAN (geometric)	0.079	0.020	0.617	0.038	58	49	7	4	184	23	13	5	5	0.4	10	6
Mead Pond	MEAN (arithmetic)	0.080	0.021	0.646	0.058	66	51	7	5	193	26	14	5	5	0.4	10	6
Mead Pond	MAX	0.105	0.039	0.860	0.162	160	78	9	7	363	45	29	8	9	1	10	8
Mead Pond	MIN	0.052	0.009	0.250	0.015	28	32	5	3	125	9	6	3	4	0.1	10	4
Mead Pond	MEDIAN	0.082	0.018	0.685	0.038	53	50	7	5	175	29	15	5	5	0.4	10	7
Mead Pond	STDEV	0.016	0.009	0.179	0.053	39	16	1	1	68	12	7	2	1	0.3	0.000	2
Mead Pond	NUMBER	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	10
Mead Pond	COV	0.199	0.435	0.277	0.920	0.598	0.317	0.211	0.276	0.352	0.459	0.513	0.378	0.260	0.568	0.000	0.254
Hiawatha Outlet Pond E	MEAN (geometric)	0.129	0.016	2.03	0.322	99	324	9	4	537	17	7	3	5	0.1	10	6
Hiawatha Outlet Pond E	MEAN (arithmetic)	0.132	0.017	2.06	0.406	99	324	10	4	539	18	9	4	5	0.3	10	6
Hiawatha Outlet Pond E	MAX	0.187	0.025	2.98	1.189	115	356	14	8	637	25	29	13	7	2	10	7
Hiawatha Outlet Pond E	MIN	0.099	0.007	1.68	0.105	80	292	5	2	470	10	2	1	3	0.1	10	5
Hiawatha Outlet Pond E	MEDIAN	0.122	0.016	1.98	0.299	102	320	10	3	528	18	7	4	5	0.1	10	6
Hiawatha Outlet Pond E	STDEV	0.031	0.007	0.365	0.315	10	23	3	2	47	5	8	3	1	0.5	0.000	1
Hiawatha Outlet Pond E	NUMBER	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Hiawatha Outlet Pond E	COV	0.238	0.385	0.177	0.777	0.099	0.070	0.342	0.416	0.087	0.294	0.872	0.791	0.254	1.78	0.000	0.090
West, Park & 44th	MEAN (geometric)	0.141	0.040	1.03	0.029	19	43	9	6	110	32	19	6	6	1	10	7
West, Park & 44th	MEAN (arithmetic)	0.150	0.046	1.08	0.050	23	45	11	8	113	34	25	8	6	1	10	7
West, Park & 44th	MAX	0.269	0.111	1.99	0.254	70	64	29	24	165	55	74	33	9	4	10	9
West, Park & 44th	MIN	0.087	0.015	0.681	0.015	10	30	3	3	85	12	5	2	5	0.3	10	6
West, Park & 44th	MEDIAN	0.126	0.042	1.02	0.015	18	42	9	6	100	32	21	5	6	1	10	7
West, Park & 44th	STDEV	0.060	0.027	0.393	0.071	18	12	9	7	27	13	21	9	1	1	0.000	1
West, Park & 44th	NUMBER	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
West, Park & 44th	COV	0.398	0.576	0.362	1.43	0.781	0.260	0.815	0.892	0.236	0.370	0.830	1.12	0.202	0.979	0.000	0.130
NPDES 2001-2017*	MEAN (arithmetic) Event Mean	0.433	0.140	NA	0.570	299	49	118	37	568	NA	NA	NA	23	22	114	NA
Diamond, 2020	MEAN (arithmetic)	0.074	NA	0.560	0.060	163	74	NA	NA	NA	NA	17	4	NA	NA	NA	NA
Grass, 2020	MEAN (arithmetic)	0.251	NA	1.45	0.060	52	100	NA	NA	NA	NA	57	12	NA	NA	NA	NA
Powderhorn, 2018-2020	MEAN (geometric)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7
Chain (Bde, Harriet, Isles, Cedar) 2016-2017	MEAN (geometric)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6

*Average Event Mean Stormwater Concentration 2001-2017 for four land use categories. NA=data not available.

Comparison of Chl-a to TP and Cl

As part of the pond screening all the ponds were monitored for Chl-*a* to TP and Cl. **Figure 23-15** through **Figure 23-31** show a comparison of Chl-*a* to TP and Cl, on two Y-axes. Chl-*a* is a measurement of algal biomass. Chl-*a* levels above 30 ug/L can indicate a greater likelihood of HABs (Heiskary and Lindon, 2009). TP level could be an indicator that the pond is sequestering phosphorus or exporting phosphorus downstream. The MPCA chronic 5-day Cl threshold standard concentration for receiving waters is 230 mg/L. High Cl values over 230 mg/L can indicate an impaired ecological habitat in the ponds and a potentially negative downstream environmental impact.

Columbus Wet Pond

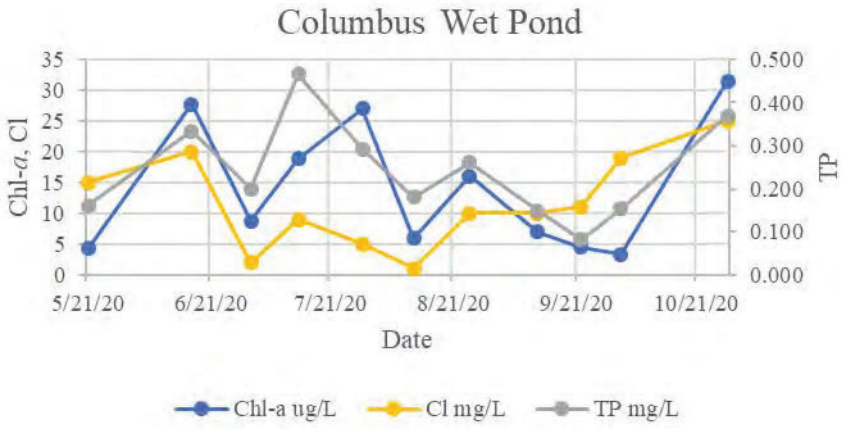


Figure 23-15. 2020 Columbus Pond (Pond 1) showing Chl-*a*, Cl and TP.

The Columbus Pond data shows that Chl-*a* does correlate well with TP, indicating TP may be a driver of Chl-*a*. Except for the last October sample the Chl-*a* values were below the 30 ug/L threshold where HABs can be a threat. The chloride values were well below the MPCA 5-day chronic threshold of 230 mg/L. This pond may be a good candidate for a retrofit for TP reduction.

Camden Pond

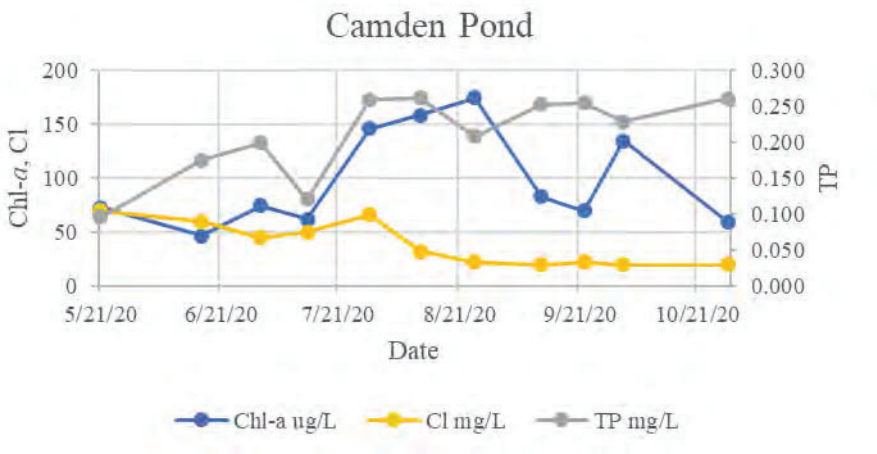


Figure 23-16. 2020 Camden Pond (Pond 2) showing Chl-*a*, Cl and TP.

The Camden Pond data shows that Chl-*a* correlates roughly with TP, indicating TP may be a driver of Chl-*a*. The Chl-*a* values were consistently above the 30 ug/L threshold where HABs can be of concern. This pond may be a good retrofit candidate for Chl-*a* reduction. The chloride values were always below the MPCA 5-day chronic threshold of 230 mg/L.

Logan Pond

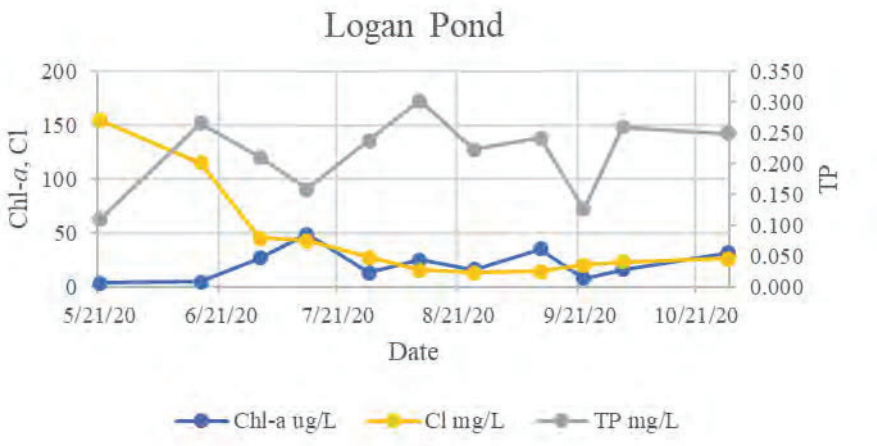


Figure 23-17. 2020 Logan Pond (Pond 3) showing Chl-*a*, Cl and TP.

The Logan Pond data shows that Chl-*a* does not appear to correlate well with TP, indicating TP is likely not a driver of Chl-*a*. The Chl-*a* values were only briefly above the 30 ug/L threshold where HABs can be of concern. The chloride values were higher in the spring but always below the MPCA 5-day chronic threshold of 230 mg/L. This pond may also be a good retrofit candidate for TP reduction.

Mead Pond

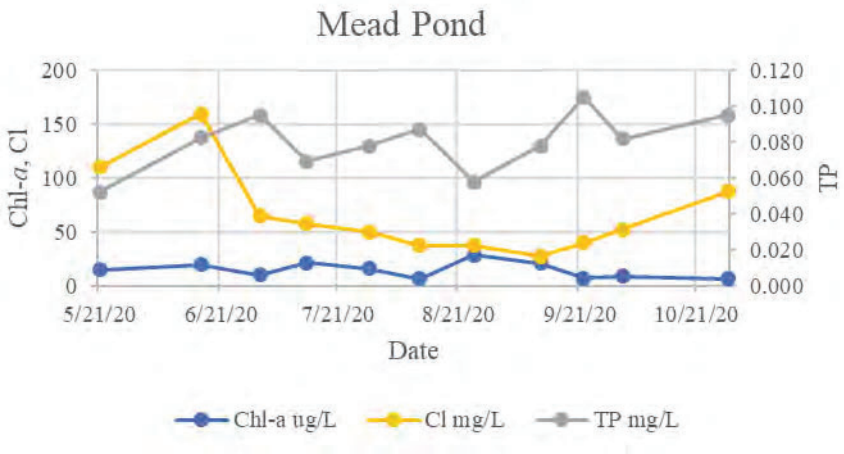


Figure 23-18. 2020 Mead Pond (Pond 4) showing Chl-*a*, Cl and TP.

The Mead Pond data shows that Chl-*a* appears to correlate roughly with TP, indicating TP may be a driver of Chl-*a*. The Chl-*a* values were not above the 30 ug/L threshold where HABs can be of concern. The chloride values were higher in the spring but always below the MPCA 5-day chronic threshold of 230 mg/L.

Hiawatha Outlet Pond

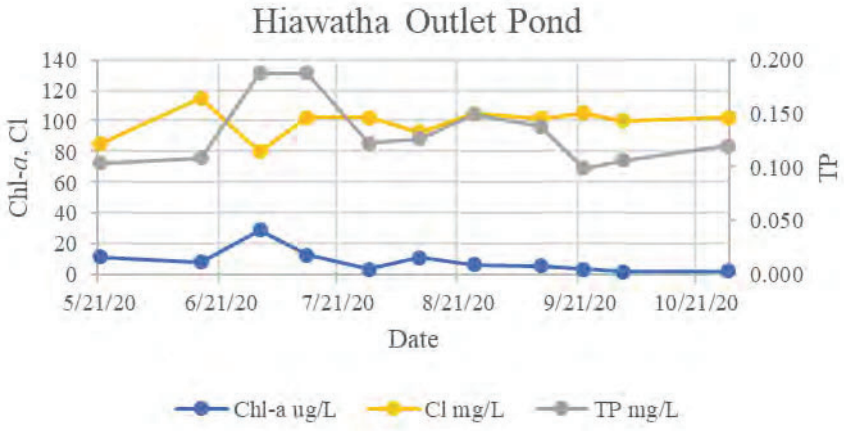


Figure 23-19. 2020 Hiawatha Outlet Pond (Pond 5) showing Chl-*a*, Cl and TP.

The Hiawatha Outlet Pond data shows that Chl-*a* appears to correlate roughly with TP, indicating TP may be a driver of Chl-*a*. The Chl-*a* values were relatively low and not above the 30 ug/L threshold where HABs can be of concern. The chloride values were always below the MPCA 5-day chronic threshold of 230 mg/L. This pond has a pumped outlet and is part of a network of ponds that drains the Hiawatha Golf Course.

West, Park & 44th Pond

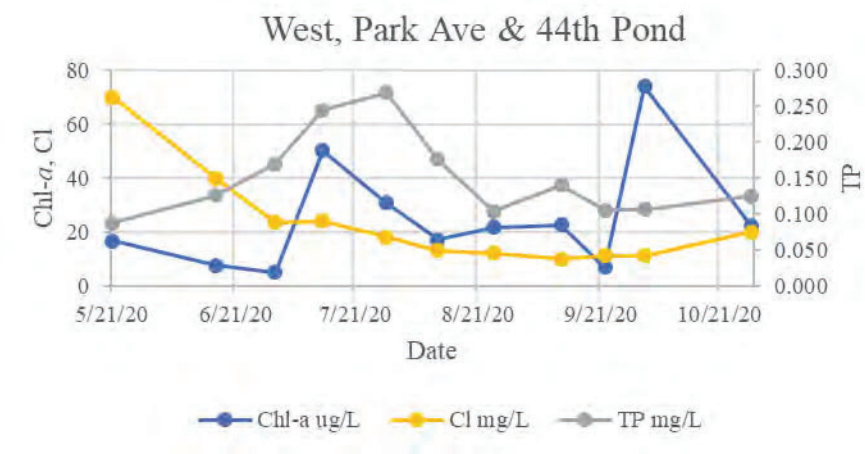


Figure 23-20. 2020 West, Park & 44th Pond (Pond 6) showing Chl-*a*, Cl and TP.

The West, Park & 44th Pond data shows that Chl-*a* appears to correlate with TP, indicating TP may be a driver of Chl-*a*. In the July and October samples, Chl-*a* values were above the 30 ug/L threshold where HABs can be of concern. The chloride values were always below the MPCA 5-day chronic threshold of 230 mg/L.

East, Park Ave & 43rd Pond

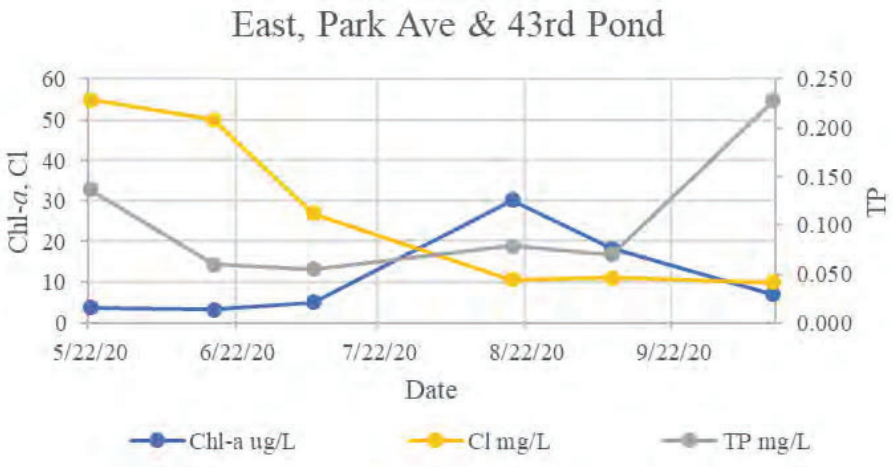


Figure 23-21. 2020 East, Park Ave. & 43rd Pond (Pond 7) showing Chl-*a*, Cl and TP.

The East, Park & 43rd Pond data shows that Chl-*a* does not correlate with TP, indicating TP is not a driver of Chl-*a*. The Chl-*a* values had a single value in late August of 30 ug/L which is the threshold where above this HABs can be of concern. The Chl-*a* values were below 30 ug/L the rest of the year. The chloride values were higher in spring but always below the MPCA 5-day chronic threshold of 230 mg/L.

25th Ave NE Pond

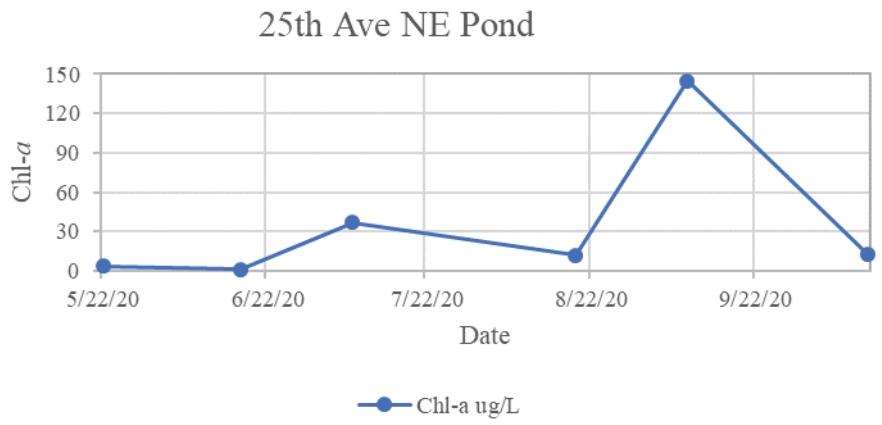


Figure 23-22. Graph of the 2020 25th Ave NE (Pond 8) showing Chl-*a*.

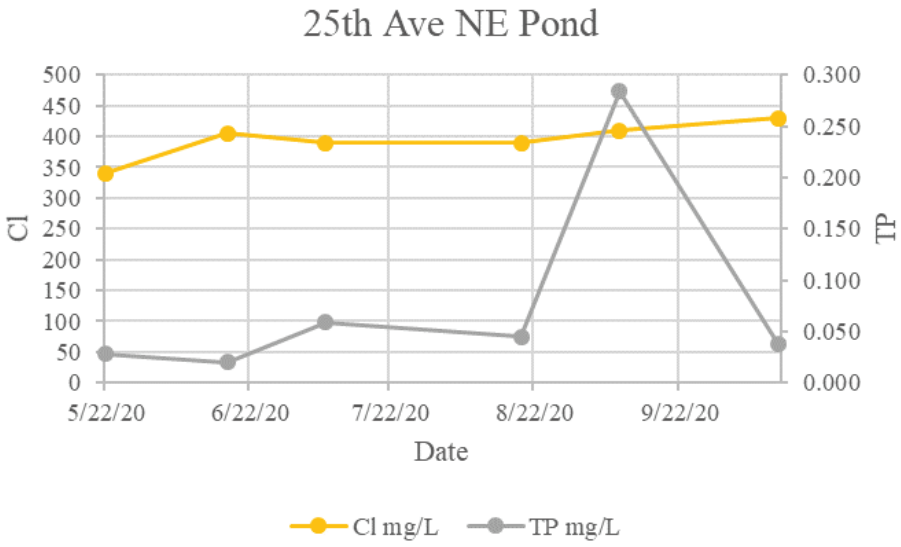


Figure 23-23. Graph of the 2020 25th Ave NE (Pond 8) showing Cl and TP.

The 25th Ave NE Pond Chl-*a* data are graphed separately to show definition. Chl-*a* does correlate with TP, indicating TP may be a driver of Chl-*a*. Two Chl-*a* values in early July and September were above 30 ug/L which is the threshold where above this HABs can be of concern. The Chl-*a* values were below 30 ug/L the rest of the year. This pond was unique in that the chloride values were always high around 400 mg/L and above the MPCA 5-day chronic threshold of 230 mg/L. This pond is a good candidate for Cl reduction.

Winter St. Basin Pond

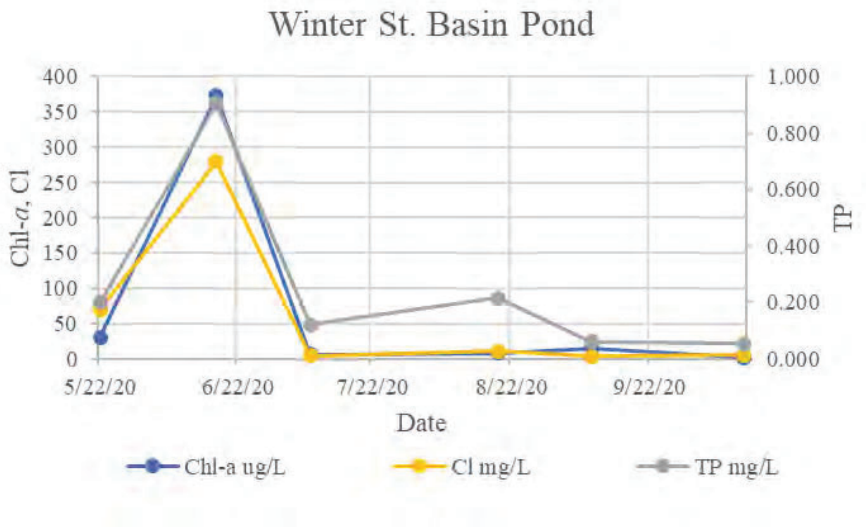


Figure 23-24. Graph of the 2020 Winter St. Basin Pond (Pond 9) showing Chl-*a*, Cl and TP.

The Winter St. Basin Pond data shows that Chl-*a* does correlate with TP, indicating TP may be a driver of Chl-*a*. All the data parameters can be seen increasing in the June 17th sample. The field notes show this June sample was brown opaque and smelled odiferous. The two Chl-*a* values in the spring were above 30 ug/L which is the threshold where above this HABs can be of concern. The Chl-*a* values were below 30 ug/L the rest of the year. The chloride values were only higher in the single June sample where it was above the MPCA 5-day chronic threshold of 230 mg/L. Other than this sample, chloride was always below the MPCA threshold. This BMP is also an infiltration basin with little open water and likely not a good candidate for pond screening or retrofit.

Currie Pond

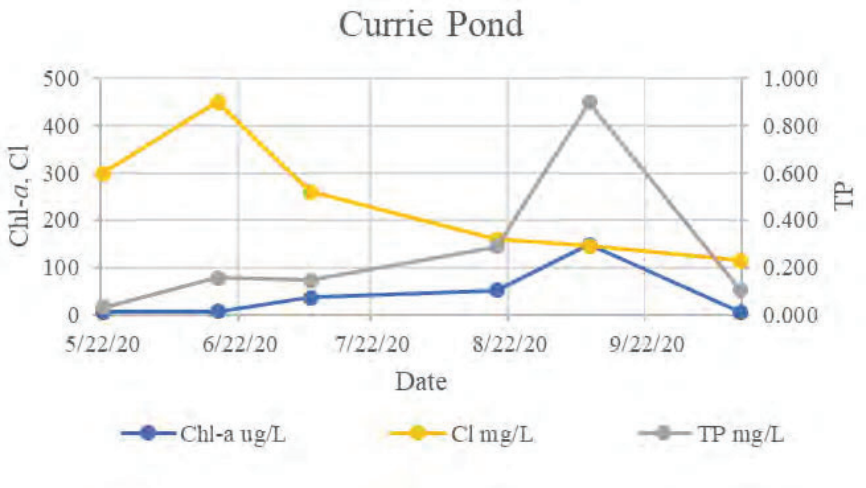


Figure 23-25. Graph of the 2020 Currie Pond (Pond 10) showing Chl-*a*, Cl and TP.

The Currie Pond data shows that Chl-*a* does correlate with TP, indicating TP may be a driver of Chl-*a*. The Chl-*a* June, July, and August values were above 30 ug/L which is the threshold where above HABs can be of concern. The Chl-*a* values were only below 30 ug/L in the spring and fall. The MPCA 5-day chronic chloride threshold is 230 mg/L. The chloride values were above 230 mg/L in May, June and July. The chloride values were quite high in June at 450 mg/L. This pond may be a good retrofit candidate for TP and Chl-*a* reduction.

Heritage Park Pond #1

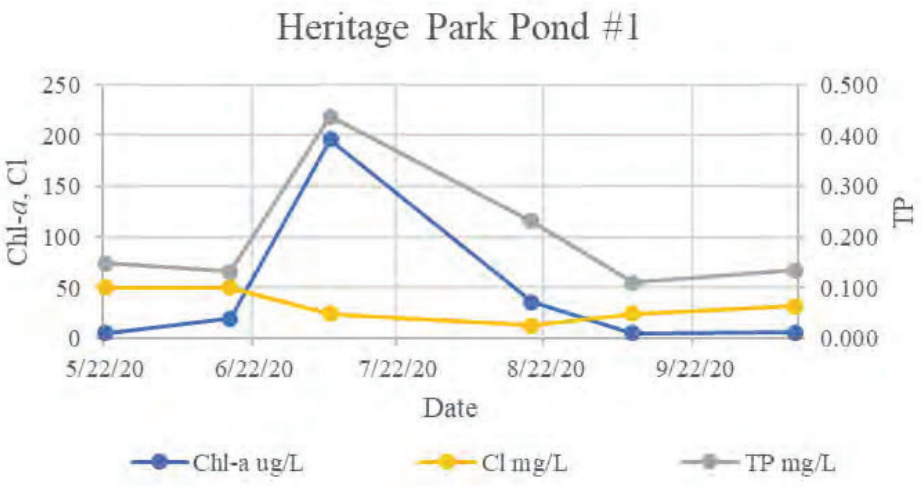


Figure 23-26. Graph of the 2020 Heritage Park Pond #1 (Pond 11) showing Chl-*a*, Cl and TP.

The Heritage Park Pond #1 data shows that Chl-*a* does correlate with TP, indicating TP may be a driver of Chl-*a*. The Chl-*a* July value was 196 mg/L and well above 30 ug/L which is the threshold where above this HABs can be of concern. The Chl-*a* values were only over 30 ug/L in July and August, and below the threshold the rest of the year. The MPCA 5-day chronic chloride threshold is 230 mg/L. The chloride values at Heritage Park Pond #1 were never above 230 mg/L.

Heritage Park Pond #2

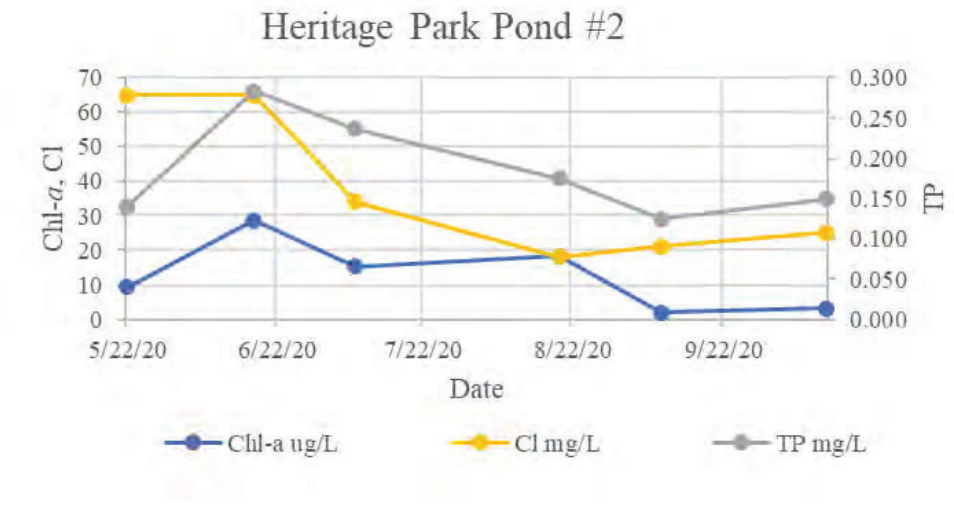


Figure 23-27. Graph of the 2020 Heritage Park Pond #2 (Pond 12) showing Chl-*a*, Cl and TP.

The Heritage Park Pond #2 data shows that Chl-*a* does correlate with TP, indicating TP may be a driver of Chl-*a*. The Chl-*a* values were never above 30 ug/L which is the threshold where above this HABs can be of concern. The MPCA 5-day chronic chloride threshold is 230 mg/L. The chloride values were never over 230 mg/L.

Heritage Park Pond #3

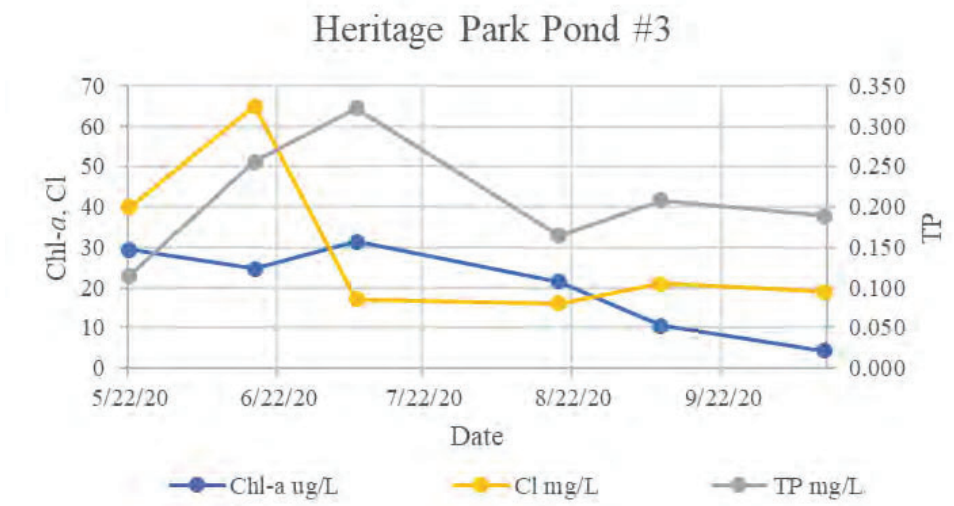


Figure 23-28. Graph of the 2020 Heritage Park Pond #3 (Pond 13) showing Chl-*a*, Cl and TP.

The Heritage Park Pond #3 data shows that Chl-*a* does correlate with TP, indicating TP may be a driver of Chl-*a*. Only the Chl-*a* July value of 31 ug/L was above 30 ug/L, which is the threshold where above this HABs can be of concern. The MPCA 5-day chronic chloride threshold is 230 mg/L. The

chloride values were never above 230 mg/L. Heritage Park Ponds #2 and #3 are hydrologically connected and often function as one pond.

Heritage Park Pond #4

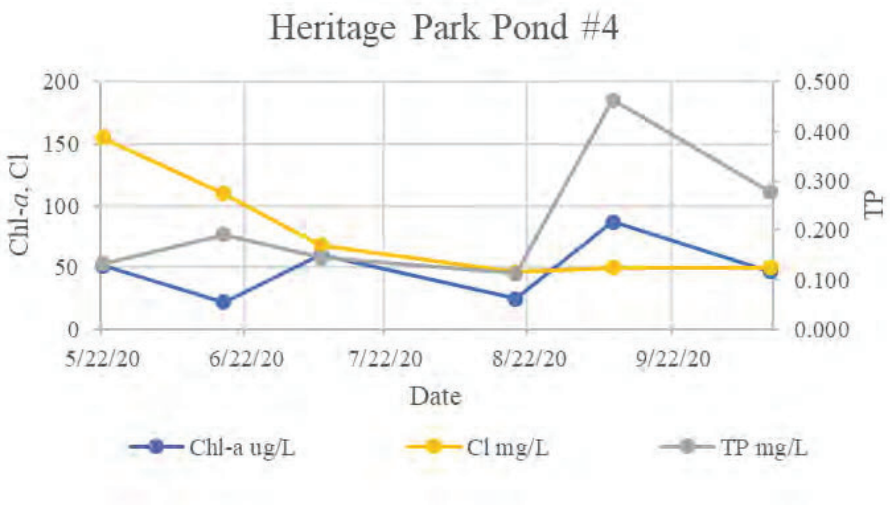


Figure 23-29. Graph of the 2020 Heritage Park Pond #4 (Pond 14) showing Chl-*a*, Cl and TP.

The Heritage Park Pond #4 data shows that Chl-*a* does correlate with TP, indicating TP may be a driver of Chl-*a*. The Chl-*a* threshold is 30 ug/L where above this HABs can be of concern. In June and September, the Chl-*a* values were 68 ug/L and 60 ug/L respectively. The MPCA 5-day chronic chloride threshold is 230 mg/L. The chloride values were never over 230 mg/L. This pond may be a good retrofit candidate for TP and Chl-*a* reduction.

Heritage Park Pond #5

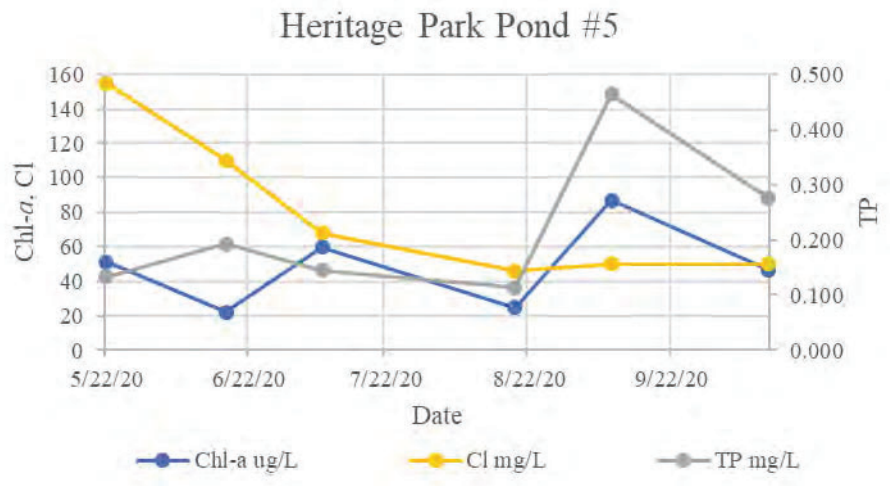


Figure 23-30. Graph of the 2020 Heritage Park Pond #5 (Pond 15) showing Chl-*a*, Cl and TP.

The Heritage Park Pond #5 data shows that Chl-*a* does correlate with TP, indicating TP may be a driver of Chl-*a*. The Chl-*a* threshold is 30 ug/L where above this HABs can be of concern. Many of the Chl-*a* samples were above 30 ug/L except the June and August samples. The MPCA 5-day chronic chloride threshold is 230 mg/L. The chloride values were never over 230 mg/L. This pond may be a good retrofit candidate for TP and Chl-*a* reduction.

Central Pond

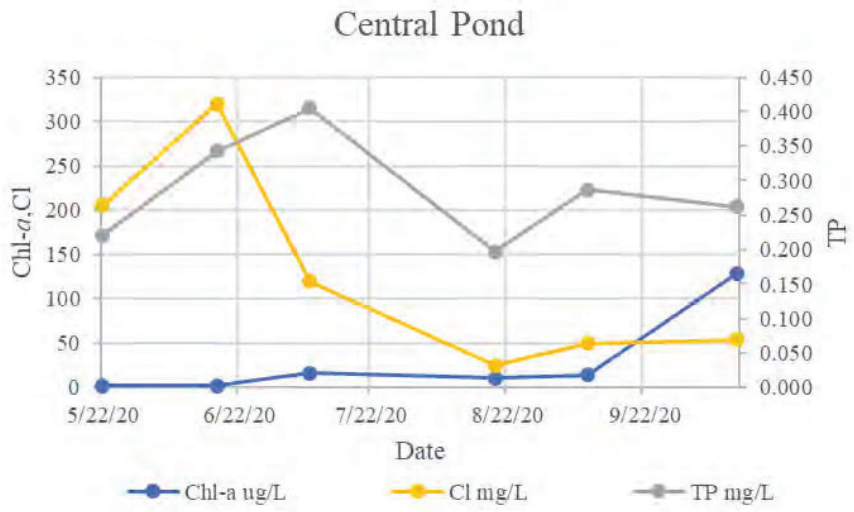


Figure 23-31. Graph of the 2020 Central Pond (Pond 16) showing Chl-*a*, Cl and TP.

The Central Pond data shows that Chl-*a* does not correlate with TP, indicating TP may not be a driver of Chl-*a*. The Chl-*a* threshold is 30 ug/L where above this HABs can be of concern. All the Chl-*a* samples were below 30 ug/L except the last October sample where Chl-*a* was 129 ug/L. The MPCA 5-day chronic chloride threshold is 230 mg/L. Only the June chloride sample of 320 mg/L was over the MPCA 230 mg/L threshold. This pond may be a good retrofit candidate for TP reduction.

Most of the ponds Chl-*a* data correlated well with TP which is not surprising. The exceptions were E. Park & 43rd, Logan, and Central where there was no Chl-*a* correlation with TP. The Central Pond was dyed green in 2020 to inhibit Chl-*a* growth which likely effected the Chl-*a* results. The Cl values at most of the ponds were below the MPCA 5-day chronic Cl threshold of 230 mg/L. These included the Columbus, Camden. Logan Mead, Hiawatha Outlet, West Park & 44th, East Park & 43rd, Heritage Park 1, 2, 3, 4, and 5 Ponds. The ponds with Cl samples above than the MPCA 5-day chronic Cl threshold were Winter St. Infiltration Basin, Currie, Central, and 25th Ave NE Ponds. The 25th Ave NE Pond was the only pond that consistently had Cl values over the MPCA 5-day Cl chronic threshold.

Ponds with Chl-*a* over 30 ug/L

Figure 23-32 shows fourteen ponds that had values greater than 30 ug/L Chl-*a* graphed on a log-scale. The red line highlights the 30 ug/L threshold where conditions above this level indicate that HABs can be of concern.

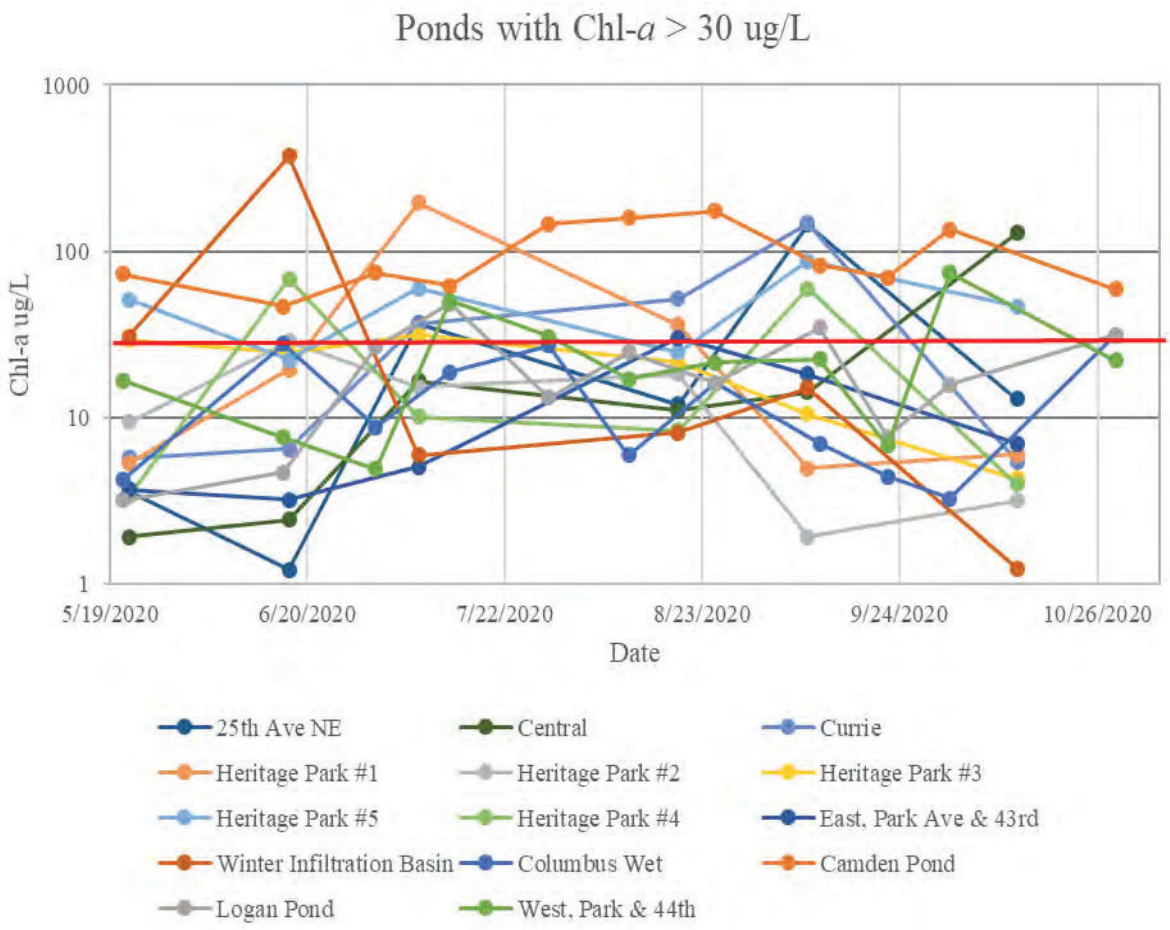


Figure 23-32. Ponds on a log-scale with Chl-*a* over 30 ug/L. The red line at 30 ug/L demonstrates the threshold where HABs are likely to occur.

In **Figure 23-32** Winter St. Basin Pond is the outlier in mid-June with Chl-*a* at approximately 375 mg/L. Chl-*a* at Camden Pond was consistently over 30 ug/L with readings lower in the spring at around 75 ug/L but between 150 to 175 ug/L in June and July. Most of the ponds intermittently exceeded the 30 ug/L Chl-*a* threshold.

Ponds with Cl over 230 mg/L and 120 mg/L

Figure 23-33 shows eight of the ponds graphed for Cl that were either over 230 mg/L or 120 mg/L. The red line in the Cl graph is the 230 mg/L chronic 5-day MPCA threshold. The green line in the Cl graph is the 120 mg/L Canadian chronic threshold for ecological impacts.

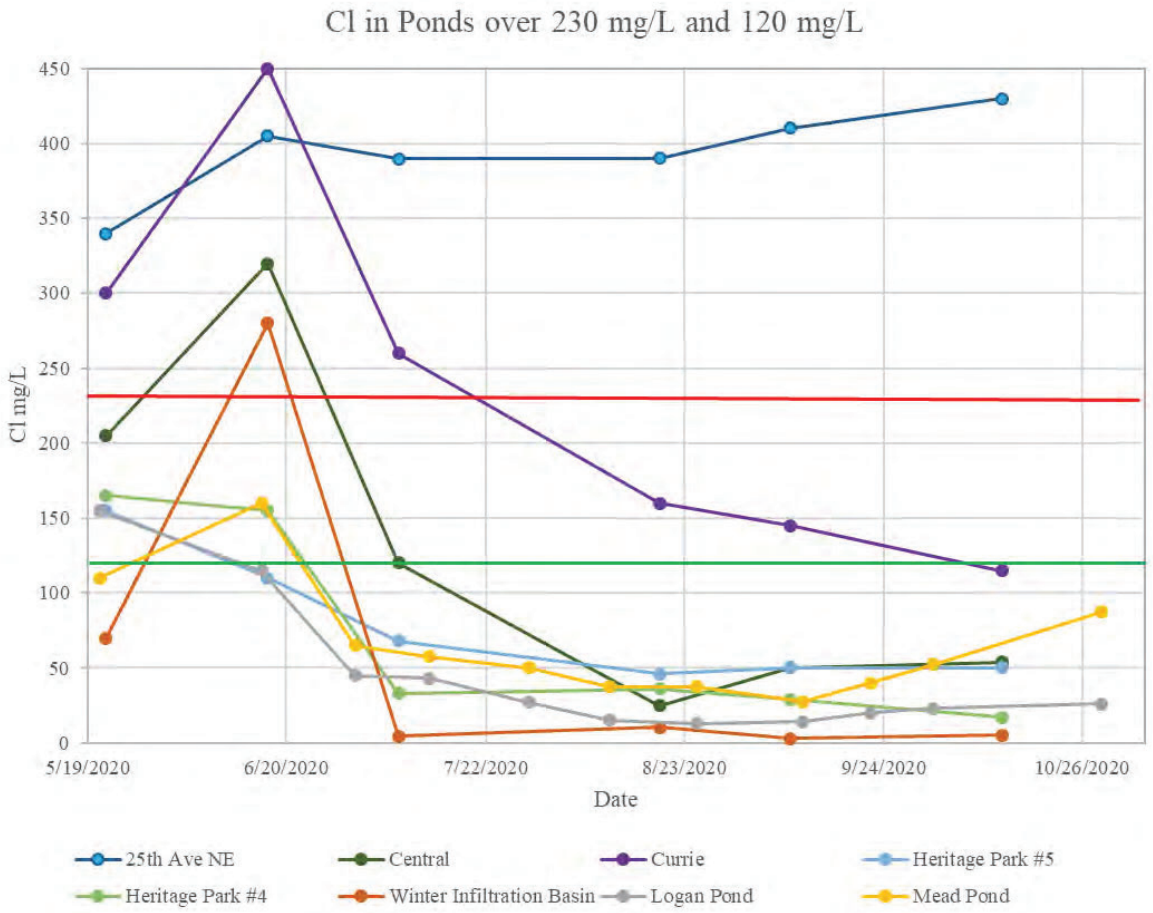


Figure 23-33. Graph of the 2020 ponds with higher Cl. The red line is the 230 mg/L MPCA 5-day chronic threshold, and the green line is the 120 mg/L Canadian chronic threshold.

Cl was consistently high at the 25th Ave NE Pond and always over the 230 mg/L MPCA 5-day chronic threshold. Cl levels at Currie, Central, and Winter St. Basin Ponds were all over the 230 mg/L standard in mid-June. The ponds that did not exceed the MPCA 230 mg/L threshold but did exceed the 120 mg/L Canadian chronic threshold were the Heritage Park 4 and 5, Logan, and Mead Ponds. With the exception of the 25th Ave NE Pond these ponds show increased Cl levels in the spring, likely from snowmelt chloride application runoff, and then a flushing throughout the year to lower levels.

Ponds with higher TP

Figure 23-34 shows the ponds graphed that had higher TP. Phosphorus is usually a limiting nutrient in aquatic ecosystems. Phosphorus can be from stormwater inputs, resuspension and disturbance of sediments, or internal release in ponds from the sediment. Higher TP values can drive phytoplankton production and then increase Chl-*a*.

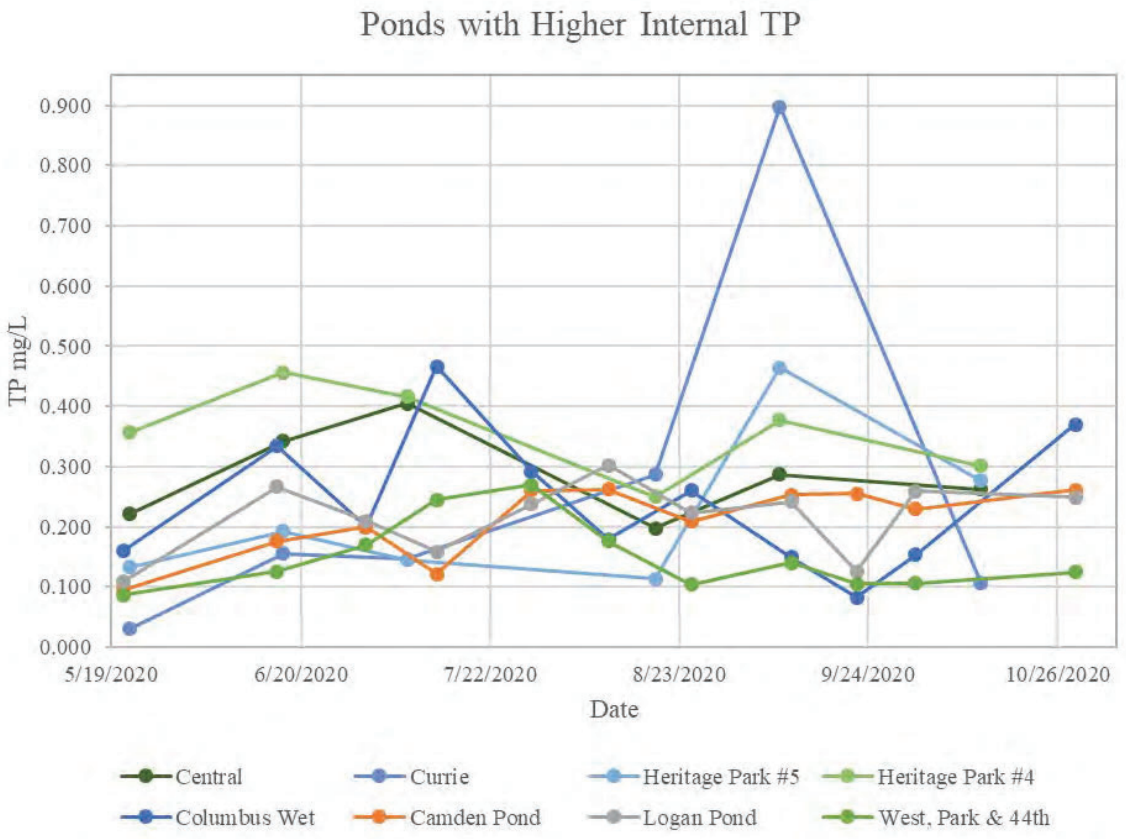


Figure 23-34. Ponds with higher internal TP.

Eight of the ponds that had higher internal TP were compared and appear to show the possibility of internal loading. All eight ponds had exceedances of 0.250 mg/L, which is quite high for a waterbody. TP can be a limiting nutrient for phytoplankton. Pond retrofits should focus on limiting phosphorus availability. High concentrations of TP can lead to increased phytoplankton and Chl-*a* concentrations.

TP increased to approximately 0.900 mg/L at Currie in early September, which is quite high. The Winter St. Basin Pond TP data are not presented in the graph since it is not a pond but an infiltrations basin with a very small ponding area. With the exception of the Currie Pond, the TP at seven of the eight ponds was below 0.500 mg/L all year. The data from the ponds with higher internal TP illustrate the bimodal tendency in many of the ponds, with both a mid-summer and fall rise in TP.

WENCK Pond 2020 Monitoring Data

The WENCK pond data collected in 2020 are presented in **Figure 23-35** and **Figure 23-36** showing the dissolved oxygen (DO) and temperature profiles. Oxygen and temperature profiles can indicate stratification and anoxic conditions at the pond bottom. Fourteen of the ponds WENCK studied overlapped with the sixteen ponds that MPRB studied. The MPRB did not study the Shingle Creek North and South Ponds and the graphics used are from the WENCK study.

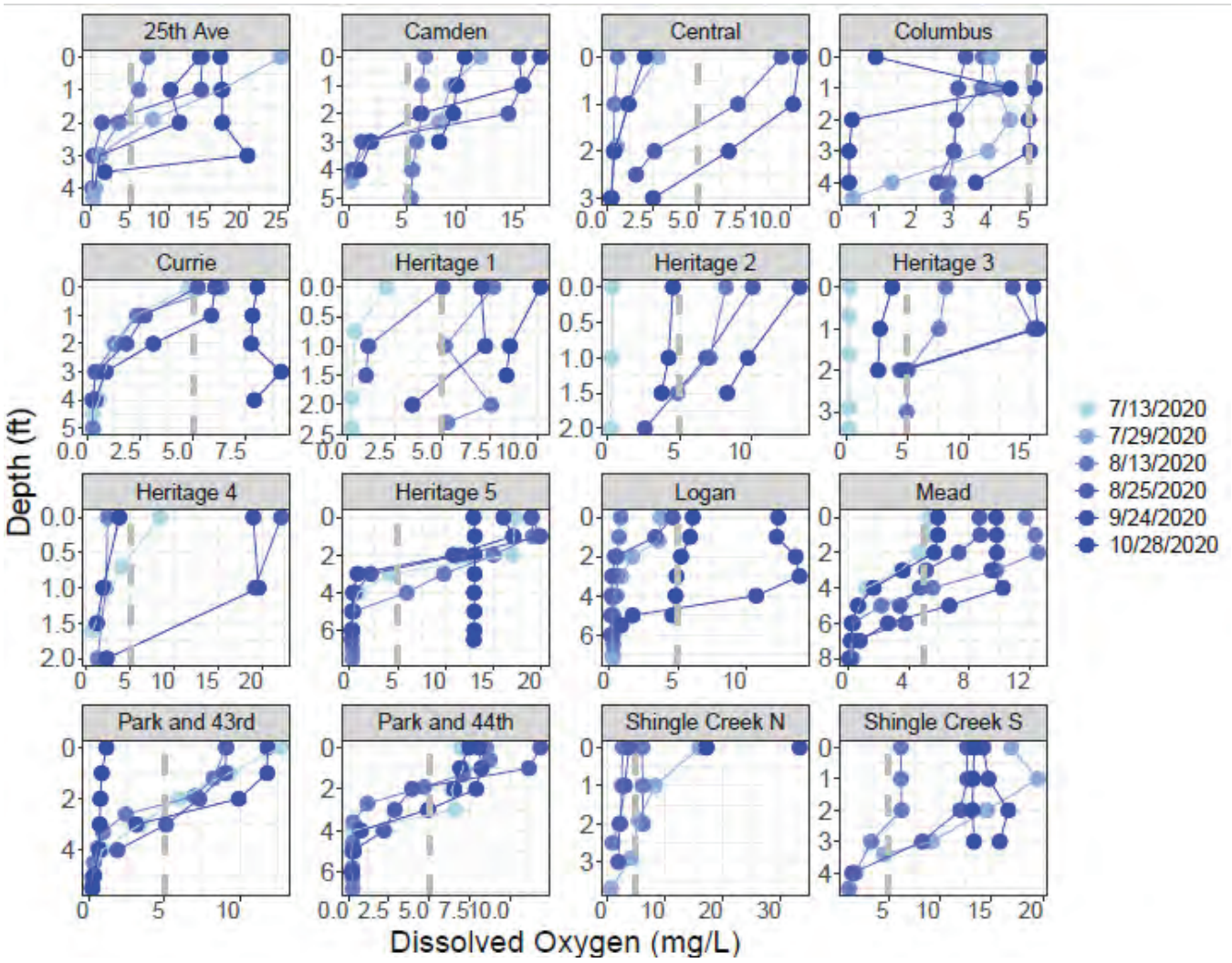


Figure 23-35. WENCK data and graph of the dissolved oxygen (DO) profiles of 14 of the 16 MPRB ponds. The Shingle Creek North and South Ponds were not part of the MPRB study. The grey dashed line shows the 5 mg/L mark.

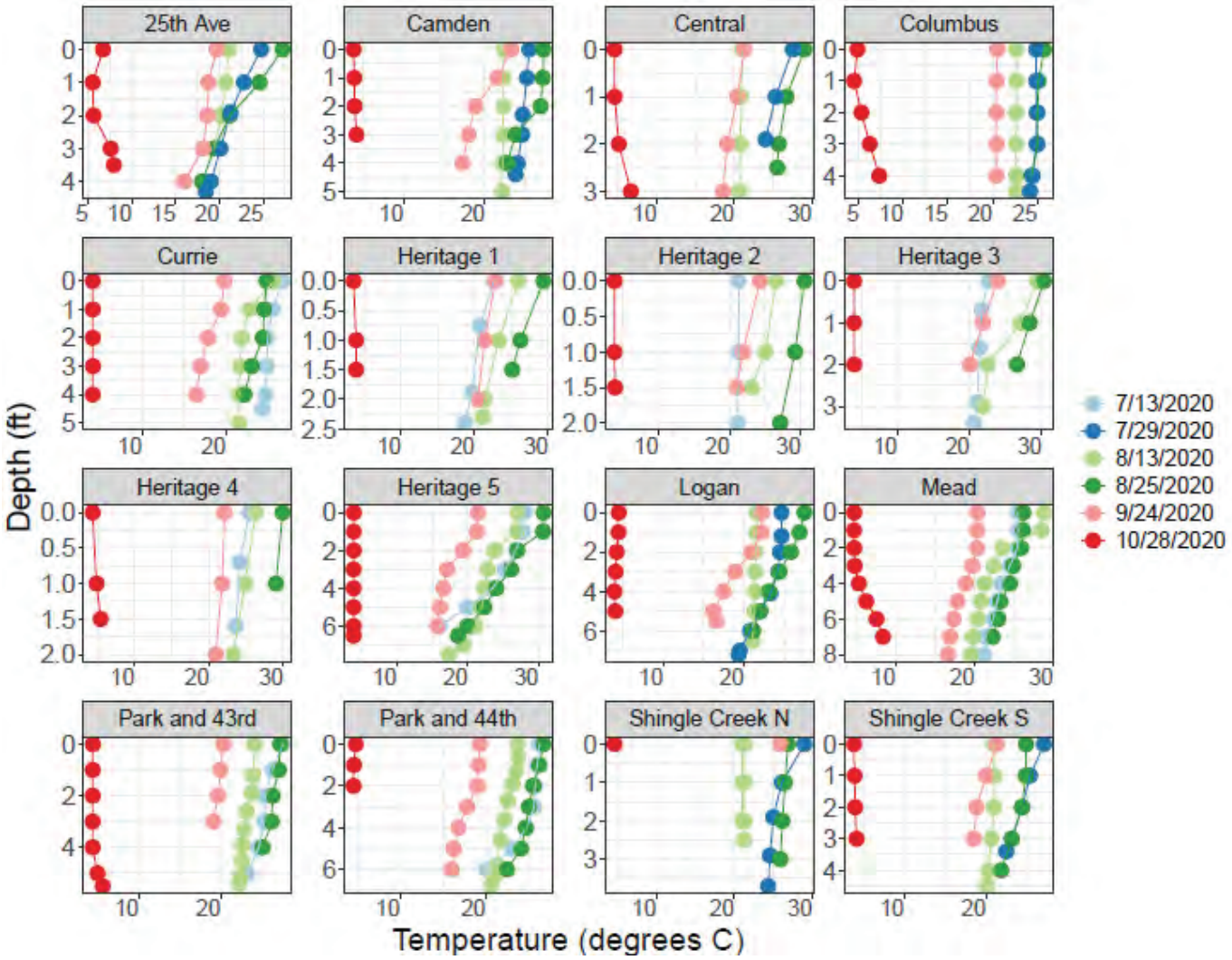


Figure 23-36. WENCK data and graph of the temperature profiles of 14 of the 16 ponds. The Shingle Creek North and South Ponds were not part of the MPRB study.

Figure 23-35 and **Figure 23-36** show that many of the ponds DO appears stratified, but the temperature is not stratified. The ponds appear to be mixing because the temperature is consistent top to bottom, but the pond sediments likely have a high oxygen demand which quickly sets up a dissolved oxygen stratification in many of the ponds. Specifically, 25th Ave NE, Mead, Park & 43rd & Park & 44th ponds have stratified DO and the bottom samples are anoxic all year. The Currie, Heritage Park 5, and Logan Pond bottom samples are anoxic, except later in the year in September and October. The Central and Columbus Ponds bottom samples are anoxic in July and Sept. The Heritage Park Ponds 1-4 bottom samples are all anoxic in mid-July. When the bottom pond water is anaerobic the pond sediments can release phosphorus internally back to the pond water column where it can facilitate unwanted algae growth and increase Chl-*a* concentrations possibly leading to HABs.

CONCLUSION

The pond screening looked for:

1) Pond Chl-*a* values greater than 30 ug/L when HABs can be of concern.

2) High pond TP values, usually greater than 0.250 mg/L or higher, and what the source could be. Higher TP pond values can be associated with internal release from the pond sediments. The Wenck pond data show anoxic conditions at the pond bottom where iron-bound phosphorus can be released. Some of the ponds had limited TSS, VSS and metals data that could shed light on bioturbation or resuspension of pond sediments.

3) Pond chloride values that either exceeded the MPCA 5-day chronic standard of 230 mg/L or the Canadian chronic aquatic standard of 120 mg/L.

Chlorophyll-*a*

Fourteen of the ponds had Chl-*a* measurements above the 30 ug/L threshold where HABs can occur. HABs are made up of a phytoplankton organism called cyanobacteria which has the capability to produce toxins. Cyanotoxins were not monitored in 2020. These toxins can be a health concern to humans or animals. Human body contact does not usually occur in stormwater ponds, but it can occur in downstream waterbodies.

HABs are not a concern at Winter St. Infiltration Basin since it is an infiltration basin and does not maintain much standing water. The Chl-*a* at Camden Pond is the most concerning since recorded concentrations had the potential to produce a sustained HAB event.

There are two main HAB concerns with stormwater ponds. First, the possible seeding of downstream water bodies with phytoplankton HAB resting cells. The other concern is the possibility, if a HAB event were to occur, that the HAB could become aerosolized by the wind. If a HAB was to be aerosolized by the wind, it could pose a risk burden to the local surrounding community. Many of the stormwater ponds are in lower income and minority communities and reducing HABs could be part of environmental justice issues.

Ponds that should be investigated for high Chl-*a* and HAB potential are:

- Camden
- Heritage Park #4
- Heritage Park #5
- Currie
- West, Park & 44th

Chloride

Chloride is also present in stormwater in significant concentrations, particularly snowmelt. Novotney et.al. (2009) showed that 77% of the chloride is not flushed through but retained in the Twin Cities Metropolitan Area (TCMA) watershed, and pre-settlement background levels

were roughly 3 mg/L. The Minnesota Cl standard for aquatic life is 230 mg/L. The Canadian Water Quality Guidelines for the Protection of Aquatic Life recommend that long term chloride concentrations for freshwater be less than 120 mg/L (Canadian Environmental Quality Guidelines, Canadian Council of Minister of the Environment, 2011).

The Cl of many of the ponds increases in mid-June and then decreases throughout rest of the summer. The 25th Ave NE Pond had very high Cl levels all season of around 400 mg/L. It is unknown where the Cl is coming from at the 25th Ave NE Pond since most of the surrounding watershed is owned by the University of Minnesota. Spring is when most aquatic life is emerging, growing, and vulnerable to damage due to high levels of chloride. Chloride in ponds originates from the surrounding watershed. These watersheds should be investigated for Cl reduction strategies. Ponds cannot be retrofit to remove dissolved chloride.

- 25th Ave NE pond should be investigated for consistently high chloride levels.

Total Phosphorus

Most of the ponds in this study are flood control ponds that may be able to have a stormwater benefit. Stormwater ponds are specifically designed to settle material and sediment bound TP from incoming stormwater. Sometimes this phosphorus is resuspended or internally released from pond sediments. Total phosphorus is a target pollutant for removal because it can be a driver of Chl-*a* in waterbodies. An MPCA study of 98 stormwater ponds showed that nearly 40% had a summer median TP concentration exceeding average stormwater runoff concentrations of 0.380 mg/L (Vinicius, et.al., 2020). The MPCA study concludes stormwater ponds are highly susceptible to internal phosphorus release which can add to eutrophication of downstream waterbodies. One mechanism of the internal release of phosphorus in stormwater ponds occurs when the sediment water interface becomes anaerobic, allowing iron-bound phosphorus to be released. Resuspension or bioturbation may be another source. If the pond mixes intermittently the sediment released phosphorus will become bio-available to phytoplankton near the surface.

The TP data show a mix of results. Some ponds showed TP increases in both the spring and fall. Most of the pond's TP levels remained below 0.400 mg/L. Not all ponds with high TP translated into high Chl-*a*. This relationship appears complicated by multiple factors. It is interesting to note that Camden Pond which had consistently high Chl-*a* values had no TP values above 0.300 mg/L. There appears to sometimes be a correlation with high TP and high Chl-*a*, but not always.

Ponds that should be investigated for potential high internal loading of TP are:

- Heritage Park #4
- Heritage Park #5
- Central
- Columbus
- Currie
- Logan

Ponds tested for NPDES parameters

The ponds monitored in 2020 for the full NPDES chemistry suite show that Chl-*a* appears to correlate well with TSS and VSS at all the ponds, except Columbus. When looking at the possibility of resuspension in the ponds, a significant portion of the TSS appears to be VSS. Almost half or more of the TSS is VSS. The majority of the VSS is likely phytoplankton or fine organic colloidal material in the ponds that does not settle well. The metals values are also very low which would indicate that sediment is not being resuspended and bioturbation is not occurring in the ponds with these data.

Future Work and Retrofits

Dredging may be needed at Mead, West Park & 44th, East Park & 43rd, Camden, and Central Ponds. They have been in service for 20 years and never been dredged. As-built bathymetric construction maps should ideally be compared to current bathymetry to help determine if dredging is needed. Organic sediments consume oxygen from the water column and may create anoxic conditions above sediments where iron-bound phosphorus may be released back to the pond. Dredging may enhance their efficacy of future stormwater pollutant settling and removal. It should be noted that dredging with other improvements should help create aerobic conditions to keep iron-bound phosphorus in the pond sediments.

Aeration may also be added to keep the ponds mixed and aerobic. The Columbus Pond has a small aeration system for odor control, but it appears to be undersized to create aerobic conditions at the bottom or inhibit Chl-*a* production. Oxygenated water at the pond bottom would prevent the iron-bound phosphorus release from sediments. Phosphorus release can increase Chl-*a* creating conditions for algae to grow.

Most of the ponds were developed for flood control and not as green space or for wildlife habitat. The City would like to investigate the possibility of enhancing pond wildlife habitat. High chloride levels can have a negative effect on aquatic life. Chloride levels were only consistently high at the 25th Ave NE Pond with levels around 400 mg/L. Cl in spring, greater than 230 mg/L, at Currie, Central, and Winter St. Infiltration Basin may also negatively affect the spring emerging aquatic life and chloride should be mitigated to lower levels if ponds are expected to function as habitat.

If duckweed is growing or planted in a pond it could be harvested as a final nutrient sink for removal. Logan Pond has extensive duckweed mats that could be harvested. There are smaller commercially available remote-controlled vehicles that could help facilitate duckweed management. Harvested duckweed should be quantified and tested for the nutrients removed from the pond.

The addition of biodegradable colored dyes or herbicides e.g. Aquashade, to ponds has been shown to inhibit the production of Chl-*a*. Dyes and herbicides would need to be continually added as they would be flushed out with the short residence time of stormwater ponds. Central Pond is on Columbia Golf Course and was dyed blueish-green most of the season to inhibit algae. Central Pond had Chl-*a* below 30 ug/L all season except for the October sample where it was approximately 130 ug/L. This may be a useful seasonal short-term tool for the prevention of HABs.

Alum injection systems, for pond inlet stormwater, could be investigated where the stormwater aluminum bound phosphorus can then settle in the pond and later be dredged out and removed. These systems exist but also require a high degree of maintenance. Treating pond influent with alum to bind, settle, and limit phosphorus may also inhibit the formation of Chl-*a* and potentially HABs.

Future Monitoring

Flow-weighted sampling at pond inlets and outlets would help to determine both the external load to the ponds and give a more complete picture of nutrient removal. This sampling could be done prior to and after a retrofit project to calculate the nutrient removal benefit of specific projects.

Regular pond profiles of DO and temperature should be done to determine if the pond is stratified or mixing and if the pond bottom is anaerobic. If the pond bottom becomes anaerobic it can release phosphorus from the sediment back to the water column.

If HABs in stormwater ponds are of concern, Chl-*a* along with HAB cyanotoxins could also be tested. This would provide evidence of not just conditions for potential HABs, but credible evidence of cyanotoxins presence and their concentrations. These data would support a more complete risk assessment. Ponds with Chl-*a* greater than 30 ug/L should also have a phytoplankton sample taken to determine the dominant species. Different types of algae may require different management strategies.

Fat, Oil, and Grease (FOG) and Quarterly Grab Monitoring

BACKGROUND

As part of the federal Clean Water Act, the Minneapolis Park and Recreation Board (MPRB) and the City of Minneapolis are co-signatories on the Environmental Protection Agency (EPA) issued National Pollutant Discharge Elimination System (NPDES) Municipal Separate Stormsewer System (MS4) Permit. The permit requires quarterly grab samples for NPDES chemistry, pH, *E. coli*, and a pilot project to monitor fat, oils, and grease (FOG). The purpose of this monitoring is to characterize the seasonality of runoff for parameters that cannot be collected with flow-weighted composite monitoring (e.g. pH, *E. coli*, FOG). Criteria for snowmelt sample collection was a winter snowpack melt. Criteria for spring, summer, and fall grab sample collection was precipitation greater than 0.10" separated by at least 8 hours from other rain events.

The NPDES permit requires quarterly grab stormwater event monitoring to be attempted, but it is not always possible to carry out. Rain events must occur when staff are working, and the laboratory is open to receive samples. Ideally, annual quarterly grab monitoring includes two snowmelt grab samples, and a one each of a spring, summer and fall grab sample. Quarterly grab monitoring includes a pH, *E. coli*, NPDES water chemistry sample, and a Fat Oil and Grease (FOG) sample. The water chemistry samples are analyzed for the 14 chemistry parameters included in the NPDES permit. The pH, *E. coli*, and FOG sample data cannot be collected from regular composite sampling and can only be collected from a grab sample.

Grab sampling characterizes a point in time of a snowmelt or rain event. The first snowmelt event usually has higher pollutant concentration than subsequent snowmelt events. The chemical concentrations can change over time and throughout the hydrograph as the rising limb usually mobilizes fine particles and FOG material on hard surfaces first. Chemical concentrations can vary not only throughout the individual hydrograph but also from storm to storm, largely driven by the time since the last precipitation. It can be helpful to think of pollution in a watershed as behaving like dust. It accumulates over time and then washes off in a melt or rain event. The longer the time between wash off (snowmelt or rain) the more material (pollutants) accumulates.

As part of the NPDES permit, a study of quarterly FOG grab samples were conducted along with regular grab sample monitoring with the intent to sample six sites. The latest NPDES permit it was determined that if a FOG sample was measured greater than 15 mg/L at a site, then that site would continue to be monitored throughout the permit cycle. FOG in stormwater can come from a variety of sources such as: vehicles, industry, food waste and gas stations. Elevated levels of hydrocarbons can be harmful to aquatic plants and animals. It is important to minimize FOG in stormwater through best practices in industry, public education about vehicle maintenance, and the prevention of improper waste disposal.

In 2018 quarterly grabs were collected at the representative land use sites. Following snowmelt, grab samples could not be collected from the Pershing land use site since auto-monitoring equipment was housed in a box on top of the manhole. 61st and Lyndale had extensive road construction beginning mid-summer 2018 that restricted access. In 2019, the grab sites were changed to the Powderhorn Lake Inlets (SE, S, and W) and the 24th & Elm infiltration basin Inlets (N and S). It had been intended to continue sampling at the 61st and Lyndale site, but the site was again inaccessible due to pipe replacement and road reconstruction. In 2020, the quarterly grab sites were, 24th& Elm Inlets (N and S) and Powderhorn Inlets (N, SE, S, and W) and 61st & Lyndale. The Powderhorn Inlet N site was deemed inaccessible and dropped from sampling after several attempts. 61st and Lyndale was only sampled one time in July, and a full year of sampling at this site will be attempted again.

METHODS

Grab Sampling

The sample bottle was either attached to a modified pool skimmer pole a clean white 5-gallon bucket was lowered into the stormsewer to collect an aliquot and poured off if flow was not adequate to collect with the bottle method. If the protocol required rinsing, one rinse was done, if rinsing was not protocol samples were collected without rinsing.

The pH grab sample was analyzed in the field by a hand-held Oakton pH meter that had a two-point calibration prior to field use that day. The pH probe was rinsed with the grab sample water and the pH measurement taken directly from the aliquot.

The *E. coli* samples were collected in sterile 100 mL bottes and not rinsed. These samples were immediately stored directly on ice in a cooler.

Standard FOG sampling protocol was followed, and FOG samples were collected in an unrinsed amber glass bottle. Rinsing could introduce additional FOG material which would stick to the inside glass container walls and produce artificially high results.

NPDES water chemistry samples were collected in a 2-liter Nalgene bottle that was rinsed once with the stormwater prior to filling.

A 2-liter field blank of DI water accompanied all samples while in the field. All samples were stored and transported on ice to the laboratory within holding times.

Samples could only be collected when enough flow was present to collect a sample. Snowmelt and precipitation needed to produce at least over 1" of stage in the pipe to be sampled. Precipitation events needed to be greater than 1/10" to produce enough runoff.

In 2020, quarterly grab samples were attempted on 2/24/20, 10/22/20 and 11/9/20 but no samples could be collected due to limited flow of less than 1".

All FOG, NPDES water chemistry, and *E. coli* samples were analyzed at Instrumental Research Incorporated (IRI) Laboratory in Fridley, Minnesota. All metals and DOC samples were analyzed by Pace Laboratory in Minneapolis, MN.

Table 24-1 shows all the NPDES chemistry parameters tested in each sample collected. **Table 24-2** shows approved methods, reporting limits, and holding times for each parameter as reported by the contract laboratory Instrumental Research, Inc. (IRI). Pace Laboratory analyzed all metals and DOC samples.

Table 24-1. The list of required NPDES permit chemistry parameters to be monitored.

Parameter	Abbreviation	Units
Chemical Oxygen Demand	COD	mg/L
Dissolved Organic Carbon	DOC	mg/L
Chloride, Total	Cl	mg/L
***E. coli* (*Escherichia Coli*)**	*E. coli*	MPN/100mL
Hardness	Hard	mg/L
Copper, Total	Cu	µg/L
Lead, Total	Pb	µg/L
Zinc, Total	Zn	µg/L
Nitrite+Nitrate, Total as N	NO_3NO_2	mg/L
Total Nitrogen	TN	mg/L
pH	pH	standard unit
Fat, Oil, and Grease (FOG)	FOG	mg/L
Phosphorus, Total Dissolved	TDP	mg/L
Phosphorus, Total	TP	mg/L
Solids, Total Dissolved	TDS	mg/L
Solids, Total Suspended	TSS	mg/L
Solids, Volatile Suspended	VSS	mg/L

Table 24-2. Analysis method, reporting limit, and holding times for parameters used by Instrumental Research, Inc. and Pace Laboratories.

Parameter	Method	Reporting Limit	Holding Times
COD	SM 5220-D	20 mg/L	28 days
DOC‡	SM 5310-C-00	1.5 mg/L	28 days
Chloride, Total	SM 4500-Cl^- B	2.0 mg/L	28 days
***E. coli* (*Escherichia Coli*)**	SM 9223 B	1 MPN per 100mL	< 24hrs
Hardness	SM 2350 C	5.0 mg/L	6 months
Copper, Total‡	EPA 200.8	1 µg/L	6 months
Lead, Total‡	EPA 200.8	0.10 µg/L	6 months
Zinc, Total‡	EPA 200.7	20 µg/L	6 months
Nitrite+Nitrate, Total as N	SM 4500-NO_3 E	0.030 mg/L	28 days
Total Nitrogen	Alk Persulfate Oxidation method	0.500 mg/L	28 days
pH	SM 4500 H^+ B	0.01 units	15 minutes
Fat, Oil, and Grease (FOG)	EPA 1664A	5.0 mg/L	28 days
Phosphorus, Total Dissolved	SM 4500-PE	0.010 mg/L	48 hours
Phosphorus, Total	SM 4500-PE	0.010 mg/L	48 hours
Solids, Total Dissolved	SM 2540 C	5.0 mg/L	7 days
Solids, Total Suspended	SM 2540 D	1.0 mg/L	7 days
Solids, Volatile Suspended	EPA 160.4	2.0 mg/L	7 days

‡Metals and DOC were analyzed by Pace Laboratories.

Figure 24-1 shows the location of the 61st & Lyndale, industrial land use site, within the City of Minneapolis, MN. **Figure 24-2** show the location of the Powderhorn Lake SE, S, and W Inlets, and **Figure 24-3** show the location of the 24th and Elm infiltration basin N and S Inlets.

Figure 24-1. Aerial photo of the 2020 61st & Lyndale stormwater quarterly grab monitoring sites.

Figure 24-2. Aerial photo of the 2020 Powderhorn quarterly grab monitoring sites.

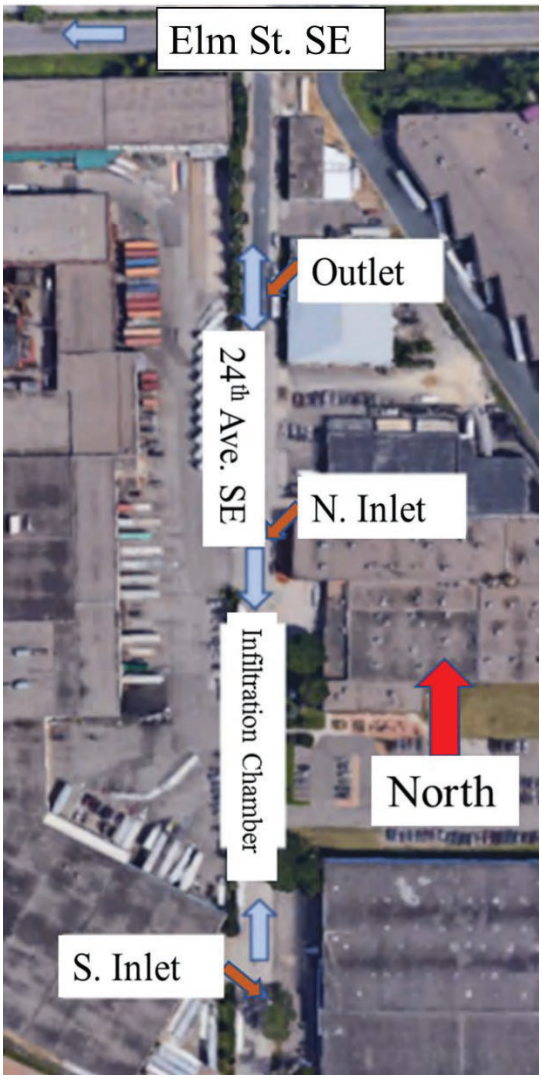


Figure 24-3. Aerial photo of 24th & Elm Infiltration Chamber and its two inlets and outlet. Blue arrows show the direction of flow.

Table 24-3 shows the land use and drainage area for the sampled sites at the Powderhorn inlets and 61st & Lyndale. **Table 24-4** shows the 24th & Elm and Winter Infiltration basins land use and drainage area.

Table 24-3. The 2020 Powderhorn Inlets and 61st & Lyndale sites monitored for NPDES chemistry, *E. coli*, pH, and FOG.

Site ID	Powderhorn Inlet Southeast	Powderhorn Inlet South	Powderhorn Inlet West	61st & Lyndale
Location	3421 15th Ave S.	13th Ave S. and E. 35th St.	3318 19th Ave S.	335 ft. east of 61st St and Harriet Ave S.
Land Use	Multi–Family, Residential, Mixed Use	Residential, Mixed Use	Residential, Mixed Use	Commercial/Industrial
Drainage Area	68.8 acres	81.2 acres	99.4 acres	34.9 acres

Table 24-4. The 2020 24th & Elm sites monitored for NPDES chemistry, *E. coli*, pH, and FOG.

Site ID	24th & Elm Infiltration Basin North Inlet	24th & Elm Infiltration Basin South Inlet
Location	24th Ave SE	24th Ave SE
Land Use	Light Industrial	Light Industrial
Drainage Area	3.9 acres	10.3 acres

Field Quality Assurance Samples

A variety of quality assurance quality control (QAQC) measures were taken to ensure defensible data. Ten percent of the samples were laboratory quality assurance samples (e.g. duplicates, spikes). A field blank was also generated for each sampling trip and was analyzed for all NPDES chemical parameters. Field blanks consisted of deionized water which accompanied samples from the field sites to the analytical laboratory. All field blank parameters were below the reporting limits in 2020. As part of the overall QAQC program, blind monthly performance samples of known concentration were made for all monitored parameters and delivered to IRI. If any parameter failed that month all the data for that parameter were flagged for the entire month.

Field measurements were recorded on a Field Measurement Form in the 2020 Field Log Book. Electronic data from the laboratory were forwarded to the MPRB in preformatted spreadsheets via email. Electronic data from the laboratory were checked and passed laboratory quality assurance procedures. Protocols for data validity followed those defined in the Stormwater Monitoring Program Manual (MPRB, 2001). For data reported below the reporting limit, the reporting limit value was divided in half for use in statistical calculations.

Manual transcription of data was minimized to reduce error introduction. A minimum of 10% of the final data were checked by hand against the raw data sent by the laboratory to ensure there were no errors entering, manipulating, or transferring the data. See **Chapter 29,** Quality Assurance Assessment Report for details.

A Chain of Custody form accompanied each set of sample bottles delivered to the lab. Each sample container was labeled indicating the date and time of collection, the site location, and the field personnel initials. Samples were transported to the laboratory on ice in a cooler. The time that each grab sample was collected was recorded onto field sheets. A complete description of methods can be found in the Stormwater Monitoring Program Manual (MPRB, 2001). Common statistics were calculated using Microsoft Excel.

Results and Discussion

Snowmelt usually has the highest geometric mean concentrations for most chemical parameters. This is as expected as snowmelt is the release of 4-5 months of deposition and debris from the watershed. Snowmelt usually has the lowest geometric mean for *E. coli*. The *E. coli* concentrations are temperature dependent because bacteria do not survive well in cold conditions.

Table 24-5 shows the 2020 quarterly NPDES chemistry grab sample results. Snowmelt has more pollutants than the summer grab samples, but lower *E. coli*. It should be noted that all of the Powderhorn (SE, S, and W) Inlet snowmelt samples have significantly more pollutants than the other sites sampled. Specifically, the Powderhorn (SE, S, and W) Inlet snowmelt phosphorus and metals samples are high in comparison to the other sites sampled. All the sites monitored had pH quarterly grab samples ranged between 6.9 and 8.3.

Table 24-5. The 2020 quarterly stormwater grab sample chemistry collected, NA=data not available.

Site Location	Date Sampled	Time	Sample Type	TP mg/L	TDP mg/L	TN mg/L	NO3NO2 mg/L	Cl mg/L	Hardness mg/L	pH Units	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	FOG mg/L	E. Coli MPN	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
24th & Elm In N	3/3/2020	13:30	Grab	0.339	0.175	1.55	0.237	160	40	7.4	23	12	432	46	<5.00	<1	13	3	64	11
24th & Elm In N	3/4/2020	12:20	Grab	0.382	0.192	1.52	0.306	170	48	7.3	38	13	415	62	<5.00	<1	21	12	76	9
24th & Elm In N	7/14/2020	8:20	Grab	0.195	0.083	2.75	1.42	16	64	7.0	22	10	148	85	<5.00	3270	12	3	63	16
24th & Elm In N	7/21/2020	9:40	Grab	0.164	0.016	1.59	0.706	8	40	6.6	64	16	117	61	<5.00	6131	15	5	69	8
24th & Elm In S	3/3/2020	13:20	Grab	0.459	0.297	2.33	0.216	260	36	7.6	22	13	537	48	<5.00	4	10	2	44	11
24th & Elm in S	3/4/2020	12:10	Grab	0.400	0.287	1.79	0.184	200	32	7.1	11	6	410	25	<5.00	<1	11	1	35	9
24th & Elm In S	7/14/2020	8:10	Grab	0.197	0.065	2.41	0.698	8	36	7.1	57	21	199	101	<5.00	441	16	4	91	16
24th & Elm In S	7/21/2020	9:30	Grab	0.170	0.055	1.61	0.480	<2.00	16	6.9	11	6	58	32	<5.00	24196	6	0	<20.0	6
24th & Elm Out	7/14/2020	8:30	Grab	0.163	0.046	4.72	2.88	190	150	7.1	72	17	548	117	7	272	19	8	129	16
61st & Lyndale	7/7/2020	9:30	Grab	0.076	0.019	2.46	0.701	72	70	8.0	226	52	255	185	6	294	40	19	155	17
61st & Lyndale	7/21/2020	8:35	Grab	0.224	0.018	1.66	0.328	16	44	8.4	152	30	108	107	<5.00	2620	18	8	113	10
Powderhorn In S	2/24/2020	13:42	Grab	1.00	0.419	5.14	0.250	750	50	8.0	128	65	1360	197	31	133	41	28	236	24
Powderhorn In S	3/3/2020	12:40	Grab	1.30	0.473	5.17	0.169	550	64	7.6	338	196	1112	326	14	2420	46	38	245	27
Powderhorn In S	7/7/2020	10:05	Grab	0.099	0.083	1.13	0.319	<2.00	14	8.0	29	12	53	22	3	41	18	11	34	4
Powderhorn In S	7/21/2020	9:00	Grab	0.203	0.067	1.63	0.604	<2.00	20	6.6	28	12	50	49	<5.00	9330	13	8	34	7
Powderhorn In SE	3/3/2020	12:50	Grab	1.08	0.592	3.57	0.151	450	72	NA	75	39	950	167	6	2420	26	14	116	43
Powderhorn In SE	3/4/2020	11:45	Grab	0.806	0.582	3.57	0.143	450	72	NA	24	14	868	108	6	121	18	8	74	27
Powderhorn In SE	7/7/2020	9:55	Grab	0.152	0.119	1.41	0.561	<2.00	18	6.6	20	10	40	26	5	>24200	20	7	30	6
Powderhorn In SE	7/21/2020	8:50	Grab	0.173	0.080	1.44	0.534	2	14	6.6	19	9	30	42	<5.00	7701	8	3	24	6
Powderhorn In W	2/24/2020	14:15	Grab	1.04	0.324	3.93	0.250	800	70	8.3	175	104	1434	412	109	517	38	20	174	25
Powderhorn In W	3/3/2020	12:20	Grab	1.79	0.512	5.33	0.142	450	80	7.4	430	206	1068	470	13	866	70	135	396	26
Powderhorn In W	7/7/2020	10:10	Grab	0.149	0.039	1.21	<0.030	<2.00	14	7.2	33	14	43	33	4	>24200	14	18	30	4
Powderhorn In W	7/21/2020	9:10	Grab	0.236	0.028	1.69	0.455	2	22	6.4	30	17	42	66	<5.00	98040	10	10	47	8

For historical consideration of the FOG project **Table 24-6** shows the 2018 and **Table 24-7** shows the 2019 FOG data. In 2018 none of the FOG data were reported greater than 15 mg/L. In 2019, the only data where FOG samples were reported greater than 15 mg/L were from 61st & Lyndale snowmelt. All other FOG samples were below 15 mg/L.

Table 24-6. Shows the 2018 FOG event dates and grab samples collected.

Site Location & Date Sampled	1/10/2018	1/19/2018	1/26/2018	3/19/2018	3/26/2018	7/12/2018	7/13/2018	10/1/2018
14th & Park	<5.00	6				<5.00		<5.00
22nd & Aldrich	8	8		6			<5.00	<5.00
61st & Lyndale		<5.00	9					
Pershing				<5.00	<5.00			

Table 24-7. Shows the 2019 FOG event dates and grab samples collected. Data in bold are over 15 mg/L.

Site Location & Date Sampled	3/12/2019	3/13/2019	3/19/2019	3/20/2019	5/8/2019	6/27/2019	8/26/2019	9/12/2019
14th & Park	9	10						
22nd & Aldrich	Attempted‡	7						
61st & Lyndale	**21**	**19**						
Pershing			<5.00	<5.00				
24th & Elm In N					<5.00	<5.00	<5.00	<5.00
24th & Elm In S					<5.00	<5.00	<5.00	<5.00
24th & Elm In Out								
Winter Basin In S					<5.00	<5.00	6	6
Winter Basin In W					5	5	5	<5.00

‡Attempted refers to sampling that was attempted but could not be collected.

All 2020 Fat Oil and Grease (FOG) samples are shown in **Table 24-8.** Two snowmelt samples from Powderhorn Inlet South and Inlet West collected on 2/24/20 were over the 15 mg/L MPCA threshold. All other FOG grab samples were below 15 mg/L.

Table 24-8. 2020 FOG event dates and grab samples collected. Bold data are FOG samples were greater than 15 mg/L.

Site Location & Date Sampled	2/24/2020	3/3/2020	3/4/2020	7/7/2020	7/14/2020	7/21/2020
61st & Lyndale				6		<5.00
24th & Elm In N	Attempted‡	<5.00	<5.00		<5.00	<5.00
24th & Elm In S	Attempted‡	<5.00	<5.00		<5.00	<5.00
Powderhorn In N	Attempted‡	Attempted‡				
Powderhorn In SE	Attempted‡	6	6	5		<5.00
Powderhorn In S	**31**	14		3		<5.00
Powderhorn In W	**109**	13		4		<5.00

‡Attempted refers to sampling that was attempted but could not be collected.

CONCLUSION

In 2020, an attempt was made to monitor six sites quarterly for NPDES water chemistry, *E. coli*, pH, and FOG. In 2020 the six sites were chosen were 24th& Elm Inlets (N and S) and Powderhorn Inlets (N. SE, S, and W). In 2020 the Powderhorn Inlet N site could not be grab sampled for snowmelt due to the pipe flow path relationship to the manhole being inaccessible, so it was abandoned as a quarterly grab sample site. In 2020 following snowmelt it was decided to add back 61st & Lyndale to the quarterly grab monitoring since the 2019 snowmelt FOG samples had come back greater than 15 mg/L at this site.

Grab samples of stormwater represent chemistry at a point in time. Following sampling protocol, some parameters can only be characterized by a grab sample, e.g. pH, *E. coli*, and FOG. The 2020 quarterly grab sampling data show that snowmelt has high values for all chemical parameters when compared to runoff at other times of the year. Snowmelt chemistry values were also high at the Powderhorn Inlet (S and W) sites, specifically the phosphorus, solids, metals, and FOG data.

The pH ranged between seven and eight. The *E. coli* levels were low in the snowmelt and higher in the warmer months since *E. coli* are temperature-dependent organisms.

In 2020, two February FOG snowmelt grabs from Powderhorn Inlet South and West were the only samples above 15 mg/L. All other FOG samples collected in 2020 were below the 15 mg/L threshold.

Snowmelt is a unique event the temporarily suspends 4-5 months of frozen debris into the watershed. As seen in the data snowmelt samples are extremely polluted from material deposited in the watershed over the winter, and it is common to see an oily sheen on a snowmelt grab sample. In adherence to the NPDES permit the MPRB will continue to attempt to monitor 6 sites quarterly for NPDES water chemistry, *E. coli*, pH, and FOG. The stormwater pipe has been replaced at 61st & Lyndale and is now accessible and since it had a 2019 snowmelt FOG sample greater than 15 mg/L it will continue to be part of the quarterly grab sampling sites.

Powderhorn Lake Inlet Monitoring

BACKGROUND

The City of Minneapolis and Minneapolis Park and Recreation Board undertook a restoration plan for Powderhorn Lake in 1999, due to poor lake conditions. Part of the restoration plan included the installation of Continuous Deflective Separators (CDS) to remove trash and solids from the stormwater to Powderhorn Lake. In 2001, five CDS grit chambers were installed at the outlets to the larger watersheds flowing to Powderhorn Lake to remove solids from stormwater inflow **Figure 25-3**. A drawing of a CDS unit is shown in **Figure 25-1**. The Powderhorn Lake watersheds are shown in **Figure 25-2**.

Despite this and other restoration work, the lake was listed as impaired and placed on the Environmental Protection Agency (EPA) 303d list based on eutrophication and biological

indicators in 2001. Powderhorn Lake later trended towards better water quality and was subsequently delisted in 2012 after meeting state standards for several years. Powderhorn was relisted on the EPA 303d list as impaired for nutrients in 2018 after relapsing to poor water quality.

The purpose of monitoring the stormwater inlets into Powderhorn Lake is to measure the external nutrient load of the main tributaries to the lake. Information collected will help create a plan to decrease the amount of external nutrients impacting Powderhorn Lake. In 2020, the COVID-19 pandemic disrupted the ability to carry out equipment installations and only grab samples were collected at the Powderhorn inlets

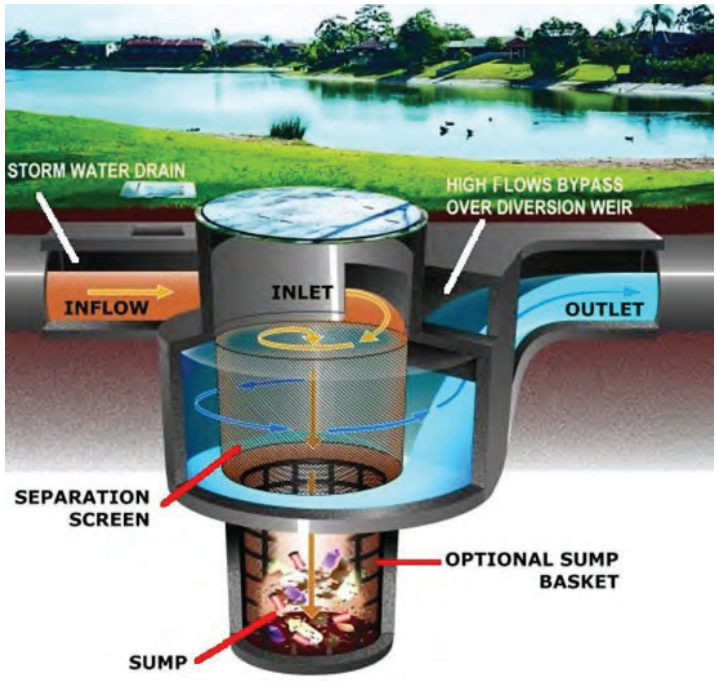


Figure 25-1. Cross section showing components of a CDS grit chamber unit.

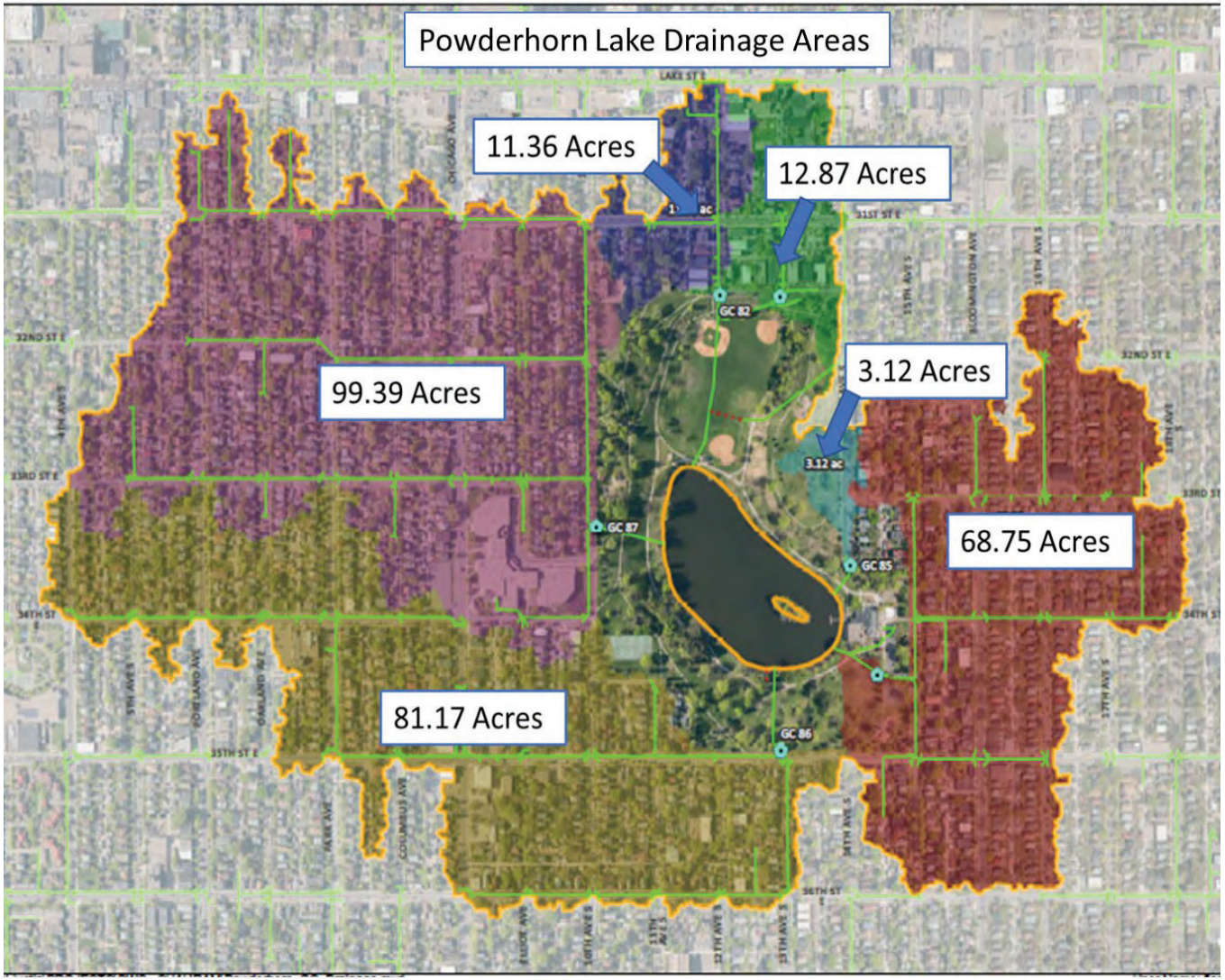


Figure 25-2. Powderhorn Lake individual watershed drainage areas with acreage. All inlets have CDS units except the small 3.12-acre area which has a sump.

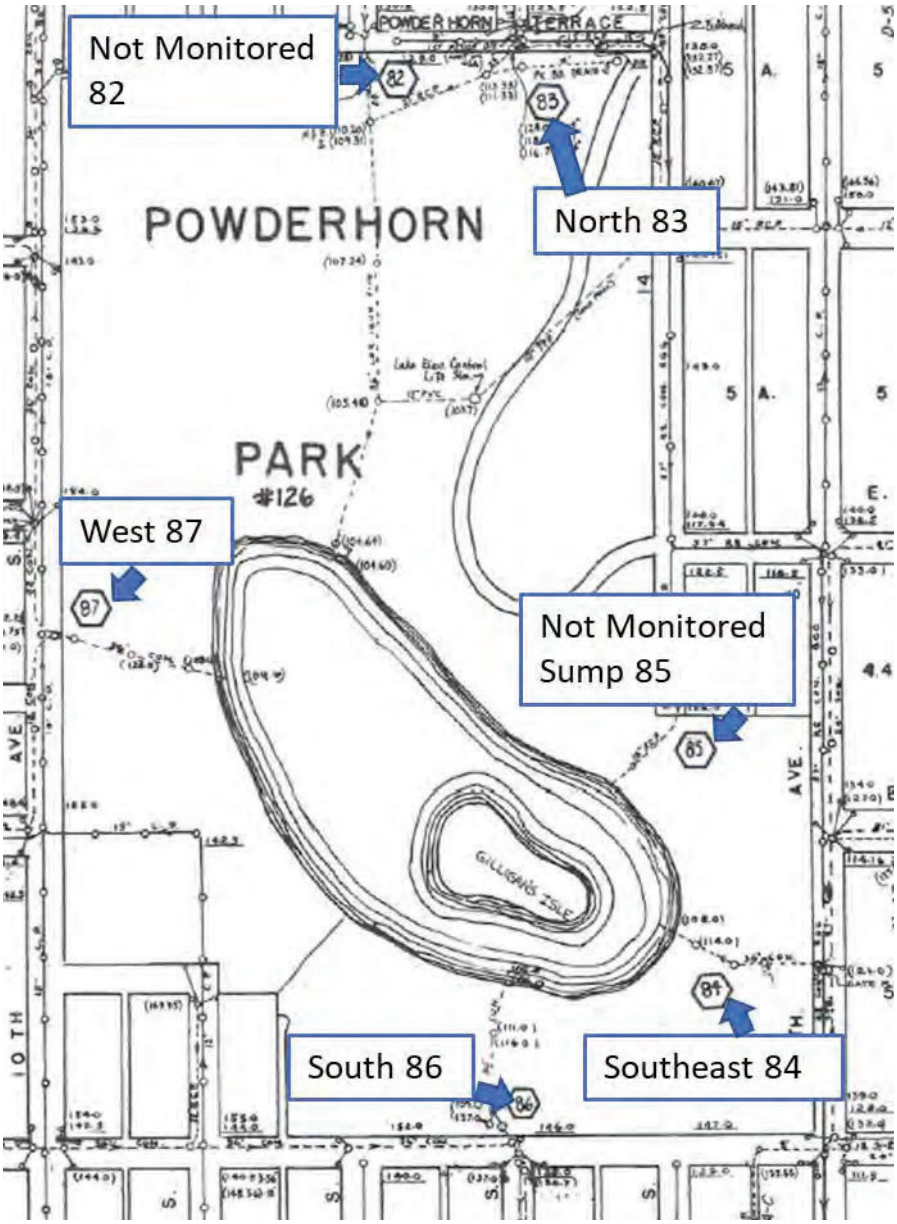


Figure 25-3. Stormsewer map of CDS grit chambers 82-87 surrounding Powderhorn Park.

There are five CDS grit chambers and one sump structure installed in stormwater pipes leading to Powderhorn Lake. A sump is a pit, usually in a catch basin, that traps solids. **Table 25-1** shows the Powderhorn CDS grit chamber assigned numbers, location, and drainage areas for each CDS unit. CDS unit 82 was not monitored since it is adjacent to and has an almost identically sized watershed to CDS unit 83. Sump 85 was not monitored because the watershed is only 3.1 acres which is about 1% of the watershed and it is unlikely that this watershed contributes a significant portion of nutrient loading to Powderhorn Lake.

Table 25-1. A list of the Best Management Practices (BMP's) surrounding Powderhorn Lake, their associated drainage areas.

Monitoring ID Name	BMP Type	Grit_ID	Drainage (Acres)	Location
Not Monitored	CDS Hydrodynamic Separator	82	11.4	12th Ave S and Powderhorn Terrace
Inlet North	CDS Hydrodynamic Separator	83	12.9	13th Ave S and Powderhorn Terrace
Inlet Southease	CDS Hydrodynamic Separator	84	68.8	3421 15th Ave S
Not Monitored	Sump Manhole	85	3.1	3329 14th Ave S
Inlet South	CDS Hydrodynamic Separator	86	81.2	13th Ave S and East 35th Street
Inlet West	CDS Hydrodynamic Separator	87	99.4	3318 10th Ave S back of sidewalk oppisite of house #3318

METHODS

Site Installation

In 2020, the COVID-19 pandemic prevented installation of equipment and auto-monitoring of the Powderhorn Inlet sites. The sites continued to be part of the NPDES quarterly grab sample schedule.

The Inlet South and Inlet West had significant sedimentation upstream of the CDS overflow weirs. It is believed that this is caused by the CDS screens becoming plugged and water backing up the inlet pipes where settling occurred. If the pandemic has subsided to the point where safe monitoring can be done, it is planned that auto-monitoring equipment will be installed spring of 2021.

Sample Collection

Auto-monitoring with flow-paced composite sampling was not done in 2020. Only quarterly grab sampling was done at the Inlet South, Inlet Southeast, and Inlet West for chemistry, *E. coli*, pH, and Fat Oil and Grease (FOG) analysis.

Sample collection was done with either a modified pool skimmer pole or a white bucket tied to a rope. The 2-Lsample bottle was rinsed prior to sample collection for water chemistry, pH aliquots poured off for analysis in the field. The pH data were collected by a handheld Oakton pH meter that had a two-point calibration with 7 and 10 pH standards in the office. Following protocol, the *E. coli* sample bottles were not rinsed prior to sample collection. *E. coli* samples were collected in single-use sterile bottles. FOG samples were collected in non-rinsed1-L bottle for analysis.

Sample Collection

In 2020, Powderhorn Inlet samples were collected from storms ranging from 0.32" to 0.88''. Samples were collected from two snowmelt events and two individual storms at the Inlet South, Inlet Southeast, and Inlet West sites. **Table 25-2** shows the grab sample storms collected and the precipitation measured by a rain gauge at MPRB's service center at 3800 Bryant Ave. S. Minneapolis, MN. A precipitation event was defined as a storm greater than 0.10" and separated by eight hours or more from other precipitation.

Table 25-2. 2020 Precipitation and grab samples collected at the Powderhorn Lake inlets.

Start Date	Start Time	End Date	End Time	Rain (inches)	Duration (hours)	Intensity (in/hr)	Hours since last Rain.	Powderhorn In S	Powderhorn In SE	Powderhorn In W
2/24/2020	13:42	Snowmelt						X	NS	X
3/3/2020	12:40	Snowmelt						X	X	X
3/4/2020	11:45	Snowmelt						NS	X	NS
7/7/2020	7:45	7/7/2020	8:30	0.70	0.75	0.93	176	X	X	X
7/21/2020	6:30	7/21/2020	8:30	0.32	2	0.16	59	X	X	X

NS indicates storms that were not sampled.

When grab samples were collected at the South Inlet and West Inlet water appeared to be backed up to the height of the overflow weir, approximately two feet high, indicating that the CDS unit is partially plugged. A plugged CDS screen appears to cause stormwater to back up the inlet pipe which settles out solids upstream, **Figure 25-4**. Untreated stormwater flows by the overflow weir directly to the lake. The water impounded in the upstream pipe then appears to have slowly drained down between storms through the CDS unit screen.

Figure 25-4. A 2019 photograph of the upstream Powderhorn Inlet South offset AV probe and intake strainer after removing 8" of sand and debris.

Table 25-3 shows the 2020 grab sample chemistry data for samples collected at the Powderhorn inlets. Data underlined failed the blind monthly laboratory standard for the corresponding test and month. When the laboratory cannot recover the blind standard at ± 20%, all the data are marked for that month. These data were deemed usable but should be used with caution.

The snowmelt samples had significant amounts of pollutants. The July grab samples had very high *E. coli* values. The Powderhorn West Inlet March snowmelt metals were high. The March lead concentrations at this inlet was high, at 135 ug/L, and should be investigated for a possible source. There are no stormwater standards, but the lead drinking water action standard is 15 ug/L. The source of the lead is currently unknown, but one possibility may be exterior lead paint coming from the older residential buildings.

Table 25-3. 2020 Powderhorn Inlet Stormwater grab sample chemistry data. Data that are underlined in red had a blind performance standard failure for that month, for that parameter. NA = data not available.

Site Location	Date Sampled	Time	Sample Type	TP mg/L	TDP mg/L	TN mg/L	NO3NO2 mg/L	Cl mg/L	Hardness mg/L	pH Units	TSS mg/L	VSS mg/L	TDS mg/L	COD mg/L	FOG mg/L	E. Coli MPN	Cu ug/L	Pb ug/L	Zn ug/L	DOC mg/L
Powderhorn In S	**2/24/2020**	13:42	Grab	1.00	0.419	5.14	0.250	750	50	8.0	128	65	1360	197	31	133	41	28	236	24
Powderhorn In S	**3/3/2020**	12:40	Grab	1.30	0.473	5.17	0.169	550	64	7.6	338	196	1112	326	14	2420	46	38	245	27
Powderhorn In S	**7/7/2020**	10:05	Grab	0.099	0.083	1.13	0.319	<2.00	14	8.0	29	12	53	22	3	41	18	11	34	4
Powderhorn In S	**7/21/2020**	9:00	Grab	0.203	0.067	1.63	0.604	<2.00	20	6.6	28	12	50	49	<5.00	9330	13	8	34	7
Powderhorn In SE	**3/3/2020**	12:50	Grab	1.08	0.592	3.57	0.151	450	72	NA	75	39	950	167	6	2420	26	14	116	43
Powderhorn In SE	**3/4/2020**	11:45	Grab	0.806	0.582	3.57	0.143	450	72	NA	24	14	868	108	6	121	18	8	74	27
Powderhorn In SE	**7/7/2020**	9:55	Grab	0.152	0.119	1.41	0.561	<2.00	18	6.6	20	10	40	26	5	>24200	20	7	30	6
Powderhorn In SE	**7/21/2020**	8:50	Grab	0.173	0.080	1.44	0.534	2	14	6.6	19	9	30	42	<5.00	7701	8	3	24	6
Powderhorn In W	**2/24/2020**	14:15	Grab	1.04	0.324	3.93	0.250	800	70	8.3	175	104	1434	412	109	517	38	20	174	25
Powderhorn In W	**3/3/2020**	12:20	Grab	1.79	0.512	5.33	0.142	450	80	7.4	430	206	1068	470	13	866	70	135	396	26
Powderhorn In W	**7/7/2020**	10:10	Grab	0.149	0.039	1.21	<0.030	<2.00	14	7.2	33	14	43	33	4	>24200	14	18	30	4
Powderhorn In W	**7/21/2020**	9:10	Grab	0.236	0.028	1.69	0.455	2	22	6.4	30	17	42	66	<5.00	98040	10	10	47	8

CONCLUSION

Snowmelt likely contributes a significant amount of the nutrient load to Powderhorn Lake. Further monitoring will be needed to determine annual loads.

The 2021 monitoring plan is to install monitoring equipment at the South Inlet, SE Inlet, N Inlet, and West Inlet sites. The West Inlet is the largest watershed at 99 acres, and the South Inlet is the second largest at 81 acres. It is planned to move monitoring equipment locations at the South and West inlets to pipes downstream of the CDS units. If the monitoring equipment cannot be moved at these two sites, upstream monitoring will continue with an enhanced upstream pipe and CDS unit cleaning.

To determine the external pollutant load from the watershed, monitoring data from the inlets is needed. When collected, these data will provide information that can be used to determine the external pollutant load to Powderhorn Lake. The data could assist in a creation of a lake diagnostic study and inform a plan to mitigate the external pollutant load to the lake, ideally leading to improving in-lake conditions.

FROG & TOAD CALLING SURVEYS IN STORMWATER PONDS: 2018-2020 SUMMARY

Prepared for MaryLynn Pulscher, Minneapolis Park & Recreation Board
By Jenny Winkelman
March 14, 2020

American toad (*Anaxyrus americanus*). *Photograph by J. Winkelman*

Funding for this project was provided by the City of Minneapolis Department of Public Works

Background and Objectives

The presence and abundance of frogs and toads is a useful indicator of water and habitat quality, as well as short and long-term environmental changes. Long-term surveys by natural resource agencies have resulted in standardized methods of collecting data. The Minnesota Department of Natural Resources (DNR) implements statewide monitoring using the Minnesota Frog & Toad Calling Survey (MFTCS), which contributes to the nation-wide North American Amphibian Monitoring Program (NAAMP).

The question has been raised whether or not stormwater ponds, constructed to intercept and treat runoff, can also function as a refuge for amphibians. In addition, the public has complained about the absence of formerly abundant frogs and toads calling from Hiawatha Golf Course and the surrounding area. To evaluate these concerns, preliminary frog and toad listening surveys were conducted at Lake Hiawatha golf course in 2016 and 2017, and formalized in 2018 to the present. Additional stormwater ponds were added to the surveys in 2018 and again in 2019 to reflect different types and locations of stormwater ponds with standing water throughout Minneapolis.

The purpose of these surveys are to:

1) Determine if any frog and toad species (anurans) and if so, which ones, are living in or near stormwater ponds.

2) Use the Minnesota Frog and Toad Calling Survey protocols adapted for Theodore Wirth Park to Identify species and abundance in stormwater ponds.

3) Generate ideas about why or why not species may use stormwater ponds.

4) Involve volunteers and concerned citizens in monitoring Hiawatha Golf Course ponds in a systematic way.

Funding for this project was provided by the City of Minneapolis Department of Public Works.

Methods

Survey methods for this study were adapted from the MFTCS survey protocols[1] (see Appendix 1 for a comparison). Modifying the MFTCS protocol for this study enabled the documentation of species presence and was done in a way that can still be compared with statewide survey data.

At each site, species presence and abundance, based on strength of calling (calling index of 1-3), was recorded for each run. In some cases, a "1" may also indicate a species was seen but not heard, to capture the information that it was present (recorded on data sheets as a P for present). Variability among observers was reduced by having the same lead observer and passing the USGS frog calling identification[2] each year.

Minneapolis Park and Recreation Board staff identified sites and added or dropped sites as more was learned. Stormwater pond sites and sampling effort by year are shown in Table 1. In 2019 a) an extra, early survey was conducted at the Hiawatha Golf Course, and b) more locations were added across the city.

[1] 2002 Anderson, Y. and R. Baker. Minnesota Frog and Toad Calling Survey, 1996-2002. MN Department of Natural Resources.

[2] https://www.pwrc.usgs.gov/frogquiz/index.cfm?fuseaction=main.lookupNAAMP calling quiz. Last accessed February 1, 2021.

In 2020, the pond at 37th St E and Chicago Ave S was dropped from the study because only one toad was heard once in two years and there are a lot of lights, noise and even an active fountain. Robert's Bird Sanctuary was added and sampled early in the hopes of finding wood frogs. Due to civil unrest and the pandemic, stormwater sites were only sampled once, instead of three times. The ponds at 43rd and Park and southeast of Lake Nokomis were not sampled at all due to civil unrest, a road closure, and time constraints.

In 2020, some preliminary chloride measurements were taken at select sites using Hach titration strips with the intention of comparing the results with laboratory analyses. However, COVID closures precluded comparisons with lab analyses.

Table 1. Sampling effort at each stormwater pond location, 2016-20.

Location	Total no. surveys	Number of times sampled				
		2016	2017	2018	2019	2020
South Minneapolis Type to enter text						
37th and Chicago	5	—	—	2	3	0
43rd S and Park - NE pond	5	—	—	2	3	0
43rd S and Park - SW pond	5	—	—	2	3	0
60th S and 1st (north of 62, west of 35W)	4	—	—	—	3	1
Bde Maka Ska (southwest ponds)	3	—	—	—	2	1
Hiawatha Golf Course, corresponds to pond 1	7	1	—	1	4	1
Hiawatha Golf Course, corresponds to pond 5	8	1	—	2	4	1
Hiawatha Golf Course pond 2	5	—	—	—	4	1
Hiawatha Golf Course pond 3	6	—	—	1	4	1
Hiawatha Golf Course pond 4	5	—	—	—	4	1
Nokomis SE pond	2	—	—	—	2	0
Nokomis SW pond	3	—	—	—	2	1
Roberts Bird Sanctuary	1	—	—	—	—	1
North Minneapolis						
52nd N and Upton (two ponds)	6	—	—	2	3	1
Camden pond (42nd N and Morgan)	4	—	—	—	3	1
Columbia Hts. Golf Course	3	—	—	—	2	1
Heritage Park N (north of 55, outlet to Mississippi River)	4	—	—	—	3	1
Heritage Park S (south of 55)	4	—	—	—	3	1

Findings

- Six species of anurans—of 14 total known in MN—were reported across all sites, but only three or fewer species were found at any single location (Table 2).

- American toads were the most widespread and abundant, and found at least once all but one stormwater pond (Table 2). They were also the only species heard in full chorus (index of 3) at any site at any time. At Hiawatha Golf Course toads were routinely found and in 2019, at least five adults were also seen, swimming at the surface, in each of two ponds (ponds 1 and 2).

  Toads are largely terrestrial (except for egg laying), overwinter in soil below the frostline, and breed in mid season. Consequently, they are less susceptible to poor water quality during "first flush" stormwater runoff and thus, are likely more resilient to urbanization as long as other habitat needs are met.

- Gray treefrogs and Cope's gray treefrogs were uncommon but heard at least once at three sites——Upton and 52nd, Columbia Hts. Golf Course, Bde Maka Ska, and Hiawatha Golf Course (pond 5; Charts 1,2, 6,14, respectively). Individual gray treefrogs were heard in the distance, and not from the actual ponds. At Hiawatha, the only gray treefrogs called from the wooded area closer to Minnehaha Parkway.

  On the other hand, the sole Cope's gray treefrog heard was actually at the pond's edge at Columbia Hts. Golf Course. It was found at the pond with the most riparian vegetation that included shrubs and small trees (probably because mowing was not possible on the steep bank). Cope's gray treefrogs are found in woodland and field edges; whereas gray treefrogs live in predominantly wooded areas. In the Theodore Wirth Park surveys, Cope's gray treefrogs were most abundant also at a golf course pond near Regency Hospital.

- Surprisingly, green frogs, an aquatic frog, were present *and* abundant—with a chorus of 2—in the northern pond at Upton Ave N and 52nd Ave N, in 2019 (Chart 1). Green frogs have not even been heard in six years of similar surveys at Theodore Wirth Park (2015-20).

  Perhaps the proximity to Shingle Creek and Lion's Park ponds acted as a source for this species, which started breeding in 2019. Also, by 2019, riparian habitat was finally becoming established, which is good for water quality, and creates vegetated cover and corridors for dispersing froglets. Green frogs overwinter in water that does not freeze solid, and require an ongoing supply of oxygen, making them dependent on high quality water resources. Consequently they are also more vulnerable to urbanization than the more terrestrial anurans. Is winter,(e.g., water freezing solid, low oxygen and concomitant pollution from deicers) a key stressor that determines presence or absence of aquatic frogs in stormwater ponds? Why is this pond suitable for this aquatic frog? Does its depth preclude freezing? Is there water flowing in or moving that prevents freezing and if why, from where? As the pond fills in with sediment, will green frogs survive? The answers to these questions may be used to direct future stormwater design to benefit amphibians.

- Boreal chorus frogs were heard, once, for the first time in 2020 (Bde Maka Ska SW pond; Chart 6). Chorus frogs are most often heard during the early and mid-season surveys. Chorus frogs are a treefrog (Family Hylidae) and overwinter on land, under rocks, logs and leaf litter. No early run (April) has taken place here, and this was the first mid-season survey conducted at or near Bde Maka Ska; thus, chorus frogs may be more common. This information highlights the importance of having baseline records of where frogs and toads are known, or not.

Table 2. Species found at stormwater ponds sampled, 2016-20 (presence shown by "+")*.

Location	Total no. species found	Species Found					
		American Toad *Anaxyrus americanus*[1]	Gray Treefrog *Hyla versicolor*	Cope's Gray Treefrog *Hyla chrysoscelis*	Green Frog *Lithobates clamitans*[2]	Northern Leopard Frog *Lithobates pipens*[2]	Boreal Chorus Frog *Pseudacris maculata*
South Minneapolis							
37th & Chicago	**1**	+					
43rd S & Park - NE pond	**2**	+	+				
43rd S & Park - SW pond	**0**						
60th S and 1st —north of 62, west of 35W	**1**	+					
Bde Maka Ska SW ponds	**3**	+	+				+
Roberts Bird Sanctuary	**0**						
Hiawatha Golf Course, corresponds to ponds 1-4	**1**	+					
Hiawatha Golf Course, corresponds to pond 5	**2**	+	+				
Nokomis SE pond	**1**	+					
Nokomis SW pond	**1**	+					
North Minneapolis							
52nd N and Upton, two ponds	**3**	+	+		+		
Camden pond—42nd N & Morgan	**1**	+					
Columbia Golf Course	**2**	+		+			
Heritage Park N— north of 55, outlet to Mississippi River	**2**	+				+	
Heritage Park S— south of 55	**1**	+					

* Includes all species seen or heard at each site, including outside of the 5-minute sampling. In Minnesota, 14 species of frogs and toads are found.

[1]The genus *Anaxyrus* was formerly called *Bufo.*

[2] The genus *Lithobates* was formerly called *Rana.*

- Northern leopard frogs were heard, once, for the first time in 2020 (Heritage Park north of Hwy 55; Chart 3). Like the green frog, the Northern leopard frog is aquatic and overwinters in water that does not freeze solid. Questions, similar to those raised regarding the habitat for the green frog apply here as well. While aquatic, this species is considered a grassland frog of open fields and meadows—so its success may be associated with the upland habitat created around the stormwater basin. Interestingly, in 2020 leopard frogs were also heard for the

first time, and were abundant at one site in Theodore Wirth Park, which was unusually very quiet due to citywide pandemic restrictions.

Additional Habitat Observations/Implications

- **Salt.** Chloride measurements were low but detectable in the few locations sampled (Table 3). Due to pandemic restrictions, values were not able to be compared to laboratory analyses. Also the only stormwater pond sampled at this time was Robert's Bird Sanctuary (the other samples are from Theodore Wirth Park anuran sampling sites).

Table 3. Chloride concentrations in select locations on 3/26/20.

Location	Chloride levels (ppm)*
Roberts Bird Sanctuary	42
Wirth-pothole wetland near Wayzata Blvd	0
Wirth-Birch Pond	31
Wirth-EBWG spring	37
Wirth-EBWG Dike	40

* Measured at site with Hach titration strips.

In Minnesota, chronic chloride impairment is assigned at concentrations of 230 ppm. While levels detected are much lower, it should be of concern that chloride was measurable at all. Road salt from deicing applications is the only chloride source, and it accumulates in ponds, which will eventually affect frog and toad populations.

- **Irrigation.** Sprinkler irrigation at night creates a humid microhabitat at golf course pond locations, creating unique habitat conditions, with potential for benefitting amphibians.

- **Riparian areas.** Restored and natural riparian areas are being reduced incrementally by mowing, evident in the plants cut. This disturbance reduces important habitat and corresponds with invasive species growing at the newly mowed edges. The Columbia Hts. Golf Course uses red stakes pounded into the ground surrounding the ponds to delineate mowing edges; however, as it is minimal, stake placement appears to be a safeguard for the mowers rather than for defining an adequate riparian buffer for habitat.

The golf course pond (Columbia Hts.) with most riparian vegetation, including shrubs and small trees, was not mowed (probably because of the steep slope) was the only location where Cope's gray treefrogs were found.

- **Flooded areas.** Low-lying areas near the Lake Nokomis and Bde Maka Ska stormwater ponds and flooded parkways from spring rains (in 2019) expanded anuran habitat. These wet meadow areas/ vernal ponds (usually managed as turf) were generally three degrees warmer than the nearby stormwater ponds and when sampled side by side were preferred by calling/breeding toads.

- **Pond design and maintenance.** Aquatic frogs were found in only two stormwater ponds—Upton and 52nd and Heritage Park (north). Something, yet unknown, about these ponds enables them to support breeding green and leopard frogs. Additional monitoring will determine whether they continue to be used by anurans.

Care should be taken with the timing of maintenance activities if stormwater ponds are intended to also support amphibians. For example, ponds without aquatic frogs, can be dewatered and cleaned out after juveniles disperse from the breeding ponds. Ponds with aquatic frogs should not be dewatered in the hottest days of summer, nor dredged in winter. An example of an easily avoidable turtle-kill took place in 2020, when one metro area city (not Minneapolis!) dewatered and dredged a stormwater pond during the hottest days of

the year (at least 20 turtles died in the pond and on the road fleeing the pond; JW personal observation). When maintaining ponds for wildlife and water treatment, the timing of maintenance activities matters.

Recommendations

The intent of stormwater ponds is to treat runoff prior to discharge, so water quality is inherently not supposed to be "good". Toads are on the more terrestrial side of the spectrum compared to green and leopard frogs, which remain mostly aquatic throughout their lives (including overwintering). Toads spend the majority of their lives on land and breed in mid to late season, enabling them to escape water quality events associated with runoff especially in the early spring, when the "first flush" if runoff accumulated on land over winter reaches the ponds. In contrast, green frogs, and leopard frogs, even if limited to certain locations, suggests some characteristics of pond design that increases compatibility as amphibian habitat. Identifying what distinguishes these two ponds is of interest.

- Continue to conduct surveys. Sampling variability emphasizes the importance of multiyear, ongoing surveys. Some sites were recently added and have a shorter sampling history. Also, the data in 2020 may be anomalous due pandemic restrictions and the subsequent reduction in human activity around the ponds.
- Collect additional habitat information such as water quality data in winter and/or at first sampling, and vegetation information to assess extent and structure of existing riparian vegetation. The aforementioned habitat data would need to be collected during the daytime.
- Fine-tune and educate managers regarding amphibian habitat considerations when planning and implementing maintenance activities in and around the pond. Share and coordinate information so that changes in survey data can be associated, or not, with maintenance activities.
- Consider not mowing areas that flood seasonally and encourage their predisposition to function as vernal ponds.

Charts

North Minneapolis:

Chart 1. Upton and 52nd - N. Minneapolis

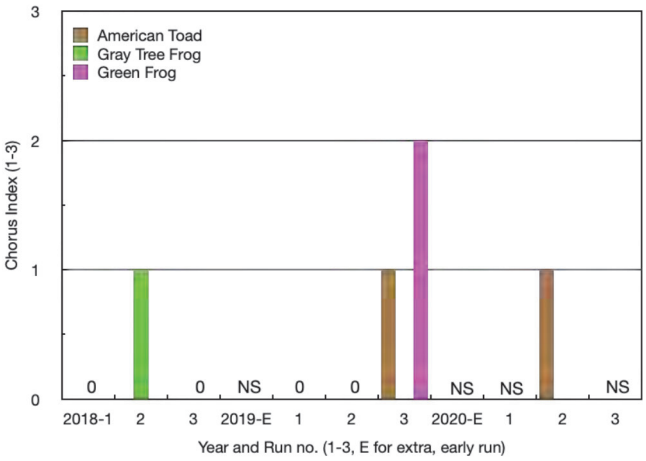


Chart 2. Columbia Hts Golf Course - N. Minneapolis

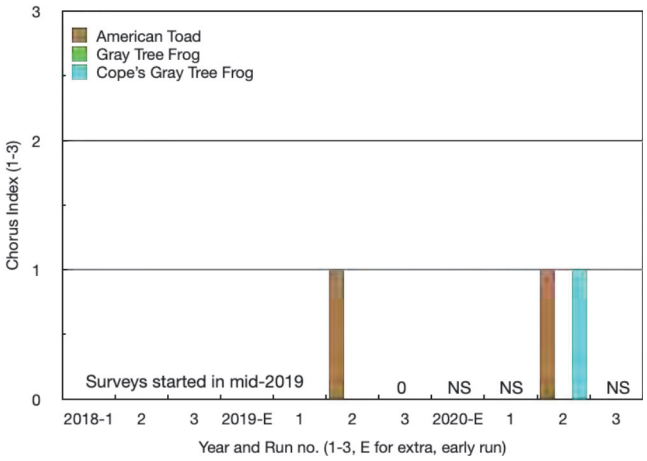


Chart 3. Heritage Park North - N. Minneapolis

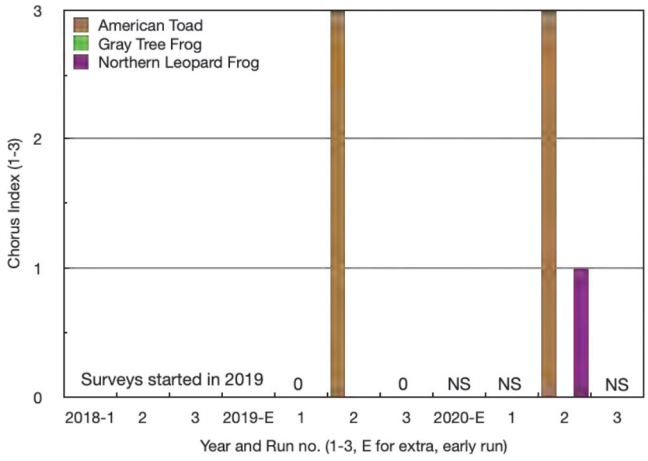


Chart 4. Heritage Park South - N. Minneapolis

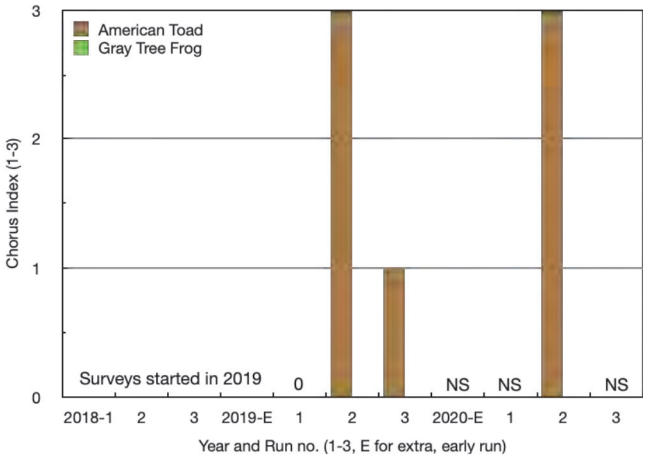
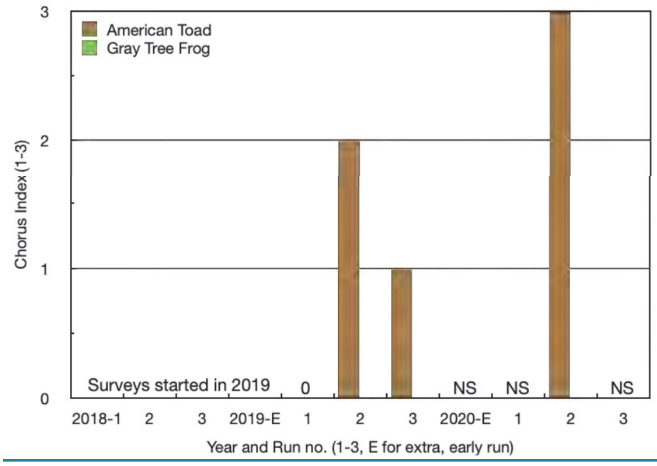


Chart 5. Camden Pond, 42nd and Morgan - N. Minneapolis



South Minneapolis:

Chart 6. Bde Maka Ska - S. Minneapolis

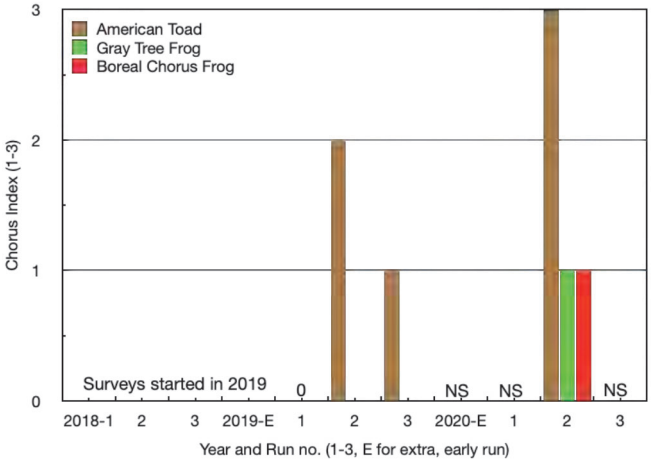


Chart 7. 60th and 1st - S. Minneapolis

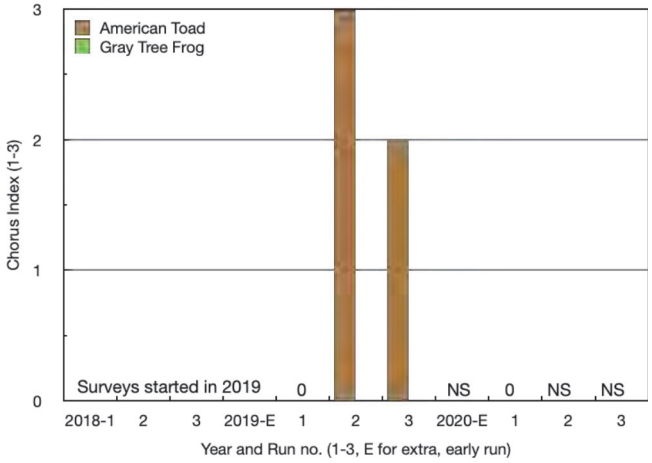


Chart 8. Nokomis SE - S. Minneapolis

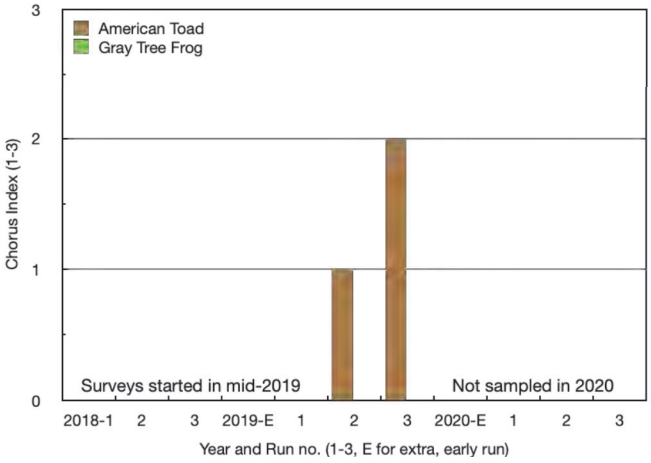
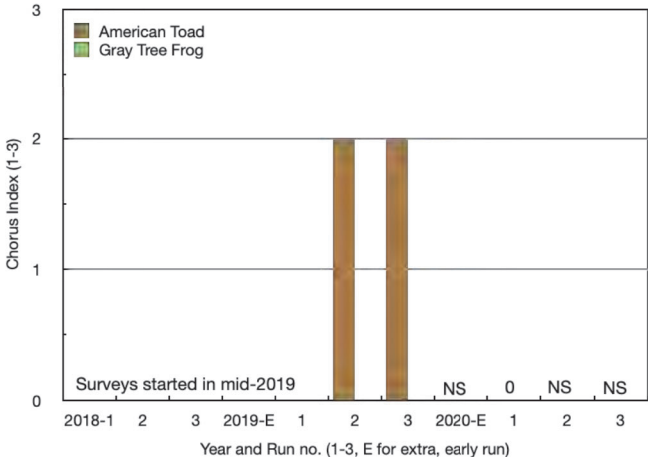


Chart 9. Nokomis SW - S. Minneapolis



Hiawatha Golf Course:

Chart 10. Hiawatha, Pond 1 - S. Minneapolis

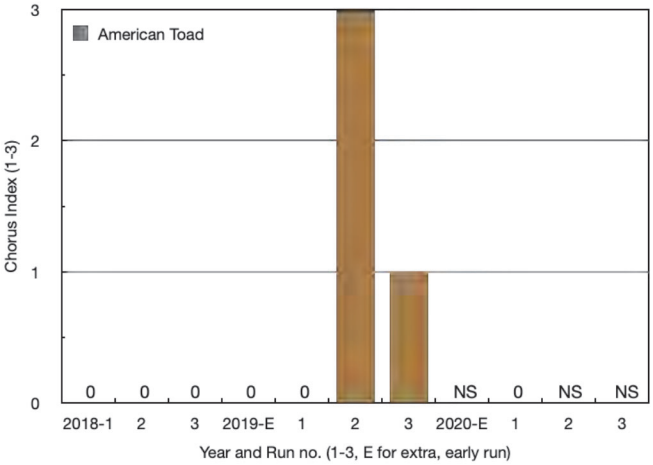


Chart 11. Hiawatha, Pond 2 - S. Minneapolis

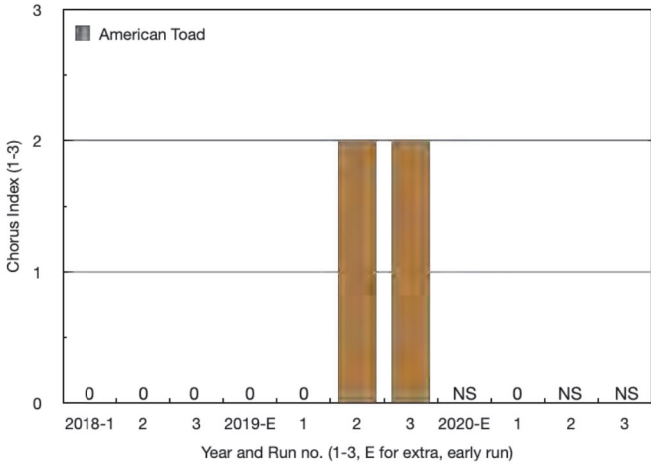


Chart 12. Hiawatha, Pond 3 - S. Minneapolis

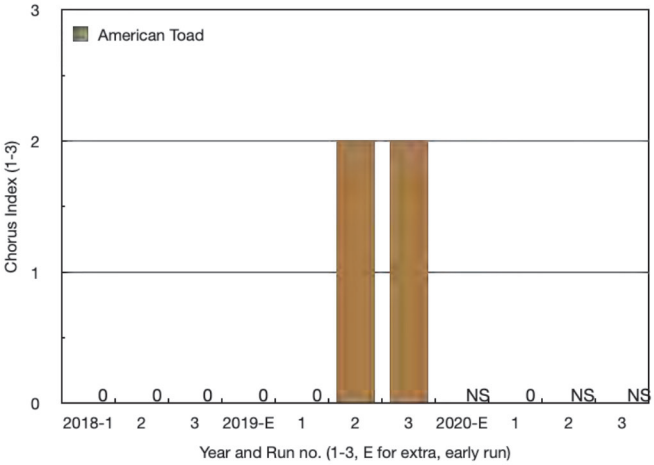


Chart 13. Hiawatha, Pond 4 - S. Minneapolis

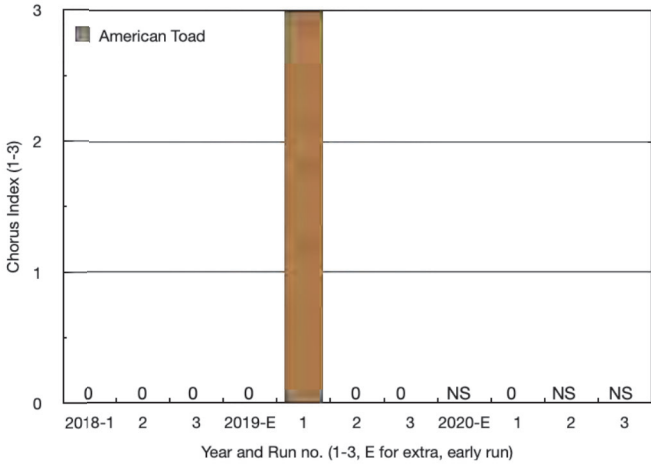
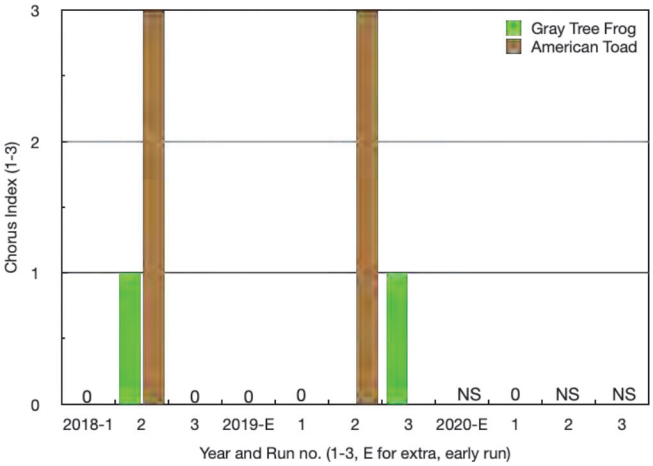


Chart 14. Hiawatha, Pond 5 - S. Minneapolis

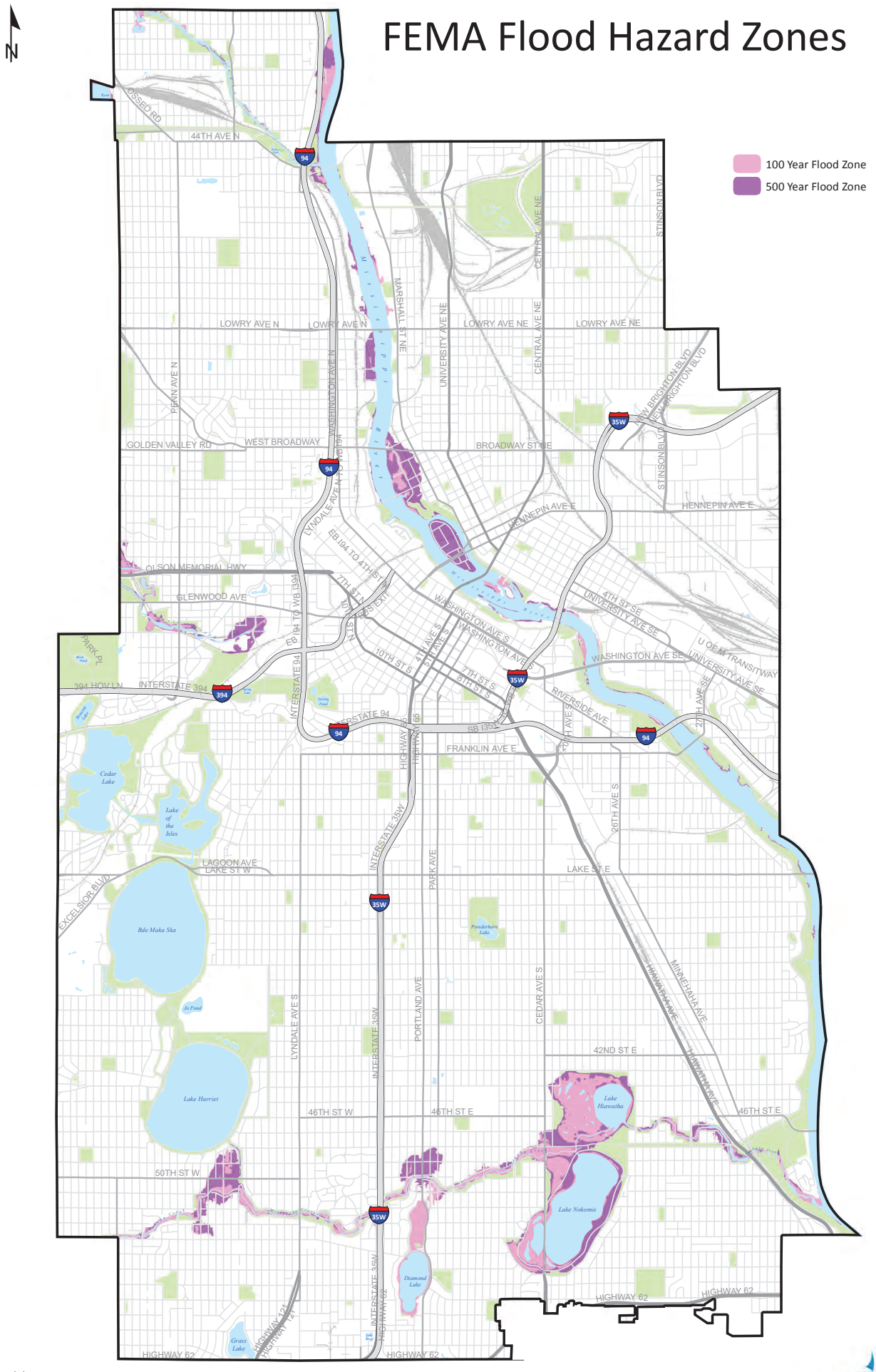


APPENDIX 1

Comparison between two survey protocols, showing how MFTCS was adapted to sample stormwater ponds.		
	Modified Survey for Stormwater Ponds	MFTCS
Sampling Locations	Selected to align with survey goals. Some are less than a half mile apart.	Randomly assigned. Minimum of 0.5 mile apart.
Data Collection	Water temperature recorded at all sites, where safely accessible.	Measuring water temperature optional; one reading per run used for all sites.
	Additional observations recorded at each location. A field was added to each site for notes about habitat, phenology, etc.	Comments limited to one field for all sites and dedicated to how sampling was done (e.g., tried to silence frogs at site X).
	Records frogs and toads heard outside of the 5-minute listening period. **P,** for present, was used instead of the numeric calling index to distinguish this type of observation from MFTCS protocol.	Records only species heard during the 5-minute listening period. Optional to note in comments species heard outside of the listening period.
	Records frogs and toads seen at a site outside of the 5-minute listening period. **P,** for present, was used instead of the numeric calling index to distinguish this type of observation from MFTCS protocol.	Records only species heard during the 5-minute listening period. Optional to note in comments species seen and not heard.
	Distinguishes between species heard at the sampling site and those heard in the distance (which could be from a nearby site since some are less than a 0.5 mile apart). This is particularly relevant for Woodland Pothole on Wayzata Blvd and Birch Pond, two EBWG sites, and two sites near Regency Hospital. Species heard far in the distance, possibly at another site, denoted by parentheses around the numeric calling index—for example, (3).	Records all species heard during the 5-minute listening period—regardless of distance. Sites are located a minimum distance apart, which prevents data from more than one site being included in the data..

Appendix B

FEMA Flood Hazard Zones



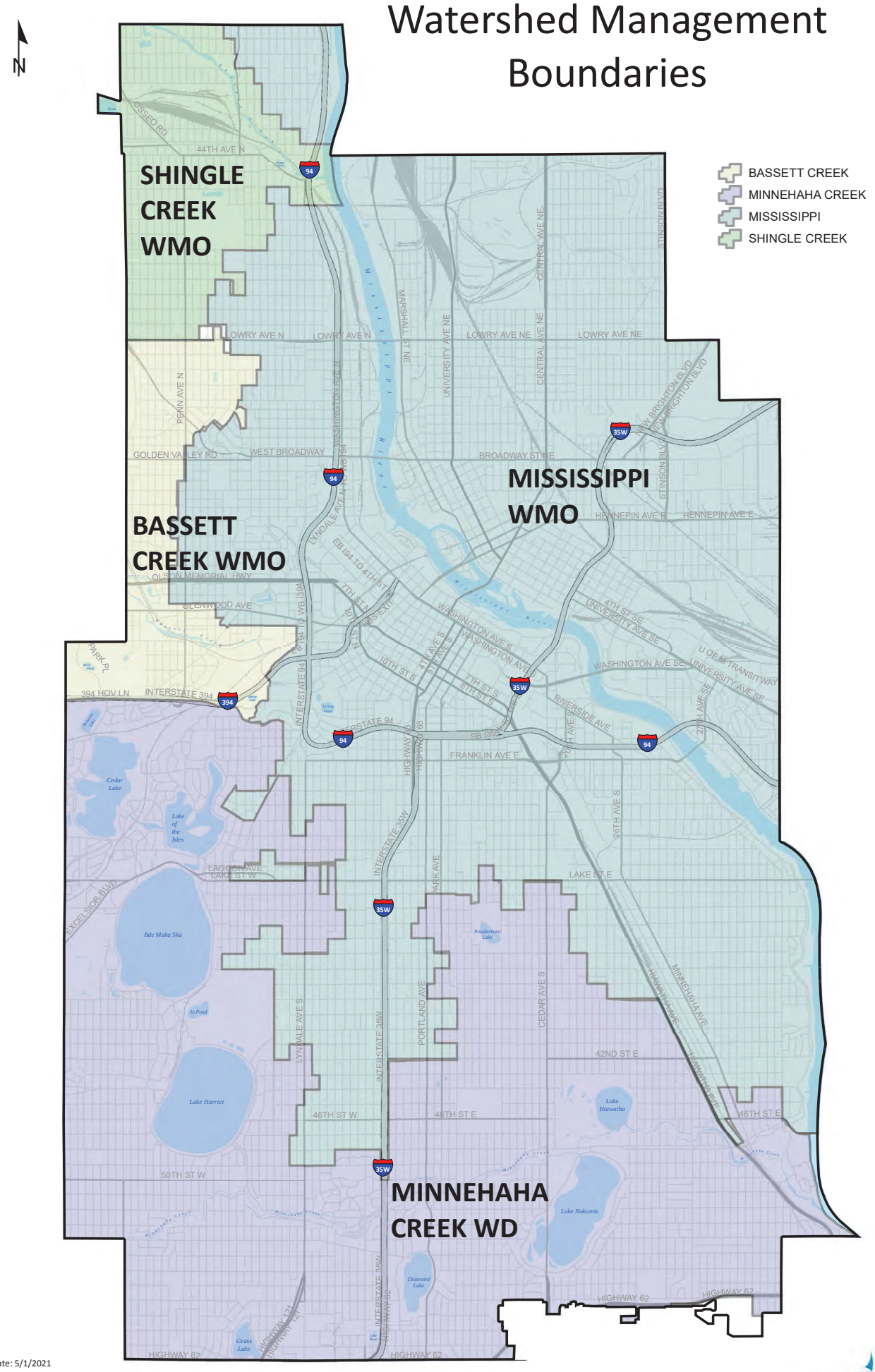
Date: 5/1/2021

Source: National Flood Hazard Layer - Federal Emergency Management Agency
Effective Date : 11-04-2016; Accessed : 06-19-2019

Appendix B1

Minneapolis Public Works

Watershed Management Boundaries



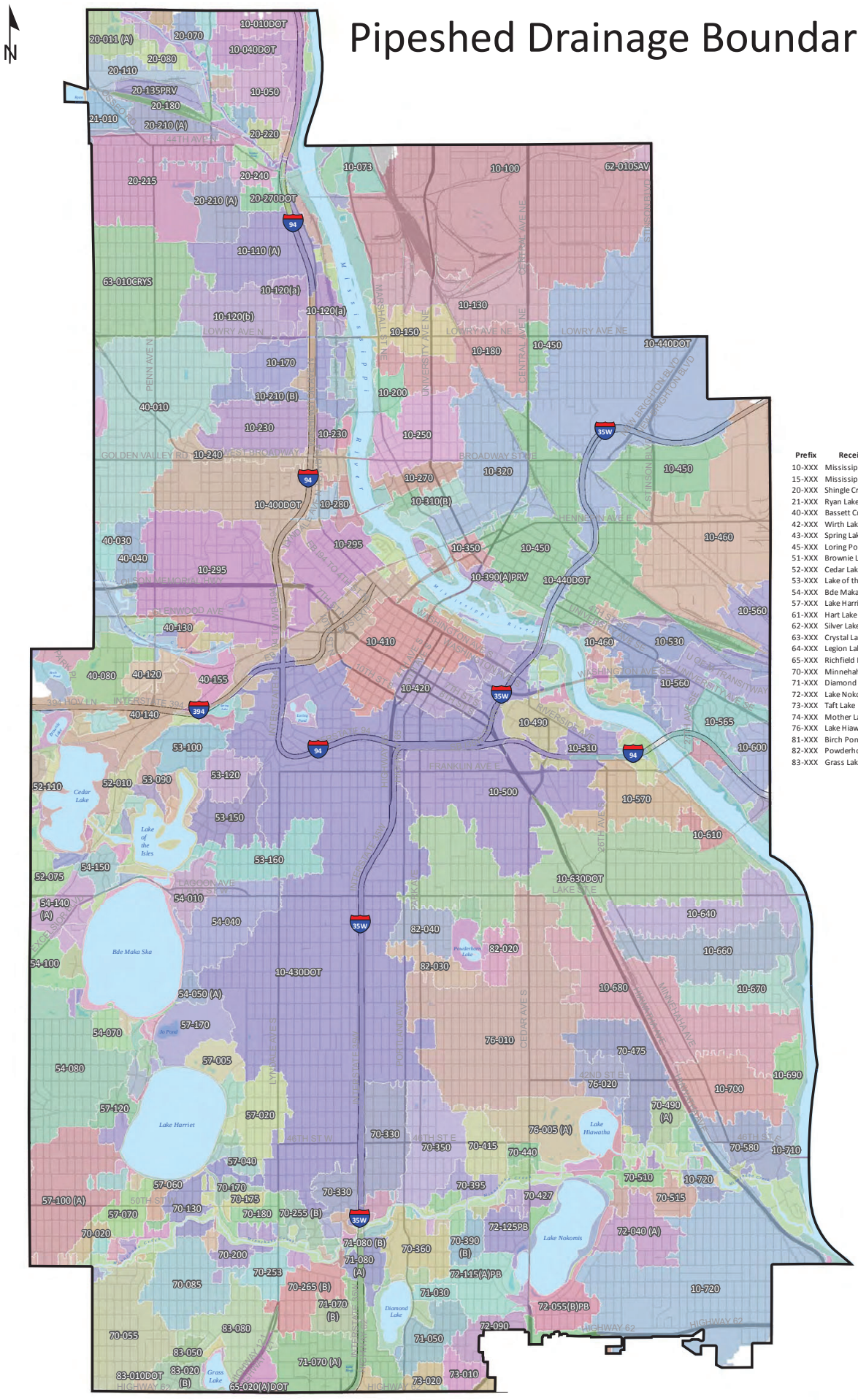
Date: 5/1/2021

Source: Board of Water and Soil Resources
Effective Date : 02-12-2020
Accessed : 05-06-2020

Appendix B2

Minneapolis Public Works

Pipeshed Drainage Boundaries



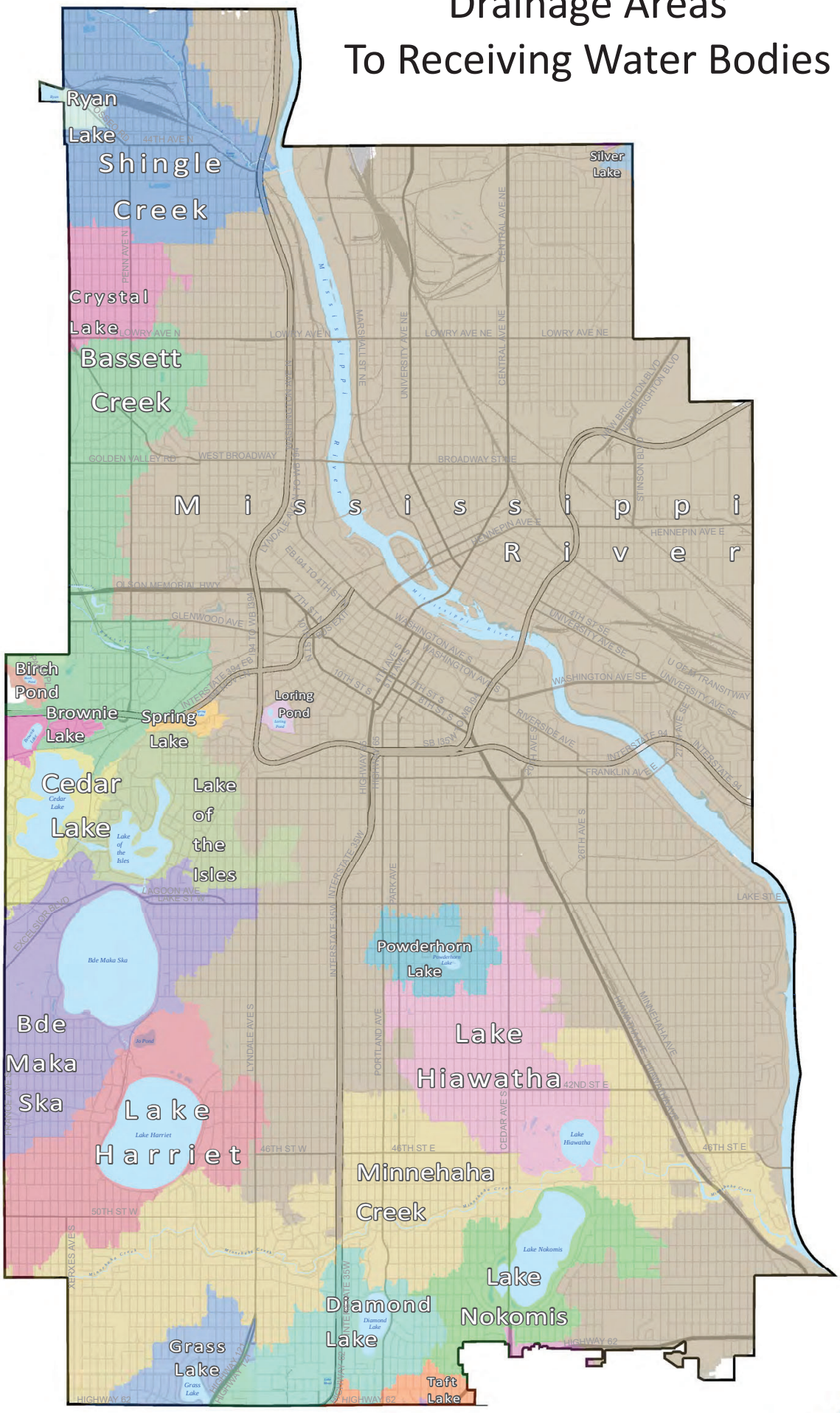
Prefix	Receiving Water
10-XXX	Mississippi River (Mpls)
15-XXX	Mississippi River (UofM)
20-XXX	Shingle Creek
21-XXX	Ryan Lake
40-XXX	Bassett Creek
42-XXX	Wirth Lake
43-XXX	Spring Lake
45-XXX	Loring Pond
51-XXX	Brownie Lake
52-XXX	Cedar Lake
53-XXX	Lake of the Isles
54-XXX	Bde Maka Ska
57-XXX	Lake Harriet
61-XXX	Hart Lake
62-XXX	Silver Lake
63-XXX	Crystal Lake
64-XXX	Legion Lake
65-XXX	Richfield Lake
70-XXX	Minnehaha Creek
71-XXX	Diamond Lake
72-XXX	Lake Nokomis
73-XXX	Taft Lake
74-XXX	Mother Lake
76-XXX	Lake Hiawatha
81-XXX	Birch Pond
82-XXX	Powderhorn Lake
83-XXX	Grass Lake

Date: 5/1/2021
Source: Minneapolis Public Works - Surface Water & Sewers
Effective Date : 05-07-2020; Accessed : 05-07-2020

Appendix B3

Minneapolis
Public Works

Drainage Areas To Receiving Water Bodies

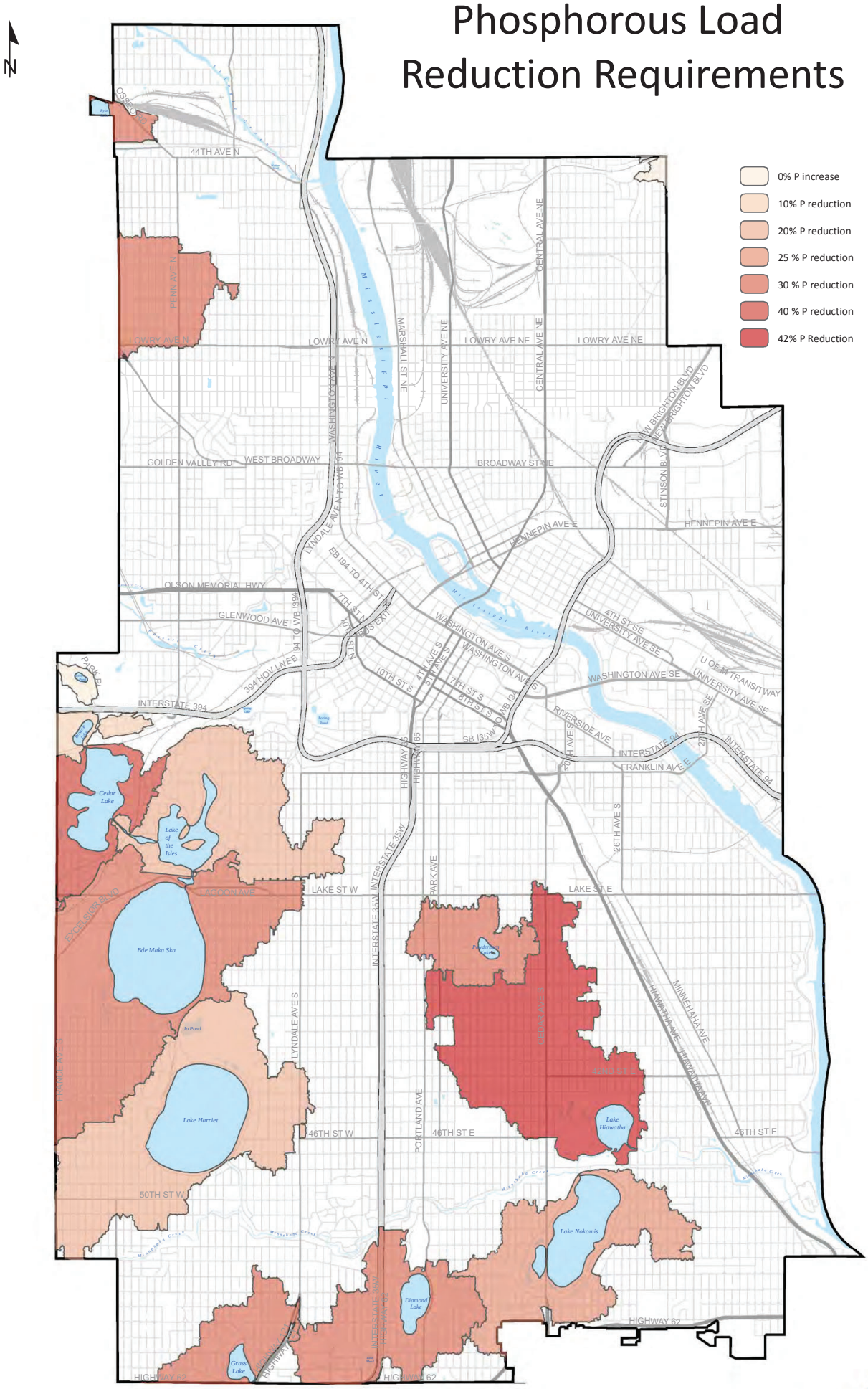


Date: 5/1/2021
Source: Minneapolis Public Works - Surface Water & Sewers
Effective Date: 05-07-2020; Accessed: 05-07-2020

Appendix B4

Minneapolis Public Works

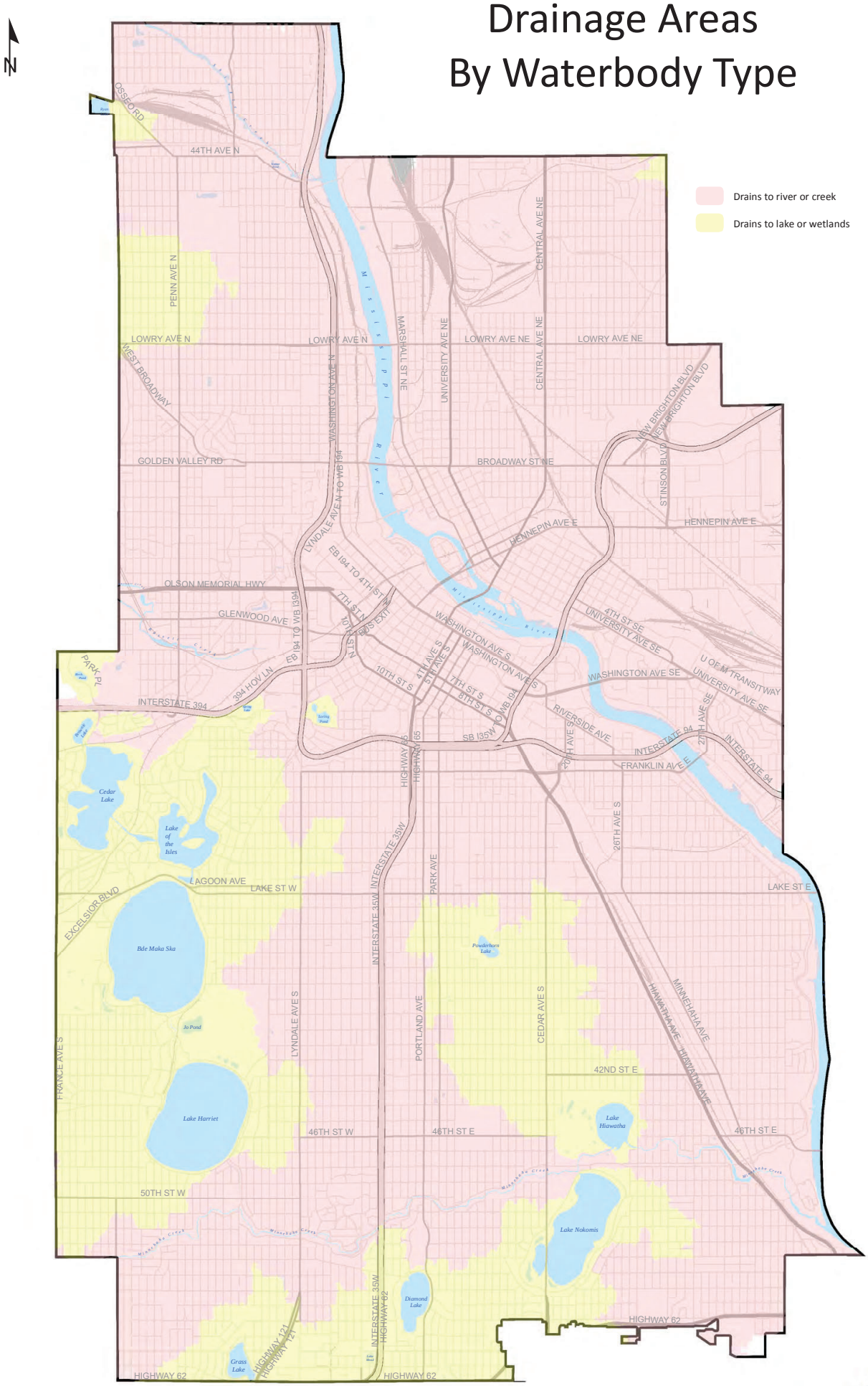
Phosphorous Load Reduction Requirements



Appendix B5

Date: 5/1/2021
Source: Minneapolis Public Works - Surface Water & Sewers

Drainage Areas By Waterbody Type

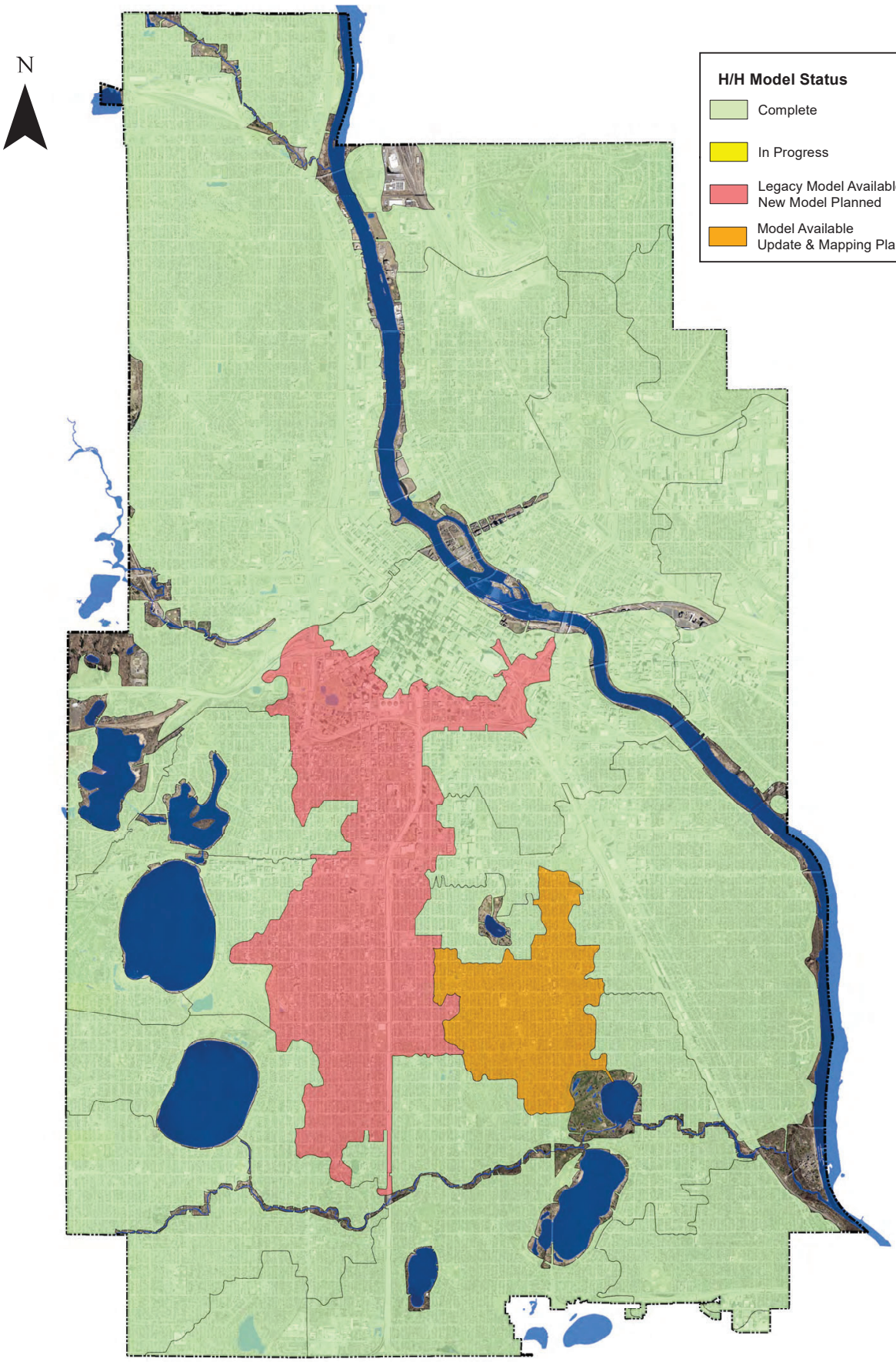


Date: 5/1/2021
Source: Minneapolis Public Works - Surface Water & Sewers
Effective Date : 05-07-2020; Accessed : 05-07-2020

Appendix B6

Minneapolis Public Works

Hydrologic / Hydraulic Storm Modeling Status



Document Path: M:\PWSW\MODELS\RESOURCES\Hydraulic Modeling Status\2021_April_Model Status.mxd

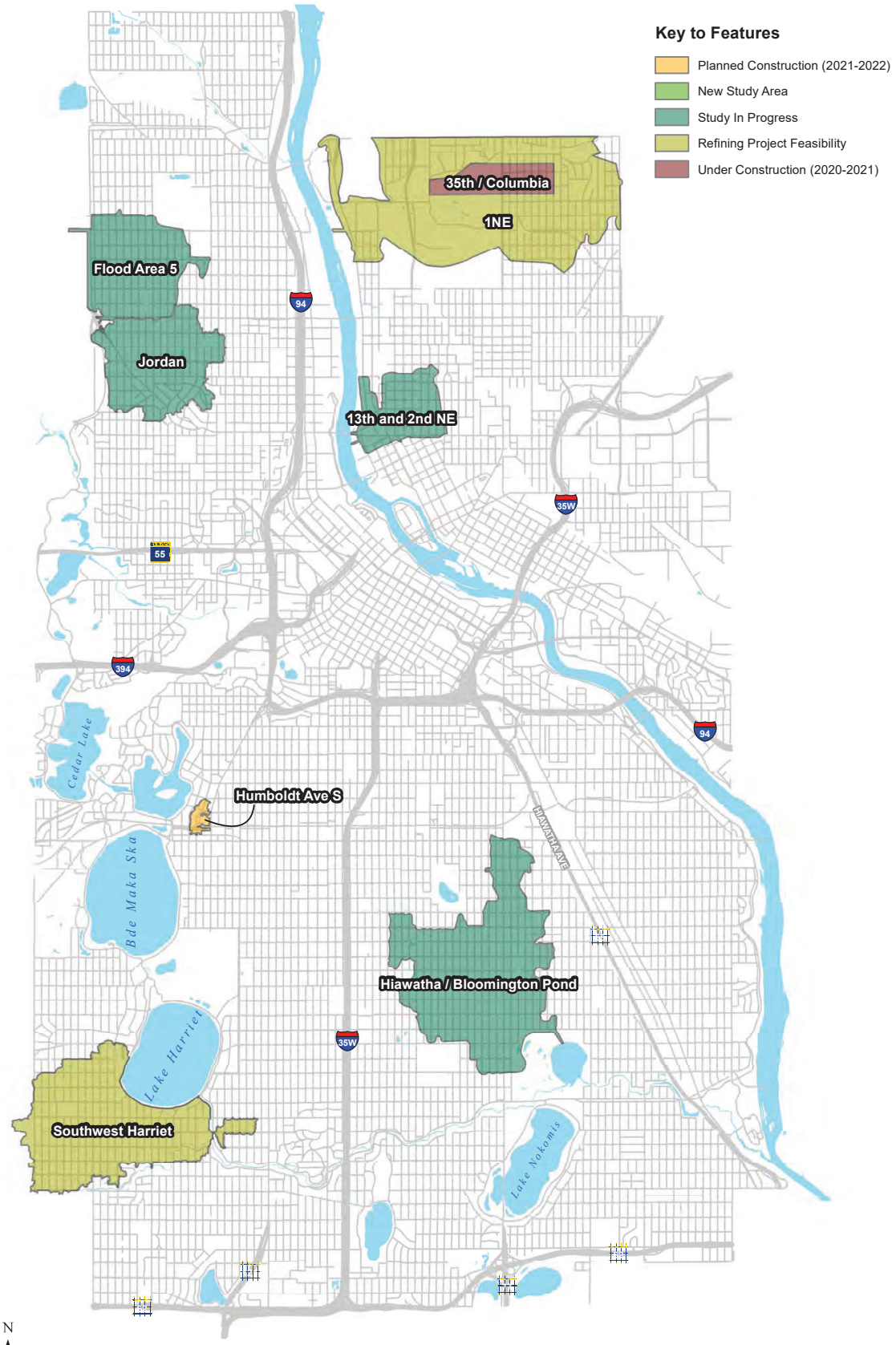
Storm Modeling Status - Appendix B7

Minneapolis
City of Lakes

Surface Water & Sewers Division
Regional Hydrologic / Hydraulic Model
April 2021 Project Status

4,200 2,100 0 4,200
Feet

Current Flood Mitigation Study Areas



Storm Modeling Status - Appendix B8

Minneapolis
City of Lakes

M:\PWSWS\ES_Directory\Grp2PatWrase\Grp2Shared\SewerReports\CSO Reports\2021 Integrated Permit Section NPDES Report\Graphics\2021_04_Flood_Mitigation_Study_Areas.mxd