NPDES MS4 Phase I Permit No. MN0061018
Annual Report for 2014 Activities

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




Prepared by:

Minneapolis Public Works Department

in conjunction with

Minneapolis Park & Recreation Board

July 31, 2015

Minneapolis Park & Recreation Board

Minneapolis
City of Lakes

Minneapolis
City of Lakes

NPDES MS4 Phase I Permit
Annual Report for 2014 Activities

July 31, 2015

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.

Lisa K. Cerney

Lisa Cerney, PE

Date 7/30/2015 Registration No. 42688

NPDES PERMIT NO. MN0061018

Issued December 1, 2000

Re-issued January 21, 2011

CITY OF MINNEAPOLIS
CERTIFICATION

STATE OF MINNESOTA)
COUNTY OF HENNEPIN) SS
CITY OF MINNEAPOLIS)

I, Casey Joe Carl, City Clerk of the City of Minneapolis, in the County of Hennepin, and State of Minnesota, certify that I have examined the attached copy of **RESOLUTION 2015R-303 adopting the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4 Phase I Permit Stormwater Management Program and Annual Report for 2014 activities**, adopted by the Minneapolis City Council at a meeting held on **July 24, 2015**, and have carefully compared the same with the original on file in this office, and that the attached copy is a true, correct and complete copy of the original.

SEAL OF THE CITY OF MINNEAPOLIS MINN. EN AVANT APPROVED JUNE 5TH 1878

IN WITNESS WHEREOF, I have signed and affixed the City seal on **August 3, 2015**.

Casey Joe Carl, City Clerk

2015R-303

TPW 1

RESOLUTION
of the
CITY OF
MINNEAPOLIS

By Reich

Adopting the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Phase I Permit Stormwater Management Program and Annual Report for 2014 Activities.

Whereas, the City of Minneapolis is committed to improving water quality in the lakes, wetlands, streams, and Mississippi River; and

Whereas, on January 21, 2011, the City of Minneapolis was issued National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit No. MN0061018 (Permit); and

Whereas, the STORMWATER MANAGEMENT PROGRAM was prepared in accordance with the Permit, was approved by the Minnesota Pollution Control Agency (MPCA) in 2013, and was updated in 2014 and provided to the MPCA; and

Whereas, as required under the Permit, a public hearing was held on July 14, 2015; and

Whereas, the ANNUAL REPORT FOR 2014 ACTIVITIES will now be submitted to the Minnesota Pollution Control Agency;

Now, Therefore, Be It Resolved by The City Council of The City of Minneapolis:

That the Minneapolis City Council hereby adopts the STORMWATER MANAGEMENT PROGRAM and the ANNUAL REPORT ON 2014 ACTIVITIES.

Certified as an official action of the City Council:

RECORD OF COUNCIL VOTE (X INDICATES VOTE)

COUNCIL MEMBER	AYE	NAY	ABSTAIN	ABSENT	VOTE TO OVERRIDE	VOTE TO SUSTAIN	COUNCIL MEMBER	AYE	NAY	ABSTAIN	ABSENT	VOTE TO OVERRIDE	VOTE TO SUSTAIN
Reich	X						Glidden	X					
Gordon	X						Cano	X					
Frey	X						Bender				X		
B Johnson	X						Quincy				X		
Yang	X						A Johnson	X					
Warsame	X						Palmisano	X					
Goodman	X												

ADOPTED JUL 24 2015
DATE

[X] APPROVED [ ] NOT APPROVED [ ] VETOED

ATTEST [signature] CITY CLERK

[signature] MAYOR HODGES

JUL 27 2015
DATE

Acknowledgements

Public Works-Surface Water & Sewers

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Table of Contents

Acronyms

BCWMC	Bassett Creek Water Management Commission
BMP	Best Management Practices
CB	Catch Basin
CSO	Combined Sewer Overflow
CWA	Clean Water Act
DNR	Department of Natural Resources
EPA	Environmental Protection Agency
ESC	Erosion and Sediment Control
FWMC	Flow Weighted Mean Concentration
LAURI	Lake Aesthetic and User Recreation Index
I & I	Inflow & Infiltration
LID	Low Impact Design
MCES	Metropolitan Council Environmental Services
MCWD	Minnehaha Creek Watershed District
MECA	Minnesota Erosion Control Association
MH	Manhole
MDR	Minneapolis Development Review
MnDOT	Minnesota Department of Transportation
MOU	Memorandum Of Understanding
MPCA	Minnesota Pollution Control Agency
MPRB	Minneapolis Park & Recreation Board
MPW	Minneapolis Public Works
MWMO	Mississippi Watershed Management Organization
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NURP	Nationwide Urban Runoff Program
RDP	Rainleader Disconnect Program
SCWMC	Shingle Creek Watershed Management Commission
SOP	Standard Operating Procedure
SSO	Sanitary Sewer Overflow
SW	Stormwater
SWPPP	Storm Water Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
XP-SWMM	Stormwater Modeling design software
WMO	Watershed Management Organization

I. Executive Summary

Report Objective

This Report provides documentation and analysis of the Minneapolis Stormwater Management Program (SWMP) activities conducted during the previous year, 2014. The City and Minneapolis Park & Recreation Board departments that are responsible for the SWMP activities are jointly responsible for the completion of the required Permit submittals. Public Works provides program management and completes each Annual Report. Opportunities for public input into the SWMP and priorities is required, as is adoption by City Resolution of the Annual Report.

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 (City) and the Minneapolis Park & Recreation Board (MPRB) as co-permittees. Permit No. MN0061018 was issued in December 2000 and reissued in January 2011. The Permit requires the implementation of approved stormwater management activities, referred to Stormwater Management Practices (SMPs), also known as Best Management Practices (BMPs).

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 Minnesota Pollution Control Agency (MPCA) is the local authority responsible for administering this program. Under this program, specific permits are issued to regulate different types of municipal, industrial activities and construction, and this report is related to the municipal program.

As required under the 2011 reissued permit, a new SWMP that describes the City and MPRB SMPs was submitted to the MPCA in September 2011 for review and approval. Subsequent to the MPCA's public comment period on the SWMP, revisions were submitted by the City to MPCA in May 2013, and the MPCA approved the SWMP in 2013. As outlined in Part V.A. of the Permit, the SWMP is based on an adaptive management system by which the Permittees continuously monitor, analyze and adjust the SWMP to achieve pollutant reductions. Using the adaptive management approach, revisions to the SWMP were made in 2014 that were primarily responsive to a 3-day field inspection in August 2013 by an EPA Inspection Team. The inspection, or audit, helped to identify opportunities for improvement regarding comprehensive training, written procedures and documentation, and availability of staff resources.

Also as required under the 2011 reissued permit, application for reissuance was required at least 180 days before the permit's expiration date of January 21, 2016. The deadline for application was July 25, 2015. The application was timely made, along with submittal of the revised SWMP and information and forms as required by MPCA.

II. Storm Drain System Operational Management and Maintenance

Program Objective

The objective of the 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. Targeted pollutants include:

- Total Suspended Solids (TSS)
- Nutrients
- Floatable Garbage

Drainage Areas and Discharges

The City of Minneapolis contributes stormwater runoff to a number of lakes, Minnehaha Creek, Bassett Creek, Shingle Creek and the Mississippi River. A map of the drainage areas that have been delineated according to topographic contours and the storm drain system is included in Appendix B. The population, size of drainage area, land uses, distribution, and runoff coefficients by body of receiving water are listed in Appendix A1.

Program Overview

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

Since 2012, the Operations section has been working on development of an Asset Management System (AMS) to help the City meet water quality targets and regulatory requirements, along with other objectives. The EPA became aware of the City's AMS project during an inspection audit of the Minneapolis MS4 in 2013, and developed the project as a Case Study, stating "EPA is encouraged by the progress demonstrated by the City and hopes to work with other municipalities and regulators to achieve similar success." (The document titled, "EPA Case Study: City of Minneapolis Stormwater Asset Management System" can be found in the Appendix.) The City's goals in implementing the AMS include:

- Identifying current state of assets and asset attributes (e.g., age, condition, etc.).
- Develop a standardized rating process for assets and asset attributes (e.g., National Association of Sewer Services Companies (NASSCO) Pipeline Assessment and Certification Program (PACP)).
- Identifying risk areas.
- Identifying criticality of system.
- Identify life-cycle costs.
- Improve future decision making as a result of data and analysis (e.g., succession planning, level of maintenance response, capital improvement project (CIP) 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.
- Use as a communication tool for staff and regulators for effective information transfer and knowledge retention.

An appropriate higher staffing level is a key component for achieving the City's overall goals. The current authorized staffing level of the Operations section is approximately 110 full-time employees, up from 75 in the previous year. This increase is helping to bring about the more proactive approach, including pollution prevention, that the City is striving for. Of these, there are currently 102 permanent, full-time and 8 seasonal employees working directly within the operations and maintenance area, and the remainder work within the construction area. General operations and maintenance efforts include pump station and pipeline inspections, pipeline cleaning, system repairs, rehabilitation or reconstruction, 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 pipe line 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 sanitary system pipes. Hydro jet-wash technique. Sanitary 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	Repair Truck	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	Vacuum 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.
2	1	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

Some of the noteworthy 2014 cleaning and repair statistics are summarized in the following list:

- Responded to 163 complaints of plugged or backed-up catch basins
- Responded to 5 complaints of cave-ins around catch basins and manholes
- Cleaned 10.8 miles of storm drain utilizing hydro-jet washing and removed 1,038 cubic yards of sediment/material
- Televised and condition assessed 148 miles of storm drain pipes
- Performed inspection of 1,100 feet of deep stormwater drainage tunnels
- Repaired 464 feet of storm tunnel

- Work on the10th Avenue SE, St. Mary's and Central City tunnels continues, which is improving 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. The St. Mary's tunnel work is completed, the others will be continued.

Removing sediment and eroded sandstone/limestone from 72" storm tunnel

Inspecting a deep drainage tunnel, about 80 ft. underground

Photo of catch basin – an inlet to the storm drain system

Cleaning debris from a plugged catch basin

III. Structural Controls Operational Management and Maintenance

Program Objective

The objective of this NPDES MS4 stormwater management program is to minimize the discharge of pollutants through the proper operational management and maintenance of structural controls within the City's storm drain system that affect system flow rates and water quality discharges.

Structural controls include:

- Grit Removal Chambers
- Outfall Structures
- Pump Stations and Level Control Weirs
- Stormwater Ponds, Stormwater Wetlands and Bio-(in)filtration (Rain Gardens)
- Catch Basins

Targeted pollutants include:

- Sediment
- Nutrients
- Floatable Garbage

Program Overview

Structural controls that are part of the City's overall storm drainage system are operationally managed and maintained by the Operations section of the Public Works Surface Water & Sewers Division. 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. Structural controls are separated into five separate categories:

Stormwater Ponds and Bio-(in)filtration (Rain Gardens)

These are structural devices that detain or retain stormwater runoff and improve water quality. They are regularly maintained for volume and functionality, and also for their park-like amenities including native plantings, turf grass, pathways, benches, and lighting. Based on current level of experience, the need for dredging ponds of sediment buildup appears to be in a 15- to 20-year cycle. For additional information on vegetation management of these facilities, see Section VIII, Pesticides and Fertilizer Control.

Grit Removal Structures

These are devices that have been installed for sediment, debris, and oil collection. The City continues with its effort to increase the number of grit chambers installed. The devices are inspected in the spring and fall of each year, and then cleaned, if required. The amount of sediment removed, the presence of floatables, and the dates that devices were cleaned are recorded on log sheets, and then added to a database. Appendix A35 contains a list of these devices, and maintenance dates.

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 where 20% of the outfalls are inspected each year. Site inspections evaluate the general condition of structures, determine if any significant erosion has occurred and observe any contaminant discharges. When indications of illicit or otherwise contaminated discharges are observed, they are reported to Minneapolis Environmental Services for reporting to the Minnesota Duty Officer and for further investigation and resolution. Any identified structural repair or maintenance work is prioritized and scheduled within the constraints of available personnel, budget funding, and coordination with other essential operations. Appendix A36 contains maintenance information for these devices.

Pumps & Weirs

These are structural devices that mechanically affect the flow of stormwater runoff through the storm drain system. Pump stations are inspected on a regular basis for routine operational checks and are inspected 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.

Catch Basins

These are structural devices located along the City's street system that provide entrance of stormwater runoff into the storm drainage system. There is no formalized inspection schedule, however 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 catch basins, also known as storm drain inlets, 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 catch basins. Repair of damaged catch basins is also a priority, given their location in city streets and ultimate impact to the traveling public.

Previous Year Activities

- Monitored and maintained 25 pump stations.
- Cleaned 103 grit chambers, removing a total of 460 cubic yards of material. The majority of the grit chambers are both maintained and owned/operated by Public Works, however some are owned and operated by others, but cleaned by Public Works under contract.
- Inspected 93 of 416 storm drain outfalls in 2014 inspection program (15 in 2013). (Note: Many of the outfalls planned for inspection in 2013 were submerged throughout the season due to high water levels.)
- Maintained 59 stormwater ponds and bio(in)filtration facilities.

Dredging was carried out at two stormwater holding ponds – King's Highway, and 37th & Columbus. Amounts of 1,080 and 360 cubic yards were removed, respectively (described further in Section IV, Disposal of Removed Substances.

Hydrodynamic separator grit chamber being installed

Grit chamber being vacuumed to remove sediments, oil and grease, trash and other debris

Removing invasive plants from stormwater pond at S 37th St and Columbus Av

Large stormwater outfall to Mississippi River

IV. 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 Garbage
- Additional pollutants analyzed for stormwater pond sediment dredging are Copper, Arsenic and Polycyclic Aromatic Hydrocarbons (PAH)

Program Overview

Minneapolis Public Works: Materials are removed from grit removal structures, catch basins, system piping, and deep drainage tunnels. Removed substances are screened for visual or olfactory indications of contamination. If contamination of the material is suspected, the 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 Minnesota Pollution Control Agency (MPCA). Non-contaminated targeted pollutants are disposed of the same way as street sweepings, as reported in **Section VI. Roadways**. During cleaning and disposing operations, erosion control measures are applied when needed to prevent removed material from re-entering the storm drain system.

The process for 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.

Minnehaha Creek Watershed District (MCWD): By agreement with the City of Minneapolis and the Minneapolis Park & Recreation Board, the MCWD monitors the design capacity of several stormwater ponds in Minneapolis and performs dredging and restoration as needed including testing for proper disposal.

Previous Year Activities

- In 2014, Minneapolis Public Works crews removed approximately 460 cubic yards of sediment and debris from grit chambers, and approximately 1,038 cubic yards from storm drains during hydro-jet washing operations.

- Approximately 1,440 cubic yards (360 and 1,080 yards, respectively) of sediment were dredged from the two stormwater holding ponds shown below. Chemical testing results were as follows:

Table 1: Sediment Sampling Results for Stormwater Ponds Sampled on July 26, 2013.
City of Minneapolis

	MN Level 1 (Residential) Soil Reference Values	MN Level 2 (Industrial) Soil Reference Values	37th St and Columbus Ave Stormwater Pond		King's Highway Holding Pond	
			SC-01	SC-02	SC-03	SC-04
Date Sampled			7/26/13	7/26/13	7/26/13	7/26/13
Depth Interval (ft)			0.0-2.0	0.0-0.8	0.0-1.7	0.0-3.3
% Solids			82%	75%	54%	63%
Arsenic	9	20	1.7 J	3.4	3.0 J	3.8
Copper	100	9,000	13.0	33	21	31
Acenaphthene	1,200	5,260	0.0044	0.0068	0.090	0.044
Anthracene	7,800	45,400	0.023	0.024	0.28	0.12
Fluoranthene	1,080	6,800	0.16	0.32	1.9	1.6
Fluorene	850	4,120	<0.0004	0.016	0.13	0.055
Naphthalene	10	28	0.0028	0.011	0.063	0.021
Pyrene	890	5,800	0.14	0.25	1.5	1.4
Quinoline	4	7	0.0025	0.0053	<0.00041	0.010
BaP equivalent*	2	3	0.30	0.33	1.9	2.0

Notes
Values reported in milligrams per kilogram (mg/kg) dry weight.
BaP equivalent* - Benzo(a)pyrene equivalent
<0.0027 Concentration was less than the Method Reporting Limit.
1.7 J Result is an estimated concentration.

Photograph #1: 37th St. and Columbus Ave. S. Stormwater Pond Sediment Sampling.

Photograph #4: King's Highway Holding Pond Sediment Sampling.

V. Stormwater Management Requirements for Development/Redevelopment

Program Objective

The objective of this stormwater management program is to minimize the discharge of pollutants through the regulation of construction projects. Regulation includes erosion and sediment control, and approval of stormwater management including ongoing operation and maintenance commitments. Minneapolis Code of Ordinances Title 3 Air Pollution and Environmental Protection, Chapter 52 (Erosion and Sediment Control and Drainage) and Chapter 54 (Stormwater Management) contain erosion and sediment control requirements and stormwater management instructions for developments and other land-disturbing construction activities.

Targeted pollutants include:

- Phosphorus
- Total Suspended Solids (TSS)

Erosion and Sediment Control

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 ordinance addresses development sites, demolition projects, and other land disturbing activities. Sites disturbing more than five cubic yards, or 500 square feet, are required to have an erosion control permit. Erosion & 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. If there will be a disturbance of greater than 5,000 square feet, demolition and construction sites also require an approved erosion control plan before the ESC Permit can be issued.

Enforcement

Ongoing site inspections are performed by 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

A summary of the 2014 inspections is as follows:

Permits issued:	384
Erosion and sediment control cases inspected:	433
Number of inspections completed:	3769
Enforcement actions issued for site compliance:	237
Citations for non-compliance after enforcement action:"	77

Construction site inspections also target concrete washout violations

Stormwater Management for Development

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 Chapter 54, which is entitled *Stormwater Management*. The ordinance establishes requirements for permanent stormwater management for development/redevelopment projects on sites that are greater than one acre.

The ordinance sets standards according to the receiving water body. These standards include but are not limited to:

- Controlled rate of runoff to all receiving water bodies
- Reductions of TSS for discharges to all receiving water bodies
- In addition to TSS, a reduction in nutrients for stormwater that discharges to lakes and wetlands
- Provision for on-site, off-site, or regional stormwater facilities
- Maximizing infiltration by minimizing the amount of impervious surface
- Employing natural drainage and vegetation

Requirements

Redevelopment of existing sites provides an opportunity to lessen the impacts of urbanization on the Mississippi River and other Minneapolis water resources. Stormwater management plans are required for all construction projects on sites greater than 1 acre in size. Sites less than 1 acre are also encouraged to incorporate stormwater Best Management Practices (BMPs) in their design as a means of satisfying other city codes such as green space requirements. Plans are reviewed through the Minneapolis Development Review (MDR) process and approved by the Minneapolis Public Works Surface Water & Sewers Division. Operation and Maintenance Plans for BMPs are required as part of the approval process. Once constructed and inspected for compliance with approved plans, the BMP stormwater devices are registered with the City of Minneapolis Environmental Services, with an annual permit required for each stormwater device registered. Inspections and document checks are carried out annually or as needed, to ensure that the BMPs continue to function as approved.

Previous Year Activities

During 2014, Minneapolis Public Works took part in the preliminary review of 142 projects. Of those 142 site plans, 101 projects with a total of 118 BMPs received final approval, with the appropriate permits issued. These BMPs will provide rate control and water quality for approximately 53 acres of land, including 40+ acres of impervious area.

Common BMP types included:

- Rain gardens
- Pervious pavement
- Infiltration basins
- Filtration basins
- Detention ponds
- Underground infiltration chambers/pipe galleries
- Underground storage/detention chambers
- Proprietary filter chambers
- Bioswales

(See next page for examples of past projects meeting Minneapolis requirements)

Rain Garden – Minneapolis Community and Technical College

Pervious Pavement – New French Bakery

(aqua shape was drawn on photo to shown how all water soaked into ground)

Bioswale – U of M TCF Stadium Parking Lot

Examples of Previous Projects Meeting Chapter 54 Requirements

VI. 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, alleys, and municipal equipment yards. Targeted pollutants include:

- TSS[1]
- BOD5[2]
- COD[3]
- 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 every year in the spring and fall. At those times, all City streets and alleys are swept systematically, and temporary parking bans are enforced to aid with sweeping operations. Operational routines and special methods are employed to address seasonal conditions, and to optimize cleaning. Flusher trucks apply pressurized water to the streets in an effort 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.

[1] Total Suspended Solids
[2] Biochemical Oxygen Demand of wastewater during decomposition occurring over a 5-day period
[3] Chemical Oxygen Demand

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. A five-year 2008 contract states that the organic materials, which are collected mostly in the fall of the year, go to Carver County Minnesota to be

composted and converted to a retail mulch material that is then distributed by a company called Organic Technologies. In 2012, The Mulch Store operated by SKB Industries was added, which has four retail locations and operates its mulch operation in Chaska, near the University of Minnesota Landscape Arboretum.

Downtown Improvement District

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 most notable activities related to stormwater runoff are operation of sweepers for gutters and sidewalks throughout the 120 block district.

<u>Snow and Ice Control</u>

The Street Maintenance section applies salt and sand to City roadways every winter for snow and ice control. Efficient application of de-icing materials is sought to reduce costs, required maintenance, and environmental impact. The most obvious cost savings is realized in a reduction of the overall amount of materials used.

Reduced material amounts 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 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.

Reducing usage of salts is the focus of the Twin Cities Metro chloride study that nearing completion. Within Minneapolis, the metrowide TMDL applies to the following lakes and creeks:

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

The city’s third creek, Shingle Creek, is not included in the Metro chloride TMDL study because a study specific to Shingle Creek was developed previously, and approved by the EPA in 2007. It places 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. Maintenance supervisors and equipment operators are trained in winter maintenance. Specific topics covered include guidelines for sand and salt application rates that are based on weather conditions, application techniques, and spreader calibration. 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 on a daily basis. Salt stockpiles are stored under cover to minimize potential groundwater contamination and runoff.

Previous Year Activities

The 2014-2015 winter season began early, with numerous snow events in the early part of the season, ten drier and warmer in the later season. There were 26 notable events with 32.4 inches for the season, as compared to an average of 48 inches. The most snowfall was observed in November. There was one declared snow emergency, compared to the annual average of four, and there were 145 days of temperatures at or below freezing. The quantities of salt and sand used in snow and ice control are tracked by recording amounts that are delivered by suppliers, and also by estimating the quantities that are on-hand on a daily basis. Street sweepings are scaled at the disposal site and reported to the City for record purposes only. Leaves picked up are weighed at certified scales that are located at City facilities or contractor transfer in Minneapolis. The statistics for last year's program are as follows:

- Tons of salt applied to roadways: 11,209
- Tons of sand applied to roadways: 8,219
- Tons of materials reclaimed during spring and summer street sweeping operations: 18,200
- Tons of leaves collected for composting during the fall citywide sweeping: 3,173
- Staff members attended eight-hour refresher for 40-hour hazardous materials training class: 22
- Staff members attended training on the use of salt as presented by watershed organizations: 8
- All division shift–staff attended the annual review of procedures. The review covers the recognition and response to hazardous materials or situations.
- The Division Director is a trainer for the American Public Works Association (APWA) Snow Fighters coursework

Performance Measures

- Amount of materials recovered as a percentage of materials applied: 94%
- Amount of salt and sand applied relative to total snowfall: 600 tons/inch

VII. Flood Mitigation

Program Objective

The primary objective of the Flood Mitigation Program is to reduce flood risks and ongoing property damages that occur due to inadequate capacity of the public drainage system. But there are benefits, too, for reducing stormwater runoff pollutant loads:

- Flood mitigation reduces soil/vegetation washouts with the associated sediment and nutrient loads that would be released,
- Flood mitigation reduces exposure of flood flows to everything lying around on parking lots, people's lawns, driveways, storage areas, and other areas, including petrochemical products, bacteria, fertilizers,

Targeted pollutants include:

- All pollutants

Program Overview

Historically, areas that have experienced localized flooding due to system capacity challenges have been reported by residents or field crews. Flood mitigation projects have included strategies such as enlarging or rerouting pipes, or installing detention or retention systems. With increasing emphasis on stormwater runoff water quality, flood mitigation projects sometimes incorporate "green infrastructure" to reduce stormwater runoff volumes or reduce pollutant loads discharged to public waters through natural processes that break down pollutants using soil or vegetation.

In addition to the work done under this Program, many other activities performed by the City reduce flood risks. Some of these activities include:

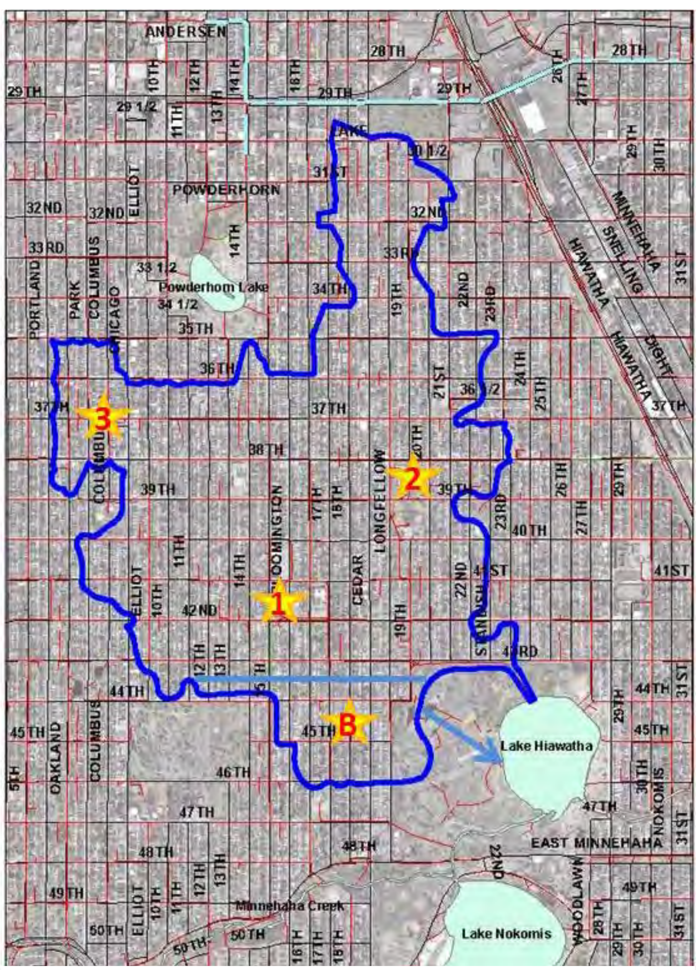
- Operation of backup generators for existing pump stations during power outages
- Inspection and maintenance of catch basin inlets and storm drains that are located within flood-sensitive areas
- Inclusion of various rate control or volume control Best Management Practices (BMPs), including rain gardens, permeable pavers, etc. on public projects
- City stormwater regulations that require rate control and/or volume control BMPs for most private development projects
- Inspection and maintenance work on major tunnel systems that reduce system failure risks that could lead to flooding

Previous Year Activities

At the start of 2014, hydrologic and hydraulic models existed for about 25% of the City. In 2014, a 3-year plan was initiated to complete additional, detailed hydrologic / hydraulic models that will span the entire City. Models developed as a part of this work will be used to better identify, prioritize, and design the City's flood mitigation projects. Models created in 2014 cover more than 6 square miles and include:

- Northern portion of Northeast Minneapolis
- Downtown (Central City, 11th Avenue, and Chicago Avenue Tunnel systems)
- Lowry Avenue NE adjacent to Mississippi River
- Southwest Minneapolis, south of Minnehaha Creek and west of I-35W

In 2014, a study was completed for Flood Areas 21 and 22, located north and northwest of Lake Hiawatha Golf Course, and shown on the map below. The study identified and evaluated several additional improvements that could be pursued to reduce flood risks for homes and businesses in this area. Previous flood mitigation projects in the area include the (1) Bancroft Meadows detention basin at Bloomington Avenue S and S 42nd Street, built in 1989; (2) Sibley Field detention basin at x and y, built in 1990; (3) 37th & Columbus detention basin/wet pond system, built in 2003, and (B) constructed in 2013, a project that reroutes stormwater runoff through stormwater ponds built earlier for that purpose in the Hiawatha Golf Course.



1 - Map of Minneapolis pipesheds that drain to Lake Hiawatha

Performance Measures

The primary performance measures for this program are to identify, prioritize, design, and construct flood mitigation projects that are able to reduce the risk of flooding to habitable buildings. While most citizens will measure success by whether there is reduced neighborhood flooding, success is also achieved by reduction in runoff of sedimentation and nutrients from soil/vegetation washout, and exposure to lawn chemicals, pet waste, auto fluids, litter and other products from water flowing over parking lots, lawns, and storage areas. Flood mitigation projects may also improve surface water quality by incorporating stormwater volume control and stormwater treatment features.

VIII. Pesticides and Fertilizer Control

Program Objective

The objective of this stormwater management program is to minimize the discharge of pollutants by controlling the application of pesticides and fertilizers. Targeted pollutants include:

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

Program Overview – Minneapolis Park & Recreation Board Properties

Integrated Pest Management (IPM) Policy and Procedures

The Minneapolis Park and Recreation Board's (MPRB) Integrated Pest Management (IPM) policy for golf courses and general park areas is included in the MPRB's General Operating Procedures. Specific areas where IPM is heavily used are the Cowles Conservatory, the Minneapolis Sculpture Garden, and the major display gardens at Lyndale Park, Loring Park, and Minnehaha Falls Park. Gardener staff have adopted IPM techniques and use them as the appropriate course of corrective action.

The golf course foremen, along with other staff, attend the annual Minnesota Green Expo in January. There they receive updated information on the newest turf and other related research as it applies to fertilizers, pesticides, biocontrols, and other topics.

MPRB Staff Pesticide Applicator Licensing and Continuing Education

All new hires for position of park keeper, Mobile Equipment Operator (MEO), gardener, golf course park keeper, and arborist are required to obtain their Minnesota Non-Commercial Pesticide Applicator license within one year of being hired. Every two years, as mandated by the Minnesota Department of Agriculture, staff attends re-certification training, offered and coordinated by the University of Minnesota. This effort is in conjunction with the Agronomy Services Division of the Minnesota Department of Agriculture.

Use of Pesticides and Fertilizers on Park Lands

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

Pesticide Use

Use of pesticides to control turf weeds is not a regular practice of park maintenance. Weed control pesticides may be used when a park is being renovated, or when athletic fields and surrounding areas are being sodded/seeded. It may also be used when weeds exceed 50% of the ground "turf" cover. These procedures for general grounds and athletic fields are included in the MPRB's General Operating Procedures.

The MPRB actively manages Eurasian watermilfoil and purple loosestrife, which are two non-native, invasive plant species. Eurasian watermilfoil, an aquatic weed, is harvested mechanically on Lakes Harriet, Wirth, Cedar, Isles and Calhoun throughout the summer months and harvested by hand at the beaches at Lake Nokomis and Wirth Lake. In its General Operating Procedures, the MPRB has established that no chemical application will be used to control aquatic weeds. Eurasian watermilfoil harvesting is permitted through the Minnesota Department of Natural Resources, Division of Ecological and Water Resources. Coordination of control programs for Eurasian watermilfoil are determined and supervised by the Environmental Stewardship Department.

The MPRB does use herbicides to control certain problem invasive species in natural areas, but reduces herbicide use through the use of biocontrols on targeted species. MPRB maintenance and environmental staff use biocontrol in place of pesticides to control purple loosestrife, spotted knapweed and leafy spurge. Purple loosestrife is controlled using a leaf-feeding beetle. Populations of released beetles in Minneapolis parks maintain themselves, thereby eliminating the need for chemical spraying. In particular situations where the biocontrol agent is not as effective in controlling purple loosestrife, hand-pulling is done by volunteers. In 2004, biocontrol was released for two other species: spotted knapweed, with the seed head-eating weevil (*Larinus minutus*) and the root-eating weevil (*Cyphocleonus achales*), and leafy spurge with the root-, flower- and foliage-eating black beetle (*Aphthona lacertosa*).

The MPRB natural resources staff works with the Minnesota Department of Agriculture to stay current with biocontrol methods.

Common and glossy buckthorn are two woody invasive species controlled in woodlands through herbicide applications. Control of these species is done on a limited basis by Environmental Stewardship staff. Park Maintenance, Forestry and Environmental Operations staff document chemical applications made through our electronic database "PF Manager".

MPRB staff produce and maintain the necessary records of all pest management activities as required by the Minnesota Department of Agriculture. Annual paper records are kept by the District or Golf Course office. Electronic records of all applications began in 2008.

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 the Fire Department as to how to deal with a possible fire at these sites. 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 1980's, following a chemical company fire in north Minneapolis that resulted in the contamination of Shingle Creek.

<u>Fertilizer Use</u>

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, Lawn Fertilizer. Under the ordinance, since 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, except as allowed by Minnesota Statute 18C.60 Phosphorus Turf Fertilizer Use Restrictions. 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
- The fertilizer is being applied to newly established turf, and only during the first growing season

The fertilizer is for use on a golf course under certain conditions specified in the Statute. Fertilization of turf on Minneapolis Park & Recreation Board Property is performed for golf courses, around athletic fields, and in areas of heavy traffic. Golf course managers and maintenance foremen are instructed that no phosphorus can be used for turf fertilization unless a current soil test has demonstrated the need for this nutrient. MPRB staff is required to complete a report for every turf fertilizer application. These records are maintained for a period of 5 years, per state law.

Previous Year Activities

Staff Pesticide Applicator Licensing and Continuing Education

Currently 179 MPRB employees hold pesticide applicator licenses, through the Minnesota Department of Agriculture (MDA).

Use of Pesticides and Fertilizers on Park Lands

Pesticide Use

The MPRB maintenance and environmental staff continue to reduce the use of pesticides through biocontrol with the purple loosestrife beetle, spotted knapweed weevils, and leafy spurge black beetle. Populations of released purple loosestrife beetles in Minneapolis parks continue to maintain themselves at most sites, thereby reducing the need for chemical spraying.

Fertilizer Use

The MPRB included zero phosphorus turf fertilizers beginning with the 2002 fertilizer bid. This was done in response to the City/State regulation changes regarding phosphorus turf fertilizers. A wide range of fertilizers was offered to allow park maintenance and golf course foremen to pick the highest performing fertilizer (based on soil test results).

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 seeks to address environmental concerns while maximizing golf course opportunities thereby providing open space benefits. An important component of this program is the implementation of IPM procedures, and the reduction of chemical and fertilizer use to protect water quality and provide a healthier habitat for wildlife.

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. Additionally, the program provides assistance 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:

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

By completing projects in each of the above, the golf course receives national recognition as a Certified Audubon Cooperative Sanctuary. MPRB Operations staff, working with all MPRB Golf Course foremen, received the ACSP certification for all courses. Certified courses are Columbia, Gross, Hiawatha, Meadowbrook, and Wirth. MPRB water quality staff conducts yearly water quality and aquatic vegetation monitoring at the courses.

Performance Measures

- Number of MPRB staff with pesticide applicator licenses: 179

Program Overview –

City of Minneapolis Public Works Stormwater Ponds and Bio-(in)filtration (Rain Gardens)

INTEGRATED PEST MANAGEMENT for CITY of MINNEAPOLIS STORMWATER TREATMENT FACILITIES
ADAPTED FROM July 24, 2008 MINNEAPOLIS PARK AND RECREATION BOARD POLICY

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.

IX. Illicit Discharges and Improper Disposal to Storm Sewer System

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 pipes, gutters, swales and other conveyance infrastructure. Targeted pollutants include:

- All pollutants



Program Overview

Typical Hazardous Spill Response

The immediate goals of 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 various departments and agencies to work as a team, utilizing available resources to protect people, the environment, and property. Training and response procedures are coordinated among the Regulatory Services, Public Works, and Fire Departments. The Regulatory Services Hazardous Materials Manager 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 sand or floor-dry has absorbed the spill, it is removed and then deposited in a leak-proof container. For large or extremely hazardous spills, a Hazardous Materials Response Team is also 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 National Duty Officer as required by law.

The protocol used by the Street Maintenance section for handling spills is documented in Appendix 32: Standard Operating Procedure for Vehicle Related Spills (VRS).

Emergency Response Program

The Department of Regulatory Services operates a boat for use on the Mississippi River and other Minneapolis water bodies, to be able to respond to spills that could impact our valuable water resources. The presence of 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 have 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.

Additionally, Regulatory Services uses the boat for the placement of monitoring and sampling equipment used for tracking water quality, identifying points of illegal discharges, illegal sewer connections, infiltration from sanitary sewers or water mains, assessment of outfalls, and investigation of complaints that are inaccessible from shore. The City assists the Mississippi Watershed Management

Organization in conducting a sampling program of the storm drainage system that drains to the Mississippi River. The intent of this sampling is to detect illegal discharges, and to establish a baseline of chemical, physical, and biological parameters.

Previous Year Activities

- Fire Inspection Services responded to 52 Emergency Response requests. The Minneapolis Fire Department also responds to a number of these requests. The response time varies between 5 to 20 minutes depending on Fire Department response and type of Emergency Response request.
- Conducted 30 days of outfall sampling, visual inspections of outfalls and developing spill response strategies by boat. Participating agencies included Minneapolis Fire, Minneapolis Public Works, Minnesota Pollution Control Agency (MPCA) and Mississippi Watershed Management Organization.
- Responded to 2 spill incidents on the Mississippi River where containment boom was deployed. Minneapolis Fire Inspection Services and MPCA participated in these efforts.
- Responded to 0 spill incidents on Minneapolis lakes where containment booms were deployed.
- Conducted 1 day of formal River Spill Response/Containment Boom Deployment training on the Mississippi River for the Minneapolis Fire Department. Spill response strategies and Standard Operating Procedures were discussed, storm sewer outfall map reading was reviewed. Boats were deployed.
- Minneapolis Fire Inspection Services assisted in planning and participated in a spill response at the Minneapolis municipal water intake location on the Mississippi River. Minneapolis Public Works and Regulatory Services staff were involved. Spill response strategies to protect the water intakes were discussed, and containment boom was deployed to practice these strategies.
- Minneapolis Fire Inspection Services assisted in a spill response overview of the Mississippi River in Minneapolis for MPCA Emergency Response staff. Boat launches and river points of access, major outfalls, and potential pollution sources were visited.
- Fire Inspections Services participated in WAKOTA CAER Boom School spill response planning.
- Fire Inspection Services participated in planning and involvement in Operation Raging River, a radiological response drill on the Mississippi River. Participating agencies included U.S. Coast Guard, FBI, National Guard, and the Minneapolis Fire, Police Public Works, Regulatory Services, and Health Departments.

September 2013 training of Fire Department for boom deployment in case of a spill on the waterway

Unauthorized Discharges

Environmental Services personnel carry out pollution prevention and control activities. Results are achieved through educational efforts, inspections, and coordinated community outreach events. These activities may include enforcement, pursuant to Chapter 48[4] and other applicable City codes, and coordination with other regulatory agencies at the county, state and federal levels. Enforcement yields identification of the responsible party, documentation of clean-up activities, and also 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 the public, City and private contractors, City staff and other government agencies, by the following means:

- Environmental Management Complaint Form
- Confidential calls to Minneapolis Information & Services. Within Minneapolis, the phone number is 311. Outside of Minneapolis, the phone number is 612-673-3000
- Reports from sewer maintenance crews, plumbing inspectors, and other City personnel
- Direct contact to Environmental Services staff at 612-673-3867

[4] Minneapolis Code of Ordinances, Chapter 48 Minneapolis Watershed Management Authority.

Previous Year Activities

- Addressed 121 calls for emergency response (containment of spills, chemical dumping, illegal disposal or handling of regulated or hazardous materials). These spills ranged from transformer leaks to spilled automotive fluids.
- Investigated 693 water and land pollution complaints (illegal dumping, improper storage of material, and chemical storage).
- Carried out brownfield maintenance, monitoring and treatment activities. Sites include:
    - Superfund sites
    - Leaking petroleum sites
    - Remediation systems
        - Pump, treat and discharge groundwater
        - Soil venting
    - Wells
        - Monitoring wells – water samples taken to monitor the level of contamination
        - Recovery wells – contaminated groundwater is pumped from the ground. It is typically treated prior to discharge usually to the sanitary sewer.
- Approved 20 limited duration sanitary sewer and storm drain discharge permits.
- Approved 80 storage tank permits:
    - Above ground - 0 abandoned-in-place, 11 installed, 30 removed
    - Underground - 10 abandoned-in-place, 0 installed, 52 removed

Brownfields

At the end of 2014 there were 7 locations with 9 listings that would qualify as superfund sites. Minneapolis is also tracking 14 properties that are identified as petroleum leak sites that require additional work and monitoring before they can be closed. Over the course of 2014 there were several sites where a tank removal or an environmental site investigation identified low level petroleum contamination. These sites were reported to the state duty officer and with additional work were closed within the same calendar year and not record in the this number.

For the existing open sites along with voluntary clean-up efforts there are 17 sites with 22 operating remediation systems for cleanup of impacted soils and groundwater. Throughout the city there are 79 properties with 628 active monitoring wells checking the perform of the cleanup activities and site conditions. Samples are obtained from these wells and analyzed for contaminants of concern.

Ongoing chemical storage is occurring at 811 locations with an identified quantity of 1684 items. This with the land use activities are monitored to eliminated the risks future site problems.

Permits were issued for specific tasks and projects related to brownfield sites. These tasks and projects were for the maintenance, monitoring and treatment. Overall 247 individual permits were issued.

Detection and Removal Screening Program

The field screening program to detect and investigate contaminated flows in the storm drain system is an integral part of daily operations for personnel of Public Works Surface Water & Sewer Operations, Environmental Services, and Regulatory Services. Maintenance crews routinely inspect and clean storm drain structures throughout the City. 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 then 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. These combined efforts result in an annual screening of more than 20% of City drainage areas.

Facility Inspection Program

Inspectors perform site visits of facilities that store large quantities of regulated and hazardous materials. Inspections include review of 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. The Minneapolis Fire Department participates in the majority of inspections, reviewing spill response strategies. In addition, site plan inspections yield the following information:

- Drainage patterns from the site to the nearest drain or water body
- Watershed destination and outlet location

Previous Year Activities

- Conducted inspections on 74 TIER II Hazardous Materials Facilities. Inspections include review of the storage of hazardous materials, spill response plans and equipment on site, employee training on spill response procedures, identification of required spill response contractor. The Minneapolis Fire Department participates in the majority of inspections, reviewing spill response strategies.
- Reviewed 334 Emergency Response plans for TIER II Hazardous Materials Facilities. Reviews include hazardous materials storage and spill response plans.

X. Storm Sewer Design for New Construction

Program Objective

There is a continuing effort to minimize the discharge of pollutants to public waters. This section describes the current focus and outlines the design measures used to control the discharge of pollutants by controlling the volume, loading or rate of stormwater discharged.

Targeted pollutants include:

- Total Suspended Solids (TSS)
- Phosphorus
- Bacteria

A. CSO Program

Overview

In 2014 the City of Minneapolis continued its program to reduce inflow and infiltration (I & I) to the combined sewer system. Inflow is stormwater and other clear water sources connected directly to the sanitary sewer, and infiltration is groundwater that enters the sanitary sewer, usually through pipe and system defects. The program is continuing a City focus to work toward eliminating combined sewer overflows. This effort began when the first storm drains were constructed in the 1930s. (Prior to that time, all stormwater discharge was combined with sanitary sewer discharge). The effort to eliminate combined sewer overflows was accelerated in 1960 when the City began a 40-year residential paving program. Separate storm sewers built as part of the paving program accounted for elimination of most of the City's remaining combined sewer areas. More information on the history and progress of the CSO Program can be found online.

The principal work currently is to continue to make reasonable progress of eliminating known public and private stormwater inlets or rainleaders connected to the sanitary sewer. Additionally, the City is using a targeted sanitary sewer flow metering program to identify other clear water sources. The flow metering program includes follow-up smoke testing where a smoke-like vapor is blown into the sanitary sewer in order to expose openings where inflow is entering the sanitary sewer.

The City's success with reducing I & I is transferring a problem from the sanitary sewer system to the stormwater management system, because there is limited storm sewer capacity for the inflow removed from the sanitary sewer. This has contributed to the challenges the City has to manage in the Flood Mitigation Program discussed earlier in this report.

Previous Year Activities

The storm drain project areas for 2014, and associated water quality impacts, are referenced in the following table:

PROJECT AREA	PROJECT DESCRIPTION	STORMWATER RUNOFF BENEFITS
CSO Area 148 (31st St E & Columbus Av S)	Eliminated cross connection from storm to sanitary sewer	Eliminated CSO area of 5.57 acres
CSO Area 166 (Buchanan St N & Hennepin Av E)	Eliminated cross connection from storm to sanitary sewer	Eliminated CSO area of 1.92 acres
CSO Area 168 (26th St W & Nicollet Av S)	Eliminated cross connection from storm to sanitary sewer	Eliminated CSO area of 12.65 acres
CSO Area 169 (4th Av S & 19th St E)	Eliminated cross connection from storm to sanitary sewer	Eliminated CSO area of 3.97acres
CSO Area 170 (3rd Av S & 19th St E)	Eliminated cross connection from storm to sanitary sewer	Eliminated CSO area of 10.85 acres
CSO Area 178 (5th Av S & 19th St E)	Eliminated cross connection from storm to sanitary sewer	Eliminated CSO area of 2.24 acres

B: Street Projects

For street reconstruction projects, whenever storm drain upgrades are required, installations of volume reduction systems, pollutant load-reducing facilities, and rate reduction BMPs are all considered.

Previous Year Activities

In 2014, in conjunction with the 15th and 4th Paving Project, an infiltration BMP was constructed to provide volume control for six acres of previously untreated stormwater that otherwise drains to the S 4th Street outfall to the Mississippi River. (See graphics on next page.)

- Converted road to pedestrian walkway to Cedar Riverside LRT Station
- Installed volume reduction and water quality benefits for runoff from 6 acres that were previously untreated.
- Pilot project for City of Minneapolis – first use of Underground Infiltration Chambers in public right-of-way

Storm Sewer Design for New Construction

City of Minneapolis 16th Avenue S Infiltration Project

XI. Public Education and Outreach

Program Objective

The objective of this stormwater management program is to educate the public regarding point and non-point source stormwater pollution. Targeted pollutants include:

- All pollutants

Program Overview

The City of Minneapolis and the Minneapolis Park & Recreation Board (MPRB) implement their Public Education Program to promote, publicize, and facilitate the proper management of stormwater discharges to the storm sewer system. The program's focus is to educate Minneapolis residents, business owners, employees and visitors about how *everyone's* actions affect the quality of our lakes, wetlands, streams and the Mississippi River, and how to control pollutants at the sources to reduce the discharge of pollutants to our receiving waters. The desired result is to change behavior in ways that will improve water quality. Many of the components of the program can be found at the following City of Minneapolis Stormwater web site: http://www.minneapolismn.gov/publicworks/stormwater/.

Some of the program activities are carried out directly by the co-permittees - the City and the MPRB. Other activities are coordinated with and carried out by watershed organizations, Hennepin County and other entities.

Previous Year Activities

Metro Blooms Rain Garden Workshop Program

A. Ongoing Program: In 2014, the City and others again sponsored a multi-part stormwater education workshop program conducted by Metro Blooms, a non-profit organization that grew out of the City's Committee on the Urban Environment (CUE). The goals of the workshop program are to reduce stormwater runoff, prevent stormwater pollution that damages our water bodies and improve the environmental and visual quality of the urban landscape. The workshops serve to inform, coach and offer consultation to Minneapolis residents protecting the upper Mississippi River watershed by installing properly designed bio-infiltration areas (rain gardens), redirecting downspouts and using native plants. One of the means of publicizing the workshops is a utility bill insert that reaches most of the approximately 100,000 households in Minneapolis. In 2014, 6 workshops were held within Minneapolis.

B. Lake Nokomis Neighbors for Clean Water: In 2014, the City of Minneapolis was awarded a Clean Water Fund Grant by the Minnesota Board of Water & Soil Resources Competitive Grants Program for this project, in the amount of $400,000. Metro Blooms and the Minnehaha Creek Watershed District (MCWD) are project partners. Additional funding for the project is being provided by MCWD ($100,000) and Hennepin county ($50,000). Metro Blooms is managing the project, which is a major expansion of a 2013 pilot program to engage residents in an initiative to reduce pollutants in stormwater runoff entering Lake Nokomis, one of the most visited lakes in Minnesota, and determined by the State to be impaired due to excessive nutrients. Building on the success of its Powderhorn Neighborhood of Rain Gardens initiative, Metro Blooms conducted an analysis of the subwatershed to identify priority areas for BMP installations based on drainage pattern, land uses and presence of previously constructed BMPs, and is focusing on reducing runoff and pollutants from residential backyards, rooftops and driveways. WinSLAMM modeling of potential projects demonstrates 90-92% reduction in stormwater volume, TP and TSS from drainage areas. Installations will be paired with education and outreach to property owners focused on long-term benefits of sustainable source control.

Minneapolis Park & Recreation Board Education Activities and Events

In 2014, Minneapolis Park & Recreation Board (MPRB) staff provided water quality education programs throughout the City. Environmental Operations naturalist staff participated in 53 Minneapolis community festivals and neighborhood events (see site below), including concerts at Bryant Square, Lake Harriet, Father Hennepin Bluffs Park, Minnehaha Park, Nicollet Island, and along Victory Memorial Drive. Hands-on water quality educational displays focused on neighborhood watersheds and how human activities impact local water bodies (see images of Water Quality mini-golf below).

2014 List of parks that had water-quality education program events. Several sites hosted multiple events.

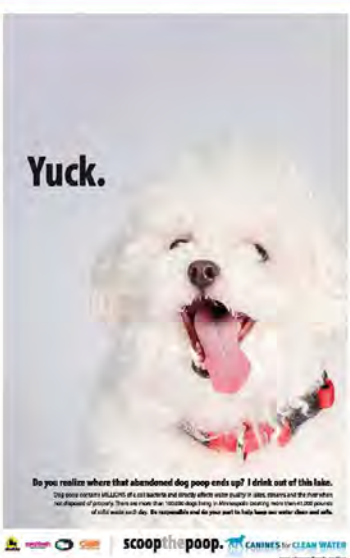
- Armatage Park
- Bryant Square Park
- Father Hennepin Bluffs Park
- Fuller Park
- Loring Park
- Minnehaha Falls Park
- Martin Luther King Park
- Nicollet Island Park Amphitheatre
- Open Streets Minneapolis
- Painter Park
- Sibley Park
- Theodore Wirth Park
- Victory Memorial Park

CANINES for CLEAN WATER

<u>Canines for Clean Water</u>

More than 100,000 dogs reside in the City of Minneapolis. They generate an estimated 41,000 pounds of solid waste each day. A water quality education program targeting dog owners was initiated in 2009 called Canines for Clean Water, and we continue to build on this work.

In 2014 the Canines for Clean Water campaign continued to focus on Public Service Announcements (PSAs) shown at the Riverview Theatre, located near the Mississippi River and Lakes Nokomis and Hiawatha. The PSAs focus on two main actions: getting pet owners to pick up after the dogs, and encouraging all property owners to stop or reduce their use of salt or chlorides. The PSAs had a simple message with images of the Mississippi River, Lake Nokomis, and Minnehaha Creek. The summer and fall message was to <u>Protect the River, Protect the Lake, Protect the Creek: Grab a Bag and Scoop the Poop</u>. For winter, the images featured winter scenes of the Mississippi River, Lake Nokomis, and dogs frolicking in the snow. The message here was <u>to Protect the River, Protect the Lakes, Protect the Paws: Shovel, Don't Salt</u>. The word *chloride* was not used in the PSA because more people understood ice melt as salt. However, detailed information about chlorides, their impacts, best practices for distribution was found on the Minneapolis Park & Recreation Board website www.minneapolisparks.org/dogs The same was true for information about the impact of dog poop on water quality.



One of a new series of posters for the Minneapolis Canines For Clean Water Campaign.

<u>The caption says:</u>

Do you realize where that abandoned dog poop ends up? I drink out of this lake.

Dog poop contains MILLIONS of e.coli bacteria and directly affects water quality in lakes, streams and the river when not disposed of properly. There are more than 100,000 dogs living in Minneapolis creating more than 41,000 pounds of solid waste each day. Be responsible and do your part to help keep our water clean and safe.

Mississippi River Green Team

The Mississippi River Green Team (Green Team) is a conservation-based teen crew engaged in daily hands-on environmental work throughout the summer. There are two crews of ten youth each, that work mostly in the natural areas of the Minneapolis park system, and also within the watershed of the Mississippi River. Typical work days include invasive species removal, weed wrenching, planting, watering, mulching, and citizen science work. Weekly education days in 2014 included learning from National Park Service Rangers, Minneapolis Park & Recreation Board Gardeners, Conservation Corps Minnesota. The team members also toured the City of Minneapolis water treatment plant, and explored the University of Minnesota Monarch Lab. An overview of their summer work and education activities can be seen at this link: https://www.youtube.com/watch?v=2IPzAJkuhjQ.

Blue Dasher. **Photo by D. Thottungal**

In 2014 the Green Team served as citizen scientists for the Minnesota Dragonfly Society, formerly known as the Minnesota Odonata Survey Project. Each week the teens helped catch and identify dragonflies at North Mississippi Regional Park. The crew also surveyed Heritage Park. Dragonflies are an indicator species for assessing habitat and water quality in wetlands, riparian forests, and lakeshore habitats. You can read more about the survey work here: http://www.mndragonfly.org

Other summer work sites included Lake Nokomis, Mill Ruins Park, B. F. Nelson Park, Heritage Park/Sumner Field, Audubon Park, J. D. Rivers' Children's Garden and Powderhorn Park. The Green Team also worked at stormwater holding ponds owned by the City of Minneapolis including Heritage Park, Camden Central Pond, Central Avenue Pond at Columbia Golf Course, 37th/Columbus Av S pond, and the Park Avenue ponds. The teens removed invasive species and weed trees, picked up trash, and mulched trees and shrub beds. The crews also planted native species in prairie areas to enhance habitat for pollinators and other wildlife, and to improve the diversity of the BMPs.

The Mississippi River Green Team is made possible through a partnership between the Minneapolis Park & Recreation Board and the Mississippi Watershed Management Organization, with additional funding through the City of Minneapolis STEP-UP Youth Employment Program.

Photos by NorthernLights.mn

RUINATION: CITY OF DUST
Lake Nokomis and Minnehaha Creek
October 18/29, 2014

Ruination: City of Dust

Ruination: City of Dust is an interactive, site-specific, multi-player mystery game played on bicycles, using the landscape of Lake Nokomis and Minnehaha Creek as a game board. Contemporary environmental science informs the sci-fi narrative, while elements of art intertwine with physical and mental challenges. Almost 400 people time traveled to the year 2314 to explore the ruins of Minneapolis, a city abandoned and covered in dust. Teams of explorers braved the harsh conditions (in reality, it was gorgeous fall weather) to excavate the ruins, searching for answers about which of six 'Deadly Problems' brought the city to its final ruination.

With the help of costumed guides, explorers learned how water quality is impacted by chemicals, trash, poop, and invasive species, and actions they could take to improve water quality. Explorers sampled smoked Asian carp, paddled to a plastic bag island, and battled giant dung beetles to keep *e.coli* out of the lake.

The game took place on October 18 and 19, and was produced by Northern Lights.mn in collaboration with the Minnehaha Creek Watershed District and writer Guy Ken Eklund, and in partnership with the Minneapolis Park & Recreation Board.

Earth Day Watershed Clean-Up Event

Clean-up was initiated in 1995 to draw attention to the water quality improvement needs of Minneapolis' lakes, and the effects that individual actions have on urban water quality. The goals of Earth Day Clean-up are to prevent trash and debris from entering Minneapolis water bodies, and to provide a volunteer experience and environmental education to Minneapolis residents and park users. This annual event involves cleaning Minneapolis park and neighborhood areas that are part of the watersheds of Minneapolis water bodies, including the Chain of Lakes, Lake Nokomis, Lake Hiawatha, Powderhorn Lake, Diamond Lake, Shingle Creek, Minnehaha Creek, Bassett Creek, and the Mississippi River. Since the inception of the Earth Day clean-up, more than 140,000 pounds of garbage have been removed from Minneapolis parks.

Previous Year Activities

The 2014 Earth Day Clean-Up took place on April 26 and was a huge success.

Pounds of trash collected:	over 8,000 (6,700 litter, 1,100 recycling, 250 metal)
Volunteers:	over 1,700

Storm Drain Inlet Stenciling

Stenciling of storm drain inlets, also called catch basins, educates the people painting stormwater messages on the storm drains, and also shares an environmentally friendly message with area residents and other people passing by. It is a great team building exercise that allows volunteer organizations to educate people about simple steps they can take to help improve the quality of the lakes, rivers and streams in Minneapolis.

In 2014, the City continued the program by providing self-contained stenciling kits. Each kit contains everything needed to stencil storm drains inlets: stencils, a map with storm drain inlet (catch basin) locations, stenciling paint, traffic cones, facemasks, a broom for prepping the site, latex gloves and trash bags, safety vests and glasses, and door hangers to explain the stenciling to area residents. By providing educational stormwater door hangers to distribute to residents, dialogue is encouraged between the stencilers and people who live nearby.

The stencils are specific to the type of receiving waterbody, thus referring to “Mississippi River”, “lake”, or “creek” as the case may be. The City has three versions of the “Mississippi River” stencils: in English, Spanish and Somali languages. The “lake” and “creek” stencils in 2014 were only in English, but Spanish and Somali versions are being added.

Safety of the volunteers is very important, so we encourage groups to stencil on low volume streets, and we provide traffic cones and safety vests. If children are part of the group, we request that an adult be present at all times to supervise. The trash bags and gloves are used by the volunteers to pick up trash in the areas around the storm drain inlets, especially on the uphill side. Efforts of the organizations doing the stenciling are tracked, including maps of the target areas, the locations and numbers of the stenciled catch basins, the number of volunteers, and the number of door hangers distributed.

Previous Year Activities

Participants:	175
Catch basins painted:	558
Bags of trash and debris collected:	42
Door hangers distributed	1,349

Volunteers can visit the following web site:

http://www.minneapolismn.gov/publicworks/stormwater/stenciling

Web sites

STORM & SURFACE WATER MANAGEMENT – The City provides the following primary web site for information about Storm and Surface Water Management:
http://www.minneapolismn.gov/publicworks/stormwater/index.htm

ENVIRONMENTAL SERVICES – The City's Environmental Services section maintains the following web site for additional information about its initiatives and programs:

http://www.minneapolismn.gov/environment/index.htm

STORMWATER MANAGEMENT PROGRAM and ANNUAL MS4 REPORT – The City and MPRB work with local watershed organizations and other partners to fulfill the requirements of the City's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit. The Stormwater Management Program and current and prior annual reports can be reviewed at the following web site to provide education to interested parties:
http://www.minneapolismn.gov/publicworks/stormwater/stormwater_npdesannualreportdocuments

LOCAL SURFACE WATER MANAGEMENT PLAN – This document is a key component of the City's comprehensive plan, The Minneapolis Plan For Sustainable Growth:
http://www.minneapolismn.gov/publicworks/stormwater/stormwater_local-surface

REGULATORY CONTROLS OF SURFACE WATER MANAGEMENT – The City of Minneapolis provides information regarding pesticides, fertilizers, illicit discharges, improper disposal and other water quality issues via the following City web site: http://www.minneapolismn.gov/publicworks/stormwater/stormwater_regulatory-controls

FLOOD MITIGATION INFORMATION – The City web site provides educational information regarding flood mitigation. For information on flooding and safety precautions, the following web site can be viewed by interested parties: http://www.minneapolismn.gov/publicworks/stormwater/flood/index.htm

COMBINED SEWER OVERFLOW – (CSO) PROGRAM – The City maintains a web site to educate Minneapolis residents and property owners about the City's CSO program to eliminate Combined Sewer Overflows: http://www.minneapolismn.gov/publicworks/stormwater/cso/

MINNEAPOLIS STORMWATER UTILITY FEE and BEST MANAGEMENT PRACTICES (BMPs) – As a component of the City's Stormwater Utility Fee, the City web site encourages the implementation of various Best Management Practices (BMPs) such as rain gardens, rain swales and pervious pavement that would reduce the overall amount of impervious surface area throughout the City. These practices would also filter and cleanse stormwater.

http://www.minneapolismn.gov/publicworks/stormwater/fee/stormwater_fee_stormwater_faq

The City also maintains a link to the following MPCA web site where numerous BMP suggestions are available for implementation at various scales:

Minnesota Stormwater Manual:

http://stormwater.pca.state.mn.us/index.php/Main_Page

PUBLIC EDUCATION & OUTREACH – Additional information about how the City and MPRB advance stormwater education activities can be found at the following web sites:

City of Minneapolis – http://www.minneapolismn.gov/publicworks/stormwater/stormwater_outreach

Minneapolis Park & Recreation Board - https://www.minneapolisparks.org/

EROSION and SEDIMENT CONTROL EDUCATION for CONTRACTORS and DEVELOPERS

During Minneapolis Development Review and the Site Plan Review processes, and during on-site inspections, Public Works and Environmental Services personnel provide Erosion and Sediment Control (ESC) guidance to contractors and developers. This guidance includes information regarding the City's ordinances, and local, state and federal regulations.

http://www.minneapolismn.gov/publicworks/stormwater/erosion/index.htm

XII. Public Participation Process

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 the 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 MPCA re-issued Municipal Separate Storm Sewer System (MS4) NPDES Permit No. MN0061018 to the City of Minneapolis and the MPRB as co-permittees in January 2011. The Permit requires the implementation of approved stormwater management activities, referred to as Best Management Practices (BMPs). A new Stormwater Management Program (SWMP), documenting the BMPs the City and the MPRB have or will put in place for the re-issued 2011 permit, was submitted to the MPCA for public comment and approval in September, 2011 and revised and finalized in May 2013. Additional revisions were made in 2014 and in July 2015. The SWMP is at the following web site:

Each year, the City holds a public hearing at a meeting of the Transportation & Public Works Committee of the City Council, 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 also publicized through public service announcements on the City cable television channel. This year's public hearing date was July 14, 2015 at 9:30 AM in Council Chambers, Room 317 City Hall, 350 S 5th Street, Minneapolis, MN. The slide presentation is available at the following web site:

http://www.minneapolismn.gov/www/groups/public/@clerk/documents/webcontent/wcms1p-143883.pdf

A notice of the availability of the Stormwater Management Program was sent to the 81 Minneapolis neighborhood organizations, to the governmental entities that have jurisdiction over activities relating to stormwater management, and to other interested parties announcing the web site link, and informing that written comments were being accepted until Noon on July 17, 2015. A list of the notice recipients is below.

The notice explained that emails or faxes were the preferred methods for submitting written comments, rather than conventional mail due to the additional time involved. The contact information for written comments was listed as:

City of Minneapolis, Department of Public Works
Surface Water & Sewers Division c/o Lois Eberhart
300 City of Lakes Building, 309 2nd Avenue S, Room 300
Minneapolis MN 55401-2268
Phone: 612-673-3260 Fax: 612-673-2048
E-mail: lois.eberhart@minneapolismn.gov

All testimony presented at the public hearing, and all written comments received, are recorded and given due consideration. The comments are included with the Annual Report as Appendix C. 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 at http://www.minneapolismn.gov/publicworks/stormwater/stormwater_npdesannualreportdocuments.

As outlined in Part V.A. of the Permit, 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 being submitted along with the Annual Report. The revisions are primarily responsive to a 3-day field inspection in August 2013 by an EPA Inspection Team. The inspection, or audit, helped to identify opportunities for improvement regarding comprehensive training, written procedures and documentation, and availability of staff resources.

Performance Measures

- Number of interested parties that were directly notified of public hearing, Stormwater Management Program (SWMP) availability, and proposed SWMP changes: 99 (includes 81 neighborhood organizations) (list follows)

Organization	Email address	Contact Person
Bassett Creek Water Management Commission	Laura.jester@keystonewaters.com	Laura Jester
Blue Water Association	sheila62sdmn@yahoo.com	Sheila Cracraft-Fehler
Clean Water Action	mzellar@cleanwater.org	Marie Zellar
Friends of the Mississippi River	wclark@fmr.org	Whitney Clark
Hennepin County Environmental Dept.	randy.anhorn@co.hennepin.mn.us	Randy Anhorn
Metropolitan Council Environmental Services	judy.sventek@metc.state.mn.us	Judy Sventek
Minneapolis Citizens Environmental Advisory Committee	jen.wendland.kader@gmail.com	Jen Kader
(all) Minneapolis Neighborhood Organizations	Bob.Cooper@minneapolismn.gov	c/o Bob Cooper, CPED
Minnehaha Creek Watershed District	jwisker@minnehahacreek.org	James Wisker
Minnehaha Creek Watershed District	bchristopher@minnehahacreek.org	Becky Christopher
MN Center for Environmental Advocacy	ksigford@mncenter.org	Kris Sigford
MN Dept of Agriculture, Pesticide Mgmt	ron.struss@state.mn.us	Ron Struss
MN Dept of Natural Resources, Ecological and Water Resources Division	steve.hirsch@state.mn.us	Steve Hirsch
MN Dept of Transportation, Water Resources	beth.neuendorf@dot.state.mn.us	Beth Neuendorf
MN Environmental Partnership	stevemorse@mepartnership.org	Steve Morse
Mississippi River Revival	solomonsimon@hotmail.com	Sol Simon
Mississippi Watershed Management Organization	dsnyder@mwmo.org	Doug Snyder
St. Paul, City of	anne.weber@ci.stpaul.mn.us	Anne Weber, Sewer Utility
Shingle Creek Watershed Mgmt. Commission.	judie@jass.biz	Judie Anderson

Attachment: List of Recipients for Review and Comment

XIII. Coordination with Other Governmental 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: Bassett Creek Water Management Commission, Mississippi Watershed Management Organization, Minnehaha Creek Watershed District, and Shingle Creek Watershed Management Commission. Coordination activities and partnerships with other governmental entities also include MnDOT, Hennepin county, MPCA, 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)

At the end of 2014, the BCWMC had nearly completed its Third Generation Watershed Management Plan efforts, with Minneapolis and the other 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 Mississippi Watershed Management Organization (MWMO)

The MWMO adopted its Third Generation Watershed Management Plan in 2011. The City and MPRB participated in its planning committees. 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

Coordination with the Minnehaha Creek Watershed District (MCWD)

The MCWD adopted its Third Generation Plan in 2006. The MCWD receives revenue through direct taxation against properties within its jurisdiction. 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 Shingle Creek Watershed Management Commission (SCWMC)

The SCWMC adopted its Third Generation Watershed Management Plan in April 2013, 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 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, WAKOTA CARE, and South Metro River Response

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

Previous Year Activities and Ongoing Coordination Efforts

- The Minneapolis Park and Recreation Board (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 a number of 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 (TAC) meetings
    - Inform the organizations of upcoming City capital projects in an effort 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.
- A 2012-2015 project with Bassett Creek Watershed Management Commission is shoreline restoration along the creek. The project was primarily funded by the Commission, and is being implemented by the City and the MPRB.
- In 2014 the City and the MWMO began a three-year project in 2014 to develop hydrologic and hydraulic models (H&H models) for all areas in Minneapolis that are within the MWMO watershed. The MWMO is participating both technically and financially with these models.
- A multi-year project with the Minnehaha Creek Watershed District is determining capital projects that will be jointly funded that will address localized flooding challenges while also addressing water quality issues. One key project is to mitigate flooding at the MPRB's Hiawatha Golf Course such as occurred in 2014. The goals of this project are to reduce the risk of localized neighborhood flooding, improve water quality, and improve course conditions.
- In 2014, the City and the Minnehaha Creek Watershed District completed work on Weather – Extreme Trends: A Stormwater Adaptation Study. Along with a team of academic principal investigators, the City and the District used downscaled global circulation models to quantify the impacts of projected precipitation trends and land cover changes on stormwater infrastructure, and explore community climate change adaptation strategies, using a fully developed portion of Minneapolis and the developing city of Victoria MN as case studies. http://www.minnehahacreek.org/project/weather-extreme-trends

- 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.
- Erosion and sediment control permit inspections are coordinated with the MCWD and the BCWMC.
- The MPRB coordinates with the watershed organizations and the Metropolitan Council on watershed outlet monitoring.
- The MPRB and the City coordinate and partner with the watershed organizations on capital projects and water quality programs.
- The MPRB works with the DNR and surrounding suburbs on various capital projects and programs.

- Public Works and MPRB staff coordinate with the MPCA, the watershed organizations and other stakeholders for Total Maximum Daily Load (TMDL) studies and implementation plans.
- Public Works staff participated in the multi-year MPCA's Minimal Impact Development Standards (MIDS) Committee and several of its sub-committees. The MIDS project was essentially completed in 2013.
- Public Works engages with MPRB, MnDOT, Hennepin County, Metropolitan Council and watershed organizations on those entities' capital projects and infrastructure maintenance within the City in regards to compliance with NPDES issues.

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

XIV. Stormwater Monitoring Results and Data Analysis

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.

In addition to stormwater monitoring, the Minneapolis Park & Recreation Board carries out an extensive lake monitoring program which is sometimes illustrative of stormwater conditions. For example, E. coli monitoring following the MPCA's inland lakes standard is carried out at the MPRB's 12 official beaches located on six lakes, is important for public health and provides almost immediate indications of elevated bacteria issues (see in particular Section 19, Public Beach Monitoring, of the MPRB's Water Resources Report referenced in the next paragraph). E. coli is a bacteria 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.

2013 Water Resources Report

The Minneapolis Park & Recreation Board's annual ***2013 Water Resources Report*** is a comprehensive technical reference of water quality information for the citizens of Minneapolis. Due to the its length, only the NPDES stormwater runoff monitoring and BMP monitoring sections are included in this Annual Report, later in this Section. (In prior years, they have appeared as Appendices A4 and A5 of the Annual Report). The *2013 Water Resources Report* is available electronically on the MPRB web page at www.minneapolisparks.org. The whole report can be found in the "Caring for Our Parks - Lakes & Water Resources- Water Quality" section of the website. Reports are also available from the Minneapolis public libraries archive department. The ***2014 Water Resources Report*** will be available in approximately October 2015.

Minneapolis Lake Trends

In 2014, MPRB scientists monitored 13 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. Changes in lake water quality can be tracked by looking for trends in TSI scores over time. 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.

All the lakes in Minneapolis fall into either the mesotrophic or eutrophic category. Calhoun, Cedar, Harriet, and Wirth Lakes are mesotrophic with moderately clear water and some algae. Brownie, Isles, Hiawatha, Nokomis, Spring, Loring and Powderhorn Lakes are eutrophic with higher amounts of algae. Trends in lake water quality can be seen by using the annual average TSI score over the last 20 years.

Lakes with increasing water quality indicators	Lakes with stable trend	Lakes with decreasing water quality indicators
Lake Calhoun Powderhorn Lake Wirth Lake	Brownie Lake Cedar Lake Grass Lake Lake Harriet Lake Hiawatha Lake of the Isles Loring Pond Lake Nokomis Spring Lake	Diamond Lake

Lakes Calhoun, Powderhorn, and Wirth have all seen a significant improvement in water quality indicators since the early 1990s (linear regression, $p < 0.1$). Most of the Minneapolis lakes have experienced no significant trend in water quality indicators. Lakes Cedar and Harriet were treated with alum in 1996 and 2001 respectively and showed improved water quality for a few years following treatment; however, recent conditions appear to be stabilizing or at the beginning of a trend to poorer water quality. Loring Pond experienced decreased water quality immediately following a dredging project in 1997; however, conditions have stabilized since. Improvements in the Diamond Lake and Lake Nokomis watersheds may soon switch these two lakes to showing increasing water quality indicators.

NPDES Land Use Sites Monitoring Results (Stormwater Runoff Monitoring)

In 2014, stormwater runoff monitoring was carried out at four management sites representative of Multi-Family Residential, Recreational/Parkland, Commercial/High-Rise, and Commercial/Industrial land uses. (In previous Annual Reports, the following material appeared in Appendix A as A4.)

BACKGROUND

The Minneapolis Park and Recreation Board (MPRB) and the City of Minneapolis are co-signatories on the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit. The MPRB has performed the NPDES MS4 stormwater monitoring since 2000. The purpose of the stormwater monitoring is to characterize the quantity and pollutant load of runoff from small areas representing various types of land use under a "no BMP" scenario. In reality, the results do not represent actual conditions for either runoff quantity or quality because there are numerous BMPs – Best Management Practices and other structural controls and management practices that reduce pollutants in stormwater runoff and/or temper stormwater runoff quantity in the watershed.

At the beginning of the first NPDES MS4 permit (2001-2004), the MPRB and City of Minneapolis partnered with the City of St. Paul to fulfill the NPDES monitoring requirements. Five sites in Minneapolis and St. Paul were jointly monitored between 2001–2004. In 2005, the MPRB stopped monitoring stormwater in St. Paul, and four new sites in Minneapolis were selected for monitoring. In 2006, new sites were chosen in Minneapolis to comply with the NPDES permit and to assist with modeling and load allocation efforts.

In 2014, the same four sites, representing the major land uses in Minneapolis -- residential, commercial/industrial, mixed use, and parkland -- were monitored for stormwater runoff quantity and quality. Representative sampling is mathematically extrapolated to calculate potential contaminant loading on a citywide scale, under the "no BMP" scenario. While the results do not represent actual impacts of stormwater discharge to receiving waters because they do not reflect the effects of structural controls and management practices, they nevertheless are useful to compare land uses and to posit baseline conditions for water quality modeling exercises.

METHODS

The summary below includes descriptions of equipment installation at each site, parameters monitored, field quality assurance sampling, computer models used, data handling, validation, and reporting.

Site Installation

The ISCO equipment installed at each site included a 2150 datalogger with low profile area/velocity pressure transducer probe, 2105 interface module, 2105ci or 2103ci cell phone modem, and a 3700 sampler. The sampler collected stormwater with 3/8" ID vinyl intake tubing complete with strainer. The dataloggers flow-paced the samplers to collect flow-weighted stormwater samples over the entire storm hydrograph. Each site automatically uploaded data, via cell phone modem, to the network server database Monday through Friday. Each site could also be communicated with remotely by

Flowlink Pro software in order to adjust pacing, enable or disable samplers, and see if a site had triggered.

Equipment installation began when freezing spring temperatures were no longer a concern in order to prevent area velocity transducer damage. See **Figure 24-1** for a map of site locations. Site 6 (22nd/Aldrich) was installed on 5/6/14. Site 7 (14th/Park), was installed on 5/2/14. Site 8a (Pershing Park) and Site 9 (61st/Lyndale) were installed on 4/25/14. See **Table 24-1** for site characteristics.

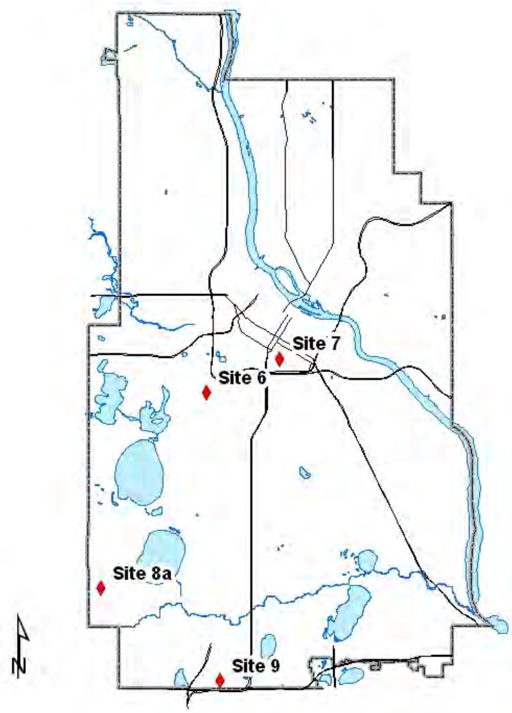


Figure 24-1. Map of the 2014 NPDES sites located in Minneapolis.

Table 24-1. 2014 NPDES stormwater monitoring sites for Minneapolis.

Site ID	Site 6	Site 7	Site 8a	Site 9
Location	22nd St & Aldrich Ave S	E 14th St & Park Ave S	Pershing Field east of 49th St & Chowen Ave	335 ft. east of 61st St & Harriet Ave S
Land Use	Multi–Family Residential	Commercial/Industrial/ High Rise Residential	Recreational/Parkland	Commercial/Industrial
Area (acres)	8.9	13.1	2.5	34.9
Pipe Diameter (inches)	18	42	12	36
Outfall ID#	10 – 430J	10 – 430D	57 – 100A/B	71 – 070

Sample Collection and Monitored Parameters

The MS4 permit target frequency for storm event sample collection is 15 samples per site, per year. If a sample was missed during one month due to lack of precipitation events, then two or more were taken the next month. In 2014, flow-paced storm event samples were collected from May through early November.

The total volume sampled for each site and total recorded volumes in 2014 are given in **Table 24-2** along with the seasonal aggregate percentage sampled. Detailed information on sampling events is shown in **Table 24-3**.

Table 24-2. NPDES site volume totals for the sampling period 5/8/14 – 11/6/14.

	Site 6	Site 7	Site 8a	Site 9
Total volume recorded (with Flowlink) for 2014 (cf)	282,613	767,212	69,580	1,685,780
Total volume of sampled events (cf)	168,594	482,412	54,410	1,087,615
% sampled ANNUAL	60%	63%	78%	65%
% sampled SPRING (May- June)	71%	76%	93%	88%
% sampled SUMMER (July- September)	29%	19%	6%	5%
% sampled FALL (October- November)	0%	5%	2%	7%

Table 24-3. 2014 precipitation event data and samples collected for NDPES sites. A precipitation event is defined as being greater than 0.10 inches and separated by 8 hours. The rain gage is located at 3800 Bryant Ave. S., Minneapolis, MN.

										2014 NPDES Events Collected			
Event	Start Date/Time		End Date/Time		Precip (inches)	Duration (hours)	Intensity (in/hr)	Time since last Precip. (hours)	Sample Type	Site 6 22nd/Aldrich	Site 7 14th/Park	Site 8a Pershing	Site 9 61st/Lyndale
+1	2/19/2014	14:15	n/a	n/a	n/a	n/a	n/a	n/a	grab		X(w/Ecoli)		X(w/Ecoli)
+2	3/10/2014	14:30	n/a	n/a	n/a	n/a	n/a	n/a	grab	X(w/Ecoli)	X(w/Ecoli)		X(w/Ecoli)
+3	3/14/2014	15:05	n/a	n/a	n/a	n/a	n/a	n/a	grab	X			
+4	3/21/2014	14:00	n/a	n/a	n/a	n/a	n/a	n/a	grab			X(w/Ecoli)	
+5	3/26/2014	13:55	n/a	n/a	n/a	n/a	n/a	n/a	grab	X(w/Ecoli)	X(w/Ecoli)		
+6	3/27/2014	13:55	n/a	n/a	n/a	n/a	n/a	n/a	grab			X(w/Ecoli)	
+7	4/27/2014	11:58	n/a	n/a	n/a	n/a	n/a	n/a	grab			X	X
8	5/8/2014	0:30	5/8/2014	20:00	1.02	19.5	0.05	180.0	composite	X	X	X(lmtd)	X
9	5/11/2014	21:30	5/12/2014	21:30	0.82	24.0	0.03	46.5	composite	X	X	X	X
10	5/19/2014	10:30	5/19/2014	22:30	1.80	12.0	0.15	169.0	comp/grab	X(w/Ecoli)	X(w/Ecoli)	X	X(w/Ecoli)
11	5/31/2014	16:30	6/1/2014	21:00	1.97	28.5	0.07	310.5	composite	X	X(lmtd)	X(lmtd)	X(lmtd)
12	6/11/2014	23:30	6/12/2014	12:00	0.11	0.5	0.22	118.5	composite	X(lmtd)	X		X
13	6/14/2014	10:00	6/15/2014	9:30	1.90	23.5	0.08	69.5	composite		X(lmtd)	X(lmtd)	X(lmtd)
14	6/16/2014	17:00	6/16/2014	21:00	0.45	4.0	0.11	35.5	composite	X	X		
15	6/18/2014	2:30	6/18/2014	4:30	0.43	2.0	0.22	31.5	composite	X	X	X	X
16	6/19/2014	3:30	6/19/2014	20:30	3.00	17.0	0.18	40.0	comp/grab	X(w/Ecoli)	X(w/Ecoli)	X	X
17	6/28/2014	15:30	6/29/2014	1:30	1.00	10.0	0.10	221.0	composite				X(lmtd)
18	7/7/2014	18:00	7/7/2014	22:30	0.33	4.5	0.07	38.5	composite	X	X	X(lmtd)	X(lmtd)
19	7/11/2014	6:00	7/11/2014	10:00	1.11	4.0	0.28	83.5	composite	X		X	
20	7/25/2014	5:00	7/25/2014	7:00	0.42	2.0	0.21	250.5	composite	X	X	X(lmtd)	X
21	8/17/2014	14:00	8/18/2014	0:30	0.32	10.5	0.03	365.5	composite	X			X
22	8/29/2014	1:15	8/30/2014	11:15	1.02	34.0	0.03	214.0	composite	X			
23	9/3/2014	8:30	9/3/2014	21:00	0.16	12.5	0.01	65.0	comp/grab	X(Ecoli only)	X(w/Ecoli)		X(Ecoli only)
24	9/9/2014	21:15	9/10/2014	9:00	0.41	11.8	0.03	156.0	composite		X	X	X
25	9/20/2014	17:30	9/20/2014	18:30	0.21	1.0	0.21	249.5	composite		X(lmtd)		
26	9/28/2014*	15:00	9/29/2014	1:00	0.51*	11.0*	0.21*	96.2*	composite		X(lmtd)		
27	10/1/2014	7:30	10/2/2014	22:45	1.04	39.2	0.03	292.2	composite		X(lmtd)	X	X(lmtd)
			Totals		**17.52**					**17**	**19**	**15**	**18**

+snowmelt event

n/a = not applicable

X = event sampled with full parameters

X(lmtd) = event sampled with limited parameters generally due to holding times e.g.BOD, Ortho P, and TDP

X(w/Ecoli) = event sampled with *E. coli*

X(Ecoli only) = only *E. coli* sampled

*NWS data collected at MSP airport

Table 24-4 shows the parameters tested as part of the MS4 permit for each sample collected. **Table 24-5** gives the approved methods used for analysis, reporting limit, and holding time for each parameter as reported by the contract laboratory Instrumental Research, Inc. (IRI). Legend Technical Services Laboratory analyzed all metals samples.

Limited parameter sample designation is when the sample is collected after some of the parameters (e.g. BOD, TDP) holding times have expired and those parameters are not analyzed. In 2014, limited parameters were collected nineteen times. These samples were recovered after more than 24 hours and parameters with short holding times were not analyzed (e.g. cBOD, TDP) or there was limited composite volume.

As required by the MS4 permit, *Escherichia Coliform* (*E. coli*) grab and pH samples were collected by quarterly sampling. *E.coli* was collected annually at all sites except at Site 8a (Pershing). Site 8a was inaccessible for grab sampling after snowmelt and equipment installation. When flow and time were sufficient, *E. coli* grab samples were collected. A total of eighteen *E. coli* grabs were collected in 2014. Site 6 (22^{nd}/Aldrich) was collected five times. Site 7 (14^{th}/Park) was collected six times. Site 8a (Pershing) was collected twice. Site 9 (61^{st}/Lyndale) was collected five times. The pH was measured in the field using an Oakton Waterproof pHTestr 2™ or at the laboratory IRI. If the Oakton field meter was used, the pH meter was calibrated with 2-point calibration prior to each sampling trip.

With the exception of Site 8 (Pershing) all required *E. coli* grab and pH samples sampling were successfully accomplished in 2014.

Table 24-4. The list of monitored chemical parameters for the NPDES permit. BOD is biochemical oxygen demand.

Parameter	Abbreviation	Units	Sample Type
BOD –carbonaceous, 5 Day	cBOD	mg/L	Composite
Chloride, Total	Cl	mg/L	Composite
Specific Conductivity	Sp. Cond	µmhos/cm	Composite
E. coli (*Escherichia Coliform*)	E. coli	MPN/100mL	Grab (4X year)
Hardness	Hard	mg/L	Composite
Copper, Total	Cu	µg/L	Composite
Lead, Total	Pb	µg/L	Composite
Zinc, Total	Zn	µg/L	Composite
Nitrite+Nitrate, Total as N	NO_3NO_2	mg/L	Composite
Ammonia, Un-ionized as N	NH_3	mg/L	Composite
Kjeldahl Nitrogen, Total	TKN	mg/L	Composite
pH	pH	standard unit	Grab (4X year)
Phosphorus, Ortho-P	Ortho-P	mg/L	Composite
Phosphorus, Total Dissolved	TDP	mg/L	Composite
Phosphorus, Total	TP	mg/L	Composite
Solids, Total Dissolved	TDS	mg/L	Composite
Solids, Total Suspended	TSS	mg/L	Composite
Solids, Volatile Suspended	VSS	mg/L	Composite
Sulfate	SO_4	mg/L	Composite

Table 24-5. Analysis method, reporting limit, and holding times for parameters used by Instrumental Research, Inc.

Parameter	Method	Reporting Limit	Holding Times
cBOD, carbonaceous, 5 Day (20°C)	SM 5210 B	1.0 mg/L	24 hours
Chloride, Total	SM 4500-Cl^- B	2.0 mg/L	28 days
Specific Conductivity	SM 2510 B	10 µmhos/cm	28 days
E. coli (*Escherichia Coliform*)	SM 9223B	1 MPN per 100mL	< 24hrs
Hardness	SM 2340 C	2.0 mg/L	6 months
Copper, Total	EPA 200.9	1.4 µg/L	6 months
Lead, Total	SM 3500-Pb B	3 µg/L	6 months
Zinc, Total	SM 3500-Zn B	2 µg/L	6 months
Nitrite+Nitrate, Total as N	SM 4500-NO_3 E	0.030 mg/L	28 days
Ammonia, Un-ionized as N	SM 4500-NH_3 F	0.500 mg/L	7 days
Kjeldahl Nitrogen, Total	SM 4500-Norg B	0.500 mg/L	7 days
pH	SM 4500 H^+ B	0.01 units	15 minutes
Phosphorus, Ortho-P	SM 4500-P A, B, G	0.010 mg/L	48 hours
Phosphorus, Total Dissolved	SM 4500-P A, B, G	0.010 mg/L	48 hours
Phosphorus, Total	SM 4500-P A, B, E	0.010 mg/L	48 hours
Solids, Total Dissolved	SM 2540 C	10.0 mg/L	7 days
Solids, Total Suspended	SM 2540 D	1.0 mg/L	7 days
Solids, Volatile Suspended	SM 2540 E	2.0 mg/L	7 days
Sulfate*	ASTM D516-90	15 mg/L	28 days

Sulfate* samples were spiked (10 mg/L) and then spike later subtracted to lower the 2014 detection limit to 5 mg/L.

FIELD QUALITY ASSURANCE SAMPLES

Ten percent of samples were laboratory quality assurance samples (e.g. duplicates, spikes). Field blanks consisted of deionized water which accompanied samples from the field sites to the analytical laboratory. A field blank was generated for each sampling trip and was analyzed for all NPDES parameters. All field blank parameters were below the minimum detection limits in 2014. As part of the overall QA/QC program, blind monthly performance samples were made for all monitored parameters and delivered to IRI.

If the Oakton field meter was used, the pH meter was calibrated with 2-point calibration prior to each sampling trip.

An equipment blank (~ 2 L sample) was collected at Site 8a (Pershing) 11/07/14. This site has a standard NPDES stormwater monitoring set up. To collect the equipment blank, a large bottle of deionized water was placed at the strainer end of the sampler tubing. The intake line was filled and flushed with deionized water simulating the presample flush. After the flush was pumped to waste, a sample of deionized water was collected. The sample taken was of sufficient volume to allow analysis of all parameters. All analytes came back from the laboratory below the minimum detection limits.

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 **Section 30**, Quality Assurance Assessment Report for details.

Field measurements were recorded on a Field Measurement Form in the 2014 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 Storm Water 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.

A Chain of Custody form accompanied each set of sample bottles delivered to the lab. Each sampler tray or container was iced and labeled indicating the date and time of collection, the site location, and the field personnel initials. The ultimate collection date and time assigned to the sample was the time when the last sample of the composite was collected. The time that each composite sample was collected was recorded from the ISCO sampler onto field sheets. A complete description of methods can be found in the Storm Water Monitoring Program Manual (MPRB, 2001). All statistics were calculated using Microsoft Excel.

Computer Models used (P-8 and Flux)

The computer model P8 (v3.4) was calibrated and verified for each site. P8 was used to estimate daily cfs snowmelt runoff from January through May. Daily temperature and hourly precipitation files used as P8 inputs were obtained from the National Oceanic and Atmospheric Administration (NOAA) National Data Center (NDC). Data from a heated rain gauge (for snowmelt water equivalent) was used and is located at the Minneapolis/St. Paul International Airport.

A description of P8 as described in the software's introduction:

> P8 is a model for predicting the generation and transport of stormwater runoff pollutants in small urban catchments. Simulations are driven by hourly rainfall and daily air-temperature time series.

The P8 estimated daily average cfs snowmelt data, with the ISCO Flowlink measured daily average cfs runoff data, the grab and composite water chemistry data were put into FLUX32 (v3.10) and used to calculate flow-weighted mean concentrations.

In Flux32, all the data were run unstratified, and also if possible stratified by flow and month. A minimum of three data points are required to cut the data in any stratification. FLUX32 methods 2 and 6 were recorded for each parameter run. The mean concentration value with the lowest coefficient of variation was chosen and used for load calculations.

A description of FLUX32 as described in the help menu (US Army Corps, 2009):

> Flux32 is interactive software designed for use in estimating the transport (load) of nutrients or other water quality constituents past a tributary sampling station over a given period of time. The basic approach of Flux32 is to use several calculation techniques to map the flow/concentration relationship developed (modeled) from the sample record onto the entire flow record. This provides an estimate of total mass transport for the whole period of study with

associated error statistics. Note that this approach does NOT focus on estimating changes in loads over time (i.e. time series).

An important option within Flux32 is the ability to stratify the data into groups based upon flow, date, and/or season. This is a key feature of the FLUX approach and one of its greatest strengths. In many (most) cases, stratifying the data increases the accuracy and precision of loading estimates.

RESULTS & DISCUSSION

Seasonal statistics (snowmelt, spring, summer, and fall) of the data for the combination of all sites were calculated and are listed in **Table 24-6**. Seasonal patterns are evident.

Snowmelt had the highest geometric mean concentrations for most of the parameters: TP, TDP, TKN, NH_3, Cl, hardness, TDS, cBOD, sulfate, pH, Cu, and Zn. Snowmelt had the lowest geometric mean concentration for .*E coli,* which is temperature dependent.

Spring stormwater had the highest geometric mean concentrations for Ortho-P, TSS, VSS, and Pb. Spring had the lowest geometric mean concentration for sulfate.

Summer had the highest geometric mean concentrations of NO_3NO_2, and *E. coli*. Summer had the lowest geometric mean concentrations for NH_3, hardness, VSS, TDS, cBOD, pH, and Zn.

Fall had none of the highest geometric mean concentrations. Fall had lowest geometric mean concentration for the majority of parameters: TP, TDP, Ortho-P, TKN, NO_3NO_2, Cl, TSS, CU, and Pb.

Table 24-6. 2014 statistical summary of concentrations by season from all sites (6 –9).

2014 Season	Statistical Function	TP mg/L	TDP mg/L	Ortho-P mg/L	TKN mg/L	NH_3 mg/L	NO_3NO_2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	cBOD mg/L	Sulfate mg/L	pH std units	*E. coli* MPN/100mL	Cu ug/L	Pb ug/L	Zn ug/L
SNOWMELT (February-March)	**MEAN (geometric)**	0.575	0.183	0.127	3.39	1.53	0.512	507	65	109	36	592	17	17	7.5	63	33	12	119
	MEAN (arithmetic)	0.675	0.238	0.136	3.83	1.75	0.653	1402	91	180	51	2244	20	23	7.6	90	36	15	145
	MAX	1.25	0.515	0.185	6.80	3.20	1.54	5895	308	610	161	9699	57	63	10.8	166	78	30	270
	MIN	0.158	0.043	0.087	0.90	0.536	0.146	10	24	24	10	45	8	5	6.6	10	22	3	27
	MEDIAN	0.596	0.228	0.136	4.08	1.71	0.608	382	56	115	37	558	14	14	7.0	102	32	13	140
	STDEV	0.352	0.160	0.069	1.65	0.825	0.429	1978	85	187	44	3340	15	20	1.32	62	18	8	77
	NUMBER	12	12	2	12	11	12	12	12	12	12	12	10	10	12	8	9	10	9
	COV	0.521	0.67	0.510	0.431	0.472	0.656	1.41	0.937	1.04	0.867	1.49	0.726	0.882	0.175	0.685	0.492	0.557	0.531
SPRING (April-May)	**MEAN (geometric)**	0.200	0.104	0.142	3.19	1.20	1.57	9	38	172	50	54	8	5	7.1	786	32	14	71
	MEAN (arithmetic)	0.266	0.120	0.185	3.59	1.25	1.80	35	43	239	65	63	8	6	7.2	1736	37	21	95
	MAX	1.10	0.274	0.686	8.16	2.14	4.68	438	96	913	170	147	13	15	9.2	4352	95	87	280
	MIN	0.064	0.037	0.061	1.34	0.858	0.578	2	16	51	17	23	3	3	6.3	160	20	3	20
	MEDIAN	0.150	0.105	0.142	2.90	1.11	1.35	8	40	169	47	52	8	5	6.9	697	28	15	69
	STDEV	0.244	0.070	0.168	1.93	0.368	1.05	101	21	213	48	35	3	4	0.9	2281	23	21	76
	NUMBER	19	15	14	17	13	18	18	18	19	19	15	14	8	17	3	10	18	18
	COV	0.919	0.579	0.909	0.538	0.295	0.581	2.90	0.493	0.889	0.749	0.565	0.316	0.670	0.123	1.31	0.629	1.01	0.800
SUMMER (June-August)	**MEAN (geometric)**	0.237	0.070	0.101	1.73	0.775	0.629	7	28	53	20	47	6	7	6.8	8418	24	13	61
	MEAN (arithmetic)	0.276	0.108	0.126	2.12	0.886	0.838	16	33	74	26	64	7	7	6.8	12975	24	26	75
	MAX	0.678	0.490	0.438	6.47	2.25	3.07	70	136	230	91	188	15	15	8.4	19863	30	150	280
	MIN	0.071	0.017	0.038	0.710	0.295	0.167	1	12	3	2	15	3	3	5.0	1733	21	3	22
	MEDIAN	0.239	0.054	0.109	1.58	0.641	0.589	5	24	68	21	44	5	6	6.7	17329	24	9	58
	STDEV	0.153	0.111	0.093	1.51	0.514	0.717	23	23	55	20	56	5	4	0.7	9818	3	34	57
	NUMBER	37	27	25	35	16	37	20	36	37	37	27	22	12	26	3	6	26	25
	COV	0.553	1.03	0.739	0.712	0.580	0.856	1.37	0.717	0.746	0.770	0.869	0.637	0.505	0.102	0.757	0.134	1.32	0.761
FALL (Sept-Nov)	**MEAN (geometric)**	0.186	0.043	0.061	1.24	0.989	0.446	5	33	51	22	59	8	9	6.9	3270	23	5	82
	MEAN (arithmetic)	0.195	0.051	0.068	1.47	1.09	0.503	10	36	70	26	83	9	10	6.9	3347	23	6	86
	MAX	0.271	0.113	0.132	3.51	1.76	1.03	42	70	219	50	233	12	13	7.6	4352	27	10	140
	MIN	0.098	0.022	0.037	0.531	0.638	0.170	1	18	14	8	23	5	6	6.3	2613	20	3	53
	MEDIAN	0.211	0.033	0.063	1.18	0.862	0.452	3	28	43	20	44	9	10	6.8	3076	23	5	77
	STDEV	0.058	0.037	0.038	0.974	0.594	0.259	14	17	64	14	86	3	5	0.4	901	3	3	28
	NUMBER	10	5	5	10	3	9	9	10	9	9	5	4	2	10	3	5	7	9
	COV	0.299	0.73	0.560	0.663	0.546	0.515	1.32	0.476	0.918	0.550	1.04	0.320	0.500	0.054	0.269	0.111	0.468	0.329

-highest concentration (blue)

-lowest concentration (orange)

STDEV= standard deviation, COV= coefficient of variation, "Blue" highlighted cells have the highest seasonal geometric mean, "Orange" has the lowest seasonal geometric mean.

Table 24-7 shows the 2014 sampled storm event raw data concentrations. These data generally show peaks during snowmelt and early spring for many parameters, but at some sites there are additional peaks that occurred in late fall. Stormwater concentrations can be extremely variable because the concentrations can be due to precipitation, the intensity of precipitation, BMP activity and maintenance, etc.

Table 24-7. 2014 NDPES sampled event data by site.

Date Sampled	Time	Site Location	Sample Type	TP mg/L	TDP mg/L	OPO4 mg/L	TKN mg/L	NH3 mg/L	NO3NO2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	cBOD mg/L	Sulfate mg/L	Sp.Cond. uhmos	pH std units	E. Coli MPN	Cu ug/L	Pb ug/L	Zn ug/L
3/10/2014	14:45	Site 6, 22nd & Aldrich	Grab	1.20	0.475		6.80	3.20	0.517	1719	108	143	51	2829	24	21	5310	6.8	166	32	19	210
3/14/2014	15:05	Site 6, 22nd & Aldrich	Grab	1.246	0.515		5.15	2.31	0.321	382	56	120	30	755	8	12	1461	7.1		22	24	140
3/26/2014	14:15	Site 6, 22nd & Aldrich	Grab	0.619	0.225		4.02	1.82	0.224	238	36	80	24	317	11	5	614	7.0	21	25	30	140
5/8/2014	9:09	Site 6, 22nd & Aldrich	Composite	0.346			7.68		2.636	8	52	360	122				130	6.3		42	16	26
5/8/2014	20:20	Site 6, 22nd & Aldrich	Composite	0.229	0.105	0.154	4.91	2.14	2.35	2	16	326	102	48	6	<5.0	7101	7.0		21	87	130
5/12/2014	2:20	Site 6, 22nd & Aldrich	Composite	0.150	0.111	0.083		0.924	0.990	2	16	77	27	26	10	<5.0	52	6.5		<5.00	29	51
5/12/2014	22:17	Site 6, 22nd & Aldrich	Composite	0.393	0.149	0.088	3.19	1.57	1.45	9	48	76	29	80	7	8	143	7.0		21	27	58
5/19/2014	10:25	Site 6, 22nd & Aldrich	Grab																4352			
5/19/2014	13:05	Site 6, 22nd & Aldrich	Composite	0.147	0.128	0.090	3.28	1.50	1.15	3	32	169	53	23	11	3	45	6.4		20	57	98
6/1/2014	2:39	Site 6, 22nd & Aldrich	Composite	0.197			2.51		0.251	3	32	74	28				63			<5.00	20	<20.0
6/12/2014	0:44	Site 6, 22nd & Aldrich	Composite	0.678			5.78		1.95	<2.0	36	104	44				97			<5.00	150	280
6/13/2014	20:43	Site 6, 22nd & Aldrich	Composite	0.152			2.38		0.324	<2.0	20	83	33				49			<5.00	46	81
6/16/2014	21:19	Site 6, 22nd & Aldrich	Composite	0.191	0.08	0.074	1.39	<0.500	0.653	<2.0	16	12	7	20	4	<5.0	43	6.5		<5.00	15	29
6/18/2014	3:34	Site 6, 22nd & Aldrich	Composite	0.198	0.046	0.083	1.97	0.576	0.469	<2.0	20	77	28	19	3	<5.0	39	6.8		<5.00	50	58
6/19/2014	14:10	Site 6, 22nd & Aldrich	Composite	0.136	0.041	0.068	1.03	0.530	0.367	<2.0	24	39	13	24	3	<5.0	29	6.5		<5.00	11	22
6/19/2014	20:49	Site 6, 22nd & Aldrich	Composite	0.307	0.041	0.055	0.891	<0.500	0.421	1	28	20	8	31	3	3	41	6.4	19863	<5.00	7	<20.0
7/7/2014	18:22	Site 6, 22nd & Aldrich	Composite	0.347	0.097	0.115	6.47	1.40	0.799	<2.0	22	230	91	44	<1.00	<5.0	61	6.3		30	90	160
7/11/2014	9:09	Site 6, 22nd & Aldrich	Composite	0.184	0.048	0.121	1.06	0.576	0.248	<2.0	12	82	26	20	6	<5.0	26	6.5		<5.00	47	58
7/25/2014	6:17	Site 6, 22nd & Aldrich	Composite	0.496	0.200	0.238	2.50	0.652	1.32	<2.0	24	82	35	49	15	<5.0	67	6.9		21	31	74
8/18/2014	15:45	Site 6, 22nd & Aldrich	Composite	0.498	0.280	0.151	4.28	1.12	1.44	<2.0	26	174	72	44	7	<5.0	78	7.5		23	30	70
8/29/2014	10:11	Site 6, 22nd & Aldrich	Composite	0.277	0.122	0.116	2.89	0.768	1.02	1	24	105	41	16	13	<5.0	58	6.7		<5.00	58	90
9/3/2014	10:20	Site 6, 22nd & Aldrich	Grab																3076			
2/19/2014	14:15	Site 7, 14th & Park	Grab	0.720	0.097		4.64	2.55	0.690	5020	192	161	66	8409	35	54	15950	7.3	109	46	13	27
3/10/2014	14:30	Site 7, 14th & Park	Grab	0.429	0.342		3.56	1.71	0.526	1003	76	110	44	1710	14	16	3230	7.0	94	22	7	160
3/26/2014	13:55	Site 7, 14th & Park	Grab	0.547	0.181		1.81	0.536	0.146	286	28	76	27	361	13	13	702	6.7	32	24	8	130
5/8/2014	8:36	Site 7, 14th & Park	Composite	0.146			5.22		2.10	17	40	328	97				167	6.5		47	35	280
5/8/2014	20:20	Site 7, 14th & Park	Composite	0.064	0.037	0.193	2.90	1.32	1.89	3	36	229	64	52	6	<5.0	76	7.7		<5.00	14	87
5/12/2014	1:06	Site 7, 14th & Park	Composite	0.105	0.075	0.067	2.26	0.858	1.30	4	16	117	34	30	6	<5.0	66	6.8		<5.00	11	79
5/19/2014	10:40	Site 7, 14th & Park	Grab																697			
5/19/2014	13:12	Site 7, 14th & Park	Composite	0.073	0.066	0.061	2.05	1.00	1.18	3	24	109	29	31	11	4	52	6.8		<5.00	15	86
5/30/2014	7:45	Site 7, 14th & Park	Composite	1.10			3.76		0.578	26	72	441	112							95	8	<20.0
6/1/2014	2:45	Site 7, 14th & Park	Composite	0.131			2.34		0.666	4	36	90	26				78			<5.00	41	<20.0
6/12/2014	1:01	Site 7, 14th & Park	Composite	0.301	0.044	0.104	5.12	1.49	1.97	5	36	162	66	67	14	11	97	6.3		<5.00	5	51
6/14/2014	22:04	Site 7, 14th & Park	Composite	0.141			0.910		0.435	<2.0	16	42	16				44			<5.00	10	55
6/16/2014	21:02	Site 7, 14th & Park	Composite	0.090	0.025	0.038	<0.500	<0.500	0.362	4	20	10	6	29	4	12	48	6.3		<5.00	3	32
6/18/2014	4:10	Site 7, 14th & Park	Composite	0.123	0.017	0.047	1.04	<0.500	0.407	3	16	31	9	15	3	<5.0	42	7.1		<5.00	5	32
6/19/2014	5:13	Site 7, 14th & Park	Composite	0.087	0.019	0.046	0.888	<0.500	0.222	5	20	21	6	28	4	<5.0	28	6.1		<5.00	<3.00	<20.0
6/19/2014	20:30	Site 7, 14th & Park	Composite	0.071	0.019	0.041	0.732	<0.500	0.513	6	36	17	8	48	3	4	62	6.6	1733	<5.00	<3.00	22
7/7/2014	18:55	Site 7, 14th & Park	Composite	0.125	0.050	0.038	1.07	<0.500	0.167	<2.0	12	38	13	20	<1.00	<5.0	36	6.4		<5.00	4	33
7/25/2014	6:41	Site 7, 14th & Park	Composite	0.214	0.074	0.151	1.89	0.295	1.14	3	18	43	21	43	13	<5.0	58	7.7		<5.00	6	77
9/3/2014	11:10	Site 7, 14th & Park	Composite	0.147	0.059	0.042	1.55	<0.500	1.03	2	24	34	16	44		<5.0	64	7.3	2613	<5.00	3	53
9/9/2014	23:27	Site 7, 14th & Park	Composite	0.124	0.029	0.037	1.14	0.638	0.717	1	18	43	19	23	5	<5.0	47	6.9		<5.00	4	63
9/20/2014	18:34	Site 7, 14th & Park	Composite	0.219			0.531		0.286	1	28	58	26				58	7.6		<5.00	10	94
9/24/2014	13:01	Site 7, 14th & Park	Composite	0.173			0.694		0.318	2	28	37	20				74	7.0		23	6	86
9/29/2014	10:48	Site 7, 14th & Park	Composite	0.213			0.903		0.505	3	28	24	14				70	6.8		<5.00	<3.00	69
10/1/2014	7:37	Site 7, 14th & Park	Composite	0.231			1.57			8	40						118	6.5		20	<3.00	70

Table 24-7. 2014 NDPES sampled event data by site. (Continued)

Date Sampled	Time	Site Location	Sample Type	TP mg/L	TDP mg/L	OPO4 mg/L	TKN mg/L	NH3 mg/L	NO3NO2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	cBOD mg/L	Sulfate mg/L	Sp.Cond. uhmos	pH std units	E. Coli MPN	Cu ug/L	Pb ug/L	Zn ug/L
3/21/2014	14:00	Site 8, Pershing	Grab	0.555	0.234		3.70	1.57	0.150	10	44	24	14	79	14	9	129	6.8	147	<5.00	3	<20.0
3/27/2014	13:55	Site 8, Pershing	Grab	0.573	0.375		4.14	2.39	0.789	382	28	24	12	67	11	7	106	6.8	144	<5.00	<3.00	<20.0
4/27/2014	13:48	Site 8, Pershing	Grab	0.158	0.073	0.087	0.895	<0.500	0.986	227	24	29	10	45	<1.00	<5.0	63	6.6		<5.00	<3.00	<20.0
5/8/2014	1:04	Site 8, Pershing	Composite	0.122	0.095							400	157	86		5		6.9		27	14	180
5/8/2014	17:10	Site 8, Pershing	Composite	0.322	0.129	0.225	2.64	0.902	1.40	438	40	177	47	58	10	<5.0	98	7.0		<5.00	10	46
5/12/2014	2:07	Site 8, Pershing	Composite	0.301	0.252	0.225	2.33	1.11	1.03	3	44	51	23	64	7	<5.0	106	6.5		<5.00	<3.00	35
5/19/2014	13:27	Site 8, Pershing	Composite	0.187	0.183	0.148	1.86	0.935	1.00	3	32	57	20	37	13	3	57	6.5		<5.00	3	23
6/1/2014	2:57	Site 8, Pershing	Composite	0.267			1.58		0.566	3	36	68	21				59			<5.00	<3.00	<20.0
6/14/2014	23:19	Site 8, Pershing	Composite	0.473			0.973		0.437	<2.0	20	16	7				51			<5.00	<3.00	<20.0
6/18/2014	9:02	Site 8, Pershing	Composite	0.589	0.490	0.438	2.75	1.42	0.669	<2.0	48	17	9	100	10	5	121	7.3		<5.00	<3.00	<20.0
6/19/2014	4:26	Site 8, Pershing	Composite	0.330	0.175	0.164	1.50	0.518	0.265	<2.0	24	45	18	32	4	<5.0	42	6.6		<5.00	<3.00	<20.0
6/19/2014	20:09	Site 8, Pershing	Composite	0.237	0.187		0.955	<0.500	0.645		136	3	2	188		10	268	6.7		<5.00	<3.00	<20.0
7/7/2014	18:52	Site 8, Pershing	Composite	0.413					0.571	7	24	127	50				90					
7/11/2014	9:41	Site 8, Pershing	Composite	0.335	0.241	0.274	1.13	0.565	0.365	<2.0	32	39	14	29	5	<5.0	42	6.6		<5.00	4	<20.0
7/25/2014	6:24	Site 8, Pershing	Composite	0.516	0.284		2.53		1.84			28	17	83		6	105					
9/9/2014	21:41	Site 8, Pershing	Composite	0.271	0.022	0.065	3.51	0.862	0.419	10	40	86	43	80	8	6	110	6.3		23	3	77
10/2/2014	22:53	Site 8, Pershing	Composite	0.209	0.113	0.132	0.736	<0.500	0.452	<2.0	24	14	8	37	10	<5.0	58	6.7		<5.00	<3.00	<20.0
2/19/2014	13:30	Site 9, 61st & Lyndale	Grab	1.05	0.066		4.31	1.39	1.14	5895	308	610	161	9699	57	63	18710	10.8	<10	78	17	39
3/10/2014	13:55	Site 9, 61st & Lyndale	Grab	0.807	0.230		5.12	1.16	0.807	1480	136	461	96	2567	17	28	4890	9.4	10	42	11	270
4/27/2014	11:58	Site 9, 61st & Lyndale	Grab	0.198	0.043	0.185	1.83	0.582	1.54	180	56	316	75	89	<1.00	<5.0	209	8.6		37	13	190
5/9/2014	4:24	Site 9, 61st & Lyndale	Composite	0.137	0.092	0.686	4.16	1.41	3.13	17	52	913	170	109	3	6	190	9.2		46	21	250
5/12/2014	6:00	Site 9, 61st & Lyndale	Composite	0.132	0.048	0.063	1.34	<0.500	1.10	10	36	123	28	52	9	<5.0	120	8.2		<5.00	4	59
5/13/2014	4:43	Site 9, 61st & Lyndale	Grab	0.423	0.274	0.377	2.76	1.46	3.20	27	72	56	17	147	6	15	263	8.0		<5.00	4	53
5/19/2014	11:05	Site 9, 61st & Lyndale	Composite																160			
5/19/2014	12:40	Site 9, 61st & Lyndale	Composite	0.105	0.063	0.135	2.53	1.07	1.28	12	52	433	72	99	8	5	114	8.8		29	15	140
5/31/2014	23:54	Site 9, 61st & Lyndale	Composite	0.569			8.16		4.68	41	96	107	21				295			20	6	20
6/12/2014	0:32	Site 9, 61st & Lyndale	Composite	0.471	0.054	0.145	4.90	2.25	3.07	29	84	62	50	184	15	5	249	5.0		<5.00	4	71
6/15/2014	20:58	Site 9, 61st & Lyndale	Composite	0.148			0.823		0.589	11	24	98	19				100			<5.00	4	56
6/18/2014	5:59	Site 9, 61st & Lyndale	Composite	0.201	0.024	0.104	1.53	0.611	0.695	9	32	114	25	56	5	<5.0	96	7.7		<5.00	7	90
6/19/2014	23:36	Site 9, 61st & Lyndale	Composite	0.131	0.020	0.051	0.710	<0.500	0.225	9	20	47	11	76	3	4	82	6.7	17329	<5.00	<3.00	24
6/28/2014	19:20	Site 9, 61st & Lyndale	Composite	0.239			0.944		0.681	59	48	139	30				530			22	7	83
7/7/2014	19:14	Site 9, 61st & Lyndale	Composite	0.277	0.103	0.109	1.59		0.638	70	32	71	20	124		6	236	6.8		<5.00	3	50
7/25/2014	7:10	Site 9, 61st & Lyndale	Composite	0.298	0.048	0.254	2.34	0.630	1.80	67	50	162	43	164	14	8	297	8.4		26	9	170
8/18/2014	9:13	Site 9, 61st & Lyndale	Composite	0.331	0.086	0.114	2.81	0.780	2.80	32	72	166	46	182	7	15	313	8.0		24	<3.00	110
9/3/2014	9:40	Site 9, 61st & Lyndale	Grab																4352			
9/10/2014	8:15	Site 9, 61st & Lyndale	Composite	0.267	0.033	0.063	2.84	1.76	0.17	42	62	116	35	233	12	13	287	7.2		22	5	120
10/1/2014	11:34	Site 9, 61st & Lyndale	Composite	0.098			1.23		0.638	23	70	219	50				187	6.8		27	9	140

Median Comparison

Table 24-8 shows a comparison of MPRB and Nationwide Urban Runoff Program (NURP) median residential, mixed use, and composite land use stormwater values. The MPRB data are split into 2014 and 2001-2013 data for comparison. In 2014, all three MPRB land use categories saw a significant decrease in the median value concentrations of all parameters when compared to the NURP data, with the exception of TKN. It is unknown why all MPRB TKN data are higher than the NURP TKN data. A possible explanation is there is more vegetative material in the Minneapolis watersheds decaying than in the NURP watersheds, studied from 1979 to 1983.

When the NURP study data were collected lead (Pb) was widely used in gasoline (from the 1920's to 1990's) and banned after 1996. The lead reduction in the environment is clearly seen in the MPRB data sets.

It is important to note that the MPRB sites monitored in 2001-2004 are located in different watersheds and have similar but not identical land uses to those monitored in 2005-2014.

Table 24-8. Typical Median stormwater sampled concentrations.

Land Use	Residential			Mixed			Composite of all categories		
Location	MPRB[1]	MPRB[2]	NURP	MPRB[3]	MPRB[4]	NURP	MPRB[5]	MPRB[6]	NURP
Year(s)	2014	2001–2013		2014	2001–2013		2014	2001–2013	
TP (mg/L)	0.292	0.436	0.383	0.146	0.251	0.263	0.234	0.364	0.33
TKN (mg/L)	3.19	2.39	1.9	1.57	1.59	1.29	2.33	2.04	1.5
NO_3NO_2 (mg/L)	0.726	0.338	0.736	0.552	0.416	0.558	0.675	0.406	0.68
cBOD (mg/L)	7	12	10	6	8	8	8	10	9
TSS (mg/L)	83	85	101	51	62	67	82	84	100
Cu (µg/L)	11	18	33	3	19	27	3	18	30
Pb (µg/L)	30	31	144	6	13	114	8	14	140
Zn (µg/L)	72	79	135	63	85	154	58	84	160

[1] Site 6 data.
[2] Sites 1 and 2 data, (Site 6, 2005-2013).
[3] Site 7 data.
[4] Sites 5 and 5a data, (Site 7, 2005-2013).
[5] Sites 6 – 9 data.
[6] Sites 1 – 5a data, (Site 6 – 9, 2005-2013).
NURP = median event mean concentrations as reported by the Nationwide Urban Runoff Program (USEPA, 1996).
MPRB = median values calculated by the MPRB for the identified year(s).

Geometric Mean Comparison

Table 24-9 lists the statistical calculations for all measured parameters for each site. Most of the geometric mean maximums occurred at Site 9 (61st and Lyndale) the industrial site. The lowest geometric mean values generally occur at Site 8 (Pershing) and Site 7 (14th & Park). This is as expected since Site 8 (Pershing) is parkland and Site 7 (14th & Park) is a mixed use watershed with little vegetation.

Table 24-9. 2014 event concentration statistics.

Site ID	Statistical Function	TP mg/L	TDP mg/L	Ortho-P mg/L	TKN mg/L	NH_3 mg/L	NO_3NO_2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	cBOD mg/L	Sulfate mg/L	pH std units	E. coli MPN/100mL	Cu ug/L	Pb ug/L	Zn ug/L
6, 22nd Aldrich	MEAN (geometric)	0.314	0.122	0.102	2.98	0.711	0.962	4	28	93	34	57	6	4	6.7	985	8	32	64
6, 22nd Aldrich	MEAN (arithmetic)	0.400	0.166	0.110	3.59	0.945	1.22	119	32	122	43	272	8	5	6.7	5496	14	42	90
6, 22nd Aldrich	MAX	1.25	0.52	0.238	7.68	2.64	3.20	1719	108	360	122	2829	24	21	7.5	19863	42	150	280
6, 22nd Aldrich	MIN	0.136	0.041	0.055	0.89	0.224	0.250	1	12	12	7	16	1	3	6.3	21	3	7	10
6, 22nd Aldrich	MEDIAN	0.292	0.117	0.090	3.19	0.726	1.02	1	25	83	32	38	7	3	6.7	3076	11	30	72
6, 22nd Aldrich	STDEV	0.323	0.15	0.049	2.07	0.722	0.830	389	22	92	31	708	6	5	0.3	8246	13	34	70
6, 22nd Aldrich	NUMBER	20	16	13	19	20	16	20	20	20	20	16	16	16	17	5	20	20	20
6, 22nd Aldrich	COV	0.809	0.874	0.442	0.577	0.765	0.678	3.27	0.666	0.754	0.721	2.61	0.710	1.07	0.051	1.50	0.911	0.811	0.778
7, 14th Park	MEAN (geometric)	0.176	0.051	0.061	1.56	0.596	0.563	7	29	64	24	73	6	5	6.8	318	6	6	51
7, 14th Park	MEAN (arithmetic)	0.242	0.076	0.072	2.04	0.779	0.793	279	37	101	34	727	9	9	6.9	880	14	9	70
7, 14th Park	MAX	1.10	0.342	0.193	5.22	2.10	2.55	5020	192	441	112	8409	35	54	7.7	2613	95	41	280
7, 14th Park	MIN	0.064	0.017	0.037	0.250	0.146	0.250	1	12	10	6	15	1	3	6.1	32	3	2	10
7, 14th Park	MEDIAN	0.146	0.050	0.047	1.57	0.552	0.536	4	28	51	23	43	6	3	6.8	403	3	6	63
7, 14th Park	STDEV	0.247	0.085	0.051	1.49	0.588	0.700	1055	37	109	29	2169	9	13	0.5	1067	22	10	59
7, 14th Park	NUMBER	23	15	12	23	22	15	23	23	22	22	15	14	15	20	6	23	23	23
7, 14th Park	COV	1.02	1.12	0.709	0.731	0.755	0.882	3.79	1.00	1.08	0.877	2.98	0.915	1.503	0.068	1.21	1.63	1.07	0.844
8, Pershing	MEAN (geometric)	0.313	0.164	0.169	1.80	0.608	0.721	7	35	40	17	62	7	4	6.7	145	3	2	18
8, Pershing	MEAN (arithmetic)	0.345	0.204	0.195	2.08	0.724	0.919	78	40	71	28	70	9	5	6.7	146	6	3	31
8, Pershing	MAX	0.589	0.490	0.438	4.14	1.84	2.39	438	136	400	157	188	14	10	7.3	147	27	14	180
8, Pershing	MIN	0.122	0.022	0.065	0.736	0.150	0.250	1	20	3	2	29	1	3	6.3	144	3	2	10
8, Pershing	MEDIAN	0.322	0.185	0.164	1.86	0.608	0.882	3	32	39	17	65	10	4	6.7	146	3	2	10
8, Pershing	STDEV	0.150	0.124	0.113	1.11	0.442	0.640	153	28	96	36	41	4	3	0.3	2	8	4	46
8, Pershing	NUMBER	17	14	9	15	16	12	14	15	17	17	14	11	14	13	2	15	15	15
8, Pershing	COV	0.435	0.608	0.580	0.532	0.610	0.697	1.97	0.706	1.35	1.30	0.580	0.473	0.542	0.038	0.01	1.45	1.08	1.48
9, 61st Lyndale	MEAN (geometric)	0.257	0.064	0.141	2.23	1.11	0.866	46	58	162	40	196	7	8	7.9	227	12	6	85
9, 61st Lyndale	MEAN (arithmetic)	0.327	0.085	0.191	2.77	1.57	1.05	445	72	234	54	984	12	13	8.0	4371	22	8	108
9, 61st Lyndale	MAX	1.05	0.274	0.686	8.16	4.68	2.25	5895	308	913	170	9699	57	63	10.8	17329	78	21	270
9, 61st Lyndale	MIN	0.098	0.020	0.051	0.710	0.170	0.250	9	20	47	11	52	1	3	5.0	5	3	2	20
9, 61st Lyndale	MEDIAN	0.253	0.059	0.125	2.44	1.12	1.07	30	54	131	39	136	8	6	8.0	160	22	7	87
9, 61st Lyndale	STDEV	0.258	0.075	0.181	1.93	1.28	0.60	1402	65	232	47	2592	14	16	1.4	7479	20	6	74
9, 61st Lyndale	NUMBER	18	14	12	18	18	13	18	18	18	18	14	13	14	15	5	18	18	18
9, 61st Lyndale	COV	0.790	0.893	0.952	0.696	0.815	0.573	3.15	0.901	0.993	0.864	2.63	1.19	1.29	0.172	1.71	0.942	0.699	0.686
All	MEAN (geometric)	0.253	0.090	0.107	2.06	0.726	0.765	10	35	79	28	83	7	5	7.0	363	7	8	50
All	MEAN (arithmetic)	0.324	0.133	0.138	2.62	0.998	1.00	238	45	131	40	509	10	8	7.0	3050	14	16	76
All	MAX	1.25	0.515	0.686	8.16	4.68	3.20	5895	308	913	170	9699	57	63	10.8	19863	95	150	280
All	MIN	0.064	0.017	0.037	0.250	0.146	0.250	1	12	3	2	15	1	3	5.0	5	3	2	10
All	MEDIAN	0.234	0.092	0.107	2.33	0.675	0.860	5	32	82	27	56	8	3	6.8	163	3	8	58
All	STDEV	0.257	0.122	0.120	1.79	0.863	0.708	919	43	152	37	1703	9	11	0.9	5867	18	24	68
All	NUMBER	78	59	46	75	76	56	75	76	77	77	59	54	59	65	18	76	76	76
All	COV	0.793	0.918	0.869	0.684	0.866	0.707	3.86	0.968	1.16	0.924	3.35	0.937	1.43	0.125	1.92	1.28	1.46	0.887
(blue)	-Highest value																		
(orange)	-Lowest value																		

All = all 4 sites, STDEV = standard deviation, COV = coefficient of variation.

Site 6 (22nd & Aldrich), a residential watershed, had the highest geometric means for TP, TKN, NO_2NO_3, *E. coli* , and Pb. The cause of the higher TP, TKN, and NO_2NO_3 values may be the dense leaf canopy in the watershed adding to the organic load. Higher *E. coli* levels may be shed from urban wildlife or the pets owned by the higher population density at this site. The geometric mean concentration of Pb has been persistently high at this site, and is possibly a remnant of lead based paints shedding from the older houses and soils.

Site 7 (14th & Park) had none of highest geometric mean concentrations for any of the parameters. Site 7 also had the lowest geometric mean for all phosphorus, nitrogen, and chloride values. This is likely the result of the hard surface landscape in this mixed use watershed.

Site 8 (Pershing) had the highest geometric mean TDP and Ortho-P values likely due to decaying organic material in the parkland watershed or turf maintenance. Site 8 also had the lowest geometric mean TSS, VSS, *E. coli*, and all metals this is also likely due to the parks vegetated watershed.

Site 9 (61st and Lyndale) had the highest geometric mean for NH_3, Cl, hardness, TSS, VSS, TDS, cBOD, sulfate, Cu, and Zn. Site 9 had none of the lowest geometric mean values. This watershed is a light industrial site (cement factory, natural gas facility, etc.) and it is expected that many of the parameters would be higher than other watersheds due to industrial activities.

Mean Comparison

Mean data were comparable to typical urban stormwater data from the Nationwide Urban Runoff Program (NURP), Center for Watershed Protection (CWP), and Bannerman *et al.* (1993) (**Table 24-10)**.

Data from MPRB Sites 1–5a (2001–2004) and 6–9 (2005–2014) were generally similar to Sites 6–9 in 2014. All measured and compared parameters were roughly equal to or lower in 2014, with the exception of NO_3NO_2 and TSS. The 2014 mean increase in NO_3NO_2 and TSS are likely the result of organic material in the watersheds interacting with the wet spring and dry summer/fall.

Table 24-10. Typical Mean urban stormwater concentrations. " -- " = not reported.

Parameter	NURP[1]	CWP[2]	Bannerman *et al.*[3]	Mpls PW[4]	St. Paul[5]	MWMO 2014[6]	MPRB[7] 2001–2013	MPRB[8] 2014
TP (mg/L)	0.5	0.3	0.66	0.417	0.484	0.490	0.476	0.324
TDP (mg/L)	--	--	0.27	0.251	--	0.173	0.147	0.133
TKN (mg/L)	2.3	--	--	--	2.46	2.69	2.80	2.62
NO_3NO_2 (mg/L)	0.86	--	--	--	0.362	0.562	0.516	0.998
NH_3 (mg/L)	--	--	--	0.234	--	0.350	1.02	1.00
Cl (mg/L)	--	230 (winter)	--	--	--	334	284	238
BOD (mg/L)	12	--	--	14.9	25	14	16	10
TDS (mg/L)	--	--	--	73.3	78	656	556	509
TSS (mg/L)	239	80	262	77.6	129	202	123	131
Cu (µg/L)	50	10	16	26.7	30	25.0	26.0	14.1
Pb (µg/L)	240	18	32	75.5	233	26.0	25.3	16.5
Zn (µg/L)	350	140	204	148	194	154	124	76

[1] USEPA (1996)
[2] Center for Watershed Protection (2000)
[3] Monroe study area of Bannerman *et al.* (1993)
[4] City of Minneapolis Public Works Department (1992) – average from a combination of land uses
[5] City of St. Paul 1994 stormwater data – average from a combination of land uses
[6] Mississippi Watershed Management Organization 2014 data, average of snowmelt and storms from all sites
[7] MPRB arithmetic mean data calculated from NPDES Sites 1 – 5a (2001 – 2004), 6 – 9 (2005 – 2013)
[8] MPRB arithmetic mean data calculated from NPDES Sites 6 – 9 (2014)

Flow-weighted Mean Comparison

The flow-weighted mean concentrations presented in **Table 24-11** were calculated using FLUX32. Sample chemistry concentrations and associated daily average flows were used as input for these calculations. The data were run unstratified and often stratified by flow or season to achieve the most accurate and precise results. The method (2 or 6) and event mean concentration with the lowest coefficient of variation was chosen as the final concentration value.

Table 24-11. Flow–weighted mean concentrations and related statistics for NPDES parameters in 2014.

Site	TP (mg/L)	TDP (mg/L)	Ortho-P (mg/L)	TKN (mg/L)	NO_3NO_2 (mg/L)	NH_3 (mg/L)	Cl* (mg/L)	Hardness (mg/L)	TSS (mg/L)	VSS (mg/L)	TDS* (mg/L)	cBOD (mg/L)	Sulfate (mg/L)	Cu (µg/L)	Pb (µg/L)	Zn (µg/L)
6, 22nd Aldrich	0.378	0.161	0.108	3.11	0.786	1.30	165	35.2	118	40	393	9	7.8	14	42	94
7, 14th Park	0.274	0.073	0.066	1.93	0.716	0.866	242	33.1	85	30	422	9	6.5	13	11	58
8a, Pershing	0.315	0.186	0.176	1.65	0.724	0.931	139	30.0	51	18	50	9	3.2	3	3	18
9, 61st Lyndale	0.284	0.066	0.167	2.92	1.52	0.919	274	65.1	238	49	572	12	9.9	20	8	100
MEAN	**0.313**	**0.121**	**0.129**	**2.40**	**0.937**	**1.00**	**205**	**40.9**	**123**	**34**	**359**	**10**	**6.8**	**13**	**16**	**68**
MEDIAN	**0.300**	**0.117**	**0.138**	**2.43**	**0.755**	**0.925**	**204**	**34.2**	**102**	**35**	**408**	**9**	**7.1**	**14**	**10**	**76**
STANDEV	**0.047**	**0.061**	**0.052**	**0.721**	**0.390**	**0.199**	**63**	**16.3**	**81**	**13**	**221**	**2**	**2.8**	**7**	**18**	**38**
(blue)	-Highest value															
(orange)	-Lowest value															

* Flow–weighted mean concentrations for Cl and TDS were difficult to estimate using FLUX32 due to large outliers from the two snowmelt samples; these estimates should be used with caution. STANDEV= standard deviation.

Site 6 (22^{nd} & Aldrich) is a multi-family residential watershed. Site 6 had the highest modeled concentrations of TP, TKN, NH_3, and Pb. It is believed this may be due to its location between two heavily traveled thoroughfares (Hennepin and Lyndale) where a mature leaf canopy may collect airborne material and deposit it following precipitation. Site 6 had none of the lowest modeled parameters.

Site 7 (14^{th} & Park) is a densely developed mixed-use watershed. Site 7 did not have any of the highest modeled parameters. Site 7 had the lowest modeled TP, Ortho-P, NO_3NO_2, and cBOD.

Site 8a (Pershing) is a parkland watershed. Site 8a had the highest modeled event mean concentrations of TDP and Ortho-P. The reason is unknown, but it may be due to turf maintenance. Site 8a had the lowest modeled TKN, Cl, hardness, TSS, VSS, TDS, sulfate, Cu, Pb, and Zn.

Site 9 (61^{st} and Lyndale) is a commercial/industrial watershed. Site 9 had the highest modeled concentration of NO_3NO_2, Cl, hardness, TSS, VSS, TDS, cBOD, sulfate, Cu, and Zn. Site 9 had the lowest modeled NH_3. Industrial activities in this watershed likely explain the higher pollutant loads. Site 9 is located adjacent to a large cement aggregate mixing facility which may explain the higher TSS values. This site sometimes had a very small baseflow. In 2008, the baseflow was significantly diminished when the cement aggregate mixing facility improved its on-site runoff and ponding.

Table 24-12 includes flow-weighted mean pollutant concentrations of data collected in the 1980s and reported by the U.S. Geological Survey (USGS) for various sites within the Twin Cities (as cited in MPCA, 2000). The Yates watershed was a stabilized residential area, the Iverson site was a residential watershed under development, and the Sandberg watershed was predominantly a light industrial land-use area, as reported by the USGS. Site 6 (22nd & Aldrich) is more closely related to the Yates residential watershed land-use characteristics. Site 7 (14th & Park) and Site 9 (61st and Lyndale) are more comparable to the Sandberg light industrial watershed land-use characteristics.

When comparing the USGS flow-weighted mean concentrations to the MPRB sites in **Table 24-12** Site 6 had lower or similar concentrations with Yates for all parameters. The Iverson data are shown for comparison purposes of a developing residential neighborhood only.

Compared to Sandberg, Sites 7 and 9 have lower flow-weighted mean concentrations for almost all parameters and are well within the ranges shown in **Table 24-12**. Site 7 had significantly lower values than Sandberg for all parameters. Site 9 had roughly half of the Sandberg values with the notable exception of TKN. The Site 9 TKN was slightly higher than Sandberg's TKN but was comparable.

The overall mean comparison of **Table 24-12** to MPRB water quality values at sites 6, 7, 8a, and 9 shows Minneapolis sites were the same or roughly half of the values for the compared parameters. The Minneapolis mean lead values are much lower than the Yates and Sandburg studies.

Table 24-12. Flow-weighted mean stormwater pollutant concentrations (mg/L) and ranges as reported by the USGS (as cited in MPCA, 2000).

Pollutant	Monitoring Site					
	Yates area (stabilized residential)	**Site 6 (22nd Aldrich)**	**Iverson area (developing residential)**	**Sandburg area (light industrial)**	**Site 7 (14th Park)**	**Site 9 (61st Lyndale)**
TSS (Mean Range)	133 (2 – 758)	118 (12 – 360)	740 (17- 26,610)	337 (7 – 4,388)	85 (10 – 441)	238 (47 – 913)
Pb (Mean Range)	0.23 (0.015 –1.8)	0.042 (0.007 -0.150)	0.02 (0.008-0.31)	0.19 (0.003 –1.5)	0.011 (0.002 – 0.041)	0.008 (0.002 – 0.021)
Zn (Mean Range)	0.198 (0.02 – 2.2)	0.094 (0.010 -0.280)	0.235 (0.028-0.53)	0.185 (0.02 –0.81)	0.058 (0.010 – 0.280)	0.100 (0.020 – 0.270)
TKN (Mean Range)	3.6 (0.6 – 28.6)	3.11 (0.89 – 7.68)	1.2 (1.0 – 29.2)	2.5 (0.4 – 16.0)	1.93 (0.250 – 5.22)	2.92 (0.710 – 8.16)
TP (Mean Range)	0.63 (0.10 –3.85)	0.378 (0.136 – 1.25)	0.62 (0.2 – 13.1)	0.63 (0.07 – 4.3)	0.274 (0.064 – 1.10)	0.284 (0.098 – 1.05)

Table 24-13 shows the flow-weighted mean concentrations in 2014 compared to previous years. Flow-weighted mean concentrations for Cl and TDS were difficult to estimate using FLUX32 due to large outliers from the snowmelt samples. These estimates should be used with caution. When samples were below the RL (reporting limit), half of the RL was used for calculations.

Table 24-13. MPRB Flow–weighted mean concentration compared to previous years. Each year is the average flow–weighted mean concentration of all sites monitored that year.

	Flow-weighted mean concentrations													
	Sites 1-5a				**Site 6-9**									
Parameter	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
TP (mg/L)	0.470	0.337	0.474	0.332	0.354	0.548	0.472	0.486	0.583	0.341	0.355	0.368	0.369	0.313
TDP (mg/L)	0.112	0.095	0.114	0.121	0.123	0.135	0.108	0.139	0.249	0.063	0.126	0.123	0.157	0.121
Ortho-P (mg/L)	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.179	0.097	0.194	0.129
TKN (mg/L)	2.21	1.60	2.10	1.94	3.48	3.54	4.43	3.22	3.61	1.53	1.74	2.00	2.34	2.40
NO_3NO_2 (mg/L)	0.398	0.423	0.496	0.382	0.448	0.638	0.496	0.582	0.755	0.414	0.498	0.397	0.402	0.937
NH_3(mg/L)	0.494	0.722	0.346	0.918	1.74	1.64	0.970	0.966	1.64	0.666	0.922	0.719	0.747	1.00
Cl (mg/L)	37	11	587	40	18	91	412	139	803	60	213	14	72	205
Hardness (mg/L)	nc	na	nc	nc	na	nc	nc	nc	nc	na	48.0	37	41	41
TSS (mg/L)	116	83	116	70	108	156	180	148	121	107	104	101	95	123
VSS (mg/L)	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	30.2	31	29	34
TDS (mg/L)	306	85	725	130	252	183	737	507	3323	124	693	97	301	359
cBOD (mg/L)	12	8	16	20	9	9	17	25	53	7	11	13	13	10
Sulfate (mg/L)	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	15.4	18.4	8.1	6.8
Cd (µg/L)	0.532	0.518	2.11	2.80	2.50	nc	nc	nc	nc	nc	nc	nc	nc	nc
Cu (µg/L)	15	31	23	15	19	29	36	16	40	23	25	16	19	13
Pb (µg/L)	23	17	22	14	41	31	34	28	23	24	18	15	22	16
Zn (µg/L)	180	76	107	76	86	94	133	132	204	100	103	90	79	68

nc = data not collected.

na= data not analyzed for.

Note: Cadmium (Cd) was discontinued from monitoring in 2006 because Cd concentrations had typically been below detection for the Minneapolis/St. Paul area and it was not useful information. It should also be noted the detection limit for Cd has changed over time. In 2002 it was <0.500 µg/L; in 2003 it was <2.00 µg/L and in 2004 it was <5.00 µg/L. In 2011, ortho-P (or TDP), hardness (for metals toxicity calculations), and sulfate were added.

Chemical concentrations in stormwater are highly variable. Climatological factors such as precipitation amount and intensity, street sweeping type and frequency, BMP maintenance schedule frequency, etc. can cause fluctuations in chemical concentrations. **Table 24-13** illustrates the variability of stormwater from year to year.

The variability from year to year is due to three likely causes. First, the watersheds monitored have occasionally changed. Second, the timing between street sweeping frequency, BMP maintenance frequency, and sampling probably affect variability within the monitoring year and between years. Third, precipitation frequency, intensity, and duration affect results.

Surcharge Events

Surcharge events happen during high precipitation totals or high intensity storm events that exceed the drainage capacity of the pipes. Surcharges occur when water backs up in pipes and creates a hydrostatic pressure head, beyond the diameter of the pipe, which can result in inaccurate daily flow calculations and must be considered when evaluating flow-weighted mean concentrations. If surcharge water inundates the auto-sampler tray the samples are considered contaminated and dumped.

Table 24-14 show the 2014 NPDES surcharge dates. With the exception of Site 8a, most of the surcharging events were storms greater than 1 inch.

Table 24-14. Surcharge events in 2014 at associated NPDES sites.

Site	Surcharge Dates
Site 6 (22nd and Aldrich)	6/7, 6/15, 6/19, 6/28, 7/11, 7/25, 9/20.
Site 7 (Park and 14th)	7/11.
Site 8a (Pershing)	4/27, 5/8, 5/19, 6/1, 6/7, 6/14, 6/19, 6/28, 7/7, 7/11, 8/29, 8/31.
Site 9 (61st and Lyndale)	5/13, 6/19.

Site 8a (Pershing) is of special concern as it had twelve surcharges in 2014. At this site, storms as small as 0.33 inches or as large as 3.00 inches caused surcharging. At this site, two pipes and overland flow enter the manhole basin and exit the outlet, a 12 inch PVC pipe. The Site 8 watershed/area of Minneapolis is lower in elevation than the surrounding areas causing a regular back up of many stormsewers in the system. Minneapolis Public Works is aware of this problem. The surcharges at this site do not appear to have caused any flooding problems. Site 8a samples appear to not be significantly affected by surcharging because the sampler is secured in an above ground enclosure.

Best Management Practices Monitoring Results

Best management practices (BMPs) include procedures and structures designed to help reduce pollutants in stormwater runoff. The City and the MPRB carry out BMP monitoring as part of the effort to determine and improve system/BMP effectiveness through adaptive management.

In 2014, baseline monitoring was continued in a small watershed on the southeast side of Lake Nokomis, a lake that is impaired for phosphorus. The purpose of the baseline sampling was in preparation for a pilot study in the area to quantify the measurable pollutant load reduction for street sweeping as a Best Management Practice.

(In previous Annual Reports, the following material appeared in Appendix A as A5.)

BACKGROUND

Best management practices (BMPs) include procedures and structures designed to help reduce water pollution through good housekeeping practices like street sweeping. Monitoring of BMPs in Minneapolis is done as a part of the Federal NPDES MS4 stormwater permit activities (permit #MN0061018).

Minneapolis Public Works is attempting to quantify the measurable stormwater effects of street sweeping. The project will use both grab (snowmelt) and flow paced (event) sampling to collect runoff and measure stormwater solids (TSS, TVS) and phosphorus (TP, TDP) in a watershed targeted to monitor the effects of street sweeping and its effects on stormwater.

Target watersheds chosen for study were on the southeast side of Lake Nokomis. A paired watershed design was initially attempted. After initial reconnaissance the paired watershed design was deemed unworkable due to site conditions. Three sites were investigated. 1) Woodlawn & 50th was too shallow to hang a sampler and had four 10 inch leaders making laminar flow and accurate measurement impossible. 2) Woodlawn & 53rd had 12+ inches of standing water in the pipe which would negatively affect results due to settling and re-suspension. 3) The watershed outlet of 56th & 21st was acceptable. It had approximately 3 inches of standing water but did not have major issues with standing water, and it had room for equipment. It was chosen and monitored in 2012 - 2014 for baseline conditions (see **Figure 25-1)** prior to commencement of the street sweeping project.

The drainage area to the 56th and 21st site is approximately 50 acres, as measured from the Minneapolis pipeshed GIS layer, and the majority land use is single family homes. The outfall ID associated with the site is 72-060.

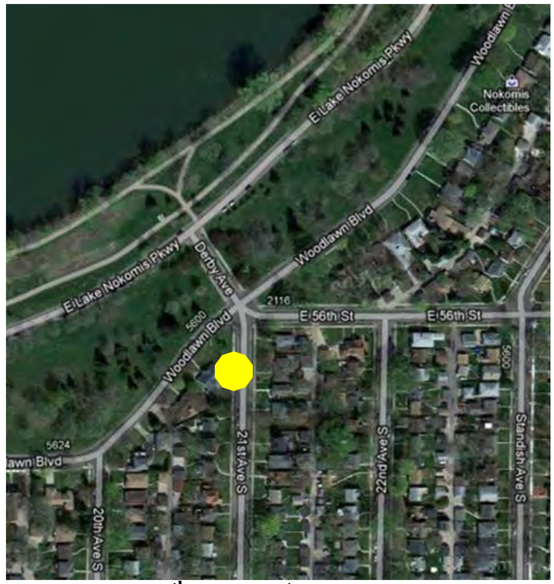


Figure 25-1. Aerial photograph of 56th and 21st monitoring location on the S.E. side of Lake Nokomis in Minneapolis.

METHODS

The summary below includes descriptions of equipment installation at each site, parameters monitored, field quality assurance sampling, data handling, validation, and reporting.

Site Installation

The 56th & 21st outlet is a 30” reinforced concrete pipe, as shown in **Figure 25-2**. The ISCO equipment installed at each site included a 2150 datalogger with low profile area/velocity pressure transducer probe, 2105 interface module, 2103ci cell phone modem, and a 3700 sampler. The sampler collected stormwater with 3/8” ID vinyl intake tubing complete with strainer. The dataloggers flow-paced the samplers to collect flow-weighted stormwater samples over the entire storm hydrograph. Each site automatically uploaded data, via cell phone modem, to the network server database Monday through Friday. Each site could also be communicated with remotely by Flowlink Pro software in order to adjust pacing, enable or disable samplers, or view events.

Equipment installation began when freezing temperatures were no longer a concern in order to prevent area velocity transducer damage. Installation occurred on 5/5/14.

Figure 25-2. View into the manhole access at the 56^{th} and 21^{st}, 30" pipe.

Monitoring
The MS4 permit target frequency for storm event sample collection is 15 samples per site per year. If a sample was missed during one month due to lack of precipitation events, then two or more were taken the next month. Snowmelt grab samples were collected on 2/18, 2/19, and 3/10 in 2014. The auto monitoring sampling period was from 5/5/14 – 11/7/14. With the exception of snowmelt grabs, all stormwater samples in 2014 were collected by flow weighted auto monitoring. **Figure 25-3** shows the sample intake strainer and A/V probe being placed in the invert of the pipe for monitoring.

Figure 25-3. The AV probe and intake strainer being anchored to the invert.

Normally the 56th & 21st site has approximately 3" of standing water that was present for most of the season. In 2014, significant spring/summer flooding occurred. Flooding resulted in large amounts of tailwater from Lake Nokomis inundating the site, which made monitoring impossible.

The 2014 sampled events collected are shown in **Table 25-1.** The precipitation data were collected from a weather station at 38th and Bryant Ave S. Minneapolis, the MPRB Southside Service Center.

Table 25-1. The 56th and 21st 2014 events and illicit discharge events. A precipitation event was defined as greater than 0.10 inches separated by 8 hours.

Event	Start Date/Time		End Date/Time		Precip (inches)	Duration (hours)	Intensity (in/hr)	Time since last Precip. (hours)	Sample Type	2014, 56th & 21st Events Collected
+1	2/18/2014	14:00	n/a	n/a	n/a	n/a	n/a	n/a	grab	X
+2	2/19/2014	14:15	n/a	n/a	n/a	n/a	n/a	n/a	grab	X
+3	3/10/2014	14:30	n/a	n/a	n/a	n/a	n/a	n/a	grab	X
4	5/8/2014	0:30	5/8/2014	20:00	1.02	19.5	0.05	180.0	composite	X
5	5/11/2014	21:30	5/12/2014	21:30	0.82	24.0	0.03	46.5	composite	X
6	5/19/2014	10:30	5/19/2014	22:30	1.80	12.0	0.15	169.0	comp/grab	X
7	6/14/2014	10:00	6/15/2014	9:30	1.90	23.5	0.08	69.5	composite	X
8	6/18/2014	2:30	6/18/2014	4:30	0.43	2.0	0.22	31.5	composite	X
9	9/9/2014	21:15	9/10/2014	9:00	0.41	11.8	0.03	156.0	composite	X
10	10/1/2014	7:30	10/2/2014	22:45	1.04	39.2	0.03	292.2	composite	X
			Totals		**7.42**					**10**

+snowmelt event

n/a = not applicable

X = event sampled with full parameters

Monitored Parameters

The parameters chosen for this site were solids (TSS, VSS) and phosphorus (TP, TDP), listed below in **Table 25-2**. These were chosen as the best parameters to evaluate the effectiveness of street sweeping.

Table 25-2 Parameters monitored at 56th and 21st.

Parameter	Abbreviation	Units	Sample Type
Phosphorus, Total Dissolved	TDP	mg/L	Composite
Phosphorus, Total	TP	mg/L	Composite
Solids, Total Suspended	TSS	mg/L	Composite
Solids, Volatile Suspended	VSS	mg/L	Composite

Holding times and detection limits for all parameters are listed in **Section 24, Table 24-5**.

FIELD QUALITY ASSURANCE SAMPLES

Ten percent of samples were laboratory quality assurance samples (e.g. duplicates, spikes). Field blanks consisted of deionized water which accompanied samples from the field sites to the analytical laboratory. A field blank was generated for each sampling trip and was analyzed for all NPDES parameters. All field blank parameters were below the minimum detection limits in 2014. As part of the overall QA/QC program, blind monthly performance samples were made for all monitored parameters and delivered to IRI.

An equipment blank (~ 2 L sample) was collected at 8a (Pershing) 11/07/14. This site has a standard NPDES stormwater monitoring set up. To collect the equipment blank, a large bottle of deionized water was placed at the strainer end of the sampler tubing. The intake line was filled and flushed with deionized water simulating the pre-sample flush. After the flush was pumped to waste, a sample of deionized water was collected. The sample taken was of sufficient volume to allow analysis of all parameters. All analytes came back from the laboratory below the minimum detection limits.

Data Handling
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 **Section 30**, Quality Assurance Assessment Report for details.

Field measurements were recorded on a Field Measurement Form in the 2014 Field Log Book and then entered into a computer database. Electronic data from the laboratory were forwarded to the MPRB in pre-formatted 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 Storm Water Monitoring Program Manual (MPRB, 2001).

A Chain of Custody form accompanied each set of sample bottles delivered to the lab. Each sampler tray or container was iced and labeled indicating the date and time of collection, the site location, and the field personnel initials. The ultimate collection date and time assigned to the sample was when the last sample of the composite was collected. The time that each composite sample was collected was recorded from the ISCO sampler onto field sheets. A complete description of methods can be found in the Storm Water Monitoring Program Manual (MPRB, 2001).

RESULTS & DISCUSSION

In 2014, monitoring became extremely difficult due to flooding and back water from Lake Nokomis. **Figure 25-4** shows the 2014 level and discharge at the 56th and 21st monitoring site.
Surcharge events are normally very infrequent at this site. But in 2014 there were eight surcharge events, 5/19, 6/1, 6/14, 6/18, 6/19, 6/28, 7/11, and 8/29. The 6/19 event reached 64” in the 30” pipe.

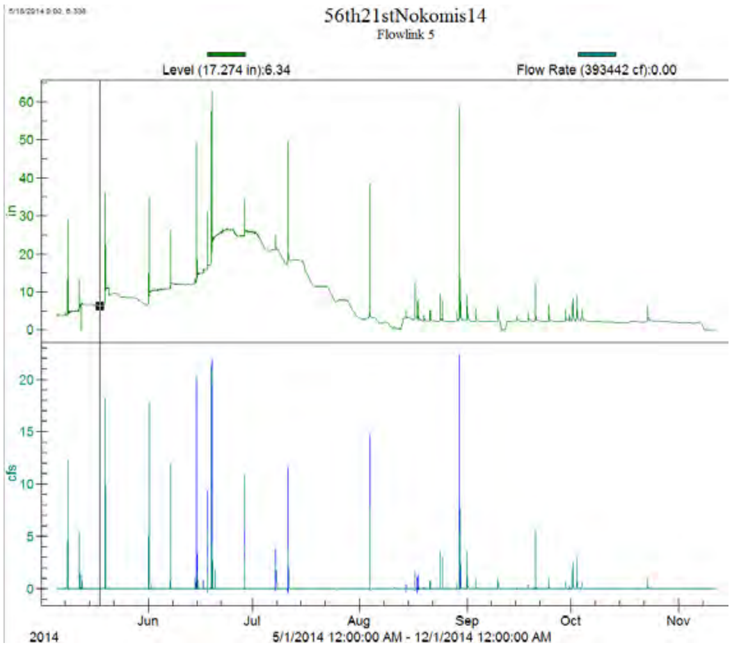


Figure 25-4 The 2014 water level and discharge in the 30", 56th and 21st pipe.

Table 25-3 shows the volumes collected for each event, the total annual volume, and the annual percentage of runoff collected. Using flow paced sampling approximately 48% of the annual storm runoff was measured and collected. No illicit discharges were detected. The flooding required the sampling to be shut down for much of the summer (mid-June through early September) but data collection continued.

Table 25-3 The 56th and 21st, 2014 sampled event discharges, annual flow measured, and percent captured.

Event	Start Date/Time		End Date/Time		Precip (inches)	Duration (hours)	Intensity (in/hr)	Time since last Precip. (hours)	Sample Type	2014, 56th & 21st Event Volumes (cf)
+1	2/18/2014	14:00	n/a	n/a	n/a	n/a	n/a	n/a	grab	X
+2	2/19/2014	14:15	n/a	n/a	n/a	n/a	n/a	n/a	grab	X
+3	3/10/2014	14:30	n/a	n/a	n/a	n/a	n/a	n/a	grab	X
4	5/8/2014	0:30	5/8/2014	20:00	1.02	19.5	0.05	180.0	composite	15,637
5	5/11/2014	21:30	5/12/2014	21:30	0.82	24.0	0.03	46.5	composite	19,498
6	5/19/2014	10:30	5/19/2014	22:30	1.80	12.0	0.15	169.0	comp/grab	73,242
7	6/14/2014	10:00	6/15/2014	9:30	1.90	23.5	0.08	69.5	composite	25,837
8	6/18/2014	2:30	6/18/2014	4:30	0.43	2.0	0.22	31.5	composite	7,026
9	9/9/2014	21:15	9/10/2014	9:00	0.41	11.8	0.03	156.0	composite	5,239
10	10/1/2014	7:30	10/2/2014	22:45	1.04	39.2	0.03	292.2	composite	43,143
			Totals		**7.42**	Number of Events				**10**

+snowmelt event	**Total volume of sampled events (cf)**	**189,622**
n/a = not applicable	**Total volume of recorded (with Flowlink) for 2014 (cf)**	**393,442**
X = event sampled with full parameters	**Percent Annual Volume Sampled**	**48%**

Flow-weighted composite data and associated statistics are shown in **Table 25-4**. It is interesting to note that the geometric mean percentage of TDP is 34% of the TP, and VSS is 43% of the TSS. This means in 2014 one third of the phosphorus (TP) are dissolved (TDP) and over 40% of the solids (TSS) are organic solids (VSS). The data show most of the TSS (57%) as inert, and most likely sand.

It would be expected that street sweeping would address the TP, TSS, and VSS but have a very small effect on TDP, which makes up approximately a third of the load. This watershed may be a candidate for an enhanced iron sand filter, which targets dissolved phosphorus.

Table 25-4 The 56th & 21st 2014 Sampled event data with associated statistics.

Date Sampled	Time	Site Location	Type	TP mg/L	TDP mg/L	% TDP	TSS mg/L	VSS mg/L	% VSS
2/18/2014	14:00	56th & 21st	Grab	1.75	0.110	6%	334	108	32%
2/19/2014	13:45	56th & 21st	Grab	1.21	0.578	48%	290	113	39%
3/10/2014	14:05	56th & 21st	Grab	0.957	0.407	43%	159	55	35%
5/8/2014	3:14	56th & 21st	Composite	0.447	0.138	31%	59	24	41%
5/8/2014	3:14	56th & 21st	Composite	0.447	0.138	31%	59	24	41%
5/12/2014	22:14	56th & 21st	Composite	0.164	0.099	60%	12	6	55%
5/19/2014	13:17	56th & 21st	Composite	0.298	0.087	29%	159	45	28%
6/1/2014	7:43	56th & 21st	Composite	0.222	0.075	34%	75	24	32%
6/14/2014	20:31	56th & 21st	Composite	0.396	0.133	34%	130	57	43%
6/18/2014	1:44	56th & 21st	Composite	1.05	0.256	24%	45	35	78%
9/10/2014	0:58	56th & 21st	Composite	0.603	0.354	59%	20	16	80%
10/1/2014	13:37	56th & 21st	Composite	0.425	0.244	57%	40	15	38%
			Mean	0.664	0.218	33%	115	43	38%
			Geo Mean	0.528	0.177	**34%**	75	32	**43%**
			Median	0.447	0.138	31%	67	29	44%
			Std Dev	0.478	0.157		105	35	
			Max	1.75	0.578	60%	334	113	80%
			Min	0.164	0.075	6%	12	6	28%
			Number	12	12		12	12	

Baseline data have been collected and future monitoring will be done to assess the efficacy of street sweeping and any impacts on TP, TDP, TSS, and VSS.

Minnehaha Creek At Xerxes Avenue Monitoring Station Results

(In previous Annual Reports, the following material appeared in Appendix A as A6.)

BACKGROUND

The Minnehaha Creek headwaters originates at Gray's Bay on Lake Minnetonka and discharges into the Mississippi River below Minnehaha Falls, as seen in **Figure 26-1**. The creek carries significant amounts of stormwater from seven upstream suburban communities located between Lake Minnetonka and Minneapolis. Approximately one third of the downstream length of Minnehaha Creek is located within Minneapolis.

In 2009, the City of Minneapolis and MPRB added a monitoring station where Xerxes Avenue South crosses Minnehaha Creek at the Minneapolis border. Monitoring at the Xerxes station is used to determine what is coming into the City from upstream areas and helps to determine the impact of Minneapolis stormwater on Minnehaha Creek.

The water in Minnehaha Creek at Xerxes has four main sources:

- runoff from the immediately surrounding watershed.
- runoff from the watershed between Lake Minnetonka and Xerxes.
- discharge from Lake Minnetonka at Gray's Bay dam, which is intermittent because the outlet from Lake Minnetonka (into Minnehaha creek) is adjustable so discharge rates vary and the dam closes when Lake Minnetonka reaches 928.6 msl.
- groundwater, which can flow into (discharge to) and out of (recharge from) Minnehaha Creek.

Figure 26-1. Map of Minnehaha Creek showing Gray's Bay Dam, the outlet from Lake Minnetonka, the Xerxes station, and the USGS station.

METHODS

Site Installation

To monitor the creek in 2014, an ISCO 2150 datalogger, 2105 interface module, and 2013ci cell phone modem were installed with a low-profile A/V (area velocity) level probe. Power was provided to all equipment by a 12 V deep cycle battery. The datalogger used the cell phone modem to remotely upload data to the server Monday through Friday. The datalogger could also be remotely called up and programmed to change the pacing or triggers.

The sampler was a flow-paced ISCO 3700 equipped with 24 one liter bottles, 3/8" ID (inner diameter) vinyl tubing, and an intake strainer. The sampler was programmed to multiplex and take four flow-paced samples per bottle allowing 96 flow-paced samples per storm. Both the level probe cable and intake strainer tubing were armored in flexible metal conduit and anchored to the northwest upstream Xerxes bridge abutment (**Figure 26-2**).

Figure 26-2. Top: Xerxes monitoring station location at Minnehaha Creek looking downstream. The staff gauge is a vertical white line in the middle right. Left: Knaack box installation with sampler and datalogger. Right: Close up of intake strainer and level probe anchored to the northwest bridge abutment.

Rating Curve

Standard protocols and methodology were used to build a stage discharge rating curve and look up table, **Figure 26-3**. A USGS wading rod (or 15 pound lead fish), and a Marsh McBirney Flowmate™ velocity meter were used to gather stage discharge data points in the field, at one foot cross sectional increments. The MPRB continues to refine and check the stage/discharge rating curve.

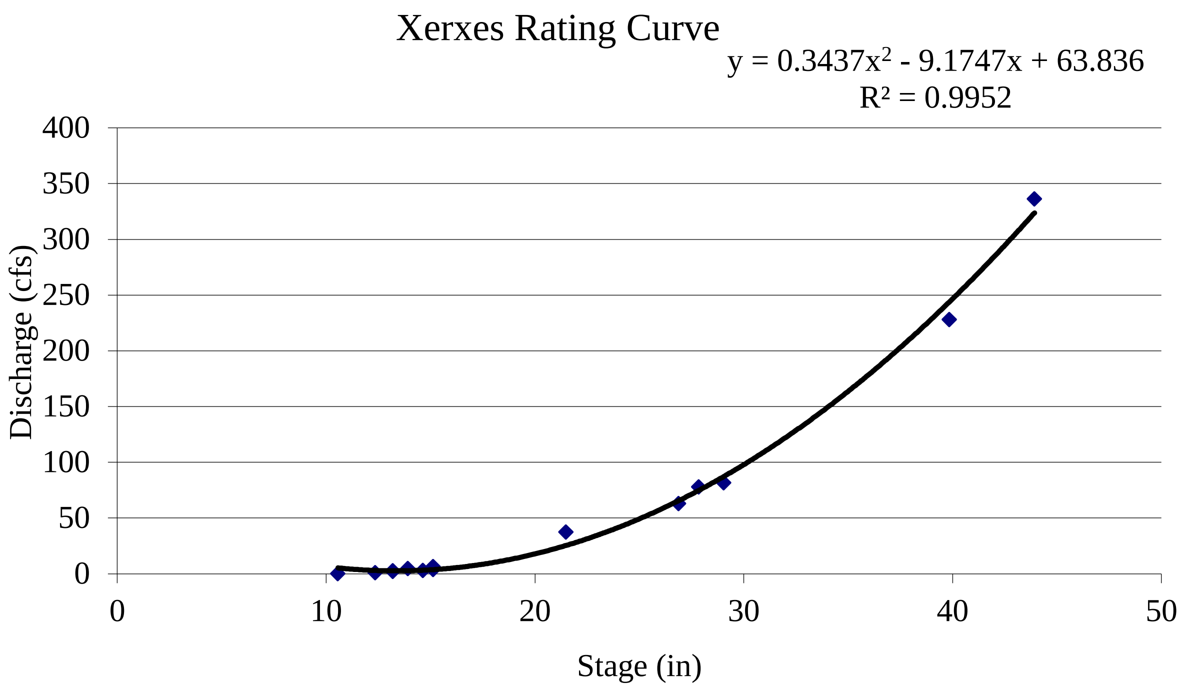


Figure 26-3. Xerxes rating curve at Minnehaha Creek.

Stage readings were checked against tape-downs and adjusted accordingly. Tape downs are a measured distance from a fixed point located at the middle of the upstream side of the Xerxes bridges to the top of the water. From the tape down point on the bridge to the stream bed is 18.00 ft. (Eighteen feet minus the distance from the bridge to the water surface is the water depth or stage). The bridge tape down point elevation is 863.01 msl. There is also a staff gauge affixed to the southwest bridge abutment. The staff gauge reading minus 4.00 equals the stream depth (stage) in feet.

The level feature of the ISCO A/V probe was used to obtain stage. The stage discharge rating curve was used by the datlogger for accurate flow weighted sampler pacing.

Sample Collection

Storm events were collected with flow-paced multiplexed ISCO auto samplers. Snowmelt and baseflow samples were both collected as grab samples. Snowmelt stage readings were rough estimations of the depth of flow on top of the ice. Baseflow sampling was year round if moving water was available. Tape-down stage readings were always collected during baseflow sampling, except during winter ice conditions.

RESULTS & DISCUSSION

2014 was the sixth year of monitoring at the Xerxes-Minnehaha Creek station. Freezing temperatures can damage the level feature of the A/V probe. In 2014, installation was on 4/25/14 when freezing conditions had subsided.

Stage and Discharge Hydrograph

Stream stage (level) and discharge (cubic feet per second -cfs) fluctuated widely over the sampling season, (see **Figure 26-4)**. The average 2014 stage was approximately 35 inches. In 2014, peak stage was 70 inches on June 19th, and the lowest stage was ~15 inches November 5th.

In reviewing **Figure 26-4**, most of the storms collected were characterized by a sharp peak from the immediate watershed, followed by a sustained pulse of water from the larger watershed and Lake Minnetonka which can last two to four days. The spring of 2014 was very wet and was followed by a significant late-summer drought.

In **Figure 26-4** both the large rainfall volumes and sustained rainstorms of April through June and the July through September drought can be seen in the hydrograph. The Gray's Bay dam was opened April 28th remained open until October 27th when it was closed for the remainder of the year.

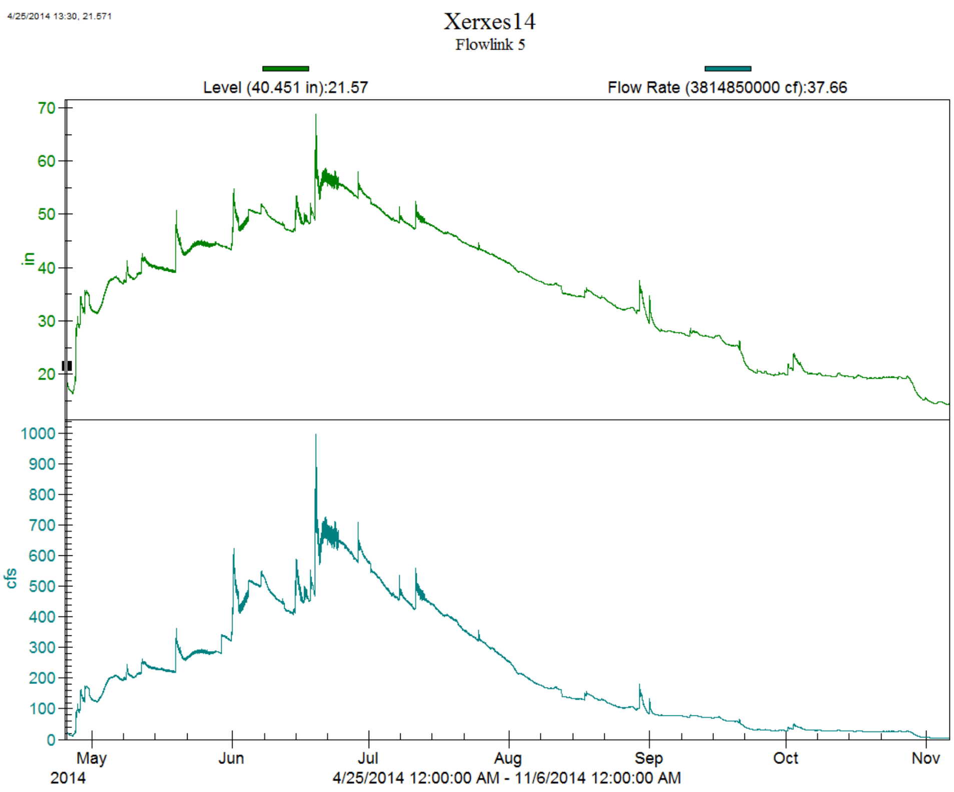


Figure 26-4. 2014 stage discharge graph of the Minnehaha Creek Xerxes monitoring station from late April to November. The (top) line represents stage data (inches) and the (bottom) line depicts discharge (cubic feet per second).

Sample Collection

In 2014, three snowmelt, eleven baseflow, and sixteen storm samples were captured, and are shown in **Table 26-1**. Both the event-pacing and stage trigger were adjusted for each storm to attempt collection of the entire hydrograph.

Table 26-1. The 2014 snowmelt, precipitation, and baseflow events captured at the Xerxes Minnehaha Creek station. A precipitation event was defined as a storm greater than 0.10 inches, separated by eight hours or more from other precipitation. If the sample exceeded holding time, some parameters (e.g. TDP, cBOD) were dropped from analysis.

Event	Start Date/Time		End Date/Time		Precip (inches)	Duration (hours)	Intensity (in/hr)	Time since last Precip. (hours)	Sample Type	2014 Xerxes Events Collected
+1	3/10/2014	14:30	n/a	n/a	n/a	n/a	n/a	n/a	grab	X(w/Ecoli)
+2	3/14/2014	14:40	n/a	n/a	n/a	n/a	n/a	n/a	grab	X
+3	3/27/2014	13:55	n/a	n/a	n/a	n/a	n/a	n/a	grab	X(w/Ecoli)
4	4/29/2014	3:00	5/1/2014	8:00	0.67	53.0	0.01	62.0	composite	X
5	5/8/2014	0:30	5/8/2014	20:00	1.02	19.5	0.05	180.0	composite	X
6	5/10/2014	20:00	5/10/2014	23:00	0.11	3.0	0.04	51.0	composite	X
7	5/11/2014	21:30	5/12/2014	21:30	0.82	24.0	0.03	46.5	composite	X(lmtd)
8	5/19/2014	10:30	5/19/2014	22:30	1.80	12.0	0.15	169.0	comp/grab	X
9	5/31/2014	16:30	6/1/2014	21:00	1.97	28.5	0.07	310.5	composite	X(lmtd)
10	6/14/2014	10:00	6/15/2014	9:30	1.9	23.5	0.08	69.5	composite	X
11	6/18/2014	2:30	6/18/2014	4:30	0.43	2.0	0.22	31.5	composite	X
12	6/19/2014	3:30	6/19/2014	20:30	3.00	17.0	0.18	40.0	comp/grab	X
13	7/6/2014	5:30	7/6/2014	8:00	0.13	2.5	0.05	174.5	composite	X
14	7/25/2014	5:00	7/25/2014	7:00	0.42	2.0	0.21	250.5	composite	X
15	9/9/2014	21:15	9/10/2014	9:00	0.41	11.8	0.03	156.0	composite	X
16	10/1/2014	7:30	10/2/2014	22:45	1.04	39.2	0.03	292.2	composite	X(lmtd)
			Totals		**13.72**					**16**

Baseflow Event	Date	Time	Sample Type	Collected
1	1/10/2014	13:30	Grab	X
2	2/7/2014	11:45	Grab	X
3	4/14/2014	9:25	Grab	X(w/Ecoli)
4	5/19/2014	9:55	Grab	X(w/Ecoli)
5	6/13/2014	13:30	Grab	X
6	7/9/2014	10:00	Grab	X(w/Ecoli)
7	8/20/2014	9:05	Grab	X(w/Ecoli)
8	9/2/2014	9:30	Grab	X(w/Ecoli)
9	10/6/2014	0.5625	Grab	X(w/Ecoli)
10	11/4/2014	0.572917	Grab	X(w/Ecoli)
11	12/5/2014	0.364583	Grab	X

+snowmelt event

n/a = not applicable

X = event sampled with full parameters

X(lmtd) = event sampled with limited parameters generally due to holding times e.g.BOD, TDP, etc.

X(w/Ecoli) = event sampled with fecal coliform

Event and Baseflow Raw Data

Table 26-2 shows the 2014 raw baseflow and event data collected at the Xerxes station. The duplicates have been averaged and the less than values are shown. These event runoff data show a general tendency of both very dirty snowmelt and early spring runoff as seen in the TP and TSS data.

The baseflow data show Cl and TDS being higher in January, April, and December. The January and December chloride levels are just below the 230 mg/L chronic level MPCA standards. The April chloride level is above the standard. The baseflow data show a relativity consistent concentration of most parameters in summer and fall.

Table 26-2. **Minnehaha Creek at Xerxes 2014 water chemistry of snowmelt, event, and baseflow data. Cells with "less than" values indicate that the concentration of that parameter was below detection limit. NA = data not available due to expired holding time or low volume, SM = snowmelt.**

Date Sampled	Time	Site Location	Sample Type	TP mg/L	TDP mg/L	OPO4 mg/L	TKN mg/L	NH3 mg/L	NO3NO2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	cBOD mg/L	Sulfate mg/L	Sp.Cond. uhmos	pH std units	E. Coli MPN	Cu ug/L	Pb ug/L	Zn ug/L
3/10/2014	13:40	Xerxes SM	Grab	0.692	0.407	NA	5.30	1.67	0.514	1385	132	313	100	2361	17.9	24	4460	7.7	19863	45	14	250
3/14/2014	14:40	Xerxes SM	Grab	0.417	0.274	NA	3.26	1.86	0.302	668	316	27	8	1256	4	17	2310	7.6		<5.00	<3.00	26
3/27/2014	14:05	Xerxes SM	Grab	0.230	0.116	NA	2.24	1.48	1.07	382	232	16	7	836	4	18	1477	7.5	411	<5.00	<3.00	26
4/29/2014	10:12	Xerxes	Composite	0.146	0.041	0.067	1.03	<0.500	0.684	275	156	47	16	1820	<1.00	9	753	7.6		<5.00	<3.00	26
5/2/2014	7:51	Xerxes	Composite	0.071	0.063	0.024	0.689	<0.500	0.723	180	148	9	5	385	<1.00	11	655	7.4		<5.00	<3.00	<20.0
5/9/2014	5:22	Xerxes	Composite	0.044	0.028	0.032	1.04	<0.500	1.84	68	148	44	12	263	<1.00	5	491	7.6		<5.00	3.3	<20.0
5/11/2014	10:12	Xerxes	Composite	0.038	0.015	0.003	0.640	<0.500	0.600	88	160	9	3	275	<1.00	5	509	7.8		<5.00	<3.00	<20.0
5/13/2014	18:03	Xerxes	Composite	0.036	NA	NA	<0.500	NA	0.091	83	144	7	<2.0	NA	NA	NA	493	NA		<5.00	<3.00	<20.0
5/20/2014	9:05	Xerxes	Composite	0.041	0.028	0.019	0.616	<0.500	0.260	79	136	29	7	245	3	5	432	6.7		<5.00	<3.00	<20.0
5/30/2014	19:53	Xerxes	Composite	0.046	NA	NA	0.957	NA	0.061	63	164	5	<2.0	NA	NA	NA	415	NA		<5.00	<3.00	<20.0
5/31/2014	17:35	Xerxes	Composite	0.026	NA	NA	0.697	NA	<0.030	58	164	5	<2.0	NA	NA	NA	398	NA		<5.00	<3.00	<20.0
6/3/2014	6:47	Xerxes	Composite	0.035	0.035	NA	0.610	NA	0.041	72	192	5	3	NA	NA	NA	381	NA		<5.00	3.1	<20.0
6/15/2014	21:17	Xerxes	Composite	0.049	0.033	0.031	<0.500	<0.500	0.103	56	136	9	2	234	<1.00	<5.0	356	7.5		<5.00	<3.00	<20.0
6/18/2014	10:03	Xerxes	Composite	0.058	0.027	0.030	0.779	<0.500	0.057	71	144	8	2	251	<1.00	5	386	7.6		<5.00	<3.00	<20.0
6/20/2014	8:04	Xerxes	Composite	0.088	0.038	0.060	0.700	<0.500	0.147	61	116	22	5	250	<1.00	5	317	7.0		<5.00	<3.00	<20.0
7/7/2014	22:25	Xerxes	Composite	0.060	0.036	0.030	0.526	<0.500	0.107	70	144	9	<2.0	267	<1.00	<5.0	389	7.8		<5.00	<3.00	<20.0
7/25/2014	7:52	Xerxes	Composite	0.069	0.045	0.040	0.840	<0.500	0.071	67	148	12	5	213	<1.00	<5.0	408	6.7		<5.00	<3.00	<20.0
9/10/2014	8:10	Xerxes	Composite	0.052	0.025	0.029	0.837	<0.500	0.385	67	168	11	5	298	<1.00	<5.0	447	7.9		<5.00	<3.00	<20.0
10/1/2014	14:27	Xerxes	Composite	0.063	NA	NA	0.725	NA	0.152	67	168	6	4	NA	NA	NA		NA		<5.00	<3.00	30
1/10/2014	13:30	Xerxes BF	Grab	0.032	0.010	0.012	1.44	<0.500	0.811	215	490	4	1	801	<1.00	10	1462	7.1		<5.00	<3.00	<20.0
2/7/2014	11:45	Xerxes BF	Grab	0.029	0.006	0.024	<0.500	<0.500	0.426	NA	448	5	3	685	<1.00	41	1306	7.5		<5.00	<3.00	<20.0
4/14/2014	9:25	Xerxes BF	Grab	0.091	0.043	0.022	0.879	<0.500	0.522	240	224	10	4	681	3	14	1234	7.7	15	<5.00	<3.00	<20.0
5/19/2014	9:55	Xerxes BF	Grab	0.017	0.011	0.006	<0.500	<0.500	0.128	73	160	5	<2.0	278	<1.00	<5.0	491	7.7	35	<5.00	<3.00	<20.0
6/13/2014	13:30	Xerxes BF	Grab	0.032	0.024	0.020	0.576	<0.500	0.060	66	160	5	2	268	<1.00	<5.0	389	7.1		<5.00	<3.00	<20.0
7/9/2014	10:00	Xerxes BF	Grab	0.061	0.038	0.027	0.559	<0.500	0.067	75	156	5	<2.0	250	<1.00	6	394	7.6	96	<5.00	<3.00	<20.0
8/20/2014	9:05	Xerxes BF	Grab	0.048	0.031	0.040	1.07	<0.500	0.441	62	156	8	2	254	<1.00	6	425	7.7	74	<5.00	<3.00	<20.0
9/2/2014	9:30	Xerxes BF	Grab	0.038	0.034	0.026	0.574	<0.500	0.190	62	160	7	4	276	<1.00	<5.0	444	7.8	109	<5.00	<3.00	<20.0
10/6/2014	13:30	Xerxes BF	Grab	0.026	0.019	0.014	0.725	<0.500	0.284	86	200	<1.00	<2.00	344	<1.00	<5.0	559	8.0	34	<5.00	<3.00	<20.0
11/4/2014	13:45	Xerxes BF	Grab	0.043	0.017	0.009	<0.500	<0.500	0.132	95	224	8	3	382	<1.00	<5.0	610	8.0	32	<5.00	<3.00	30
12/5/2014	8:45	Xerxes BF	Grab	0.022	0.013	0.010	0.719	<0.500	0.459	200	352	<1.00	<2.00	680	<1.00	14	1220	7.9		<5.00	<3.00	<20.0

Baseflow Data and Statistics

Table 26-3 show the Xerxes station baseflow data and associated statistics. Statistics were only calculated for a chemical parameter if there were two or more measured values. When statistical analysis was performed on the data sets and less than values were present, half of the reporting limit less than value was used in the calculations.

Throughout the 2014 sampling season, a total of eleven baseflow samples were taken to determine background conditions in the stream. In April no baseflow sample was collected because the stream was frozen to the bed. Seven *E. coli* grab samples were collected during baseflow conditions.

Winter baseflow had high concentrations for Cl, hardness, TDS, and specific conductivity. The levels of these dissolved parameters indicate that there was a problem with winter chlorides as well as a background amount of chloride being shed the rest of the year.

Baseflow samples generally had lower concentrations of nutrients and metals than storm events (**Table 26-4**). All metals and *E. coli* levels were relatively low and not of concern.

Table 26-3. Minnehaha Creek at Xerxes 2014 baseflow data showing both water chemistry data and statistics. All "less than data" were transformed into half the reporting limit for statistical calculations (e.g. Pb <3 becomes 1.5). NA = data not available due to expired holding time or low volume, BF = baseflow.

Date Sampled	Time	Site Location	Sample Type	TP mg/L	TDP mg/L	OPO4 mg/L	TKN mg/L	NH3 mg/L	NO3NO2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	cBOD mg/L	Sulfate mg/L	Sp.Cond. uhmos	pH std units	E. Coli MPN	Cu ug/L	Pb ug/L	Zn ug/L
1/10/2014	13:30	Xerxes BF	Grab	0.032	0.010	0.012	1.444	0.250	0.811	215	490	4	1	801	1	10	1462	7.1		2.5	1.5	10
2/7/2014	11:45	Xerxes BF	Grab	0.029	0.006	0.024	0.250	0.250	0.426		448	5	3	685	1	41	1306	7.5		2.5	1.5	10
4/14/2014	9:25	Xerxes BF	Grab	0.091	0.043	0.022	0.879	0.250	0.522	240	224	10	4	681	3	14	1234	7.7	15	2.5	1.5	10
5/19/2014	9:55	Xerxes BF	Grab	0.017	0.011	0.006	0.250	0.250	0.128	73	160	5	1	278	1	3	491	7.7	35	2.5	1.5	10
6/13/2014	13:30	Xerxes BF	Grab	0.032	0.024	0.020	0.576	0.250	0.060	66	160	5	2	268	1	3	389	7.1		2.5	1.5	10
7/9/2014	10:00	Xerxes BF	Grab	0.061	0.038	0.027	0.559	0.250	0.067	75	156	5	1	250	1	6	394	7.6	96	2.5	1.5	10
8/20/2014	9:05	Xerxes BF	Grab	0.048	0.031	0.040	1.07	0.250	0.441	62	156	8	2	254	1	6	425	7.7	74	2.5	1.5	10
9/2/2014	9:30	Xerxes BF	Grab	0.038	0.034	0.026	0.574	0.250	0.190	62	160	7	4	276	1	3	444	7.8	109	2.5	1.5	10
10/6/2014	13:30	Xerxes BF	Grab	0.026	0.019	0.014	0.725	0.250	0.284	86	200	1	10	344	1	3	559	8.0	34	2.5	1.5	10
11/4/2014	13:45	Xerxes BF	Grab	0.043	0.017	0.009	0.250	0.250	0.132	95	224	8	3	382	1	3	610	8.0	32	2.5	1.5	30
12/5/2014	8:45	Xerxes BF	Grab	0.022	0.013	0.010	0.719	0.250	0.459	200	352	1	10	680	1	14	1220	7.9		2.5	1.5	10
			Mean	0.040	0.022	0.019	0.663	0.250	0.320	117	248	5	4	445	1	9	776	7.6	56	2.5	1.5	12
			Geo Mean	0.036	0.019	0.017	0.570	0.250	0.237	102	226	4	3	401	1	6	678	7.6	46	2.5	1.5	11
			Median	0.032	0.019	0.020	0.576	0.250	0.284	81	200	5	3	344	1	6	559	7.7	35	2.5	1.5	10
			Std Dev	0.021	0.012	0.010	0.370	0.000	0.234	71	124	3	3	217	1	11	429	0.3	36	0	0	6
			Max	0.091	0.043	0.040	1.44	0.250	0.811	240	490	10	10	801	3	41	1462	8.0	109	2.5	1.5	30
			Min	0.017	0.006	0.006	0.250	0.250	0.060	62	156	1	1	250	1	3	389	7.1	15	2.5	1.5	10
			Number	11	11	11	11	11	11	10	11	11	11	11	11	11	11	11	7	11	11	11

Storm Event Data and Statistics

Table 26-4 shows the Xerxes station event data and associated statistics. Statistics were only calculated for a chemical parameter if there were two or more measured values. When statistical analysis was performed on the data sets and less than values were present, half of the reporting limit value was used in the calculations.

Table 26-4 shows snowmelt as having the highest values for all measured parameters. Two of the snowmelt grab sample parameters of concern are phosphorus and chloride since they are quite high at 0.692 mg/L and 1385 mg/L respectively. The non-snowmelt chloride values were between 56 mg/L and 275 mg/L. The MPCA chronic stream chloride standard is 230 mg/L for four days and an acute standard of 860 mg/L for one hour. Chloride was generally below the MPCA acute and chronic standards.

The source of low level chronic chloride in Minnehaha Creek is likely caused by winter road salt (NaCl) continuously leaching from the upstream soils. The MPCA TCMA Chloride Management Plan states the natural background chloride level is considered to be 8% or 18.7 mg/L for the chronic criteria.

Table 26-4. Minnehaha Creek at Xerxes 2014 precipitation event water chemistry data showing concentrations during or after a precipitation event (defined as more than 0.10 inches) or snowmelt. All "less than data" were transformed into half the reporting limit for statistical calculations (e.g. Pb <3 becomes 1.5). SM = snowmelt, NA = data not available.

Date Sampled	Time	Site Location	Sample Type	TP mg/L	TDP mg/L	OPO4 mg/L	TKN mg/L	NH3 mg/L	NO3NO2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	cBOD mg/L	Sulfate mg/L	Sp.Cond. uhmos	pH std units	E. Coli MPN	Cu ug/L	Pb ug/L	Zn ug/L
3/10/2014	13:40	Xerxes SM	Grab	0.692	0.407	NA	5.30	1.67	0.514	1385	132	313	100	2361	18	24	4460	7.7	19863	45	14	250
3/14/2014	14:40	Xerxes SM	Grab	0.417	0.274	NA	3.26	1.86	0.302	668	316	27	8	1256	4	17	2310	7.6		2.5	1.5	26
3/27/2014	14:05	Xerxes SM	Grab	0.230	0.116	NA	2.24	1.48	1.07	382	232	16	7	836	4	18	1477	7.5	411	2.5	1.5	26
4/29/2014	10:12	Xerxes	Composite	0.146	0.041	0.067	1.03	0.250	0.684	275	156	47	16	1820	1	9	753	7.6		2.5	1.5	26
5/2/2014	7:51	Xerxes	Composite	0.071	0.063	0.024	0.689	0.250	0.723	180	148	9	5	385	1	11	655	7.4		2.5	1.5	10
5/9/2014	5:22	Xerxes	Composite	0.044	0.028	0.032	1.04	0.250	1.84	68	148	44	12	263	1	5	491	7.6		2.5	3.3	10
5/11/2014	10:12	Xerxes	Composite	0.038	0.015	0.003	0.640	0.250	0.600	88	160	9	3	275	1	5	509	7.8		2.5	1.5	10
5/13/2014	18:03	Xerxes	Composite	0.036	NA	NA	0.250	NA	0.091	83	144	7	1	NA	NA	NA	493	NA		2.5	1.5	10
5/20/2014	9:05	Xerxes	Composite	0.041	0.028	0.019	0.616	0.250	0.260	79	136	29	7	245	3	5	432	6.7		2.5	1.5	10
5/30/2014	19:53	Xerxes	Composite	0.046	NA	NA	0.957	NA	0.061	63	164	5	1	NA	NA	NA	415	NA		2.5	1.5	10
5/31/2014	17:35	Xerxes	Composite	0.026	NA	NA	0.697	NA	0.015	58	164	5	1	NA	NA	NA	398	NA		2.5	1.5	10
6/3/2014	6:47	Xerxes	Composite	0.035	0.035	NA	0.610	NA	0.041	72	192	5	3	NA	NA	NA	381	NA		2.5	3.1	10
6/15/2014	21:17	Xerxes	Composite	0.049	0.033	0.031	0.250	0.250	0.103	56	136	9	2	234	1	3	356	7.5		2.5	1.5	10
6/18/2014	10:03	Xerxes	Composite	0.058	0.027	0.030	0.779	0.250	0.057	71	144	8	2	251	1	5	386	7.6		2.5	1.5	10
6/20/2014	8:04	Xerxes	Composite	0.088	0.038	0.060	0.700	0.250	0.147	61	116	22	5	250	1	5	317	7.0		2.5	1.5	10
7/7/2014	22:25	Xerxes	Composite	0.060	0.036	0.030	0.526	0.250	0.107	70	144	9	1	267	1	3	389	7.8		2.5	1.5	10
7/25/2014	7:52	Xerxes	Composite	0.069	0.045	0.040	0.840	0.250	0.071	67	148	12	5	213	1	3	408	6.7		2.5	1.5	10
9/10/2014	8:10	Xerxes	Composite	0.052	0.025	0.029	0.837	0.250	0.385	67	168	11	5	298	1	3	447	7.9		2.5	1.5	10
10/1/2014	14:27	Xerxes	Composite	0.063	NA	NA	0.725	NA	0.152	67	168	6	4	NA	NA	NA		NA		2.5	1.5	30
			Mean	0.119	0.081	0.033	1.16	0.555	0.380	203	164	31	10	640	2	8	838	7.5	10137	4.7	2.3	26
			Geo Mean	0.073	0.048	0.027	0.846	0.375	0.194	112	160	14	4	431	1	6	591	7.4	2857	2.9	1.8	15
			Median	0.058	0.036	0.030	0.725	0.250	0.152	71	148	9	5	271	1	5	440	7.6	10137	2.5	1.5	10
			Std Dev	0.167	0.111	0.018	1.22	0.610	0.459	325	44	69	22	689	5	7	1031	0.4	13755	9.8	2.9	55
			Max	0.692	0.407	0.067	5.30	1.86	1.84	1385	316	313	100	2361	18	24	4460	7.9	19863	45	14	250
			Min	0.026	0.015	0.003	0.250	0.250	0.015	56	116	5	1	213	1	3	317	6.7	411	2.5	1.5	10
			Number	19	15	11	19	14	19	19	19	19	19	14	14	14	18	14	2	19	19	19

In comparing Table 24-3 (baseflow) with Table 24-4 (runoff events) geometric means and medians, the runoff events have a higher concentration of every parameter measured except hardness and conductivity. Baseflow appears to be dominated by both groundwater and overflow from Lake Minnetonka. The runoff events show precipitation picking up significant amounts of surface and erosion debris and carrying it downstream. The watershed map shows that Minnehaha Creek appears to be an urban stream used as a stormwater conduit for many communities draining to it. The MPRB data has been used with Minnehaha Creek Watershed District to create TMDL's for *E. Coli* and phosphorus in Minnehaha Creek with chlorides being of recent concern.

Due to the annual and seasonal variability, long term water quality is important to understand both background and year to year variations in stream chemistry.

ESTIMATES OF ANNUAL AND SEASONAL POLLUTANT LOADS

Statistics for event mean concentrations were calculated using Microsoft Excel spreadsheets. FLUX32 (v.3.1) and P8 (v.3.4) were used to calculate flow-weighted mean concentrations and snowmelt runoffs, respectively.

All flow-weighted mean concentrations were calculated using the model FLUX32. FLUX32 calculates total mass discharge and associated error statistics based on six different calculation methods. Calculation methods 1-Direct Mean Loading and 5-Regression, Second-Order were ignored because they are inappropriate for storm sewer applications where the daily flow file contains a significant number of zero flows (Bruce Wilson, personal communication, 2001). Sample concentrations and associated daily average flows were used as input for these calculations. In order to achieve the most accurate and precise results, the data was often stratified by flow or by season. The calculation methods used were: not stratified, methods 2 and 6, if the data were able to be stratified. Generally, the method and associated concentration value with the lowest coefficient of variation was chosen.

The model P8 was used to calculate daily flows for the snowmelt events during January through April. Daily average temperature, winter water equivalent snowpack (using a heated tipping bucket rain gauge), and hourly precipitation files obtained from the National Oceanic and Atmospheric Administration (NOAA) National Data Center (NNDC) were used as input for P8.

A description of FLUX32 as described in the help menu (US Army Corps, 2009):

> The theory and the file formats described in this original manual, as well as much of the software's operation and menu structure, is still applicable to Flux.
>
> This version of FLUX for the Win32 environment is a major revision to the original DOS/FORTRAN program authored by William W. Walker Ph.D.
>
> Flux32 is interactive software designed for use in estimating the transport (load) of nutrients or other water quality constituents past a tributary sampling station over a given period of time.
>
> The basic approach of Flux32 is to use several calculation techniques to map the flow/concentration relationship developed (modeled) from the sample record onto the entire flow record. This provides an estimate of total mass transport for the whole period of study with associated error statistics. Note that this approach does NOT focus on estimating changes in loads over time (i.e. time series).
>
> An important option within Flux32 is the ability to stratify the data into groups based upon flow, date, and/or season. This is a key feature of the FLUX approach and one of its greatest strengths. In many (most) cases, stratifying the data increases the accuracy and precision of loading estimates.

A description of P8 as described in the software's introduction:

> "P8 is a model for predicting the generation and transport of stormwater runoff pollutants in small urban catchments. Simulations are driven by hourly rainfall and daily air-temperature time series."

The following formula was used to calculate the total annual pollutant load. Conversion factors were used to convert acres to square meters and adjust units for concentration.

$$L = \left[(P)\ (Pj)\ (Rv)\ (C/1000)\ (A*4046.9)\right]$$

where: L = seasonal pollutant load, kilograms/season
P = seasonal precipitation, inches/season (meters/season)
Pj = correction factor for storms which do not produce runoff = 0.85
Rv = runoff coefficient
C = median event mean concentration of pollutants, mg/L
A = area, acres
Conversion factors 4046.9 for acres to square meters
1000 for liters to cubic meters

The flow-weighted mean concentration (FWMC) expressed as a mean of all sites was used for the annual load estimation calculations as it most accurately reflects storm water loadings on an annual basis. The seasonal loadings were calculated from the pooled data using the median event mean concentration as there were too few data points from each watershed to use FLUX32 to determine with a reasonable degree of accuracy a seasonal FWMC for each site. The median of the data set is a better representation of the runoff data than the mean values (Bannerman et al., 1992). The annual load and a summation of the seasonal loads will not be equal due to this difference in calculation methods.

Seasonal loads were calculated on the following basis:

Season	Inclusive dates	Precipitation for period
Winter/snowmelt	01/01/14 – 03/31/14	3.65 inches (0.093 m)
Spring	04/01/14 – 05/31/14	10.82 inches (0.275 m)
Summer	06/01/14 – 08/31/14	16.53 inches (0.420 m)
Fall	09/01/14 – 12/31/14	4.40 inches (0.112 m)
Total	01/01/14 – 12/31/14	35.40 inches (0.900)

Flow-weighted mean concentrations and related statistics for NPDES parameters in 2014.

Site	TP (mg/L)	TDP (mg/L)	Ortho-P (mg/L)	TKN (mg/L)	NO_3NO_2 (mg/L)	NH_3 (mg/L)	Cl* (mg/L)	Hardness (mg/L)	TSS (mg/L)	VSS (mg/L)	TDS* (mg/L)	cBOD (mg/L)	Sulfate (mg/L)	Cu (µg/L)	Pb (µg/L)	Zn (µg/L)
6, 22nd Aldrich	0.378	0.161	0.108	3.11	0.786	1.30	165	35.2	118	40	393	9	7.8	14	42	94
7, 14th Park	0.274	0.073	0.066	1.93	0.716	0.866	242	33.1	85	30	422	9	6.5	13	11	58
8a, Pershing	0.315	0.186	0.176	1.65	0.724	0.931	139	30.0	51	18	50	9	3.2	3	3	18
9, 61st Lyndale	0.284	0.066	0.167	2.92	1.52	0.919	274	65.1	238	49	572	12	9.9	20	8	100
MEAN	**0.313**	**0.121**	**0.129**	**2.40**	**0.937**	**1.00**	**205**	**40.9**	**123**	**34**	**359**	**10**	**6.8**	**13**	**16**	**68**
MEDIAN	**0.300**	**0.117**	**0.138**	**2.43**	**0.755**	**0.925**	**204**	**34.2**	**102**	**35**	**408**	**9**	**7.1**	**14**	**10**	**76**
STANDEV	**0.047**	**0.061**	**0.052**	**0.721**	**0.390**	**0.199**	**63**	**16.3**	**81**	**13**	**221**	**2**	**2.8**	**7**	**18**	**38**
	-Highest value															
	-Lowest value															

* Flow-weighted mean concentrations for Cl and TDS were difficult to estimate using FLUX32 due to large outliers from the two snowmelt samples; these estimates should be used with caution.
STANDEV= standard deviation.

Stormwater Monitoring Results and Data Analysis

Statistical summary for event mean concentrations by season in 2014. Statistics were calculated from all sites (6-9). STDEV= standard deviation,

2014 Season	Statistical Function	TP mg/L	TDP mg/L	Ortho-P mg/L	TKN mg/L	NH_3 mg/L	NO_3NO_2 mg/L	Cl mg/L	Hardness mg/L	TSS mg/L	VSS mg/L	TDS mg/L	cBOD mg/L	Sulfate mg/L	pH std units	*E. coli* MPN/100mL	Cu ug/L	Pb ug/L	Zn ug/L
SNOWMELT (February-March)	MEAN (geometric)	0.575	0.183	0.127	3.39	1.53	0.512	507	65	109	36	592	17	17	7.5	63	33	12	119
	MEAN (arithmetic)	0.675	0.238	0.136	3.83	1.75	0.653	1402	91	180	51	2244	20	23	7.6	90	36	15	145
	MAX	1.25	0.515	0.185	6.80	3.20	1.54	5895	308	610	161	9699	57	63	10.8	166	78	30	270
	MIN	0.158	0.043	0.087	0.90	0.536	0.146	10	24	24	10	45	8	5	6.6	10	22	3	27
	MEDIAN	0.596	0.228	0.136	4.08	1.71	0.608	382	56	115	37	558	14	14	7.0	102	32	13	140
	STDEV	0.352	0.160	0.069	1.65	0.825	0.429	1978	85	187	44	3340	15	20	1.32	62	18	8	77
	NUMBER	12	12	2	12	11	12	12	12	12	12	12	10	10	12	8	9	10	9
	COV	0.521	0.67	0.510	0.431	0.472	0.656	1.41	0.937	1.04	0.867	1.49	0.726	0.882	0.175	0.685	0.492	0.557	0.531
SPRING (April-May)	MEAN (geometric)	0.200	0.104	0.142	3.19	1.20	1.57	9	38	172	50	54	8	5	7.1	786	32	14	71
	MEAN (arithmetic)	0.266	0.120	0.185	3.59	1.25	1.80	35	43	239	65	63	8	6	7.2	1736	37	21	95
	MAX	1.10	0.274	0.686	8.16	2.14	4.68	438	96	913	170	147	13	15	9.2	4352	95	87	280
	MIN	0.064	0.037	0.061	1.34	0.858	0.578	2	16	51	17	23	3	3	6.3	160	20	3	20
	MEDIAN	0.150	0.105	0.142	2.90	1.11	1.35	8	40	169	47	52	8	5	6.9	697	28	15	69
	STDEV	0.244	0.070	0.168	1.93	0.368	1.05	101	21	213	48	35	3	4	0.9	2281	23	21	76
	NUMBER	19	15	14	17	13	18	18	18	19	19	15	14	8	17	3	10	18	18
	COV	0.919	0.579	0.909	0.538	0.295	0.581	2.90	0.493	0.889	0.749	0.565	0.316	0.670	0.123	1.31	0.629	1.01	0.800
SUMMER (June-August)	MEAN (geometric)	0.237	0.070	0.101	1.73	0.775	0.629	7	28	53	20	47	6	7	6.8	8418	24	13	61
	MEAN (arithmetic)	0.276	0.108	0.126	2.12	0.886	0.838	16	33	74	26	64	7	7	6.8	12975	24	26	75
	MAX	0.678	0.490	0.438	6.47	2.25	3.07	70	136	230	91	188	15	15	8.4	19863	30	150	280
	MIN	0.071	0.017	0.038	0.710	0.295	0.167	1	12	3	2	15	3	3	5.0	1733	21	3	22
	MEDIAN	0.239	0.054	0.109	1.58	0.641	0.589	5	24	68	21	44	5	6	6.7	17329	24	9	58
	STDEV	0.153	0.111	0.093	1.51	0.514	0.717	23	23	55	20	56	5	4	0.7	9818	3	34	57
	NUMBER	37	27	25	35	16	37	20	36	37	37	27	22	12	26	3	6	26	25
	COV	0.553	1.03	0.739	0.712	0.580	0.856	1.37	0.717	0.746	0.770	0.869	0.637	0.505	0.102	0.757	0.134	1.32	0.761
FALL (Sept-Nov)	MEAN (geometric)	0.186	0.043	0.061	1.24	0.989	0.446	5	33	51	22	59	8	9	6.9	3270	23	5	82
	MEAN (arithmetic)	0.195	0.051	0.068	1.47	1.09	0.503	10	36	70	26	83	9	10	6.9	3347	23	6	86
	MAX	0.271	0.113	0.132	3.51	1.76	1.03	42	70	219	50	233	12	13	7.6	4352	27	10	140
	MIN	0.098	0.022	0.037	0.531	0.638	0.170	1	18	14	8	23	5	6	6.3	2613	20	3	53
	MEDIAN	0.211	0.033	0.063	1.18	0.862	0.452	3	28	43	20	44	9	10	6.8	3076	23	5	77
	STDEV	0.058	0.037	0.038	0.974	0.594	0.259	14	17	64	14	86	3	5	0.4	901	3	3	28
	NUMBER	10	5	5	10	3	9	9	10	9	9	5	4	2	10	3	5	7	9
	COV	0.299	0.73	0.560	0.663	0.546	0.515	1.32	0.476	0.918	0.550	1.04	0.320	0.500	0.054	0.269	0.111	0.468	0.329

(blue) -highest concentration

(orange) -lowest concentration

COV= coefficient of variance.

Supporting Documents

Bannerman, R.T., D.W. Owens, R. Dodds, and P. Hughes. 1992. Sources of Pollutants in Wisconsin Stormwater. WI Dept. of Natural Resources, Madison, WI.

Walker, W. W., 1996. *Simplified Procedures for Eutrophication Assessment and Prediction: User Manual*. Instruction Report W-96-2, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

[End of Annual Report]

Stormwater Monitoring Results and Data Analysis

Appendix A

STORM DRAINAGE AREAS BY RECEIVING WATER BODY

Surface Water	Outfall	Total (acres)	Res. %	Comm. %	Ind. %	Public %	Open %	Rail %	Runoff Coeff.	Pop.
Mississippi River (Minneapolis)	10-xxx	18,077	0.53	0.16	0.16	0.04	0.07	0.04	0.46	263,400
Mississippi River (Columbia Heights)	10-100	348	0.48	0.11	0.33	0.00	0.08	0.00	0.37	2,765
Mississippi River (UofM)	15-xxx	100	0.00	0.00	0.00	1.00	0.00	0.00	0.55	0
Shingle Creek	20-xxx	1,365	0.62	0.17	0.06	0.03	0.04	0.07	0.44	11,493
Ryan Lake (Minneapolis)	21-xxx	49	1.00	0.00	0.00	0.00	0.05	0.00	0.45	388
Bassett Creek	40-xxx	2,293	0.58	0.12	0.13	0.03	0.08	0.05	0.44	26,756
New Bassett Creek Tunnel	41-xxx	219	0.22	0.26	0.26	0.04	0.10	0.11	0.45	669
Brownie Lake (Minneapolis)	51-xxx	34	0.99	0.00	0.01	0.00	0.00	0.00	0.45	193
Cedar Lake (Minneapolis)	52-xxx	224	0.79	0.01	0.00	0.00	0.17	0.03	0.38	1,674
Lake of the Isles	53-xxx	760	0.76	0.07	0.02	0.01	0.12	0.01	0.42	13,644
Lake Calhoun (Minneapolis)	54-xxx	1,249	0.69	0.11	0.03	0.10	0.07	0.00	0.46	13,640
Cemetary Lake	55-xxx	205	0.00	0.99	0.00	0.00	0.01	0.00	0.60	41
Sanctuary Pond	56-xxx	68	0.00	1.00	0.00	0.00	0.00	0.00	0.60	0
Lake Harriet	57-xxx	863	0.83	0.09	0.01	0.04	0.02	0.00	0.46	12,249
Hart Lake (Minneapolis)	61-xxx	3	0.32	0.68	0.00	0.00	0.00	0.00	0.55	0
Silver Lake (Minneapolis)	62-xxx	28	0.94	0.03	0.00	0.00	0.03	0.00	0.44	245
Crystal Lake (Minneapolis)	63-xxx	469	0.92	0.04	0.00	0.02	0.03	0.00	0.45	5,985
Legion Lake (Minneapolis)	64-xxx	49	1.00	0.00	0.00	0.00	0.00	0.00	0.45	332
Legion Lake (Richfield)	64-xxx	1,700	0.96	0.00	0.01	0.00	0.03	0.00	0.30	9,781
Richfield Lake (Minneapolis)	65-xxx	715	0.88	0.06	0.02	0.00	0.04	0.00	0.32	4,388
Richfield Lake (Richfield)	65-xxx	58	0.58	0.37	0.05	0.00	0.01	0.00	0.51	442
Wood Lake (Richfield)	66-xxx	627	0.75	0.05	0.02	0.00	0.18	0.00	0.29	7,316
Minnehaha Creek	70-xxx	3,213	0.85	0.07	0.01	0.04	0.03	0.00	0.44	38,399
Diamond Lake	71-xxx	685	0.72	0.11	0.09	0.03	0.05	0.00	0.47	6,456
Lake Nokomis	72-xxx	620	0.78	0.03	0.00	0.03	0.16	0.00	0.40	7,120
Taft Lake	73-xxx	100	0.76	0.00	0.00	0.00	0.24	0.00	0.37	675
Mother Lake (Minneapolis)	74-xxx	49	0.83	0.19	0.00	0.00	0.00	0.00	0.48	111
Mother Lake (Richfield)	74-xxx	245	0.71	0.09	0.00	0.00	0.20	0.00	0.30	2,025
Unnamed Wetland W of Mother Lake	75-xxx	41	0.91	0.00	0.00	0.00	0.00	0.09	0.41	344
Lake Hiawatha	76-xxx	1,008	0.87	0.07	0.02	0.03	0.02	0.00	0.46	14,707
Birch Pond	81-xxx	31	0.00	0.00	0.00	0.00	1.00	0.00	0.10	0
Powderhorn Lake	82-xxx	286	0.88	0.05	0.02	0.04	0.01	0.00	0.46	5,621
Grass Lake	83-xxx	386	0.90	0.04	0.00	0.05	0.02	0.00	0.46	4,128
Unnamed Wetland on Hwy 62	84-xxx	17	0.86	0.00	0.14	0.00	0.00	0.00	0.47	0
Unnamed Wetland on Ewing Ave S	85-xxx	22	0.86	0.00	0.14	0.00	0.00	0.00	0.47	0
GRAND TOTAL		**36,205**	**0.58**	**0.13**	**0.10**	**0.04**	**0.06**	**0.03**	**0.42**	**454,987**

Appendix A1 - Storm Drainage Areas by Receiving Water Body
Source: Minneapolis Public Works - Surface Water & Sewers

Appendix A-3: Sources of Pollutants in Stormwater Runoff[1]

	Coal Plants / Incinerators	Gasoline / Diesel Fuel Combustion	Metal Corrosion / Metal Protection	Road Salts	Deterioration of Brake Pads / Tires	Asphalt	Fertilizers / Pesticides / Soil Treatments	Wood Preservatives	Paints and Stains	Plastics	Soil Erosion	Sanitary Waste	Manufacturing	Animal Waste	Atmospheric Deposition	Grass Clippings, Leaves and other Plant Materials	Coal Tar Based Sealants for Parking Lots, Driveways
METALS																	
Copper [a, b]	X		X		X		X	X	X	X		X	X	X			
Lead [a]		X	X	X	X		X		X	X			X		X		
Zinc [a]			X	X	X		X		X	X			X	X			
OTHER POLLUTANTS																	
Arsenic [b]	X						X	X			X		X	X	X		
Bacteria: E. Coli [a]											X	X		X			
Cyanide		X	X	X					X	X		X					
Chloride, Total [a]	X	X		X						X		X		X			
Oil and Grease [a]		X			X	X							X				
Polycyclic Aromatic Hydrocarbons (PAH) [b]	X	X				X	X					X	X				X
Sulfate [a]	X	X				X			X	X		X		X	X		X
Volatile Organic Compounds (VOC)	X	X		X		X	X		X	X		X	X	X	X		
SEDIMENT AND OTHER SOLIDS																	
Total Dissolved Solids (TDS) [a]	X			X		X	X					X		X	X	X	
Total Suspended Solids (TSS) [a]	X		X	X	X	X	X			X	X	X	X	X	X	X	
NUTRIENTS																	
Nitrate / Nitrite [a]		X					X				X	X	X	X	X	X	
Nitrogen, Ammonia Un-Ionized [a]	X	X	X				X					X		X	X	X	
Nitrogen, Total Kjeldahl (TKN) [a]							X				X	X		X	X	X	
Phosphorus, Total [a]	X	X			X	X	X				X	X	X	X	X	X	
Phosphorus, Total Dissolved [a]	X	X					X				X	X		X	X	X	
LABORATORY ANALYSIS PARAMETERS																	
Biochemical Oxygen Demand (BOD_5) [a]							X				X	X		X	X	X	
pH [a]	X		X	X													

[a] MS4 Monitored Parameter
[b] Stormwater Pond Dredging Parameter

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[1] Sources:

Massachusetts Department of Environmental Protection, Source Water Assessment Program, DRAFT Land Use/Associated Contaminants Matrix, 1999

Mississippi Watershed Management Organization, 2006 Annual Report, Appendix C, Table 4

MPCA, Managing Dredged Materials in the State of Minnesota, Figure 2, 2009

Texas Commission on Environmental Quality (TCEQ) Source Water Assessment and Protection (SWAP) Program's List of Potential Source of Contamination Types and Subtypes Detailed Listing, Descriptions, and Applied Contaminants, 2009

APPENDIX A4

This year, material previously included as Appendix A4, NPDES Monitoring, is located in the Main Body of the Annual Report starting on page 62.

APPENDIX A5

This year, material previously included as Appendix A5, BMP Monitoring, is located in the Main Body of the Annual Report starting on page 82.

APPENDIX A6

This year, material previously included as Appendix A5, Monitoring of Minnehaha Creek at Xerxes Avenue, is located in the Main Body of the Annual Report starting on page 90.

CITY OF MINNEAPOLIS
STORMWATER MANAGEMENT ORDINANCE SUMMARY

Ordinance: On November 24, 1999 the Minneapolis City Council amended Title 3 of the Minneapolis Code of Ordinances, relating to Air Pollution and Environmental Protection, by adding Chapter 54, entitled "*Stormwater Management*". The Chapter 54 ordinance establishes requirements for projects with land disturbing activities on sites greater than one (1) acre, including phased or connected actions, and for existing stormwater devices.

Goals: The purpose of this ordinance is to minimize negative impacts of stormwater runoff rates, volumes and quality on Minneapolis lakes, streams, wetlands, and the Mississippi River by guiding future significant development and redevelopment activity, and by assuring long-term effectiveness of existing and future stormwater management constructed facilities. The Chapter 54 Ordinance specifies that stormwater management standards be set according to the receiving water body, and the table below lists discharge requirements by receiving water. The standards include but are not limited to:

- Reductions of suspended solids for Mississippi River discharges
- Controlled rate of runoff for discharges to streams, areas prone to flooding and areas with infrastructure limitations
- A reduction in nutrients for stormwater discharging to Minneapolis lakes and wetlands

Minneapolis Development Review: Stormwater Management Plans are required for all construction projects greater than 1 acre in size. These plans are reviewed through the "Minneapolis Development Review" process. Responsibility for ongoing operation and maintenance is one component of the Stormwater Management Plan.

Registration: Stormwater devices shall be registered with the City of Minneapolis Department of Regulatory Services, with an annual permit being required for each registered stormwater device.

Stormwater 'Buyout' for off-site management, in lieu of on-site treatment:
This option is reserved for only those sites that demonstrate that performance of on-site stormwater management is not feasible. With approval of the City Engineer, the Chapter 54 Ordinance allows developers to contribute to the construction of a regional stormwater facility in lieu of on-site treatment/management. Final plan approval is conditional on payment received.

For the complete text of the *Chapter 54 Ordinance* requirements, see the Minneapolis Storm and Surface Water Management web site:
http://www.ci.minneapolis.mn.us/stormwater/stormwater-management-for-projects/CHAPTER54Ordinance.pdf

CITY OF MINNEAPOLIS
STORMWATER MANAGEMENT ORDINANCE SUMMARY

Receiving Waters	Total Discharge Requirements
All receiving waters	70% removal of total suspended solids
Brownie Lake	10% phosphorus load reduction
Cedar Lake	40% phosphorus load reduction
Lake of the Isles	20% phosphorus load reduction
Lake Calhoun	30% phosphorus load reduction
Lake Harriet	20% phosphorus load reduction
Powderhorn Lake	30% phosphorus load reduction
Lake Hiawatha	42% phosphorus load reduction
Lake Nokomis	25% phosphorus load reduction
Loring Park Pond	0% phosphorus load increase
Webber Pond	0% phosphorus load increase
Wirth Lake[1]	30% phosphorus load reduction
Spring Lake	30% phosphorus load reduction
Crystal Lake[2]	30% phosphorus load reduction
Diamond Lake	30% phosphorus load reduction
Grass Lake	30% phosphorus load reduction
Birch Pond	0% phosphorus load increase
Ryan Lake	30% phosphorus load reduction
Other wetlands	30% phosphorus load reduction
Mississippi River	70% removal of total suspended solids
Minneapolis streams	No increase in rate of runoff from site

[1] Wirth Lake is not within the limits of the City of Minneapolis
[2] Crystal Lake in located in Robbinsdale, but receives run-off from Minneapolis

City of Minneapolis

Fire Inspection Services

Spill Response Protocol

1) Report to the State Duty Officer/911 Emergency Communications.

2) Assessment of the site/incident, determination of Incident Action Plan (IAP).

3) Secure appropriate City/ State/ Federal resources, as well as private contractors, for implementation of IAP.

4) Oversight of site incident remediation and recovery activities.

5) Investigation/determination of causation, potential penalties, and future prevention measures.

Source: Minneapolis Emergency Preparedness
February 2009

CITY OF MINNEAPOLIS
PUBLIC WORKS DEPARTMENT
Street Maintenance Division
Standard Operating Procedure for Vehicle Related Spills (VRS)
May, 2014

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

DEFINITION of TERMS

FIS: Fire Inspection Services (also historically known as Minneapolis Environmental Management or Minneapolis Pollution Control)

MPCA: Minnesota Pollution Control Agency

MSMD: Minneapolis (Public Works) Street Maintenance Division

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 chemical or material in any quantity is reportable.

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

Scenario Number 1: MPCA informs FIS of VRS

The driver of a vehicle involved in a spill is responsible for notifying the MPCA Duty Officer, if the VT is exceeded. The Duty Officer will immediately notify the MPCA Emergency Response Unit. If the spill is of the size and nature that the Emergency Response Unit determines should be handled by FIS, the MPCA will notify FIS and provide them with the details relating to the spill incident. The FIS representative will make a determination based on the information provided by the MPCA on how to proceed, and if appropriate (typically VRM in manageable quantities), contacts MSMD.

The MSMD will dispatch personnel with appropriate equipment to apply sand to the spill site. The sand will be given a period of time in which to absorb the VRM. The sand (spill debris) will then be removed by means of a street sweeper, and deposited at the established disposal site in a designated VRM spill debris pile. If a secondary sanding is required, the procedure will remain the same. Since the volume of the spill is greater than 5 gallons, a Hazardous Material Spill Data form (see Appendix A) 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 as soon as possible. A final report on the action(s) taken will be sent to the MPCA from FIS.

Spill Debris Pile Management

Arrangements for disposal of the spill debris pile will be a collaborative effort by the MSMD and the Engineering Laboratory. As the spill debris pile reaches a size that becomes difficult to manage within the boundaries of the disposal site, the Engineering Laboratory will be contacted. The spill debris pile will be mechanically blended and the Laboratory will select representative samples for laboratory analysis, as required by 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 Number II: The MSMD discovers a VRS

MSMD personnel discover a spill or are informed of a potential VRM spill from sources other than FIS or MPCA. After arriving at the scene, they will determine whether the incident is a VRM spill, (possibly from a vehicle collision, a spill from a labeled container, etc.) and will determine if the volume of the spill is greater than the VT (5 gallons).

- <u>Less than 5 gallons:</u> If the spill quantity is judged to be less than 5 gallons, no contact with FIS is necessary. Sand will be 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, <u>but is not to be sent to FIS.</u>

- <u>5 gallons or more:</u> If the MSMD representative determines that a volume of 5 gallons or more of VRM has been spilled, MSMD must contact FIS or MPCA. The same procedures for cleanup and reporting (using the Hazardous Material Spill Data form) as in Scenario I will be followed. This form <u>must</u> be sent to FIS.

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

Potential Modification 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 Number III: The MSMD becomes aware of a spill of unknown material or composition

The MSMD shall contact 911 before taking any action to clean up a spill of unknown composition. FIS 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 cannot be contacted, the MPCA Duty Officer should be contacted immediately.

ADDITIONAL INFORMATION

1. Currently the disposal site for spill debris is at the Linden Yards site. The material shall be placed in two 20 cubic-yard leak-proof roll-off containers with counter-balanced lockable lids at the City Site.

2. List of Potential Contacts:

    - **Minnesota Pollution Control Agency (MPCA)**
      Duty Officer: 651-649-5451; 24 hours a day, seven days a week
    - **Fire Inspection Services (FIS)**
      Steve Kennedy: 612-685-8528 (work)
      Tom Frame: 612-673-8501 (work)
      Emergency after-hours contacts:
      Steve Kennedy 612-685-8528
    - **Engineering Laboratory**
      Paul Ogren: 612-673-2456
      Stephanie Malmberg: 612-673-3365
    - **Minneapolis Street Maintenance Division (MSMD)**
      Steve Collin: 612-673-5720 (work)
      Rick Jorgensen: 612-673-5720 (work)
      24 hours a day, 7 days a week: 612-673-5720

3. MSMD will be responsible for any billing of outside parties for services rendered for the cleanup/disposal of a spill event. The MSMD, FIS and the Engineering Laboratory will develop a system for tracking cost 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

DATE OF REPORT	TIME OF REPORT	NAME & ADDRESS OF RESPONSIBLE PARTY
DATE OF INCIDENT	TIME OF INCIDENT	
TYPE OF POLLUTANT	QUANTITY	CAUSE OF SPILL
PRECISE LOCATION		PERSON MAKING REPORT/PHONE NUMBER
AREAS AFFECTED		PARTY REPORTING SPILL TO STREET DEPT.
PROBABLE FLOW DIRECTION	SOIL TYPE	OTHERS CONTACTED: FIS________________________ MPCA________________________ FIREDEPT________________________ POLICE________________________ OTHER
WATERS POTENTIALLY AFFECTED		
EFFECTS OF SPILL/ IMMEDIATE DANGER TO HUMAN LIFE, PROPERTY		PROXIMITY OF WELLS, SEWER, BASEMENTS
ACTION TAKEN TO DATE		IS THIS FIRST NOTICE REGARDING SPILL?
CONTAINMENT OF SPILL		WHO SHOULD BE CONTACTED FOR FURTHER INFORMATION? PHONE NO.
CLEAN-UP TO DATE: MATERIAL USED____________________ LOADER USED____________________ TRUCKS USED____________________ PICK-UP TRUCK USED______________ MACHINE SWEEPER USED____________ LABOR: FOREMAN HOURS____________ MAINT CREW LEADER ____________ CONST LABORER____________ OTHER____________________		COMMENTS?

ORIGINAL: When job completed, send immediately to Street Accounting.
COPY 1 : Send to Street Accounting with daily time when labor/eq. first used.
COPY 2 : PCA NOTIFICATION COPY - send immediately(first available interoffice mailing) to Steve Kennedy, FIS – Environmental Management, PSC, Room 401

STREET JOB#____________

LABOR COST $____________
EQUIP COST $____________
MAT'L COST $____________
TOTAL COST$____________

Grit ID	Location	Date Inspected	Floatables Y/N	Volume Of Sediment Removed	Date Cleaned
1	UPTON AVE N & 53RD AVE N	4/17/14	N	0.333	4/17/14
2	UPTON AVE N & 53RD AVE N	4/17/14	N	0.333	4/17/14
3	SHERIDAN AVE N, N OF 52ND AVE N	6/18/14	Y	5	6/18/14
4	RUSSELL AVE N NORTH OF 52ND AVE N	4/17/14	N	0.333	4/14/14
5	PENN AVE N & 52ND AVE N	5/29/14	N	1	5/29/14
6	PENN AVE N & 52ND AVE N	5/28/14	N	1	5/28/14
7	OLIVER AVE N & 52ND AVE N	5/28/14	N	1	5/28/14
8	NEWTON AVE N & SHINGLE CREEK	5/28/14	N	1	5/28/14
9	OLIVER AVE N & 51ST AVE N	5/28/14	N	1	5/28/14
10	MORGAN AVE N & 51ST AVE N	5/29/14	N	1	5/29/14
11	KNOX AVE N & 51ST AVE N	9/29/14	Y	2	9/29/14
12	KNOX AVE N & 50TH AVE N	6/18/14	Y	3	6/18/14
13	IRVING AVE N & 50TH AVE N	5/29/14	N	1	5/29/14
14	JAMES AVE N, NORTH OF 49TH AVE N	5/29/14	N	1	5/29/14
15	21ST AVE N & 1ST ST N	8/23/14	Y	20	8/23/14
16	XERXES AVE N & 14TH AVE N	10/21/14	N	36	10/22/14
17	XERXES AVE N & GLENWOOD AVE	6/11/14	Y	3	6/11/14
18	MORGAN AVE N & CHESNUT AVE	6/6/14	Y	2	6/6/14
19	GIRARD AVE NO & CURRIE AVE NO				
20	BRIDAL VEIL TUNNEL OUTLET				
21	LAKE OF THE ISLES PKWY & LOGAN AVE				
22	W 22ND ST & JAMES AVE S				
23	YARD SUMPS, 26TH & HIAWATHA				
24	DREW AVE S & W LAKE ST				
25	EXCELSIOR BLVD & MARKET PL	10/21/14	N	10	10/21/14
26	W LAKE ST & ALDRICH AVE S	6/26/14	Y	1	6/26/14
27	W 32ND ST & BRYANT AVE S	7/2/14	Y	3	7/2/14
28	W 33RD ST & HOLMES AVE S	10/27/14		14	10/28/14
29	W 33RD ST & GIRARD AVE S	10/20/14	N	20	10/21/14
30	YORK AVE S & W LAKE CALHOUN PARKWAY	10/30/14	Y	0.5	10/30/14
31	CHOWEN AVE S & W 41ST ST				
32	E 42ND ST & BLOOMINGTON AVE S				
33	E 43RD ST & PARK AVE S				

34	W 44TH ST & LAKE HARRIET PARKWAY				
35	E 44TH ST & OAKLAND AVE S	10/29/14	N	4	10/29/14
36	E 46TH ST & 31ST AVE S				
37	46TH AVE S & GODFREY RD				
38	W 47TH ST & YORK AVE S	8/7/14	N	1	8/7/14
39	W 47TH ST & WASHBURN AVE S	8/7/14	N	1	8/7/14
40	W 47TH ST & LAKE HARRIET PARKWAY				
41	W 48TH ST & YORK AVE S	10/29/14	N	1	10/25/14
42	QUEEN AVE S & LAKE HARRIET PARKWAY	10/15/14		49	10/17/14
43	16TH AVE S & E MINNEHAHA PKWY				
44	SHERIDAN AVE S & W 50TH ST	9/19/14	N	3	9/19/14
45	JAMES AVE S & MINNEHAHA CREEK				
46	MORGAN AVE S & W 53RD ST				
47	E 55TH ST & PORTLAND AVE S	8/1/14	N	1	8/1/14
48	E 56TH ST & PORTLAND AVE S	8/4/14	N	1	8/4/14
49	E 57TH ST & PORTLAND AVE S	8/5/14	N	6	8/5/14
50	E 57TH ST & PORTLAND AVE S				
51	GIRARD AVE S BETWEEN W 59TH ST & W 60TH ST				
52	E 59TH ST & 12TH AVE S				
53	GIRARD AVE S & W 60TH ST	6/25/14	N	1	6/25/14
54	GIRARD AVE S, W 60TH ST - DUPONT AVE S				
55	GRASS LAKE TERRACE, GIRARD TO JAMES AVE S				
56	GRASS LAKE SERVICE ROAD BEHIND #6035 JAMES AVE S	6/25/14	N	1	6/25/14
57	GRASS LAKE SERVICE ROAD BEHIND #6077 JAMES AVE S	6/25/14	N	1	6/25/14
58	GRASS LAKE SERVICE ROAD BEHIND #1416 W 61ST ST	6/25/14	N	1	6/25/14
59	W 61ST ST & GRASS LAKE SERVICE ROAD	5/29/14	N	1	5/29/14
60	IRVING AVE S & W 61ST ST				
61	E RIVER RD & CECIL ST				
62	HIAWATHA PARK REFECTORY TURN-A-ROUND	8/28/14	Y	2	8/28/14
63	33RD AVE N & 1ST ST N/RAILROAD TRACKS	7/24/14	N	0	7/24/14
64	26TH AVE N & PACIFIC (N TRANSFER STATION)	6/24/14	N	0	6/24/14
65	SOUTH TRANSFER STATION				
66	MAPLE PLACE & EAST ISLAND AVE	5/21/14	N		
67	DELASALLE DR & E ISLAND	5/21/14	N		
68	W ISLAND - 300' S OF MAPLE PLACE	5/21/14	N		
69	EASTMAN AVE & W ISLAND	5/21/14	N		
70	ROYALSTON & 5TH AVE N				
71	THE MALL & E LAKE OF THE ISLES				
72	S OF 37TH AVE NE & ST ANTHONY PKWY	5/21/14	N		
73	4552 KNOX AVE N (IN ALLEY BEHIND)	6/11/14	N	1	6/11/14

74	STEVENS AVE S 300' S OF MINNEHAHA CREEK				
75	IRVING AVE N (IMPOUND LOT)				
76	MARKET PLAZA & EXCELSIOR BLVD	10/21/14	N	7	10/22/14
77	ALLEY - 38TH TO 39TH ST & NICOLLET TO BLAISDELL AVE	8/12/14	N	2	8/12/14
78	SHINGLE CREEK WETLAND - W SIDE	6/13/14	Y	10	6/17/14
79	SHINGLE CREEK WETLAND - EAST SIDE	6/12/14	Y	8	6/17/14
80	WOODLAWN BLVD & E 50TH ST	8/28/14	Y	4	8/28/14
81	WOODLAWN BLVD & E 53RD ST				
82	12TH AVE S & POWDERHORN TERRACE				
83	13TH AVE S & POWDERHORN TERRACE				
84	3421 15TH AVE S (180' W OF CL)	7/22/14	Y	1	7/22/14
85	3329 14TH AVE S	7/22/14	N	1	7/22/14
86	13TH AVE S & E 35TH ST				
87	3318 10TH AVE S				
88	ACROSS THE STREET FROM 702, NO. BD. VAN WHITE BLVD.	5/27/14	Y	0.333	5/27/14
89	ACROSS THE STREET FROM 706, NO. BD. VAN WHITE BLVD.	5/27/14	Y	0.5	5/27/14
90	10TH AVE. NO. & ALDRICH AVE. NO. (S.W.C.)	5/28/14	Y	1	5/28/14
91	SO. BD. VAN WHITE BLVD., 200' SO. OF 8TH AVE. NO.	5/28/14	Y	0.333	5/28/14
92	ACROSS THE STREET FROM 701, SO. BD. VAN WHITE BLVD.	5/27/14	Y	3	5/27/14
93	SO. BD. VAN WHITE BLVD., 250' SO. OF 10TH AVE. NO	5/29/14	Y	3	5/29/14
94	10TH AVE. NO. & NO. BD. VAN WHITE BLVD. (S.W.C.)	5/29/14	Y	3.5	5/29/14
95	WEST SIDE OF ALDRICH AVE. NO. & 9TH AVE. NO.	6/3/14	Y		6/3/14
96	8TH AVE. NO. & NO. BD. VAN WHITE BLVD. (N.E.C.)	5/28/14	Y	4	5/28/14
97	29TH AVE. & LOGAN AVE. - NO. STORM WATER DET. POND (E & W)	4/22/14	Y	2	4/22/14
		10/30/14	Y	7	10/30/14
98	MALMQUIST LN. & HUMBOLDT NO.	6/12/14	N	2	6/12/14
99	SHINGLE CREEK DR. & HUMBOLDT NO.				
100	SO. OF 49TH AVE. NO. & HUMBOLDT NO.				
101	NO. OF 49TH AVE. NO. & HUMBOLDT NO.	6/18/14	Y	4	6/18/14
		10/24/14	Y	10	12/24/14
102	28TH ST. E. & HIAWATHA * MNDOT HIAWATHA				
103	E. LAKE ST. & HIAWATHA * MNDOT HIAWATHA				
104	NAWADAHA LN./SERVICE RD. & HIAWATHA * MNDOT HIAWATHA				
105	MINNEHAHA PARKWAY (NO. SIDE) S.B. LANE * MNDOT HIAWATHA				
106	E. 50TH ST. (SW COR) & HIAWATHA * MNDOT HIAWATHA				
107	E. 54TH ST. & RIVERVIEW RD. * MNDOT HIAWATHA RE-ROUTE				
108	ALLEY SUMP MH WEST OF COLUMBUS AVE S & E 37TH ST - no as-builts				
109	22ND AVE N AND W RIVER ROAD				
110	W. CALHOUND PARKWAY 100' NO. OF RICHFIELD RD.	10/30/14	Y	2	10/30/14
111	RICHFIELD RD. NEAR W. CORNER OF THE PARKING LOT	10/30/14	Y	2	10/30/14
112	W. 36TH ST. 30' W. OF CALHOUN PARKWAY	10/21/14	Y	1	10/31/14
113	20' EAST OF VAN WHITE MEM. BLVD (N.B.) AND 5TH AVE N (1016 - 5TH AVE N)	6/6/14	Y	4	6/6/14

114	DUPONT AVE. NO. & 4TH AVE. NO.				
115	VAN WHITE MEM. BLVD (S.B.) AND 4TH AVE N	6/4/14	Y	2	6/4/14
116	400' NORTH (60' INTO POND) VAN WHITE MEM. BLVD (S.B.) AND 4TH AVE N	6/6/14	Y	1	6/6/14
117	300' NORTH (WEST SIDE) OF VAN WHITE MEM. BLVD (S.B.) AND 4TH AVE N	6/4/14	Y	1	6/4/14
		6/12/14	Y	4	6/12/14
118	200' NORTH (POND SIDE) OF VAN WHITE MEM. BLVD (S.B.) AND 10TH AVE N	6/3/14	Y	4	6/3/14
119	11TH AVE N AND VAN WHITE BLVD (N.B.)	6/12/14	Y	1	6/12/14
120	VAN WHITE MEM. BLVD (S.B.) (160' so. of fremont ave. no. on the e. side of the street)	6/10/14	Y	0.33	6/10/14
121	50' NORTH (EAST SIDE) OF VAN WHITE MEM. BLVD (S.B.) AND FREMONT AVE N	6/10/14	Y	1.5	6/10/14
122	MINNEHAHA PARKWAY @ 39TH AVE S N SIDE OF PKWY				
123	COLUMBUS AVE S SOUTH OF E 37TH ST REROUTE - no as-builts	8/13/14	N	2	8/13/14
124	COLUMBUS AVE S - CHICAGO AVE S ALLEY - no as-builts	8/13/14	N	2	8/13/14
125	COLUMBUS AVE S ACROSS FROM #3644 - no as-builts	8/14/14	N	3	8/14/14
126	E 37TH ST AND COLUMBUS S # 3640 COLUMBUS - no as-builts	8/13/14	N	2	8/13/14
127	E 37TH ST AND COLUMBUS S # 3700 COLUMBUS - no as-builts				
128	W 27TH ST AND LAKE OF THE ISLES PKWY - no as-builts				
129	YARD SUMPS, 26TH AND HIAWATHA				
130	YARD SUMPS, 26TH AND HIAWATHA				
131	YARD SUMPS, 26TH AND HIAWATHA				
132	YARD SUMPS, 26TH AND HIAWATHA				
133	ALLEY DRY WELL, BETWEEN HUMBOLDT/IRVING AVE S AND W 25TH ST/26TH ST, no as-builts	8/14/14	N	2	8/14/14
134	W 22ND ST @ E LAKE OF THE ISLES BLVD, no as-builts				
135	CHICAGO AVE S BETWEEN WASHINGTON AVE S AND 2ND ST S - no as-builts				
136	111 22ND AVE N (ALLEY BETWEEN 1ST ST N AND 2ND ST N AT VACATED 21ST AVE N)	6/9/14	Y	0.5	6/9/14
137	W 44TH ST @ LAKE HARRIET PKWY EAST (Installed on existing 54" Concrete Pipe)				
138	EWING AVE S BETWEEN W. FRANKLIN AVE AND W 22ND ST - Pending as-built info				
139	EWING AVE S @ W FRANKLIN AVE - Pending as-built info	6/9/14	Y	1	6/9/14
140	E LAKE ST WEST OF 14TH AVE S (Hennepin County const. Lake St.)				
141	W LAKE ST EAST OF 14TH AVE S (Hennepin County const. Lake St.)				
142	18TH AVE S SOUTH OF E LAKE ST (Hennepin County const. Lake St.)				
143	LONGFELLOW AVE S SOUTH OF E LAKE ST (Hennepin County const. Lake St.)				
144	31ST AVE S NORTH OF E LAKE ST (Hennepin County const.. Lake St.)				
145	CEDAR AVE S AND E MINNEHAHA PARKWAY (20' S. of S. curb of Minnehaha & 5' W. of W. curb of Cedar)				
146	E LAKE ST AND 46TH AVE S 12' W OF THE W CURB AND 9' SO OF THE N CURB ON LAKE ST (added 10/31/07) (service pending)				
147	E LAKE ST AND 47TH AVE S 6' S OF THE N CURB ON LAKE ST AND 1' W OF THE W CURB ON 47TH AVE EXTENDED (added 10/31/07) (service pending)				
148	E LAKE ST AT 42ND AVE S (8.4' W of the E curb on 42nd St and 38' N of the N curb on Lake St) (Hennepin Co. Construction) (added 11/1/07) (service pending)				
149	W 44TH ST AND ALDRICH AVE S SWC				
150	W RIVER ROAD AND 23RD AVE N				
151	DIAMOND LK RD & CLINTON AVE S	6/9/14	Y	1	6/9/14
152	3RD AVE. SO. & 2ND ST. S.	6/13/14	Y	1	6/13/14
153	PLEASANT AVE & W LAKE ST	8/19/14	Y	2	8/19/14

154	W LAKE ST AND DUPONT AVE S	8/18/14	Y	4	8/18/14
155	W LAKE ST AND BLAISDELL AVE S	8/19/14	Y	7	8/20/14
156	W 43RD ST & E LAKE HARRIET PARKWAY				
157	STEVENS AVE S & DIAMOND LK RD				
158	E 61ST ST & COLUMBUS AVE S	6/26/14	Y	1.5	6/26/14
159	2ND AVE N & 7TH ST N (Target Center)	6/5/14	Y	0.5	6/5/14
160	2ND AVE N & 6TH ST N	6/11/14	Y	1	6/11/14
161	3RD AVE N & WASHINGTON AVE N	6/4/14	Y	1	6/4/14
162	DOWLING AVE N & OLIVER AVE N	6/5/14	Y	1	6/5/14
163	PLYMOUTH AVE N & WEST SIDE OF RIVER	6/4/14	N	0.3	6/4/14
164	PLYMOUTH AVE N & EAST SIDE OF RIVER	6/4/14	N	0.3	6/4/14
165	1409 Washington Ave N	6/4/14	Y	1	6/4/14
166	Thomas Ave S & Dean Pkwy to Kenilworth Lagoon (Lake of the Isles) (Burka- plan sheet only)				
167	E River Rd north of Washington Ave SE (CCLRT) no information on file per Lois E 11/15/2013				
168	Dowling Ave N Alley Drain between Morgan Ave N and Newton Ave N				
169	Dowling Ave N Alley Drain between Newton Ave N and Oliver Ave N				
170	Dowling Ave N at Oliver Ave N				
171	Newton Ave N at Dowling Ave N sump MH	6/24/14	Y	1	6/24/14
	New Van White Blvd Bridge				

Body of Water	Outfall_ID	Location	Inspection Date	Structure Type	Outfall Pipe Size	Material Type
Shingle Creek	20-050	Newton Ave N	17-Jun-14	Concrete Apron	0	RCP
Shingle Creek	20-080	50th Ave N (Knox Ave N)	17-Jun-14	Concrete Apron	0	RCP
Shingle Creek	20-140	47th Ave N (Shingle Crk Pkwy)	17-Jun-14	Pipe	12	CMP
Shingle Creek	20-140A	47th & Humboldt Bridge (westside)	17-Jun-14	Concrete Apron	0	RCP
Mississippi 1	10-040	49th Ave. N	27-Aug-14	Head Wall	78	RCP
Mississippi 1	10-030	49th Ave N.	28-Aug-14		0	
Mississippi 1	10-020	51st Ave. N (Mississippi Ct.)	28-Aug-14	Pipe	48	CMP
Mississippi 1	10-015	53rd Ave N	28-Aug-14	Pipe	30	CMP
Mississippi 1	10-010	53rd Ave N.	28-Aug-14	Head Wall	60	RCP
Mississippi 1	10-050	46th Ave N (I-94)	28-Aug-14		0	
Mississippi 1	10-070	41st Ave N & Sooline R.R. (sanitary overflow)	28-Aug-14	Head Wall	72	RCP
Mississippi 1	10-055	water plant outfall	28-Aug-14	Box Culvert	0	
Mississippi 1	10-060	St. Anthony Pkwy & 36th Ave NE	28-Aug-14	CMP Apron	15	CMP
Mississippi 1	10-055A	Under Camden bridge East bank	28-Aug-14	Pipe	21	DIP
Mississippi 1	10-120B	Approx. 33rd Ave N (At River)	17-Sep-14	Head Wall	72	RCP
Mississippi 1	10-120A	Approx. 34th Ave N	17-Sep-14	Pipe	60	CMP
Mississippi 1	10-010	St Anthony Pkwy-N of Soo Line RR	17-Sep-14	Concrete Apron	48	RCP
Mississippi 1	10-080	1st St. N approx. 39th Ave N	25-Sep-14	CMP Apron	36	CMP

Appendix A36
Outfall Inspections
Source: Minneapolis Public Works - SWS Operations

Mississippi 1	10-170	30th Ave N (Mill St Extended)	25-Sep-14		0	w
Mississippi 1	10-160	31st Ave N (Pacific St N)	15-Oct-14	Head Wall	48	RCP
Mississippi 1	10-140B	Lowry Ave NE (At River) South	15-Oct-14	Head Wall	36	RCP
Mississippi 1	10-090C	37th Ave N (Sooline R.R.)	15-Oct-14	Pipe	24	CMP
Mississippi 1	10-110	Dowling Ave N (At River)	15-Oct-14	Pipe	60	RCP
Mississippi 1	10-080	1st St. N approx. 39th Ave N	15-Oct-14	CMP Apron	48	
Mississippi 1	10-090A	39th Ave N (At River)	15-Oct-14	Pipe	15	CMP
Mississippi 1	10-100	Marshall St (31st Ave NE)	15-Oct-14		102	CMP
Mississippi 1	10-150	Marshall St NE (Lowry Ave NE)	15-Oct-14	Concrete Apron	60	RCP
Mississippi 1	10-200	Marshall St NE (18th Ave NE)	15-Oct-14	Concrete Apron	36	RCP
Mississippi 1	10-210	26th Ave N (Mill St N)	15-Oct-14	Concrete Apron	60	RCP
Mississippi 1	10-220	22nd Ave N	15-Oct-14	Concrete Apron	48	RCP
Mississippi 1	10-230	21st Ave N	15-Oct-14	Pipe	0	CMP
Mississippi 1	10-240	West Broadway	15-Oct-14	Concrete Apron	0	
Mississippi 1	10-250	12th Ave NE (Vacated)	15-Oct-14		60	CMP
Mississippi 1	10-260	17th Ave N	15-Oct-14	CMP Apron	24	CMP
Mississippi 1	10-270	10th Ave NE	15-Oct-14		0	
Mississippi 1	10-280	14th Ave (extended)	15-Oct-14	CMP Apron	48	CMP
Mississippi 1	10-290	Plymouth Ave N	15-Oct-14	Concrete Apron	48	RCP

Mississippi 1	10-300	8th Ave NE	15-Oct-14	Head Wall	0	RCP
Mississippi 1	10-340	W River Pkwy at 1st Ave N (extended)	16-Oct-14	Concrete Apron	36	RCP
Mississippi 1	10-330	W River Pkwy approx. 500' SE of 4th Ave N	16-Oct-14		0	
			16-Oct-14		0	
Mississippi 1	10-310	Ramsey St NE (extension)	16-Oct-14	Concrete Apron	36	RCP
Mississippi 1	10-315A	E Island Ave & Maple Pl (Extended)\	16-Oct-14		0	
Mississippi 1	10-485	West River Road 100' S of Washington Ave	21-Oct-14	Concrete Apron	15	RCP
Mississippi 1	10-460	Approx 230' S of RR bridge across from 10-465	21-Oct-14	Concrete Apron	92	RCP
Mississippi 1	10-450A		21-Oct-14	Head Wall	27	RCP
Mississippi 1	10-450	Approx 140' E of 10th Ave SE bridge across Miss R, N bank	21-Oct-14		0	
Mississippi 1	10-462		21-Oct-14	Concrete Apron	24	RCP
Mississippi 1	10-465	West River Pkwy @ RR Bridge	21-Oct-14		0	
			21-Oct-14		0	
Mississippi 1	10-490	West River Road @ 4th St S	21-Oct-14	Concrete Apron	48	RCP
Mississippi 1	10-450	Approx 140' E of 10th Ave SE bridge across Miss R, N bank	21-Oct-14	CMP Apron	92	CMP
Mississippi 1	10-501A		21-Oct-14	Head Wall	12	RCP
Mississippi 1	10-501B		21-Oct-14	Head Wall	12	RCP
Mississippi 1	10-501C		21-Oct-14	Head Wall	0	
Mississippi 1	10-510	West River Road @ 27th Ave S (extended)	21-Oct-14		0	

Mississippi 1	10-515B		21-Oct-14	Head Wall	24	RCP
Mississippi 1	10-515C		21-Oct-14	Head Wall	24	RCP
Mississippi 1	10-540	West River Road @ I-94	21-Oct-14	Head Wall	36	RCP
Mississippi 1	10-570A	West River Road @ 33rd Ave S	21-Oct-14	Box Culvert	0	
Mississippi 1	10-630A	West River Rd @ 28th Ave S (extended)	21-Oct-14	Concrete Apron	0	RCP
Mississippi 1	10-640	W River Pkwy at E Lake St	21-Oct-14	Head Wall	0	RCP
Mississippi 1	10-660	W River Pkwy at E 33rd St	21-Oct-14	Pipe	120	CMP
Mississippi 1	10-680	W River Pkwy at E 38th St	21-Oct-14		0	RCP
Mississippi 2	10-700	W River Pkwy at E 44th St	21-Oct-14	Concrete Apron	60	RCP
Mississippi 2	10-700A	W River Pkwy 250' S of E 45th St	21-Oct-14	Pipe	36	RCP
Mississippi 2	10-710	W River Pkwy 250' S of E 46th St	21-Oct-14		0	
Mississippi 1	10-5058	UOFM Boat launch	24-Oct-14	Concrete Apron	18	RCP
Mississippi 1	10-502		24-Oct-14	Head Wall	30	CMP
Mississippi 1	10-520	U of M Outfall	24-Oct-14	Head Wall	30	RCP
Mississippi 1	10-520A	30' south of 10-520	24-Oct-14	Pipe	15	CMP
Mississippi 1	10-530	Oak St SE	24-Oct-14	Box Culvert	0	RCP
Mississippi 1	10-560A	E River Rd @ I-94 (S of bridge)	24-Oct-14	Head Wall	0	RCP
Mississippi 1	10-560B	26th Ave SE Bridal Vail Creek Tunnel	24-Oct-14	Head Wall	0	RCP
Mississippi 1	10-570B		24-Oct-14	CMP Apron	36	CMP

Mississippi 1	10-605A		24-Oct-14	Pipe	12	CMP
Mississippi 1	10-605B		24-Oct-14	Pipe	12	VCP
Mississippi 1			24-Oct-14	Pipe	46	PVC
Mississippi 1	10-610	East City Limits	24-Oct-14		0	
Mississippi 1	10-670	W River Pkwy at E 36th St	24-Oct-14	Head Wall	48	RCP
Mississippi 2	10-690	W River Pkwy at E 42nd St	24-Oct-14	Pipe	27	CMP
Mississippi 1	10-330	W River Pkwy app.. 500' SE - 4th Ave N	24-Oct-14	Pipe	0	RCP
Mississippi 1	40-030		24-Oct-14		0	

Introduction:
The federal Clean Water Act requires states to adopt water quality standards to protect waters from pollution. The goal is to protect high-quality waters and improve the quality of impaired waters, so that beneficial uses (such as fishing, swimming and protection of aquatic life) are maintained and restored, where these uses are attainable. *Adapted from MPCA 12/2011 Guidance Manual for Assessing the Quality of Minnesota Surface Waters.*

The process includes the following steps: Assess waters, Determine whether impaired, Place water on the impaired list, Monitor and study the water body, Complete a pollutant load allocation formula (called a "Total Maximum Daily Load", or TMDL), Develop a restoration strategy, Implement the strategy, Monitor changes in water quality, and then De-list if standards are being achieved, or Determine next steps. The list of impaired water bodies, or 303(d) List, is updated every two years.

City of Minneapolis TMDL Status

Name of Surface Water (includes lakes, creeks, wetlands and Mississippi River). Alphabetical order. * indicates waterbody is not in Minneapolis.	Receives Minneapolis municipal stormwater runoff?	State ID	Next-in-line Receiving Water	Status of Impairment and TMDL Study
BASSETT CREEK	yes (and from upstream municipalities)	07010206-538	Mississippi River ("new" tunnel designed for 1,000 cfs, "old" tunnel obligated to be available for additional 50 cfs)	1) FISHES BIOASSESSMENTS (listed 2004) - TMDL study not started yet, may be reassessed. 2) BACTERIA (listed 2008) - TMDL approved Nov. 2014 (metro-wide). 3) CHLORIDE (listed 2010) - TMDL study underway (metro-wide).
BASSETT'S POND (Part of Bassett Creek. Located in City of Golden Valley, in Wirth Park owned and managed by Minneapolis Park & Recreation Board)	yes	27-0036	Bassett Creek	No impairments.
BIRCH POND	yes (portion of southbound Wirth Parkway)	27-0653	Landlocked (historic pumping to Chain of Lakes)	No impairments.
BROWNIE LAKE	yes (and from City of Saint Louis Park)	27-0038	Cedar Lake	1) MERCURY IN FISH TISSUE (listed 1998) - Statewide TMDL approved 2008, not stormwater-related, no MS4 responsibilities, target completion 2025. 2) EXCESS NUTRIENTS (listed 2004) - **DE-LISTED** 2010 (could be listed again if TP rises again). 3) CHLORIDE (listed 2014) - TMDL study underway metro-wide, target TMDL completion 2015.
CEDAR LAKE	yes (and from City of Saint Louis Park)	27-0039	Lake of the Isles	1) MERCURY IN FISH TISSUE (listed 1998) - Statewide TMDL approved 2008, not stormwater-related, no MS4 responsibilities, target completion 2025.
CEMETERY LAKE	no	27-0017	Lake Calhoun	No impairments.
CRYSTAL LAKE * (Located in Robbinsdale)	yes (and from City of Robbinsdale)	27-0034	Shingle Creek	1) EXCESS NUTRIENTS (listed 2002) - TMDL Study approved 2009, in implementation stage.
DIAMOND LAKE	yes	27-0022	Minnehaha Creek	1) Was formerly listed for EXCESS NUTRIENTS, but removed from list in 2008 because it was determined to be a wetland (or game lake) that had been mischaracterized by DNR as a lake. There are no nutrient standards for wetlands at this time. 2) CHLORIDE (listed 2014) - TMDL study underway metro-wide, target TMDL completion 2015.
FERDINAND POND (see Legion Lake)	yes (and MnDOT Crosstown)	--	Legion Lake	No impairments. Status as a "wetland" to be determined.
GRASS LAKE (Officially a wetland. Was previously part of Richfield Lake, which was divided by construction of Highway 62)	yes	27-0681		1) EXCESS NUTRIENTS (listed in 2006) - TMDL study has not started, MPCA target start date is 2020.
LAKE CALHOUN	yes (and from upstream municipalities)	27-0031	Lake Harriet	1) MERCURY IN FISH TISSUE (listed 1998) - statewide TMDL completed 2008, not stormwater-related, no MS4 responsibilities, target completion 2025. 2) PFOS IN FISH TISSUE (listed 2008) - regulatory action by MPCA in lieu of TMDL is underway (pollutant source in St. Louis Park), target completion 2022.
LAKE HARRIET	yes	27-0016	Minnehaha Creek	1) MERCURY IN FISH TISSUE (listed 1998) - statewide TMDL completed 2008, not stormwater-related, no MS4 responsibilities. Target completion 2025. 2) PFOS IN FISH TISSUE (listed 2008) - regulatory action by MPCA in lieu of TMDL is underway (pollutant source in St. Louis Park), target completion 2022.
LAKE HIAWATHA (Part of Minnehaha Creek)	yes (and from upstream municipalities)	27-0018	Minnehaha Creek	1) EXCESS NUTRIENTS (listed 2002) - part of <u>Minnehaha Creek *E. Coli* Bacteria/Lake Hiawatha Nutrients TMDL</u> Study. TMDL approved 2014.
LAKE NOKOMIS	yes (and from Richfield and a portion of MSP Airport)	27-0019	Minnehaha Creek	1) MERCURY IN FISH TISSUE (listed 1998) - Statewide TMDL approved 2008, not stormwater-related, no MS4 responsibilities, target completion 2025. 2) PCB IN FISH TISSUE (listed 1998) - TMDL status unknown, target completion 2025. 3) EXCESS NUTRIENTS (listed 2002) - TMDL study approved 2011, in implementation stage. (TMDL name: Minnehaha Creek Watershed Lakes)

Name of Surface Water (includes lakes, creeks, wetlands and Mississippi River). Alphabetical order. * indicates waterbody is not in Minneapolis.	Receives Minneapolis municipal stormwater runoff?	State ID	Next-in-line Receiving Water	Status of Impairment and TMDL Study
LAKE OF THE ISLES	yes	27-0040	Lake Calhoun	1) MERCURY IN FISH TISSUE (listed 1998) - Statewide TMDL approved 2008, not stormwater-related, no MS4 responsibilities, target completion 2025. 2) PFOS IN FISH TISSUE (listed 2008) - regulatory action underway by MPCA in lieu of TMDL (pollutant source in St. Louis Park), target completion 2022.
LEGION LAKE * (Located in Richfield; the former Legion Lake wetland area in Minneapolis is now Ferdinand Pond)	no (lake is in Richfield; a wetland area formerly considered part of Legion Lake is now Ferdinand Pond)	27-0024	Taft Lake	No impairments for Legion Lake, but Legion Lake is involved in the TMDL for Lake Nokomis.
LORING LAKE (commonly called Loring Pond)	yes (little direct runoff BUT takes runoff on occasion from 35W Tunnel)	27-0655	Mississippi River	1) CHLORIDE (listed 2014) - TMDL study underway metro-wide, target TMDL completion 2015.
MINNEHAHA CREEK	yes (and from upstream municipalities)	07010206-539	Mississippi River	1) FISHES BIOASSESSMENTS (listed 2004) - TMDL study not started, may reassess (baseflow not constant), appears to be on hold until 2020. 2) CHLORIDE (listed 2008) - TMDL study underway metro-wide, target TMDL completion 2015. 3) BACTERIA (listed 2008) - part of Minnehaha Creek *E. Coli* Bacteria/Lake Hiawatha Nutrients TMDL study. TMDL approved 2014. 4) DISSOLVED OXYGEN (listed 2010) - TMDL study not started, may reassess (baseflow not constant), appears to be on hold until 2020. 5) AQUATIC MACROINVERTEBRATE BIOASSESSMENTS (listed 2014) - TMDL study not started.
MISSISSIPPI RIVER (the specific reach upstream of Upper Saint Anthony Falls, to Coon Creek)	yes (and from upstream municipalities)	07010206-509	n/a	1) MERCURY IN FISH TISSUE (listed 1998) - Statewide TMDL approved 2008, not stormwater-related, no MS4 responsibilities, target completion 2025. 2) PCB IN FISH TISSUE (listed 1998) - targeted TMDL completion date is 2025. 3) BACTERIA (listed 2002) TMDL approved Nov. 2014 (metro-wide), bacteria not an issue in this river segment this round, MPCA plans to look again in 2020.
MISSISSIPPI RIVER (the specific reach between Upper and Lower Saint Anthony Falls)	yes (and from upstream municipalities)	07010206-513	n/a	1) MERCURY IN FISH TISSUE (listed 1998) - not stormwater-related, statewide TMDL approved 2008. 2) PCB IN FISH TISSUE (listed 1998) - targeted TMDL completion date is 2025. 3) BACTERIA (not listed, but part of TMDL approved Nov. 2014 (metro-wide) - bacteria not an issue in this river segment this round, MPCA plans to look again in 2020.
MISSISSIPPI RIVER (the specific reach downstream of Lower Saint Anthony Falls, to Lock and Dam #1)	yes (and from upstream municipalities)	07010206-503	n/a	1) MERCURY IN FISH TISSUE (listed 1998) - Statewide TMDL finalized 2008, not stormwater-related, so no MS4 responsibilities. 2) BACTERIA (listed 2002) TMDL approved Nov. 2014 (metro-wide), bacteria not an issue in this river segment this round, MPCA plans to look again in 2020.
MISSISSIPPI RIVER * (impaired downstream of confluence with Minnesota R., to Lake Pepin)	this impairment is downstream of the Minneapolis segments	07010206-xxx	n/a	1) TOTAL SUSPENDED SOLIDS (TSS) (listed 1998) (replaced turbidity standard with site-specific TSS standard) - South Metro Ms. R. TSS TMDL study near completion. **Zero reduction required for Minneapolis.**
LAKE PEPIN * (widening of MISSISSIPPI RIVER) (as tributary to Lake Pepin nutrient/eutrophication biological indicators TMDL)	this impairment is downstream of the Minneapolis segments	25-0001	n/a	1) EXCESS NUTRIENTS (listed 2002) - Lake Pepin TMDL study in progress. MPCA is listing 2015 as target completion date for study.
MOTHER LAKE * (formerly in Minneapolis, now Airport)	no	27-0023	Lake Nokomis	No excess nutrients impairment for Mother Lake, but Mother Lake is involved in the TMDL for Lake Nokomis.
POWDERHORN LAKE	yes	27-0014	Landlocked (has been pumped to Mississippi River in the past)	1) MERCURY IN FISH TISSUE (listed 1998) - Statewide TMDL approved 2008, not stormwater-related, no MS4 responsibilities, target completion 2025. 2) EXCESS NUTRIENTS (listed 2002) - **DE-LISTED** in 2012, due to improved water quality. 3) CHLORIDE (listed 2014) - TMDL study underway metro-wide, target TMDL completion 2015.
RYAN CREEK (primarily conveyed by storm drain pipe, about two blocks exposed, on industrial property)	yes (and Ryan Lake)	don't know	Shingle Creek	No impairments.

Name of Surface Water (includes lakes, creeks, wetlands and Mississippi River). Alphabetical order. * indicates waterbody is not in Minneapolis.	Receives Minneapolis municipal stormwater runoff?	State ID	Next-in-line Receiving Water	Status of Impairment and TMDL Study
RYAN LAKE part * (located in Minneapolis and in Cities of Robbinsdale and Brooklyn Center)	yes (and from upstream municipalities)	27-0058	Ryan Creek	1) EXCESS NUTRIENTS (listed 2002) - TMDL Study approved 2007, **DE-LISTED** 2014 because of restoration activities under TMDL Implementation Plan.
SANCTUARY MARSH	no	27-0665	Lake Harriet	No impairments.
SHINGLE CREEK	yes (and from upstream municipalities)	07010206-506	Mississippi River	1) CHLORIDE (listed 1998) - TMDL approved 2007, now in implementation stage. 2) DISSOLVED OXYGEN (listed 2004) - TMDL approved 2011, now in implementation stage. 3) AQUATIC MACROINVERTEBRATE BIOASSESSMENTS (listed 2006) - TMDL approved 2011, now in implementation stage. 4) BACTERIA (listed 2014) - TMDL approved Nov. 2014 (metro-wide).
SILVER LAKE * (located in Cities of New Brighton and Columbia Heights)	yes, from a very small corner of Minneapolis (and from New Brighton, Columbia Heights and St. Anthony Village)	62-0083	Ramsey County Ditch 3, then Rice Creek	1) EXCESS NUTRIENTS (listed 2002) - TMDL approved 2010, now in implementation stage. 1) MERCURY IN FISH TISSUE (listed 1998) - Statewide TMDL approved 2008, not stormwater-related, no MS4 responsibilities, target completion 2025. 3) CHLORIDE (listed 2014) - TMDL study underway metro-wide, target TMDL completion 2015.
SPRING LAKE	yes (and from I-394)	27-0654	Landlocked?	1) CHLORIDE (listed 2014) - TMDL study underway metro-wide, target TMDL completion 2015.
TAFT LAKE * (formerly in Minneapolis, now Airport)	no (formerly part of Minneapolis, now Airport)	27-0683	Lake Nokomis	1) No excess nutrients impairment for Taft Lake, but Taft Lake is involved in the TMDL for Lake Nokomis.
WEBBER POND	no (reconstructed 2013-2015 with no stormwater outfalls to it)	27-1118	Shingle Creek	No impairments.
WIRTH LAKE * (located in City of Golden Valley, in Wirth Park owned and managed by Minneapolis Park & Recreation Board)	no apparent Minneapolis municipal runoff (MPRB only; parkway runoff appears to be only in Golden Valley)	27-0037	Bassett Creek	1) MERCURY IN FISH TISSUE (listed 1998) - Statewide TMDL approved 2008, not stormwater-related, no MS4 responsibilities, target completion 2025. 2) EXCESS NUTRIENTS (listed 2002) - TMDL approved 2010 (Wirth Lake Excess Nutrients TMDL Report). **DE-LISTED** 2014 because of activities carried out under TMDL Implementation Plan.

Color Key:

Chloride.
Bacteria.
Excess nutrients.
related to Lake Nokomis Excess Nutrients TMDL.
Total Suspended Solids (TSS)
Dissolved oxygen, or bioassessments for fish or aquatic macroinvertebrates.
PFOS or PCB
Mercury - no MS4 responsibilities.

Notes:

MERCURY -- Presence of mercury is primarily airborne, not stormwater runoff. Statewide Mercury TMDL is being carried out by MPCA. No MS4 responsibilities.

PFOS -- Presence of perfluorooctane sulfonate (PFOS) is primarily related to industrial discharge. Regulatory action in lieu of TMDL is underway.

PCB -- Polychlorinated biphenyls.

* indicates waterbody is not in Minneapolis.

Message from Minnesota's Clean Water Council: We recognize that people are hungry for immediate results; however, managing water resources is an ongoing task, and some clean water outcomes may take several decades to achieve. Once a best management practice has been implemented, it often takes many years, or decades, before a positive environmental outcome is achieved in a highly degraded river, lake or groundwater source.

EROSION CONTROL

Goal: To set a consistent standard for erosion control inspections performed by City of Minneapolis Regulatory Services Inspectors that is transparent and accountable to the public.

All enforceable erosion control standards can be found in Minneapolis Code of Ordinances

- Title 3, Chapter 52 EROSION AND SEDIMENT CONTROL FOR LAND DISTURBANCE ACTIVITIES,

Best Management Practices (BMPs) used are adapted from Minnesota Department of Transportation erosion control measures.

I. Demolition and Construction >500 ft² and <5,000 ft²

A. APPLICABILITY

- This section pertains to construction and demolition activities with ground disturbance greater than 500 square feet or 5 cubic yards but less than 5,000 square feet.
- Construction or Demolition permit issued by the City of Minneapolis;

B. ADMINISTRATIVE ACTIVITIES:

- On a bi-weekly basis administrative staff reviews KIVA for erosion control permits
- Upon issuance of an erosion control permit for construction or demolition administrative staff will develop a request for services (RFS) in KIVA for EMBESE.

C. INSPECTOR ACTIVITIES:

- All inspectors must attend and pass an approved erosion control course and possess a current storm water erosion control license
- Upon receiving the EMBESE RFS through KIVA the inspector conducts an initial inspection.

- If a demolition project the inspector verifies that the demolition is complete and properly graded. If there are concerns they are addressed with the Problem Properties Unit or Code Construction Services.
- If the site does not have a construction permit the inspector verifies that the contractor graded the site and removed construction debris.
- The inspector checks the contractor's erosion control best management practices to ensure that the measures are adequate to prevent erosion of soil from the site.
- Inspect sidewalk, alley, and street for soil eroding from the site or tracking from demolition activities.
- Identify and inspect storm drains in vicinity to ensure that soil eroding from the site is not entering storm drains.
- If a significant amount of soil has escaped the site and entered the storm drain which cannot be recovered a citation may be issued without prior notice.
- If demolition and site grading are complete, BMPs are in place and adequate to control erosion, and no soil is noted in public thoroughfares enter notes into KIVA noting compliance.
- Schedule site visit in 5 weeks if conditions are compliant to check erosion control status at that time or to assess the establishment of vegetation. Enter as an EMS02 for single or multi-family residential or small commercial.
- Contact the contractor directly and establish a due date to correct site issues. Follow up by writing orders in KIVA to the contractor outlining deficiencies and due date for compliance. If a contractor is notified directly their due date may be as short as 24hrs depending on severity and no longer than 7 days. The due date within this time frame is the sole discretion of the trained inspector. Any due date shorter than 24 hours or longer than 7 days requires a supervisor's or manager's approval.
- Schedule re-inspection for due date.
- If site is not in compliance upon re-inspection issue a citation to the contractor through KIVA.
- When outstanding non-compliance is resolved schedule the next round of inspections or final inspection for determining vegetative cover.
- If vegetative cover is at least 70% close RFS and permit in KIVA.

D. **RECORD KEEPING**

- Digital photographs are to be downloaded into stellant under the appropriate EMBESE folder using the correct RFS number.
- If created, paper files are to be placed into the company file in the main filing cabinet.

III. Construction >5,000 ft^2

E. APPLICABILITY

- This section pertains to construction and demolition activities with ground disturbance greater than 5000 square feet.
- Construction or demolition permit issued by the City of Minneapolis;

F. ADMINISTRATIVE ACTIVITIES:

- Administrative staff reviews KIVA for erosion control permits
- Upon issuance of an erosion control permit for construction of sites greater than 5000 square feet administrative staff develop a request for services (RFS) in KIVA for EMBESE.

G. INSPECTOR ACTIVITIES:

- All inspectors must attend and pass an approved erosion control course and possess a storm water erosion control
- Upon receiving the EMBESE RFS through KIVA on the Daily Inspection Report the inspector conducts an initial inspection.
- Upon entering the site all staff members MUST be wearing a hard hat, safety glasses and steel toed boots.
- Inspect Stormwater Pollution Prevention Plans at the job site trailer. Note inspection dates, occurrences and issues. Ensure the site was inspected on days with rains over 0.5 inches.
- If a demolition project the inspector verifies that the demolition is complete and properly graded. If there are concerns they are addressed with Code Construction Services.
- Any drainage concerns that may impact adjacent properties are noted.
- If the site does not have a construction permit the inspector verifies that the contractor graded the site and removed construction debris.
- The inspector checks the contractor's erosion control best management practices to ensure that the measures are adequate to prevent erosion of soil from the site.
- Inspect sidewalk, alley, and street for soil eroding from the site or tracking from demolition activities.
- Identify and inspect storm drains in vicinity to ensure that soil eroding from the site is not entering storm drains.
- If a significant amount of soil has escaped the site and entered the storm drain which cannot be recovered a citation may be issued without prior notice.

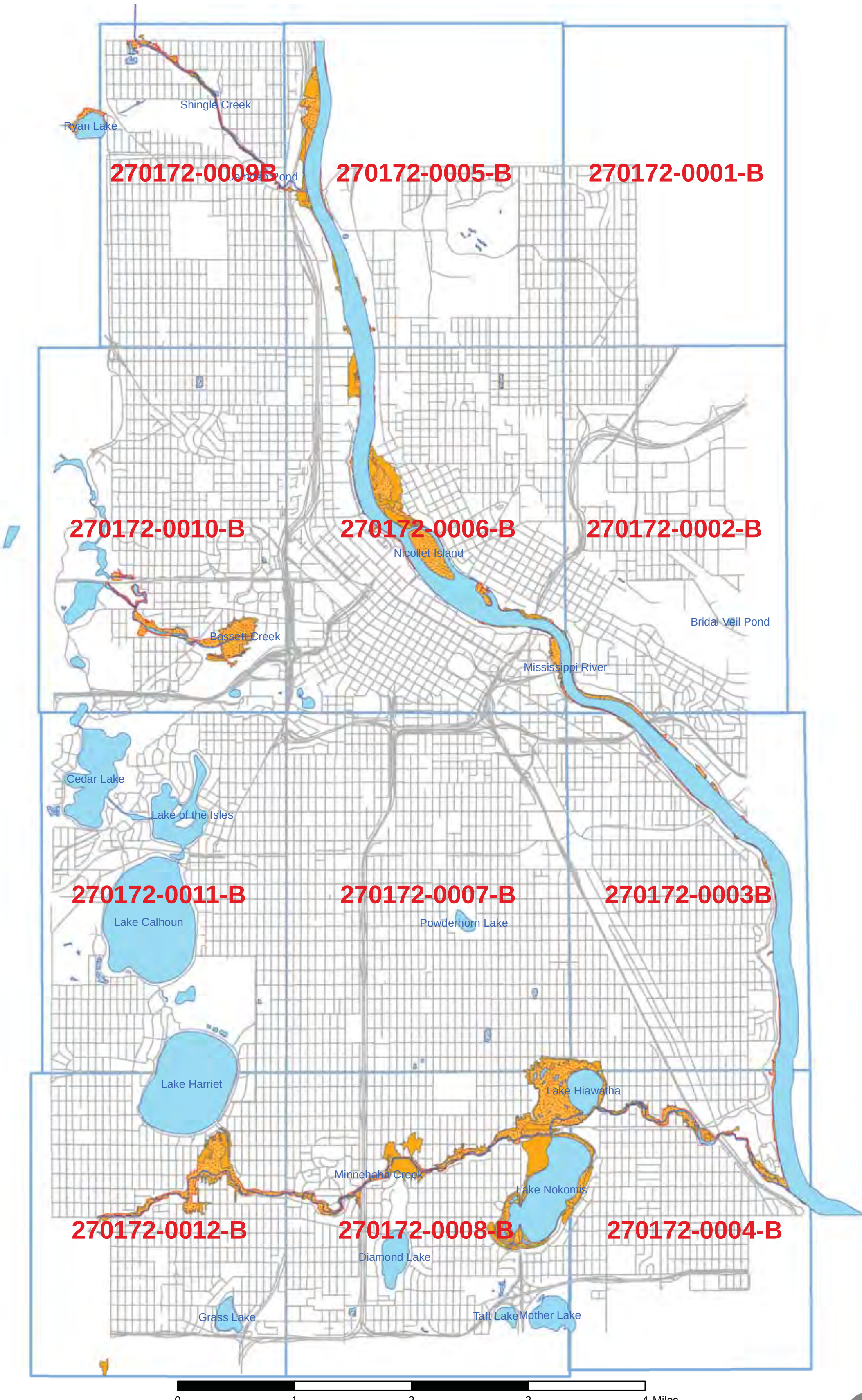
- If demolition and site grading are complete, BMPs are in place and adequate to control erosion, and no soil is noted in public thoroughfares enter notes into KIVA noting compliance.
- Schedule site visit in 7 weeks if conditions are compliant to check erosion control status at that time or to assess the establishment of vegetation.
- Following storm events greater than 0.5 inches of rain in 24hrs inspect records to ensure contractor conducted required additional inspections
- Contact the contractor directly and establish a due date to correct site issues. Follow up by writing orders in KIVA to the contractor outlining deficiencies and due date for compliance. If a contractor is notified directly their due date may be as short as 24hrs depending on severity and no longer than 7 days. The due date within this time frame is the sole discretion of the trained inspector. Any due date shorter than 24 hours or longer than 7 days requires a supervisor's or manager's approval.
- Schedule re-inspection for due date.
- If site is not in compliance upon re-inspection issue a citation to the contractor through KIVA.
- When outstanding non-compliance is resolved schedule the next round of inspections or final inspection for determining vegetative cover.
- If vegetative cover is at least 70% close RFS and permit in KIVA.

H. **RECORD KEEPING**

- Digital photographs and related documents are to be downloaded into Stellant.
- All notes of inspections must be entered in KIVA

Appendix B

2008 F.E.M.A. DESIGNATED FLOOD ZONES



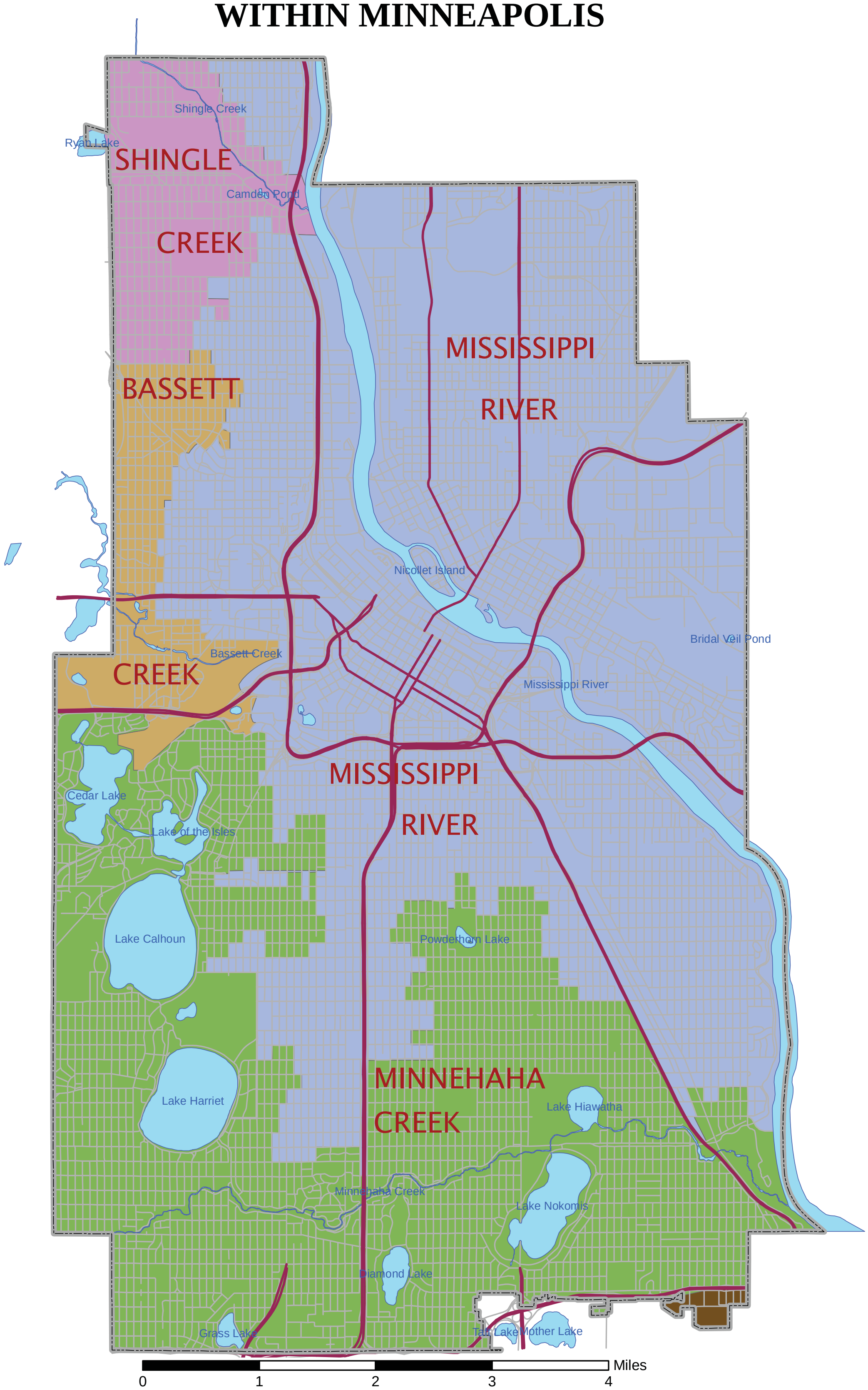
March, 2008

EFFECTIVE DATE FOR MAP PANEL 270172-0010-B IS DECEMBER 12, 2002
EFFECTIVE DATE FOR ALL OTHER MAP PANELS IS FEBRUARY 18, 1981

Map Panels
100 Year Flood Zone
500 Year Flood Zone

MINNEAPOLIS PUBLIC WORKS
SURFACE WATER & SEWERS DIVISION

WATERSHED MANAGEMENT BOUNDARIES WITHIN MINNEAPOLIS



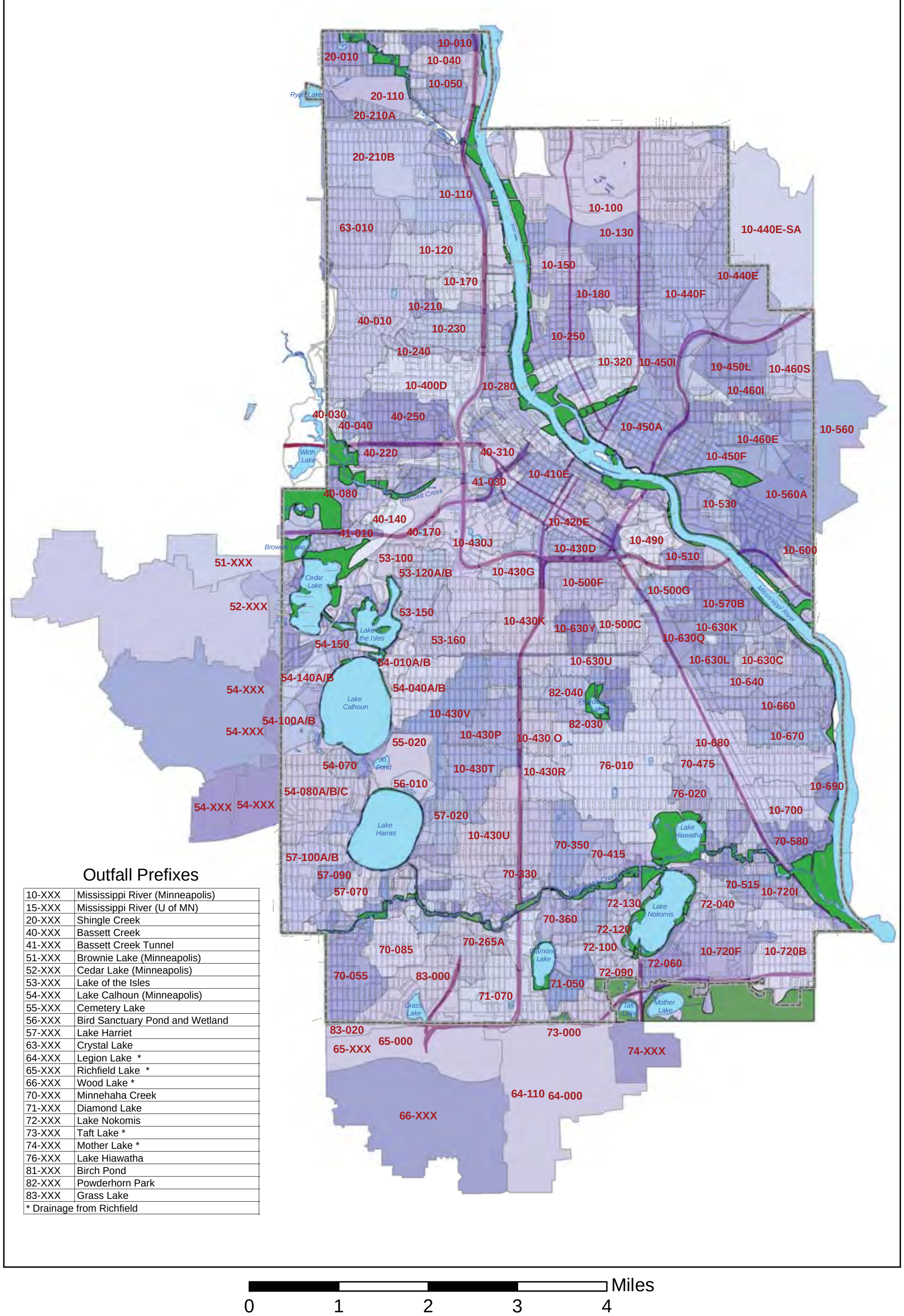
- Lakes & Streams
- Bassett Creek Water Management Commission
- Minneapolis/St. Paul International Airport
- Minnehaha Creek Watershed District
- Mississippi Watershed Management Organization
- Shingle Creek Watershed Management Commission

MINNEAPOLIS PUBLIC WORKS
SURFACE WATER & SEWERS DIVISION

March, 2008

This Map was created from the City of Minneapolis Public Work's Geographic Information System (GIS), it is a compilation of information and data from various sources. This Map is not a surveyed or legally recorded document and is intended to be used as a reference. The City of Minneapolis and its Public Works Department is not responsible for any inaccuracies contained herein or any consequences resulting from the user's use of or reliance on this GIS data.

MINNEAPOLIS STORMWATER RUNOFF DRAINAGE SUB-AREA BOUNDARIES



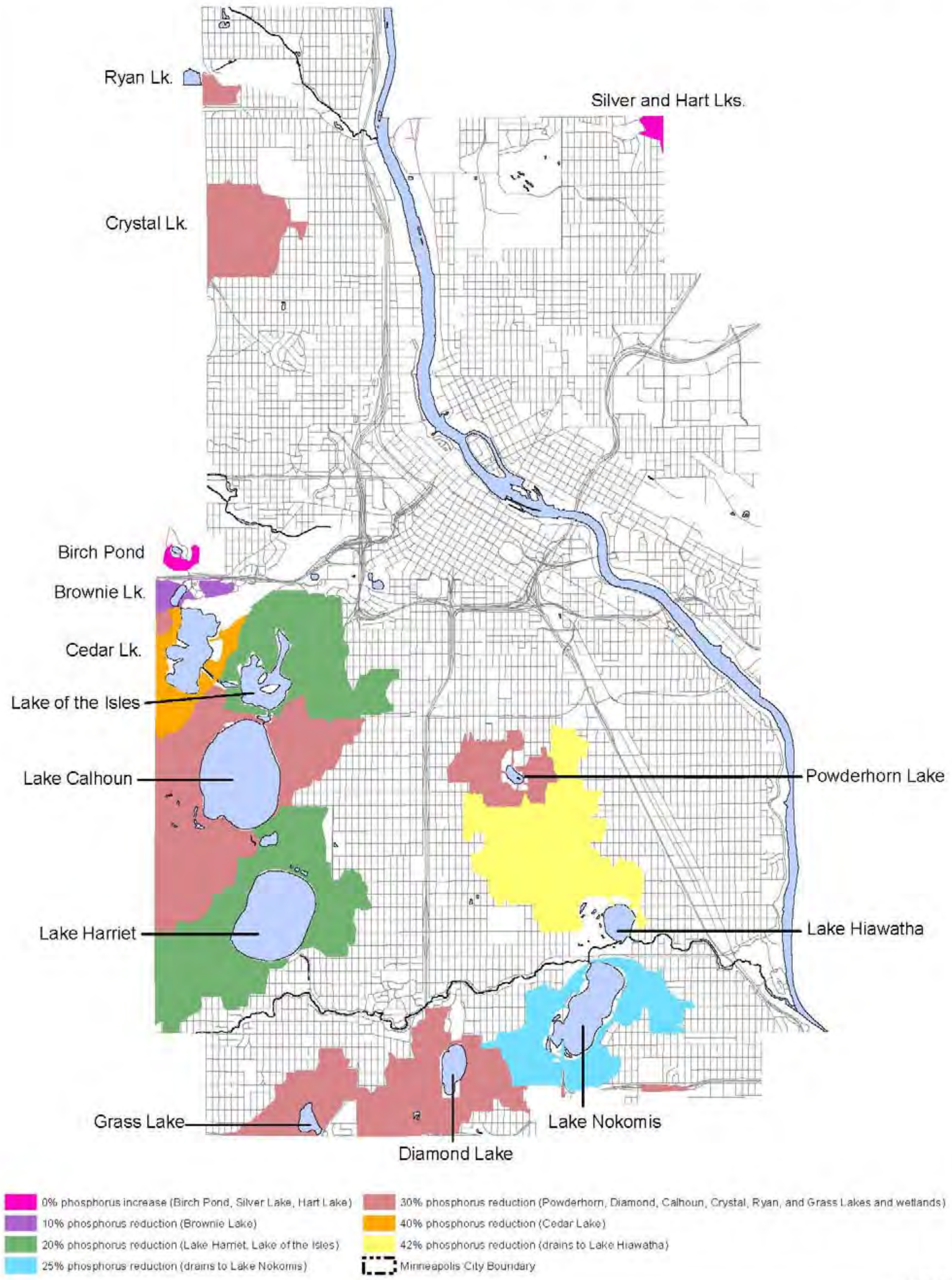
Outfall Prefixes

10-XXX	Mississippi River (Minneapolis)
15-XXX	Mississippi River (U of MN)
20-XXX	Shingle Creek
40-XXX	Bassett Creek
41-XXX	Bassett Creek Tunnel
51-XXX	Brownie Lake (Minneapolis)
52-XXX	Cedar Lake (Minneapolis)
53-XXX	Lake of the Isles
54-XXX	Lake Calhoun (Minneapolis)
55-XXX	Cemetery Lake
56-XXX	Bird Sanctuary Pond and Wetland
57-XXX	Lake Harriet
63-XXX	Crystal Lake
64-XXX	Legion Lake *
65-XXX	Richfield Lake *
66-XXX	Wood 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 Park
83-XXX	Grass Lake
* Drainage from Richfield	

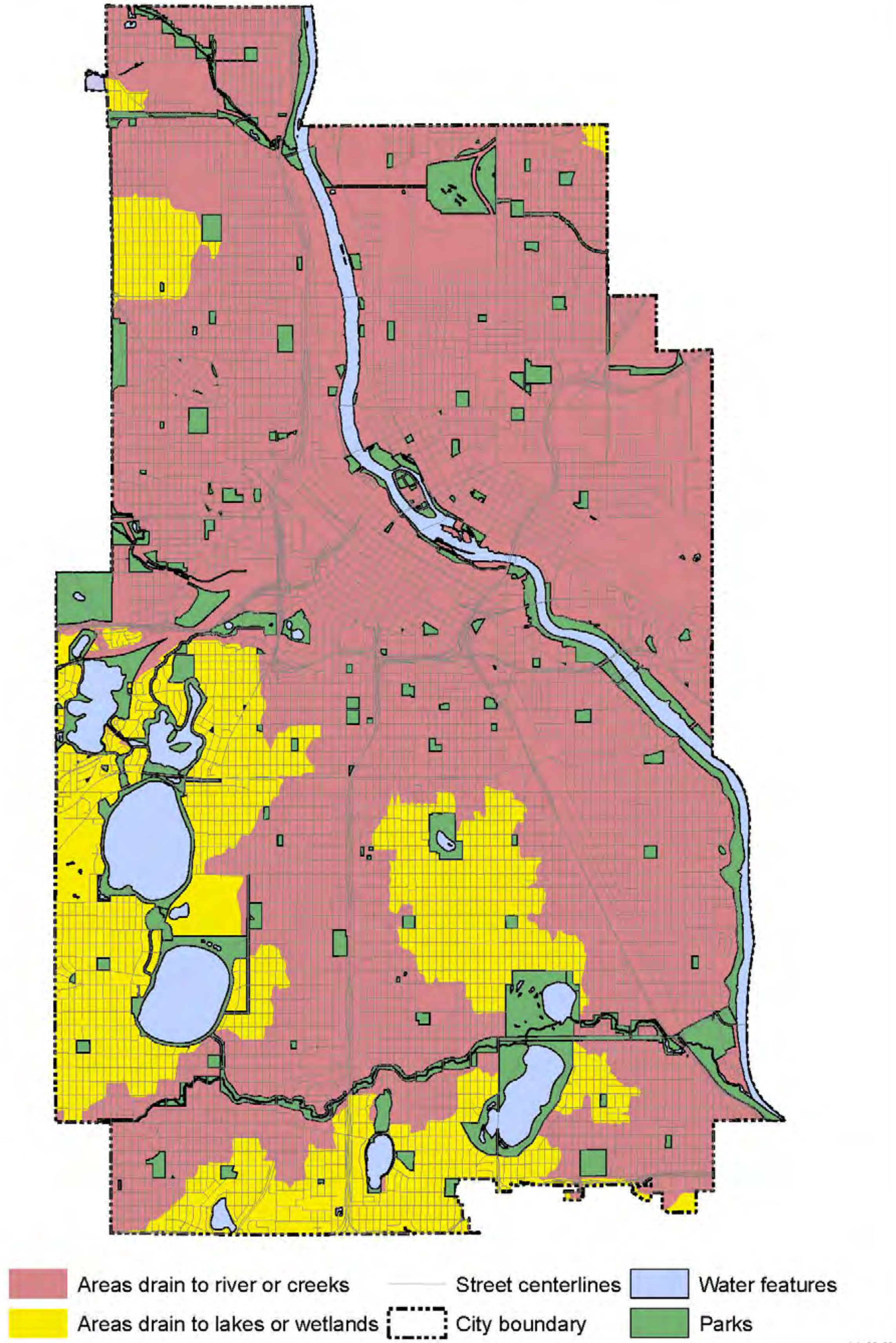
March, 2008

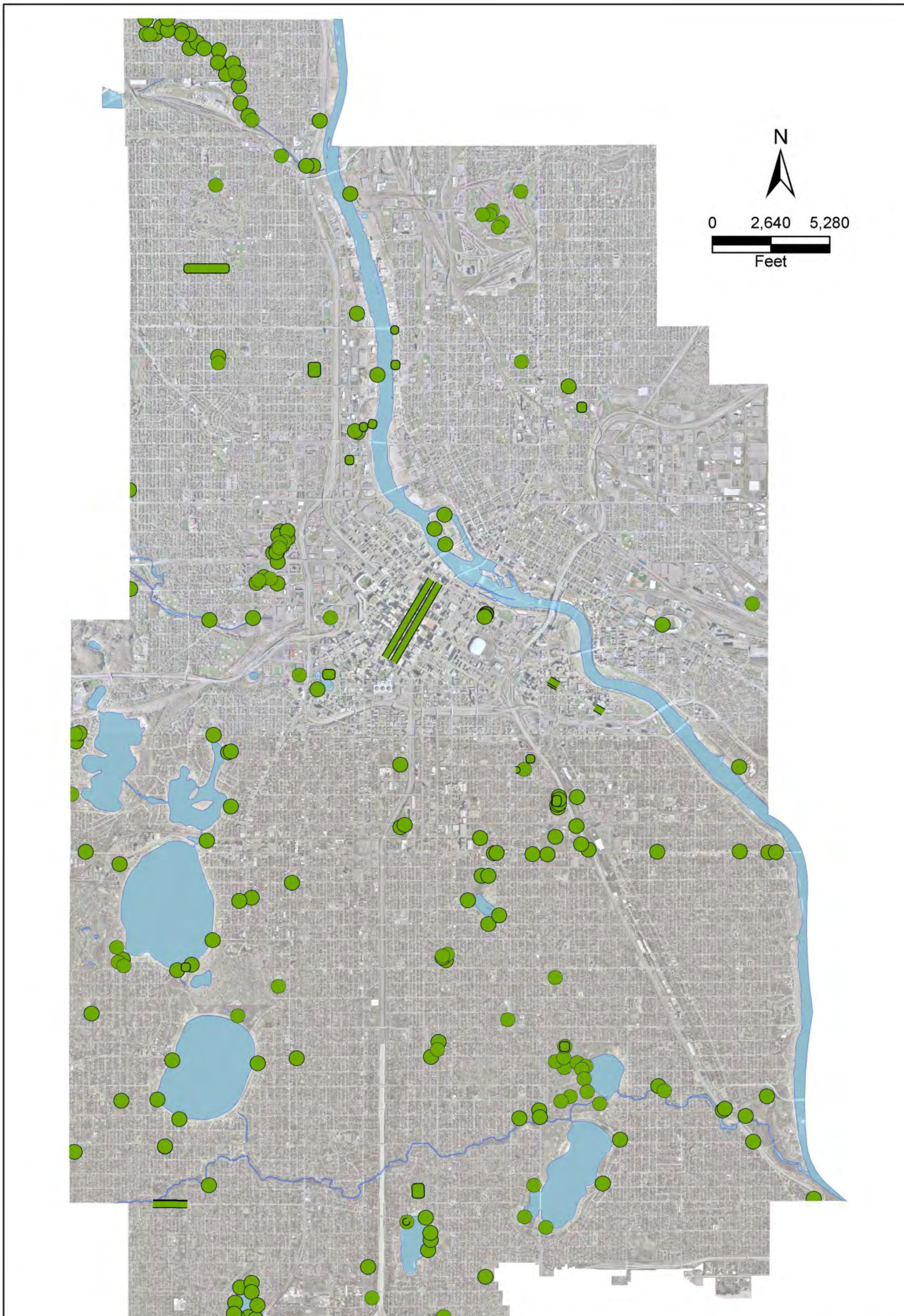
MINNEAPOLIS PUBLIC WORKS
SURFACE WATER & SEWERS DIVISION

Appendix B5: Phosphorus Load Reductions for Lakes and Wetlands



Appendix B6: Drainage Areas By River/Creeks OR Lakes/Wetlands





minneapolis city of lakes

Appendix B7: CITY OF MINNEAPOLIS
MUNICIPAL POST CONSTRUCTION BMPS
AUGUST 19 2013

MINNEAPOLIS DEPARTMENT OF PUBLIC WORKS
DIVISION OF SURFACE WATER & SEWERS
city of lakes

Appendix C

CEAC Comments on the Stormwater Management Plan - Message (HTML)

You forwarded this message on 7/16/2015 11:52 AM.

From: Anna Abruzzese <abbey.anna@gmail.com> Sent: Thu 7/16/2015 11:44 AM
To: Eberhart, Lois E.
Cc: Prest, Gayle A.; Gordon, Cam A.
Subject: CEAC Comments on the Stormwater Management Plan

Message | CEAC SWMP Letter 2015_07_10 signed final-signed.pdf (248 KB)

Lois-

Please consider the attached document as formal comments on the Stormwater Management Plan (SWMP) for the City of Minneapolis, updated 2014, from the Minneapolis Community Environmental Advisory Commission (CEAC).

Thank you for the opportunity to provide comments.
--
Anna Abruzzese, CEAC Chair
abbey.anna@gmail.com

CEAC Members: Dylan Bradford Kesti, Andrew Murray, Alejandro Ojeda Saint-Martin, Allan Campbell, Jen Kader, Eduardo Cardenas, Shalini Gupta, Roxxanne OBrien, Lisa Daniels, Michelle Stockness, Darrell Gerber, Meleah Houseknecht, James Nash, Brian Ross, Tony Hainault, Adam Arvidson

CEAC Detailed Comments to Stormwater Management Program

(July 2015)

Thank you for the opportunity for the individuals signed below to comment on the Stormwater Management Program (SWMP) for the City of Minneapolis, updated in 2014. The SWMP is a requirement under the Municipal Separate Storm Sewer System (MS4) Phase I permit issued to the City of Minneapolis and the Minneapolis Park and Recreation Board. The plan lays out, in great detail, several programs that would improve water quality throughout the city. We find the SWMP to be a well thought out and thorough document especially with regard to scientific and engineering related elements.

We do offer some comments, suggestions, and requests for clarification:

- Page 13: Aren't there other types of loans besides bonds that are used to pay for capital project work?
- Page 15: In Table 1-4 there should be a row for mercury/methylated mercury since Mercury in Fish Tissue is one a common impairment for water bodies receiving Minneapolis municipal stormwater.
- Page 15: In Table 1-4, under coal plants, they also can release lead.
- Page 15: In Table 1-4, Fertilizers/Pesticides/Soil Treatments is missing e.coli (primarily from large ag sources but could be if individuals use untreated manure), cyanide (sodium cyanide and hydrogen cyanide used as a predacide/rodenticide and as an insecticide.), sulfate (likely ammonium sulfate, elemental sulfur, or gypsum to change pH or use along with other pesticides like glyphosate), pH (see intentional changes to soil pH above).
- SMP 1.1 or SMP 2.1: Explicitly list opportunities to grow and leverage the people in the community who can do some of the public education, non-point source projects, etc. One example is the Master Water Stewards (MWS) program at Freshwater Society (http://freshwater.org/master-water-stewards-a-community-approach-to-protecting-water/). The purpose of MWS is to increase the force of people in the community doing water pollution prevention by training and developing community leaders. As the pilot project in Minnehaha Creek Watershed wraps up this year there will be about 100 Certified Master Water Stewards. The program is expanding to include MWMO and other watersheds next year including an on-line curriculum. It will be growing team of trained and enthusiastic community members ready to work with the city to prevent stormwater related pollution. There are also other programs that the city might leverage.
- SMP 2.1: The 311 expansion to include environmental reporting is good but it is still limited. The smartphone apps tell you to call the phone number instead of making tools available in-app to report environmental violations. This should be expanded and coupled with other violations covered by the inspectors in order to provide GPS info and photos. It also needs to be advertised and encouraged as ways for the community to assist in addressing elicit discharges.
- SMP 2.2: The workplan is focused on more passive forms of public outreach -- make the information available in case someone comes looking for it. However, how/why would someone come looking for it? How is that going to result in changes reducing water impacts? There needs to be a workplan component to make sure that the information is used to bring about the changes needed. Who are partners to work with that can increase the effectiveness and reduce the resource pressures on city staff? Some could be pushed down to individual sections but there needs to be an overarching stated intent to be more intentional and strategic.
- SMP 3.7: Inserts with information included in billing will not reach those electing to have e-billing. What methods are being used to reach these individuals?
- SMP 3.8: For street stenciling, why are "Drains to Lake" and "Drains to Creek" stencils only available in English. Include options for multi-lingual stencils or using images?
- SMP 3.9: Could the training be expanded to or required of any private contractor operating within the city? (Special Service Districts, Parking lots, etc.) Is there any check-in to ensure compliance? Is there any measurement or tracking is in place to demonstrate progress?
- SMP 4.1 & 4.2: Programs only call for a general "establishment of vegetative cover" without criteria for what type of vegetative cover is acceptable. Given anecdotal and first-hand experience in use of fast-establishing seed to establish ground cover without regard to long term impact, this language should be tightened. For instance, while sweet clover is great for erosion control and quickly establishes, it should not be included in the seed mix for vegetative cover. Is there specific language governing this elsewhere, or could it be included here that non-native, invasive, and/or overabundant seed stocks should not be incorporated?
- SMP 5.1: How are sites selected? What criteria is used? Who is doing the evaluation? What barriers are there that could limit the number of "problem properties" that are able to be reviewed? Could volunteer groups with training, like Master Water Stewards, or non-city staff be utilized?
- SMP 5.2: Who is inspecting and certifying the projects? Is this another area where volunteers or non-city staff could be used?
- SMP 5.4: When streets are redone, what options are being considered to leverage the opportunities to gain additional stormwater benefits by reducing volume, pollutant load, and/or rate and at what point in the project

development process is this considered? Is there a menu of options to choose from such as bump outs, tree boxes, raingardens the project managers can select from where applicable? Does the land covered in this category include MPRB boulevards?

- SMP 5.5:
  - (First bullet) What are the projects, and who is developing them? What is the criteria?
  - (Second bullet) Is the flooding data going to be public? This would help with outreach and in aiding the development of ownership from the local community. The information makes the problem less of an unknown, increasing the likelihood for enduring behavior change. Also, use Master Water Stewards for outreach and project implementation.
- SMP 5.6: What pilot programs are being considered? Who proposes these, and what mechanisms are in place to allow for public input/idea generation?
- SMP 6.1.2: For the public involvement metrics, would there be interest amplifying an "Adopt-a-Storm Drain" program? Local schools, neighborhood groups, etc. may be interested in this opportunity in addition to Master Water Stewards.
- SMP 6.1.11: To whom will this mapping data be available? Will it be a part of the information available through the open data policy? Can it be provide in an easy to understand and use form for the general public? Interactive web GIS technologies can make it simple for community members to find out where their stormwater goes.
- SMP 6.3: Will the manuals developed be available for public consumption/as examples for best management practices? Also, for fleet washing and other heavy water use practices, is stormwater reuse being considered as a way to even further reduce runoff volume?
- SMP 6.5: Sweeping up of excess deicers when an excess occurs should be included in the practice. Also, parks should not encourage excess use of deicers by making the correct method the easy method (appropriate application tools) and by not leaving the deicers easily accessible to the public (i.e., not immediately next to the door with a giant cup available for anyone to grab and use).
- SMP 6.6:
  - Is any consideration being given to design the right-of-ways to better intercept the flow? Breaking up impervious surface and using catchments of different kinds has been mentioned elsewhere in the SWMP, but not here. In other words, is consideration being given to design elements that direct water into boulevards, medians, sunken islands, etc.?
  - Assessment – add tracking of infrastructure changes
  - "Public participation" needs to be more specific – and needs to be meaningful. Showing up to a meeting shouldn't be the only thing that counts – what does participation actually look like on the ground? How are communities beyond white, middle class, property owners being reached?
  - Will roots be left intact during sidewalk construction? After finding the role sidewalk construction played in the loss of trees to high winds it should be explicitly stated that this work will not damage or threaten important natural stormwater management elements except where absolutely necessary.
  - Leveraging of groups like Master Water Stewards should be called out in this SMP.
- SMP 8.2: Can the language be made any stronger? Increasing specificity for how outreach will be done will help, as would as identifying language for non-city contractors. Possible suggestions are: "Working through neighborhood associations, business associations, and other similar groups, increase the number of property managers and maintenance staff..." or "Ensure all special service districts, commercial districts, or other areas of the city with high levels of impervious surfaces or deicer use follow city-stated BMPs" or something to that effect. Remove the "coffee shop employee" reference and instead reference the need for proper training of all employees especially at businesses those with heavily trafficked sidewalk areas.

Thank you again for the opportunity to provide comment. We look forward to the opportunity to work with city staff to continue to improve water quality in Minneapolis.