# NPDES MS4 Phase I Permit
# Annual Report for 2013 Activities
# City of Minneapolis and the Minneapolis Park & Recreation Board

NPDES MS4 Phase I Permit No. MN0061018 Annual Report


Prepared by:
Minneapolis Public Works Department
in conjunction with
Minneapolis Park & Recreation Board


June 30, 2014

Minneapolis Park & Recreation Board

Minneapolis
City of Lakes

minneapolis
city of lakes

# NPDES MS4 Phase I Permit
# Annual Report for 2013 Activities

June 30, 2014

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 7/11/2014 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 2014R-282**, adopted by the Minneapolis City Council at a meeting held on **June 27, 2014**, 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.

IN WITNESS WHEREOF, I have signed and affixed the City seal on **July 8, 2014**.

Casey Joe Carl, City Clerk

2014R-282

# RESOLUTION of the CITY OF MINNEAPOLIS

By Reich

**Adopting the NPDES MS4 PHASE I PERMIT STORMWATER MANAGEMENT PROGRAM and ANNUAL REPORT FOR 2013 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 #MN0061018 (Permit); and

Whereas, as required under the Permit, a public hearing was held on June 17, 2014; and

Whereas, updates to the MPCA-approved STORMWATER MANAGEMENT PROGRAM will now be submitted to the Minnesota Pollution Control Agency; and

Whereas, the ANNUAL REPORT FOR 2013 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 2013 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 JUN 2 7 2014
DATE

[X] APPROVED [ ] NOT APPROVED [ ] VETOED

ATTEST [signature]
CITY CLERK

[signature]
MAYOR HODGES

JUL 0 2 2014
DATE

## *Acknowledgements*

### *Surface Water & Sewers*

Paul Chellsen

Lane Christianson

Dennis Daly

Kevin Danen

Lois Eberhart

Kelly Moriarity

Matt Stonich

Jeremy Strehlo

John Studtmann

Dick Thornbloom

Karl Westermeyer

### *Transportation Maintenance & Repair*

Steve Collin

### *Minneapolis Park & Recreation Board*

Rachael Crabb

Michael Perniel

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MaryLynn Pulscher

### *Environmental Services*

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Dan Huff

### *Regulatory Services*

Steve Kennedy

Source: Minneapolis Public Works – Surface Water and Sewers

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## *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

The National Pollutant Discharge Elimination System (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.

This annual report is prepared in compliance with the requirements of 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. This Report provides documentation and analysis of the activities conducted during the previous year, 2013. Public input into the development of the priorities and programs is required, as is adoption by City Resolution of the Annual Report.

Permit No. MN0061018 was issued in December 2000 and reissued in January 2011. A new Stormwater Management Program (SWMP) was submitted to the Minnesota Pollution Control Agency (MPCA) in September 2011 for review and approval as required under the new permit. Revisions were submitted in May 2013, and the MPCA approved the SWMP in 2013. The Permit requires the implementation of approved stormwater management activities, referred to as Best Management Practices (BMPs). The Minneapolis NPDES Stormwater Management program is developed and administered by the City and MPRB departments/agencies that are responsible for permit activities. These stakeholders are jointly responsible for the completion of the required Permit submittals. Public Works provides program management and completes each Annual Report. This year's Annual Report primarily follows the format used since 2001, in transition to the format more consistent with the SWMP which was approved by the MPCA 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 Stormwater Management 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.

# 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.

The current authorized staffing level of the Operations section is approximately 75 full-time employees. Of these, there are currently 65 permanent, full-time and 15 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. |
| 2 | 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 2013 cleaning and repair statistics are summarized in the following list:

- Responded to 683 complaints of plugged or backed-up catch basins
- Responded to 68 complaints of cave-ins around catch basins and manholes
- Cleaned 2.21 miles of storm drain utilizing hydro-jet washing and removed 80 cubic yards of sediment/material
- Televised and condition assessed 129 miles of storm drain pipes
- Performed inspection of 1.3 miles of deep stormwater drainage tunnels
- Repaired 1278 feet of storm tunnel

- Removed approximately 267 cubic yards (400 tons) of eroded sandstone/limestone sand/sediment from storm tunnels
- Work on the 10th 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.

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:

### *1. 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.

***2. 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.

***3. 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.

***4. Ponds and Bio-(in)filtration (Rain Gardens)***

These are structural devices that detain or retain stormwater runoff and improve the 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. At present, only a few of the City's holding ponds are at or near this age such that the need for sediment removal from them is considerable.

***5. 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 Surface Water & Sewers crews and Street maintenance crews both routinely look for plugged or damaged structures. Reported damages and/ or plugs are given a priority for repair and/or cleaning. Cleaning catch basins, while ensuring proper runoff conveyance from City streets, also removes accumulated sediments, trash, and debris. Augmenting this effort is the street sweeping program carried out by the Street maintenance section 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.
- Performed 111 grit chamber inspections. Cleaned 103 of the structures (some did not need cleaning). A total of 421 cubic yards of material was removed from grit chambers. 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 15 of 416 storm drain outfalls in 2013 inspection program. Of the 15 outfalls inspected, 0 were found to be in need of repair or maintenance. (Note: In 2012, 320 of the 416 outfalls were inspected. Unfortunately, many of the outfalls planned for inspection in 2013 were submerged due to high water levels.)
- Maintained 11 stormwater holding ponds.
- A series of six stormwater ponds in the Hiawatha Golf Course provide water quality management for a major catchment area that discharges to Lake Hiawatha. Three of the ponds were dredged by the City in early 2013. An amount of 1,192 tons of material was removed (described further in the next section).

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 2013, Minneapolis Public Works crews removed approximately 421 cubic yards of sediment and debris from grit chambers, and approximately 80 cubic yards from storm drains during hydro-jet washing operations.
- Approximately 267 cubic yards of eroded sandstone/limestone granular material was removed from storm tunnels. This material was stockpiled for use in making fill material.
- Minneapolis removed 1,192 tons of material from Hiawatha Golf Course Stormwater Ponds A, E and F, built for water quality of Lake Hiawatha. Because chemical testing determined Soil Reference Values above Level 3 at one of the ponds for arsenic and BaP Equivalent (using 2009 MPCA guidance), the material removed from all three ponds was disposed of at a landfill in Becker MN. Below are the results of chemical testing:

Summary of Sediment Testing Results
Project Name: Minneapolis Blue Lake Partnership Project
Sample Date: 13-Jun-11

| Parameters | Dredge Mgmt Level 1 | Dredge Mgmt Level 2 | A-1 (0-2.5') | | A-2 (o-2.5') | | E | | F | |
|---|---|---|---|---|---|---|---|---|---|---|
| Other (mg/kg) | | | | | | | | | | |
| Ammonia | NE | NE | <(5.4) | | 13 | | 120 | | <(7.5) | |
| Total Kjeldahl Nitrogen NE NE 6,800 6,300 9,600 8,400 7,600 170 320 1,600 7,200 | NE | NE | 6800 | | 6300 | | 1600 | | 7200 | |
| Nitrate+Nitrite NE NE <(5.4) 6.1 13 <(6.9) <(5.2) <(1.5) <(1.7) 85 41 | NE | NE | <(5.4) | | 6.1 | | 85 | | 41 | |
| Metals (mg/kg) | | | | | | | | | | |
| Arsenic | 9 | 20 | <(3.7) | | 3.8 | | 4.7 | | [illegible] | |
| Copper | 100 | 9000 | 4.5 | | 6.5 | | 9.1 | | 15 | |
| Carcinogenic PAHs & BaP Equiv. | Potency Equiv Factor | | Result | BaP Equiv | Result | BaP Equiv | Result | BaP Equiv | Result | BaP Equiv |
| Benz[a]anthracene | 0.100 | | 0.013 | 0.000 | 0.070 | 0.007 | 0.015 | 0.002 | 0.059 | 0.006 |
| Benzo[b]fluoranthene | 0.100 | | | | | | | | | |
| Benzo[j]flouranthene | 0.100 | | 0.018 | 0.002 | 0.093 | 0.009 | 0.031 | 0.003 | 0.052 | 0.005 |
| Benzo[k]fluoranthene | 0.100 | | | | | | | | | |
| Benzo[a]pyrene | 1.000 | | 0.016 | 0.016 | 0.085 | 0.085 | 0.010 | 0.010 | 0.062 | 0.062 |
| Chrysene | 0.010 | | 0.021 | 0.000 | 0.110 | 0.001 | 0.017 | 0.000 | 0.066 | 0.001 |
| Dibenz[a,j]acridine | 0.100 | | 0.008 | 0.001 | 0.008 | 0.001 | 0.004 | 0.000 | 0.013 | 0.001 |
| Dibenz[a,h]acridine | 0.100 | | 0.008 | 0.001 | 0.008 | 0.001 | 0.004 | 0.000 | 0.013 | 0.001 |
| Dibenz[a,h]anthracene | 0.560 | | 0.003 | 0.002 | 0.012 | 0.007 | 0.002 | 0.001 | 0.005 | 0.003 |
| 7H-Dibenzo[c,g]carbazole | 1.000 | | 0.008 | 0.008 | 0.008 | 0.008 | 0.004 | 0.004 | 0.013 | 0.013 |
| Dibenzo[a,e]pyrene | 1.000 | | 0.008 | 0.008 | 0.008 | 0.008 | 0.004 | 0.004 | 0.013 | 0.013 |
| Dibenzo[a,h]pyrene | 10.000 | | 0.003 | 0.030 | 0.003 | 0.032 | 0.008 | 0.080 | 0.005 | 0.050 |
| Dibenzo[a,i]pyrene | 10.000 | | 0.003 | 0.030 | 0.003 | 0.032 | 0.008 | 0.080 | 0.005 | 0.050 |
| Dibenzo[a,l]pyrene | 10.000 | | 0.008 | 0.075 | 0.016 | 0.160 | 0.004 | 0.041 | 0.027 | 0.270 |
| 7,12 Dimethylbenz-anthracene | 34.000 | | 0.003 | 0.102 | 0.003 | 0.107 | 0.002 | 0.056 | 0.005 | 0.170 |
| 1,6-Dinitropyrene | 10.000 | | 0.150 | 1.500 | 0.155 | 1.550 | 0.080 | 0.800 | 0.026 | 2.600 |
| 1,8-Dinitropyrene | 1.000 | | 0.150 | 0.150 | 0.155 | 0.155 | 0.080 | 0.080 | 0.260 | 0.260 |
| Indeno[1,2,3,-c,d]pyrene | 0.100 | | 0.012 | 0.001 | 0.055 | 0.006 | 0.002 | 0.000 | 0.054 | 0.005 |
| 3-Methylcholanthrene | 3.000 | | 0.008 | 0.023 | 0.008 | 0.024 | 0.004 | 0.012 | 0.013 | 0.039 |
| 5-Methylchrysene | 1.000 | | 0.003 | 0.003 | 0.003 | 0.003 | 0.002 | 0.002 | 0.005 | 0.005 |
| 5-Nitroacenenapthene | 0.020 | | 0.015 | 0.000 | 0.016 | 0.000 | 0.008 | 0.000 | 0.026 | 0.001 |
| 1-Nitropyrene | 0.100 | | 0.015 | 0.002 | 0.016 | 0.002 | 0.021 | 0.002 | 0.026 | 0.003 |
| 4-Nitropyrene | 0.100 | | 0.015 | 0.002 | 0.016 | 0.002 | 0.021 | 0.002 | 0.026 | 0.003 |
| 6-Nitrochrysene | 10.000 | | 0.008 | 0.075 | 0.008 | 0.080 | 0.004 | 0.041 | 0.013 | 0.130 |
| 2-Nitrofluorene | 0.010 | | 0.015 | 0.000 | 0.016 | 0.000 | 0.021 | 0.000 | 0.026 | 0.000 |
| (BaP) Equivalent** | | | | 2.03 | | 2.28 | | 1.22 | | [illegible] |

Notes:
* = The laboratory was not able to analyze for this compound.
** = Benzo(a)pyrene (BaP) equivalent is calculated based on the concentration and weighted toxicity of carcinogenic PAHs (cPAH); Minnesota Pollution Control
mg/kg = Milligrams per kilogram.
< = Less than the reporting limit indicated in parentheses.
Dredge Management Level 1= results less than SRV 1 (suitable for residential landuse)
DredgeManagement Level 2= results less than SRV 2 (suitable for industrial landuse)
[illegible]
NE = Not established for this parameter.

# 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 2013 inspections is as follows:

- 438 permits issued
- 3,048 site inspections completed
- 353 enforcement actions issued for site compliance
- 113 citations for non-compliance after enforcement action
- Coordinated inspections with Minnehaha Creek Watershed District (MCWD)

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:

- Reductions of TSS for discharges to all receiving water bodies
- In addition to TSS, controlled rate of runoff for discharges to streams, areas prone to flooding, and areas with infrastructure limitations
- 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.

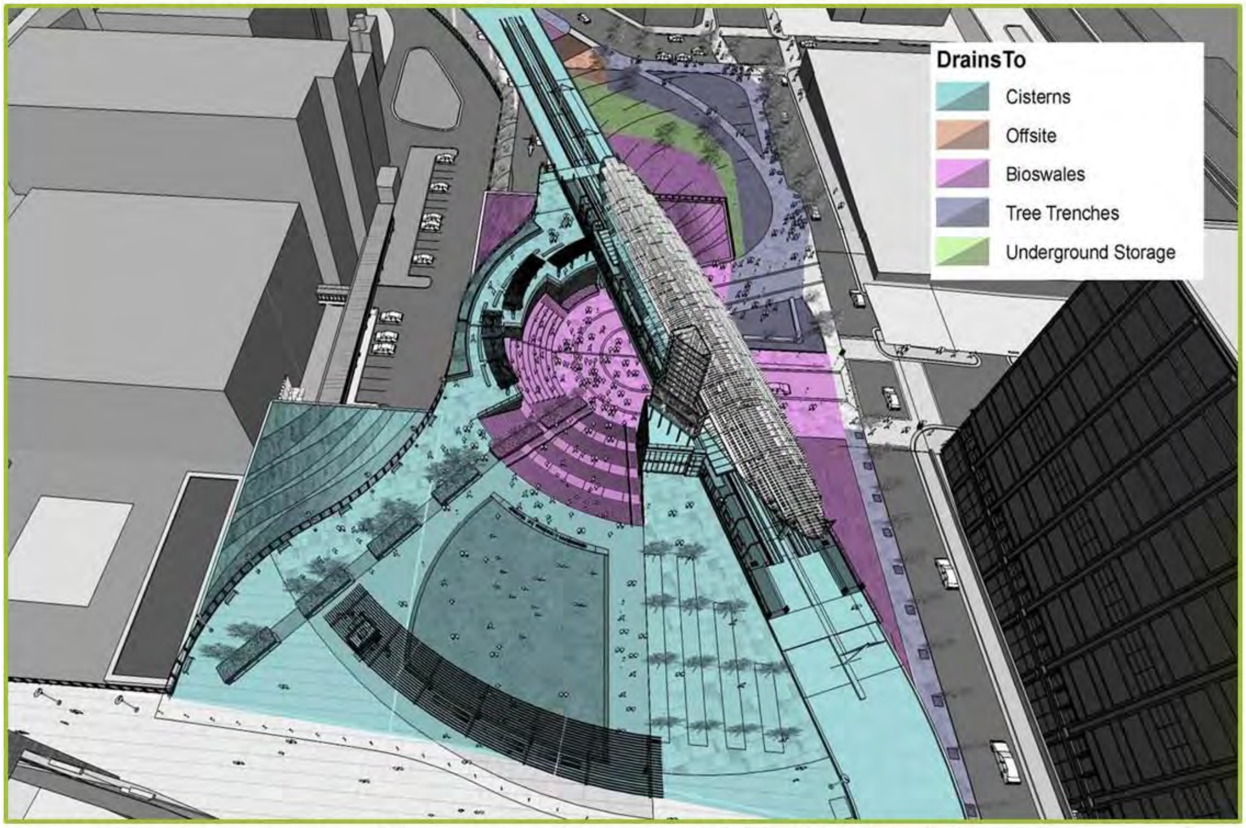
## Previous Year Activities

During 2013, Minneapolis Public Works took part in the preliminary review of 121 projects. Of those 121 site plans, 77 projects with a total of 93 BMPs received final approval, with the appropriate permits issued. These BMPs will provide rate control and water quality for approximately 70 acres of land, including 45+ acres of impervious area.

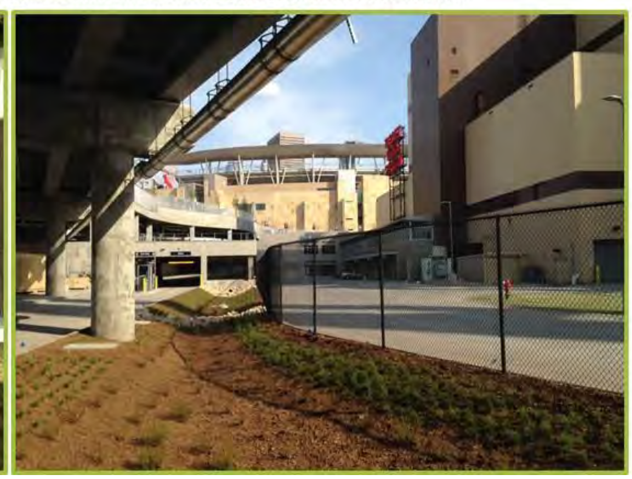
BMP types included:

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

**Example Redevelopment Project: HENNEPIN COUNTY INTERCHANGE**




**In 2013, Hennepin County constructed the 13-acre Interchange – a transit hub for light rail transit, buses and commuter rail. Nearly all the stormwater is treated on site. The photos below show the rain cisterns and one of the bioswales.**

# 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.

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[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.

***Snow and Ice Control***

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. 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. 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. In 2007, the EPA approved a Total Maximum Daily Load (TMDL) study that places limits on chlorides (salt) discharged to Shingle Creek which had been assessed as impaired for chlorides. 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. A metro-wide chloride TMDL study is underway. 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.

***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.

## Previous Year Activities

The 2013-2014 winter season was colder, with numerous snow events. There were 32 notable events with 70.0 inches for the season, as compared to an average of 48 inches. The most snowfall was observed in January. There were seven declared snow emergencies, which is four over the annual average, and there were 160 days of snow and/or temperatures 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:

- 15,384 tons of salt applied to roadways
- 17,052 tons of sand applied to roadways
- 14,404 tons of materials reclaimed during spring and summer street sweeping operations
- 6,009 tons of leaves collected for composting during the fall citywide sweeping
- 22 staff members attended an eight-hour refresher for the 40-hour hazardous materials training class
- 11 staff members attended training on the use of salt as presented by watershed organizations
- 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: 44%
- Amount of salt and sand applied relative to total snowfall: 463 tons/inch

# VII. Flood Control

## Program Objective

The objective of the Minneapolis stormwater management program is to design flood control systems that manage stormwater quantities so that the runoff does not exceed the capacity of the existing facilities while minimizing the adverse impacts on the water quality of the receiving water body. Targeted pollutants include:

- Phosphorus
- Total Suspended Solids (TSS)

## Program Overview

In July 1997, Minneapolis experienced torrential rainstorms that exceeded the capacity of the City's existing storm drain system and caused flooding throughout the City, causing physical damage to homes, businesses and vehicles. In response, Minneapolis Public Works established the Flood Mitigation Program to develop potential solutions and a plan for implementation for each of 39 areas that experienced flooding and/or property damage as a result of the 1997 storms.

The Flood Mitigation Program began in 1998 and was originally scheduled to run through 2009. However, due to the state of the City's available finances, this Program was temporarily suspended. In addition, new flooding areas continue to be identified by residents, or through continued analysis of the system. In 2012, a new program, Flood Mitigation with Alternative Stormwater Management, was established to address the backlog of identified flood areas throughout the City, with consideration of alternative or "green infrastructure" strategies. Storm drains are designed to accommodate open channel flow during a 10-year, 24-hour design[4] and minimize the risk of flooding of homes from the 100-year, 24-hour design event. However due to ever-increasing emphasis on water quality and Total Maximum Daily Load (TMDL) standards, flood mitigation strategies have changed to become one of several factors considered with projects. The new type of project tries to achieve the three R's or the three ***REDUCTIONS*** of ***VOLUME***, ***LOAD*** and ***RATE***.

With this strategy, the designer first looks for ***VOLUME REDUCTION***. This is a successful approach for responding to TMDL targets, because these volume reducing techniques do not concentrate the phosphorus or suspended solids, so there is a corresponding ***LOAD REDUCTION***. Next the designer

[4] City of Minneapolis 10-year design based on 4.3" of rainfall in a 24-hour event and 100-year design based on 7.5" of rainfall in a 24-hour event. Amounts updated for NOAA Atlas 14.

looks for ***RATE REDUCTION***. This also is a successful approach for responding to TMDL targets, because the techniques slow the water down at its source, thereby reducing the initial amount of sediment that reaches the stormwater system. Rather than only relying on enlarging pipes to drain more stormwater faster, new techniques focus on green initiatives that treat stormwater where it falls and this approach develops options that attempt to minimize the need for new or larger pipes.

A project that proposes to use street right-of-way for infiltration is a ***Three "R"*** project because phosphorus-laden suspended solids would be filtered by porous media and then infiltrate into the soil. If the project is in an area that precludes infiltration due to clay soils or other factors, after filtration by porous media, the stormwater would enter an underground reservoir/underground storage to feeds tree roots for evapotranspiration and then be slowly released to the stormwater system.

In many cases, adding catch basins or augmenting inlet capacity has the negative effect of increasing the runoff rate. New strategies would look for volume-reducing techniques upstream so the existing system would then have capacity for existing flows. Here are other strategies to help control flooding:

- 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.

## Previous Year Activities

In 2013, two flood control projects were completed. One project was to address repeated flooding in an alley in the vicinity of Hennepin Av S and S 25-1/2 Street that was causing property damage and contributing to clear water inflow to the sanitary sewer system.

The other project was in conjunction with the Hennepin County Interchange transit station project, located next to the Minnesota Twins Ballpark, which was built to link commuter rail, light rail transit and bus service. Storm drains in the vicinity of 5th Street N and 6th Avenue N were reconfigured, to reduce frequent flooding of streets and adjacent properties. (The Interchange project itself is referenced in Section V of this annual report, Stormwater Management Requirements for Development/Redevelopment. The project incorporated a number of stormwater management features to provide water quality benefits, as well as rate and volume control.)

## Performance Measures

While most citizens will measure success by whether there is reduced neighborhood flooding, the flood control work now also targets water quality. Many of the projects are intended to determine and demonstrate technology that works specifically for this City. Continuing the objectives of previous years, the goal is increased water quality of lakes, river and streams in Minneapolis. The Flood Mitigation Program Projects now include attempting to treat stormwater where it falls and making ***VOLUME REDUCTION*** the common element of systems, because volume-reducing systems provide for reduction of TSS, nutrients, litter, and other pollutants, as well as providing some ***RATE CONTROL***.

# 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

### *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. Plant Health Care/Integrated Pest Management Action Forms are filed when there are specific plant health problems for these garden areas. These forms document the specific problems and the recommended 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 invasive, non-native plant species. Eurasian watermilfoil, an aquatic weed, is harvested mechanically on Lakes Harriet, Wirth, Cedar, Isles and Calhoun throughout the summer months. 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 MPRB 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. The MPRB natural resources staff works with the Minnesota Department of Agriculture to stay current with biocontrol methods. 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 seedhead-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*).

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.

Fertilizer Use

In September 2001, the Minneapolis City Council amended Title 3 of the Minneapolis Code of Ordinances (relating to Air Pollution and Environmental Protection) by adding Chapter 55, 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.

***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 Golf Course foremen, received the ACSP certification for all courses. In 2013, three additional courses were certified. Certified courses are Colombia, 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, through the Minnesota Department of Agriculture: 172

# 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

- Spill response time in 2013: Not recorded. Spill response time in 2012: 42 minutes. Baseline spill response time in 2011: 38 minutes.

## *Illicit Discharges and Improper Disposal to Storm Sewer System*

- Conducted 22 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 1 spill incident on the Mississippi River where containment boom was deployed at a sinking houseboat. Minneapolis Fire, Minneapolis Fire Inspection Services, and MPCA participated in these efforts.
- Responded to 2 spill incidents on Minneapolis lakes where containment booms were deployed. Minneapolis Fire, Minneapolis Fire Inspection Services, Minneapolis Public Works, Minneapolis Park & Recreation Board and the MPCA participated.
- Conducted 3 days 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 and boom was set at outfalls.
- 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 as in instructor.

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[5] 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

## Previous Year Activities

- Addressed 155 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 581 water and land pollution complaints (illegal dumping, improper storage of material, and chemical storage).
- Carried out 620 brownfield maintenance, monitoring and treatment activities at 96 sites. Sites include:
    1. Superfund sites: 1
    2. Leaking petroleum sites: 13
    3. Remediation systems: 8
        - Pump, treat and discharge groundwater
        - Soil venting

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

4. Wells: 74
    - 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 24 limited duration sanitary sewer and storm drain discharge permits.
- Approved 80 storage tank permits:
    - Above ground - 0 abandoned-in-place, 7 installed, 29 removed
    - Underground - 15 abandoned-in-place, 5 installed, 46 removed

***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 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 79 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.
- Reviewed 325 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

## Part A. CSO Program

**CSO Program Overview**

In 2013 the City of Minneapolis continued its program to reduce inflow and infiltration (I & I) to the sanitary 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 focus that the city has had since the 1960s when the city began a 40-year residential paving program.

The principal work 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 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. Management techniques are required for volume reduction or rate reduction, and the techniques vary with each project. Cumulatively, the runoff from these projects can be significant.

At this time, mitigation begins with an effort to reduce the volume of runoff. Options that reduce volume must have space within the right-of-way or must have an off-site area, with suitable soils for volume reduction in either case. Next, load reduction options are investigated, using recognized Best Management Practices (BMPs) such as prefabricated swirl-type grit chambers, biofiltration or ponds. Space constraints in fully developed urban areas like Minneapolis limit many projects to use of compact prefabricated BMPs for load reduction.

**Previous Year Activities**

The storm drain project areas for 2013, and associated water quality impacts, are referenced in the following table:

| PROJECT AREA | PROJECT DESCRIPTION | STORMWATER RUNOFF BENEFITS |
|---|---|---|
| **CSO Area 155 (2nd St N & 14th Av N** | Eliminated cross connection from storm to sanitary sewer | Eliminated CSO area of 30.84 acres |
| **CSO Area 157 (Pillsbury Av S & 40th St W)** | Redirected catch basin from sanitary sewer to storm sewer | Eliminated CSO area of 0.93 acres |
| **CSO Area 156 (Washington Av N & Dowling Av N)** | Redirected catch basin from the sanitary sewer to storm sewer | Eliminated CSO area of 0.23 acres |
| **CSO Area 144 (Glenwood Av N & Colfax Av N)** | Redirected catch basin from the sanitary sewer to the storm sewer | Eliminated CSO area of 0.16 acres |
| **CSO Area 136 (Grand Av S & 44th St W)** | Redirected catch basin from the sanitary sewer to the storm sewer | Eliminated CSO area of 0.14 acres |

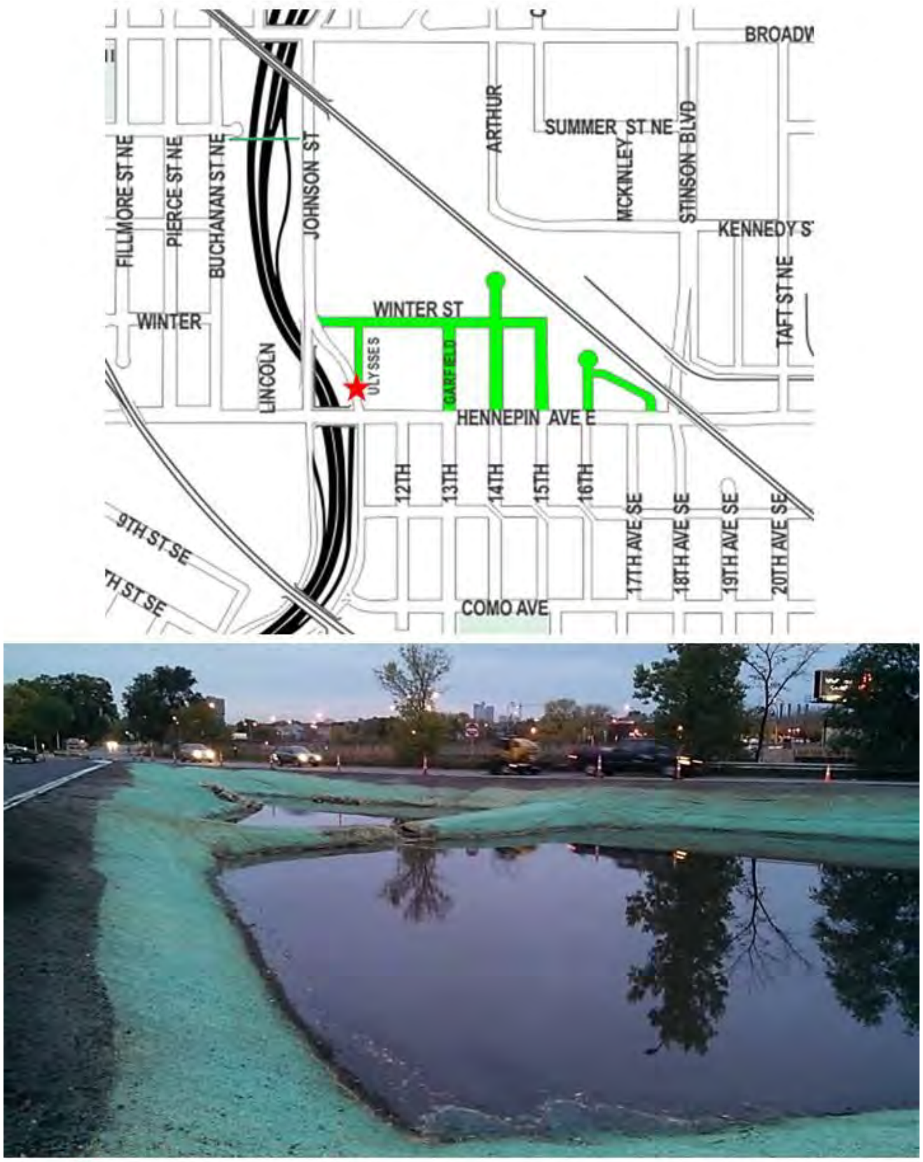
## Part B: Street Projects

For street renovation or 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 2013, in conjunction with the Winter Street Paving Project (see map below), construction commenced on a 2-cell infiltration basin with a lined sedimentation forebay and a pre-treatment hydrodynamic separator. Soil amendments and plantings will be installed in 2014. The stormwater practice addresses a number of issues:

- Disconnecting stormwater runoff from 7.2 acres previously discharging to the sanitary sewer system, which addresses the Metropolitan Council inflow/infiltration (I/I) program as well as the city's combined sewer overflow elimination program.
- Controlling flow rates to both the I-35W storm tunnel and the 10th Avenue storm tunnel. Discharge rates to both tunnels will be lower than they were prior to the sanitary sewer disconnection.
- Providing water quality benefits for runoff from 37.4 acres that were previously untreated.




★ Winter Street 3-cell pond. 2013-2014 construction. Pond discharges to the I-35W (north) tunnel.

# 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 stormwater. The program's goals include showing 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 2013, 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 watersheds 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 2013, 6 workshops were held within Minneapolis.

B. Lake Nokomis Area Alley Project: In 2013, Metro Blooms, the City, the Minnehaha Creek Watershed District and neighborhood participants continued work on a project to engage residents and business owners in an initiative to reduce pollutants in stormwater runoff entering Lake Nokomis, that has been determined by the State of Minnesota to be impaired due to excessive phosphorus. Building on the success of the Powderhorn Lake Rain Garden initiative, Metro Blooms is focusing on minimizing the discharge of sediment-laden stormwater to alleys, by working with residents to install filter strips or rain gardens.

***Minneapolis Park & Recreation Board Education Activities and Events***

In 2013, Minneapolis Park & Recreation Board (MPRB) staff provided water quality education programs throughout the City. Environmental Operations naturalist staff participated in 76 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).

**2013 List of neighborhood parks and agencies that had water-quality education program events. Several sites hosted multiple events.**

- Armatage
- Bottineau
- Central Avenue Open Streets
- Creekview
- Dickman
- Folwell
- Fuller
- Kenny
- Lake Hiawatha
- Linden Hills
- Lowry Avenue Open Streets
- Martin Luther King
- Matthews
- McRae
- Mississippi Watershed Management Organization
- Nokomis
- Painter
- Pearl
- Pershing
- Swedish Institute
- Van Cleve
- Victory Memorial Parkway
- Windom South
- Wirth Park

**CANINES for CLEAN WATER**

***Canines for Clean Water***

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 2013 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.

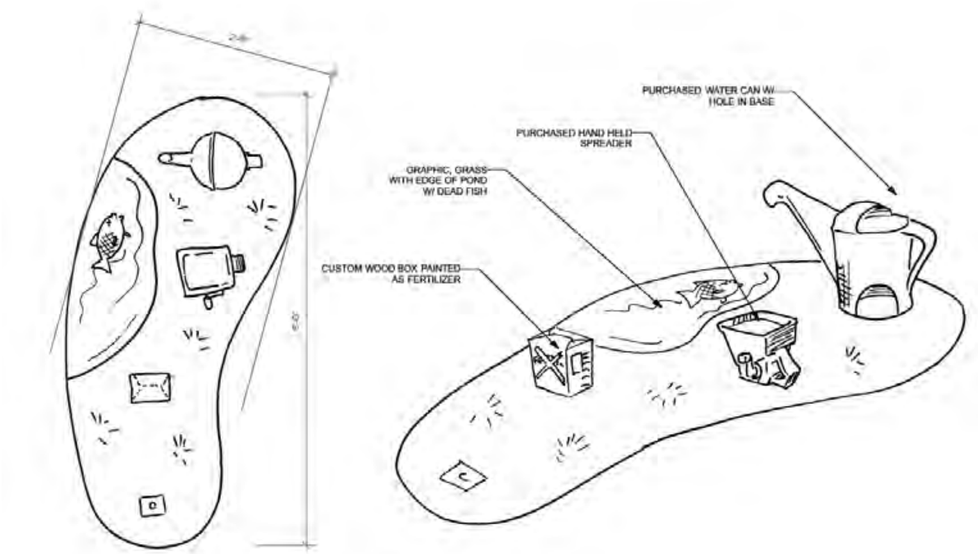

One of a new series of posters for the Minneapolis Canines For Clean Water Campaign.

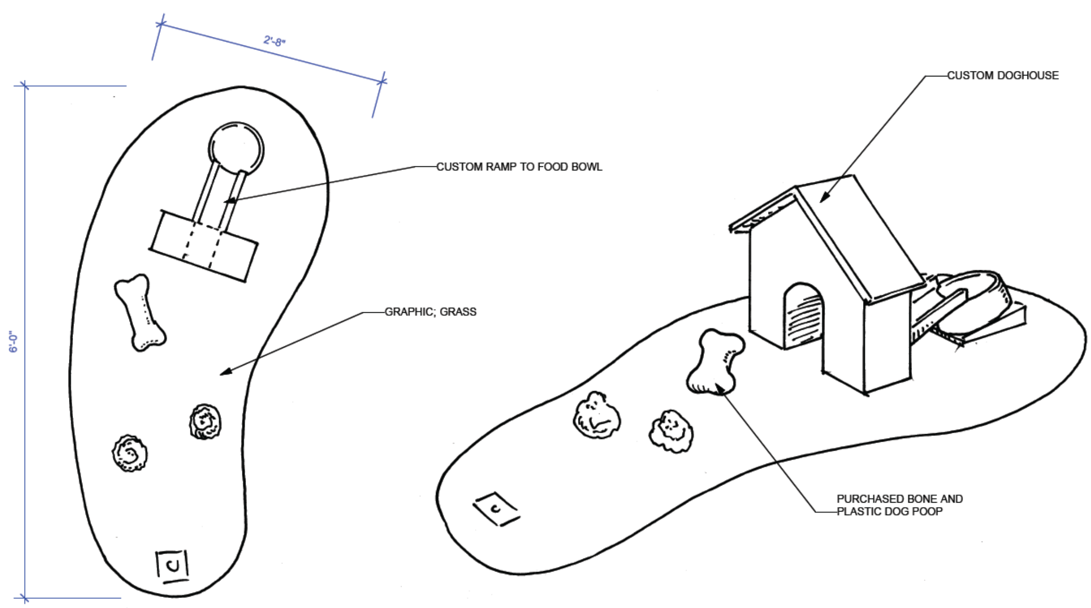
**<u>The caption says:</u>**
**Do you realize where that abandoned dog poop ends up? I drink out of this lake.**

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.

***Upgrade of Water Education Materials***

In 2013, work was completed on a series of portable mini-golf holes that feature water quality messages or best practices, such as reducing the use of fertilizer, redirecting the down spout, picking up after a pet, and keeping leaves and grass out of the street. Lawn signs accompany each hole and utilize simple graphics as well as text to encourage children and parents to take action to protect water quality. The portable putt-putt course was used at neighborhood festivals and events like National Get Outdoors Day.




DOG POOP
Scale: 1" = 1'-0"

***Mississippi River Green Team***

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

The 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 in the natural areas of the Minneapolis park system, and mostly within the watershed of the Mississippi River. Typical work days include invasive species removal, weed wrenching, planting, watering, mulching, and citizen science work. Their Youth In Action video is at this link: https://www.youtube.com/watch?v=myois1Y4eNE

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

In 2013 the Green Team served as citizen scientists as part of the Minnesota Odonata Survey Project. Each week the teens helped catch and identify dragonflies at North Mississippi Park. They also surveyed dragonflies at eight other parks. Dragonflies are an indicator species for assessing habitat and water quality in wetlands, riparian forests, and lakeshore habitats. You can read more about the Odonata Project, and volunteer for it, here: http://www.mndragonfly.org

Other summer work sites included Heritage Park/Sumner Field, Audubon Park, Powderhorn Park, and Mill Ruins Park. The Green Team also worked at stormwater holding ponds owned by the City of Minneapolis including the $37^{th}$/Columbus Pond, Camden Central Pond, Central Avenue Pond at Columbia Golf Course, and the two Park Avenue ponds. The teens removed invasive species and volunteer trees that sprouted in the wrong places, and picked up trash. To support monarch butterflies and other pollinators at the BMPs, the crew installed a variety of native plants.

Green Team youth completed training on Turfgrass Maintenance for Reduced Environmental Impacts. The training was funded by the Mississippi Watershed Management Organization. Another highlight of the season was working with Augsburg College students to sample area lakes for *Daphnia*, an indicator genus useful for water quality testing.

The Green Team worked with local artist Gita Ghei to create bronze medallions with water quality messages. The youth etched designs and words into wax, including Don't Feed the Geese!, Stop Erosion, and Don't Litter. Molds were created from the wax, which were then used to cast the bronze medallions. They were embedded into the new concrete sidewalk that rings Powderhorn Lake. The medallions help remind park users that their actions directly impact the water quality of Powderhorn Lake.

***Earth Day Watershed Clean-Up Event***

The 2013 Earth Day Clean-Up was cancelled due to snow cover and poor weather. Earth Day is a collaborative effort between the City of Minneapolis and the Minneapolis Park & Recreation Board. The goals include preventing trash and debris from entering local waterbodies, providing a rewarding volunteer experience, and sharing environmental information to Minneapolis residents and park users who participate in the event.

***On-the-Water-Learning***

In 2013, fabrication was completed for a new self-directed on-the-water learning quest for use on Lake Nokomis. This learning activity is aimed at people in canoes, kayaks, sailboats, and fishing boats, as well as those on stand-up paddle boards. A series of buoys will route people around the lake, bringing them close to storm water outlets, alluvial fans, algae blooms, erosion, etc. Water quality questions have been printed on the buoys. Answers can be found by pulling up on the attached wire. The buoys will be deployed in the summer of 2014.

***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 residents and 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 Minnesota's lakes, rivers and streams.

In 2013, the City continued the program using four self-contained stenciling kits, each containing everything needed to stencil storm drains: stencils, a map with 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 nearby 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 are only in English.



Safety of the volunteers is very important, so we provide traffic cones and safety vests. We encourage groups to stencil on low volume streets, which provides a safer environment. If children are part of the group, we request that an adult be present at all times to supervise. Trash bags and gloves are provided to pick up trash in the areas around the storm drain inlets, especially on the upstream 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. In 2013, the City furnished kits that were used by 157 participants painting 432 catch basins and distributing over 600 door hangers.


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 CONTROL INFORMATION*** – The City web site provides educational information regarding flood control. 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/

***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/index.htm

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://www.pca.state.mn.us/index.php/water/water-types-and-programs/stormwater/stormwater-management/minnesota-s-stormwater-manual.html

***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 – http://www.minneapolisparks.org/home.asp

***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.

The Annual Report is due June 30 of each year, for the prior year's activities. Each year, the City holds a public hearing at a meeting of the Transportation & Public Works Committee of the City Council. 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 June 17, 2014 at 9:30 AM in Council Chambers, Room 317 City Hall, 350 S 5th Street, Minneapolis, MN.

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 June 25, 2014. 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. A response to those public comments is then 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 | Address |
|---|---|---|---|
| Bassett Creek Water Management Commission | kchandler@barr.com | c/o Karen Chandler, Barr Eng. Co. | 4700 W 77th St, Mpls, MN 55435 |
| Bassett Creek Watershed Management Commission | kchandler@barr.com | c/o Karen Chandler, Barr Eng. Co. | 4700 W 77th St, Mpls, MN 55435 |
| Bassett Creek Watershed Management Commission | Laura.jester@keystonewaters.com | Laura Jester | |
| Blue Water Association | sheila62sdmn@yahoo.com | Sheila Cracraft-Fehler | 4116 32nd Av S, Mpls, MN 55406 |
| Clean Water Action | mzellar@cleanwater.org | Marie Zellar | 308 Hennepin Ave E, Mpls, MN 55414 |
| Friends of the Mississippi River | wclark@fmr.org | Whitney Clark | 360 N Robert St, St. Paul, MN 55101 |
| Hennepin County Environmental Dept. | rosemary.lavin@co.hennepin.mn.us | Rosemary Lavin | 701 4th Avenue S, #700, Mpls, MN 55415 |
| Hennepin County Environmental Dept. | randy.anhorn@co.hennepin.mn.us | Randy Anhorn | 701 4th Avenue S, #700, Mpls, MN 55415 |
| Hennepin County Environmental Dept. | carl.michaud@co.hennepin.mn.us | Carl Michaud | 701 4th Avenue S, #700, Mpls, MN 55415 |
| Metropolitan Council Environmental Services | bill.moeller@metc.state.mn.us | Bill Moeller | 3565 Kennebec Dr, Eagan, MN 55122 |
| Minneapolis Citizens Environmental Advisory Committee | gayle.prest@minneapolismn.gov | c/o Gayle Prest, Coordinator's Office | |
| (all) Minneapolis Neighborhood Organizations | Bob.Cooper@minneapolismn.gov | c/o Bob Cooper, CPED | |
| Minnehaha Creek Watershed District | jwisker@minnehahacreek.org | James Wisker | 15320 Minnetonka Blvd, Minnetonka, MN 55345 |
| Minnehaha Creek Watershed District | bhoudek@minnehahacreek.org | Becky Houdek | 15320 Minnetonka Blvd, Minnetonka, MN 55345 |
| MN Center for Environmental Advocacy | ksigford@mncenter.org | Kris Sigford | 26 E Exchange St, # 206, St. Paul, MN 55101 |
| MN Dept of Agriculture, Pesticide Mgmt | ron.struss@state.mn.us | Ron Struss | 625 Robert St N, St. Paul, MN 55155 |
| MN Dept of Natural Resources, Eco/Waters Division | kate.drewry@state.mn.us | Kate Drewry | 1200 Warner Road, St. Paul, MN 55106 |
| MN Dept of Transportation, Water Resources | beth.neuendorf@dot.state.mn.us | Beth Neuendorf | Waters Edge, 1500 W Cty Road B-2, Roseville, MN 55113 |

| | | | |
|---|---|---|---|
| MN Environmental Partnership | stevemorse@mepartnership.org | Steve Morse | 2356 University Av W, #244, St. Paul, MN 55114 |
| Mississippi River Revival | solomonsimon@hotmail.com | Sol Simon | 51 E 4th St, Suite 305, Winona, MN 55987 |
| Mississippi Watershed Management Organization | dsnyder@mwmo.org | Doug Snyder | 2522 Marshall Street NE, Minneapolis, MN 55418 |
| St. Paul, City of | anne.weber@ci.stpaul.mn.us | Anne Weber, Sewer Utility | 25 W 4th St, 700 City Hall, Saint Paul, MN 55102 |
| Shingle Creek Watershed Mgmt. Commission. | judie@jass.biz | Judie Anderson | 3235 Fernbrook Lane, Plymouth, MN 55447 |

**Attachment: List of Recipients of Public Hearing Information and Draft Modifications to Stormwater Management Program 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, 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)*

The BCWMC approved its Second Generation Watershed Management Plan in September 2004, and is nearing the end of its Third Generation planning efforts. 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 MWMO delegates stormwater management requirements for new developments 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.

### *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. 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) Spill Response***

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.

***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 special 2012-2014 project with Bassett Creek Watershed Management Commission is shoreline restoration along the creek. The project was bonded by the Commission, and is being implemented by the City and the MPRB.
- A special 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 water quality issues.
- A special 2011-2013 project with the Minnehaha Creek Watershed District was 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 in the Minnehaha Creek watershed, and explore community adaptation strategies.

- 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.

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.

***NPDES Land Use Sites Monitoring Results (Stormwater Runoff Monitoring)***

In 2013, stormwater runoff monitoring was carried out at four representative management sites of land use types Multi-Family Residential, Recreational/Parkland, Commercial/High-Rise, and Commercial/Industrial. A complete description of the Stormwater Runoff monitoring program, including site locations, is located in Appendix A4 of this annual report. In 2013, flow-paced storm event samples were collected from May through the beginning of November. Two snowmelt samples were collected at Sites 6, 7 and 9 on 1/10/13, 1/22/13, and 2/27/13 and at site 8a on 4/3/13 and 4/23/13. With the exception of Site 8a, snowmelt samples were generally brown to dark brown. Samples at Site 8a were relatively clear.

If a sample was not taken one month, more than one sample was taken the next month to catch up. The required number of samples was met or exceeded for the year. The total volume sampled at each site and the total recorded volume is given in **Table 24-2** of **Appendix A4** along with the percentage sampled per season. For detailed information on sampling events see **Table 24-3** of **Appendix A4**. The parameters listed in the Limits and Monitoring Requirements section of the permit were monitored and analyzed for the samples collected. Bacteria grab samples were taken throughout the season using standard protocols.

Sampled data for 2013 were similar to typical urban stormwater data (**Tables 24-8** and **24-9 of Appendix A4**, respectively). **Table 24-8** shows median values for residential sampled sites. Results were similar or less than Nationwide Urban Runoff Program (NURP) values with the notable exception of TKN values. It is unknown why MPRB TKN median values are higher than NURP values. Most MPRB representative watershed land use category values collectively were similar to the NURP values. All metals monitored were well below NURP levels.

Most median 2013 parameters were comparable or lower than the data from 2001-2012 with the notable exception of residential Pb. It is unknown why residential 2013 Pb data are higher than previous year’s medians, but may possibly be due to soil disturbance or home exterior maintenance disturbing lead paint in the watershed. In 2013, all three land use categories saw a decrease in all the median value concentrations of many parameters from the previous comparative years. It is important to note that the sites monitored in 2005-2013 are located in different watersheds and have similar but not identical land uses to those monitored in 2001-2004.

Data from MPRB Sites 1–5a (2001–2004) and 6–9 (2005–2012) were generally similar to Sites 6–9 in 2013. Sites 1–5a (2001–2004) and 6–9 (2005–2012) were generally similar to Sites 6–9 in 2013. All measured mean compared parameters were roughly equal to or lower in 2013, with the exception of TDP, TDS, and TKN. The 2013 increase in TDP, TDS, and TKN are likely the result of organic material in the watersheds interacting with the wet spring and dry summer/fall.

***Best Management Practices Monitoring Results***[6]

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.

Minneapolis is initiating a study to quantify the measurable stormwater effects of street sweeping. A pilot watershed was selected for the study on the southeast side of Lake Nokomis, a lake that is impaired for phosphorus. Monitoring in 2012 and 2013 was to establish baseline data prior to testing street sweeping changes in the pilot watershed. A complete description of the monitoring is located in Appendix A5 of this annual report.

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, did not have major issues with standing water, and had room for equipment. It was chosen and monitored in 2012 - 2013 for baseline conditions. Future monitoring will be compared to these initial data and conclusions drawn.

Snowmelt grab samples were collected on 1/11/13 and 2/26/13 in 2013. The auto monitoring sampling period was from 5/23/13 – 11/14/13. With the exception of snowmelt grabs, all stormwater samples in 2013 were collected by flow weighted auto monitoring.

The 56th & 21st outlet is a 30” reinforced concrete pipe. In 2013, at the 56th & 21st site, a total of 15 storms and 10 non-precipitation illicit discharge sample events were collected. As a by-product of the monitoring, it was revealed that dry weather flows were occurring some nights between 2:30 and and 3:00 am, from late summer to fall (July – November). Automated lawn sprinklers in the watershed were

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[6] For tables referenced in this section, see Appendix A5. This section, along with Appendix A5, are adapted from the 2012 Water Resources Report, which is produced by the Minneapolis Park & Recreation Board. These annual reports can be found at this Minneapolis Park & Recreation website.

suspected, and an extensive physical watershed investigation was carried out by MPRB and City staff. No source, however, has yet been found.

In **Appendix A5**, **Table 25-4**, it is interesting to note that the geometric mean percentage of both TDP and VSS are roughly 50% or greater. This means over half of the phosphorus (TP) are dissolved (TDP) and the solids (TSS) are organic solids (VSS). 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 half of the load.

***Other Monitoring***[7]

Minnehaha Creek at Xerxes Avenue South was monitored in 2013, the fifth year of monitoring at this location. Installation was on May 10, 2013 when freezing conditions had subsided. Xerxes Avenue South crosses Minnehaha Creek at the border of Minneapolis and Edina. The station should allow Minneapolis to determine what is coming into the City from the upstream areas and help determine the impact of Minneapolis's stormwater on Minnehaha Creek.

The water in Minnehaha Creek at Xerxes can be describes as having four main sources. First is runoff from the immediate watershed. Second is runoff from the larger watershed, between Lake Minnetonka and Xerxes Avenue S. Third is discharge from Lake Minnetonka at Gray's Bay Dam, which is intermittent because the outlet from Lake Minnetonka into Minnehaha Creek is adjustable, therefore discharge rates vary. The fourth source of water is groundwater. Groundwater can flow into (discharge to) and out of (recharge from) Minnehaha Creek.

Stream stage (level) and discharge (cubic feet per second -cfs) fluctuated widely over the sampling season **Appendix A6**, **Figure 26-4**. The average 2013 stage was approximately 25.9 inches. In 2013, peak stage was 61 inches on July 13, and the lowest stage was ~15 inches November 12.

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 which can last two to four days. The spring of 2013 was very wet and was followed by a significant mid-summer drought. Both the large rainfall volumes and sustained rainstorms of April through June and the August through September drought were visible. In 2013, the Gray's Bay Dam was opened and closed intermittently in October. The dam was opened May 6 and closed October 2, opened October 4 and closed October 11, opened October 16 and closed October 28 for the remainder of the year.

The field equipment instrumentation was an ISCO 2150 datalogger, 2105 interface module, and 2013ci cell phone modem were installed with a low-profile A/V (area velocity) level probe. The datalogger

[7] For tables referenced in this section, see Appendix A6. This section, along with Appendix A6, are adapted from the 2012 Water Resources Report, which is produced by the Minneapolis Park & Recreation Board. These annual reports can be found at this Minneapolis Park & Recreation website.

software used Flowlink Pro and had the ability to remotely push up data to the server and be remotely called up and programmed to change the pacing or triggers, using the cell phone modem. With the Xerxes bridge vertical concrete wall restrictions and a relatively flat stream bottom, the discharge was calculated with a weir discharge equation (a broad crested weir with end contractions). When enough stage discharge readings were developed by stream gauging, a datalogger look-up table was used as the rating curve.

In 2013, nine baseflow samples and seven storms of varying intensity (minimum 0.19 in, maximum 3.00 in storms) were captured throughout the sampling season. The event-pacing and trigger stage were adjusted for each storm to attempt collection of the entire hydrograph.

2013 baseflow conditions in the stream were markedly different from storm events. Baseflow samples generally had lower concentrations of nutrients and metals than did storm events. Baseflow also had the highest geometric mean concentrations for Cl, hardness, TDS, and specific conductivity. The levels of these dissolved parameters indicate that baseflow is likely dominated by groundwater discharge comingled with Lake Minnetonka surface water.

The majority of Minnehaha Creek storm events are from urban stormwater. The 2013 storm events show the single highest individually measured TP and TSS values. Storm event data consistently show higher TP and TSS values than baseflow, as shown in **Appendix A6**, **Table 26-3** and **Table 26-4**.

Non-snowmelt chloride values were between 17 mg/L and 93 mg/L. Chloride was generally below MPCA standards but higher than expected during the sampling season for both baseflow and storms, as shown in Table 26-2. The source of low level chronic $Cl^-$ in Minnehaha Creek is likely caused by winter road salt (NaCl) continuously leaching from the upstream soils. The MPCA chronic stream chloride standard is 230 mg/L for four days and an acute standard of 860 mg/L for one hour. The May 8 baseflow sample had a chloride level measured at 255 mg/L which was above the 230 mg/L chronic standard. Other than the December 17 sample (220 mg/L), the other baseflow samples collected were well below the chronic stream standard. No sample approached the acute 860 mg/L one hour standard.

### ***Minneapolis Lake Trends***

In 2013, MPRB scientists monitored 14 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 (2) | Brownie Lake | Diamond Lake (1) |
| Cedar Lake (2) | Lake of the Isles | Loring Pond |
| Lake Harriet (2) | Lake Nokomis (1) | Spring Lake |
| Powderhorn Lake | Lake Hiawatha | |
| Wirth Lake | | |

Notes on trends: (1) Improvements in Diamond Lake and Lake Nokomis may soon shift these lakes to the next higher-level category, due to increasing water quality indicators. (2) Lakes Calhoun, Cedar and Harriet were treated with alum in the late 1990s to early 2000s. Future monitoring may indicate that the effects of the alum treatments may be fading, and TSI scores may stabilize at a level that is not as low as the immediate post-alum years.

***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 length of this NPDES MS4 Annual Report, only the NPDES stormwater runoff monitoring and BMP monitoring sections are included (in Appendix A). Electronic copies of the *2013 Water Resources Report* will be available 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.

## Event Mean Concentration and Annual Pollutant Loadings

Calculated event mean concentrations and annual pollutant loading are included in Appendix A7.

- The following formula was used to calculate the total annual pollutant load:

**L** = [(**P**) (**Pj**) (**Rv**) (**C**/1000) (**A***4046.9)], 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, in acres

Conversion factors were used to convert acres to square meters, and to adjust the concentration data units. Conversion factors are as follows:

4,046.9 for acres → square meters

1,000 for liters → cubic meters

The Flow Weighted Mean Concentration (FWMC), expressed as a mean of all sites, was used for the annual load estimation calculations. The FWMC most accurately reflects stormwater loading on an annual basis. The seasonal loads were calculated from the pooled data using the median event mean concentration, as there were too few data points from each watershed. 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, National Weather Service |
|---|---|---|
| Winter/snowmelt | 01/01/13 – 03/31/13 | **4.23 inches (0.107 meters)** |
| Spring | 04/01/13 – 05/31/13 | **11.46 inches (0.291 meters)** |
| Summer | 06/01/13 – 08/31/13 | **10.75 inches (0.273 meters)** |
| Fall | 09/01/13 – 12/31/13 | **6.33 inches (0.161 meters)** |
| Total | 01/01/13 – 12/31/13 | **32.77 inches (0.832 meters)** |

[end of document]

# 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

# 24. National Pollutant Discharge Elimination System (NPDES) Monitoring

## 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.

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, 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 2013, 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, data handling, validation, and reporting.

### Site Installation

The equipment installed at each site included an ISCO 3700 sampler, a low profile area/velocity pressure transducer, and an ISCO 2150 datalogger. The dataloggers were flow-paced and adjusted throughout the year to collect samples over the entire hydrograph of a storm event. Each site was equipped with a 2103ci or 2105ci interface module that contained a cell phone modem. Each site automatically uploaded data to the network server database daily. Each site could also be communicated with remotely by Flowlink Pro software in order to adjust pacing, on/off conditions, etc.

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. 8a (Pershing Park) was installed on 5/14/13. Site 6 ($22^{nd}$/Aldrich), Site 7 ($14^{th}$/Park), and Site 9 ($61^{st}$/Lyndale) were installed on 5/15/13. See **Table 24-1** for site characteristics.

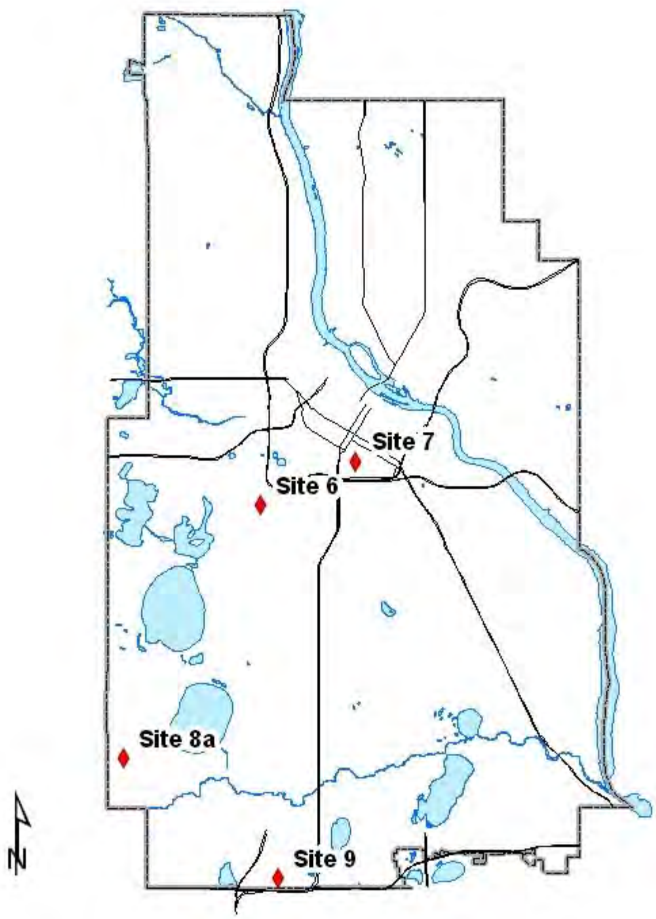



**Figure 24-1. Map of the 2013 NPDES sites located in Minneapolis.**

**Table 24-1. 2013 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 newMS4 permit target frequency for storm event sample collection annually 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 2013, flow-paced storm event samples were collected from May through early November. Two snowmelt grab samples were collected in 2013 from each site. Snowmelt samples were collected at Sites 6, 7, and 9 on 1/10/13, 1/11/13, and 2/27/13 and at site 8a on 4/3/13 and 4/23/13. Most snowmelt samples were brown to dark brown and very turbid except Site 8a which was relatively clear.

The total volume sampled for each site and total recorded volumes in 2013 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 5/15/13 – 11/14/13.**

| | Site 6 | Site 7 | Site 8a | Site 9 |
|---|---|---|---|---|
| **Total volume of sampled events (cf)** | 91,825 | 378,173 | 38,084 | 912,745 |
| **Total volume recorded (with Flowlink) for 2013 (cf)** | 195,381 | 724,710 | 71,371 | 1,306,830 |
| **% sampled ANNUAL** | 47% | 52% | 53% | 70% |
| **% sampled SPRING (May- June)** | 26% | 26% | 13% | 30% |
| **% sampled SUMMER (July- September)** | 12% | 21% | 37% | 34% |
| **% sampled FALL (October- November)** | 10% | 5% | 3% | 5.2% |

**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 2013, 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, *E. coli* grab and pH samples were collected by quarterly sampling. *E.coli* was collected at all sites except at Site 8a, which is inaccessible for grab sampling after installation of equipment. When flow and time were sufficient, *E. coli* grab samples were collected four times per year. Two sites ($14^{th}$/Park, and $61^{st}$/Lyndale) were collected four times, one site ($22^{nd}$/Aldrich) was collected five times, and one site (Pershing) was collected twice for a total of fifteen *E. coli* grabs in 2013. 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 the drought when fall quarter of *E. coli* grab and pH samples were not collected, all required sampling was successfully accomplished in 2013.

**Table 24-3. 2013 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.**

| Event | Start Date/Time | | End Date/Time | | Precip (inches) | Duration (hours) | Intensity (in/hr) | Time since last Precip. (hours) | Sample Type | 2013 NPDES Events Collected: Site 6 22nd/Aldrich | Site 7 14th/Park | Site 8a Pershing | Site 9 61st/Lyndale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| +1 | 1/10/2013 | 14:45 | n/a | | n/a | n/a | n/a | | grab | X(w/Ecoli) | | | X(w/Ecoli) |
| +2 | 1/11/2013 | 14:00 | n/a | | n/a | n/a | n/a | | grab | X(w/Ecoli) | X(w/Ecoli) | | X(w/Ecoli) |
| +3 | 2/26/2013 | 14:00 | n/a | | n/a | n/a | n/a | | grab | | | | X(w/Ecoli) |
| +4 | 2/27/2013 | 14:15 | n/a | | n/a | n/a | n/a | | grab | X(w/Ecoli) | X(w/Ecoli) | | |
| +5 | 4/13/2012 | 14:20 | n/a | | n/a | n/a | n/a | | grab | | | X(w/Ecoli) | |
| +6 | 4/23/2013 | 13:00 | n/a | | n/a | n/a | n/a | | grab | | | X(w/Ecoli) | |
| 7 | 5/17/2013 | 1:30 | 5/17/2013 | 17:30 | 0.27 | 16.0 | 0.02 | 194.0 | composite | | X(lmtd) | | |
| 8 | 5/18/2013 | 6:30 | 5/18/2013 | 11:00 | 0.93 | 4.5 | 0.21 | 13.0 | composite | | X(lmtd) | X(lmtd) | X(lmtd) |
| 9 | 5/19/2013 | 6:30 | 5/22/2013 | 21:00 | 2.09 | 86.5 | 0.02 | 19.5 | composite | X | X | | X |
| 10 | 5/29/2013 | 16:30 | 5/30/2013 | 1:30 | 1.04 | 9.0 | 0.12 | 111.0 | composite | X | X | | X |
| 11 | 5/31/2013 | 1:30 | 5/31/2013 | 15:30 | 0.42 | 14.0 | 0.03 | 24.0 | composite | X | X | | X |
| 12 | 6/5/2013 | 4:00 | 6/5/2013 | 18:30 | 0.20 | 14.5 | 0.01 | 108.5 | composite | X | | | X |
| 13 | 6/9/2013 | 2:00 | 6/9/2013 | 14:30 | 0.46 | 12.5 | 0.04 | 79.5 | composite | X | X | | X |
| 14 | 6/12/2013 | 1:30 | 6/12/2013 | 18:30 | 0.59 | 17.0 | 0.03 | 59.0 | comp/grab | X | X(w/Ecoli) | X | X(w/Ecoli) |
| 15 | 7/9/2013 | 8:15 | 7/9/2013 | 9:15 | 0.51 | 1.0 | 0.51 | 236.0 | comp/grab | X(Ecoli only) | X(Ecoli only) | X | X(w/Ecoli) |
| 16 | 7/13/2013 | 3:30 | 7/13/2013 | 7:30 | 3.00 | 4.0 | 0.75 | 90.3 | composite | X(lmtd) | X(lmtd) | X(lmtd) | X(lmtd) |
| 17 | 7/21/2013 | 6:15 | 7/21/2013 | 9:45 | 0.18 | 3.5 | 0.05 | 190.7 | composite | X(lmtd) | X(lmtd) | | X(lmtd) |
| 18 | 8/5/2013 | 2:00 | 8/5/2013 | 8:00 | 0.52 | 6.0 | 0.09 | 227.8 | composite | X | X | X | X |
| 19 | 8/6/2013 | 19:30 | 8/6/2013 | 21:00 | 0.86 | 1.5 | 0.57 | 35.5 | composite | X | X | X | X |
| 20 | 9/14/2013 | 16:30 | 9/15/2013 | 12:00 | 0.54 | 19.5 | 0.03 | 931.5 | composite | X(lmtd) | X | X(lmtd) | X(lmtd) |
| 21 | 9/17/2013 | 19:00 | 9/18/2013 | 8:30 | 0.11 | 13.5 | 0.01 | 55.0 | composite | | | | X(lmtd) |
| 22 | 9/19/2013 | 11:30 | 9/19/2013 | 12:30 | 0.19 | 1.0 | 0.19 | 27.0 | composite | X | X | | X |
| 23 | 9/28/2013 | 10:30 | 9/28/2013 | 13:30 | 0.15 | 3.0 | 0.05 | 214.0 | composite | X(lmtd) | X | | X(lmtd) |
| 24 | 10/2/2013 | 19:00 | 10/3/2013 | 23:00 | 1.12 | 28.0 | 0.04 | 101.5 | composite | X | X | X | X |
| 25 | 10/4/2013 | 21:30 | 10/5/2013 | 16:00 | 0.31 | 18.5 | 0.02 | 22.5 | composite | X(lmtd) | | | X(lmtd) |
| 26 | 10/17/2013 | 19:00 | 10/18/2013 | 5:30 | 0.33 | 10.5 | 0.03 | 39.5 | composite | X | | | X |
| 27 | 10/29/2013 | 22:00 | 10/31/2013 | 5:30 | 0.17 | 31.5 | 0.01 | 280.5 | composite | | | | X |
| 28 | 11/4/2013 | 12:00 | 11/4/2013 | 13:30 | 0.16 | 1.5 | 0.11 | 102.5 | composite | X | X | | |
| | | | **Totals** | | **14.15** | | | | | **21** | **19** | **10** | **23** |

+ 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

X(Ecoli only) = only fecal coliform sampled

**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 | $NO_2NO_3$ | 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 |
| 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 2013 detection limit.

# 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. As part of the overall QA/QC program, blind monthly performance samples were made for all monitored parameters and delivered to IRI. 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.

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 8a (Pershing) 11/19/13. 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.

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 2013 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). 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 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).

Statistics for event mean concentrations were calculated using Microsoft Excel. The computer model P8 v2.41 was calibrated and verified and used to estimate snowmelt runoff. The P8 snowmelt estimated runoff, ISCO Flowlink measured runoff, and 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 in any stratification cut in the data. 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 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.

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.

The P8 model was used to estimate daily flows for snowmelt events and grab samples from January through early May. Average daily flows (using both P8 and Flowlink measurements) and collected chemical data were used as input for the interactive program FLUX32. Daily temperature and hourly precipitation files obtained from the National Oceanic and Atmospheric Administration (NOAA) National Data Center (NDC) were used as input for P8. Data from a heated rain gauge (for snowmelt water equivalent) was used and is located at the Minneapolis/St. Paul International Airport.

## RESULTS & DISCUSSION

2013 event data concentrations are listed in **Table 24-6**. 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.

### Snowmelt

Most snowmelt samples were brown to dark brown and very turbid except for the parkland site, Site 8a which was relatively clear. The snowmelt clarity of site 8a is most likely due to the filtering effect of the parkland turf as this site receives mostly park overland flow runoff and little or no street runoff.

### TSS and TDS

TDS and TSS generally tend to be high during the snowmelt/spring months and late fall with the exception of Site 8a which is parkland. High TSS values in the snowmelt/spring might be attributed to the wash-off of accumulated sand applied to icy winter roads. A small amount of sand can lead to very high TSS values. The high late fall values of TSS are likely the product of a very dry fall and subsequent accumulation and wash-off during precipitation events.

## Chloride

High $Cl^-$ concentrations are typical seen during winter snowmelt and early spring stormwater. The majority of the $Cl^-$ is from road salt which is used throughout the winter and subsequently washed off the streets and gutters during snowmelt and early spring rains. Site 9 (61st & Lyndale) and Site 6 (22nd and Aldrich) showed small amounts of chloride continuously washing off throughout the summer months. Site 9 has many commercial industries surrounding it which may be contributing to increased chloride levels during the summer months.

## *E. Coli* monitoring

*E. coli* values were generally lowest for the snowmelt event and peaked mid-summer to fall. This result is expected, since temperature plays a significant role in bacterial growth and survival. There was a significant drought during August and September that may have played a role in build-up and wash-off of animal excrement. There currently is no standard for *E. coli* in stormwater.

## Metals

It is interesting to note that Site 6 (22nd & Aldrich) had a marked increase in Pb (lead), when compared to the other sites. This is an older residential watershed and it is unknown where the Pb is originating. It is possible that it is a remnant from old lead house paint loading the surrounding soils and then continually washing off. Pb was below the detection limit for two thirds of Site 8a (Pershing) events and it continues to generally decrease in the environment. The Pb levels in stormwater have historically been decreasing since it was removed from gasoline in the 1990’s.

It was observed that maximum metal (Pb, Cu, and Zn) values generally followed the same trend as TSS throughout the year, this is as expected since metals generally tend to stick to organic solids.

## TSS and VSS

The annual VSS data show that a much less than expected portion of the TSS number is organic (~20-40%). Many of the VSS peaks were observed in the spring and fall, and were likely organic material (e.g. bud drop, grass clippings, leaf fall) washing off the watershed. The remaining (60- 80%) of VSS were likely inorganic sand (see **Table 24-6)**.

## Table 24-6. 2013 NDPES sampled event data by site.

| Date Sampled | Time | Sample Type | Site Location | TP mg/L | TDP mg/L | OrthoP 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 | Cu ug/L | Pb ug/L | Zn ug/L | E. Coli MPN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/10/2013 | 14:45 | Grab | Site 6, 22nd & Aldrich -SM | 0.940 | 0.156 | | 10.7 | 6.31 | 0.435 | 4883 | 276 | 106 | 51 | 7261 | 37 | 46.0 | 7230 | 7.8 | 48 | 140 | 210 | 173 |
| 1/11/2013 | 14:00 | Grab | Site 6, 22nd & Aldrich -SM | 0.888 | 0.492 | | 6.26 | 2.40 | 0.668 | 460 | 64 | 75 | 38 | 828 | 18 | 7.5 | 1183 | 6.8 | 25 | 69 | 150 | 1043 |
| 2/27/2013 | 14:15 | Grab | Site 6, 22nd & Aldrich -SM | 2.33 | 0.036 | | 13.3 | 4.12 | 3.10 | 2223 | 176 | 1333 | 426 | 3538 | 34 | 11.0 | >20,000 | 6.4 | 180 | 510 | 1100 | <10 |
| 5/20/2013 | 23:39 | Composite | Site 6, 22nd & Aldrich | 0.239 | 0.025 | | 2.16 | 1.14 | 0.251 | 4 | 18 | 88 | 30 | 19 | 4 | 4.4 | 32 | 6.8 | 17 | 53 | 59 | |
| 5/29/2013 | 23:32 | Composite | Site 6, 22nd & Aldrich | 0.282 | 0.021 | | 2.29 | 0.705 | 0.109 | <2.0 | 18 | 103 | 39 | 44 | 8 | <15.0 | 48 | 7.2 | 18 | 90 | 73 | |
| 5/31/2013 | 2:14 | Composite | Site 6, 22nd & Aldrich | 0.554 | 0.070 | | 2.30 | 0.782 | 0.271 | <2.0 | 18 | 78 | 32 | 56 | 13 | 4.9 | 48 | 7.0 | 18 | 34 | 48 | |
| 6/5/2013 | 19:05 | Composite | Site 6, 22nd & Aldrich | 0.599 | 0.091 | | 3.91 | 0.959 | 0.334 | <2.0 | 30 | 69 | 42 | 81 | 35 | 9.8 | 100 | 6.6 | 21 | 50 | 87 | |
| 6/9/2013 | 13:20 | Composite | Site 6, 22nd & Aldrich | 0.328 | 0.079 | | 1.78 | 0.683 | 0.025 | <2.0 | 22 | 39 | 24 | 61 | 16 | 7.0 | 66 | 7.0 | 16 | 34 | 68 | |
| 6/12/2013 | 10:42 | Composite | Site 6, 22nd & Aldrich | 0.321 | 0.070 | | 2.13 | 0.672 | <0.030 | 151 | 16 | 56 | 26 | 78 | 10 | 5.9 | 49 | 7.1 | 14 | 68 | 70 | >24196 |
| 7/9/2013 | 8:55 | Grab | Site 6, 22nd & Aldrich | | | | | | | | | | | | | | | | | | | 9208 |
| 7/13/2013 | 5:20 | Composite | Site 6, 22nd & Aldrich | 0.240 | | | 1.73 | | 0.035 | <2.0 | 16 | 57 | 25 | | | | | | 13 | 27 | 44 | |
| 7/21/2013 | 9:37 | Composite | Site 6, 22nd & Aldrich | 0.588 | | | 4.00 | | 0.045 | 6 | 44 | 37 | 27 | | | | 120 | | 30 | 71 | 140 | |
| 8/5/2013 | 4:24 | Composite | Site 6, 22nd & Aldrich | 0.378 | 0.112 | 0.142 | 3.02 | <0.500 | <0.030 | <2.0 | 24 | 54 | 29 | 99 | 33 | 8.3 | 58 | 6.8 | 20 | 29 | 75 | |
| 8/6/2013 | 20:51 | Composite | Site 6, 22nd & Aldrich | 0.195 | 0.074 | 0.027 | 1.44 | 0.898 | 0.187 | <2.0 | 16 | 73 | 28 | 30 | 6 | 5.4 | 38 | 7.1 | | | | |
| 9/15/2013 | 5:13 | Composite | Site 6, 22nd & Aldrich | 0.318 | | | 2.17 | | 0.378 | <2.0 | 26 | 49 | 33 | | | | 70 | | 22 | 33 | 89 | |
| 9/19/2013 | 9:02 | Composite | Site 6, 22nd & Aldrich | 0.398 | 0.107 | 0.167 | 2.60 | 0.735 | 0.470 | <2.0 | 24 | 149 | 66 | 40 | 7 | 7.1 | 64 | 7.1 | 20 | 55 | 90 | |
| 9/28/2013 | 14:15 | Composite | Site 6, 22nd & Aldrich | 0.510 | | | 5.05 | | 0.114 | 8 | 46 | 58 | 33 | | | | 136 | | 24 | 40 | 90 | |
| 10/3/2013 | 0:26 | Composite | Site 6, 22nd & Aldrich | 0.275 | 0.078 | 0.108 | 2.32 | 0.862 | 0.746 | <2.0 | 26 | 86 | 42 | 28 | 14 | 5.9 | 67 | 7.1 | 16 | 66 | 76 | |
| 10/6/2013 | 19:15 | Composite | Site 6, 22nd & Aldrich | 0.193 | | | 1.25 | | 0.219 | 2 | 24 | 34 | 18 | | | | 57 | | 12 | 23 | 43 | |
| 10/18/2013 | 2:21 | Composite | Site 6, 22nd & Aldrich | 0.282 | 0.136 | 0.185 | 1.16 | <0.500 | <0.030 | <2.00 | 20 | 23 | 16 | 44 | 23 | 7.6 | 59 | 6.9 | <5.00 | 37 | 41 | |
| 10/19/2013 | 15:05 | Composite | Site 6, 22nd & Aldrich | 0.449 | | | 3.19 | | <0.030 | 4 | 38 | 95 | 52 | | | | 83 | | 28 | 78 | 110 | |
| 10/20/2013 | 12:23 | Composite | Site 6, 22nd & Aldrich | 0.336 | | | 1.26 | | <0.030 | <2.0 | 30 | 18 | 13 | | | | 82 | | <5.00 | 9 | 36 | |
| 11/4/2013 | 13:58 | Composite | Site 6, 22nd & Aldrich | 0.599 | 0.201 | 0.176 | 3.93 | <0.500 | <0.030 | 7 | 38 | 115 | 73 | 101 | 76 | 10.0 | 113 | 7.2 | 27 | 63 | 120 | |
| 1/11/2013 | 13:45 | Grab | Site 7, 14th & Park -SM | 0.424 | 0.214 | | 2.42 | 1.17 | 0.689 | 460 | 60 | 26 | 11 | 813 | 11 | 3.3 | 1241 | 6.7 | 16 | 8 | 98 | 1700 |
| 2/27/2013 | 14:30 | Grab | Site 7, 14th & Park -SM | 0.690 | 0.034 | | 4.06 | 1.48 | 1.57 | 2624 | 128 | 169 | 73 | 3928 | 32 | 5.7 | >20,000 | 6.5 | 40 | 35 | 210 | 187 |
| 5/17/2013 | 15:12 | Composite | Site 7, 14th & Park | 0.583 | | | 4.61 | | 0.106 | <2.0 | 30 | 178 | 63 | | | | 97 | | 52 | 23 | 230 | |
| 5/18/2013 | 9:38 | Composite | Site 7, 14th & Park | 0.287 | | | 2.47 | | 0.423 | <2.0 | 20 | 120 | 37 | | | | 47 | | 26 | 18 | 99 | |
| 5/21/2013 | 0:23 | Composite | Site 7, 14th & Park | 0.128 | 0.025 | | 1.38 | 0.920 | 0.298 | 4 | 16 | 52 | 18 | 20 | 3 | 4.3 | 37 | 6.8 | 16 | 12 | 50 | |
| 5/29/2013 | 23:27 | Composite | Site 7, 14th & Park | 0.125 | <0.010 | | 1.45 | <0.500 | 0.246 | <2.0 | 14 | 69 | 23 | 51 | 6 | <15.0 | 48 | 7.6 | 19 | 18 | 63 | |
| 5/31/2013 | 2:30 | Composite | Site 7, 14th & Park | 0.190 | 0.019 | | 1.37 | 0.594 | 0.316 | <2.0 | 14 | 56 | 20 | 45 | 6 | 4.6 | 48 | 7.1 | 13 | 11 | 45 | |
| 6/9/2013 | 15:03 | Composite | Site 7, 14th & Park | 0.117 | 0.034 | | 0.530 | <0.500 | 0.462 | <2.0 | 16 | 20 | 11 | 57 | 5 | 6.0 | 54 | 6.9 | 10 | 3 | 34 | |
| 6/12/2013 | 11:07 | Composite | Site 7, 14th & Park | 0.157 | 0.048 | | 1.32 | 0.572 | 0.285 | <2.0 | 12 | 44 | 18 | 82 | 5 | 4.1 | 40 | 7.5 | 12 | 10 | 58 | 12997 |
| 7/9/2013 | 9:15 | Grab | Site 7, 14th & Park | | | | | | | | | | | | | | | | | | | 1467 |
| 7/13/2013 | 8:18 | Composite | Site 7, 14th & Park | 0.126 | | | 0.875 | | 0.272 | <2.0 | 16 | 53 | 10 | | | | | | 15 | 7 | 45 | |
| 7/21/2013 | 10:00 | Composite | Site 7, 14th & Park | 0.234 | | | 1.83 | | 0.938 | 5 | 34 | 43 | 15 | | | | | | 27 | 7 | 78 | |
| 8/5/2013 | 4:44 | Composite | Site 7, 14th & Park | 0.116 | 0.073 | 0.095 | 1.09 | <0.500 | 0.337 | <2.0 | 14 | 38 | 16 | 70 | 8 | 8.1 | 44 | 7.4 | 16 | 6 | 62 | |
| 8/6/2013 | 21:13 | Composite | Site 7, 14th & Park | 0.113 | 0.034 | 0.032 | 1.07 | <0.500 | 0.301 | <2.0 | 14 | 49 | 16 | 29 | 4 | 4.9 | 39 | 7.4 | 15 | 10 | 57 | |
| 9/15/2013 | 2:46 | Composite | Site 7, 14th & Park | 0.345 | | | 3.35 | | 0.523 | 6 | 48 | 55 | 29 | | | | 148 | | 32 | 8 | 120 | |
| 9/19/2013 | 13:00 | Composite | Site 7, 14th & Park | 0.137 | 0.031 | 0.068 | 1.40 | 0.517 | 0.995 | <2.0 | 22 | 66 | 24 | 39 | 5 | 7.8 | 75 | 7.5 | 13 | 9 | 81 | |
| 9/20/2013 | 18:08 | Composite | Site 7, 14th & Park | 0.511 | | | | | <0.030 | 23 | 74 | | | | | | 268 | | | | | |
| 9/28/2013 | 12:43 | Composite | Site 7, 14th & Park | 0.255 | | | 2.48 | | 0.610 | 6 | 36 | 42 | 18 | | | | 124 | | 26 | 6 | 60 | |
| 10/2/2013 | 21:45 | Composite | Site 7, 14th & Park | 0.221 | | | 2.34 | | 0.672 | 4 | 28 | 123 | 74 | | | | 93 | | 19 | 10 | 110 | |
| 11/4/2013 | 13:28 | Composite | Site 7, 14th & Park | 0.323 | 0.041 | 0.063 | 2.79 | 0.625 | 0.445 | 5 | 26 | 77 | 36 | 47 | 21 | 9.1 | | 7.2 | 29 | 9 | 110 | |

## Table 24-6. 2013 NDPES sampled event data by site. (Continued)

| Date Sampled | Time | Sample Type | Site Location | TP mg/L | TDP mg/L | OrthoP 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 | Cu ug/L | Pb ug/L | Zn ug/L | E. Coli MPN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/3/2013 | 14:20 | Grab | Site 8a, Pershing -SM | 1.49 | 1.31 | | 4.86 | 2.88 | 0.047 | 2 | 20 | 25 | 15 | 69 | 20 | 7.8 | 82 | 6.6 | <5.00 | <3.00 | <20.0 | 146 |
| 4/23/2013 | 13:00 | Grab | Site 8a, Pershing -SM | 0.038 | 0.024 | | <0.500 | <0.500 | 0.222 | <2.0 | 22 | 3 | 2 | 55 | <1.00 | <15.0 | 63 | 6.2 | <5.00 | <3.00 | <20.0 | 1 |
| 5/18/2013 | 8:32 | Composite | Site 8a, Pershing | 1.31 | | | 6.43 | | 0.033 | <2.0 | 26 | 80 | 49 | | | | 64 | | 17 | 3 | 81 | |
| 6/12/2013 | 12:18 | Composite | Site 8a, Pershing | 0.309 | 0.169 | | 1.31 | 0.506 | 0.199 | 67 | 34 | 39 | 12 | 92 | 3 | 6.4 | 93 | 7.4 | 9 | 3 | 16 | |
| 7/9/2013 | 8:55 | Composite | Site 8a, Pershing | 0.378 | 0.288 | | 1.81 | 0.813 | 0.725 | <2.0 | 20 | 46 | 10 | 53 | 9 | 5.0 | 70 | 7.0 | 11 | <3.00 | <20.0 | |
| 7/13/2013 | 5:22 | Composite | Site 8a, Pershing | 0.162 | | | 0.829 | | 0.183 | <2.0 | 12 | 18 | 5 | | | | | | <5.00 | <3.00 | <20.0 | |
| 8/5/2013 | 4:28 | Composite | Site 8a, Pershing | 0.386 | 0.232 | 0.256 | 1.55 | <0.500 | <0.030 | 3 | 26 | 16 | 9 | 60 | 14 | 11.3 | 72 | 6.7 | 7 | <3.00 | <20 | |
| 8/6/2013 | 21:35 | Composite | Site 8a, Pershing | 0.421 | 0.301 | 0.266 | 1.53 | <0.500 | 0.206 | <2.0 | 30 | 62 | 16 | 42 | 5 | 11.1 | 64 | 7.2 | 11 | 4 | <20.0 | |
| 9/15/2013 | 4:50 | Composite | Site 8a, Pershing | 0.344 | | | <0.500 | | 0.499 | 2 | 30 | 48 | 30 | | | | 80 | | 14 | <3.00 | 59 | |
| 10/3/2013 | 0:29 | Composite | Site 8a, Pershing | 0.628 | 0.542 | 0.536 | 1.535 | 0.698 | 0.546 | <2.0 | 32 | 29 | 13 | 43 | 6 | 6.2 | 73 | 7.1 | 7 | <3.00 | <20.0 | |
| 1/10/2013 | 13:30 | Grab | Site 9, 61st & Lyndale -SM | 1.58 | 0.403 | | 4.60 | 1.13 | 3.43 | 3073 | 700 | 645 | 143 | 5788 | 114 | 71.7 | >20000 | 9.7 | 59 | 18 | 240 | |
| 1/11/2013 | 13:05 | Grab | Site 9, 61st & Lyndale -SM | 0.547 | 0.091 | | 2.29 | 0.808 | 0.927 | 1113 | 96 | 108 | 36 | 1853 | 12 | 11.8 | 3340 | 6.4 | 30 | 13 | 190 | 20 |
| 2/26/2013 | 14:00 | Grab | Site 9, 61st & Lyndale -SM | 0.412 | 0.051 | | 3.02 | 0.782 | 3.93 | 1973 | 212 | 197 | 39 | 3189 | 301 | 23.7 | 3830 | 9.2 | 29 | 7 | 110 | 23 |
| 5/18/2013 | 9:00 | Composite | Site 9, 61st & Lyndale | 0.591 | | | 3.68 | | 0.601 | 32 | 70 | 340 | 71 | | | | 212 | | 43 | 26 | 240 | |
| 5/21/2013 | 0:29 | Composite | Site 9, 61st & Lyndale | 0.634 | 0.296 | | 2.39 | 1.13 | 0.493 | 24 | 42 | 139 | 34 | 117 | 3 | 12.3 | 170 | 6.7 | 24 | 17 | 91 | |
| 5/29/2013 | 23:41 | Composite | Site 9, 61st & Lyndale | 0.757 | 0.334 | | 2.09 | 0.882 | 0.252 | 107 | 44 | 214 | 42 | 249 | 5 | 11.5 | 467 | 7.8 | 33 | 19 | 210 | |
| 5/31/2013 | 2:28 | Composite | Site 9, 61st & Lyndale | 0.440 | 0.056 | | 2.68 | 0.838 | 1.93 | 432 | 54 | 165 | 42 | 776 | 7 | 11.6 | 1501 | 7.2 | 23 | 20 | 100 | |
| 6/5/2013 | 18:59 | Composite | Site 9, 61st & Lyndale | 0.389 | 0.055 | | 1.93 | 0.838 | 0.678 | 71 | 44 | 148 | 20 | 193 | 6 | 10.2 | 377 | 7.7 | 24 | 20 | 120 | |
| 6/9/2013 | 13:51 | Composite | Site 9, 61st & Lyndale | 0.220 | 0.104 | | 0.84 | <0.500 | 0.490 | 42 | 48 | 61 | 12 | 148 | 5 | 13.0 | 273 | 9.2 | 13 | 5 | 50 | |
| 6/12/2013 | 14:52 | Composite | Site 9, 61st & Lyndale | 0.381 | 0.082 | | 1.33 | <0.500 | 0.249 | <2.0 | 46 | 247 | 38 | 127 | 3 | 7.6 | 183 | 9.3 | 24 | 16 | 130 | 1529 |
| 7/5/2013 | 7:47 | Composite | 61st & Lyndale -Illicit Disch | 0.617 | | | 10.9 | | 0.538 | 67 | 300 | 753 | 80 | | | | 710 | | 48 | 28 | 410 | |
| 7/9/2013 | 9:58 | Composite | Site 9, 61st & Lyndale | 0.378 | 0.103 | | 2.34 | 0.835 | 0.388 | 15 | 44 | 288 | 35 | 107 | 14 | 9.0 | 176 | 9.6 | 26 | 10 | 110 | 4106 |
| 7/13/2013 | 5:36 | Composite | Site 9, 61st & Lyndale | 0.186 | | | 2.08 | | 0.251 | 7 | 54 | 114 | 17 | | | | | | 17 | 8 | 73 | |
| 7/21/2013 | 10:29 | Composite | Site 9, 61st & Lyndale | 0.225 | | | 5.40 | | 0.525 | 35 | 58 | 139 | 20 | | | | 275 | | 21 | 5 | 90 | |
| 8/5/2013 | 8:09 | Composite | Site 9, 61st & Lyndale | 0.391 | 0.170 | 0.287 | 3.78 | 2.52 | 0.363 | 22 | 56 | 109 | 21 | 125 | 9 | 18.4 | 198 | 8.6 | 21 | 9 | 120 | |
| 8/6/2013 | 20:58 | Composite | Site 9, 61st & Lyndale | 0.261 | 0.073 | 0.132 | 1.72 | 0.599 | 0.235 | 8 | 52 | 229 | 32 | 55 | 4 | 7.1 | 108 | 8.8 | 20 | 13 | 100 | |
| 9/6/2013 | 0:44 | Composite | 61st & Lyndale -Illicit Disch | 0.230 | | | | | 26.1 | 194 | 292 | | | | | | | | 19 | <3.00 | 68 | |
| 9/10/2013 | 12:12 | Composite | 61st & Lyndale -Illicit Disch | 0.206 | | | | | 2.25 | | 272 | | | | | | 1288 | | | | | |
| 9/15/2013 | 8:23 | Composite | Site 9, 61st & Lyndale | 0.345 | | | <0.500 | | 0.476 | 16 | 56 | 72 | 22 | | | | 187 | | 15 | 4 | 160 | |
| 9/18/2013 | 8:06 | Composite | Site 9, 61st & Lyndale | 0.226 | | | 9.60 | | 1.41 | 50 | 96 | 39 | 15 | | | | 372 | | 18 | 4 | 140 | |
| 9/19/2013 | 13:46 | Composite | Site 9, 61st & Lyndale | 0.666 | 0.070 | 0.362 | 7.82 | 2.12 | 0.755 | 36 | 84 | 511 | 85 | 158 | 11 | 22.1 | 279 | 8.3 | 48 | 27 | 340 | |
| 9/25/2013 | 20:00 | Composite | 61st & Lyndale -Illicit Disch | 0.282 | | | | | 4.14 | 68 | 200 | | | | | | 661 | | | | | |
| 9/28/2013 | 13:57 | Composite | Site 9, 61st & Lyndale | 0.402 | | | 7.71 | | 0.307 | 37 | 98 | 177 | 48 | | | | 323 | | 37 | 10 | 170 | |
| 10/3/2013 | 0:58 | Composite | Site 9, 61st & Lyndale | 0.281 | 0.064 | 0.226 | 2.15 | 1.03 | 0.674 | 9 | 58 | 179 | 39 | 75 | 7 | 7.2 | 174 | 9.2 | 17 | 9 | 100 | |
| 10/4/2013 | 23:23 | Composite | Site 9, 61st & Lyndale | 0.648 | | | | | | | | 436 | 16 | | | | | | | | | |
| 10/5/2013 | 16:45 | Composite | Site 9, 61st & Lyndale | 0.263 | | | | | | | | 142 | | | | | | | | | | |
| 10/6/2013 | 14:24 | Composite | 61st & Lyndale -Illicit Disch | 1.41 | | | | | | | | 57 | | | | | | | | | | |
| 10/7/2013 | 13:45 | Composite | 61st & Lyndale -Illicit Disch | 1.41 | | | | | | | | 70 | | | | | | | | | | |
| 10/18/2013 | 3:16 | Composite | Site 9, 61st & Lyndale | 0.228 | 0.044 | 0.228 | 2.24 | <0.500 | 0.394 | 21 | 60 | 88 | 27 | 106 | 13 | 13.0 | 208 | 8.3 | <5.00 | 5 | 64 | |
| 10/21/2013 | 9:51 | Composite | 61st & Lyndale -Illicit Disch | 0.267 | | | 1.09 | | | | | 29 | 5 | 159 | | | 268 | | | | | |
| 10/22/2013 | 15:58 | Composite | 61st & Lyndale -Illicit Disch | 0.284 | | | | | | | | | | | | | 555 | | | | | |
| 10/22/2013 | 17:13 | Composite | 61st & Lyndale -Illicit Disch | 0.943 | | | | | | | | | | | | | 538 | | | | | |
| 10/25/2013 | 15:58 | Composite | 61st & Lyndale -Illicit Disch | 0.108 | | | | | | | | | | | | | 790 | | | | | |
| 10/30/2013 | 5:34 | Composite | Site 9, 61st & Lyndale | 1.28 | 1.20 | 0.305 | 15.0 | 6.62 | 0.954 | 58 | 156 | 101 | 38 | 377 | | | | | | | | |
| 11/2/2013 | 13:50 | Composite | 61st & Lyndale -Illicit Disch | 0.302 | 0.227 | 0.247 | | | 0.777 | 72 | 139 | 24 | 4 | 322 | | 26.4 | | | | | | |
| 11/4/2013 | 17:11 | Composite | Site 9, 61st & Lyndale | 1.44 | 0.131 | 0.705 | 5.94 | 1.45 | 0.681 | 29 | 106 | 368 | 70 | 158 | 15 | 16.7 | 349 | 9.3 | 66 | 38 | 350 | |

**Table 24-7** 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.

## Geometric Mean Comparison

Site 6 (22nd & Aldrich), a residential watershed, had a maximum geometric mean for VSS, BOD, and Pb. The cause of VSS and BOD may be the dense leaf canopy in the watersheds organic load. The geometric mean concentration of Pb has been persistently high at this site and is likely a remnant of lead based paints shedding from the older houses and soils.

Site 7 (14th & Park) had the highest *E. coli* geometric mean concentration. High bacteria levels may be shed from urban wildlife or pets owned by a dense concentration of apartment/condo dwellers. Site 7 also had the lowest geometric mean for all phosphorus, $NO_2NO_3$, and sulfate 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 park . Site 8 also had the lowest geometric mean TKN, Cl, Hardness, TSS, VSS, BOD, *E. coli*, Pb, and Zn.

Site 9 (61st and Lyndale) had the highest geometric mean for TP, TKN, NH3, NO2NO3, CL, Hardness, TSS, TDS, Sulfate, Cu, and ZN. 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.

**Table 24-7. 2013 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) | 0.416 | 0.086 | 0.114 | 2.80 | 0.109 | 0.883 | 5 | 31 | 71 | 36 | 112 | 16 | 8 | 7.0 | 726 | 18.5 | 51.6 | 87.7 |
| 6, 22nd Aldrich | MEAN (arithmetic) | 0.511 | 0.117 | 0.134 | 3.54 | 0.340 | 1.40 | 353 | 46 | 127 | 53 | 820 | 22 | 10 | 7.0 | 6925 | 27.3 | 75.2 | 134 |
| 6, 22nd Aldrich | MAX | 2.33 | 0.49 | 0.185 | 13.3 | 3.10 | 6.31 | 4883 | 276 | 1333 | 426 | 7261 | 76 | 46 | 7.8 | 24196 | 180.0 | 510 | 1100 |
| 6, 22nd Aldrich | MIN | 0.193 | 0.021 | 0.027 | 1.16 | 0.015 | 0.250 | 1 | 16 | 18 | 13 | 19 | 4 | 4 | 6.4 | 5 | 2.50 | 9.00 | 36.0 |
| 6, 22nd Aldrich | MEDIAN | 0.357 | 0.079 | 0.155 | 2.31 | 0.151 | 0.78 | 1 | 25 | 71 | 32 | 61 | 16 | 8 | 7.0 | 1043 | 20.0 | 53.0 | 76.0 |
| 6, 22nd Aldrich | STDEV | 0.46 | 0.11 | 0.059 | 3.05 | 0.653 | 1.68 | 1119 | 61 | 271 | 85 | 1998 | 19 | 10 | 0.3 | 10387 | 36.3 | 103.6 | 225 |
| 6, 22nd Aldrich | NUMBER | 22 | 15 | 6 | 22 | 22 | 15 | 22 | 22 | 22 | 22 | 15 | 15 | 15 | 15 | 5 | 21.0 | 21.0 | 21.0 |
| 6, 22nd Aldrich | COV | 0.890 | 0.983 | 0.443 | 0.861 | 1.92 | 1.20 | 3.17 | 1.34 | 2.14 | 1.60 | 2.43 | 0.844 | 1.03 | 0.045 | 1.50 | 1.33 | 1.38 | 1.68 |
| 7, 14th Park | MEAN (geometric) | 0.224 | 0.035 | 0.060 | 1.77 | 0.367 | 0.516 | 4 | 26 | 60 | 23 | 88 | 7 | 6 | 7.1 | 1569 | 19.9 | 9.93 | 78.0 |
| 7, 14th Park | MEAN (arithmetic) | 0.267 | 0.051 | 0.065 | 2.05 | 0.500 | 0.625 | 166 | 33 | 71 | 28 | 471 | 10 | 6 | 7.1 | 4088 | 22.0 | 11.6 | 89.4 |
| 7, 14th Park | MAX | 0.690 | 0.214 | 0.095 | 4.61 | 1.57 | 1.48 | 2624 | 128 | 178 | 74 | 3928 | 32 | 9 | 7.6 | 12997 | 52.0 | 35.0 | 230 |
| 7, 14th Park | MIN | 0.113 | 0.005 | 0.032 | 0.530 | 0.015 | 0.250 | 1 | 12 | 20 | 10 | 20 | 3 | 3 | 6.5 | 187 | 9.80 | 3.30 | 34.0 |
| 7, 14th Park | MEDIAN | 0.221 | 0.034 | 0.066 | 1.64 | 0.423 | 0.572 | 1 | 22 | 54 | 19 | 51 | 6 | 6 | 7.2 | 1584 | 17.5 | 9.55 | 70.5 |
| 7, 14th Park | STDEV | 0.173 | 0.057 | 0.026 | 1.12 | 0.363 | 0.411 | 604 | 29 | 46 | 21 | 1169 | 9 | 2 | 0.4 | 5977 | 11.02 | 7.64 | 53.9 |
| 7, 14th Park | NUMBER | 19 | 11 | 4 | 18 | 19 | 11 | 19 | 19 | 18 | 18 | 11 | 11 | 11 | 11.0 | 4 | 18.0 | 18.0 | 18.0 |
| 7, 14th Park | COV | 0.647 | 1.119 | 0.400 | 0.547 | 0.72 | 0.658 | 3.65 | 0.88 | 0.646 | 0.727 | 2.48 | 0.928 | 0.321 | 0.052 | 1.46 | 0.501 | 0.657 | 0.603 |
| 8, Pershing | MEAN (geometric) | 0.371 | 0.248 | 0.332 | 1.30 | 0.154 | 0.537 | 2 | 24 | 28 | 11 | 57 | 5 | 8 | 6.9 | 12 | 6.82 | 2.48 | 15.4 |
| 8, Pershing | MEAN (arithmetic) | 0.547 | 0.409 | 0.353 | 2.04 | 0.268 | 0.807 | 8 | 25 | 37 | 16 | 59 | 8 | 8 | 6.9 | 74 | 8.41 | 2.58 | 22.6 |
| 8, Pershing | MAX | 1.49 | 1.31 | 0.536 | 6.43 | 0.725 | 2.88 | 67 | 34 | 80 | 49 | 92 | 20 | 11 | 7.4 | 146 | 17.0 | 3.7 | 81.0 |
| 8, Pershing | MIN | 0.203 | 0.114 | 0.315 | 0.78 | 0.070 | 0.412 | 1 | 23 | 16 | 7 | 55 | 2 | 7 | 6.8 | 2 | 5.27 | 2.38 | 12.6 |
| 8, Pershing | MEDIAN | 0.382 | 0.288 | 0.266 | 1.53 | 0.203 | 0.506 | 1 | 26 | 34 | 12 | 55 | 6 | 8 | 7.0 | 74 | 8.10 | 2.50 | 10.0 |
| 8, Pershing | STDEV | 0.477 | 0.427 | 0.159 | 2.01 | 0.242 | 0.943 | 21 | 7 | 23 | 14 | 17 | 7 | 2 | 0.4 | 103 | 5.00 | 0.72 | 25.6 |
| 8, Pershing | NUMBER | 10 | 7 | 3 | 10 | 10 | 7 | 10 | 10 | 10 | 10 | 7 | 7 | 7 | 7.0 | 2 | 10.0 | 10.0 | 10.0 |
| 8, Pershing | COV | 0.874 | 1.04 | 0.450 | 0.989 | 0.903 | 1.17 | 2.58 | 0.268 | 0.637 | 0.862 | 0.294 | 0.818 | 0.308 | 0.062 | 1.39 | 0.595 | 0.279 | 1.13 |
| 9, 61st Lyndale | MEAN (geometric) | 0.436 | 0.119 | 0.285 | 2.88 | 0.621 | 0.911 | 46 | 74 | 169 | 34 | 265 | 11 | 14 | 8.4 | 232 | 23.6 | 11.3 | 132 |
| 9, 61st Lyndale | MEAN (arithmetic) | 0.526 | 0.196 | 0.321 | 3.95 | 0.886 | 1.31 | 313 | 101 | 210 | 40 | 800 | 33 | 17 | 8.4 | 1420 | 27.8 | 13.8 | 150 |
| 9, 61st Lyndale | MAX | 1.58 | 1.20 | 0.705 | 15.0 | 3.93 | 6.62 | 3073 | 700 | 645 | 143 | 5788 | 301 | 72 | 9.7 | 4106 | 66.0 | 38.0 | 350 |
| 9, 61st Lyndale | MIN | 0.186 | 0.044 | 0.132 | 0.250 | 0.235 | 0.250 | 1 | 42 | 39 | 12 | 55 | 3 | 7 | 6.4 | 20 | 2.50 | 3.60 | 50.0 |
| 9, 61st Lyndale | MEDIAN | 0.391 | 0.091 | 0.287 | 2.39 | 0.525 | 0.838 | 35 | 58 | 165 | 36 | 158 | 8 | 12 | 8.7 | 776 | 24.0 | 11.5 | 120 |
| 9, 61st Lyndale | STDEV | 0.378 | 0.280 | 0.184 | 3.39 | 0.969 | 1.49 | 755 | 137 | 149 | 29 | 1525 | 76 | 15 | 1.0 | 1927 | 15.1 | 8.8 | 82 |
| 9, 61st Lyndale | NUMBER | 25 | 17 | 7 | 23 | 23 | 17 | 23 | 23 | 25 | 24 | 17 | 16 | 16 | 16.0 | 4 | 22.0 | 22.0 | 22.0 |
| 9, 61st Lyndale | COV | 0.717 | 1.43 | 0.575 | 0.857 | 1.093 | 1.14 | 2.41 | 1.35 | 0.707 | 0.713 | 1.91 | 2.30 | 0.928 | 0.122 | 1.36 | 0.543 | 0.638 | 0.547 |
| All | MEAN (geometric) | 0.357 | 0.091 | 0.162 | 2.27 | 0.268 | 0.739 | 8 | 38 | 80 | 27 | 130 | 10 | 9 | 7.4 | 381 | 17.7 | 13.9 | 75.7 |
| All | MEAN (arithmetic) | 0.460 | 0.170 | 0.218 | 3.10 | 0.541 | 1.117 | 246 | 57 | 129 | 38 | 630 | 21 | 11 | 7.5 | 3787 | 23.4 | 29.8 | 112 |
| All | MAX | 2.33 | 1.31 | 0.705 | 15.0 | 3.93 | 6.62 | 4883 | 700 | 1333 | 426 | 7261 | 301 | 72 | 9.7 | 24196 | 180 | 510 | 1100 |
| All | MIN | 0.038 | 0.005 | 0.027 | 0.250 | 0.015 | 0.250 | 1 | 12 | 3 | 2 | 19 | 1 | 3 | 6.2 | 1 | 2.50 | 1.50 | 10.0 |
| All | MEDIAN | 0.345 | 0.079 | 0.181 | 2.29 | 0.350 | 0.782 | 5 | 33 | 75 | 28 | 79 | 9 | 8 | 7.2 | 1043 | 19.0 | 12.0 | 87.0 |
| All | STDEV | 0.388 | 0.255 | 0.168 | 2.78 | 0.711 | 1.34 | 798 | 89 | 181 | 51 | 1501 | 45 | 11 | 0.9 | 6811 | 22.8 | 63.2 | 138 |
| All | NUMBER | 76 | 50 | 20 | 73 | 74 | 50 | 74 | 74 | 75 | 74 | 50 | 49 | 49 | 49.0 | 15 | 71.0 | 71.0 | 71.0 |
| All | COV | 0.844 | 1.50 | 0.771 | 0.899 | 1.31 | 1.20 | 3.24 | 1.56 | 1.40 | 1.35 | 2.38 | 2.16 | 1.02 | 0.125 | 1.80 | 0.973 | 2.12 | 1.24 |
| (blue) | -Highest value | | | | | | | | | | | | | | | | | | |
| (orange) | -Lowest value | | | | | | | | | | | | | | | | | | |

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

## Median Comparison

**Table 24-8** shows median residential, mixed use, and composite values for the 2013 sites. Most results were similar or less than Nationwide Urban Runoff Program (NURP) values with the notable exception of TKN. It is unknown why MRPB TKN median values are higher than NURP values. A possible explanation is there is more vegetative material in Minneapolis watershed decaying than in the NURP watersheds studied. The NURP studies were done in the 1980's when lead was widely used in gasoline (from the 1920's to 1990's) and banned after 1996. The lead (Pb) reduction in the environment is clearly seen in the MPRB data sets.

Most 2013 parameters were comparable or lower than the data from 2001-2012 with the notable exception of residential Pb. It is unknown why residential 2013 Pb data are higher than previous year's medians, but may possibly be due to soil disturbance or home exterior maintenance disturbing lead paint in the watershed. In 2013, all three land use categories saw a decrease in all the median value concentrations of many parameters from the previous comparative years. It is important to note that the sites monitored in 2005-2013 are located in different watersheds and have similar but not identical land uses to those monitored in 2001-2004.

**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) | 2013 | 2001–2012 | | 2013 | 2001–2012 | | 2013 | 2001–2012 | |
| TP (mg/L) | 0.357 | 0.441 | 0.383 | 0.221 | 0.255 | 0.263 | 0.345 | 0.364 | 0.33 |
| TKN (mg/L) | 2.31 | 2.41 | 1.9 | 1.64 | 1.59 | 1.29 | 2.29 | 2.02 | 1.5 |
| $NO_3NO_2$ (mg/L) | 0.151 | 0.352 | 0.736 | 0.423 | 0.415 | 0.558 | 0.35 | 0.407 | 0.68 |
| cBOD (mg/L) | 16 | 11 | 10 | 6 | 9 | 8 | 9 | 10 | 9 |
| TSS (mg/L) | 71 | 87 | 101 | 54 | 64 | 67 | 75 | 85 | 100 |
| Cu (µg/L) | 20.0 | 17.9 | 33 | 17.5 | 19 | 27 | 19.0 | 18.2 | 30 |
| Pb (µg/L) | 53.0 | 26.8 | 144 | 9.6 | 14 | 114 | 12.0 | 14.1 | 140 |
| Zn (µg/L) | 76.0 | 79.0 | 135 | 70.5 | 86 | 154 | 87.0 | 83.0 | 160 |

[1] Site 6 data.
[2] Sites 1 and 2 data, (Site 6, 2005-2012).
[3] Site 7 data.
[4] Sites 5 and 5a data, (Site 7, 2005-2012).
[5] Sites 6 – 9 data.
[6] Sites 1 – 5a data, (Site 6 – 9, 2005-2012).
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).

## 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 (**Table 24-9)**. Most MPRB mean concentrations were comparable to other studies as listed in **Table 24-9** below. Data from MPRB Sites 1–5a (2001–2004) and 6–9 (2005–2012) were generally similar to Sites 6–9 in 2013. All measured compared parameters were roughly equal to or lower in 2013, with the exception of TDP, TDS, and TKN. The 2013 increase in TDP, TDS, and TKN are likely the result of organic material in the watersheds interacting with the wet spring and dry summer/fall.

**Table 24-9. Typical Mean urban stormwater concentrations. " -- " = not reported.**

| Parameter | NURP[1] | CWP[2] | Bannerman *et al.*[3] | Mpls PW[4] | St. Paul[5] | MWMO 2013[6] | MPRB[7] 2001–2012 | MPRB[8] 2013 |
|---|---|---|---|---|---|---|---|---|
| TP (mg/L) | 0.5 | 0.3 | 0.66 | 0.417 | 0.484 | 0.395 | 0.478 | 0.460 |
| TDP (mg/L) | -- | -- | 0.27 | 0.251 | -- | 0.107 | 0.145 | 0.170 |
| TKN (mg/L) | 2.3 | -- | -- | -- | 2.46 | 2.69 | 2.76 | 3.10 |
| $NO_3NO_2$ (mg/L) | 0.86 | -- | -- | -- | 0.362 | 0.695 | 0.512 | 0.541 |
| $NH_3$ (mg/L) | -- | -- | -- | 0.234 | -- | 0.331 | 1.02 | 1.12 |
| Cl (mg/L) | -- | 230 (winter) | -- | -- | -- | 459 | 290 | 246 |
| BOD (mg/L) | 12 | -- | -- | 14.9 | 25 | 16 | 16 | 21 |
| TDS (mg/L) | -- | -- | -- | 73.3 | 78 | 911 | 549 | 630 |
| TSS (mg/L) | 239 | 80 | 262 | 77.6 | 129 | 116 | 122 | 129 |
| Cu (µg/L) | 50 | 10 | 16 | 26.7 | 30 | 24.7 | 26.3 | 23.4 |
| Pb (µg/L) | 240 | 18 | 32 | 75.5 | 233 | 14.6 | 24.7 | 29.8 |
| Zn (µg/L) | 350 | 140 | 204 | 148 | 194 | 125 | 125 | 112 |

[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 2013 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 – 2012)
[8] MPRB arithmetic mean data calculated from NPDES Sites 6 – 9 (2013)

## Flow-weighted Mean Comparison

The flow-weighted mean concentrations presented in **Table 24-10** were calculated using FLUX32. Sample concentrations and associated daily average flows were used as input for these calculations. The data were often stratified by flow or season to achieve the most accurate and precise results. The method and event mean concentration with the lowest coefficient of variation was chosen as the final value.

**Table 24-10. Flow–weighted mean concentrations and related statistics for NPDES parameters in 2013.**

| 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 | 0.311 | 0.081 | 0.106 | 2.89 | 0.299 | 0.832 | 37 | 47.8 | 77 | 33 | 60 | 13 | 6.6 | 17 | 60 | 76 |
| 7 | 0.204 | 0.047 | 0.064 | 1.69 | 0.388 | 0.653 | 43 | 23.5 | 65 | 24 | 164 | 7 | 5.6 | 19 | 11 | 77 |
| 8a | 0.504 | 0.331 | 0.363 | 2.24 | 0.226 | 0.508 | 5 | 28.7 | 54 | 21 | 68 | 7 | 8.1 | 14 | 2 | 23 |
| 9 | 0.455 | 0.171 | 0.244 | 2.52 | 0.696 | 0.996 | 205 | 63.9 | 184 | 37 | 913 | 24 | 12.3 | 24 | 16 | 139 |
| **MEAN** | **0.369** | **0.157** | **0.194** | **2.34** | **0.402** | **0.747** | **72** | **41.0** | **95** | **29** | **301** | **13** | **8.1** | **19** | **22** | **79** |
| **MEDIAN** | **0.383** | **0.126** | **0.175** | **2.38** | **0.344** | **0.743** | **40** | **38.3** | **71** | **29** | **116** | **10** | **7.3** | **18** | **14** | **77** |
| **STANDEV** | **0.137** | **0.127** | **0.136** | **0.506** | **0.207** | **0.212** | **90** | **18.5** | **60** | **8** | **411** | **8** | **2.9** | **4** | **26** | **47** |

-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.

Site 6 (22nd & Aldrich) is a multi-family residential watershed. Site 6 had the highest modeled concentrations of TKN and Pb. Site 6 had the lowest TDS. 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 7 (14th & 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, TDP, Ortho-P, TKN, hardness, and sulfate.

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 $NO_3NO_2$, $NH_3$, Cl, TSS, VSS, cBOD, Cu, Pb, and Zn.

Site 9 (61st and Lyndale) is a commercial/industrial watershed. Site 9 had the highest modeled concentration of TP, $NO_3NO_2$, $NH_3$, Cl, hardness, TSS, VSS, TDS, Sulfate, Cu, and Zn. Site 9 did not have any of the lowest modeled chemical parameters. 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 small baseflow which could be sampled during future monitoring to distinguish high concentrations from storm events or baseflow. Site 9 also had eleven events in 2013 that could not be traced to precipitation. Further investigation should locate the source of these illicit discharges of water.

**Table 24-11** 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 light industrial land-use area, as reported by the USGS. Site 6 is more closely related to the Yates watershed land-use characteristics. Sites 7 and 9 are more comparable to the Sandberg watershed land-use characteristics.

When comparing the USGS flow-weighted mean concentrations to the MPRB sites in **Table 24-11** Site 6 had lower or similar concentrations with Yates for all parameters. Compared to Sandberg, Sites 7 and 9 have lower flow-weighted mean concentrations for all parameters and are well within the ranges shown in **Table 24-11**. Site 7 had significantly lower values than Sandberg, where Minneapolis data had roughly one quarter to half of the Sandburg values.

The overall mean comparison of **Table 24-11** 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 similar to the Yates and Sandburg studies.

**Table 24-11. 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)** | **Iverson area (developing residential)** | **Sandburg area (light industrial)** |
| **TSS** | Mean Range | 133 (2 – 758) | 740 (17 – 26,610) | 337 (7 – 4,388) |
| **Pb** | Mean Range | 0.23 (0.015 – 1.8) | 0.02 (0.008 – 0.31) | 0.19 (0.003 – 1.5) |
| **Zn** | Mean Range | 0.198 (0.02 – 2.2) | 0.235 (0.028 – 0.53) | 0.185 (0.02 – 0.81) |
| **TKN** | Mean Range | 3.6 (0.6 – 28.6) | 1.2 (1.0 – 29.2) | 2.5 (0.4 – 16.0) |
| **TP** | Mean Range | 0.63 (0.10 – 3.85) | 0.62 (0.2 – 13.1) | 0.63 (0.07 – 4.3) |

**Table 24-12** shows the flow-weighted mean concentrations in 2013 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 MDL (minimum detection limit), half of the MDL was used for calculations.

**Table 24-12. 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** |
| 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 |
| 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 |
| Ortho-P (mg/L) | nc | nc | nc | nc | nc | nc | nc | nc | nc | nc | 0.179 | 0.097 | 0.194 |
| 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 |
| $NO_3NO_2$ (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 |
| $NH_3$(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 |
| Cl (mg/L) | 37 | 11 | 587 | 40 | 18 | 91 | 412 | 139 | 803 | 60 | 213 | 14 | 72 |
| Hardness (mg/L) | nc | na | nc | nc | na | nc | nc | nc | nc | na | 48.0 | 37 | 41 |
| TSS (mg/L) | 116 | 83 | 116 | 70 | 108 | 156 | 180 | 148 | 121 | 107 | 104 | 101 | 95 |
| VSS (mg/L) | nc | nc | nc | nc | nc | nc | nc | nc | nc | nc | 30.2 | 31 | 29 |
| TDS (mg/L) | 306 | 85 | 725 | 130 | 252 | 183 | 737 | 507 | 3323 | 124 | 693 | 97 | 301 |
| cBOD (mg/L) | 12 | 8 | 16 | 20 | 9 | 9 | 17 | 25 | 53 | 7 | 11 | 13 | 13 |
| Sulfate (mg/L) | nc | nc | nc | nc | nc | nc | nc | nc | nc | nc | 15.4 | 18.4 | 8.1 |
| Cd (µg/L) | 0.532 | 0.518 | 2.11 | 2.80 | 2.50 | nc | nc | nc | nc | nc | nc | nc | nc |
| Cu (µg/L) | 15 | 31 | 23 | 15 | 19 | 29 | 36 | 16 | 40 | 23 | 25 | 16 | 19 |
| Pb (µg/L) | 23 | 17 | 22 | 14 | 41 | 31 | 34 | 28 | 23 | 24 | 18 | 15 | 22 |
| Zn (µg/L) | 180 | 76 | 107 | 76 | 86 | 94 | 133 | 132 | 204 | 100 | 103 | 90 | 79 |

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 24-12** 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.

Seasonal statistics (snowmelt, spring, summer, and fall) of the data for the combination of all sites were calculated and are listed in **Table 24-13**. Seasonal patterns are evident. Snowmelt had the highest geometric mean concentrations for most of the parameters: TP, TDP, TKN, $NH_3$, $NO_2NO_3$, Cl, hardness, VSS, TDS, cBOD, sulfate, Cu, and Zn. Snowmelt had the lowest geometric mean concentration for E *coli*., which is temperature dependent. Spring stormwater had the highest TSS and Pb geometric mean concentration and it had the lowest geometric mean concentrations for TDP, hardness, TDS, cBOD, sulfate, and pH. Summer had the highest concentrations of *E coli*, but had the lowest geometric mean concentrations for the majority of parameters: TP, Ortho-P, TKN, $NH_3$, $NO_2NO_3$, Cl, hardness, TSS, VSS, Cu, Pb, and Zn. Fall had the highest geometric mean concentrations of Ortho-P and pH. Fall had none of the lowest geometric mean concentrations.

## Surcharge Events

Large rain events can lead to pipe surcharges. If surcharge water inundates the auto-sampler tray the samples are considered contaminated and dumped. Surcharges occur when water backs up in pipes and creates 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. Surcharge events happen during high precipitation totals or high intensity storm events that exceed the drainage capacity of the pipes. With the exception of Site 8a, most of the surcharging events were storms greater than 1 inch. The following surcharges occurred at the NPDES sites in 2013:

- Site 6 (22$^{nd}$ and Aldrich): 5/30, 6/22, 7/13, 8/29.
- Site 7 (Park and 14$^{th}$): 6/21.
- Site 8a (Pershing): 5/18-20, 5/29, 5/31, 6/12, 6/21, 6/23, 6/28-29, 7/13, 8/6, 9/3, 10/15.
- Site 9 (61$^{st}$ and Lyndale): 6/21, 8/6.

Site 8a (Pershing) is of special concern as it had fourteen surcharges in 2013. Storms as small as 0.42 inches or as large as 3.00 inches caused surcharging. At the site, two pipes and overland flow enter the manhole basin and the outlet is a 12 inch PVC pipe. This entire watershed/area of Minneapolis is lower in elevation than the surrounding areas causing a regular back up of many storm sewers 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 since the sampler is in a dog-house enclosure.

**Table 24-13. 2013 statistical summary of concentrations by season from all sites (6 –9).**

| 2013 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)** | 0.640 | 0.128 | | 3.57 | 1.49 | 0.813 | 392 | 104 | 93 | 36 | 1243 | 22 | 12 | 7.1 | 64 | 23.2 | 18.6 | 114 |
| | **MEAN (arithmetic)** | 0.934 | 0.281 | | 5.18 | 2.13 | 1.50 | 1681 | 175 | 269 | 83 | 2732 | 58 | 20 | 7.2 | 366 | 43.2 | 80.3 | 233 |
| | **MAX** | 2.33 | 1.31 | | 13.3 | 6.31 | 3.93 | 4883 | 700 | 1333 | 426 | 7261 | 301 | 72 | 9.7 | 1700 | 180 | 510 | 1100 |
| | **MIN** | 0.038 | 0.024 | NA | 0.25 | 0.250 | 0.047 | 1 | 20 | 3 | 2 | 55 | 1 | 3 | 6.2 | 1 | 2.50 | 1.50 | 10.0 |
| | **MEDIAN** | 0.789 | 0.124 | | 4.33 | 1.33 | 0.808 | 1543 | 112 | 107 | 38 | 2521 | 26 | 9 | 6.6 | 146 | 29.5 | 15.5 | 170 |
| | **STDEV** | 0.685 | 0.396 | | 4.00 | 1.87 | 1.44 | 1578 | 202 | 417 | 127 | 2460 | 91 | 22 | 1.26 | 598 | 51.4 | 157 | 315 |
| | **NUMBER** | 10 | 10 | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 9 | 10 | 10 | 10 |
| | **COV** | 0.734 | 1.41 | | 0.773 | 0.877 | 0.961 | 0.94 | 1.15 | 1.55 | 1.52 | 0.90 | 1.57 | 1.13 | 0.175 | 1.63 | 1.19 | 1.96 | 1.35 |
| SPRING (April-May) | **MEAN (geometric)** | 0.377 | 0.043 | | 2.45 | 0.746 | 0.268 | 5 | 26 | 111 | 36 | 71 | 6 | 7 | 7.1 | | 22.6 | 20.1 | 89.8 |
| | **MEAN (arithmetic)** | 0.471 | 0.095 | | 2.72 | 0.805 | 0.410 | 47 | 30 | 129 | 38 | 153 | 6 | 8 | 7.1 | | 24.5 | 26.5 | 107 |
| | **MAX** | 1.31 | 0.334 | | 6.43 | 1.14 | 1.93 | 432 | 70 | 340 | 71 | 776 | 13 | 12 | 7.8 | | 52.0 | 90.0 | 240 |
| | **MIN** | 0.125 | 0.005 | NA | 1.37 | 0.250 | 0.033 | 1 | 14 | 52 | 18 | 19 | 3 | 4 | 6.7 | NA | 13.0 | 3.30 | 45.0 |
| | **MEDIAN** | 0.440 | 0.025 | | 2.30 | 0.838 | 0.271 | 1 | 20 | 103 | 37 | 51 | 6 | 7 | 7.1 | | 19.0 | 19.0 | 81.0 |
| | **STDEV** | 0.327 | 0.127 | | 1.44 | 0.274 | 0.481 | 119 | 18 | 81 | 16 | 244 | 3 | 3 | 0.358 | | 11.6 | 22.6 | 71.0 |
| | **NUMBER** | 13 | 9 | | 13 | 9 | 13 | 13 | 13 | 13 | 13 | 9 | 9 | 9 | 9 | | 13 | 13 | 13 |
| | **COV** | 0.696 | 1.34 | | 0.529 | 0.341 | 1.18 | 2.55 | 0.600 | 0.623 | 0.405 | 1.60 | 0.516 | 0.438 | 0.050 | | 0.472 | 0.853 | 0.664 |
| SUMMER (June-August) | **MEAN (geometric)** | 0.262 | 0.095 | 0.115 | 1.70 | 0.494 | 0.182 | 4 | 27 | 62 | 18 | 74 | 8 | 8 | 7.6 | 5466 | 15.0 | 9.34 | 51.1 |
| | **MEAN (arithmetic)** | 0.292 | 0.115 | 0.155 | 1.97 | 0.626 | 0.298 | 17 | 31 | 83 | 21 | 84 | 10 | 8 | 7.6 | 8917 | 16.6 | 16.8 | 66.7 |
| | **MAX** | 0.599 | 0.301 | 0.287 | 5.40 | 2.52 | 1 | 151 | 58 | 288 | 42 | 193 | 35 | 18 | 9.6 | 24196 | 30.0 | 71.0 | 140 |
| | **MIN** | 0.113 | 0.034 | 0.027 | 0.530 | 0.250 | 0.015 | 1 | 12 | 16 | 5 | 29 | 3 | 4 | 6.6 | 1467 | 2.50 | 1.50 | 10.0 |
| | **MEDIAN** | 0.285 | 0.082 | 0.137 | 1.73 | 0.572 | 0.261 | 1 | 28 | 55 | 19 | 78 | 6 | 8 | 7.4 | 6657 | 16.0 | 9.30 | 68.0 |
| | **STDEV** | 0.135 | 0.080 | 0.104 | 1.16 | 0.530 | 0.234 | 34 | 16 | 72 | 10 | 42 | 9 | 3 | 0.95 | 8757 | 6.71 | 19.7 | 39.4 |
| | **NUMBER** | 26 | 19 | 8 | 26 | 19 | 26 | 26 | 26 | 26 | 26 | 19 | 19 | 19 | 19 | 6 | 25 | 25 | 25 |
| | **COV** | 0.460 | 0.70 | 0.673 | 0.590 | 0.846 | 0.784 | 1.98 | 0.507 | 0.873 | 0.466 | 0.504 | 0.893 | 0.413 | 0.124 | 0.982 | 0.404 | 1.18 | 0.590 |
| FALL (Sept-Nov) | **MEAN (geometric)** | 0.376 | 0.114 | 0.205 | 2.47 | 0.775 | 0.257 | 6 | 43 | 84 | 32 | 74 | 13 | 9 | 7.7 | | 16.3 | 13.6 | 88.2 |
| | **MEAN (arithmetic)** | 0.441 | 0.220 | 0.261 | 3.66 | 1.28 | 0.478 | 13 | 51 | 122 | 37 | 101 | 18 | 10 | 7.7 | | 21.6 | 23.7 | 112 |
| | **MAX** | 1.44 | 1.20 | 0.705 | 15.0 | 6.62 | 1.41 | 58 | 156 | 511 | 85 | 377 | 76 | 22 | 9.3 | | 66.0 | 78.0 | 350 |
| | **MIN** | 0.137 | 0.031 | 0.063 | 0.250 | 0.250 | 0.015 | 1 | 20 | 18 | 13 | 28 | 5 | 6 | 6.9 | NA | 2.50 | 1.50 | 10.0 |
| | **MEDIAN** | 0.344 | 0.093 | 0.206 | 2.41 | 0.717 | 0.476 | 6 | 38 | 82 | 33 | 61 | 13 | 8 | 7.2 | | 19.0 | 10.0 | 90.0 |
| | **STDEV** | 0.301 | 0.338 | 0.193 | 3.42 | 1.77 | 0.351 | 16 | 34 | 126 | 22 | 98 | 20 | 5 | 0.869 | | 14.8 | 23.3 | 83.4 |
| | **NUMBER** | 27 | 12 | 12 | 24 | 12 | 25 | 25 | 25 | 26 | 25 | 12 | 11 | 11 | 11 | | 23 | 23 | 23 |
| | **COV** | 0.684 | 1.53 | 0.739 | 0.935 | 1.38 | 0.736 | 1.24 | 0.661 | 1.03 | 0.579 | 0.969 | 1.12 | 0.496 | 0.112 | | 0.682 | 0.980 | 0.746 |

(blue) -highest concentration

(orange) -lowest concentration

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

# 25. NOKOMIS 56TH & 21ST BMP MONITORING

## BACKGROUND

Best management practices (BMPs) include procedures and structures designed to help reduce water pollution as well as 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 automated flow and flow paced sampling to collect runoff measuring stormwater solids (TSS, TVS) and phosphorus (TP, TDP).

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, did not have major issues with standing water, and had room for equipment. It was chosen and monitored in 2012 - 2013 for baseline conditions (see **Figure 25-1)** prior to commencement of sweeping.

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 located 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**. Automonitoring equipment installed at the site consisted of a low profile area/velocity pressure transducer with an ISCO 2150 datalogger, 2105 interface module, and 2103ci cell phone modem interface coupled with an ISCO 3700 sampler. The AV probe and intake strainer were placed at the invert as shown in **Figure 25-3**. Cell phone modems were used to allow remote communication and adjustment.

Equipment installation began when freezing temperatures were no longer a concern in order to prevent area velocity transducer damage. Installation occurred on 5/23/13.

**Monitoring**
Snowmelt grab samples were collected on 1/11/13 and 2/26/13 in 2013. The auto monitoring sampling period was from 5/23/13 – 11/14/13. With the exception of snowmelt grabs, all stormwater samples in 2013 were collected by flow weighted auto monitoring.

**Figure 25-2. The manhole street view of the 56th and 21st 30" pipe.**

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

The 56th & 21st site had approximately 3" of standing water that was present for most of the season, except during an August – September drought. At times, the site appears to have had a baseflow condition as well as water coming from a non-event illicit discharge source.

**Monitored Parameters**

The parameters chosen for this site were solids (TSS, VSS) and phosphorus (TP, TDP), listed below in **Table 25-1**. When a sample event was collected, and no precipitation was measured at the MPRB Southside Service Center weather station, it was determined to be a non-event sample or potential illicit discharge.

**Table 25-1 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 |
| Fluoride | Fl | mg/L | Composite |

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

The dates, times, and sample information on storms and illicit discharges collected are shown below in **Table 25-2.** Fluoride testing was added for a few illicit discharge samples to help determine origin.

**Table 25-2 The 56th and 21st 2013 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 | 2013, 56th & 21st Events Collected |
|---|---|---|---|---|---|---|---|---|---|---|
| +1 | 1/11/2013 | 14:00 | n/a | | n/a | n/a | n/a | n/a | grab | X(w/Ecoli) |
| +2 | 2/26/2013 | 14:00 | n/a | | n/a | n/a | n/a | n/a | grab | X(w/Ecoli) |
| 3 | 6/5/2013 | 4:00 | 6/5/2013 | 18:30 | 0.20 | 14.5 | 0.01 | 108.5 | composite | X |
| 4 | 6/9/2013 | 2:00 | 6/9/2013 | 14:30 | 0.46 | 12.5 | 0.04 | 79.5 | composite | X |
| 5 | 6/12/2013 | 1:30 | 6/12/2013 | 18:30 | 0.59 | 17.0 | 0.03 | 59.0 | composite | X |
| 6 | 7/9/2013 | 8:15 | 7/9/2013 | 9:15 | 0.51 | 1.0 | 0.51 | 236.0 | composite | X |
| 7 | 7/13/2013 | 3:30 | 7/13/2013 | 7:30 | 3.00 | 4.0 | 0.75 | 90.3 | composite | X |
| 8 | 8/5/2013 | 2:00 | 8/5/2013 | 8:00 | 0.52 | 6.0 | 0.09 | 227.8 | composite | X |
| 9 | 9/14/2013 | 16:30 | 9/15/2013 | 12:00 | 0.54 | 19.5 | 0.03 | 931.5 | composite | X |
| 10 | 9/19/2013 | 11:30 | 9/19/2013 | 12:30 | 0.19 | 1.0 | 0.19 | 27.0 | composite | X |
| 11 | 9/28/2013 | 10:30 | 9/28/2013 | 13:30 | 0.15 | 3.0 | 0.05 | 214.0 | composite | X |
| 12 | 10/2/2013 | 19:00 | 10/3/2013 | 23:00 | 1.12 | 28.0 | 0.04 | 101.5 | composite | X |
| 13 | 10/4/2013 | 21:30 | 10/5/2013 | 16:00 | 0.31 | 18.5 | 0.02 | 22.5 | composite | X |
| 14 | 10/14/2013 | 19:00 | 10/16/2013 | 3:30 | 1.31 | 32.5 | 0.04 | 32.5 | composite | X |
| 15 | 11/4/2013 | 12:00 | 11/4/2013 | 13:30 | 0.16 | 1.5 | 0.11 | 102.5 | composite | X |
| | | | **Totals** | | **9.06** | | | | | **15** |

+ snowmelt event

n/a = not applicable

X = event sampled with full parameters

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

**Illicit Discharges**

| Event | Start Date/Time | | End Date/Time | | Precip (inches) | Duration (hours) | Intensity (in/hr) | Time since last Precip. (hours) | Sample Type | 2013, 56th & 21st Events Collected |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | n/a | n/a | 7/5/2013 | 8:17 | n/a | n/a | n/a | n/a | composite | X |
| 2 | n/a | n/a | 8/3/2013 | 2:42 | n/a | n/a | n/a | n/a | composite | X |
| 3 | n/a | n/a | 8/10/2013 | 2:32 | n/a | n/a | n/a | n/a | composite | X(lmtd) |
| 4 | n/a | n/a | 8/17/2013 | 2:35 | n/a | n/a | n/a | n/a | composite | X |
| 5 | n/a | n/a | 8/20/2013 | 2:26 | n/a | n/a | n/a | n/a | composite | X(lmtd) |
| 6 | n/a | n/a | 9/20/2013 | 11:42 | n/a | n/a | n/a | n/a | composite | X |
| 7 | n/a | n/a | 10/22/2013 | 2:44 | n/a | n/a | n/a | n/a | composite | X |
| 8 | n/a | n/a | 10/26/2013 | 2:54 | n/a | n/a | n/a | n/a | composite | X |
| 9 | n/a | n/a | 10/29/2013 | 2:35 | n/a | n/a | n/a | n/a | composite | X |
| 10 | n/a | n/a | 11/2/2013 | 3:01 | n/a | n/a | n/a | n/a | composite | X |
| | | | **Totals** | | | | | | | **10** |

n/a = not applicable

X = event sampled with full parameters

X(lmtd) = event with low volume so limited parameters

# RESULTS & DISCUSSION

In 2013, at the 56th & 21st site, a total of 15 storms and 10 non-precipitation sample events were collected. Most of the non-precipitation discharge occurred from late summer to fall (July – November) and between 2:30 am and 3:00 am. At this time it is unknown where these non-precipitation events are emanating from, but it could be from automated lawn sprinklers in the watershed. An extensive physical watershed investigation was done with City staff, and no source was found to date.

Surcharge events are very infrequent at this site. Only one surcharge event occurred in 2013, on 8/6.

**Table 25-3** shows the volumes collected for each event, the total annual volume, and the annual percentage of runoff collected. Using flow paced samplers, approximately 50% of the annual storm runoff was measured and collected. Additionally 9% of the annual runoff collected was determined to be due to illicit discharges. Baseflow presence and stagnant water are issues at this site.

**Table 25-3 The 56th and 21st, 2013 sampled events and illicit discharges with associated flow data.**

| Event | Start Date/Time | | End Date/Time | | Precip (inches) | Duration (hours) | Intensity (in/hr) | Time since last Precip. (hours) | Sample Type | 2013, 56th & 21st Event Volume (cf) |
|---|---|---|---|---|---|---|---|---|---|---|
| +1 | 1/11/2013 | 14:00 | n/a | | n/a | n/a | n/a | n/a | grab | X(w/Ecoli) |
| +2 | 2/26/2013 | 14:00 | n/a | | n/a | n/a | n/a | n/a | grab | X(w/Ecoli) |
| 3 | 6/5/2013 | 4:00 | 6/5/2013 | 18:30 | 0.20 | 14.5 | 0.01 | 108.5 | composite | 5,241 |
| 4 | 6/9/2013 | 2:00 | 6/9/2013 | 14:30 | 0.46 | 12.5 | 0.04 | 79.5 | composite | 16,621 |
| 5 | 6/12/2013 | 1:30 | 6/12/2013 | 18:30 | 0.59 | 17.0 | 0.03 | 59.0 | composite | 20,980 |
| 6 | 7/9/2013 | 8:15 | 7/9/2013 | 9:15 | 0.51 | 1.0 | 0.51 | 236.0 | composite | 17,734 |
| 7 | 7/13/2013 | 3:30 | 7/13/2013 | 7:30 | 3.00 | 4.0 | 0.75 | 90.3 | composite | 83,392 |
| 8 | 8/5/2013 | 2:00 | 8/5/2013 | 8:00 | 0.52 | 6.0 | 0.09 | 227.8 | composite | 18,256 |
| 9 | 9/14/2013 | 16:30 | 9/15/2013 | 12:00 | 0.54 | 19.5 | 0.03 | 931.5 | composite | 21,582 |
| 10 | 9/19/2013 | 11:30 | 9/19/2013 | 12:30 | 0.19 | 1.0 | 0.19 | 27.0 | composite | 4,308 |
| 11 | 9/28/2013 | 10:30 | 9/28/2013 | 13:30 | 0.15 | 3.0 | 0.05 | 214.0 | composite | 4,601 |
| 12 | 10/2/2013 | 19:00 | 10/3/2013 | 23:00 | 1.12 | 28.0 | 0.04 | 101.5 | composite | 27,940 |
| 13 | 10/4/2013 | 21:30 | 10/5/2013 | 16:00 | 0.31 | 18.5 | 0.02 | 22.5 | composite | 10,489 |
| 14 | 10/14/2013 | 19:00 | 10/16/2013 | 3:30 | 1.31 | 32.5 | 0.04 | 32.5 | composite | 39,983 |
| 15 | 11/4/2013 | 12:00 | 11/4/2013 | 13:30 | 0.16 | 1.5 | 0.11 | 102.5 | composite | 5,100 |
| +snowmelt sample | | | **Totals** | | **9.06** | **Number of Events** | | | | **15** |
| | | | | | **Total volume of sampled events (cf)** | | | | | 276,227 |
| | | | | | **Total volume recorded (with Flowlink) for 2013 (cf)** | | | | | 549,041 |
| | | | | | **% sampled ANNUAL** | | | | | 50% |

**Illicit Discharges**

| Event | Start Date/Time | | End Date/Time | | Precip (inches) | Duration (hours) | Intensity (in/hr) | Time since last Precip. (hours) | Sample Type | 2013, 56th & 21st Event Volume (cf) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | n/a | n/a | 7/5/2013 | 8:17 | n/a | n/a | n/a | n/a | composite | 4,087 |
| 2 | n/a | n/a | 8/3/2013 | 2:42 | n/a | n/a | n/a | n/a | composite | 4,612 |
| 3 | n/a | n/a | 8/10/2013 | 2:32 | n/a | n/a | n/a | n/a | composite | 15,188 |
| 4 | n/a | n/a | 8/17/2013 | 2:35 | n/a | n/a | n/a | n/a | composite | 1,581 |
| 5 | n/a | n/a | 8/20/2013 | 2:26 | n/a | n/a | n/a | n/a | composite | 2,022 |
| 6 | n/a | n/a | 9/20/2013 | 11:42 | n/a | n/a | n/a | n/a | composite | 2,715 |
| 7 | n/a | n/a | 10/22/2013 | 2:44 | n/a | n/a | n/a | n/a | composite | 3,833 |
| 8 | n/a | n/a | 10/26/2013 | 2:54 | n/a | n/a | n/a | n/a | composite | 4,826 |
| 9 | n/a | n/a | 10/29/2013 | 2:35 | n/a | n/a | n/a | n/a | composite | 3,701 |
| 10 | n/a | n/a | 11/2/2013 | 3:01 | n/a | n/a | n/a | n/a | composite | 4,656 |
| | | | **Totals** | | | **Number of Events** | | | | **10** |
| | | | | | **Total volume of sampled events (cf)** | | | | | 47,221 |
| | | | | | **Total volume recorded (with Flowlink) for 2013 (cf)** | | | | | 549,041 |
| | | | | | **% sampled ANNUAL** | | | | | 9% |

Flow-weighted composite data and associated statistics are shown in **Table 25-4**. It is interesting to note that the geometric mean percentage of both TDP and VSS are roughly 50% or greater. This means over half of the phosphorus (TP) are dissolved (TDP) and the solids (TSS) are organic solids (VSS). 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 half 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 2013 Sampled event data and illicit discharge data with associated statistics. NA = data not available due to expired holding times or limited volume.**

| Date Sampled | Time | Site Location | Type | TP mg/L | TDP mg/L | % TDP | TSS mg/L | VSS mg/L | % VSS |
|---|---|---|---|---|---|---|---|---|---|
| 1/11/2013 | 13:25 | 56th & 21st -SM | Grab | 0.845 | 0.640 | 76% | 23 | 12 | 51% |
| 2/26/2013 | 14:30 | 56th & 21st -SM | Grab | 0.279 | 0.089 | 32% | 67 | 30 | 45% |
| 6/5/2013 | 19:29 | 56th & 21st | Composite | 0.449 | 0.244 | 54% | 26 | 14 | 56% |
| 6/9/2013 | 15:36 | 56th & 21st | Composite | 0.302 | 0.146 | 48% | 18 | 12 | 70% |
| 6/12/2013 | 13:07 | 56th & 21st | Composite | 0.278 | 0.120 | 43% | 35 | 20 | 56% |
| 7/9/2013 | 10:00 | 56th & 21st | Composite | 0.564 | 0.373 | 66% | 42 | 18 | 42% |
| 7/13/2013 | 6:06 | 56th & 21st | Composite | 0.211 | 0.101 | 48% | 53 | 19 | 36% |
| 8/5/2013 | 8:28 | 56th & 21st | Composite | 0.512 | 0.295 | 58% | 33 | 20 | 59% |
| 9/15/2013 | 5:54 | 56th & 21st | Composite | 0.420 | 0.210 | 50% | 57 | 24 | 42% |
| 9/19/2013 | 12:08 | 56th & 21st | Composite | 0.278 | 0.136 | 49% | 112 | 50 | 45% |
| 9/28/2013 | 14:37 | 56th & 21st | Composite | 0.503 | 0.356 | 71% | 16 | 10 | 65% |
| 10/3/2013 | 1:16 | 56th & 21st | Composite | 0.262 | 0.146 | 56% | 36 | 19 | 54% |
| 10/5/2013 | 1:26 | 56th & 21st | Composite | 0.206 | 0.142 | 69% | 10 | 6 | 58% |
| 10/17/2013 | 23:47 | 56th & 21st | Composite | 0.485 | 0.358 | 74% | 46 | 35 | 76% |
| 11/4/2013 | 14:22 | 56th & 21st | Composite | 0.990 | 0.552 | 56% | 25 | 19 | 78% |
| SM=snowmelt | | | **Mean** | 0.439 | 0.261 | 59% | 40 | 21 | 52% |
| | | | **Geo Mean** | 0.393 | 0.217 | **55%** | 34 | 18 | **54%** |
| | | | **Median** | 0.420 | 0.210 | 50% | 35 | 19 | 55% |
| | | | **Std Dev** | 0.228 | 0.168 | | 26 | 11 | |
| | | | **Max** | 0.990 | 0.640 | | 112 | 50 | |
| | | | **Min** | 0.206 | 0.089 | | 10 | 6 | |
| | | | **Number** | 15 | 15 | | 15 | 15 | |

Illicit Discharge

| Date Sampled | Time | Site Location | Type | TP mg/L | TDP mg/L | % TDP | TSS mg/L | VSS mg/L | % VSS | Fluoride mg/L |
|---|---|---|---|---|---|---|---|---|---|---|
| 7/5/2013 | 8:17 | 56th & 21st-Illicit Disch | Composite | 1.30 | 0.628 | 48% | 118 | 64 | 55% | NA |
| 8/3/2013 | 2:42 | 56th & 21st-Illicit Disch | Composite | 0.413 | 0.285 | 69% | 31 | 23 | 74% | NA |
| 8/10/2013 | 2:32 | 56th & 21st-Illicit Disch | Composite | 1.29 | 0.097 | 8% | | NA | | 0.496 |
| 8/17/2013 | 2:35 | 56th & 21st-Illicit Disch | Composite | 0.519 | 0.133 | 26% | 42 | 19 | 45% | 0.921 |
| 8/20/2013 | 2:26 | 56th & 21st-Illicit Disch | Composite | 0.695 | 0.146 | 21% | | NA | | 0.684 |
| 9/20/2013 | 11:42 | 56th & 21st-Illicit Disch | Composite | 0.297 | 0.198 | 67% | | NA | | NA |
| 10/22/2013 | 2:44 | 56th & 21st-Illicit Disch | Composite | 0.386 | 0.276 | 71% | 13 | 11 | 86% | NA |
| 10/26/2013 | 2:54 | 56th & 21st-Illicit Disch | Composite | 0.372 | 0.301 | 81% | 10 | 5 | 53% | NA |
| 10/29/2013 | 2:35 | 56th & 21st-Illicit Disch | Composite | 0.398 | 0.335 | 84% | 8 | 4 | 44% | NA |
| 11/2/2013 | 3:01 | 56th & 21st-Illicit Disch | Composite | 0.373 | 0.304 | 82% | 7 | 4 | 57% | NA |
| 11/3/2013 | 2:41 | 56th & 21st-Illicit Disch | Composite | 0.405 | 0.383 | 95% | 4 | 3 | 86% | NA |
| Illicit Discharge=non precip event | | | **Mean** | 0.586 | 0.281 | 48% | 29 | 17 | 57% | |
| | | | **Geo Mean** | 0.513 | 0.248 | **48%** | 16 | 10 | **60%** | |
| | | | **Median** | 0.405 | 0.285 | 70% | 11 | 8 | 71% | |
| | | | **Std Dev** | 0.366 | 0.147 | | 38 | 21 | | |
| | | | **Max** | 1.30 | 0.628 | | 118 | 64 | | |
| | | | **Min** | 0.297 | 0.097 | | 4 | 3 | | |
| | | | **Number** | 11 | 11 | | 8 | 8 | | |

## Non-Stormwater Discharges

The geometric mean of the non-precipitation discharges had both higher TP values (0.513) and TDP values (0.248) when compared to both the storm event TP values (0.393) and TDP values (0.217).

Fluoride levels measured in the non-stormwater discharges indicate that City water is the source. Most of the non-stormwater flow occurred in the early morning between 2:30 and 3:00 am, possibly indicating a timer. The Minneapolis water treatment plant adjusts both the fluoride and ortho-P to 1 mg/L.  Fluoride levels were between approximately 0.5 and 0.9 mg/L, indicating City water as a source.

In 2014, the source of the non-precipitation discharges, which make up approximately 10% of the flow at this site, may be further investigated.  Without stopping the non-stormwater flow, attempts to determine the effects of street sweeping will be complicated.

# 26. MINNEHAHA CREEK AT XERXES AVENUE MONITORING STATION

## BACKGROUND

Minnehaha Creek 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 between Lake Minnetonka and Minneapolis. Approximately one third of the length of Minnehaha Creek is located within Minneapolis.

Between 1999 and 2012 the MPRB, City of Minneapolis, and Metropolitan Council Environmental Services (MCES) partnered to monitor the creek using a WOMP (Watershed Outlet Monitoring Program) station near the end of the creek (see Chapter 23 for more information on the Minnehaha Creek WOMP station). The WOMP station provided information for the development of target pollutant loads for the watershed and helped to evaluate the effectiveness of best management practices in an effort to improve water quality in streams and rivers. In June of 2012 the MPRB ended its partnership with MCES, and in January 2014 the station was decommissioned. In 2009, the City of Minneapolis and MPRB added a monitoring station where Xerxes Avenue South crosses Minnehaha Creek at the Minneapolis border (see **Figure 26-2)**. Monitoring at the Xerxes station is used to determine what is coming into the City from upstream areas and help determine the impact of Minneapolis stormwater on Minnehaha Creek.

The water in Minnehaha Creek at Xerxes has four main sources. First is runoff from the immediate watershed. Second is watershed runoff between Lake Minnetonka and Xerxes. Third is 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. The fourth source of water is groundwater. Groundwater can flow into (discharge to) and out of (recharge from) Minnehaha Creek.

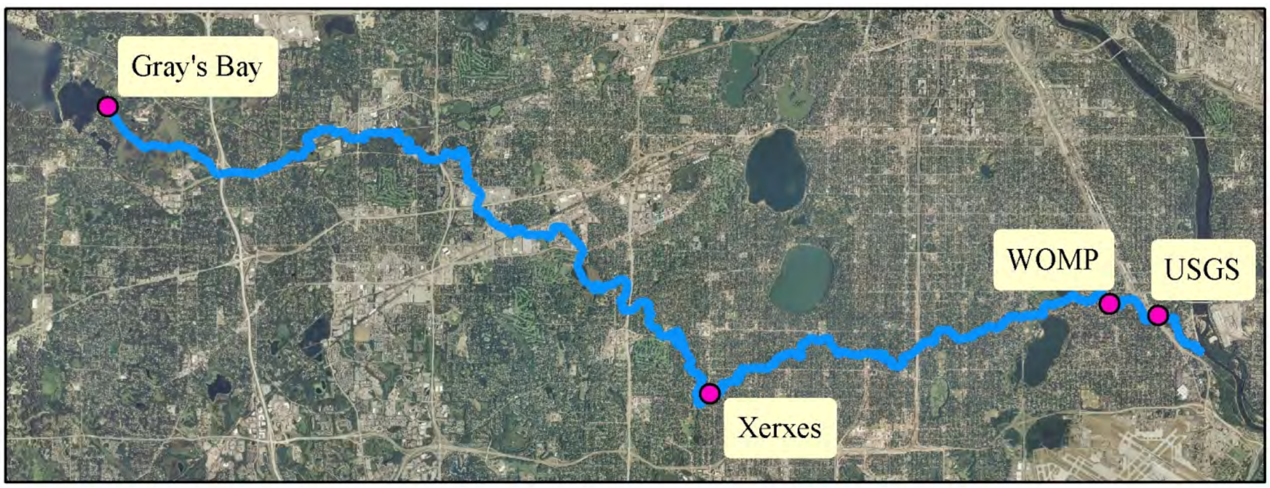



**Figure 26-1. Map of Minnehaha Creek showing Gray's Bay Dam, the outlet from Lake Minnetonka, the Xerxes station, the WOMP station (decommissioned 2012), and the USGS station.**

# METHODS

To monitor the creek in 2013, an ISCO 2150 datalogger, 2105 interface module, and 2013ci cell phone modem were installed with a low-profile A/V (area velocity) level probe. The datalogger software used Flowlink Pro and using the cell phone modem had the ability to remotely push up data to the server and 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**). In 2013, a plywood box housing the sampling station was upgraded to a larger metal Knaack box.


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

Stage readings are checked against tape downs. 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 south bridge abutment. The staff gauge reading minus 4.00 equals the stream depth (stage) in feet.

The level feature of the A/V probe was used to obtain stage. In 2009, discharge was calculated with a weir discharge equation approximating the relatively flat stream bottom and the Xerxes bridge vertical cement wall restrictions as a broad crested weir with end contractions. After 2010, enough stage/discharge readings were taken by stream gauging to develop a look-up table with a rating curve, (see **Figure 26-3)**. The MPRB has been building a rating curve using standard protocols and methodology, USGS wading rod (or 15 pound lead fish), and a Marsh McBirney Flowmate™ velocity meter. The MPRB continues to refine and check the stage/discharge rating curve.

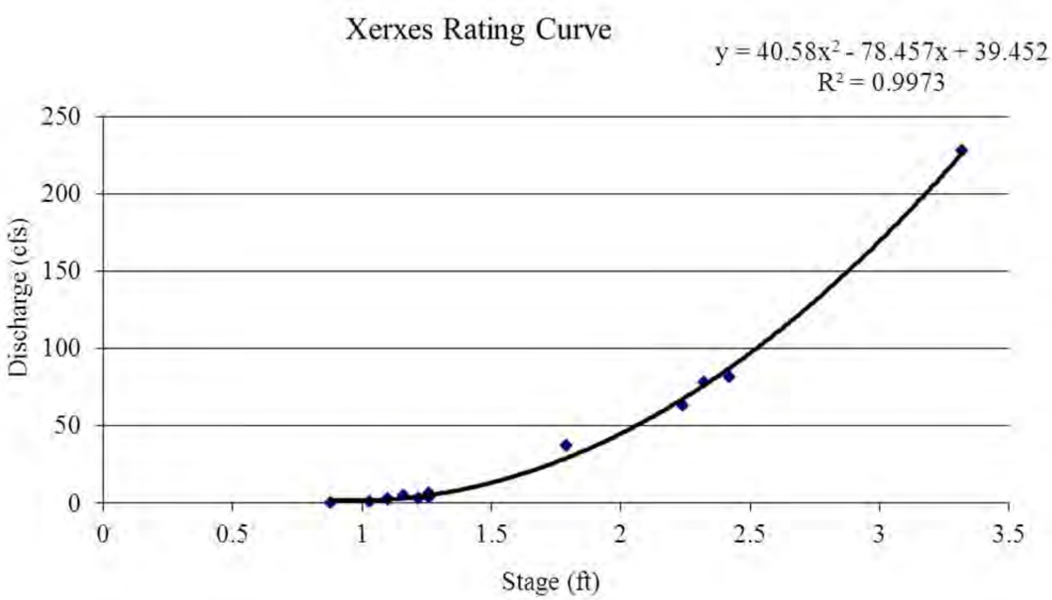



**Figure 26-3. Xerxes rating curve at Minnehaha Creek.**

## RESULTS & DISCUSSION

2013 was the fifth year of monitoring at the Xerxes-Minnehaha Creek station. In 2013, installation was on 5/10/13 when freezing conditions had subsided.

Stream stage (level) and discharge (cubic feet per second -cfs) fluctuated widely over the sampling season, (see **Figure 26-4)**. The average 2013 stage was approximately 25.9 inches. In 2013, peak stage was 61 inches on July 13th, and the lowest stage was ~15 inches November 12th.

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 which can last two to four days. The spring of 2013 was very wet and was followed by a significant mid-summer drought. In **Figure 26-4** both the large rainfall volumes and sustained rainstorms of April through June and the August through September drought can be seen. In 2013, the Gray's Bay Dam opened and closed intermittently in October and this variable discharge can also be seen in **Figure 26-4**. The dam was opened May 6th and closed October 2nd, opened October 4th and closed October 11th, opened October 16th and closed October 28th for the remainder of the year. Closing the dam cut off discharge from the headwaters at Lake Minnetonka and the drop in the creek level can be seen in **Figure 26-4**.

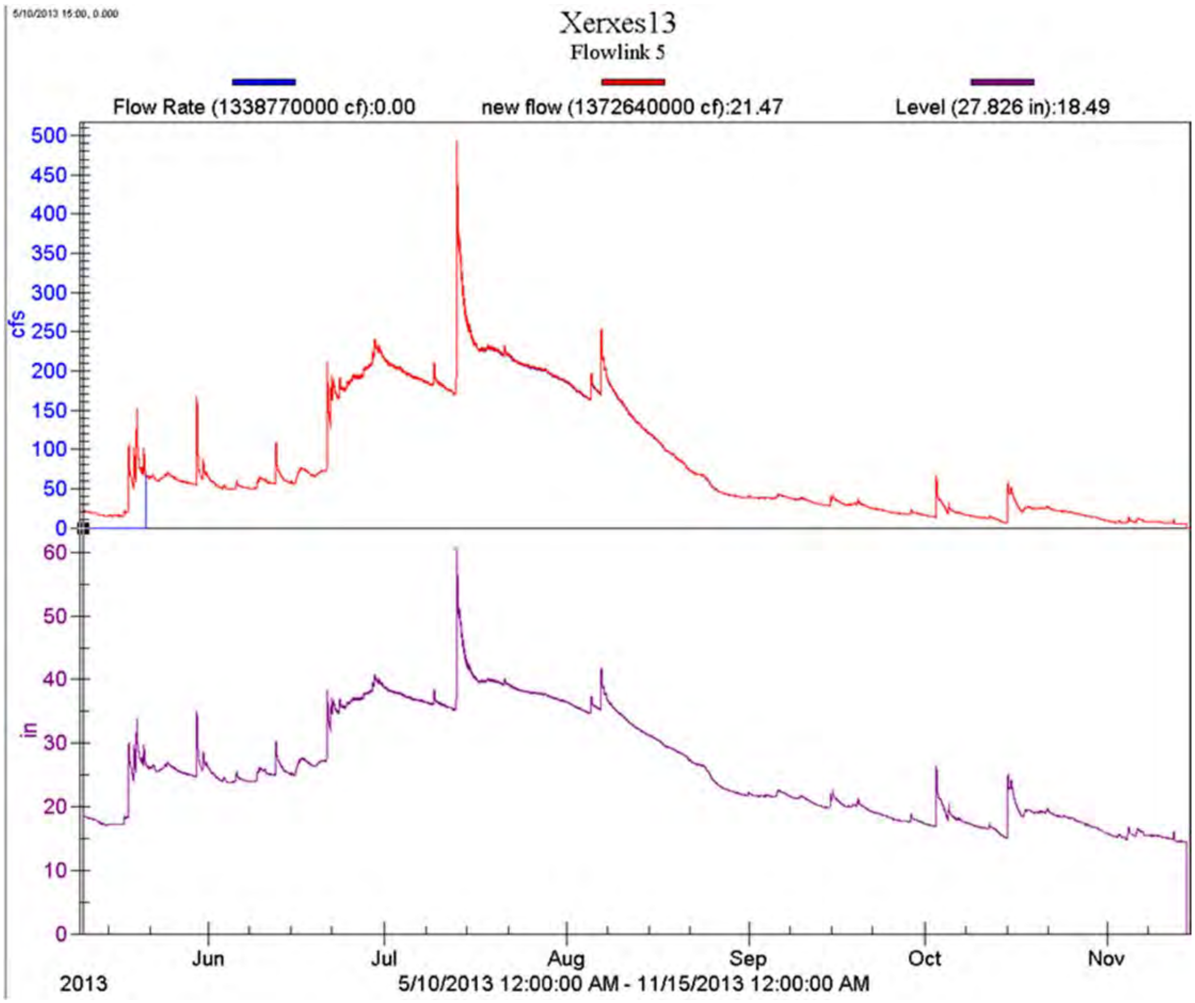



**Figure 26-4. 2013 stage discharge graph of the Minnehaha Creek Xerxes monitoring station from late April to November. The (top) line represents, discharge (cubic feet per second) and the (bottom) line depicts stage data (inches).**

In 2013, nine baseflow samples and seven storms of varying intensity (minimum 0.19 in, maximum 3.00 in storms) were captured throughout the sampling season, and are shown in **Table 26-1**. The event-pacing and trigger stage were adjusted for each storm to attempt collection of the entire hydrograph.

**Table 26-1. Snowmelt, precipitation, and baseflow events captured at Minnehaha Creek at the Xerxes station in 2013 are shown below. 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 | 2013 Xerxes Events Collected |
|---|---|---|---|---|---|---|---|---|---|---|
| +1 | 3/28/2013 | 13:30 | n/a | | n/a | n/a | n/a | n/a | Grab | X(w/Ecoli) |
| +2 | 3/29/2013 | 13:30 | n/a | | n/a | n/a | n/a | n/a | Grab | X(w/Ecoli) |
| +3 | 4/3/2013 | 14:30 | n/a | | n/a | n/a | n/a | n/a | Grab | X(w/Ecoli) |
| 4 | 5/29/2013 | 16:30 | 5/30/2013 | 1:30 | 1.04 | 9.0 | 0.12 | 111.0 | Composite | X |
| 5 | 6/12/2013 | 1:30 | 6/12/2013 | 18:30 | 0.59 | 17.0 | 0.03 | 59.0 | Composite | X |
| 6 | 7/13/2013 | 3:30 | 7/13/2013 | 7:30 | 3.00 | 4.0 | 0.75 | 90.3 | Composite | X(lmtd) |
| 7 | 8/6/2013 | 19:30 | 8/6/2013 | 21:00 | 0.86 | 1.5 | 0.57 | 35.5 | Composite | X |
| 8 | 9/19/2013 | 11:30 | 9/19/2013 | 12:30 | 0.19 | 1.0 | 0.19 | 27.0 | Composite | X |
| 9 | 10/4/2013 | 21:30 | 10/5/2013 | 16:00 | 0.31 | 18.5 | 0.02 | 22.5 | Composite | X |
| 10 | 10/17/2013 | 19:00 | 10/18/2013 | 5:30 | 0.33 | 10.5 | 0.03 | 39.5 | Composite | X |
| | | | **Totals** | | **6.32** | | | | | **10** |

| Baseflow Event | Date | Time | Sample Type | Collected |
|---|---|---|---|---|
| 1 | 4/22/2013 | 13:50 | Grab | X(w/Ecoli) |
| 2 | 5/8/2013 | 9:00 | Grab | X(w/Ecoli) |
| 3 | 6/20/2013 | 8:45 | Grab | X(w/Ecoli) |
| 4 | 7/12/2013 | 9:15 | Grab | X(w/Ecoli) |
| 5 | 8/2/2013 | 10:00 | Grab | X(w/Ecoli) |
| 6 | 9/5/2013 | 11:10 | Grab | X(w/Ecoli) |
| 7 | 10/1/2013 | 11:10 | Grab | X(w/Ecoli) |
| 8 | 11/7/2013 | 13:05 | Grab | X(w/Ecoli) |
| 9 | 12/17/2013 | 1200 | Grab | X(w/Ecoli) |

+ 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

**Tables 26-2, 26-3, and 26-4** show the Xerxes station data and associated statistic, baseflow data, and the storm event data. **Table 26-2** shows the raw data with duplicates averaged. Throughout the 2013 sampling season, a total of nine baseflow samples were taken to determine background conditions in the stream. In January through March no baseflow samples were collected due to fully frozen conditions. Nine *E. coli* grab samples were collected during baseflow condition. **Table 26-3** includes baseflow water chemistry statistics. In 2013, seven storm runoff events were collected. **Table 26-4** shows the storm event water chemistry statistics.

For **Tables 26-3, 26-4, and 26-5** statistics were only calculated for a chemical parameter if there were two or more measured values (not less than values). When statistical analysis was performed on the data sets, half of the less-than values were used in the calculations. In 2013, to lower the reporting limit, sulfate samples were spiked with 10 mg/L and the spike was later subtracted out.

2013 baseflow conditions in the stream were markedly different from storm events, see **Tables 26-3, 26-4**. Baseflow samples generally had lower concentrations of nutrients and metals than did storm events.

Baseflow also had the highest geometric mean concentrations for Cl, hardness, TDS, and specific conductivity. The levels of these dissolved parameters indicate that baseflow is likely dominated by groundwater discharge comingled with Lake Minnetonka surface water.

**Table 26-4** shows snowmelt as having the highest TP value and a storm event showing the highest TSS value. Storm event data consistently show higher TP and TSS values than baseflow samples. Non-snowmelt chloride values were between 17 mg/L and 93 mg/L. Chloride was generally below MPCA standards but higher than expected during the sampling season for both baseflow and storms, as shown in **Table 26-2**. The source of low level chronic $Cl^-$ in Minnehaha Creek is likely caused by winter road salt (NaCl) continuously leaching from the upstream soils. The MPCA chronic stream chloride standard is 230 mg/L for four days and an acute standard of 860 mg/L for one hour. The May 8$^{th}$ baseflow sample had a chloride level measured at 255 mg/L above the 230 mg/L chronic standard. Other than December 17$^{th}$ sample (220 mg/L) the other baseflow samples collected were well below the chronic stream standard. No sample approached the acute 860 mg/L one hour standard.

Baseflow grab and composite storm sampling will continue in 2014.

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

**Table 26-2**. **Minnehaha Creek at Xerxes Ave. water chemistry data for baseflow and precipitation events in 2013. 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, and BF = baseflow.**

| Date Sampled | Time | Sample Type | Site Location | TP mg/L | TDP mg/L | OrthoP 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 | Cu ug/L | Pb ug/L | Zn ug/L | E. Coli MPN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/28/2013 | 13:30 | Grab | Xerxes SM | 0.325 | 0.216 | NA | 2.57 | 1.63 | 0.357 | 261 | 156 | 11 | 6 | 575 | 5 | 29.6 | 818 | 7.6 | 12 | <3.00 | 24 | 2420 |
| 3/29/2013 | 13:30 | Grab | Xerxes SM | 0.205 | 0.204 | NA | 2.77 | 1.64 | 0.373 | 312 | 140 | 8 | 4 | 709 | 5 | 11.5 | 952 | 7.3 | 7 | <3.00 | <20.0 | NA |
| 4/3/2013 | 14:30 | Grab | Xerxes SM | 0.247 | 0.168 | NA | 2.35 | 1.41 | 1.62 | 211 | 124 | 12 | 5 | 502 | 5 | 13.8 | 751 | 7.0 | <5.00 | <3.00 | <20.0 | 160 |
| 4/22/2013 | 13:50 | Grab | Xerxes BF | 0.097 | 0.049 | NA | 1.05 | <0.500 | 0.522 | 28 | 180 | 8 | 4 | 668 | 3 | 17.6 | 953 | 6.8 | 5 | <3.00 | <20.0 | 32 |
| 5/8/2013 | 9:00 | Grab | Xerxes BF | 0.062 | 0.042 | NA | 0.900 | 0.779 | <0.030 | 255 | 272 | 2 | <2.0 | 707 | <1.00 | 22.4 | 745 | 6.9 | 7 | <3.00 | <20.0 | 147 |
| 5/30/2013 | 10:25 | Composite | Xerxes | 0.152 | 0.027 | NA | 1.19 | <0.500 | 0.182 | 82 | 148 | 50 | 15 | 314 | 3 | 8.1 | 520 | 7.6 | 13 | 4 | <20.0 | NA |
| 6/13/2013 | 0:16 | Composite | Xerxes | 0.118 | 0.063 | NA | 0.76 | <0.500 | 0.132 | 17 | 148 | 19 | 7 | 319 | <1.00 | 8.6 | 492 | 7.9 | 7 | <3.00 | <20.0 | NA |
| 6/20/2013 | 8:45 | Grab | Xerxes BF | 0.107 | 0.087 | NA | <0.500 | <0.500 | 0.118 | 93 | 156 | 4 | 2 | 369 | <1.00 | 8.8 | 581 | 7.9 | <5.00 | <3.00 | <20.0 | 115 |
| 7/12/2013 | 9:15 | Grab | Xerxes BF | 0.065 | 0.048 | NA | 0.829 | <0.500 | <0.030 | 59 | 164 | 6 | 3 | 259 | <1.00 | 6.8 | NA | 7.7 | | <5.00 | <3.00 | <20.0 |
| 7/13/2013 | 11:01 | Composite | Xerxes | 0.152 | NA | NA | 0.920 | NA | 0.175 | 30 | 84 | 57 | 12 | NA | NA | NA | NA | NA | 12 | 6 | <20.0 | NA |
| 8/2/2013 | 10:00 | Grab | Xerxes BF | 0.056 | 0.040 | 0.020 | 1.06 | <0.500 | <0.030 | 53 | 172 | 7 | 3 | 247 | <1.0 | 8.3 | 441 | 7.9 | 5 | <3.00 | <20.0 | 78 |
| 8/7/2013 | 9:24 | Composite | Xerxes | 0.098 | 0.051 | 0.041 | 0.988 | <0.500 | 0.064 | 46 | 120 | 34 | 10 | 210 | 2 | 7.8 | 360 | 7.8 | 9 | 5 | <20.0 | NA |
| 9/5/2013 | 11:10 | Grab | Xerxes BF | 0.030 | 0.021 | 0.021 | 1.05 | <0.500 | 0.082 | 70 | 164 | 4 | <2.0 | 295 | <1.00 | 9.8 | 506 | 8.0 | 148 | <5.00 | <3.00 | <20.0 |
| 9/19/2013 | 20:48 | Composite | Xerxes | 0.050 | 0.014 | 0.026 | 0.593 | <0.500 | 0.192 | 68 | 156 | 11 | <2.0 | 272 | 3 | 35.1 | 465 | 8.0 | 9 | <3.00 | <20.0 | NA |
| 10/1/2013 | 11:10 | Grab | Xerxes BF | 0.033 | 0.021 | 0.010 | 0.712 | <0.500 | 0.134 | 83 | 192 | 4 | 3 | 333 | <1.00 | 14.3 | 582 | 8.0 | <5.00 | <3.00 | <20.0 | 135 |
| 10/4/2013 | 8:54 | Composite | Xerxes | 0.064 | 0.030 | 0.027 | 0.964 | <0.500 | 0.243 | 57 | 156 | 19 | 6 | 256 | 3 | 8.4 | 456 | 7.9 | 6 | <3.00 | <20.0 | NA |
| 10/6/2013 | 22:07 | Composite | Xerxes | 0.042 | NA | NA | 0.660 | NA | 0.266 | 67 | 168 | 3 | 2 | NA | NA | NA | 517 | NA | 11 | <3.00 | <20.0 | NA |
| 10/18/2013 | 9:05 | Composite | Xerxes | 0.062 | 0.035 | 0.026 | 0.578 | <0.500 | 0.197 | 70 | 168 | 6 | 2 | 285 | 3 | 9.9 | 521 | 8.0 | <5.00 | <3.00 | <20.0 | NA |
| 11/7/2013 | 13:05 | Grab | Xerxes BF | 0.042 | 0.022 | 0.013 | 0.668 | <0.500 | <0.030 | 124 | 236 | 3 | 2 | 446 | <1.00 | 14.3 | 767 | 8.0 | <5.00 | <3.00 | <20.0 | 152 |
| 12/17/2013 | 1200 | Grab | Xerxes BF | 0.032 | 0.019 | 0.014 | 1.30 | 0.314 | <0.030 | 220 | 404 | 1 | <2.0 | 734 | <1.00 | 21 | NA | 7.7 | <5.00 | <3.00 | <20.0 | 25 |

**Table 26-3. Minnehaha Creek at Xerxes 2013 baseflow data showing water chemistry data collected during normal stream flow. 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 | Sample Type | Site Location | TP mg/L | TDP mg/L | OrthoP 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 | Cu ug/L | Pb ug/L | Zn ug/L | E. Coli MPN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/22/2013 | 13:50 | Grab | Xerxes BF | 0.097 | 0.049 | NA | 1.05 | 0.250 | 0.522 | 28 | 180 | 8 | 4 | 668 | 3 | 18 | 953 | 6.8 | 5 | 2 | 10 | 32 |
| 5/8/2013 | 9:00 | Grab | Xerxes BF | 0.062 | 0.042 | NA | 0.900 | 0.779 | 0.015 | 255 | 272 | 2 | 1 | 707 | 1 | 22 | 745 | 6.9 | 7 | 2 | 10 | 147 |
| 6/20/2013 | 8:45 | Grab | Xerxes BF | 0.107 | 0.087 | NA | 0.250 | 0.250 | 0.118 | 93 | 156 | 4 | 2 | 369 | 1 | 8.8 | 581 | 7.9 | 3 | 2 | 10 | 115 |
| 7/12/2013 | 9:15 | Grab | Xerxes BF | 0.065 | 0.048 | NA | 0.829 | 0.250 | 0.015 | 59 | 164 | 6 | 3 | 259 | 1 | 6.8 | NA | 7.7 | 3 | 2 | 10 | NA |
| 8/2/2013 | 10:00 | Grab | Xerxes BF | 0.056 | 0.040 | 0.020 | 1.06 | 0.250 | 0.015 | 53 | 172 | 7 | 3 | 247 | 1 | 8.3 | 441 | 7.9 | 5 | 2 | 10 | 78 |
| 9/5/2013 | 11:10 | Grab | Xerxes BF | 0.030 | 0.021 | 0.021 | 1.05 | 0.250 | 0.082 | 70 | 164 | 4 | 1 | 295 | 1 | 9.8 | 506 | 8.0 | 3 | 2 | 10 | 148 |
| 10/1/2013 | 11:10 | Grab | Xerxes BF | 0.033 | 0.021 | 0.010 | 0.712 | 0.250 | 0.134 | 83 | 192 | 4 | 3 | 333 | 1 | 14 | 582 | 8.0 | 3 | 2 | 10 | 135 |
| 11/7/2013 | 13:05 | Grab | Xerxes BF | 0.042 | 0.022 | 0.013 | 0.668 | 0.250 | 0.015 | 124 | 236 | 3 | 2 | 446 | 1 | 14 | 767 | 8.0 | 3 | 2 | 10 | 152 |
| 12/17/2013 | 1200 | Grab | Xerxes BF | 0.032 | 0.019 | 0.014 | 1.30 | 0.314 | 0.015 | 220 | 404 | 1 | 1 | 734 | 1 | 21 | NA | 7.7 | 3 | 2 | 10 | 25 |
| | | Mean (Geometric) | | 0.053 | 0.034 | 0.015 | 0.801 | 0.291 | 0.043 | 88 | 205 | 4 | 2 | 414 | 1 | 13 | 634 | 7.6 | 3 | 2 | 10 | 87 |
| | | Mean (Arithmetric) | | 0.058 | 0.039 | 0.016 | 0.869 | 0.316 | 0.103 | 109 | 216 | 4 | 2 | 451 | 1 | 14 | 654 | 7.6 | 4 | 2 | 10 | 104 |
| | | Max | | 0.107 | 0.087 | 0.021 | 1.304 | 0.779 | 0.522 | 255 | 404 | 8 | 4 | 734 | 3 | 22 | 953 | 8.0 | 7 | 2 | 10 | 152 |
| | | Min | | 0.030 | 0.019 | 0.010 | 0.250 | 0.250 | 0.015 | 28 | 156 | 1 | 1 | 247 | 1 | 7 | 441 | 6.8 | 3 | 2 | 10 | 25 |
| | | Median | | 0.056 | 0.040 | 0.014 | 0.900 | 0.250 | 0.015 | 83 | 180 | 4 | 2 | 369 | 1 | 14 | 582 | 7.9 | 3 | 2 | 10 | 125 |
| | | Standard Dev. | | 0.028 | 0.022 | 0.005 | 0.305 | 0.175 | 0.164 | 78 | 80 | 2 | 1 | 199 | 1 | 6 | 177 | 0.5 | 2 | 0 | 0 | 52 |
| | | Number | | 9 | 9 | 5 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 7 | 9 | 9 | 9 | 9 | 8 |
| | | COV | | 0.483 | 0.564 | 0.303 | 0.350 | 0.554 | 1.59 | 0.712 | 0.373 | 0.556 | 0.503 | 0.441 | 0.923 | 0.417 | 0.271 | 0.064 | 0.495 | 0 | 0 | 0.505 |

**Table 26-4. Minnehaha Creek at Xerxes 2013 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 | Sample Type | Site Location | TP mg/L | TDP mg/L | OrthoP 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 | Cu ug/L | Pb ug/L | Zn ug/L | E. Coli MPN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/28/2013 | 13:30 | Grab | Xerxes SM | 0.325 | 0.216 | NA | 2.57 | 1.63 | 0.357 | 261 | 156 | 11 | 6 | 575 | 5 | 30 | 818 | 7.6 | 12 | 2 | 24 | 2420 |
| 3/29/2013 | 13:30 | Grab | Xerxes SM | 0.205 | 0.204 | NA | 2.77 | 1.64 | 0.373 | 312 | 140 | 8 | 4 | 709 | 5 | 12 | 952 | 7.3 | 7 | 2 | 10 | NA |
| 4/3/2013 | 14:30 | Grab | Xerxes SM | 0.247 | 0.168 | NA | 2.35 | 1.41 | 1.62 | 211 | 124 | 12 | 5 | 502 | 5 | 14 | 751 | 7.0 | 3 | 2 | 10 | 160 |
| 5/30/2013 | 10:25 | Composite | Xerxes | 0.152 | 0.027 | NA | 1.19 | 0.250 | 0.182 | 82 | 148 | 50 | 15 | 314 | 3 | 8.1 | 520 | 7.6 | 13 | 4 | 10 | NA |
| 6/13/2013 | 0:16 | Composite | Xerxes | 0.118 | 0.063 | NA | 0.760 | 0.250 | 0.132 | 17 | 148 | 19 | 7 | 319 | 1 | 8.6 | 492 | 7.9 | 7 | 2 | 10 | NA |
| 7/13/2013 | 11:01 | Composite | Xerxes | 0.152 | NA | NA | 0.920 | NA | 0.175 | 30 | 84 | 57 | 12 | NA | NA | NA | NA | NA | 12 | 6 | 10 | NA |
| 8/7/2013 | 9:24 | Composite | Xerxes | 0.098 | 0.051 | 0.041 | 0.988 | 0.250 | 0.064 | 46 | 120 | 34 | 10 | 210 | 2 | 7.8 | 360 | 7.8 | 9 | 5 | 10 | NA |
| 9/19/2013 | 20:48 | Composite | Xerxes | 0.050 | 0.014 | 0.026 | 0.593 | 0.250 | 0.192 | 68 | 156 | 11 | 1 | 272 | 3 | 35 | 465 | 8.0 | 9 | 2 | 10 | NA |
| 10/4/2013 | 8:54 | Composite | Xerxes | 0.064 | 0.030 | 0.027 | 0.964 | 0.250 | 0.243 | 57 | 156 | 19 | 6 | 256 | 3 | 8.4 | 456 | 7.9 | 6 | 2 | 10 | NA |
| 10/6/2013 | 22:07 | Composite | Xerxes | 0.042 | NA | NA | 0.660 | NA | 0.266 | 67 | 168 | 3 | 2 | NA | NA | NA | 517 | NA | 11 | 2 | 10 | NA |
| 10/18/2013 | 9:05 | Composite | Xerxes | 0.062 | 0.035 | 0.026 | 0.578 | 0.250 | 0.197 | 70 | 168 | 6 | 2 | 285 | 3 | 9.9 | 521 | 8.0 | 3 | 2 | 10 | NA |
| | | Mean (Geometric) | | 0.113 | 0.060 | 0.029 | 1.11 | 0.460 | 0.238 | 77 | 140 | 15 | 5 | 353 | 3 | 12 | 561 | 7.7 | 7 | 2 | 11 | 622 |
| | | Mean (Arithmetric) | | 0.138 | 0.090 | 0.030 | 1.30 | 0.687 | 0.346 | 111 | 143 | 21 | 6 | 382 | 3 | 15 | 585 | 7.7 | 8 | 2 | 11 | 1290 |
| | | Max | | 0.325 | 0.216 | 0.041 | 2.77 | 1.64 | 1.62 | 312 | 168 | 57 | 15 | 709 | 5 | 35 | 952 | 8.0 | 13 | 6 | 24 | 2420 |
| | | Min | | 0.042 | 0.014 | 0.026 | 0.578 | 0.250 | 0.064 | 17 | 84 | 3 | 1 | 210 | 1 | 7.8 | 360 | 7.0 | 3 | 2 | 10 | 160 |
| | | Median | | 0.118 | 0.051 | 0.027 | 0.964 | 0.250 | 0.197 | 68 | 148 | 12 | 6 | 314 | 3 | 10 | 519 | 7.8 | 9 | 2 | 10 | 1290 |
| | | Standard Dev. | | 0.091 | 0.082 | 0.007 | 0.835 | 0.658 | 0.432 | 101 | 25 | 18 | 4 | 171 | 2 | 10 | 189 | 0.351 | 4 | 2 | 4 | 1598 |
| | | Number | | 11 | 9 | 4 | 11 | 9 | 11 | 11 | 11 | 11 | 11 | 9 | 9 | 9 | 10 | 9 | 11 | 11 | 11 | 2 |
| | | COV | | 0.657 | 0.912 | 0.245 | 0.640 | 0.959 | 1.25 | 0.909 | 0.174 | 0.867 | 0.684 | 0.447 | 0.498 | 0.695 | 0.322 | 0.046 | 0.441 | 0.666 | 0.374 | 1.24 |

# 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.

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

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 | 01/01/13 – 03/31/13 | 4.23 inches (0.107 m) |
| Spring | 04/01/13 – 05/31/13 | 11.46 inches (0.291 m) |
| Summer | 06/01/13 – 08/31/13 | 10.75 inches (0.273 m) |
| Fall | 09/01/13 – 12/31/13 | 6.33 inches (0.161 m) |

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

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

**Flow-weighted mean concentrations and related statistics for NPDES parameters in 2013.**

| 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 | 0.311 | 0.081 | 0.106 | 2.89 | 0.299 | 0.832 | 37 | 47.8 | 77 | 33 | 60 | 13 | 6.6 | 17 | 60 | 76 |
| 7 | 0.204 | 0.047 | 0.064 | 1.69 | 0.388 | 0.653 | 43 | 23.5 | 65 | 24 | 164 | 7 | 5.6 | 19 | 11 | 77 |
| 8a | 0.504 | 0.331 | 0.363 | 2.24 | 0.226 | 0.508 | 5 | 28.7 | 54 | 21 | 68 | 7 | 8.1 | 14 | 2 | 23 |
| 9 | 0.455 | 0.171 | 0.244 | 2.52 | 0.696 | 0.996 | 205 | 63.9 | 184 | 37 | 913 | 24 | 12.3 | 24 | 16 | 139 |
| **MEAN** | **0.369** | **0.157** | **0.194** | **2.34** | **0.402** | **0.747** | **72** | **41.0** | **95** | **29** | **301** | **13** | **8.1** | **19** | **22** | **79** |
| **MEDIAN** | **0.383** | **0.126** | **0.175** | **2.38** | **0.344** | **0.743** | **40** | **38.3** | **71** | **29** | **116** | **10** | **7.3** | **18** | **14** | **77** |
| **STANDEV** | **0.137** | **0.127** | **0.136** | **0.506** | **0.207** | **0.212** | **90** | **18.5** | **60** | **8** | **411** | **8** | **2.9** | **4** | **26** | **47** |

(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.

Statistical summary for event mean concentrations by season in 2013. Statistics were calculated from all sites (6-9). STDEV= standard deviation, COV= coefficient of variance.

| **2013 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)** | 0.640 | 0.128 | | 3.57 | 1.49 | 0.813 | 392 | 104 | 93 | 36 | 1243 | 22 | 12 | 7.1 | 64 | 23.2 | 18.6 | 114 |
| | **MEAN (arithmetic)** | 0.934 | 0.281 | | 5.18 | 2.13 | 1.50 | 1681 | 175 | 269 | 83 | 2732 | 58 | 20 | 7.2 | 366 | 43.2 | 80.3 | 233 |
| | **MAX** | 2.33 | 1.31 | | 13.3 | 6.31 | 3.93 | 4883 | 700 | 1333 | 426 | 7261 | 301 | 72 | 9.7 | 1700 | 180 | 510 | 1100 |
| | **MIN** | 0.038 | 0.024 | NA | 0.25 | 0.250 | 0.047 | 1 | 20 | 3 | 2 | 55 | 1 | 3 | 6.2 | 1 | 2.50 | 1.50 | 10.0 |
| | **MEDIAN** | 0.789 | 0.124 | | 4.33 | 1.33 | 0.808 | 1543 | 112 | 107 | 38 | 2521 | 26 | 9 | 6.6 | 146 | 29.5 | 15.5 | 170 |
| | **STDEV** | 0.685 | 0.396 | | 4.00 | 1.87 | 1.44 | 1578 | 202 | 417 | 127 | 2460 | 91 | 22 | 1.26 | 598 | 51.4 | 157 | 315 |
| | **NUMBER** | 10 | 10 | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 9 | 10 | 10 | 10 |
| | **COV** | 0.734 | 1.41 | | 0.773 | 0.877 | 0.961 | 0.94 | 1.15 | 1.55 | 1.52 | 0.90 | 1.57 | 1.13 | 0.175 | 1.63 | 1.19 | 1.96 | 1.35 |
| SPRING (April-May) | **MEAN (geometric)** | 0.377 | 0.043 | | 2.45 | 0.746 | 0.268 | 5 | 26 | 111 | 36 | 71 | 6 | 7 | 7.1 | | 22.6 | 20.1 | 89.8 |
| | **MEAN (arithmetic)** | 0.471 | 0.095 | | 2.72 | 0.805 | 0.410 | 47 | 30 | 129 | 38 | 153 | 6 | 8 | 7.1 | | 24.5 | 26.5 | 107 |
| | **MAX** | 1.31 | 0.334 | | 6.43 | 1.14 | 1.93 | 432 | 70 | 340 | 71 | 776 | 13 | 12 | 7.8 | | 52.0 | 90.0 | 240 |
| | **MIN** | 0.125 | 0.005 | NA | 1.37 | 0.250 | 0.033 | 1 | 14 | 52 | 18 | 19 | 3 | 4 | 6.7 | NA | 13.0 | 3.30 | 45.0 |
| | **MEDIAN** | 0.440 | 0.025 | | 2.30 | 0.838 | 0.271 | 1 | 20 | 103 | 37 | 51 | 6 | 7 | 7.1 | | 19.0 | 19.0 | 81.0 |
| | **STDEV** | 0.327 | 0.127 | | 1.44 | 0.274 | 0.481 | 119 | 18 | 81 | 16 | 244 | 3 | 3 | 0.358 | | 11.6 | 22.6 | 71.0 |
| | **NUMBER** | 13 | 9 | | 13 | 9 | 13 | 13 | 13 | 13 | 13 | 9 | 9 | 9 | 9 | | 13 | 13 | 13 |
| | **COV** | 0.696 | 1.34 | | 0.529 | 0.341 | 1.18 | 2.55 | 0.600 | 0.623 | 0.405 | 1.60 | 0.516 | 0.438 | 0.050 | | 0.472 | 0.853 | 0.664 |
| SUMMER (June-August) | **MEAN (geometric)** | 0.262 | 0.095 | 0.115 | 1.70 | 0.494 | 0.182 | 4 | 27 | 62 | 18 | 74 | 8 | 8 | 7.6 | 5466 | 15.0 | 9.34 | 51.1 |
| | **MEAN (arithmetic)** | 0.292 | 0.115 | 0.155 | 1.97 | 0.626 | 0.298 | 17 | 31 | 83 | 21 | 84 | 10 | 8 | 7.6 | 8917 | 16.6 | 16.8 | 66.7 |
| | **MAX** | 0.599 | 0.301 | 0.287 | 5.40 | 2.52 | 1 | 151 | 58 | 288 | 42 | 193 | 35 | 18 | 9.6 | 24196 | 30.0 | 71.0 | 140 |
| | **MIN** | 0.113 | 0.034 | 0.027 | 0.530 | 0.250 | 0.015 | 1 | 12 | 16 | 5 | 29 | 3 | 4 | 6.6 | 1467 | 2.50 | 1.50 | 10.0 |
| | **MEDIAN** | 0.285 | 0.082 | 0.137 | 1.73 | 0.572 | 0.261 | 1 | 28 | 55 | 19 | 78 | 6 | 8 | 7.4 | 6657 | 16.0 | 9.30 | 68.0 |
| | **STDEV** | 0.135 | 0.080 | 0.104 | 1.16 | 0.530 | 0.234 | 34 | 16 | 72 | 10 | 42 | 9 | 3 | 0.95 | 8757 | 6.71 | 19.7 | 39.4 |
| | **NUMBER** | 26 | 19 | 8 | 26 | 19 | 26 | 26 | 26 | 26 | 26 | 19 | 19 | 19 | 19 | 6 | 25 | 25 | 25 |
| | **COV** | 0.460 | 0.70 | 0.673 | 0.590 | 0.846 | 0.784 | 1.98 | 0.507 | 0.873 | 0.466 | 0.504 | 0.893 | 0.413 | 0.124 | 0.982 | 0.404 | 1.18 | 0.590 |
| FALL (Sept-Nov) | **MEAN (geometric)** | 0.376 | 0.114 | 0.205 | 2.47 | 0.775 | 0.257 | 6 | 43 | 84 | 32 | 74 | 13 | 9 | 7.7 | | 16.3 | 13.6 | 88.2 |
| | **MEAN (arithmetic)** | 0.441 | 0.220 | 0.261 | 3.66 | 1.28 | 0.478 | 13 | 51 | 122 | 37 | 101 | 18 | 10 | 7.7 | | 21.6 | 23.7 | 112 |
| | **MAX** | 1.44 | 1.20 | 0.705 | 15.0 | 6.62 | 1.41 | 58 | 156 | 511 | 85 | 377 | 76 | 22 | 9.3 | | 66.0 | 78.0 | 350 |
| | **MIN** | 0.137 | 0.031 | 0.063 | 0.250 | 0.250 | 0.015 | 1 | 20 | 18 | 13 | 28 | 5 | 6 | 6.9 | NA | 2.50 | 1.50 | 10.0 |
| | **MEDIAN** | 0.344 | 0.093 | 0.206 | 2.41 | 0.717 | 0.476 | 6 | 38 | 82 | 33 | 61 | 13 | 8 | 7.2 | | 19.0 | 10.0 | 90.0 |
| | **STDEV** | 0.301 | 0.338 | 0.193 | 3.42 | 1.77 | 0.351 | 16 | 34 | 126 | 22 | 98 | 20 | 5 | 0.869 | | 14.8 | 23.3 | 83.4 |
| | **NUMBER** | 27 | 12 | 12 | 24 | 12 | 25 | 25 | 25 | 26 | 25 | 12 | 11 | 11 | 11 | | 23 | 23 | 23 |
| | **COV** | 0.684 | 1.53 | 0.739 | 0.935 | 1.38 | 0.736 | 1.24 | 0.661 | 1.03 | 0.579 | 0.969 | 1.12 | 0.496 | 0.112 | | 0.682 | 0.980 | 0.746 |

(blue) -highest concentration

(orange) -lowest concentration

NA=not available

***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.

# Comparision of Seasonal-based Loadings and Annual-based Outfall Loadings

| Season | Precipitation | | BOD | TSS | TDS | TKN | NH3-N | NO2-NO3 | TP | TDP | Cu | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | meters | inches | mg\l | mg\l | mg\l | mg\l | mg\l | mg\l | mg\l | mg\l | mg\l | mg\l | mg\l |
| **Winter/snowmelt Median Event Mean Concentration** | | | 13.0 | 95 | 301 | 2.34 | 0.747 | 0.402 | 0.369 | 0.157 | 0.019 | 0.022 | 0.079 |
| **Precipitation** | **0.107** | **4.23** | | | | | | | | | | | |
| Winter/snowmelt Season Sum (kilograms) | | | 64,900 | 474,269 | 1,502,684 | 11,682 | 3,729 | 2,007 | 1,842 | 784 | 95 | 110 | 394 |
| **Spring Median Event Mean Concentration** | | | 13.0 | 95 | 301.0 | 2.34 | 0.747 | 0.402 | 0.369 | 0.157 | 0.019 | 0.022 | 0.079 |
| **Precipitation** | **0.291** | **11.46** | | | | | | | | | | | |
| Spring Season Sum (kilograms) | | | 175,828 | 1,284,899 | 4,071,100 | 31,649 | 10,103 | 5,437 | 4,991 | 2,123 | 257 | 298 | 1,068 |
| **Summer Median Event Mean Concentration** | | | 13.0 | 95 | 301.0 | 2.34 | 0.747 | 0.402 | 0.369 | 0.157 | 0.019 | 0.022 | 0.079 |
| **Precipitation** | **0.273** | **10.75** | | | | | | | | | | | |
| Summer Season Sum (kilograms) | | | 164,935 | 1,205,293 | 3,818,877 | 29,688 | 9,477 | 5,100 | 4,682 | 1,992 | 241 | 279 | 1,002 |
| **Fall Median Event Mean Concentration** | | | 13.0 | 95.0 | 301.0 | 2.34 | 0.747 | 0.402 | 0.369 | 0.157 | 0.019 | 0.022 | 0.079 |
| **Precipitation** | **0.161** | **6.33** | | | | | | | | | | | |
| Fall Season Sum (kilograms) | | | 97,120 | 709,722 | 2,248,697 | 17,482 | 5,581 | 3,003 | 2,757 | 1,173 | 142 | 164 | 590 |
| **Summation of Season Totals (kilograms)** | **0.832** | **32.77** | 502,783 | 3,674,183 | 11,641,357 | 90,501 | 28,891 | 15,548 | 14,271 | 6,072 | 735 | 851 | 3,055 |
| **Mean Flow Weighted Mean Concentration - all 2013 sites** | | | 13 | 95 | 301 | 2.34 | 0.747 | 0.402 | 0.369 | 0.157 | 0.019 | 0.022 | 0.079 |
| **Precipitation** | **0.832** | **32.77** | | | | | | | | | | | |
| **ANNUAL SUMMATION (kilograms)** | | | 502,783 | 3,674,183 | 11,641,357 | 90,501 | 28,891 | 15,548 | 14,271 | 6,072 | 735 | 851 | 3,055 |
| **ANNUAL POLLUTANT LOADINGS BY RECEIVING WATER (kilograms)** | | | 556,218 | 4,064,667 | 17,292,752 | 100,119 | 31,961 | 17,200 | 15,788 | 6,717 | 813 | 941 | 3,380 |

## 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

| 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:<br>FIS___________________________<br>MPCA_______________________________<br>FIREDEPT___________________________<br>POLICE_______________________________<br>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?<br>PHONE NO. |
| CLEAN-UP TO DATE:<br>MATERIAL USED______________________<br>LOADER USED________________________<br>TRUCKS USED________________________<br>PICK-UP TRUCK USED________________<br>MACHINE SWEEPER USED______________<br>LABOR: FOREMAN HOURS_____________<br>MAINT CREW LEADER _____________<br>CONST LABORER_______________<br>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 $___________
TOTAL COST$_____________


Source: Minneapolis Public Works – Street Maintenance June 2013

| Grit ID | Location | Date Inspected | Inspector | Estimated Volume In Cu Yds | Floatables Y/N | Cleaning Required Y/N | Volume Of Sediment Removed | Date Cleaned |
|---|---|---|---|---|---|---|---|---|
| 1 | UPTON AVE N & 53RD AVE N | 7/25/13 | D.G. | 2.00 | Y | Y | 2 | 7/25/13 |
| 2 | UPTON AVE N & 53RD AVE N | 4/30/13 | D.G. | 2.00 | N | Y | 2 | 4/30/13 |
| 3 | SHERIDAN AVE N, N OF 52ND AVE N | 6/17/13 | A.K. | 8.00 | Y | Y | 8 | 6/17/13 |
| 4 | RUSSELL AVE N NORTH OF 52ND AVE N | 4/25/13 | D.G. | 1.00 | N | Y | 1 | 4/25/13 |
| 5 | PENN AVE N & 52ND AVE N | 7/22/13 | D.G. | 2.00 | Y | Y | 2 | 7/22/13 |
| 6 | PENN AVE N & 52ND AVE N | 9/9/13 | D.G. | 2.00 | N | Y | 2 | 9/9/13 |
| 7 | OLIVER AVE N & 52ND AVE N | 7/22/13 | M.A. | 1.00 | N | Y | 1 | 7/22/13 |
| 8 | NEWTON AVE N & SHINGLE CREEK | 7/22/13 | M.A. | 1.00 | N | Y | 1 | 7/22/13 |
| 9 | OLIVER AVE N & 51ST AVE N | 4/26/13 | D.G. | 3.00 | Y | Y | | 4/26/13 |
| 10 | MORGAN AVE N & 51ST AVE N | 7/30/13 | D.G. | 1.00 | Y | Y | 1 | 7/30/13 |
| 11 | KNOX AVE N & 51ST AVE N | 8/5/13 | D.G. | 4.00 | Y | Y | 4 | 8/5/13 |
| 12 | KNOX AVE N & 50TH AVE N | 6/20/13 | A.K. | 4.00 | Y | Y | 4 | 6/20/13 |
| 13 | IRVING AVE N & 50TH AVE N | 7/29/13 | D.G. | 1.00 | Y | Y | 1 | 7/29/13 |
| 14 | JAMES AVE N, NORTH OF 49TH AVE N | 4/25/13 | D.G. | 1.00 | N | Y | 1 | 4/25/13 |
| 15 | 21ST AVE N & 1ST ST N | 8/14/13 | D.G. | 28.00 | Y | Y | 28 | 8/15/13 |
| 16 | XERXES AVE N & 14TH AVE N | 9/23/13 | D.G. | 72.00 | Y | Y | 72 | 9/24/13 |
| 17 | XERXES AVE N & GLENWOOD AVE | 6/18/13 | A.K. | 6.00 | Y | Y | 6 | 6/18/13 |
| 18 | MORGAN AVE N & CHESNUT AVE | 6/18/13 | A.K. | 6.00 | Y | Y | 6 | 6/18/13 |
| 19 | GIRARD AVE NO & CURRIE AVE NO | 8/21/13 | D.G. | | Y | Y | 30 | 8/22/13 |
| 21 | LAKE OF THE ISLES PKWY & LOGAN AVE | 8/29/13 | D.G. | 18.00 | Y | Y | 18 | 8/30/13 |
| 24 | DREW AVE S & W LAKE ST | 5/8/13 | R.H. | 0.50 | Y | Y | 0.5 | 5/8/13 |
| 25 | EXCELSIOR BLVD & MARKET PL | 9/4/13 | D.G. | 17.00 | Y | Y | 17 | 9/4/13 |
| 28 | W 33RD ST & HOLMES AVE S | 6/11/13 | R.H. | 0.50 | Y | Y | 3.5 | 6/11/13 |
| 33 | E 43RD ST & PARK AVE S | 7/11/13 | L.J. | 6.00 | Y | Y | 6 | 7/12/13 |
| 35 | E 44TH ST & OAKLAND AVE S | 9/3/13 | D.G. | 3.00 | N | Y | 3 | 9/3/13 |
| 36 | E 46TH ST & 31ST AVE S | 6/3/13 | R.H. | 0.25 | Y | Y | 0.25 | 6/3/13 |
| 38 | W 47TH ST & YORK AVE S | 5/8/13 | R.H. | 0.50 | Y | Y | 0.5 | 5/8/13 |
| 41 | W 48TH ST & YORK AVE S | 5/8/13 | R.H. | 0.50 | Y | Y | 0.5 | 5/8/13 |
| 42 | QUEEN AVE S & LAKE HARRIET PARKWAY | 9/5/13 | R.H. | 12.00 | | Y | 12 | 9/5/13 |
| 44 | SHERIDAN AVE S & W 50TH ST | 6/7/13 | R.H. | 0.50 | Y | Y | 0.5 | 6/7/13 |
| 46 | MORGAN AVE S & W 53RD ST | 8/5/13 | R.H. | 12.00 | Y | Y | 12 | 8/7/13 |
| 47 | E 55TH ST & PORTLAND AVE S | 5/6/13 | R.H. | 0.50 | Y | Y | 0.5 | 5/6/13 |
| 48 | E 56TH ST & PORTLAND AVE S | 5/6/13 | R.H. | 0.50 | Y | Y | 0.5 | 5/6/13 |
| 49 | E 57TH ST & PORTLAND AVE S | 5/6/13 | R.H. | 0.50 | Y | Y | 0.5 | 5/6/13 |
| 50 | E 57TH ST & PORTLAND AVE S | 9/19/13 | | | | | 2 | 9/19/13 |
| 51 | GIRARD AVE S BETWEEN W 59TH ST & W 60TH ST | 5/3/13 | R.H. | 0.50 | Y | Y | 0.5 | 5/3/13 |
| 52 | E 59TH ST & 12TH AVE S | 4/22/13 | M.S. | 1.00 | | Y | 0.5 | 4/22/13 |
| 53 | GIRARD AVE S & W 60TH ST | 5/3/13 | R.H. | 0.50 | Y | Y | 0.5 | 5/3/13 |
| 54 | GIRARD AVE S, W 60TH ST - DUPONT AVE S | 9/11/13 | D.G. | 16.00 | Y | Y | 16 | 9/11/13 |
| 55 | GRASS LAKE TERRACE, GIRARD TO JAMES AVE S | 9/10/13 | | | | | 3 | 9/10/13 |
| 56 | GRASS LAKE SERVICE ROAD BEHIND #6035 JAMES AVE S | 5/29/13 | R.H. | 0.50 | Y | Y | 0.5 | 5/29/13 |


Source: Minneapolis Public Works - SWS Operations

| Grit ID | Location | Date Inspected | Inspector | Estimated Volume In Cu Yds | Floatables Y/N | Cleaning Required Y/N | Volume Of Sediment Removed | Date Cleaned |
|---|---|---|---|---|---|---|---|---|
| 57 | GRASS LAKE SERVICE ROAD BEHIND #6077 JAMES AVE S | 5/29/13 | R.H. | 0.50 | Y | Y | 0.5 | 5/29/13 |
| 58 | GRASS LAKE SERVICE ROAD BEHIND #1416 W 61ST ST | 5/29/13 | R.H. | 0.50 | Y | Y | 0.5 | 5/29/13 |
| 59 | W 61ST ST & GRASS LAKE SERVICE ROAD | 9/18/13 | | | | | 0.25 | 9/18/13 |
| 60 | IRVING AVE S & W 61ST ST | 9/12/13 | | | | | 10 | 9/12/13 |
| 61 | E RIVER RD & CECIL ST | 5/24/13 | B.R. | 10.00 | N | Y | 12 | 7/11/13 |
| 62 | HIAWATHA PARK REFECTORY TURN-A-ROUND | 4/17/13 | M.S. | 0.50 | N | Y | 0.5 | 4/17/13 |
| 66 | MAPLE PLACE & EAST ISLAND AVE | 5/15/13 | B.R. | 1.00 | N | N | | |
| 67 | DELASALLE DR & E ISLAND | 5/15/13 | B.R. | 1.00 | N | N | | |
| 68 | W ISLAND - 300' S OF MAPLE PLACE | 5/15/13 | B.R. | 1.00 | N | N | | |
| 69 | EASTMAN AVE & W ISLAND | 5/15/13 | B.R. | 1.00 | N | N | | |
| 70 | ROYALSTON & 5TH AVE N | 7/12/13 | D.G. | 3.00 | Y | Y | 3 | 7/12/13 |
| 72 | S OF 37TH AVE NE & ST ANTHONY PKWY | 5/24/13 | B.R. | 6.00 | N | N | | |
| 73 | 4552 KNOX AVE N (IN ALLEY BEHIND) | 7/5/13 | D.G. | 1.00 | N | Y | 1 | 7/5/13 |
| 77 | ALLEY - 38TH TO 39TH ST & NICOLLET TO BLAISDELL AVE | 5/21/13 | R.H. | 0.50 | Y | Y | 0.5 | 5/21/13 |
| 78 | SHINGLE CREEK WETLAND - W SIDE | 8/9/13 | D.G. | 3.00 | Y | Y | 3 | 8/9/13 |
| 79 | SHINGLE CREEK WETLAND - EAST SIDE | 8/12/13 | D.G. | 9.00 | Y | Y | 9 | 8/13/13 |
| 80 | WOODLAWN BLVD & E 50TH ST | 4/22/13 | M.S. | 1.00 | Y | Y | 0.5 | 4/22/13 |
| 82 | 12TH AVE S & POWDERHORN TERRACE | 11/26/13 | L.J. | 3.00 | Y | Y | 2 | 11/26/13 |
| 84 | 3421 15TH AVE S (180' W OF CL) | 10/23/13 | D.G. | 4.00 | Y | Y | 4 | 10/23/13 |
| 85 | 3329 14TH AVE S | 10/23/13 | D.G. | 3.00 | Y | Y | 3 | 10/23/13 |
| 86 | 13TH AVE S & E 35TH ST | 4/24/13 | R.H. | 2.00 | Y | Y | 2 | 4/24/13 |
| 88 | ACROSS THE STREET FROM 702, NO. BD. VAN WHITE BLVD. | 7/24/13 | D.G. | 0.00 | Y | Y | 0 | 7/24/13 |
| 89 | ACROSS THE STREET FROM 706, NO. BD. VAN WHITE BLVD. | 7/24/13 | D.G. | 2.00 | Y | Y | 2 | 7/24/13 |
| 90 | 10TH AVE. NO. & ALDRICH AVE. NO. (S.W.C.) | 7/23/13 | D.G. | 1.00 | Y | Y | 1 | 7/24/13 |
| 94 | 10TH AVE. NO. & NO. BD. VAN WHITE BLVD. (S.W.C.) | 6/25/13 | A.K. | 3.00 | Y | Y | 3 | 6/25/13 |
| 95 | WEST SIDE OF ALDRICH AVE. NO. & 9TH AVE. NO. | 6/25/13 | A.K. | 2.00 | Y | Y | 2 | 6/25/13 |
| | | 9/10/13 | D.G. | 2.00 | Y | Y | 2 | 9/10/13 |
| 96 | 8TH AVE. NO. & NO. BD. VAN WHITE BLVD. (N.E.C.) | 6/14/13 | D.G. | 3.00 | Y | Y | 3 | 6/17/13 |
| | | 8/8/13 | D.G. | 2.00 | Y | Y | 2 | 8/8/13 |
| 97 | 29TH AVE. & LOGAN AVE. - NO. STORM WATER DET. POND (E & W) | 6/13/13 | D.G. | 8.00 | Y | Y | 8 | 6/14/13 |
| | | 8/16/13 | D.G. | 6.00 | Y | Y | 6 | 8/16/13 |
| 98 | MALMQUIST LN. & HUMBOLDT NO. | 7/23/13 | M.A. | 2.00 | N | | 2 | 7/23/13 |
| 99 | SHINGLE CREEK DR. & HUMBOLDT NO. | 8/9/13 | D.G. | 4.00 | Y | Y | 4 | 8/9/13 |
| 100 | SO. OF 49TH AVE. NO. & HUMBOLDT NO. | 8/7/13 | D.G. | 6.00 | Y | Y | 6 | 8/7/13 |
| 109 | 22ND AVE N AND W RIVER ROAD | 7/17/13 | D.G. | 3.00 | Y | Y | 3 | 7/17/13 |
| 111 | RICHFIELD RD. NEAR W. CORNER OF THE PARKING LOT | 8/26/13 | R.H. | 0.25 | Y | Y | 0.25 | 8/26/13 |
| 113 | 20' EAST OF VAN WHITE MEM. BLVD (N.B.) AND 5TH AVE N (1016 - 5TH AVE N) | 7/24/13 | D.G. | 1.00 | Y | Y | 1 | 7/24/13 |
| 114 | DUPONT AVE. NO. & 4TH AVE. NO. | 5/31/13 | D.G. | 2.00 | Y | Y | 2 | 5/31/13 |
| 116 | 400' NORTH (60' INTO POND) VAN WHITE MEM. BLVD (S.B.) AND 4TH AVE N | 7/24/13 | D.G. | 0.00 | Y | Y | 0 | 7/24/13 |
| 117 | 300' NORTH (WEST SIDE) OF VAN WHITE MEM. BLVD (S.B.) AND 4TH AVE N | 5/31/13 | D.G. | 3.00 | Y | Y | 3 | 5/31/13 |
| | | 7/29/13 | D.G. | 5.00 | Y | Y | 5 | 7/29/13 |
| 118 | 200' NORTH (POND SIDE) OF VAN WHITE MEM. BLVD (S.B.) AND 10TH AVE N | 6/27/13 | D.G. | 3.00 | Y | Y | 3 | 6/27/13 |
| 119 | 11TH AVE N AND VAN WHITE BLVD (N.B.) | 7/24/13 | D.G. | 1.00 | Y | Y | 1 | 7/24/13 |
| 120 | VAN WHITE MEM. BLVD (S.B.) (160' so. of fremont ave. no. on the e. side of the street) | 6/27/13 | D.G. | 1.00 | Y | Y | 1 | 6/27/13 |


Source: Minneapolis Public Works - SWS Operations

| Grit ID | Location | Date Inspected | Inspector | Estimated Volume In Cu Yds | Floatables Y/N | Cleaning Required Y/N | Volume Of Sediment Removed | Date Cleaned |
|---|---|---|---|---|---|---|---|---|
| 121 | 50' NORTH (EAST SIDE) OF VAN WHITE MEM. BLVD (S.B.) AND FREMONT AVE N | 6/27/13 | D.G. | 3.00 | Y | Y | 3 | 6/27/13 |
| 122 | MINNEHAHA PARKWAY @ 39TH AVE S N SIDE OF PKWY | 4/17/13 | M.S. | 2.00 | N | Y | 1 | 4/17/13 |
| 123 | COLUMBUS AVE S SOUTH OF E 37TH ST REROUTE - no as-builts | 6/13/13 | R.H. | 0.25 | Y | N | 0.25 | 6/13/13 |
| 124 | COLUMBUS AVE S - CHICAGO AVE S ALLEY - no as-builts | 6/13/13 | R.H. | 0.25 | Y | N | 0.25 | 6/13/13 |
| 126 | E 37TH ST AND COLUMBUS S # 3640 COLUMBUS - no as-builts | 6/13/13 | R.H. | 0.25 | Y | N | 0.25 | 6/13/13 |
| 127 | E 37TH ST AND COLUMBUS S # 3700 COLUMBUS - no as-builts | 6/13/13 | R.H. | 0.25 | Y | N | 0.25 | 6/13/13 |
| 133 | ALLEY DRY WELL, BETWEEN HUMBOLDT/IRVING AVE S AND W 25TH ST/26TH ST, no as-builts | 6/13/13 | R.H. | 0.50 | Y | N | 0.5 | 6/13/13 |
| 134 | W 22ND ST @ E LAKE OF THE ISLES BLVD, no as-builts | 8/27/13 | R.H. | 0.25 | Y | Y | 0.25 | 8/7/13 |
| 136 | 111 22ND AVE N (ALLEY BETWEEN 1ST ST N AND 2ND ST N AT VACATED 21ST AVE N) | 6/25/13 | D.G. | 2.00 | Y | Y | 2 | 6/25/13 |
| 138 | EWING AVE S BETWEEN W. FRANKLIN AVE AND W 22ND ST - Pending as-built info | 9/18/13 | | | | | 0.25 | 9/18/13 |
| 139 | EWING AVE S @ W FRANKLIN AVE - Pending as-built info | 8/5/13 | D.G. | 1.00 | N | Y | 1 | 8/5/13 |
| 140 | E LAKE ST WEST OF 14TH AVE S (Hennepin County const. Lake St.) | 7/2/13 | L.J | 1.00 | Y | Y | 1 | 7/2/13 |
| 141 | W LAKE ST EAST OF 14TH AVE S (Hennepin County const. Lake St.) | 7/2/13 | L.J. | 2.00 | Y | Y | 3 | 7/2/13 |
| 142 | 18TH AVE S SOUTH OF E LAKE ST (Hennepin County const. Lake St.) | 4/23/13 | M.S. | 0.50 | Y | Y | 0.5 | 4/23/13 |
| 143 | LONGFELLOW AVE S SOUTH OF E LAKE ST (Hennepin County const. Lake St.) | 4/22/13 | M.S. | 1.00 | Y | Y | 0.5 | 4/22/13 |
| 149 | W 44TH ST AND ALDRICH AVE S SWC | 8/20/13 | L.J. | 3.00 | Y | Y | 3 | 8/20/13 |
| 150 | W RIVER ROAD AND 23RD AVE N | 7/16/13 | D.G. | 3.00 | Y | Y | 3 | 7/16/13 |
| 152 | 3RD AVE. SO. & 2ND ST. S. | 7/17/13 | D.G. | 1.00 | N | Y | 1 | 7/17/13 |
| 156 | W 43RD ST & E LAKE HARRIET PARKWAY | 4/29/13 | D.G. | 2.00 | Y | Y | 2 | 4/29/13 |
| | | 9/6/13 | | | | | 3 | 9/6/13 |
| 157 | STEVENS AVE S & DIAMOND LK RD | 6/26/13 | L.J. | 1.00 | Y | Y | 1 | 6/26/13 |
| 158 | E 61ST ST & COLUMBUS AVE S | 6/26/13 | L.J. | 2.00 | Y | Y | 2 | 6/26/13 |
| 159 | 2ND AVE N & 7TH ST N (Target Center) | 7/25/13 | D.G. | 1.00 | Y | Y | 1 | 7/25/13 |
| 160 | 2ND AVE N & 6TH ST N | 7/30/13 | D.G. | 0.50 | N | Y | 0.5 | 7/30/13 |
| 161 | 3RD AVE N & WASHINGTON AVE N | 7/25/13 | D.G. | 2.00 | Y | Y | 2 | 7/25/13 |
| 165 | 1409 Washington Ave N | 6/26/13 | D.G. | 6.00 | Y | Y | 6 | 6/26/13 |

| Body of Water | Outfall_ID | Location | Inspection Date | Structure Type | Outfall Pipe Size | Material Type |
|---|---|---|---|---|---|---|
| Minnehaha Creek 2 | 70-505 | E 47th St 200'  W of 32nd Av S | 26-Aug-13 | Pipe | 15 | RCP |
| Minnehaha Creek 2 | 70-500 | 32nd Av  S 250' N of E M' haha Pkwy (s bank ) | 30-Aug-13 | Pipe | 10 | PVC |
| Minnehaha Creek 2 | 70-510 | 32nd Av  S 300' N of E M' haha Pkwy (s bank ) | 05-Sep-13 | Pipe | 27 | RCP |
| Minnehaha Creek 2 | 70-520A | 34th Av S '150 N of E M' haha Pkwy (s bank west side of bridge) | 05-Sep-13 | Pipe | 30 | RCP |
| Minnehaha Creek 2 | 70-520 | 34th Av S '150 N of E M' haha Pkwy (s bank east side of bridge)) | 05-Sep-13 | | 0 | |
| Minnehaha Creek 2 | 70-525 | 35th Av S @ E  M' haha Pkwy (s bank) | 05-Sep-13 | Pipe | 0 | RCP |
| Minnehaha Creek 2 | 70-540 | 35th Av S @ E 47th St ( s bank) | 05-Sep-13 | Pipe | 12 | PVC |
| Minnehaha Creek 2 | 70-535 | 35th Av S 100' S of Crosby Av S | 05-Sep-13 | Pipe | 0 | CMP |
| Minnehaha Creek 2 | 70-545A | 36th Ave S & 47th St E (100' N of 47th St E) | 05-Sep-13 | Pipe | 12 | PVC |
| Minnehaha Creek 2 | 70-530 | 35th Av S @ e 47th St | 05-Sep-13 | | 0 | |
| Minnehaha Creek 2 | 70-550 | 37th Av S 100' N of E 47th St (s bank) | 05-Sep-13 | Pipe | 12 | RCP |
| Minnehaha Creek 2 | 70-555 | 37th Av S Crosby Av S | 05-Sep-13 | Pipe | 12 | RCP |
| Minnehaha Creek 2 | 70-560 | E 47th St @ 38th Av S (s bank ) | 05-Sep-13 | Pipe | 12 | CMP |
| Minnehaha Creek 2 | 70-565 | E M' haha Pkwy @ 39th Av S ( W bank) | 21-May-13 | Pipe | 12 | PVC |

Note:  In 2012, 320 of 416 outfalls were inspected.  In 2013, many of the outfalls planned for inspection could not be inspected, because they were submerged due to high water l evels.

August 2014 - Eberhart, PW-SWS

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.<br>2) BACTERIA (listed 2008) - TMDL study underway (metro-wide).<br>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.<br>2) EXCESS NUTRIENTS (listed 2004) - **DE-LISTED** 2010 (could be listed again if TP rises again).<br>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.<br>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.<br>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.<br>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 Minnehaha Creek *E. Coli* Bacteria/Lake Hiawatha Nutrients TMDL 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.<br>2) PCB IN FISH TISSUE (listed 1998) - TMDL status unknown, target completion 2025.<br>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.<br>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 *<br>(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<br>(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.<br>2) CHLORIDE (listed 2008) - TMDL study underway metro-wide, target TMDL completion 2015.<br>3) BACTERIA (listed 2008) - part of Minnehaha Creek *E. Coli* Bacteria/Lake Hiawatha Nutrients TMDL study. TMDL approved 2014.<br>4) DISSOLVED OXYGEN (listed 2010) - TMDL study not started, may reassess (baseflow not constant), appears to be on hold until 2020.<br>5) AQUATIC MACROINVERTEBRATE BIOASSESSMENTS (listed 2014) - TMDL study not started. |
| MISSISSIPPI RIVER<br>(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.<br>2) PCB IN FISH TISSUE (listed 1998) - targeted TMDL completion date is 2025.<br>3) BACTERIA (listed 2002) TMDL study underway, metro-wide, bacteria not an issue in this river segment this round, MPCA plans to look again in 2020. |
| MISSISSIPPI RIVER<br>(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.<br>2) PCB IN FISH TISSUE (listed 1998) - targeted TMDL completion date is 2025.<br>3) BACTERIA (not listed, but part of ongoing metro-wide study - bacteria not an issue in this river segment this round, MPCA plans to look again in 2020. |
| MISSISSIPPI RIVER<br>(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.<br>2) BACTERIA (listed 2002) TMDL study underway, metro-wide, bacteria not an issue in this river segment this round, MPCA plans to look again in 2020. |
| MISSISSIPPI RIVER *<br>(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)<br>(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 *<br>(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.<br>2) EXCESS NUTRIENTS (listed 2002) - **DE-LISTED** in 2012, due to improved water quality.<br>3) CHLORIDE (listed 2014) - TMDL study underway metro-wide, target TMDL completion 2015. |
| RYAN CREEK<br>(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 study underway (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.

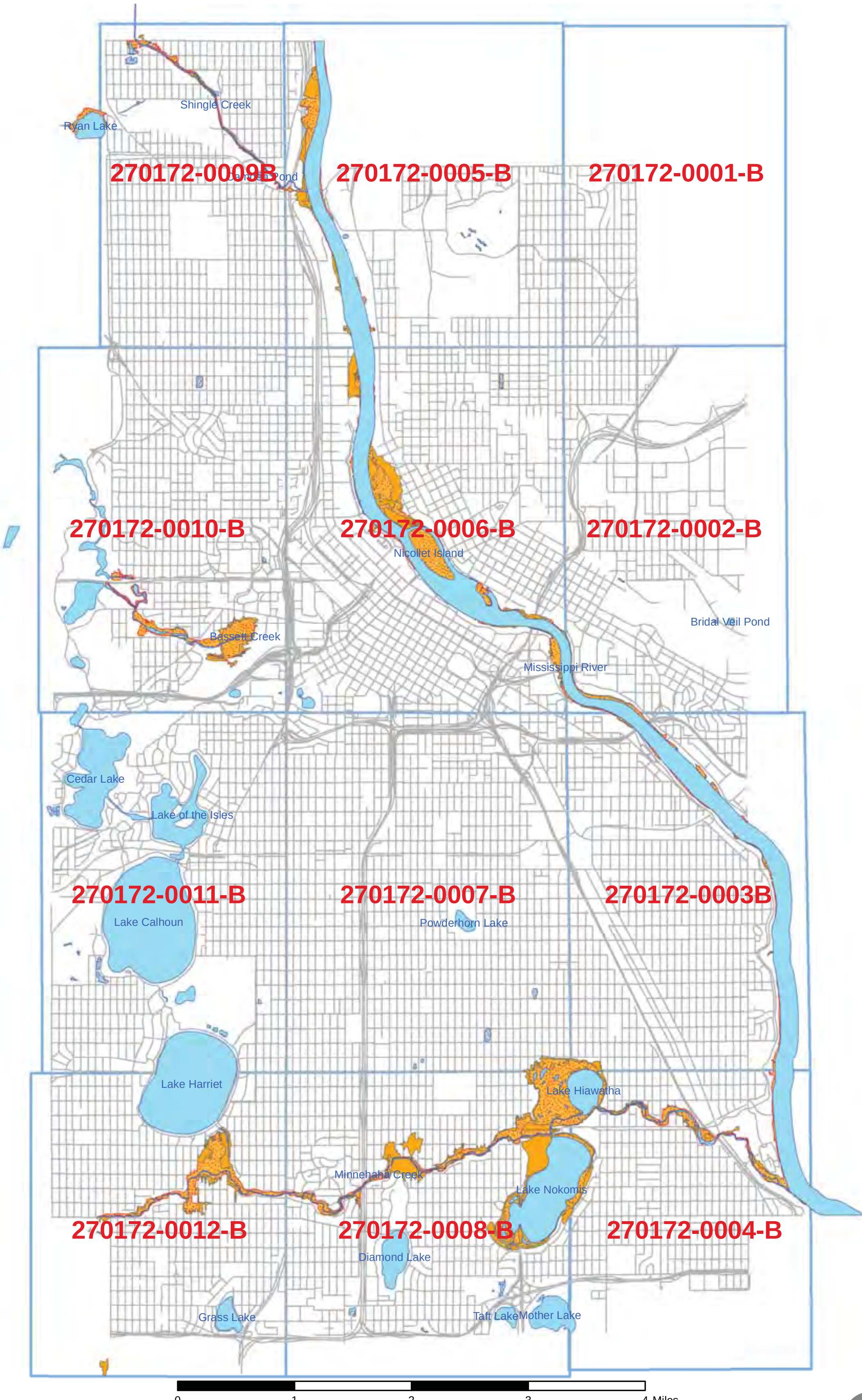
- If demolition and site grading are complete, BMPs are in place and adequate to control erosion, and no soil is noted in public thoroughfares enter notes into KIVA noting compliance.
- Schedule site visit in 7 weeks if conditions are compliant to check erosion control status at that time or to assess 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

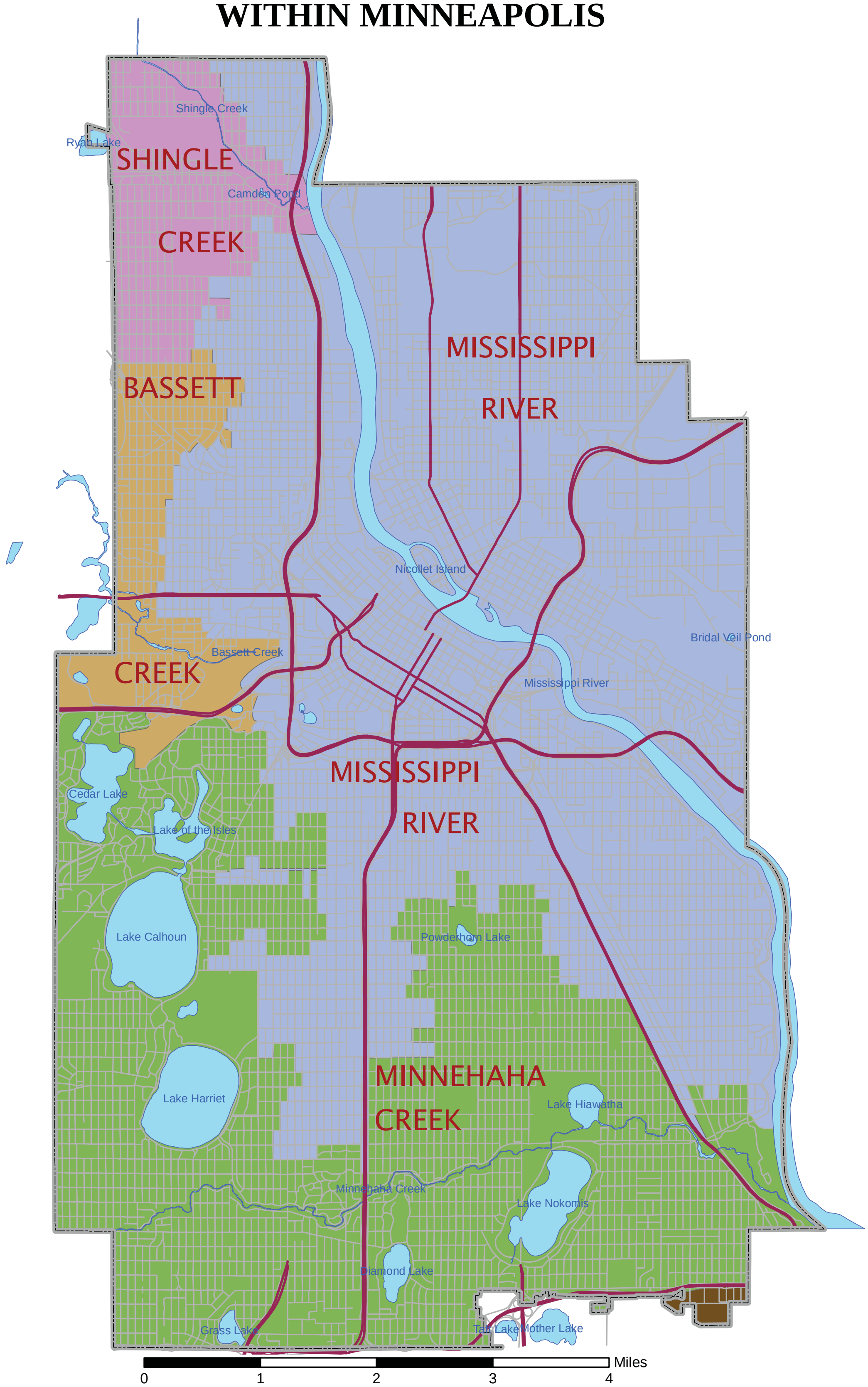
100 Year Flood Zone

500 Year Flood Zone

**MINNEAPOLIS PUBLIC WORKS**
**SURFACE WATER & SEWERS DIVISION**

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.

# 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

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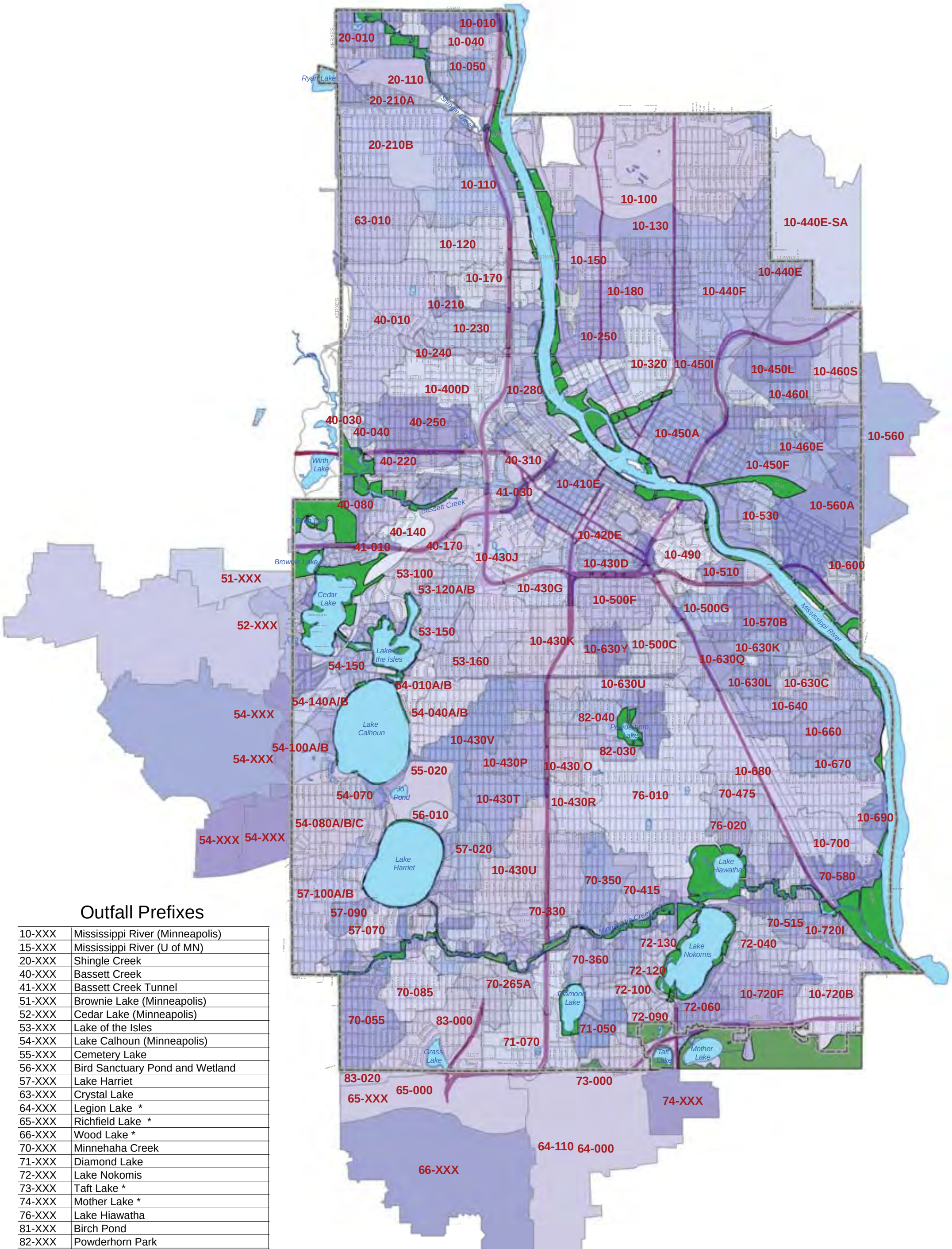
# MINNEAPOLIS STORMWATER RUNOFF DRAINAGE SUB-AREA BOUNDARIES




## 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 | |

Miles
0 1 2 3 4

March, 2008

MINNEAPOLIS PUBLIC WORKS
SURFACE WATER & SEWERS DIVISION

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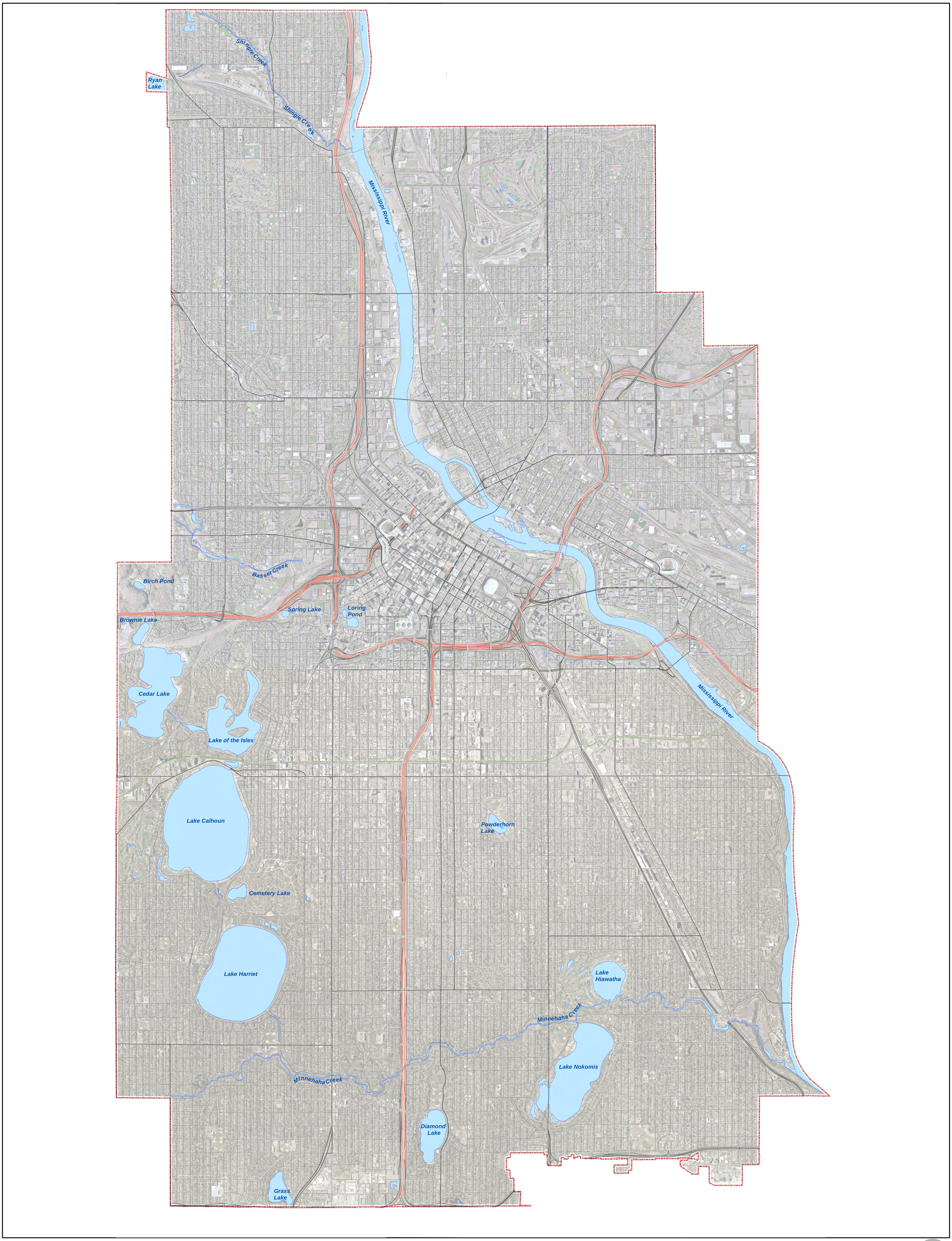



**Minneapolis Streets**

- INTERSTATES
- MAJOR ROADS
- RESIDENTIAL STREETS
- RAMPS
- TRAILS
- Minneapolis Water Bodies
- Minneapolis City Limit Boundary

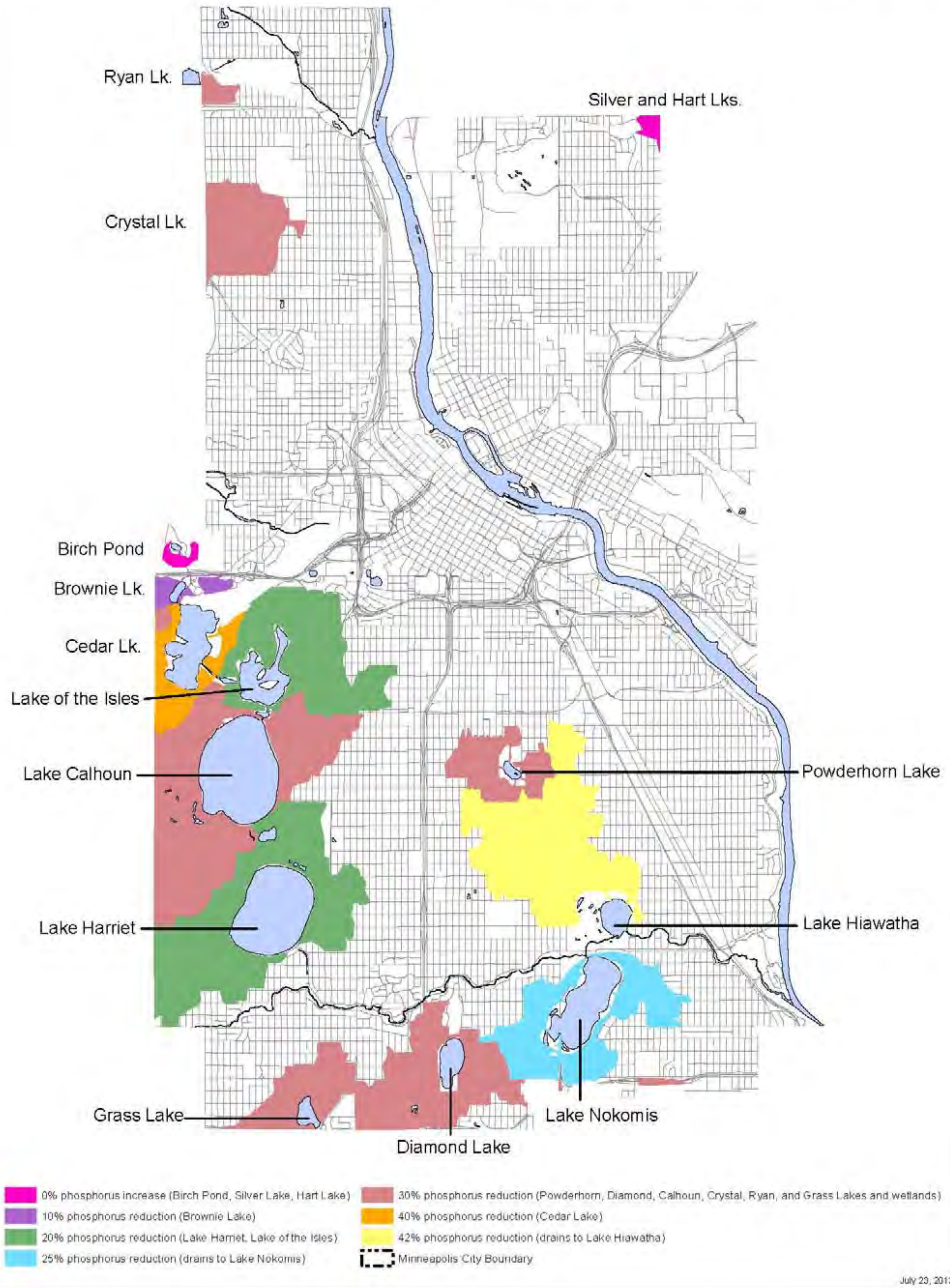
0 0.5 1 2 3 4 Miles

**MS4 Permitted Area and Receiving Waters**

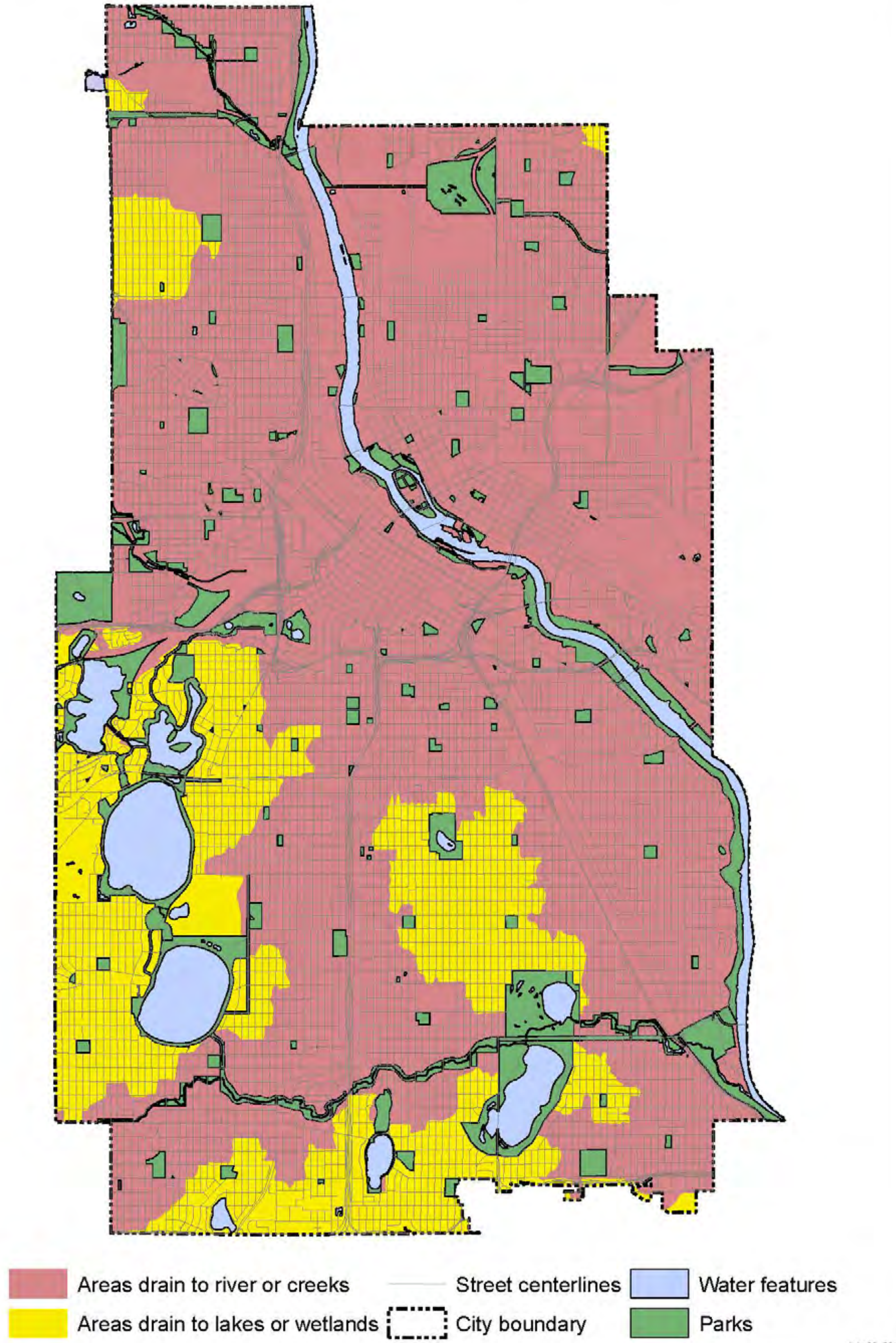
August 19, 2013

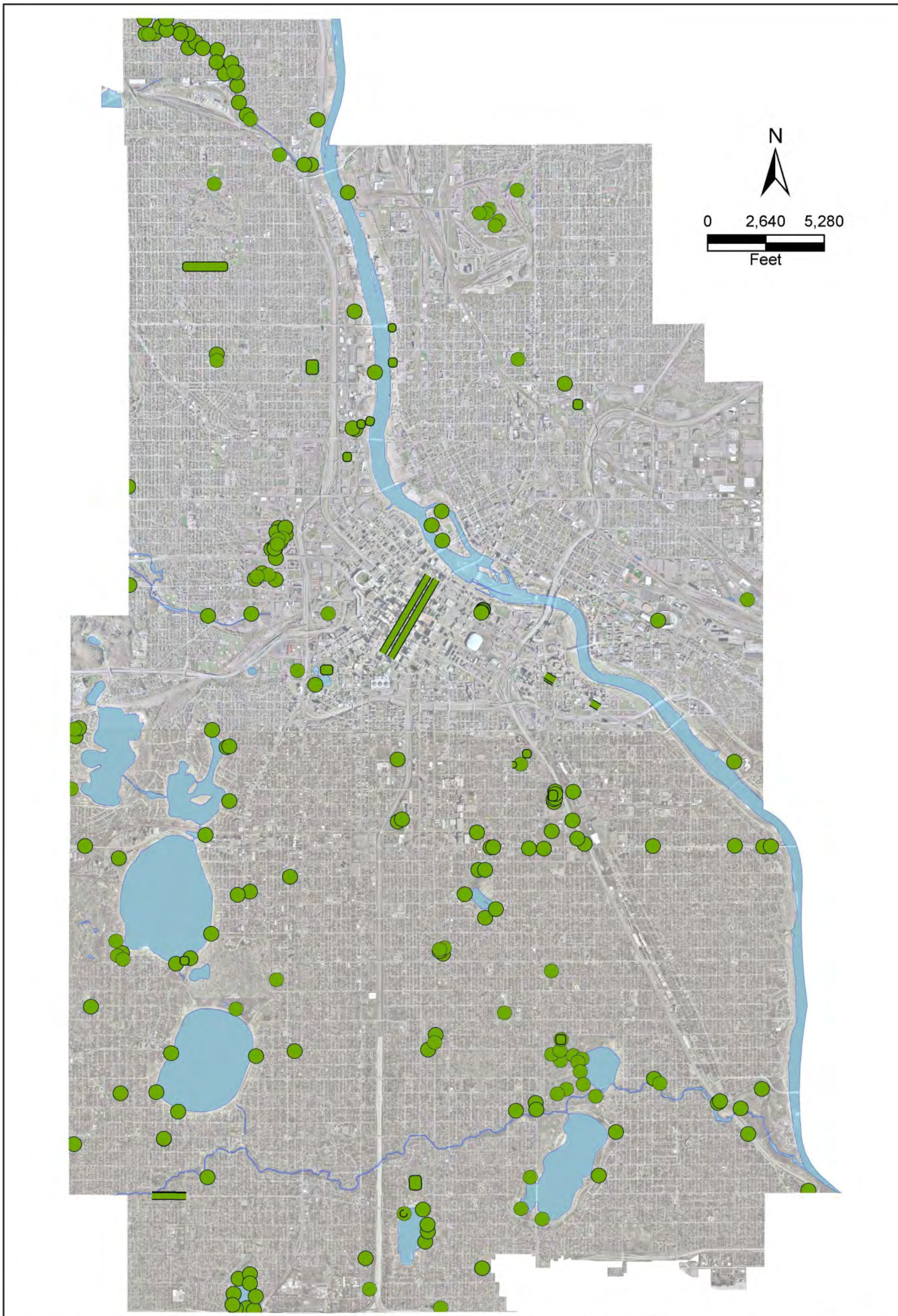
Prepared by Public Works Surface Water and Sewers

**Appendix B5:** Phosphorus Load Reductions for Lakes and Wetlands



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






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

minneapolis
city of lakes

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

# Appendix C

# Appendix C: Public Comment

## History

The Minneapolis stormwater management program endeavors to improve the water quality of Minneapolis surface waters. These are the lakes, streams, wetlands, and the Mississippi River. The goals are preservation and enhancement of our natural and historic environment, and fulfilling regulatory requirements. The National Pollutant Discharge Elimination System (NPDES) is a program created in 1990 by the United States Environmental Protection Agency (EPA) to protect water quality through the regulating of discharges of pollutants to surface waters. The Minnesota Pollution Control Agency (MPCA) is the Minnesota authority that is responsible for administering this program. Under this program, specific permits are issued in an effort to regulate municipal and industrial activities. The City of Minneapolis maintains two distinct NPDES permits:

- ***The Combined Sewer Overflow (CSO) permit***, which regulates combined storm and wastewater discharges from the sanitary sewer system (joint permittee with Metropolitan Council Environmental Services)
- The ***Municipal Separate Storm Sewer System (MS4) permit***, which regulates stormwater runoff discharges from the storm drain system (joint permittee with Minneapolis Park & Recreation Board).

## Requirements for Annual Reporting, Public Comment, and Council Action

This Annual Report fulfills the requirement for documentation and analysis of the activities conducted in the previous year, 2013. It is a coordinated effort by various City departments, as well as the Minneapolis Park & Recreation Board (MPRB). The MPCA issued an NPDES MS4 Permit (MN0061018) to the City of Minneapolis and the MPRB on December 1, 2000. The permit was re-issued on January 21, 2011.

Re-issuance of the permit also required that the City and the MPRB develop new Stormwater Management Program (SWMP). It was completed September 28, 2011, with revisions in May 2013 and August 2014, and can be found on the following website: http://www.ci.minneapolis.mn.us/publicworks/stormwater/stormwater_npdesannualreportdocuments

The Permit also requires an opportunity for public input into the development of the priorities and programs necessary for compliance, and also requires the adoption of the Report through a formal Resolution. A Public Hearing notice, accompanied by draft revisions to the

Stormwater Management Program (SWMP), was sent to environmental groups, related governmental entities, and all Minneapolis neighborhood groups and other interested parties on June 5. A Public Hearing notice was also posted in Finance and Commerce. The public hearing was held on Tuesday, June 17, 2014. A summary of the public's input and the City's response to the comments along with the formal Resolution are required to be included with the Annual Report submittal. No testimony or questions were presented. Written comments were accepted until Wednesday, June 25, 2014. No written comments were submitted.