Metropolitan Council

Environmental Services

2010

Annual Stream Water Quality Assessment Report

The Metropolitan Council has a long history of leadership in protecting the quality of water in the seven-county Twin Cities metropolitan area. As the metro area population continues to grow, it is the job of the Council in partnership with local governments to plan for and oversee growth that helps maintain the region's environmental integrity.

The Council is charged under state law with developing a comprehensive development guide for the metro area that consists of policy statements, goals, standards, programs and maps prescribing guidance for the orderly and economical development of the region. The development guide consists of the 2030 Regional Development Framework (Framework) and "system plans" for wastewater, regional recreation and open space, and transportation (including aviation).

The Framework includes a policy that directs the Council to work with local and regional partners to reclaim, conserve, protect and enhance the region's vital natural resources. A related regional benchmark for water quality states: "The water quality leaving the metropolitan area is as good as the water quality entering the metropolitan area, and in compliance with federal and state regulations." The Water Resources Management Policy Plan, which includes the wastewater system plan, includes policies and implementation strategies directing staff to monitor and assess our streams, lakes and rivers in order to measure our success in meeting the no-adverse-impact goal of the Framework.

Minnesota Stat. 103F.721 mandates the Council to assess metro area waters (streams, lakes and rivers) that have been polluted or that have the potential for pollution. As part of the commitment of Metropolitan Council Environmental Services (MCES) to preserve and protect water quality, the agency supports several water monitoring programs that collect a variety of data for area streams, lakes and rivers. Today MCES has an extensive network of monitoring sites to detect seasonal and annual changes in water quality throughout the metro area.

The purpose of this report is to summarize and assess data about stream water quality collected in 2010 by MCES. Assessments of the region's water supply, lake water quality, metro area rivers, and other water-related reports can be found on the Council's website at:
http://www.metrocouncil.org/Reports/water_reports.htm

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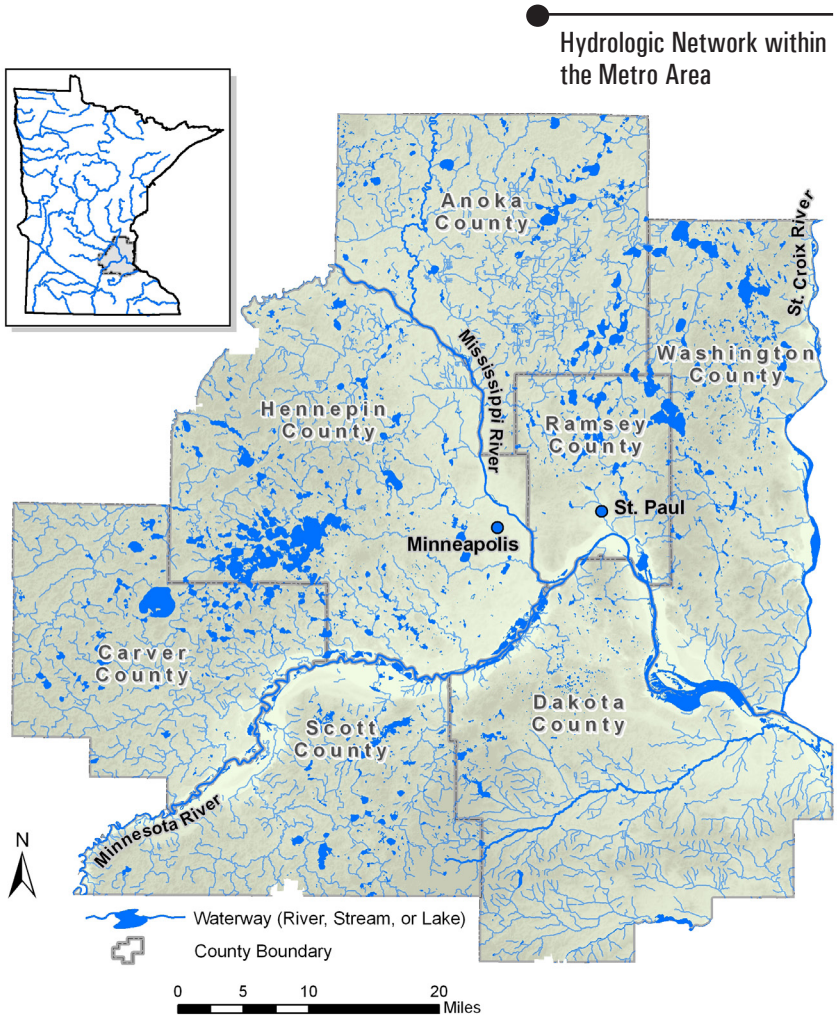
Stream Water Quality Partnerships and Collaboration



To achieve Council objectives related to surface water quality, MCES collaborates with various federal, state, and local agencies and groups to evaluate the health of the region's water resources. MCES has conducted water quality and quantity monitoring of area streams since 1989. MCES and its partners (municipalities, counties, the Minneapolis Parks and Recreation Board, watershed management organizations and districts, and local soil and water conservation districts) currently operate monitoring stations at 22 sites on 21 streams in the metro area. MCES also partners with the United States Geological Survey (USGS) and the Department of Natural Resources (DNR) to help collect stream flow information. MCES relies on the United States Environmental Protection Agency (EPA) and Minnesota Pollution Control Agency (MPCA) to provide guidance related to federal and state wastewater treatment plant effluent regulations and limits for the Council's seven treatment plants.

Potential Sources of Water Pollution

Sources of water pollution vary throughout the metro area. For regulatory purposes as defined by the federal Clean Water Act, the source of water pollution is categorized as point or nonpoint.

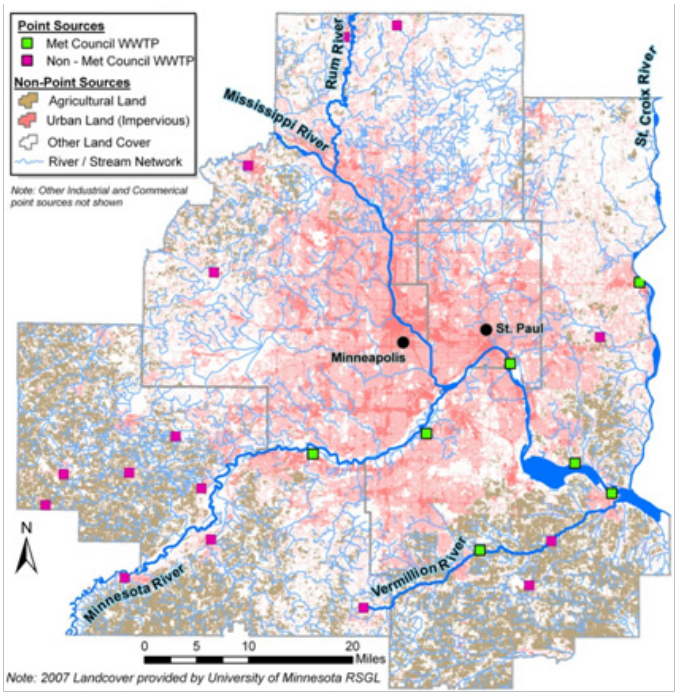
Point-Source Pollution

Point-source pollution originates from an identifiable end-of-pipe source, typically treated or untreated wastewater (called effluent), from wastewater treatment plants or industrial facilities. MCES owns and operates the region's seven largest wastewater treatment plants, which discharge treated effluent into the Mississippi, Minnesota and St. Croix rivers. Additionally, there are approximately 200 other MPCA-permitted point sources such as industrial facilities and small municipal wastewater treatment plants throughout the metro area.

Nonpoint-Source (NPS) Pollution

NPS pollution is the transport of pollutants across the landscape via runoff into waterways. Landscapes altered by agricultural production and urban development often transport runoff more efficiently than natural landscapes, leading to increased NPS pollution. NPS pollution can originate from diffuse sources such as stormwater runoff from parking lots and lawns, and erosion from farm fields, construction areas, and highways.

Point Sources (Wastewater Treatment Effluent) and Non-point Sources within the Metropolitan Area



Factors Affecting Water Quality in 2010

The origins of water pollution are dependent on multiple variables including precipitation, topography, land management and population throughout the region.

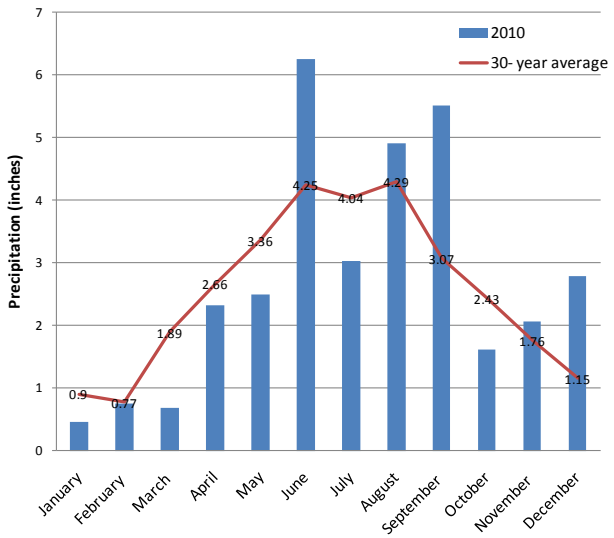
Precipitation

The transport of pollutants to streams and rivers is driven mainly by precipitation. The amount, intensity and timing of precipitation influences water quality. For example, heavy rainfall or rapid snowmelt events increase the risk of water pollution from agricultural and urban runoff. However, during dry years, stream and river flows decline and water quality deterioration may also occur when nutrients and contaminants become more concentrated in the reduced volumes.

Regional precipitation is measured at Minneapolis-St. Paul International Airport (MSP), and is a good indicator of significant runoff events because of its central location, even though actual precipitation varies throughout the metro area. In 2010, the metro area experienced slightly above-normal annual precipitation, with 32.89 inches recorded at MSP, compared to the 30-year (1981-2010) annual average of 30.57 inches. 2010 started out with a dry spring and above-normal temperatures, earlier-than-normal snowmelt and ice-out, and low precipitation. Summer was characterized by large storms that produced most of the precipitation. June and August had higher-than-normal precipitation while May and July had lower-than-normal precipitation. Fall 2010 was one of the wettest on record with much-higher-than-normal precipitation in September and December. The largest flood event to hit southern Minnesota began in the early afternoon of September 22 and tapered off during the evening of September 23. More than four inches of rain fell in nearly all southern Minnesota communities while six or more inches of rain fell in several locations. In the metro area, the Mississippi River rose above flood stage (14 feet) at St. Paul on September 29. This is the first time that the Mississippi River has exceeded flood stage in the fall. Overall the warm season precipitation total was higher than normal. Precipitation totals were above the 30-year averages for the months of June, August, September, November and December.

Precipitation also increases stream and river flow, which may affect the fate and impact of pollutants in the stream and river systems. During wet periods, nonpoint-source pollutants are carried to streams and rivers, and higher flows can also cause stream-bank erosion, habitat destruction and flooding. During dry periods, flows may be too low to sufficiently dilute pollution; sediment deposition increases and habitat quality may be adversely affected. Like precipitation, flows for 2010 were also above average at the Mississippi River above the confluence with the Minnesota River, the Mississippi River below the confluence with the Minnesota River, the Minnesota River at Jordan, and the St. Croix River at Stillwater. Flows were high in early spring due to the high temperatures and fast snowmelt, then low in late spring and early summer, and then high throughout late summer and fall. The ground was saturated going into fall; consequently much of the precipitation received became runoff, especially in the Minnesota and Mississippi River basins. Near record-high flows were experienced in November and December.

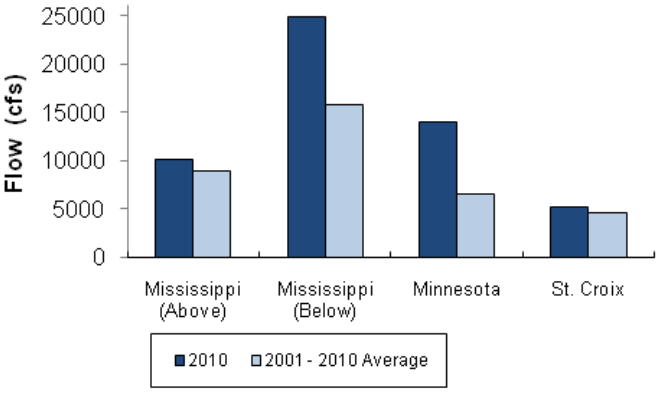
2010 and Average (1981-2010) Monthly Precipitation at Minneapolis St. Paul International Airport (MSP)



Topography

Increased slopes can lead to greater runoff and erosion potential because water can travel more quickly down a steeper slope. When coupled with an impervious land surface such as a street, the amount of runoff entering streams and rivers increases, as does erosion along the stream and river banks. Within the metro area, steep gradients can be found within the major river valleys as well as within stream sections prior to entering the major rivers.

2010 Flow Compared with Average Flow (2001-2010)

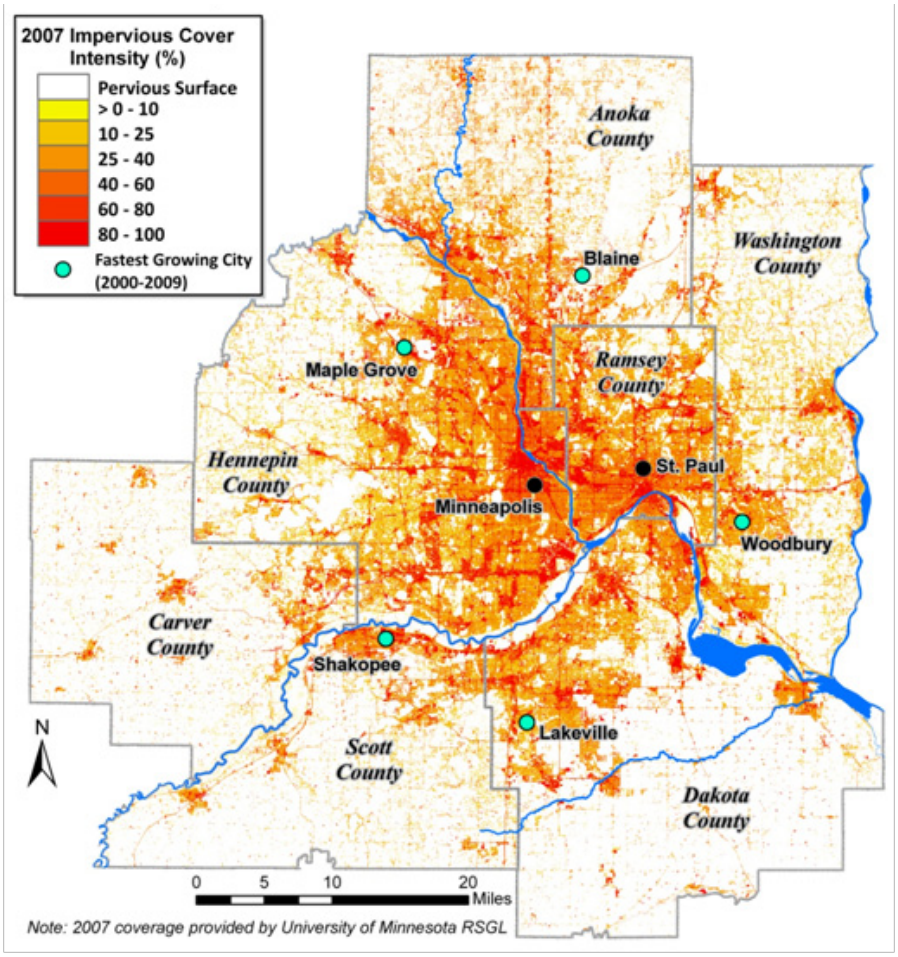


Land Use

The pressure of population growth and economic development on the metro area's landscape influences runoff, wastewater effluent volumes, and ultimately the pollution loads entering the streams and rivers. The modification of the landscape to accommodate city streets, new subdivisions, and tilled agricultural land can change the hydrologic balance. Rain that falls onto grassland or forests infiltrates into the ground and contributes to the groundwater supply. Infiltration is less prevalent on tilled, agricultural lands or in urban areas with impervious surfaces such as traditional parking lots or roofs. The runoff water from agricultural and impervious lands concentrates and carries a large number of pollutants that would otherwise remain on the landscape if the rainwater were able to infiltrate into the ground.

Based on 2007 satellite imagery processed by the University of Minnesota, the metro area is influenced by an impervious, urbanized landscape (33% of the region) and agriculture (20% of the region). The remaining land is generally characterized as grassland, forests, wetlands and open water. As an indicator of landscape changes, recently released 2010 Census Bureau information indicates that the population of the metro area increased by 207,505 people from 2000 to 2010 and the number of households increased by 96,293. The communities that have experienced the greatest population growth during the past 10 years include Shakopee, Woodbury, Lakeville, Blaine and Maple Grove. Around 90% of the new growth occurred in the developing suburbs (second-and third-ring suburbs).

Impervious Cover Percentage and Population Growth within the Metro Area



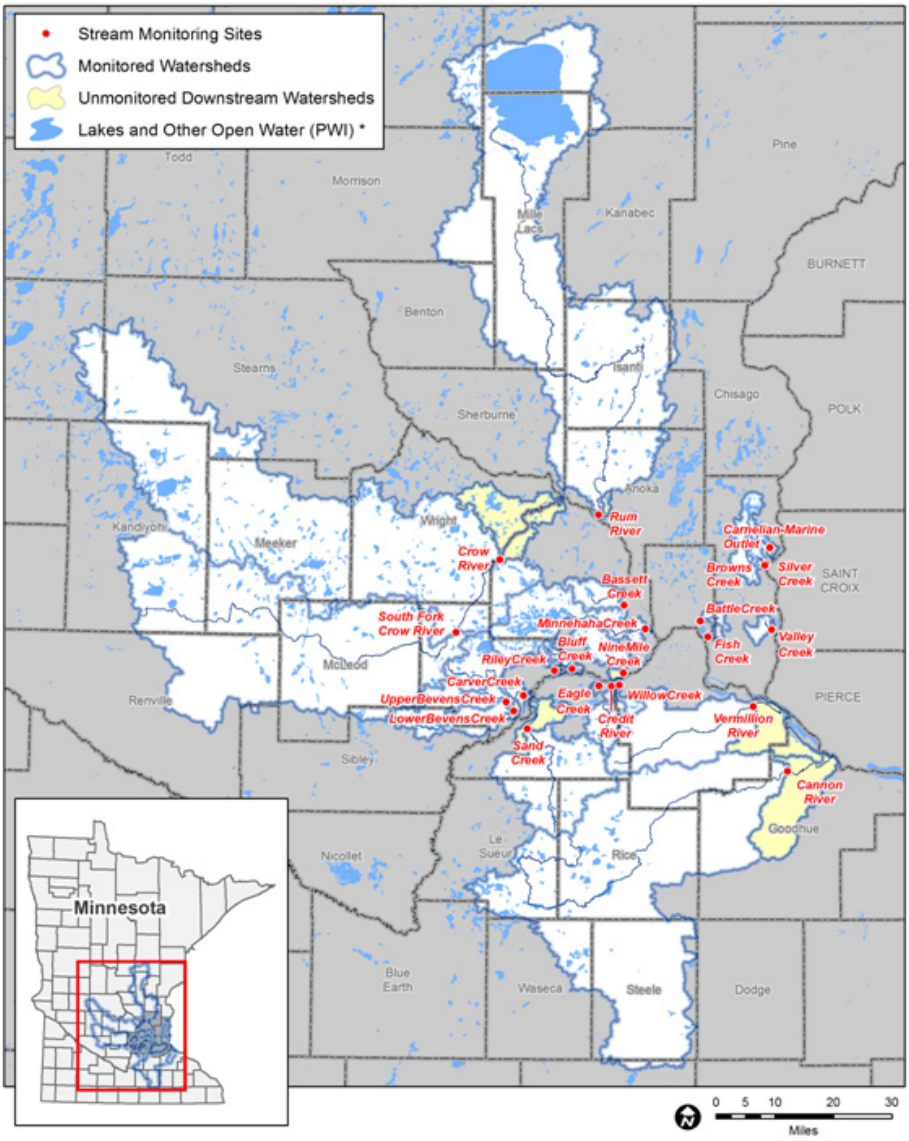
MCES Stream Water Quality Data

Within the metro area, various stressors influence the health of our rivers and streams. The EPA and MPCA are responsible for enforcing water quality standards for these stressors to ensure that designated beneficial uses are met, such as drinking water, aquatic life and human recreation. The majority of water quality impairments are currently managed through Total Maximum Daily Load (TMDL) plans, which aim to identify sources and limit pollutants entering the surface waters through a watershed assessment approach.

MCES and its partners have an extensive monitoring network for streams and rivers in the metro area. The smaller tributary streams that contribute to the river water quality are monitored for four main reasons:

1) To provide data to help determine compliance with the State of Minnesota's water quality standards.
2) To determine the extent of nonpoint-source pollution loading from tributaries to the Mississippi, Minnesota, and St. Croix rivers.
3) To assist the MPCA, watershed districts, watershed management organizations and our partners to develop TMDLs for impaired waters in the metro area.
4) To evaluate the effectiveness of watershed management practices for reducing nonpoint-source pollution, while measuring progress toward achieving water quality standards in streams and rivers.

MCES Stream Monitoring Sites within the Metro Area



Surface Water Stressors

In a diverse urbanized area such as the Twin Cities region, many different stressors can impact the health, use and enjoyment of our streams and rivers. The EPA and MPCA enforce water quality standards for these stressors to ensure that designated beneficial uses are met. The standards for water bodies vary based on their uses, sizes, locations and depths. For example, a lake is regulated differently from a river or a stream. The metro area streams monitored by MCES are designated for a variety of uses with diverse classifications such as 1B, 2A, 2B, 2C, 3B, and 3C.

Table 1: State Numeric Water Quality Standards for Evaluated Parameters within Rivers & Streams

Parameter	Numeric Limit
Total Phosphorus	No 2010 River Standard (proposed standard under development) MCES Wastewater Treatment Plant (WWTP) Permit Limit 1 mg/L
Nitrate-Nitrogen	No 2010 River Standard (proposed standard under development) No 2010 MCES WWTP Permit Limit Surface waters used for drinking water cannot exceed 10 mg/L
Turbidity	10 NTU (Class 2A waters) , 25 NTU (Class 2Bd waters) daily maximum MCES WWTP Permit Limit 25 NTU daily maximum
Total Suspended Solids	No 2010 Standard (proposed standard under development) No 2010 MCES WWTP Permit Limit
Chloride	2010 Chronic Standard 230 mg/L (four-day average concentration) (Class 2 waters) 2010 Domestic Consumption Standard 250 mg/L (Class 1A, 1B, 3C waters) No 2010 MCES WWTP Permit Limit

To help determine whether metro area streams meet water quality standards (Table 1), the following parameters were evaluated by MCES in 2010:

Total Suspended Solids/Turbidity

Elevated suspended solids concentrations within surface waters can decrease water clarity, transport excess nutrients such as phosphorus, and harm aquatic life by depleting oxygen levels, clogging gills and covering habitat. Suspended solids come from a variety of sources, including sediment which has eroded from stream banks and ravines or has been carried into a river with urban or agricultural runoff. Suspended solids can also come in the form of organic particulate such as decaying matter or algae. Suspended solids can be measured as turbidity or total suspended solids. In Minnesota, the maximum allowable amount of suspended solids is regulated as turbidity; for class 2A waters (cold-water fisheries) the chronic (long-term exposure) limit is 10 nephelometric turbidity units (NTU) and for classes 2B, 2C, and 2D (cold- and warm-water fisheries) the chronic limit is 25 NTU. In general, turbidity is an easier measurement to make but total suspended solids is more accurate.

Nutrients

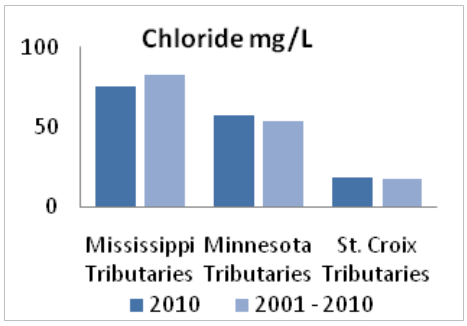
Nitrogen and phosphorus are essential nutrients for plant growth, and individually or combined are often the limiting nutrient(s) in aquatic systems. Although aquatic plants can increase water quality and improve habitat, an excess of plant growth can lead to unsightly algae blooms, which can cause oxygen depletion and odor upon decay, making the water at times unsuitable for aquatic life. Nitrate nitrogen (NO3) and phosphorus (TP) are common components of wastewater treatment plant effluents and urban and agricultural runoff.
A wastewater treatment plant standard exists for TP of no more than 1 mg/L effluent, but no stream-level standard exists. A standard to protect human health exists for NO3 concentration in streams used for drinking water (maximum NO3 allowed is 10 mg/L) but not for other streams or wastewater treatment plants.

Chloride

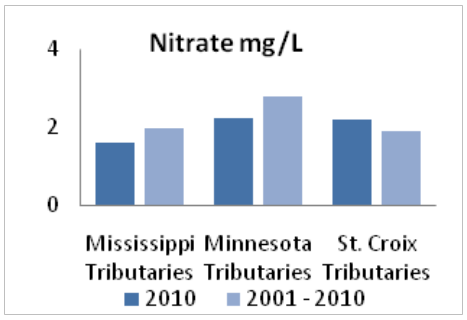
Elevated concentrations in rivers and streams can be toxic to aquatic and terrestrial organisms. The main sources of chloride – road deicing and water softeners – are typically found in the urban environment. A Minnesota stream is deemed impaired if: 1) The chronic (four-day average) chloride concentration is greater than 230 mg/L and/or 2) The instantaneous one-hour average concentration is greater than 860 mg/L, levels that are toxic to aquatic life or 3) The chloride concentration exceeds 250 mg/L in a stream used for domestic consumption. (Monitoring on these metro area streams is done approximately weekly and not continuously or daily so it is not possible to get a true hourly or four-day-average concentration.)

Metropolitan Area 2010 Stream Water Quality Compared to State Standards

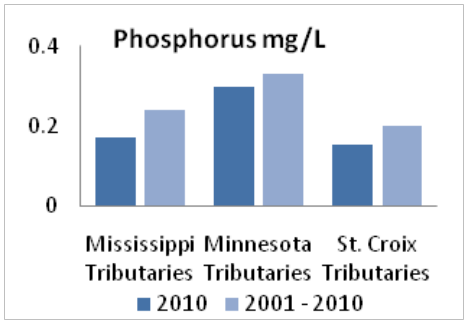
In 2010, flow and various water quality parameters were monitored at 22 stations on 21 metro area streams. These streams are tributary to the Minnesota, Mississippi or St. Croix rivers. A subset of the monitored parameters were evaluated by MCES in 2010: chloride, NO3, TP, and TSS. 2010 average chloride concentrations for streams in the Mississippi River basin were below the 10-year average (2001 – 2010). In streams in the Minnesota and St. Croix basins, however, average chloride concentrations were up compared to the 10-year average. Overall, the chronic chloride standard was exceeded only 10 times during 2010 on the 22 stream sites monitored, and the instantaneous average was exceeded only once on Bassett Creek (1,709 mg/L). Overall, high chloride concentrations were primarily seen during the winter and early spring, which would be expected with the use of road salt in the metro area.



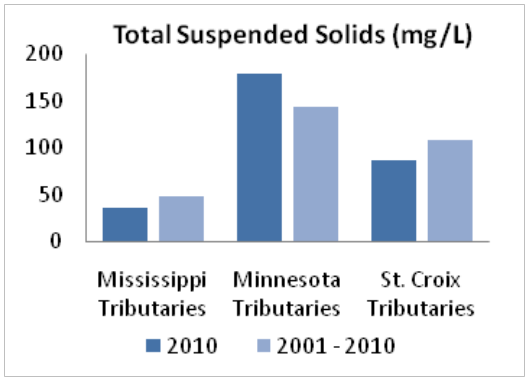
Nitrate nitrogen decreased in 2010 compared to the 10-year average in streams in both the Mississippi and Minnesota River basins. In the St. Croix River basin nitrate nitrogen increased compared to the 10-year average. Overall, the biggest reductions in nitrate nitrogen compared to the 10-year averages occurred in Upper and Lower Bevens Creek, the south fork of the Crow River, and the Vermillion River. There were no major increases in nitrate nitrogen in any given location but the largest of the increases were seen in Valley Creek (St. Croix River basin) and the Crow River (Mississippi River basin).



Phosphorus concentrations decreased in all river basins in 2010 compared to the 10-year average. As with nitrate nitrogen, major decreases in phosphorus concentration compared to the 10-year averages were measured in Lower Bevens Creek, the south fork of the Crow River, and the Vermillion River. The largest increase in total phosphorus concentration was measured in the Cannon River (Mississippi River basin). This increase in phosphorus may be associated with the almost threefold increase in total suspended solids in the Cannon River in 2010 compared to the 10- year average.



Total suspended solids concentrations increased, on average, in streams in the Minnesota River basin and decreased, on average, in streams in the Mississippi and St. Croix River basins compared to the 10-year averages. This was true even though the largest average decrease was measured in Riley Creek (Minnesota River basin) and the single greatest increase in 2010 occurred in the Cannon River (Mississippi River basin).

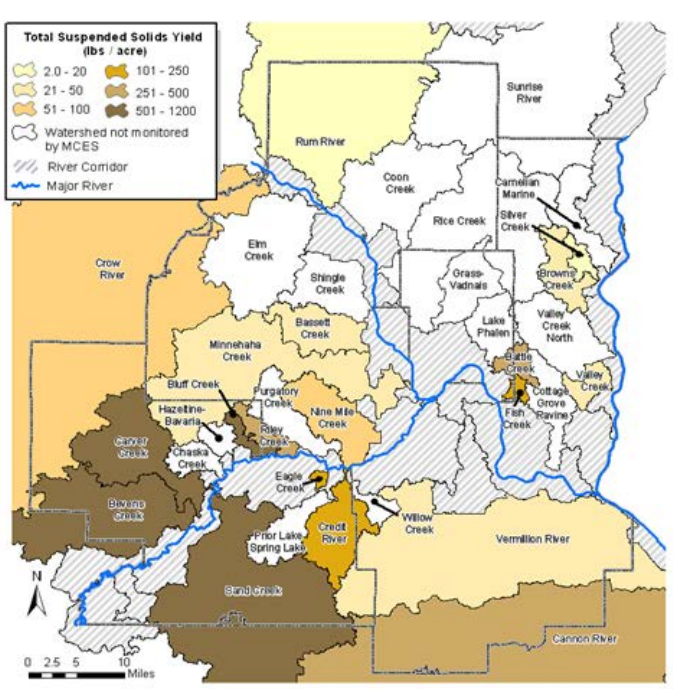


Metro Area Tributary 2010 Contributions of TP, TSS, and NO3

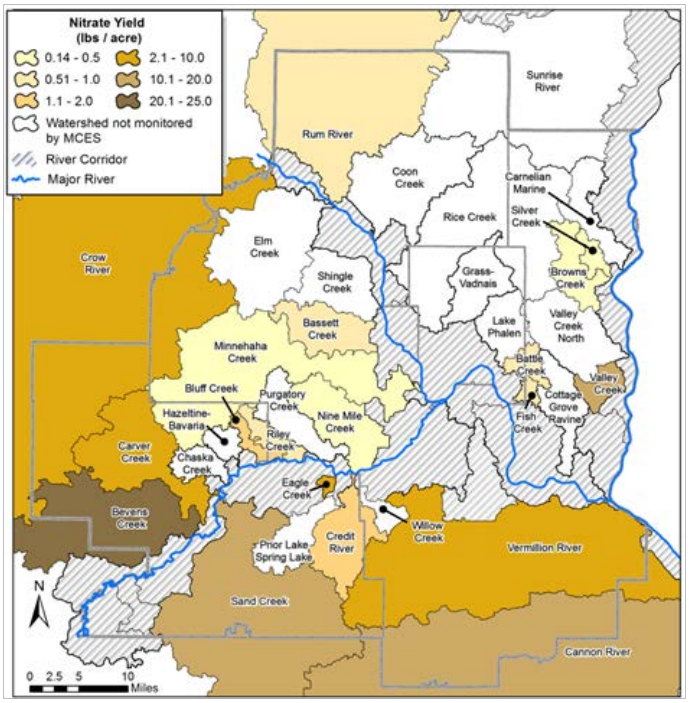
A pollutant yield is determined by dividing the pollutant load (mass) by the contributing watershed area, allowing a relative comparison to be made between watersheds. Pollutant yields are primarily a function of soil type, land use, landscape characteristics, and the amount, timing and intensity of precipitation.

Total phosphorus yields in 2010 ranged from 0.01 lbs per acre in the Silver Creek watershed to 1.63 lbs per acre in the Bevens Creek watershed. Total phosphorus yields in 2010 were highest in the Bluff, Bevens, Carver and Sand Creek watersheds relative to the other 17 tributary watersheds. Total suspended solids (TSS) yields ranged from 2 lbs per acre in the Silver Creek watershed to 1,186 lbs per acre in the Bluff Creek watershed. By yield, the highest TSS contributors included the Bluff, Bevens, Carver and Sand Creek watersheds in the Minnesota River Basin. Nitrate yields ranged from 0.15 lbs per acre in the Minnehaha Creek watershed to 24.81 lbs per acre in the Bevens Creek watershed. By yield, the highest nitrate contributors included the Valley, Bevens, Sand Creek and Cannon River watersheds.

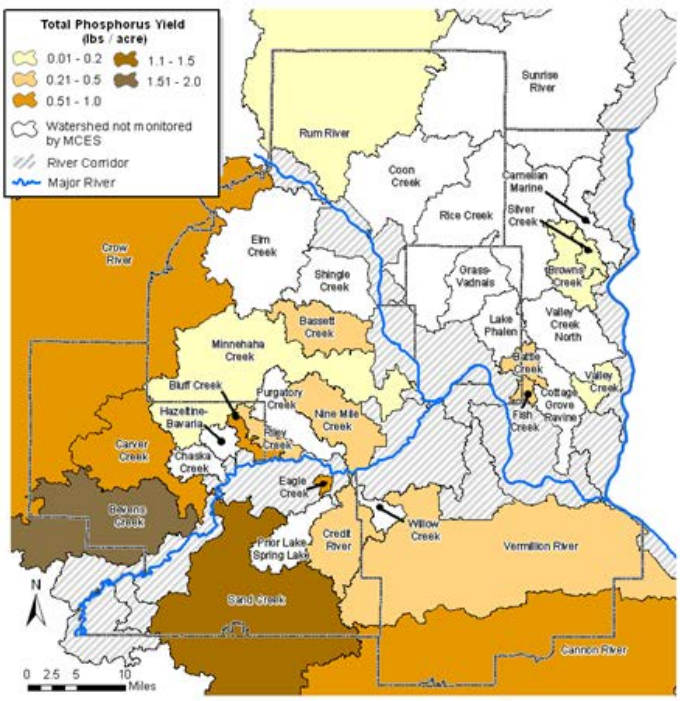
Total Suspended Solids Yield (lbs/acre)



Nitrate Yield (lbs/acre)



Total Phosphorus Yield (lbs/acre)



Upcoming MCES Water Resource Reports

The MCES Water Resources Assessment Section plans to release several additional water quality reports and assessments during 2011. These include:

- Historic Annual Pollutant Loads Dataset for Rivers (1980 – Present)
- Historic Annual Pollutant Loads Dataset for Streams (Site Inception – Present)
- Summary Report on Annual River Water Quality
- 2011 Twin Cities Metropolitan Area Stream Trends Assessment

Report Data Sources

The 2010 MCES Stream Assessment Report relied on several information sources. Monitoring data, including flow and water chemistry, originated from MCES and its partners. The watersheds cited in this report were delineated by the DNR and modified by Council staff where more detailed information on watershed areas was provided by the organizations responsible for monitoring the site. Watershed areas were calculated by MCES staff to reflect the area contributing to the monitoring site. The spatial definition of the metropolitan area impervious areas was provided by the University of Minnesota.

Information related to water quality and standards was provided by the EPA and MPCA. Information related to data and the analysis methodology used in development of this report can be obtained from the MCES Water Resources Assessment Section Manager Judy Sventek (judy.sventek@metc.state.mn.us).

About the Metropolitan Council

The Metropolitan Council was established by the Minnesota Legislature in 1967 to provide policy for regional growth for the seven-county Minneapolis-St. Paul metro area. The mission of the Metropolitan Council is to develop, in cooperation with local communities, a comprehensive regional planning framework, focusing on wastewater, transportation, parks and aviation systems, that guides the efficient growth of the metro area. The Council operates wastewater and transit services, and administers housing and other grant programs.

The Metropolitan Council consists of a chair and 16 members appointed by the Minnesota governor representing 16 geographic districts:

Susan Haigh	Chair	James Brimeyer	District 6	Harry Melander	District 12
Roxanne Smith	District 1	Gary Cunningham	District 7	Richard Kramer	District 13
Lona Schreiber	District 2	Adam Duininck	District 8	Jon Commers	District 14
Jennifer Munt	District 3	Edward Reynoso	District 9	Steven T. Chávez	District 15
Gary Van Eyll	District 4	John Đoàn	District 10	Wendy Wulff	District 16
Steven Elkins	District 5	Sandra Rummel	District 11		

Visit www.metrocouncil.org for more information about the Council.

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