METROPOLITAN COUNCIL

Environmental Services

2012

River Water Quality Summary for the Twin Cities Metropolitan Area

This document is a summary of the 2012 water quality of major rivers in the Twin Cities metropolitan area (metro area) based on monitoring results from the Metropolitan Council Environmental Services (MCES) River Monitoring program. The river monitoring program began in 1927 after the Mississippi River was declared a public health hazard. Today the river monitoring program serves a wide array of needs, including determining whether metro area waters meet state water quality standards and criteria, assessing the performance and effectiveness of MCES treatment plants, and documenting long-term trends and changes in water quality. In 2012, river monitoring was conducted at 6 automated and 16 conventional sampling sites along the Mississippi, Minnesota and St. Croix Rivers in the metro area. Samples were collected four to five times per month during the open-water season (March through October) when more recreational activities are expected and the river environment changes more quickly, and up to two times per month during the remainder of the year.

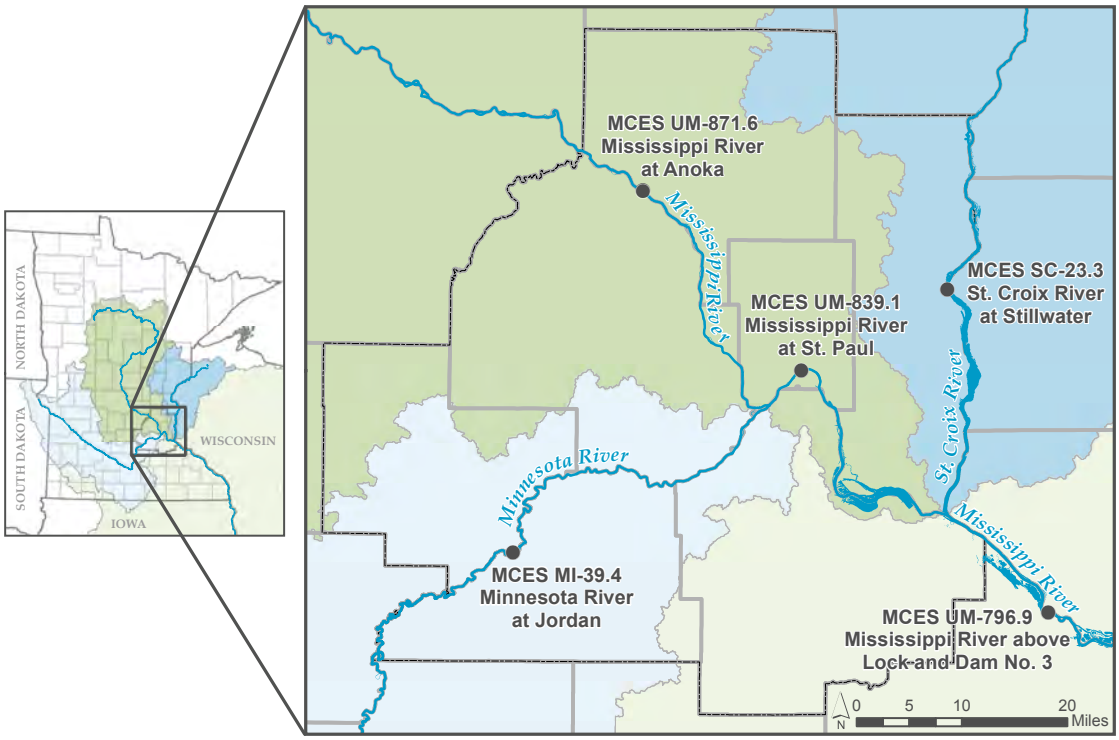


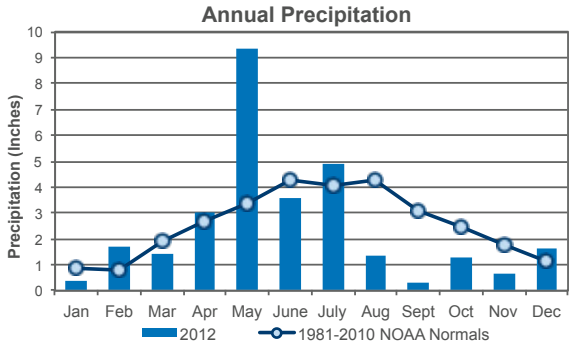
Figure 1: Key metro area monitoring locations and watersheds of the Mississippi, Minnesota, and St. Croix Rivers upstream and downstream of the metro area

As a summary of the water quality of rivers in the metro area, 2012 concentrations of key water quality variables are compared at five critical locations throughout the metro area. These locations are shown in Figure 1 and can be described as the waters entering the metro area at the Mississippi River at Anoka, Minnesota River at Jordan, and St. Croix River at Stillwater, after the Minnesota River enters the Mississippi River at downtown St. Paul, and leaving the metro area on the Mississippi River above Lock and Dam #3 near Red Wing. The water quality of each river is influenced by a number of factors including watershed size, predominant land use, level of urbanization, geology and soil type. Figure 1 also shows the entire watersheds of the Mississippi, Minnesota and St. Croix Rivers. The metro area is a relatively small percentage of this total area. Due to the size of the watersheds the metro area portion may play only a small role in impacting the water quality of the rivers.

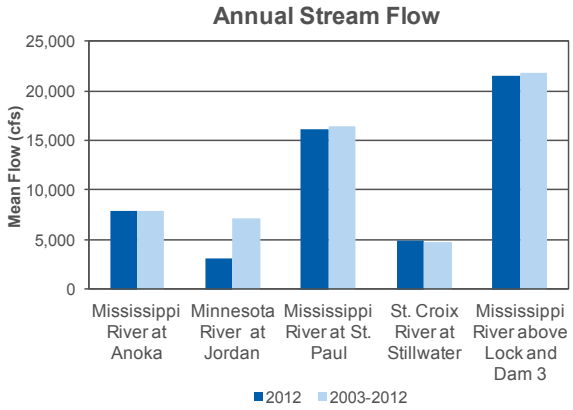
To provide a historical perspective, 2012 average values at the five monitoring points are compared to 10-year average values for the 2003-2012 time period. Whether the 2012 average concentration is higher or lower than the 10-year average should not be taken as an indication of increasing or decreasing water quality, but rather as a comparison to normal river conditions. Concentration in any given year is highly affected by the timing and quantity of river flow. Concentrations are also compared to state water quality standards where applicable. Table 1 contains a summary of results.

Precipitation and River Flow

Description: Regional precipitation is measured at the Minneapolis-St. Paul International Airport, which is a good indicator of significant rainfall events because of its central location, even though actual precipitation varies throughout the metro area. During wet periods, nonpoint source pollutants are carried through storm sewer systems and smaller streams to the 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.

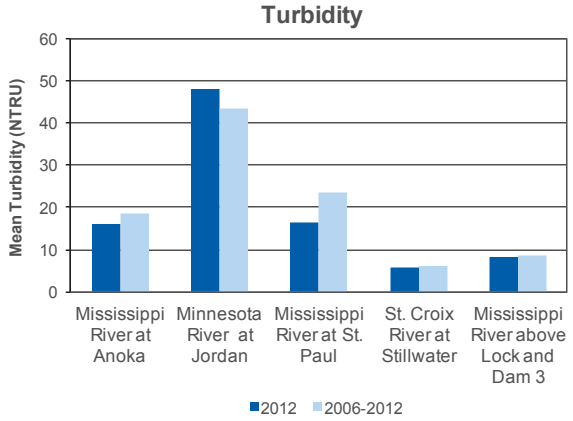


2012 Results: Precipitation in the metro area during 2012 was about 1 inch below the NOAA 1981-2010 normal precipitation for the area (a data set updated once every 10 years), though departures from normal differed greatly between the beginning and end of 2012. 2012 river flows were close to their 10-year averages, except for the Minnesota River at Jordan, which was significantly below average. Precipitation in the metro area from January through July was 6.5 inches above normal. In May alone, the Twin Cities experienced over 9.3 inches of precipitation, an anomaly of approximately 6 inches. The second half of the year was a stark contrast with a drought beginning in late July that lasted through the winter, resulting in an August-December precipitation deficit of 7.5 inches.



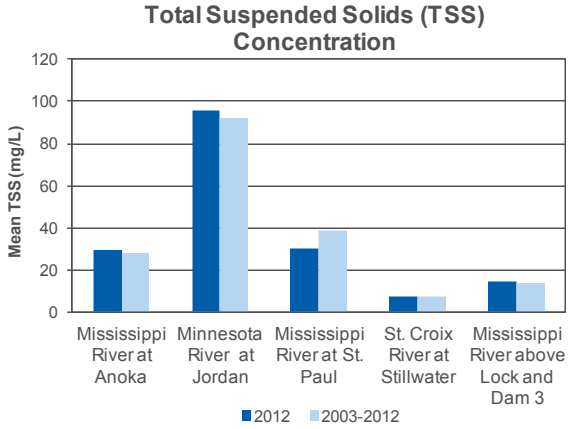
Turbidity and Total Suspended Solids (TSS)

Description: Particulate matter in the water may harm aquatic life by decreasing the light available for plant growth, increasing water temperature, clogging gills of aquatic inhabitants and covering habitat. Suspended solids can also negatively affect user perception of water quality and decrease swimmability. Particulate matter usually enters the rivers as sediment eroded from stream banks or decaying organic matter. The amount of particulate matter in a river can be measured as turbidity or total suspended solids. Turbidity is an easier measurement that can be collected in the field, but is harder to compare between sites because readings can be influenced by the presence of dissolved matter, temperature and the shape of the particles.

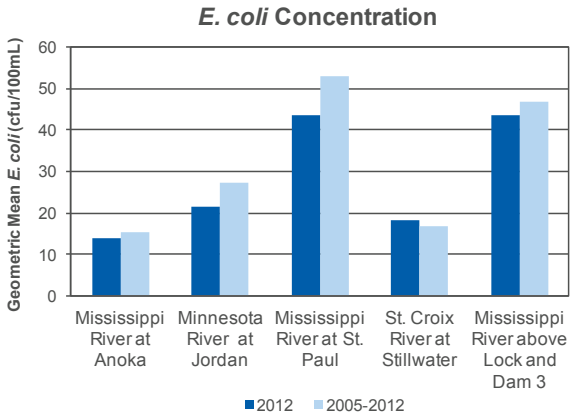


Standards: The turbidity standard is a daily maximum of 25 Nephelometric Turbidity Units (NTU). The MCES lab has measured turbidity in Nephelometric Turbidity Ratio Units (NTRUs) since 2006, and the standard of 25 NTU has been approximated as 39 NTRU by the Minnesota Pollution Control Agency. No TSS river standard exists.

2012 Results: 2012 average turbidity values in the Mississippi River at all three sites were below their 10-year averages, with the Mississippi River at St. Paul experiencing the greatest departure from average. In the St. Croix, 2012 average turbidity was slightly below its 10-year average. The Minnesota River at Jordan had a higher than average turbidity and the 2012 average turbidity was above the 39 NTRU threshold. Of the 199 turbidity samples in 2012, 15 were above the daily maximum of 39 NTRU, 12 of which were in the Minnesota River and 3 in the Mississippi River at St. Paul. Usually, turbidity and TSS track well together, however, the Mississippi River at Anoka and above Lock and Dam 3 had slightly higher than average TSS concentrations while slightly lower than average turbidity. Overall, the Minnesota River is the primary TSS contributor within the metro area.



E. coli Bacteria

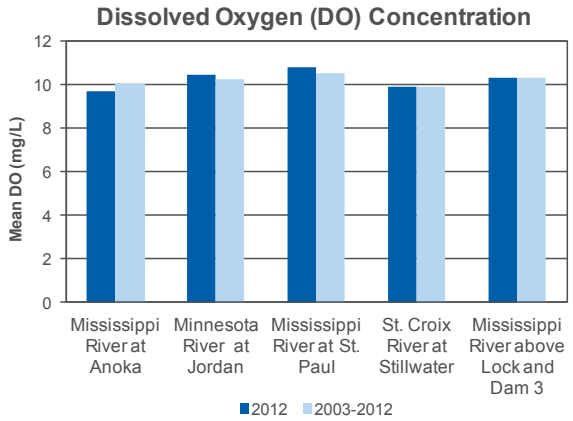


Description: Suitability for recreation is determined by the level of *Escherichia coli* (*E. coli*) bacteria. High *E. coli* levels can indicate the presence of potentially dangerous pathogens such as typhoid fever, hepatitis and dysentery. Sources can include failing septic tanks, untreated wastewater, livestock, pets and wildlife.

Standard: The geometric mean of at least five samples cannot exceed 126 organisms/100ml in any given month, and no more than 10% of samples taken during a given month can exceed 1,260 organisms/100ml. The standard applies only between April 1 and October 31.

2012 Results: 2012 average *E. Coli* concentrations were well below the average monthly water quality standard of 126 organisms/100 mL at all points, indicating favorable conditions for recreational use. There were only two samples within the April 1 to October 31 window in 2012 that exceeded 1,260 organisms/100 mL: both were in the Minnesota River at Jordan. The 2012 average concentration exceeded its 10-year average at the St. Croix River at Stillwater. The 2012 average concentrations were below their 10-year averages at Minnesota River at Jordan, Mississippi River at Anoka, Mississippi River at St. Paul, and Mississippi River above Lock and Dam 3.

Dissolved Oxygen (DO)

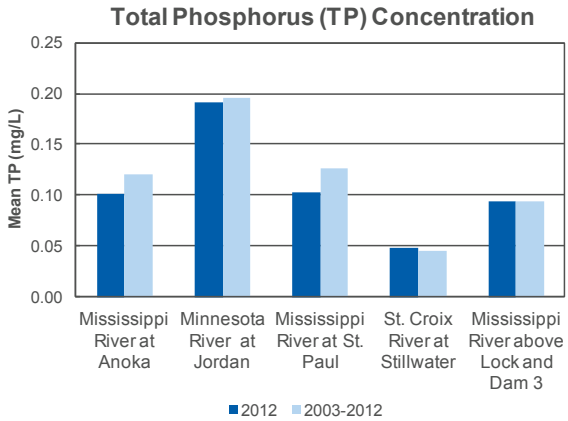


Description: High oxygen levels provide healthy conditions for a diverse fish population, indicating fishable conditions. Living organisms need oxygen to survive so the amount of dissolved oxygen in a river determines whether it can support aquatic life. Dissolved oxygen can enter an aquatic system from the atmosphere but is also produced in aquatic systems through photosynthesis. DO concentrations can be reduced through high temperatures, low flow, increased pollution, and the decomposition of organic material in the water.

Standard: Dissolved oxygen must not be below 5 mg/L for a daily minimum.

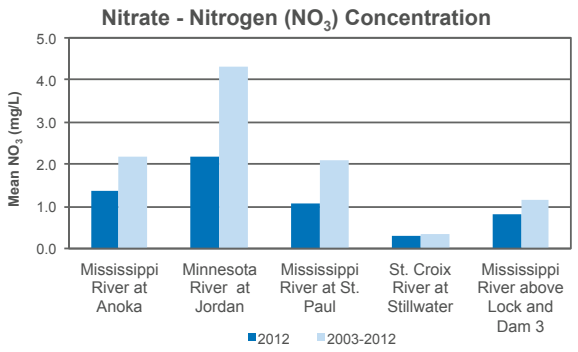
2012 Results: No individual sample measurements in 2012 at any of the five sites were below 5 mg/L, including during August low flow conditions on the Minnesota River, where traditionally concentrations have been below the standard. The 2012 average DO concentration was slightly below the 10-year average at Mississippi River at Anoka, and slightly above the 10-year average at the Minnesota River at Jordan and Mississippi River at St. Paul. The 2012 average DO concentration was not noticeably different from the 10-year average at St. Croix River at Stillwater or Mississippi River above Lock and Dam 3.

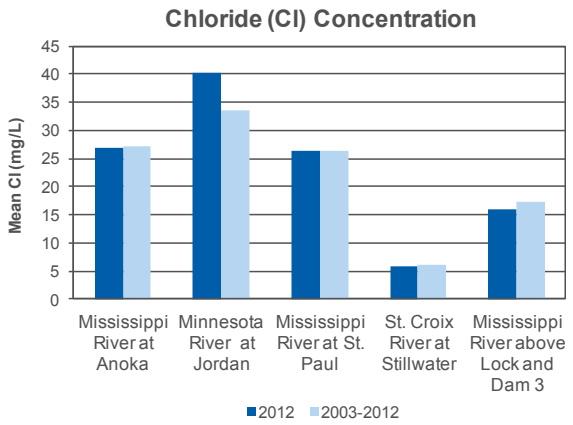
Nutrients: Total Phosphorus (TP) and Nitrate-Nitrogen (NO_3)



Description: Aquatic plants provide food, oxygen and habitat for river organisms. However, an excess of plant growth can lead to unsightly algae blooms, oxygen depletion and odor upon decaying, making the water unpleasant for recreational activities and unsuitable for aquatic life. Nitrogen and phosphorus are essential nutrients for plant growth and individually or combined are often the limiting nutrient(s) in aquatic systems. Nitrogen and phosphorus are common components of wastewater treatment plant discharges and urban and agricultural runoff. They can stimulate excessive plant growth when levels in rivers are too high.

Standards: No river standard for total phosphorus exists. Class 2Bd drinking waters cannot exceed 10 mg/l nitrate-nitrogen. The Mississippi River above the Upper St. Anthony Falls and the St. Croix River are classified as drinking waters.





2012 Results: Almost all 2012 samples met the drinking water standard except for 2 samples at the Minnesota River at Jordan. The 2012 average total phosphorus and nitrate concentrations were below the 10-year averages for the Minnesota River at Jordan, Mississippi River at Anoka, Mississippi River at St. Paul, and Mississippi River at Lock and Dam 3. The St. Croix at Stillwater 2012 average phosphorus concentration was above the 10-year average and the average nitrate concentration was below the 10-year average.

Chloride (Cl)

Description: Excess levels of chloride can be toxic to aquatic and terrestrial organisms. Although some chloride is derived from natural sources, the majority of chloride in the metro area rivers is from urban sources such as road deicing and water softening.

Standards: Chloride concentration must not exceed a 4-day average of 230 mg/l or a 1-hour average of 860 mg/l.

2012 Results: No samples at any site exceeded the 4-day average standard of 230 mg/l. The 2012 average chloride concentration was above the 10-year average at the Minnesota River at Jordan. The 2012 average chloride concentration was slightly below the 10-year average at the St. Croix River at Stillwater and the Mississippi above Lock and Dam 3. The Mississippi River at Anoka and St. Paul met their 10-year average chloride concentration.

Table 1: 2012 average water quality as compared to the 10-year average (2003 – 2012)

	Flow	Turbidity[a]	TSS	*E.coli*[b]	DO	TP	NO_3	Cl
Mississippi River at Anoka	Same	Lower	Higher	Lower	Lower	Lower	Lower	Lower
Minnesota River at Jordan	Lower	Higher	Higher	Lower	Higher	Lower	Lower	Higher
Mississippi River at St. Paul	Lower	Lower	Lower	Lower	Higher	Lower	Lower	Same
St. Croix River at Stillwater	Higher	Lower	Higher	Higher	Same	Higher	Lower	Lower
Mississippi River above Lock and Dam 3	Lower	Lower	Higher	Lower	Same	Lower	Lower	Lower

"Same" means that the average 2012 concentration was within 1% of the 10-year average concentration.
[a]Average is based on data from 2006 – 2012.
[b]Average is based on data from 2005 – 2012.

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