METROPOLITAN COUNCIL

Environmental Services

2015

River Water Quality Summary for the Twin Cities Metropolitan Area

In 2015, Metropolitan Council Environmental Services (MCES) river monitoring was conducted at six automated and 20 conventional sampling sites on five major rivers: Mississippi, Minnesota, St. Croix, Vermillion, and Rum. In 2015, the conventional sampling effort resulted in 841 field visits, 3,647 field parameter readings, and over 23,500 laboratory results.

Rivers are important natural resources for the Twin Cities metropolitan area (metro area) and provide many valuable services: they are popular destinations in summer months for boating, swimming, and camping; they are used frequently for year-round recreational fishing; and the upper Mississippi River is a significant source of drinking water. The MCES river monitoring program helps to ensure these beneficial services are efficiently maintained and protected.

To summarize the water quality of rivers in the metro area in 2015, MCES compared concentrations of key water quality parameters from five sites (Figure 1). MCES compared the 2015 average for each of the key water quality parameters at these five sampling sites to 10-year averages from 2006-2015. Since concentrations are highly affected by flow which can be very different between years, the comparison between 2015 and the previous decade should not be taken as an indication of increasing or decreasing water quality, but rather as a snapshot comparison to conditions of recent years.

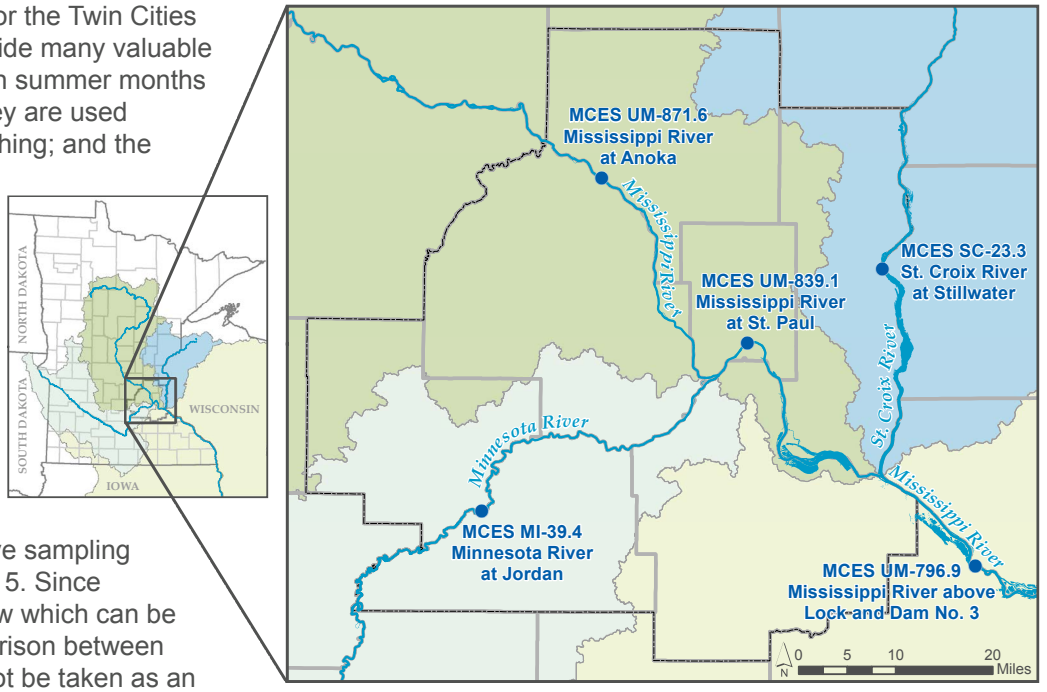


Figure 1: Key metro area monitoring locations and watersheds of the Mississippi, Minnesota, and St. Croix Rivers upstream of the metro area

MCES also compared the 2015 averages to state water quality standard values where applicable, as presented in Table 1. Standards allow the state to objectively evaluate the quality of Minnesota's water resources and ensure the region's waters are protected. The values presented in Table 1 are just part of the standards. Standards can have additional specifications such as how frequently and by how much samples can exceed the standard, in addition to the time frame in which the standard is in effect or not.

Table 1: Water quality standard values at the five sampling sites

Parameter	Mississippi River at Anoka	Minnesota River at Jordan	Mississippi River at St. Paul	St. Croix River at Stillwater	Mississippi River above Lock and Dam 3
Chloride (Cl) – mg/L	230	230	230	230	230
Dissolved Oxygen (DO) – mg/L	5	5	5	5	5
***E. coli* bacteria** – organisms/100mL	1,260	1,260	1,260	1,260	1,260
Total Suspended Solids (TSS) – mg/L	30	65	32	15	32
Total Phosphorus (TP) – mg/L	0.10	0.15	0.125	0.05	0.10
Nitrate – Nitrogen (NO_3) – mg/L	10	NA	NA	10	NA

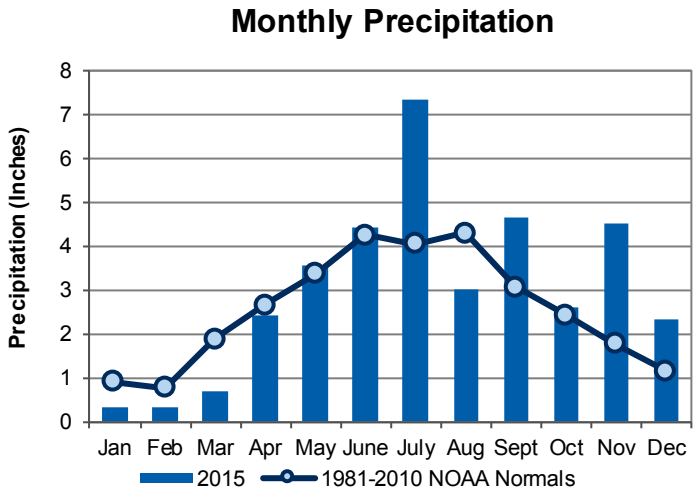
Precipitation

Description

Regional precipitation is measured at the Minneapolis-St. Paul International Airport, which is a good indicator of significant rainfall events in the metro area because of its central location.

2015 Results

Precipitation in the metro area during 2015 was 5.5 inches above the normal precipitation, as defined by NOAA 1981-2010 Climate Normals (a data set updated every 10 years). The first half of the year (January through June) was fairly dry, with a deficit of 2.1 inches of precipitation below normal. In contrast, the second half of the year (July through December) was fairly wet, experiencing 7.6 inches of precipitation above normal. The month of July was especially wet, reaching more than 7 inches above normal and going on record as the seventh wettest July since 1871!



River Flow

Description

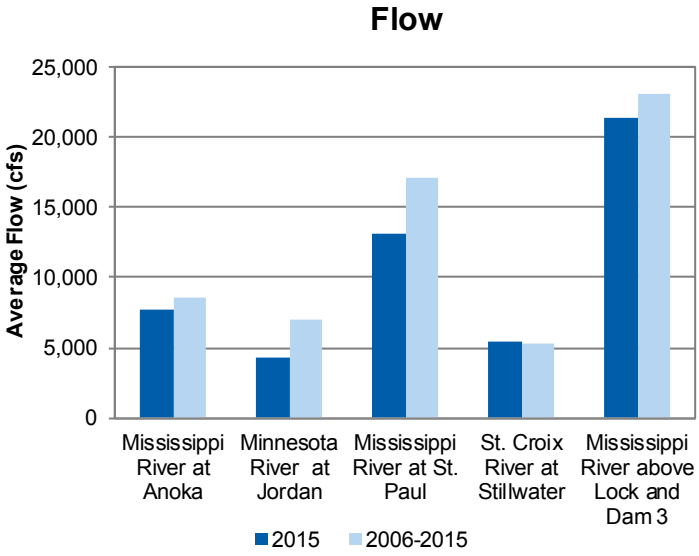
River flow, or the rate of water flowing in a river, affects aquatic life and is influenced by precipitation amounts. During wet periods, nonpoint source pollutants are carried through storm sewer systems to lakes and smaller streams and ultimately most often to the major rivers. The higher flows can cause stream bank erosion, habitat destruction, and flooding. During dry periods, low flows can result in more concentrated river pollution, increased sediment deposition, and lower habitat quality.

2015 Results

Overall, 2015 had above normal precipitation, but the annual river flows were below the 10-year averages, with the exception of the St. Croix River. Compared to the 10-year average at each site, the 2015 average river flow was:

Site	2015 vs. 10-year
Mississippi River at Anoka	Lower
Minnesota River at Jordan	Lower
Mississippi River at St. Paul	Lower
St. Croix River at Stillwater	Higher
Mississippi River above Lock and Dam 3	Lower

Comparisons between 2015 and 2006 – 2015 averages throughout this summary are reported using the following method: “Same” means the average 2015 concentration was within the 95% confidence interval (a statistical tool used to represent how spread out the data is) of the 10-year average, while “Lower” and “Higher” mean the 2015 average was below or above the 95% confidence interval of the 10-year average, respectively.



Chloride (Cl)

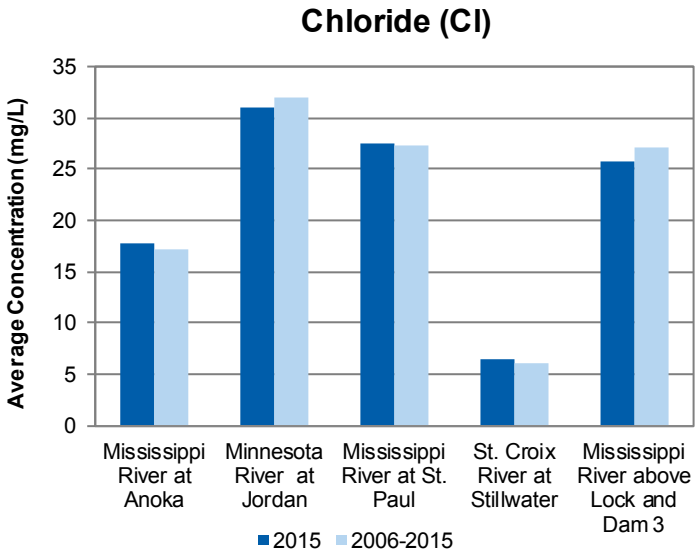
Description

Chloride, one component of salt, is typically used for winter maintenance of roads, sidewalks, and parking lots and for home water softening. Excess levels of Cl in the environment can be toxic to aquatic and terrestrial organisms.

2015 Results

Compared to the 10-year average at each site, the 2015 average Cl concentration was:

Site	2015 vs. 10-year
Mississippi River at Anoka	Higher
Minnesota River at Jordan	Same
Mississippi River at St. Paul	Same
St. Croix River at Stillwater	Higher
Mississippi River above Lock and Dam 3	Lower



Dissolved Oxygen (DO)

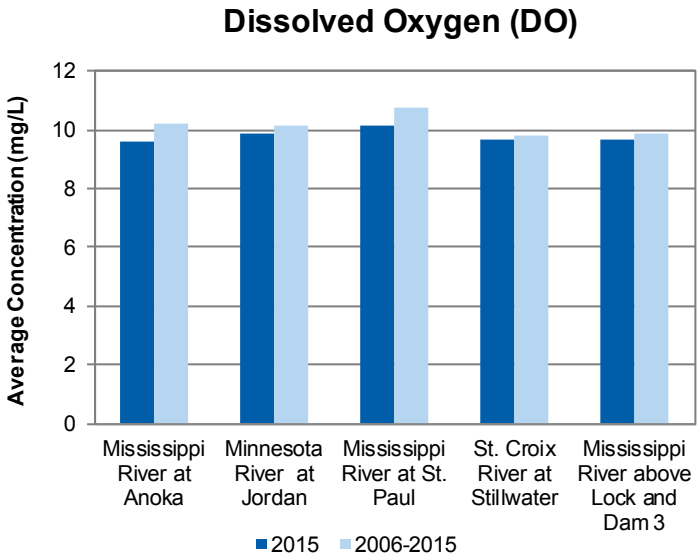
Description

DO is the amount of oxygen dissolved in water. It can enter an aquatic system from the atmosphere and it is also produced by aquatic plants through photosynthesis. DO concentrations can be reduced by high temperatures, low water flow, high pollution, and decomposition of organic material in the water. Since almost all organisms require oxygen to live, high levels of DO are essential for a healthy river system, and low levels can lead to a loss of fish and other organisms from the area.

2015 Results

Compared to the 10-year average at each site, the 2015 average DO concentration was:

Site	2015 vs. 10-year
Mississippi River at Anoka	Lower
Minnesota River at Jordan	Lower
Mississippi River at St. Paul	Lower
St. Croix River at Stillwater	Same
Mississippi River above Lock and Dam 3	Same



E. coli Bacteria

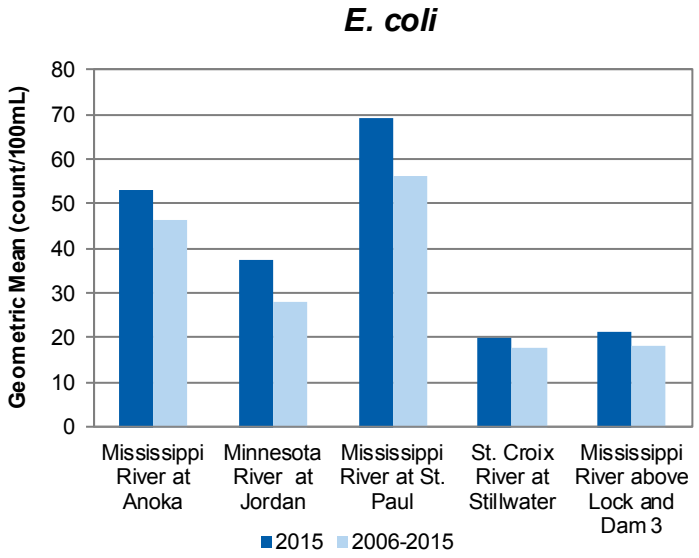
Description

Escherichia coli (*E. coli*) are bacteria which typically originate from failing septic tanks, untreated wastewater, livestock, pets and wildlife. High *E. coli* levels can indicate the presence of potentially dangerous pathogens in water bodies such as typhoid fever, hepatitis, and dysentery. Therefore the concentration of *E. coli* is one of several parameters used to determine a river's suitability for recreational purposes.

2015 Results

Compared to the 10-year average at each site, the 2015 average *E. coli* concentration was:

Site	2015 vs. 10-year
Mississippi River at Anoka	Higher
Minnesota River at Jordan	Higher
Mississippi River at St. Paul	Higher
St. Croix River at Stillwater	Higher
Mississippi River above Lock and Dam 3	Higher



Total Suspended Solids (TSS)

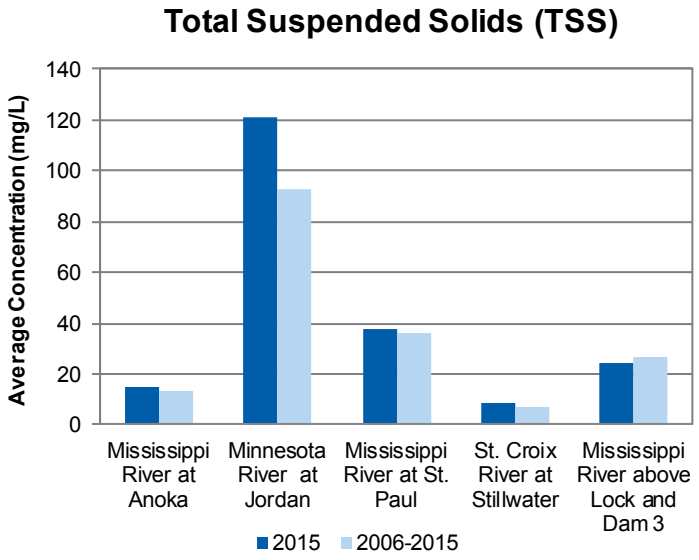
Description

TSS is any material suspended in water which can be removed with a filter. TSS has a variety of sources including eroded sediment from stream banks, lawns, construction sites, and agricultural fields as well as organic particulate such as decaying matter and algae. High levels of TSS in rivers may harm aquatic life by decreasing the light available for plant growth, increasing water temperature, clogging gills of aquatic inhabitants, and covering habitat. High TSS levels can also affect recreational use by decreasing water clarity and creating unfavorable swimming conditions.

2015 Results

Overall, the Minnesota River is the primary TSS contributor within the metro area. Compared to the 10-year average at each site, the 2015 average TSS concentration was:

Site	2015 vs. 10-year
Mississippi River at Anoka	Higher
Minnesota River at Jordan	Higher
Mississippi River at St. Paul	Same
St. Croix River at Stillwater	Higher
Mississippi River above Lock and Dam 3	Lower



Nutrients: Total Phosphorus (TP)

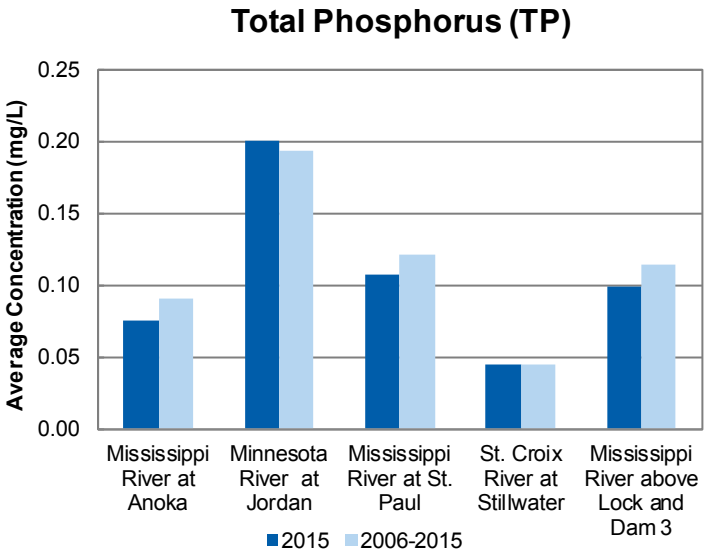
Description

Phosphorus is an essential nutrient necessary for the growth of aquatic organisms. Nutrients cycle naturally in the environment, but elevated levels of TP in rivers can be caused by the erosion of fertilized soils. High levels of TP can stimulate excess growth of aquatic plants, causing algae blooms which reduce the oxygen levels in the water. This creates unlivable conditions for most aquatic life and makes the water unusable for most recreational activities.

2015 Results

Compared to the 10-year average at each site, the 2015 average TP concentration was:

Site	2015 vs. 10-year
Mississippi River at Anoka	Lower
Minnesota River at Jordan	Same
Mississippi River at St. Paul	Lower
St. Croix River at Stillwater	Same
Mississippi River above Lock and Dam 3	Lower



Nutrients: Nitrate -- Nitrogen (NO_3)

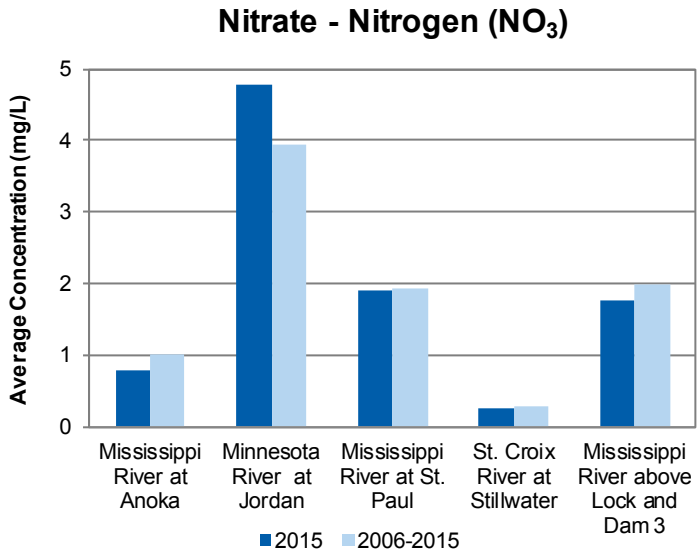
Description

Nitrogen is an essential nutrient necessary for the growth of aquatic organisms. Aside from natural processes, common sources of NO_3 include fertilizers, plant debris, and septic and municipal wastewater treatment systems. High NO_3 levels can cause the same problems associated with high phosphorous concentrations and additionally can lead to methemoglobinemia, a blood condition typically affecting infants which impairs the ability of red blood cells to efficiently transport oxygen throughout the body.

2015 Results

Compared to the 10-year average at each site, the 2015 average NO_3 concentration was:

Site	2015 vs. 10-year
Mississippi River at Anoka	Lower
Minnesota River at Jordan	Higher
Mississippi River at St. Paul	Same
St. Croix River at Stillwater	Lower
Mississippi River above Lock and Dam 3	Lower



Comparison to Standards

Table 2 shows the percentage of samples taken in 2015 that went beyond their respective standard values (Table 1). Having samples which exceed the standard value does not mean the water body is impaired. The impairment status is officially determined by the Minnesota Pollution Control Agency (MPCA) and can depend on other criteria such as the time of the year, how frequently the standard is exceeded, or by how much the samples exceed the standard.

In 2015, no chloride or dissolved oxygen samples were above the standard values, and only 12 nitrate and two *E. coli* samples were above the standard values. Many total phosphorus and total suspended solid samples were above the standard values at all five river locations.

Table 2: Comparison of 2015 results to water quality standard values

Site	Percent of 2015 Samples Beyond the Standard Values					
	Cl	NO_3	*TP*	*TSS*	*E. coli*	*DO*
Mississippi River at Anoka	0	0	29	14	2	0
Minnesota River at Jordan	0	12	50	50	0	0
Mississippi River at St. Paul	0	0	33	38	0	0
St. Croix River at Stillwater	0	0	40	5	0	0
Mississippi River above Lock and Dam 3	0	0	55	39	0	0

Concluding Remarks

Data gathered from the MCES's river monitoring program can be used to track general patterns as the Minnesota, Mississippi, and St. Croix Rivers converge and flow through the metro area. The Minnesota River had the highest concentrations of nutrients, chloride, and total suspended solids in 2015. Just upstream of the Mississippi River at St. Paul, the Minnesota River concentrations were diluted as the water entered into the Mississippi and mixed together, producing the intermediate concentrations observed at St. Paul. Further downstream at Lock and Dam 3 on the Mississippi River where water leaves the metro area, lower concentrations occurred likely due to dilution from the St. Croix River when it enters the Mississippi. There are exceptions to this general dilution pattern. Chloride and nitrate concentrations increased between St. Paul and Lock and Dam 3, indicating pollutants such as road salts may have entered the rivers within the metro area with concentrations that were higher than what was already in the river.

Table 3 summarizes the 2015 results of the water quality parameters in comparison to the 10-year averages. Overall, the river flow was lower than the past decade at most sites and *E. coli* counts were higher at all sites. Chloride, total suspended solids, and nitrate concentrations were variable in 2015, while total phosphorus and dissolved oxygen concentrations were generally lower or the same as in the past 10 years.

Table 3: Summary of 2015 average water quality parameters compared to 10-year averages (2006 – 2015)

Parameter	Mississippi River at Anoka	Minnesota River at Jordan	Mississippi River at St. Paul	St. Croix River at Stillwater	Mississippi River above Lock and Dam 3
River Flow	Lower	Lower	Lower	Higher	Lower
Chloride (Cl)	Higher	Same	Same	Higher	Lower
Dissolved Oxygen (DO)	Lower	Lower	Lower	Same	Same
***E. coli* bacteria**	Higher	Higher	Higher	Higher	Higher
Total Suspended Solids (TSS)	Higher	Higher	Same	Higher	Lower
Total Phosphorus (TP)	Lower	Same	Lower	Same	Lower
Nitrate – Nitrogen (NO_3)	Lower	Higher	Same	Lower	Lower

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

METROPOLITAN COUNCIL

390 Robert Street North
Saint Paul, MN 55101-1805
(651) 602-1000
TTY 651.291.0904

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