RUM RIVER POLLUTANT TREND UPDATE

Introduction

The Twin Cities metropolitan area of Minnesota has a wealth of streams that traverse its landscape and ultimately flow into one of three major rivers – the Mississippi, the Minnesota, and the St. Croix. These streams provide rich habitat for aquatic life and wildlife and enhance the recreational and aesthetic value of the metro area.

The Metropolitan Council is committed to the conscientious stewardship of the region's streams and tributary rivers and works with its partners to maintain and improve their health and function. The foundation for these efforts is the collection and interpretation of high-quality, long-term data to produce insightful, actionable information.

Pollutant trends are a valuable tool to understand how a stream's water quality is changing over time. The Met Council first calculated statistical trends on Twin Cities streams and tributary rivers that are part of its monitoring programs in the 2014 *Comprehensive Water Quality Assessment of Select Metropolitan Area Streams* (subsequently referred to as the 2014 Stream Report). This report is available online at https://metrocouncil.org/Wastewater-Water/Services/Water-Quality-Management/Stream-Monitoring-Assessment.aspx. At that time, water quality trends were calculated for total suspended solids, total phosphorus, and nitrate through the year 2012. In addition, in 2021 the Met Council calculated chloride trends analysis for their monitored streams. The chloride trend results are reported in a series of memos which are available on the Met Council's Environmental Information Management System (EIMS) website: https://eims.metc.state.mn.us/Documents.

This memo provides updated total suspended solids, total phosphorus, and nitrate trends originally published in the 2014 Stream Report for Rum River using data through the end of 2021.

Site Description

Water quality was monitored in Rum River at mile 0.5, downstream from the Anoka Dam in the city of Anoka, from 1996 to 2000. Monitoring of total suspended solids and total phosphorus began at this location in 1996. In 2001, monitoring moved from mile 0.5 to mile 0.7, to a location just on the upstream side of the dam. Monitoring of nitrate + nitrite began at this time. In 2013, the monitoring location moved again to mile 0.6, to a pedestrian bridge downstream from the dam. Flow monitoring occurs at a nearby USGS station at Saint Francis (USGS 05286000).

Trend Overview

Trend analysis was performed using the USGS R-QWTREND package. R-QWTREND is a statistical model specifically designed to investigate pollutant trends, which tests potential trends (increase or decrease in concentration) against a no-trend model. The model is designed to investigate trends in flow-adjusted concentrations by removing the variability of annual flow and seasonality from the statistical analysis. The resulting trend line shows how pollutant concentrations have changed over time due to factors in the stream or watershed other than flow, such as land use modification, point discharge changes, best management plan (BMP) implementation, or stream restoration. The trend results do not show causation: why a trend might be moving up or down. However, they provide information about the effects of complex interactions occurring in the

stream and watershed, which might help reassure managers that actions taken on the landscape are having an impact or motivate additional engagement in improving stream health.

Trends were assessed at a statistical significance level of 0.1. Overall and individual trends are shown whether they are statistically significant or not, but non-significant trends (trends with p-values greater than 0.1) are indicated in tables with a “NS” notation and are shown in graphs with a dotted line. A non-significant trend means that there is not enough evidence to state the trend is caused by real environmental change rather than natural variability. Often trends are identified but not significant when there are very small changes in concentration over time or when environmental data is scattered. While the underlying trend fit of the data is still valid and potentially useful, non-significant trends should be used with caution and qualified as such when describing environmental change.

For more detailed information on Met Council’s technical approach to trend analysis for this assessment using R-QWTREND, please see the Met Council’s methodology document specific to this study.

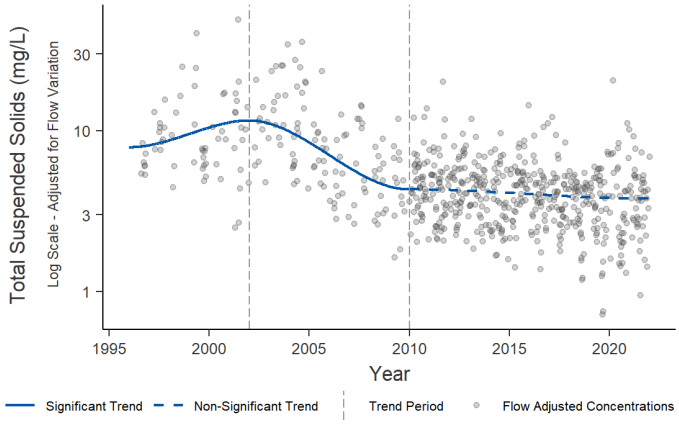
Total Suspended Solids Trend

A total suspended solids trend was calculated using data from 1996-2021. R-QWTREND analysis shows that changes in total suspended solids flow-adjusted concentration in Rum River can be best represented by a statistically significant three-trend model ($p < 0.001$). The trend increased from 1996 through 2001, decreased from 2002 through 2009, and then flattened out to a slow decrease from 2010 to the end of 2021. However, the third trend period from 2010 to 2021 was non-significant, meaning that an upwards or downwards trend could be detected with confidence among the variability of the data. The first two trend periods were statistically significant. The change in concentration percentages and p-values for each trend period are shown in Table 1 below, and a plot of the trend line with concentrations is shown in Figure 1.

Table 1: Statistical Trend Summary for Total Suspended Solids

Trend Period	Change in Concentration (%)	Trend *p* value
1996 - 2001	46.7%	0.045
2002 - 2009	-62.7%	< 0.001
2010 - 2021	-12.5%	0.148 (NS)

Figure 1: Statistical Trend Graph for Total Suspended Solids



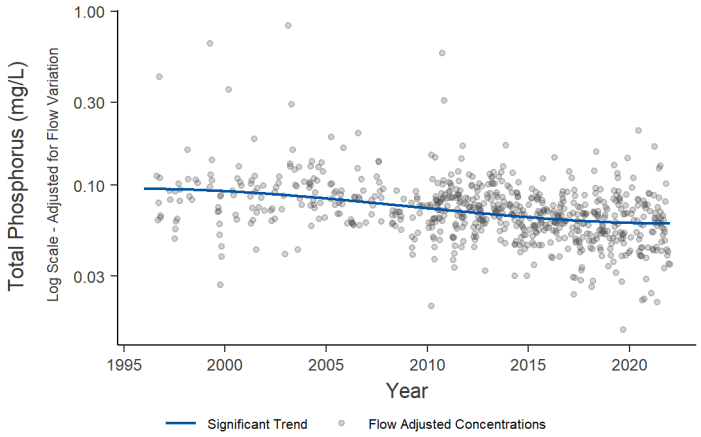
Total Phosphorus Trend

A total phosphorus trend was calculated using data from 1996-2021. R-QWTREND analysis shows that changes in total phosphorus flow-adjusted concentration in Rum River can be best represented by a statistically significant one-trend model ($p < 0.001$). The trend decreased from 1996 through the end of 2021. The change in concentration percentages and p-values for each trend period are shown in Table 2 below, and a plot of the trend line with concentrations is shown in Figure 2.

Table 2: Statistical Trend Summary for Total Phosphorus

Trend Period	Change in Concentration (%)	Trend *p* value
1996 - 2021	-36.7%	< 0.001

Figure 2: Statistical Trend Graph for Total Phosphorus



Nitrate + Nitrite Trend

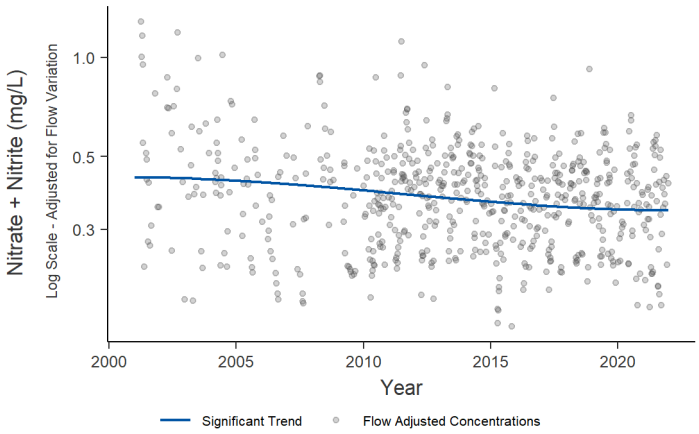
A nitrate+nitrite trend was calculated using data from 2001-2021. The trend was determined for nitrate+nitrite rather than just nitrate as in the 2014 Stream Report to be consistent with state agency partners.

R-QWTREND analysis shows that changes in nitrate+nitrite flow-adjusted concentration in Rum River can be best represented by a statistically significant one-trend model ($p = 0.062$). The trend decreased from 2001 through the end of 2021. The change in concentration percentages and p-values for each trend period are shown in Table 3 below, and a plot of the trend line with concentrations is shown in Figure 3.

Table 3: Statistical Trend Summary for Nitrate + Nitrite

Trend Period	Change in Concentration (%)	Trend *p* value
2001 - 2021	-20.5%	0.004

Figure 3: Statistical Trend Graph for Nitrate + Nitrite



For Additional Information

Met Council staff are available for additional discussions about these trend analysis results, including discussions about the potential impact of watershed activities on stream conditions, future data collection, data analysis, or other technical advice. Please contact Dan Henely, Assistant Manager, Water Resources, daniel.henely@metc.state.mn.us, to discuss options.

The raw data used to calculate trends is available on the Met Council's EIMS website: https://eims.metc.state.mn.us/.

Previous technical analysis, including the 2014 Stream Report and 2021 chloride fact sheets can be found on the EIMS document repository: https://eims.metc.state.mn.us/Documents