

South Fork Crow River Watershed

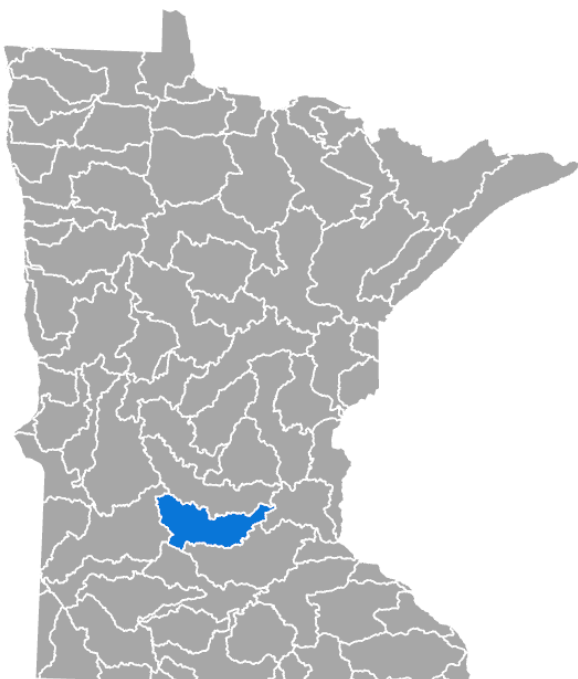
Upper Mississippi River Basin



Summary

The Minnesota Pollution Control Agency (MPCA), Minnesota Department of Natural Resources (DNR), and partners have completed a study of the South Fork Crow River Watershed, which includes the river itself along with tributaries and lakes. The South Fork Crow River and Buffalo Creek meet before joining the North Fork Crow River and finally, the Mississippi River near Dayton. Lakes and streams in this watershed continue to struggle with poor water quality. Biological communities in streams have remained in similar health compared to the previous study conducted in 2012-2013, even with highly variable water levels and weather conditions. For the first time, lakes in this watershed were studied by measuring fish community health. Lakes in this watershed were of poor water quality with only one lake supporting aquatic life and five lakes supporting aquatic recreation. Being so close to the Twin Cities metropolitan area, this watershed is at particular risk to significant agricultural land use, human activity, and increasing development. Concerns include low dissolved oxygen (DO), excess sediment, nutrients, and bacteria levels.

Figure 1. Minnesota's 80 major river drainages. South Fork Crow River Watershed highlighted.



Instead of relying on chemical testing of the water alone, scientists reached their conclusions through studying the variety of fish and bugs living in the waters. Doing so offers a more comprehensive understanding of the watershed's health over time. Volunteer water quality monitors contributed to the assessment, which is funded by Minnesota's Clean Water Land and Legacy Amendment. Details in the report will shape decisions on watershed management and pollution reduction measures for years to come.

Watershed study

The MPCA and partners monitored water quality conditions in 2012-2013 and again in 2023-2024. Chemistry data collected by local partners between 2015 and 2024 were used for the 2025 assessment. The data used to assess the condition of Minnesota water bodies focus on whether or not they are meeting water quality standards for aquatic life, recreation, and consumption. The overall goal of these assessments is to ultimately determine which waters are healthy and in need of protection or are polluted and require restoration.

Water monitoring is essential to determine whether lakes and streams meet water quality standards designed to ensure that waters are fishable and swimmable. While local partners and state agencies monitor water quality on an ongoing basis, the MPCA and local partners conduct an intensive exam of major lakes, rivers, and streams in each of the state's 80 watersheds every 10 years to detect any changes in water quality. This intensive monitoring looks at fish and macroinvertebrate (bug) communities as well as water chemistry to gauge water quality. The partners use the data to see which waters are healthy and need protection and which are impaired and need restoration. Waters are considered impaired if they fail to meet water quality standards.

Changes in water quality

To detect any changes in water quality, this recurring exam looks at fish and macroinvertebrate communities as well as water chemistry. Scientists use a tool called the Index of Biological Integrity (IBI) to assess the health of biological communities in lakes, rivers, streams, and wetlands. High IBI scores indicate a healthy aquatic community, which can only be attained when water quality, habitat, and hydrology are minimally disturbed by human activities.

Over the past decade, scientists observed little change in water quality in the South Fork Crow River Watershed. While the biological condition in individual streams may have improved or declined between 2012 and 2024, the overall health of fish and macroinvertebrate communities did not change over this period. Changes to fish communities in lakes cannot be compared, since fish community surveys were not included in the 2012-2013 study. The baseline for lake fish communities will be established during the current monitoring and assessment effort. Continued problems include excess nutrients and sediment (turbidity), elevated bacteria, low DO levels, and increased land development.

Figure 2. MPCA biologists sample for fish (left) and macroinvertebrates (right) in the South Fork Crow River Watershed.



Highlights of monitoring

- Stream biological monitoring efforts in 2023 were cut short due to intense flooding in the spring and extreme drought later in the summer. Sampling at 10 stream locations was postponed until 2024 due to these conditions.
- In recent years, flow monitoring in the South Fork Crow River Watershed highlights a pattern of springtime flooding followed by prolonged periods of extreme drought.
- McLeod Soil and Water Conservation District (SWCD) monitored two Watershed Pollutant Load Monitoring Network (WPLMN) sites and nine stream sites in this round of monitoring through a Surface Water Assessment Partnership contract.
- For lakes with long-term data sets, 29% are seeing improvements in water quality, 64% are showing no change, and 7% have declining water quality.
- Johnson Lake and Eagle Lake in McLeod County have been reclassified as wetlands; therefore, don't fall within standards for assessing aquatic recreation use.
- Total phosphorus (TP) at the South Fork Crow River in Delano has a significant decreasing trend. This trend indicates TP is decreasing by over 20% per decade.
- In 2025, two sites in the Continuous Nitrate Sensor Network (CNSN) were established within the watershed: Buffalo Creek near Glencoe ([19043001](#)) and South Fork Crow River at Delano ([19001001](#)). The CNSN is a network of monitoring sites with sensors installed at sites where high nitrogen loading has been historically measured. The MPCA has partnered with Minnesota Department of Agriculture (MDA), DNR, and the United States Geological Survey (USGS) to provide publicly available, real-time nitrate concentration and load data across watersheds in southern Minnesota.
- Eight lakes were assessed based on the fish IBI, with Whaletail Lake being split into two basins for a total of nine water bodies. All of the impaired lakes had over 50% disturbed land use in

their contributing watersheds. Whaletail Lake was the only lake assessed that is fully supporting aquatic life; it has less than 50% developed land use in the contributing watershed.

- Fish sampling in 2023-2024 resulted in the collection of 44 distinct fish species in streams. Of these species, nine are considered sensitive and 17 are considered tolerant.
- Thirty-one fish species were collected in lake IBI surveys during the watershed monitoring period. Of these species, three are considered intolerant and six are considered tolerant.
- A burbot was sampled in the South Fork Crow River Watershed by the MPCA for the first time.

Figure 3. A burbot sampled in the South Fork Crow River (left) and workers install a continuous nitrate sensor (right).



Success story

Lake Rebecca was listed as an impaired water body in 2008 for excessive nutrients. The lake experienced high phosphorus levels and poor water quality, which led to seasonal algal blooms and fish mortality events.

Figure 4. Three Rivers Park District collaborated with project partners, including Hennepin County Environmental Services, Pioneer-Sarah Creek Watershed Management Commission, Metropolitan Council, DNR, and a private landowner to improve the water quality of Lake Rebecca. Photo of Lake Rebecca from TRPD.



Starting in 2009, the Three Rivers Park District made improvements to the lake's watershed, including diverting feedlot runoff, installing livestock exclusion fencing, and bettering nearby manure practices. Three Rivers Park District also implemented a water quality improvement program, which aimed to reduce phosphorus inflow and control invasive plant species hoping to reduce algal blooms, improve water clarity, and enhance the native plant communities. Three Rivers Park District worked very closely with the local landowners, municipalities, and

watershed management organizations when planning and implementing these improvements.

In addition to those improvements, aluminum sulfate (alum) treatments were applied to Lake Rebecca in 2010 and 2011. Those applications significantly reduced the internal loading of phosphorus, but the 2013 and 2014 data suggest that these were short-term benefits, and higher levels of phosphorus were returning. When Lake Rebecca was assessed in 2014, there was still excessive phosphorus, high chlorophyll-*a*, and reduced water clarity.

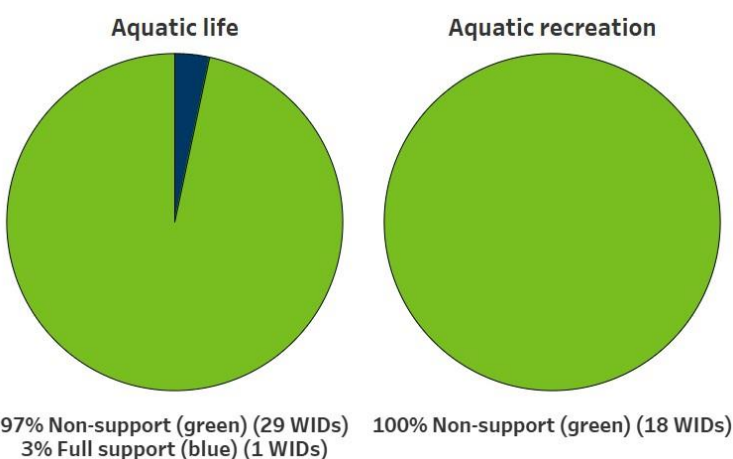
Despite the 2014 assessment, water quality improvements first implemented in 2008 worked over time. Data from 2012-2017 show Lake Rebecca was meeting the lake eutrophication standards and was delisted from the Impaired Water List in 2018. Assessed again in 2024, the lake continues to meet state water quality standards and is considered fully supporting for aquatic recreation. This delisting is a testament to the work that local partners and landowners have completed in the watershed to improve water quality.

Watershed assessment results

Streams and rivers

Aquatic life use impairments caused by elevated phosphorus, turbidity, and low DO levels are widespread. Overall, only one stream segment in the South Fork Crow River Watershed that was assessed in 2024 meets aquatic life use standards (Figure 5). Stream segments that meet aquatic life use standards have biological communities indicative of good water quality and habitat conditions. Degraded fish and macroinvertebrate communities in the majority of river and stream segments assessed in the watershed are further evidence of poor water quality. Eight new stream segments were found to have impaired macroinvertebrate communities, and two new stream segments were found to have impaired fish communities. This raises the total number of macroinvertebrate impairments to 38 and fish impairments to 44. All 18 stream segments assessed for aquatic recreation were impaired.

Figure 5. Current assessment results for aquatic life and aquatic recreation in streams of the South Fork Crow River Watershed.



In the watershed, elevated phosphorus, low DO, turbidity, and *E. coli* were the primary water quality impairments. Land use in the upper portions of the watershed mainly consists of cultivated crops with developed areas spotted throughout. Farther downstream, there is more pasture/hay and forest land cover. Many impairments in the watershed are typical for an agricultural watershed, and impaired water quality

of lakes and streams is widespread. Five segments of the South Fork Crow River that span the watershed were listed for excessive nutrients during assessments for the first round of intensive monitoring, and all

five segments continued to have high phosphorus levels, confirming nutrient impairments during 2025 assessments.

Low DO was common throughout the watershed. New impairments for DO were added to a segment of the South Fork Crow River and Unnamed Creek (-618). Three other stream segments had exceedances of the DO standard but did not warrant a listing even though they are considered vulnerable to a future impairment. Despite DO being a common impairment in the watershed, there was one segment of Buffalo Creek that showed improved DO readings, which may be due to the total maximum daily load (TMDL) that was implemented for this reach.

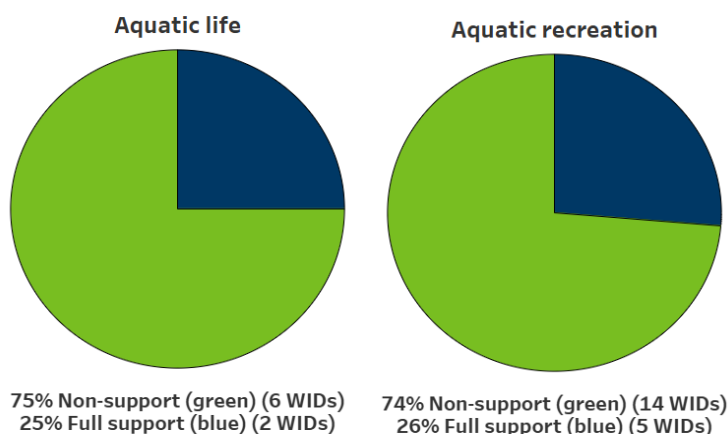
The most recent assessment resulted in two turbidity impairment delistings on the main stem of the South Fork Crow River: one segment from Bear Creek to Otter Creek in McLeod County and the other from Buffalo Creek to the North Fork Crow River in Carver County. WPLMN's daily modeled total suspended solids (TSS) data was used to indicate that these segments were in attainment of the regional TSS standard. This is the first time in the watershed that daily modeled data have been used to delist an impairment. Additionally, using daily modeled data and discrete sample data, one stream segment on Buffalo Creek (-638) was found to be vulnerable to a TSS impairment.

In the South Fork Crow Watershed, elevated *E. coli* levels were prevalent. In this assessment cycle, 18 stream segments were found to be impaired for *E. coli*, 10 of which were new impairments. Two of the stream segments with new *E. coli* impairments were fully supporting aquatic recreation previously. There was one stream segment on Judicial Ditch 1 (-572) that was listed for *E. coli* in 2016 that had no exceedances this monitoring cycle; however, there was not enough data to pursue a delisting at this time.

Lakes

In the South Fork Crow River Watershed, there were five lakes found to be fully supporting aquatic recreation. Of these five lakes, North and South Little Long Lake, Carrie Lake, and Stahl's Lake were also fully supporting during the previous assessment. Lake Rebecca was impaired in 2008 but was delisted in 2018 due to improved water conditions from management activities and is still fully supporting aquatic recreation now.

Figure 6. Current assessment results for aquatic life and aquatic recreation in lakes of the South Fork Crow River Watershed.

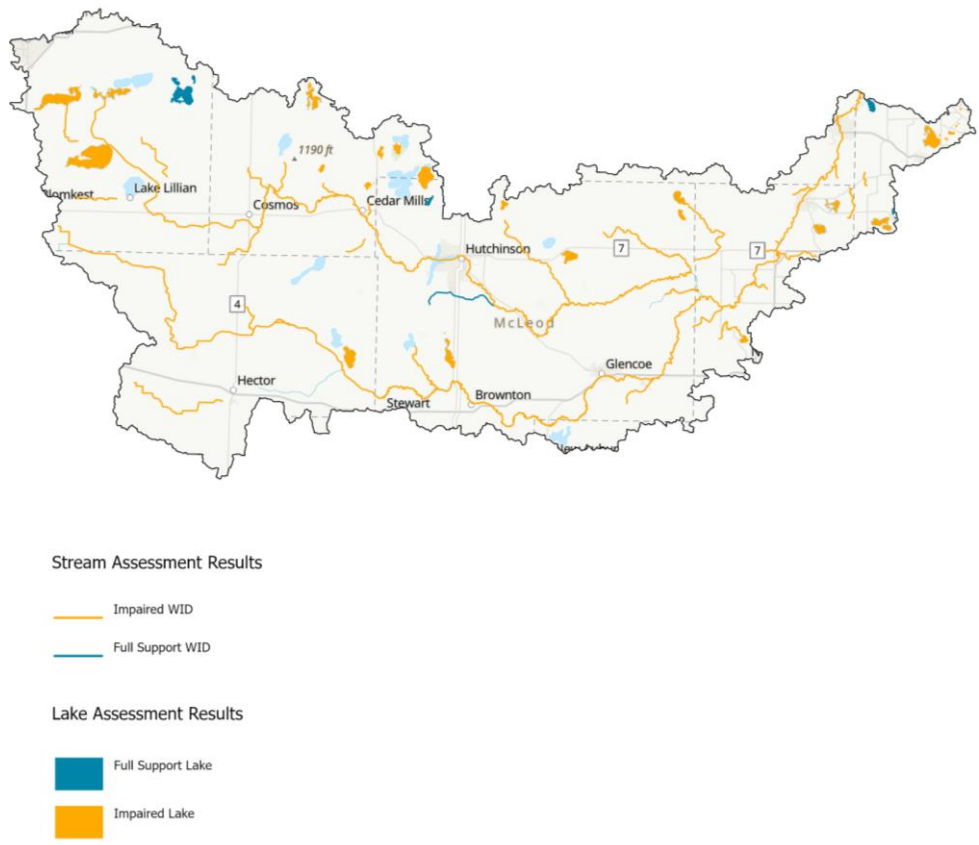


Fourteen lakes were found to be nonsupporting for aquatic recreation. Eleven lakes were confirmed to be still impaired and had existing nutrient impairments from previous years. Winterhalter Lake, Thomas Lake, and an Unnamed Lake (47-0139-00) were assessed for the first time in 2025 and were found to be impaired for excessive nutrients and were added to the 2026 Impaired Waters List. Lakes surrounded by intensively developed land or agricultural land, flow-through lakes, and shallow lakes were more likely to be impaired.

Peter Lake – North Bay, North Whaletail Lake, and Belle Lake are currently impaired for aquatic recreation but are improving and moving toward state water quality standards and should be considered barely impaired. Water quality in South Whaletail Lake improved after alum treatment, but the lake is still considered impaired due to excessive nutrients. Swan Lake and Allie Lake are not currently impaired for aquatic recreation but are considered nearly impaired.

Assessments for aquatic life use, based on fish IBI data, were completed for eight lakes in the South Fork Crow River Watershed. Five sampled lakes were considered not assessable. Although Whaletail Lake is considered two water bodies, it was assessed for aquatic life as one lake and was found to be fully supporting. Six other lakes were found to have impaired aquatic life communities, and Swan Lake (43-0040-00) was found to be vulnerable to future impairment. Stressors that are likely influencing these fish communities include excess nutrient inputs from agricultural land and developed shorelines.

Figure 7. Aquatic life and recreation use support for streams and lakes in the South Fork Crow River Watershed in the current assessment cycle.



Trends

A key objective of the 2023-2024 monitoring effort was to evaluate if and how water quality has changed since the initial monitoring in 2012-2013. If water quality has improved, it is important to understand to what extent human actions may be responsible for the change. It is equally important to understand if water quality does not appear to be changing or is declining. Either way, the knowledge will help inform future activities.

Trends in four different aspects of water quality were analyzed to provide as robust a picture as possible of what is happening in the South Fork Crow River Watershed:

1. Streamflow, sediment (TSS), TP, and nitrogen (nitrate)
2. Biological communities
3. Clarity of lakes
4. Climate

Figure 8. Average TP flow weighted mean concentration by major watershed.

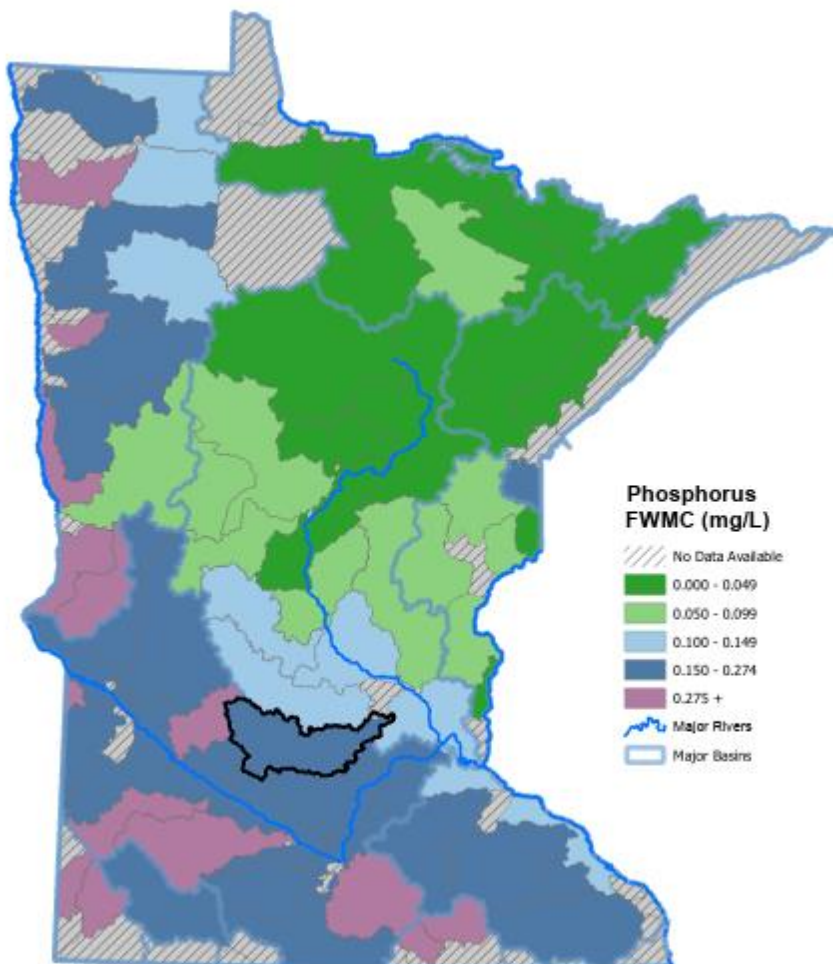
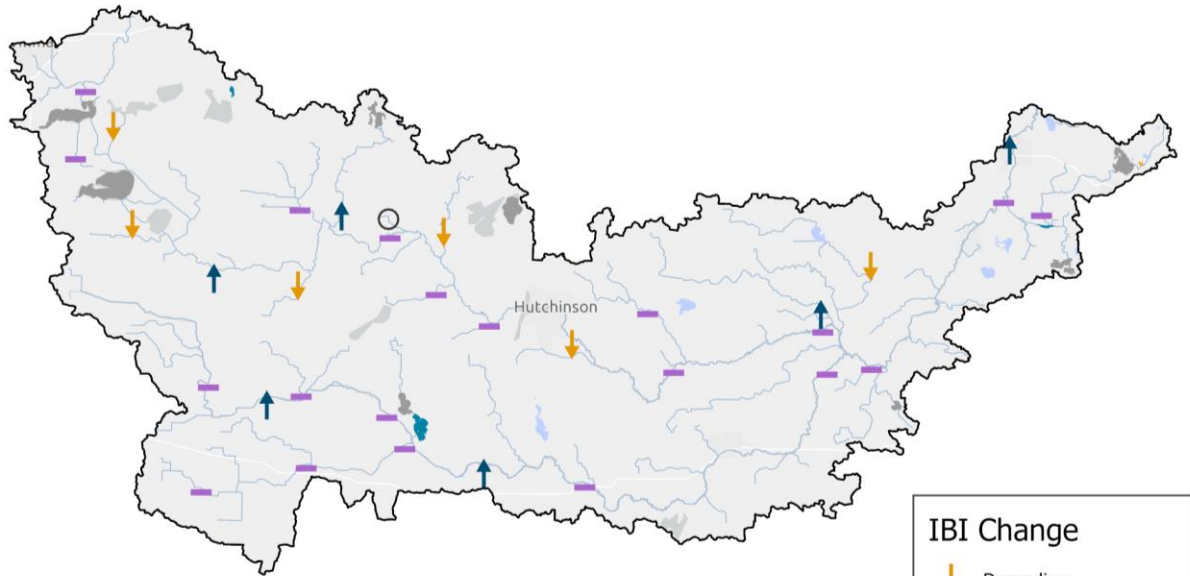
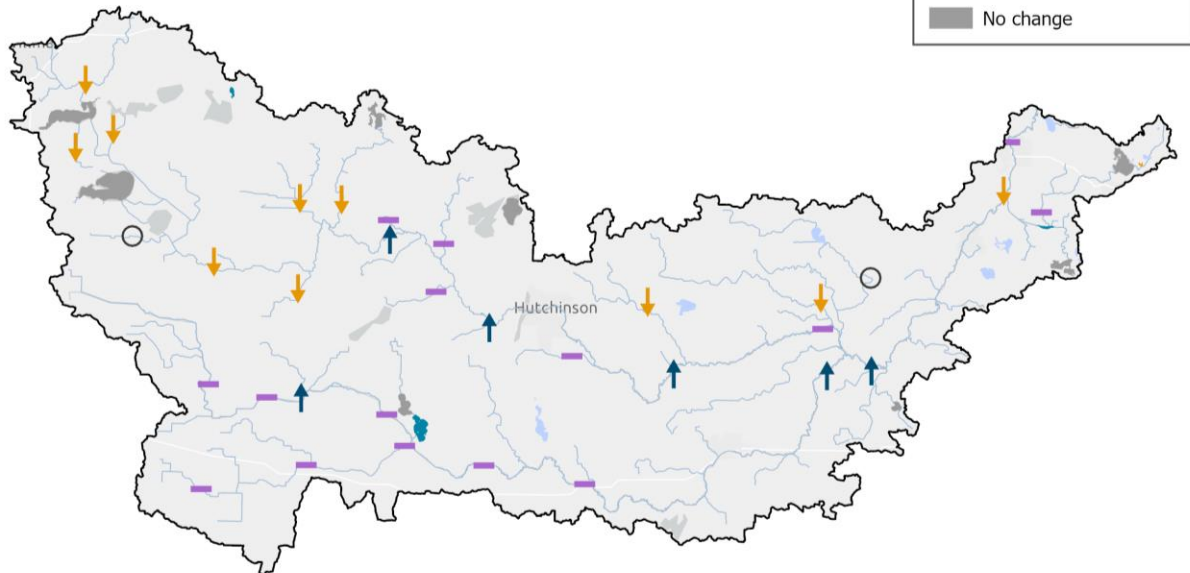


Figure 9. Change in stream biological condition and lake clarity within the South Fork Crow River Watershed.

Fish IBI Change



Invert IBI Change



IBI Change

- ↓ Degrading
- ↑ Improving
- Insufficient Information
- No Change

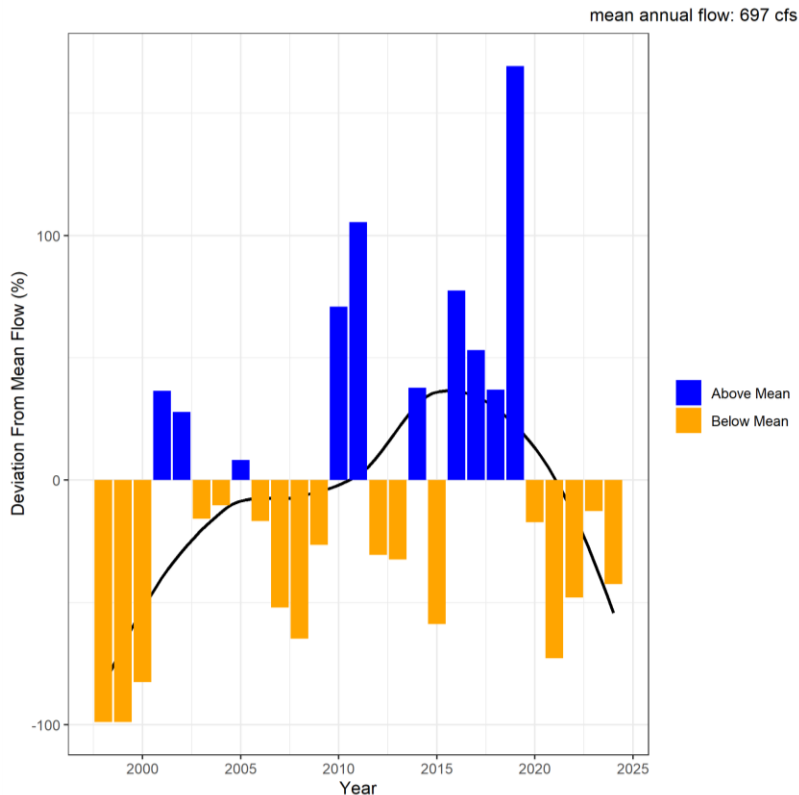
Lake Clarity Trend

- Orange square: Degrading
- Teal square: Improving
- Grey square: No change

Streamflow and pollutant concentrations

Figure 10 displays the average annual stream flow over the last 27 years at the South Fork Crow River at Delano (19001001). This gauge is located upstream of the confluence of the South Fork and North Fork Crow Rivers and exhibits a fairly stable flow trend with alternating periods of variable flow throughout the last three decades.

Figure 10. Percent deviation from normal flow over time at the South Fork Crow, Delano Station. The changing yearly average flow (black line) is calculated using locally estimated scatterplot smoothing (LOESS) with the orange and blue bars showing each year's deviation as above or below the average (697 cfs).



The South Fork Crow Watershed has three sites in the WPLMN that are intensively sampled across a range of flows and conditions by the MPCA and McLeod SWCD. For more information about this sampling, please visit: <https://www.pca.state.mn.us/wplmn>.

With streamflow contributions from the DNR, total annual pollutant loads can be estimated for each of these three sites. These annual loads are used to compare watersheds throughout the state and how they are changing over time. Seasonal trend tests on TSS, TP, and nitrate-nitrite (NOX) concentrations at the South Fork Crow outlet were used to determine if changes over time were statistically significant. Only phosphorus showed a statistically significant trend, decreasing about 21.5% per decade. This decrease is a good sign considering the widespread nutrient impairments in this watershed.

When compared to other watersheds throughout the state, Figure 10 shows that the South Fork Crow River has an elevated flow weighted mean concentration for TP. This elevated level is also true for NOX likely due to widespread agriculture in this region. These elevated concentrations are consistent with higher density agriculture in the southern part of the state. In contrast to the elevated TP and NOX

concentrations, TSS concentrations are moderate relative to other watersheds, which is likely due to the low gradient nature of this watershed.

Biological communities

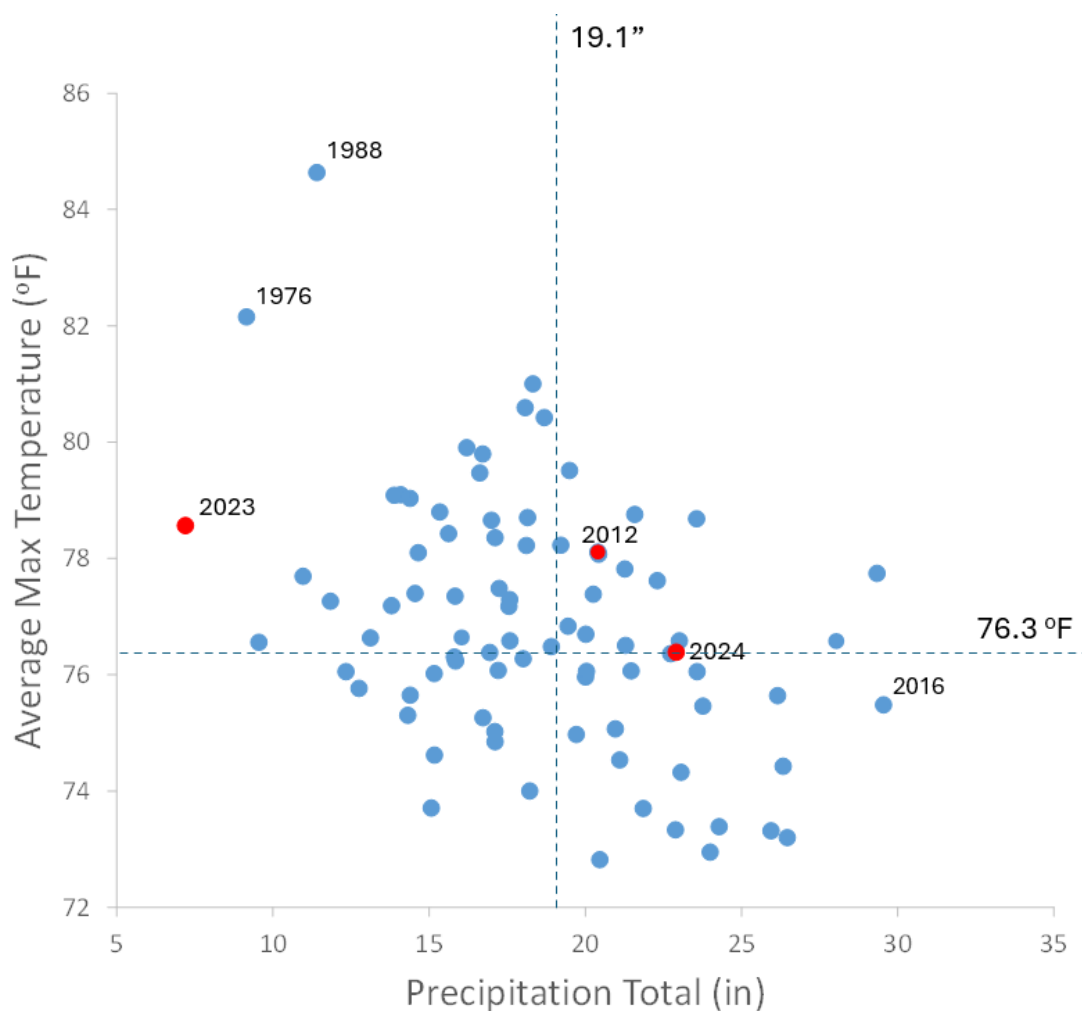
Paired t-tests of fish and macroinvertebrate IBI scores from both assessment periods were used to evaluate if biological condition in the watershed's rivers and streams has changed. Independent tests were performed on each community, with 31 sites evaluated for macroinvertebrates and 32 sites evaluated for fish. The average macroinvertebrate IBI score for the watershed decreased by 1.9 points between 2012 and 2023, which does not represent a statistically significant change. Fish IBI scores across the South Fork Crow River Watershed increased by 1.2 points, which is also not statistically significant. While the overall health of fish and macroinvertebrate communities across the watershed did not change between time periods, biological conditions at individual stream sites may have improved or degraded ($\pm >25$ IBI points). A similar change analysis was not completed for lakes because comparable fish community data had not been collected during the first time period. However, historical fish survey data has shown that extirpation events of several sensitive fish species have occurred.

Extreme weather events and climatic conditions during each biological monitoring cycle can dramatically obscure changes in condition that were the result of policies, regulations, and management activities such as restoration and protection efforts, changes in land use, and hydrologic alteration. This makes it difficult to evaluate whether biological conditions in the watershed are getting better or worse between monitoring cycles. Climatic conditions can affect stream aquatic life because of altered water flow, increased temperatures, decreased DO, habitat degradation, and decreased connectivity of water bodies. However, it is difficult to make predictions about the impact of climate and weather on stream aquatic life. Fish and macroinvertebrates respond to changes in complex ways, depending on timing, magnitude, frequency and duration of events as well as the type of stream or biological community. For instance, severe drought might negatively affect fish communities in headwater streams due to stressful conditions of higher temperature and lower DO created by lack of flowing water. Meanwhile, in larger streams that retain flow during a drought, biological condition may be unaffected or possibly somewhat inflated due to a "concentrating" effect of the fish community to a more limited habitat. Even so, it is important to characterize the climatic conditions during each monitoring period and compare them in order to better interpret the cause of any observed changes (or lack thereof) in biological condition.

Across the historical record watershed-wide rainfall totals were estimated for May-September based on gridded precipitation data from the State Climatology Office. Temperature was summarized for the May-September period by calculating the average maximum temperature at the Litchfield station because it is centrally located in the watershed and had a period of record sufficient to determine a normal value (*source*: Western Regional Climate Center, <https://wrcc.dri.edu/summary/mnF.html>). Rainfall and temperature normal values were determined by averaging each statistic over a 30-year period (1981-2010). Departures from normal values were calculated and used to characterize climatic conditions for each year. This information was then used to estimate the likelihood (high, medium, or low) that climate/weather influenced biological condition in either monitoring period.

In 2012, the South Fork Crow River watershed experienced near normal rainfall amounts (+1.3 in) and above normal temperatures (+1.8°F) during the May to September time period. In comparison, the watershed had an extreme rainfall deficit (-11.9 in) and above normal temperatures (+2.3°F) in 2023 over the May to September time period. Drought conditions during the summer of 2023 forced biological monitoring to sample several sites in 2024 because they were either completely dry in 2023 or sampling integrity was in question due to low water. Conditions in 2024 were much wetter (+3.8 in) with near-normal temperatures (+0.1°F). These departures from the 30-year rainfall and temperature averages can be seen in Figure 11, with 2023 having the least May-September rainfall on record. Overall, given the hot and dry conditions affecting the watershed in 2023 and the near-normal conditions present in 2012, there is a high likelihood that any observed changes in biological condition either across the watershed or at individual sites are at least partially due to differences in climatic conditions between the two periods.

Figure 11. Characterization of air temperature and rainfall conditions for May-September period across the historical record of climate data for the South Fork Crow River Watershed (1941-2024).



The average precipitation and max temperature from 1981-2010 are the dashed lines. Biological monitoring years are highlighted in red.

Clarity of lakes

Water transparency is typically a good indicator of overall lake water quality. As water clarity increases, there is a greater likelihood that water quality standards are being met. The South Fork Crow River Watershed has 14 lakes that met requirements for a trend analysis (50 Secchi measurements and eight years of data). Similar to statewide results, most lakes do not exhibit a significant trend, and more lakes have improving clarity than declining. Four lakes had increasing clarity: Otter Lake, Carrie Lake, Preston Lake, and Ox Yoke Lake. Only Half Moon Lake had declining water clarity.

Climate

The South Fork Crow River Watershed now receives, on average, 2.1 additional inches of rain from the historical average (1895-2018). Climate scientists suggest that precipitation events are becoming more intense. Temperatures in the watershed have increased by more than one degree over this time period. Increased rainfall and temperature can worsen existing water quality problems. More precipitation and reduced snow cover can increase soil erosion, pollutant runoff, and stream flows. Increased stream flows can lead to stream channel erosion and degraded habitat for fish and other aquatic life. Longer algal growing seasons with higher temperatures can lead to more algal blooms. These changes will complicate efforts to protect and restore the watershed [DNR climate summary for the South Fork Crow River Watershed](#).

For more information

This study of the South Fork Crow River Watershed was conducted as part of [Minnesota's Watershed Approach](#) to restoring and protecting water quality. Efforts to monitor, assess, study, and restore impaired waters, and to protect healthy waters are funded by Minnesota's Clean Water, Land, and Legacy Amendment. Stressor identification for new impairments and updates to the Watershed Restoration and Protection Strategy follow the completion of monitoring and assessment. This approach allows for efficient and effective use of public resources in addressing water quality challenges across the state. The data and assessments produced by this study can inform local efforts to restore and protect waters in the South Fork Crow River Watershed, such as the One Watershed One Plan document, a comprehensive watershed management plan that targets projects to protect and restore the watershed's most valuable resources. For more information, go to the [MPCA South Fork Crow River webpage](#), or search for "South Fork Crow River" on the [MPCA website](#).

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