



Le Sueur River Watershed

Minnesota River Basin

Why is it important?

The Le Sueur River in southern Minnesota is a valued local resource water for kayaking, fishing for species like walleye and catfish, birdwatching and other recreational opportunities. However, this river contributes more nutrients and sediment per acre to the upper Mississippi River than almost any other contributing watershed. Extensive agricultural drainage and recent increases in annual precipitation have also accelerated rates of bank and bluff erosion on the Le Sueur River, putting houses and local infrastructure at risk.

Water monitoring is essential to determining 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 Minnesota Pollution Control Agency (MPCA) and local partners conduct an intensive exam of major lakes 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.

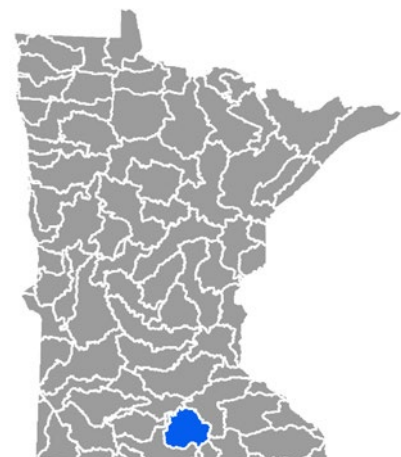
Is the water quality improving?

Overall, scientists observed little change in water quality in the Le Sueur River Watershed (map below) over the past decade. Continued problems include elevated harmful bacteria, excess suspended sediment and low dissolved oxygen levels.

While individual streams in the watershed may have improved or declined in biological condition between 2008 and 2019, the overall health of macroinvertebrate (bug) communities showed little change and fish communities showed a slight improvement. Scientists use a tool called the [Index of Biological Integrity \(IBI\)](#) to assess the biological condition of aquatic communities. High IBI scores indicate a healthy community of fish or macroinvertebrates, and a healthy community indicates that water quality, habitat, and hydrology have not been impacted by human activities.

Landowners have installed hundreds of best management practices to improve water quality, but many more are needed across the watershed. In addition, it takes time for these practices to show an impact.

Figure 1. Le Sueur River Watershed in southern Minnesota.



Water quality is a mixed bag of good and bad news for this watershed:

- St. Olaf and Reeds lakes are seeing improvements in water quality while five additional lakes (Buffalo, Madison, Elysian, Lura, and Bass) with long-term trends are showing no change.
- County Ditch 6 shows an increase in IBI scores for both fish and macroinvertebrates over the last 10 years.
- Flows in the Le Sueur River and its tributaries are increasing as a result of both artificial drainage and increased precipitation. Increasing streamflow has implications for stream channel conditions and pollutant loading. This increase could lead to more channel erosion and possibly more pollutant loading, even though nutrient concentrations and river sediment have remained stable between 2008 and 2018.
- Madison, Lura, and Bass lakes were assessed for fish community and found to be not supporting of aquatic life because of impaired fish IBI. Reeds Lake is right at the impairment threshold and is vulnerable to future impairments based on the fish IBI.

Highlights of monitoring

- Across the Le Sueur Watershed, scientists captured a total of 41 fish species in four lakes during fish IBI sampling. Five of these species are considered intolerant to human stressors within the watershed, indicating good water quality, while six species were considered to be tolerant to these stressors, indicating poor water quality.
- Elevated flows hampered fish sampling efforts in 2018. Fourteen of 44 stream stations were not sampled for fish. Sampling at these locations had to be postponed until 2019 due to persistent high flows. Flows had stabilized enough by August 2018 to allow for nearly every station to be sampled for macroinvertebrates.
- Data from 2018 show that conditions improved for the fish community was previously impaired and now supports the standard, and for macroinvertebrate communities were considered impaired and conditions now support the standard.
- Madison and St. Olaf are part of the Sentinel Lakes Program. The [Sentinel Lakes Program](#) is an intensive, long-term lake ecosystem monitoring program created to detect and understand the physical, chemical and biological changes occurring in Minnesota's lakes.
- Scientists observed improving clarity at one station on the Little Cobb River (Bull Run Creek to Cobb River).

Success story: Shovelnose sturgeon return

Shovelnose sturgeon, a threatened species, may be making a comeback in the Le Sueur River Watershed. The MPCA sampled 71 stream sites in 2008 and found no shovelnose sturgeon at any of the sites. In 2018, the MPCA sampled 38 stream sites and found five shovelnose sturgeon at three stations.

Shovelnose sturgeon are the smallest-growing sturgeon species native to the United States. They feed on aquatic insects, mussels, worms, and crustaceans. The greatest concern for shovelnose sturgeon is the blockage of dams limiting their range and cutting them off from native spawning grounds.

In 2015 the Minnesota Department of Natural Resources (DNR) removed the shovelnose sturgeon from the species of concern list, but they are still on the [International Union for Conservation of Nature](#) and [Natural Resources Red List of Threatened Species](#).



In 2018, MPCA crews sampled five shovelnose sturgeon at three stations in the Le Sueur watershed after finding none in 2008.

Watershed results

Assessment results

The MPCA and partners monitored water quality conditions in the Le Sueur watershed in 2008-2009 and again in 2018-2019. Scientists used chemistry data collected by local partners between 2010 and 2019 for assessment. The data used to assess the condition of Minnesota waterbodies focus on whether they meet water quality standards for aquatic life, recreation, and consumption. The overall goal of these assessments is to determine which waters are healthy and in need of protection, or are polluted and require restoration.

In the Le Sueur River Watershed, elevated bacteria, excess sediment (turbidity) and low dissolved oxygen were the primary chemical impairments found throughout the watershed. Many of these impairments are likely a function of the highly altered land use of this watershed. Intensive agriculture dominates the watershed, with row crops and pastures covering 86% of the land, while forest and wetland cover only 6.5%.

The MPCA determined that two lakes (St. Olaf and Reeds) were meeting aquatic recreation standards. These lakes are small compared to the watershed average and are deep with a maximum depth greater than 15 feet. They also both have small watersheds relative to their surface areas, which likely contributes to their good water quality despite watershed disturbances. Shallow lakes with highly disturbed watersheds due to agricultural and shoreline development are the norm in the Le Sueur River Watershed.

The remaining lakes in the watershed with sufficient data did not support aquatic recreation due to excess nutrients. 2018 and 2019 data confirmed previous nutrient impairments on five lakes that were previously assessed in 2008 and 2009. Ultimately, the condition of lakes in the Le Sueur River Watershed is changing slowly, if at all. Best management practices implemented on the landscape targeting improvements in lake water quality will require time to be reflected in monitoring results. Internal loading (the recycling of phosphorus within a lake) will also have to be addressed after watershed inputs of nutrients are controlled for lakes in the watershed.

The MPCA completed aquatic life assessments based on the fish community for four lakes:

- Bass, Madison, and Lura were found to have impaired fish communities, based on the number of species and number of fish. Stressors that could be influencing those communities include degraded and/or developed shorelines and agricultural land use.
- Reeds Lake is not currently considered impaired, but is identified as vulnerable based on fish community survey results. This lake should be supporting a more diverse fish population as far as number of species.

Protection priority should be given to lakes particularly sensitive to an increase in phosphorus with a documented decline in water quality (measured by Secchi disk transparency), a comparatively high percentage of developed land use in the area, or monitored phosphorus concentrations close to the lake eutrophication standard.

- St. Olaf Lake has good water quality, especially considering the land use and shoreline development pressures that impact the area.
- Bass Lake is identified as vulnerable to becoming impaired for supporting recreation. While phosphorus levels are below the impairment threshold, water clarity and chlorophyll-a (green pigment in algae) are nearing levels considered non-supporting of recreation.
- Buffalo Lake is a lake of concern, as data indicate that nutrient concentrations are too high to meet the recreation standard. However, due to a conflicting and incomplete dataset, the MPCA was not able to assess Buffalo Lake for meeting standards. Lake clarity trends on Buffalo Lake show a significant improvement which underscore the importance and benefits of timely protection efforts on both Buffalo Lake and these other vulnerable systems.

Fish and macroinvertebrate communities are a direct measure of aquatic life in the rivers and streams. Between 2008 and 2018 cycles of biological monitoring in the Le Sueur River Watershed, the MPCA adopted new rules to assess aquatic life in channelized streams and ditches associated with a [Tiered Aquatic Life Use framework \(TALU\)](#). The new rules provide reasonable aquatic life protections for waterbodies that were legally altered prior to the advent of the Clean Water Act. The 2018 sites include Aquatic Life Use designations and assessment results for 11 altered streams segments that were not assessed in 2008.

In the Le Sueur River Watershed, the MPCA found 18 new stream impairments for biology – 10 for fish and 8 for macroinvertebrates (Figure 1).

Based on the 2018 data, the MPCA found that three stream segments had improved as far as fish or macroinvertebrate populations, changing their assessments from impaired to supporting of aquatic life. In fact, the macroinvertebrate community on the lower reaches of the Maple River improved significantly in 2018, with the lowest reach being removed from the state’s impaired waters list. This follows a trend seen in other nearby watersheds of macroinvertebrate communities improving in larger drainage area streams and improved habitat.

In the Le Sueur River Watershed, 88% of the stream sections studied fail to support the standard for aquatic life, based on a review of biology and water chemistry parameters (Figure 2). In 25% of the stream sections studied, fish IBI scores support the standard for aquatic life. Macroinvertebrates IBI scores do better with 48% of the streams studied meeting the standard. In general, fish and macroinvertebrate communities in the watershed exhibit signs of degradation characterized by a dominance of pollution-tolerant species. Aquatic macroinvertebrate communities tended to be in better condition than fish in the larger tributaries and main sections of Le Sueur River.

None of the 10 assessed stream sections were found to be supporting aquatic recreation due to elevated levels of bacteria. Data from the monitoring conducted in 2018-2019 confirmed all previous bacteria impairment listings from past monitoring efforts and resulted in new *E. coli* impairments listings on Bull Run Creek and Iosco Creek (Figure 2).

Figure 2. Assessment results for aquatic life and aquatic recreation of lakes and streams in the Le Sueur River Watershed.

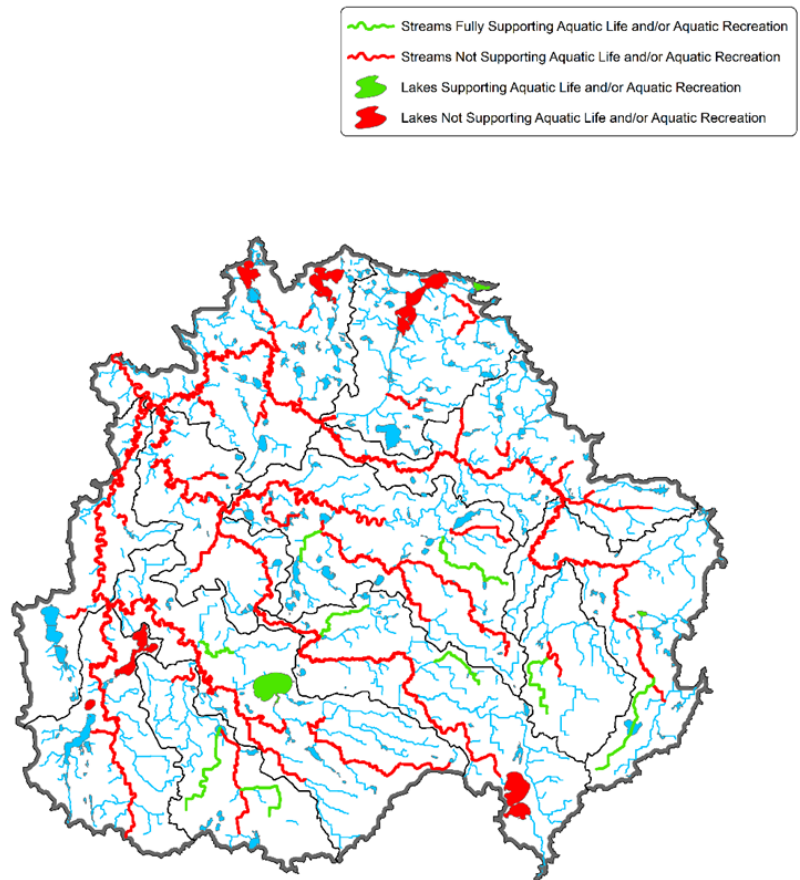
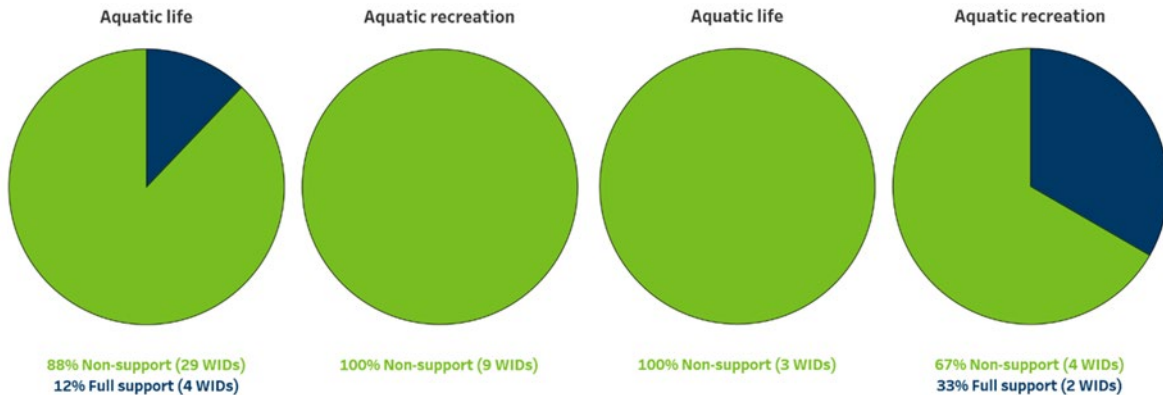


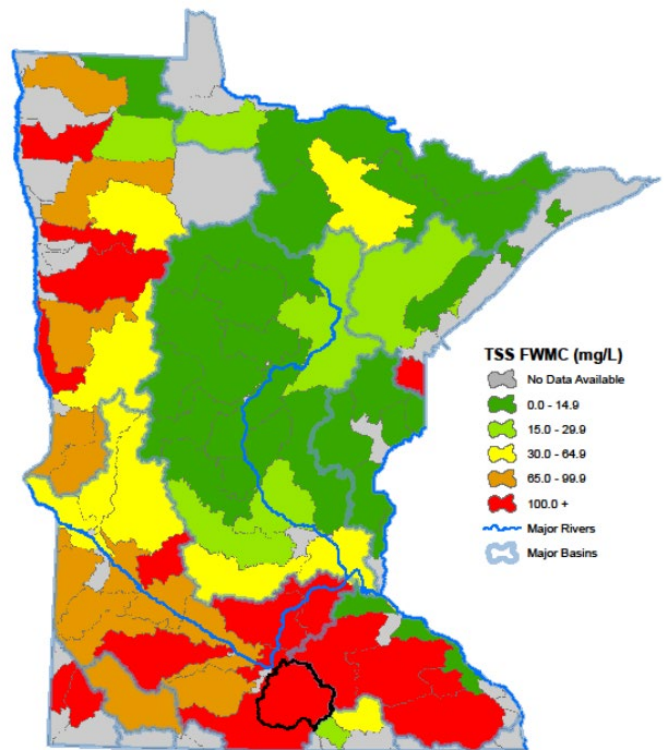
Figure 3. Watershed assessment results for aquatic life in streams and aquatic recreation in streams and lakes by Watershed ID (WID).



Due to the often-negative impact the Le Sueur River has on downstream waters, the MPCA installed six Watershed Pollutant Load Monitoring Network (WPLMN) sites to better understand water quality and pollutant loading dynamics within the watershed. The long-term nature of these stations is critical for trend analysis, measuring between-year differences in pollutant loading, and helping determine pollutant sources and their contributions.

All WPLMN sites within the Le Sueur River Watershed have much higher than desired levels of sediment and nutrients. All sites show relatively consistent concentrations of elevated nitrate-nitrogen. Phosphorus concentrations and loads are also very high throughout the watershed with levels increasing even more as waters flow through the lower sections of the watershed. This is likely a result of phosphorus attached to the additional sediment picked up along these lower sections. Average sediment concentrations are much too high to support the water quality standard with the exception of the Maple River. The Maple River site receives cleaner water from lakes and wetlands within the drainage area, helping to keep sediment concentrations low. Average sediment concentrations at the outlet of the Le Sueur River are very high compared to other watersheds in the region and state; more than four times the water quality standard (Figure 4).

Figure 4. Average total suspended solids flow weighted mean concentration by major Minnesota watershed, with the Le Sueur watershed outlined in black.



The Le Sueur contributes disproportionately high pollutant loads to the Upper Mississippi River basin when compared to other contributing watersheds. For example, the Le Sueur River Watershed accounts for less than 2% of the total drainage area above Lock and Dam 3 near Red Wing, Minnesota, the furthest downstream monitoring site on the Mississippi River above Lake Pepin. Yet it contributes the equivalent of 28% of the sediment load measured at Lock and Dam 3. Nitrate-nitrogen and phosphorus contributions from the Le Sueur have a lesser impact than sediment loads, but are still approximately 11% of the average load at Lock and Dam 3.

Trends

A key objective of the 2017 monitoring effort was to evaluate if and how water quality has changed since 2008. If water quality has improved, it is important to understand to what extent strategy development, planning, and implementation, based on the initial work and combined with actions that were already underway, may be responsible. 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 a robust picture of what is happening in the Le Sueur River Watershed:

- Streamflow and pollutant concentrations (sediment or TSS, total phosphorus, and nitrogen-nitrate)
- Biological communities
- Water clarity
- Climate

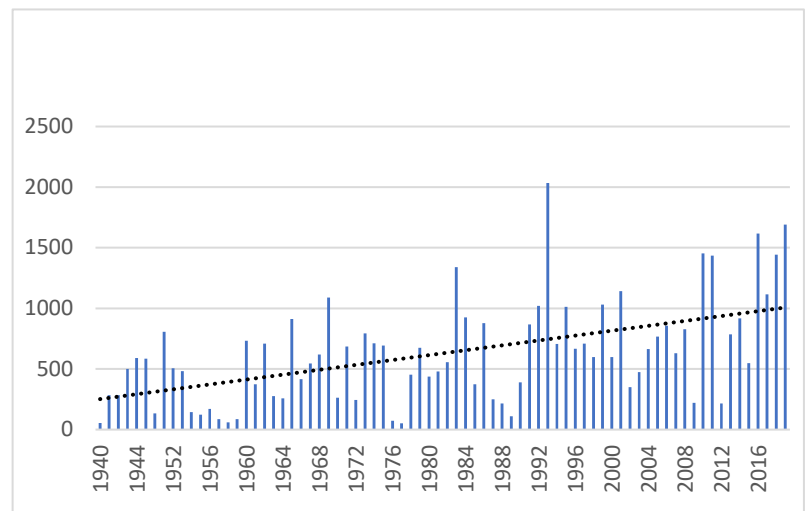
Streamflow and pollutant concentrations

The MPCA conducted trend testing for TSS, total phosphorus, and nitrate-nitrogen sample concentrations from the Le Sueur River outlet to determine if changes over time were statistically significant. No significant trends in river sediment or nutrient concentrations were detected in the Le Sueur River between 2008-2018.

Annual streamflow (discharge) data, however, showed an increasing trend in flow for the Le Sueur River from 1940 through present (Figure 5). Increased streamflow has implications for stream channel conditions and pollutant loading. Additional discharge results in increased channel erosion and larger sediment loads, even if pollutant concentrations are stable.

Increasing flow volumes in the Le Sueur have become a major concern for infrastructure and houses located along the rivers in the watersheds. Streambank and bluff erosion rates are significant throughout the Minnesota River Valley including the Le Sueur River. The recent, wetter than normal climate and ever-expanding agricultural drainage network are considered primary factors. Several houses that were once over 100 feet from the Le Sueur River in the 1970s have been demolished in recent years before the river could claim them. A few miles downstream near the confluence of the Blue Earth and Minnesota rivers, the Minnesota River is threatening to claim one of the City of Mankato's drinking water wells located along its banks; more than 44 feet of bank in front of the well have eroded since 2009, with 23 feet of bank erosion in 2018 alone. The Le Sueur is a major contributor to flow increases in the Minnesota River.

Figure 5. Le Sueur River average annual flow (cubic feet per second) has been increasing since 1940.



Biological communities: Fish and macroinvertebrates

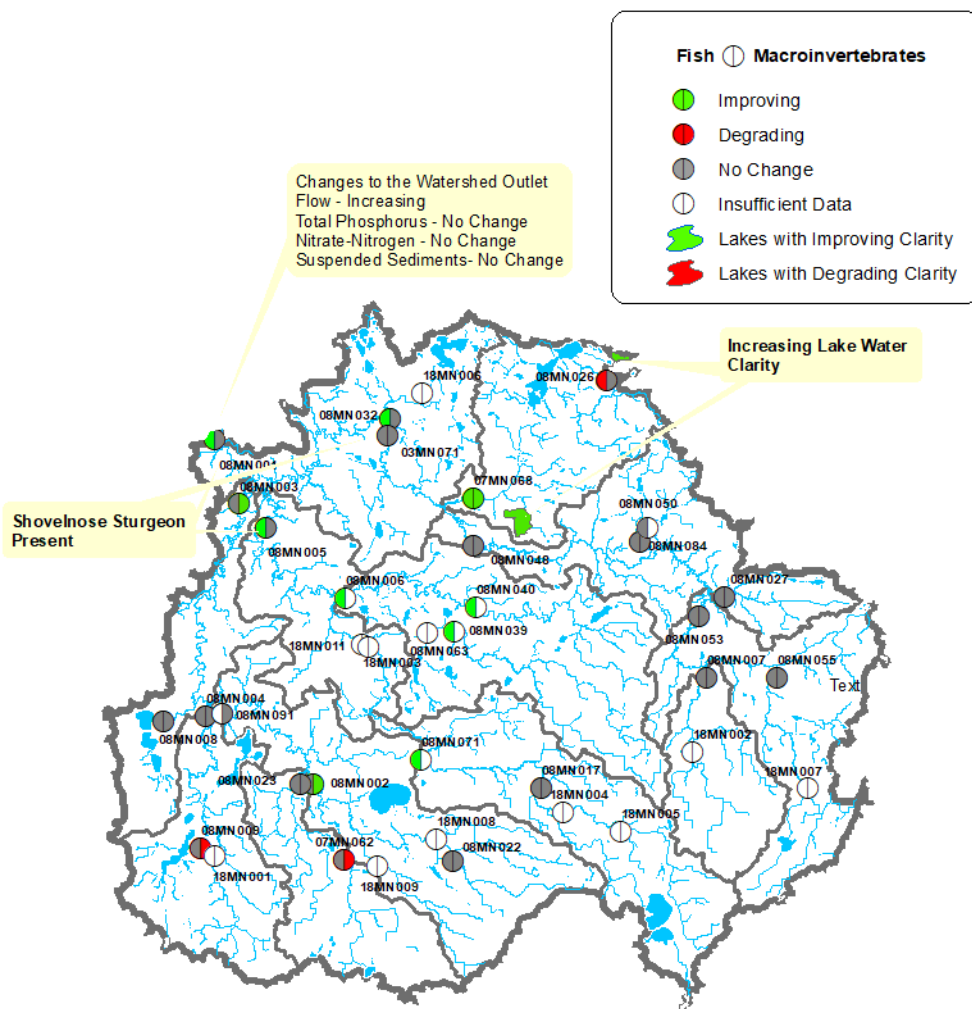
The MPCA used fish and macroinvertebrate IBI scores from 2008 and 2018-2019 to determine any changes in the biological condition of the watershed's rivers and streams. There were 22 sites evaluated for macroinvertebrates and 26 sites evaluated for fish, with these sites being sampled during both monitoring periods (Figure 6). The average macroinvertebrate IBI score for the watershed stayed nearly the same between 2008 and 2018. Fish IBI average scores across the watershed between 2008 and 2019 increased slightly.

In 2008, the Le Sueur River watershed experienced a moderate to severe rainfall deficit (-4.8 inches) and had normal temperatures from May to September. The watershed had extremely high rainfall (+10.2 inches) and above normal temperatures (+1.8 degrees Fahrenheit) in 2018 from May to September. About one-third of the stream stations in the watershed could not be sampled for fish in 2018 due to prevalent high water levels in the watershed, while invert monitoring was successfully completed in 2018. Overall, given the dry conditions affecting the watershed in 2008 and the extremely wet conditions present in 2018, there is a high likelihood that any observed changes in biological condition at either the watershed or individual site scale are at least partially due to differences in climatic conditions between the two periods.

Water clarity

Most lakes within the watershed lack sufficient data needed to determine long-term trends. Seven lakes did meet the data requirements of 50 Secchi disk measurements over at least 8 years, and the MPCA conducted a trend analysis for them. Similar to statewide results, most lakes do not exhibit a significant trend and more lakes have improving clarity than declining. Two lakes had increasing clarity: Reeds and Buffalo. None of the lakes analyzed had declining clarity. Madison, the upper basin of Elysian (upstream of the dam), Lura, Bass, and St. Olaf lakes showed no discernable change in water clarity. Much of the data needed to determine these trends comes from volunteers through the [Citizen Water Monitoring Program](#).

Figure 6. Change in water quality in the Le Sueur River Watershed.



The MPCA also conducted trend analysis was on 17 stream stations across 10 unique stream section that met data requirements. Stream water clarity must change at least 2 centimeters per decade to be considered a detectable change, or trend. Degrading clarity was observed at nine stations, which represent six stream reaches. Improving clarity was observed at one station on the Little Cobb River. The remaining seven stations, which represent five stream sections, showed no trend.

Climate

The Le Sueur Watershed currently receives on average an additional 3.7 inches of rain annually based on a comparison of 2018 data to the historical average (1895-2018). Furthermore, climate scientists suggest that precipitation events are becoming more intense. Meanwhile, the average annual temperature across the watershed has increased by 1.3 degrees Fahrenheit, with a more pronounced increase (+2.5 degrees Fahrenheit) observed from December through February. More precipitation and reduced snow cover can increase soil erosion, pollutant runoff, and stream flow. Increased stream flow in turn can lead to in-stream channel erosion and degraded habitat for aquatic life. Longer growing seasons with higher temperatures can lead to more algal blooms, especially in lakes. These changes will complicate efforts to protect and restore the aquatic resources in the watershed. For a more comprehensive analysis of climate trends for the Le Sueur River Watershed see the Minnesota Department of Natural Resources [climate summary](#).

For more information

Stressor identification for new impairments and updates to the Watershed Restoration and Protection Strategy follow the completion of monitoring and assessment. For more information, go to the MPCA [Le Sueur River webpage](#), or search for “Le Sueur River” on the [MPCA website](#).

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