**Watershed assessment and trends update**

# Mississippi River – Lake Pepin Watershed

## Lower Mississippi River Basin

## Why is it important?

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 exam looks at fish and macroinvertebrate communities as well as water chemistry to gauge water quality. Partners use this information to prioritize waters that are healthy and need protection along with waters that are degraded and need restoration.

The Mississippi River – Lake Pepin (MRLP) Watershed is the watershed scale upon which MPCA's 10-year monitoring schedule is based. It has two distinct portions bisected by the Cannon River, a northern portion represented by the Vermillion River and a southern portion represented by several creeks that flow into Lake Pepin. MPCA's initial exam of this watershed took place in 2011 using data collected 2000-2009, thus establishing baseline conditions for MPCA's 10-year monitoring cycle. A second examination of the watershed is based on monitoring data collected 2010-2019 and assessments conducted in 2020. The focus of this update report is on 2020 results for the Lake Pepin tributaries, a separate Vermillion River report has the latest results from the northern portion of the watershed.

The southern portion of the MRLP Watershed encompasses 322 $mi^2$ and is comprised of several cold water streams that flow directly into the Mississippi River or Lake Pepin such as Wells (the largest in the watershed), Bullard, Miller, Hay, and Gilbert Creeks. The entirety of the watershed lies within the Driftless Area ecoregion, which is characterized by karst topographic features such as rolling hills, porous limestone geology, sinkholes, springs, and valleys. Cold water streams are common in this region of the state and provide countless trout fishing opportunities within an hour drive of the Twin Cities, Rochester, and Mankato.

## Is the water quality improving?

Stream aquatic life in the MRLP Watershed remains healthy in 2020 but there continues to be symptoms of degradation. While most streams demonstrate high biological integrity based on assessments of fish and macroinvertebrate communities, they also have high concentrations of suspended solids. Thus, a high priority should be given to protecting these waters from further degradation.

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 are minimally disturbed by human activities. Macroinvertebrates are animals that can be seen with the naked eye and have no backbone such as aquatic insects (adult or larval stages), crayfish, and snails.

Compared to 2008 results, IBI scores for both fish and macroinvertebrates increased substantially in 2018 among the monitoring stations in the MRLP Watershed. These results are a hopeful sign that stream biological condition is improving in the watershed.

Hundreds of best management practices have been adopted across the watershed and channel restoration work has been accomplished to improve water quality through the collaborative efforts of local, state, and federal government entities as well as private landowners and organizations. More efforts are needed to address current water quality issues and to protect waters currently supporting their designated uses:

- A new total suspended solids (TSS) impairment was listed for Wells Creek based on the high rate of exceedances as well as the observed decline in macroinvertebrate community condition.
- Lake Pepin was not evaluated in this status update for the MRLP Watershed due to the broader scope of its drainage area. More information can be found for Lake Pepin at: http://www.pca.state.mn.us/mvri97f.
- The lower section of Gilbert Creek, impaired for fish in 2011, has been proposed to be removed from the Impaired Waters List based on a more comprehensive fish community data set that now indicates support. The next section upstream has been designated as Exceptional aquatic life in the tiered aquatic life use (TALU) framework.
- Two streams were found to be supporting aquatic life based on the latest monitoring results, Gilbert Creek (-532) and Handshaw Coulee (-553), while several other stream segments remain in support of aquatic life based on previous assessments.

## Highlights of monitoring

- Fish and macroinvertebrate communities remain healthy throughout the streams in this watershed.
- Brook trout densities increased in 2018 at biological monitoring stations located on Bullard Creek, Gilbert Creek, Miller Creek, and Handshaw Coulee.
- At one monitoring station on Hay Creek over 400 brown trout were captured, measured, and released.

## Gilbert Creek supports aquatic life

In 2011, Gilbert Creek was determined to be impaired for aquatic life based on an assessment of fish community data. Since that time, additional fish data were collected because of the suspicion that the low gradient nature of the stream at the monitoring station is unrepresentative of Gilbert Creek's general character. In 2015, the fish impairment was determined to be caused by an over widened stream channel and officially categorized as a 4C impairment (i.e., not caused by a pollutant). To further evaluate the suspected uniqueness of the original biological monitoring station, a second station was added in 2018 a short distance upstream. Based on these monitoring results, both stations appear to be supporting a healthy cold water fish community, prompting a

review of the fish impairment on this section of Gilbert Creek. A proposal to remove the fish impairment from the Impaired Waters List has been approved by the MPCA and is pending approval by US EPA.

## Watershed results

Monitoring data collected between 2010 and 2019 by the MPCA were used in the 2020 surface water quality assessments. The purpose of these assessments is to determine whether lakes and streams are supporting their aquatic life, aquatic recreation, and aquatic consumption designated uses. This was accomplished by comparing measurements of parameters such as TSS, dissolved oxygen, and IBI scores to established water quality criteria. The primary outcome of this process is the identification of waters that are polluted and need to be restored along with waters that are healthy and need to be protected (Figure 1).

The 2020 assessments yielded only one new aquatic life impairment, a TSS impairment on Wells Creek (Figure 2). This determination was based on a robust data set and > 95% of samples over the last decade exceeding the cold water TSS standard of 10 mg/L. These monitoring results corroborated DNR's recent geomorphic surveys of the creek, which showed excessive streambank erosion and sedimentation. While currently still attaining aquatic life expectations, macroinvertebrate community condition appears to be declining in Wells Creek relative to 2008 and earlier 2004 results. The fish community of Wells Creek also attains cold water aquatic life expectations. These mixed results among chemical and biological datasets have recently been documented in other Minnesota streams.

The MPCA is investigating the potential causes and significance of paired high sediment levels with high quality biological communities in Minnesota streams. Wells Creek was officially changed to a cold water aquatic life use classification in Minnesota's water quality standards (Minn. R. Ch. 7050) on June 8, 2020.

Subsequent to MPCA's initial watershed assessment in 2011, a TALU framework was adopted into Minnesota's water quality standards. This new framework allows channelized streams—not assessed in 2011—to be assessed against reasonable aquatic life goals if they were legally altered prior to the advent of the Clean Water Act and currently demonstrate habitat-limiting conditions for fish or macroinvertebrate communities (i.e., modified use). This framework also allows the designation of streams that exhibit exceptional aquatic communities or a much higher quality than would be expected for supporting general aquatic life use goals. Adoption of this framework resulted in the designation of Gilbert Creek (-532) as Exceptional aquatic life. All other sections of streams in this watershed retained the General aquatic life use designation, as there were no streams designated as Modified aquatic life.

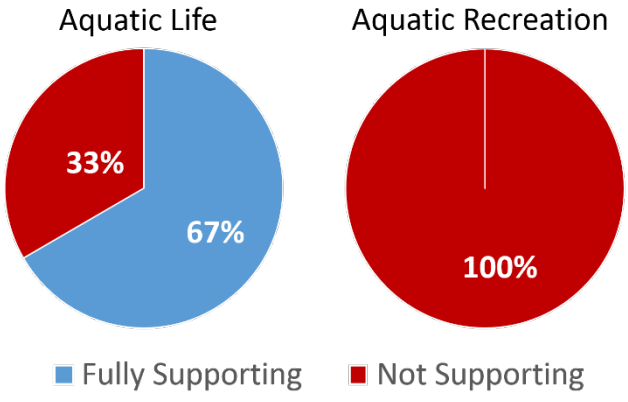


**Figure 1. 2020 watershed assessment results for stream aquatic life and recreation**.

In 2011, several streams were determined to be impaired for aquatic recreation due to excess E. coli concentrations, including sections of Bullard, Gilbert, Hay, Miller, and Wells Creeks. Bacteria concentrations were again measured in 2018 and the results indicate continued impairment of these creeks. No streams in this watershed have been determined to fully support aquatic recreation.

With the exception of Wells Creek, streams in this watershed either demonstrate a healthy aquatic community based on fish and macroinvertebrate community assessments or have an insufficient amount of monitoring data to assess aquatic life. The MPCA is committed to the continued monitoring of major streams in this watershed in 10-year intervals. Lakes in this watershed are primarily associated with the Mississippi River floodplain and highly influenced by the river itself as well as its contributing drainage area. For this reason, lakes were not included in the monitoring and assessment process for the MRLP Watershed, as they are best managed in conjunction with this lower portion of the Mississippi River.

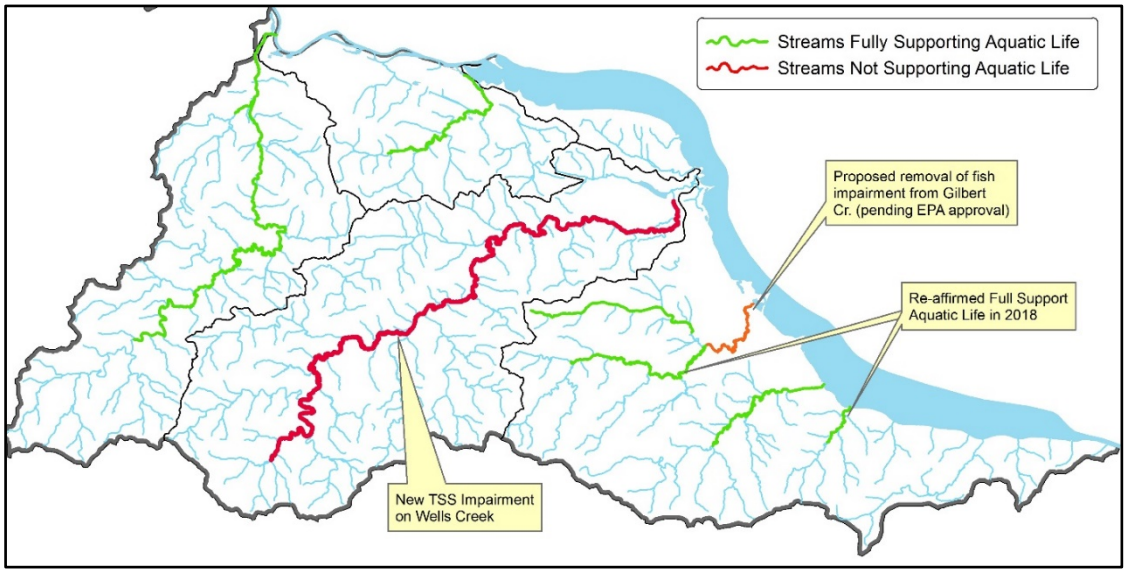


**Figure 2. Summary of stream aquatic life assessments, including full support streams from 2011 assessment**

There is one Watershed Pollutant Load Monitoring Network station in the watershed on Wells Creek that has been sampled intensively since 2013. The relatively small size of the Wells Creek watershed makes it rather difficult to sample for nutrient loads. The station can be unpredictable and flashy as isolated rain storms can hit or miss the small watershed. There have been a considerable number of water retention best management practices (BMPs) implemented in the upper reaches of Wells Creek that may lead to improved water quality. Many of these BMPs were implemented after 2015.

In comparison to neighboring watersheds, specifically the Cannon and Zumbro Rivers, Wells Creek generally produces lower annual flow weighted mean concentrations (FWMCs) of pollutants. TSS concentrations average 113 mg/L, which is high but still lower than its neighboring watersheds. Similarly, of these three watersheds, Wells Creek has the lowest average FWMC of nitrate (3.2 mg/L), total Kjeldahl nitrogen (0.77 mg/L), and total phosphorus (0.17 mg/L). There is an insufficient amount of data at this time to determine whether pollutant concentrations are changing in Wells Creek.

## Trends

A key objective of the 2018 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, this information will help inform future activities.

## Fish and macroinvertebrate communities

Statistical tests of fish and macroinvertebrate IBI scores were used to evaluate whether biological condition of the watershed's streams has changed since 2008. Independent tests were performed on each community with five sites included in each analysis (i.e., sites sampled in both time periods). The average macroinvertebrate IBI score for the MRLP Watershed increased by 11 points and the fish IBI increased by 17 points between 2008 and 2018 (Figure 3). While these results are not statistically significant, largely due to the small number of sites in the analyses, they do provide an indication that stream biological condition in the watershed is at least stable, if not improving. Furthermore, if results from both portions of the MRLP Watershed (Vermillion River + Lake Pepin tributaries) are combined, then statistical significance of the increases in IBI scores (macroinvertebrates +12, fish +13) is easily achieved.

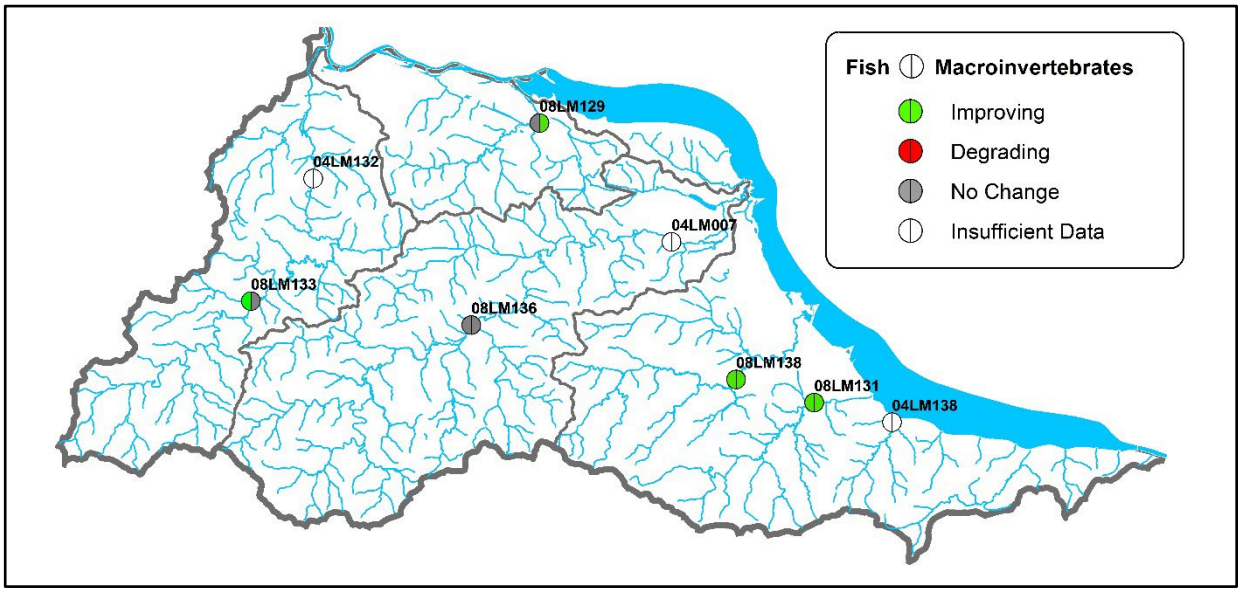


**Figure 3. Biological condition comparison for each community type between 2008 and 2018.**

Context for the observed changes above is provided by a characterization of the conditions that occurred during biological monitoring in 2008 and 2018. In 2008, the MRLP Watershed experienced a moderate to severe rainfall deficit (-5.0 in) and was abnormally cool (-1.3 $^{o}$F) during the May to September time period. Meanwhile, the watershed had above normal rainfall (+3.8 in) and was abnormally hot (+1.6 $^{o}$F) in 2018 between May and September. It is worth noting that a disproportionate amount of rainfall occurred in September of 2018, over 6 inches (~25% of May-Sept total), which was after biological monitoring had ceased in the watershed that year. Overall, given the dry conditions affecting the watershed in 2008 and the wetter than average conditions present in 2018 (Figure 4), there is a moderate likelihood that the 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 monitoring periods.

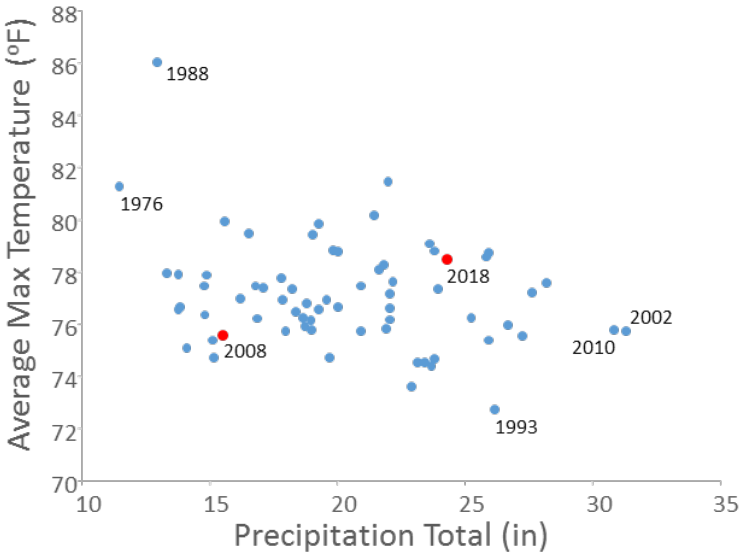


**Figure 4. Characterization of air temperature and rainfall conditions for May-September period across the historical record of climate data for the MRLP watershed. Biological monitoring years highlighted in red.**

## Climate

The MRLP Watershed currently receives on average an additional 3.2 inches of rain annually compared 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 about 1°F, with a more pronounced increase (+2.3°F) observed during the winter (Dec-Feb). 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 MRLP watershed see: http://files.dnr.state.mn.us/natural_resources/water/watersheds/tool/watersheds/climate_summary_major_38.pdf

**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 Mississippi River - Lake Pepin webpage, or search for "Mississippi River – Lake Pepin" on the MPCA website.

**Contact**

John Genet
Minnesota Pollution Control Agency
john.genet@state.mn.us
651-757-2386

CLEAN WATER LAND & LEGACY AMENDMENT

MINNESOTA POLLUTION CONTROL AGENCY