

Lower St. Croix River Watershed

Stressor Identification Update
March 2023

Purpose

Water quality monitoring is essential to determining whether lakes and streams meet water quality standards.

These standards are designed to ensure that lakes and streams are fishable and swimmable. Stressor identification (SID) is a process that looks at specifically why fish and bug communities are suffering. The purpose of Cycle 2 (C2) SID work is to perform SID in a way that supports follow-up watershed restoration and protections strategy (WRAPS) efforts and local water planning and implementation efforts, with an emphasis on meeting local partner needs, protection of biotic integrity, and identifying changes in biotic condition.

The Lower St. Croix River Watershed has many opportunities for recreation such as fishing, canoeing, and camping. Water quality monitoring, identifying impairments, and completing SID work (Figure 1) helps guide where to implement restoration best management practices (BMPs) and where to protect healthy streams that will help to preserve them for future generations. This SID update focuses on streams, while the Minnesota Department Nature Resources (DNR) will produce a SID document focused on lake SID work for this watershed.



Figure 1: Trout Brook near confluence with St. Croix River.

What have we learned about stream health and stressors in the Lower St. Croix River Watershed?

The Lower St. Croix River Watershed (Figure 2) faces issues related to dissolved oxygen (DO) and eutrophication in the Sunrise River and Bone Lake subwatersheds. Much of this can be attributed to agricultural land use, which can allow for excess algal and plant growth reducing already limited DO levels.

Habitat and connectivity were also significant issues in the watershed. The studied areas showed that habitat was a stressor in all four studied reaches and altered hydrology/connectivity was a stressor in three. These stressors were often connected, as issues like stream channelization and beaver/rock dams were significant contributors to sedimentation, lack of course substrates, and limited fish habitat features. Fixing these problem areas should be a high priority to see improvement.

Overall, in the Lower St. Croix River Watershed, there was not a statistically significant change in the Index of Biotic Integrity (IBI) values for fish or macroinvertebrates from 2009 to 2019.

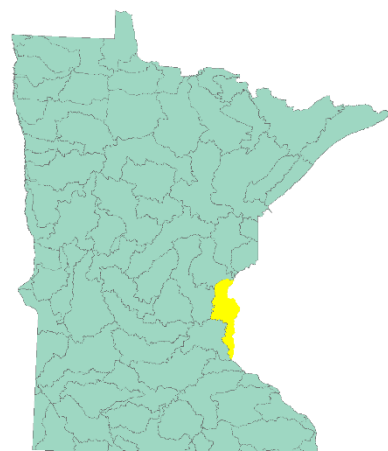


Figure 2: Lower St. Croix River Watershed

Results of these monitoring efforts indicate that restoration efforts and land management best practices have contributed to improved water quality in several water bodies throughout the watershed, while other waters show evidence of declining water quality.

Sediment and nitrate levels in the watershed remained low, however, nutrients were elevated in some of the targeted streams for C2 SID monitoring. Stressors identified such as DO, habitat, and altered stream hydrology/connectivity from the first assessment are still present.

For additional information on the updated conditions of the watershed, see the [Lower St. Croix River-St. Croix Basin: Water Assessment and Trends Update \(MPCA 2022\)](#).

Part 1: Lower St. Croix River Watershed SID Summary Results

Cycle 1 (C1) monitoring and SID reporting in the Lower St. Croix River Watershed focused on the biologically impaired reaches in Rush Creek, Goose Creek, North Branch Sunrise River, Sunrise River, Bloomquist Creek, Unnamed Creek, and West Branch Sunrise River. C1 monitoring was completed in 2010, while C1 SID work was done in 2012 through 2016. Additional SID work was completed in Browns Creek in 2010. See Table 1 for more information regarding these reaches.

Cycle 2 Biological Impairment Summary (MPCA 2022)

- Seven new fish and/or macroinvertebrate impairments were identified during C2 assessment.
- Two stream reaches had aquatic life use impairments that have been proposed to be removed from the Impaired Waters List (IWL).
- Forty-five lakes, ponds, and wetlands show an improving trend in water clarity.
- More than 40% of assessed stream reaches were determined to have low levels of pollution that impact biological communities (fully supporting aquatic life); however, seven streams were newly identified to have water quality conditions that are harmful to fish and/or macroinvertebrate communities.

Cycle 2 Stressor Identification: Areas of focus

The Lower St. Croix River Watershed is a mid-sized watershed and the SID process focused on several areas to gain additional information needed. The following list of streams were studied during the SID process in C2 and are further detailed in this report. These streams were selected based on impairment status, previous SID work, and local stakeholder input. Some streams needed additional information to understand stressor connections, while others needed information on source assessment for prioritization. The amount of information collected in each subwatershed was highly variable depending on the information needed.

- Beaver Creek/County Ditch 3 (07030005-546)
- Unnamed Creek/Trib to Comfort Lake (07030005-522)
- Judicial Ditch 4 (07030005-556)
- Trout Brook (07030005-568)

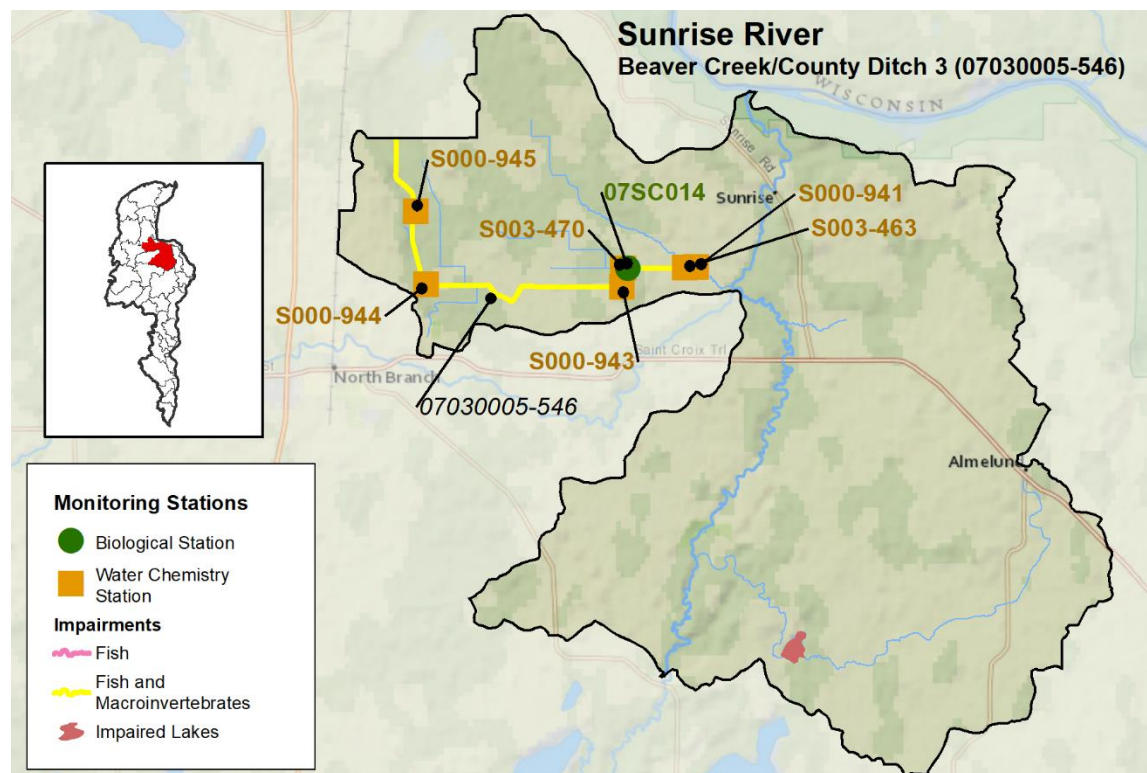
Part 2: Cycle 2 Stressor Identification Stream Reaches

Beaver Creek/County Ditch 3 (07030005-546)

Biological Community Summary

Beaver Creek/County Ditch 3 (-546), in the Sunrise River Subwatershed, is designated as impaired for aquatic life use due to the poor fish and macroinvertebrate community conditions. The fish community was sampled in 2007, 2009, and 2019 at one biological station, 07SC014. The Fish Index of Biological Integrity (FIBI) scores ranged from 21.5 to 25.5, which are all below the Fish Class 11 Northern Coldwater FIBI threshold of 35. These visits showed few coldwater species, while also having high amounts of tolerant fish species. These results limited the FIBI scores throughout stream reach. The macroinvertebrate community was sampled in 2007 and 2019. The Macroinvertebrate Index of Biological Integrity (MIBI) scores were 28.1 (2007) and 20.1 (2019) with both scores being below the Invertebrate Class 9 Southern Coldwater threshold of 43 leading to the impairment designation. See Figure 3 for map of subwatershed.

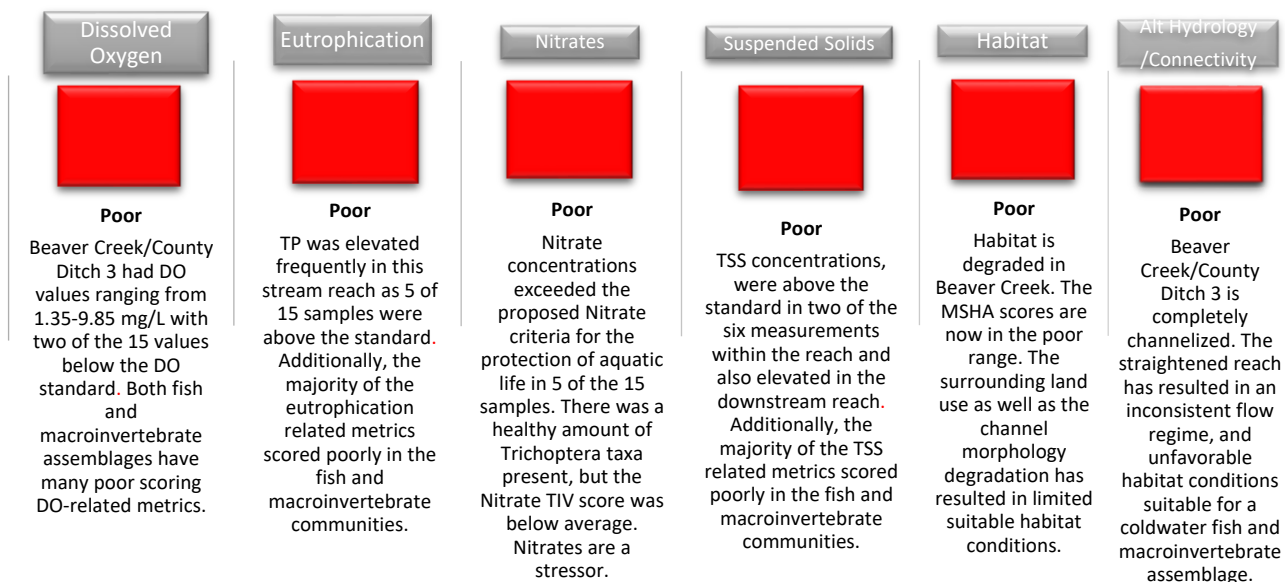
Figure 3: Map of Sunrise River Subwatershed with impairments.



What stressors are of concern?

SID monitoring in the Beaver Creek/County Ditch 3 (-546) did not occur during C1. The goal of C2 SID work was to get additional information on DO, eutrophication, nitrates, connectivity, and stream transparency. C2 SID work focused on and identified DO, eutrophication, habitat, nitrates, suspended solids and flow connectivity/alteration as stressors.

Figure 4: Biological stressor determinations for Beaver Creek/County Ditch 3. Red boxes indicate poor conditions and therefore, a stressor to aquatic life. Yellow boxes indicate fair conditions and indicate a secondary stressor. Green boxes indicate good conditions and not a stressor to aquatic life. Grey boxes indicate that the parameter is inconclusive as a stressor.



Summary of stream health in Beaver Creek/County Ditch 3

Additional biological and water chemistry information throughout Beaver Creek/County Ditch 3 has identified additional focus areas for DO, eutrophication, nitrates, suspended solids, habitat, and altered hydrology/connectivity stress in Beaver Creek/County Ditch 3. Prioritization of future work should consider these stressor impacts at various locations in the Sunrise River Subwatershed.



Figure 5: Land Use in Beaver Creek/County Ditch 3.

- DO and eutrophication issues are present in Beaver Creek/County Ditch 3. DO concentrations tend to drop to harmful levels and fluctuate greatly, which negatively impacts aquatic life. The proximity of the sod farms and increased nutrient load can lead to eutrophic conditions ([NAACAP 2014](#)). BMPs to prevent phosphorus from entering the stream system in this section, as well as upstream, are needed.
- Habitat conditions were considered fair to poor in Beaver Creek/County Ditch 3, with scores decreasing an average of 17 points from 2007 through 2019. Factors limiting the habitat along this reach were the land use (Figure 5) and lack of riparian buffer, the predominant sand substrate, moderate embeddedness, poor sinuosity, sometimes limited depth variability, and fair channel development. The channelization of this stream reach is a significant reason for the poor habitat in this reach.
- Elevated nitrates and TSS were also both found to be stressors in this reach. The proximity of intensive agriculture along with channelized streams is a potential cause of this. Sensitive

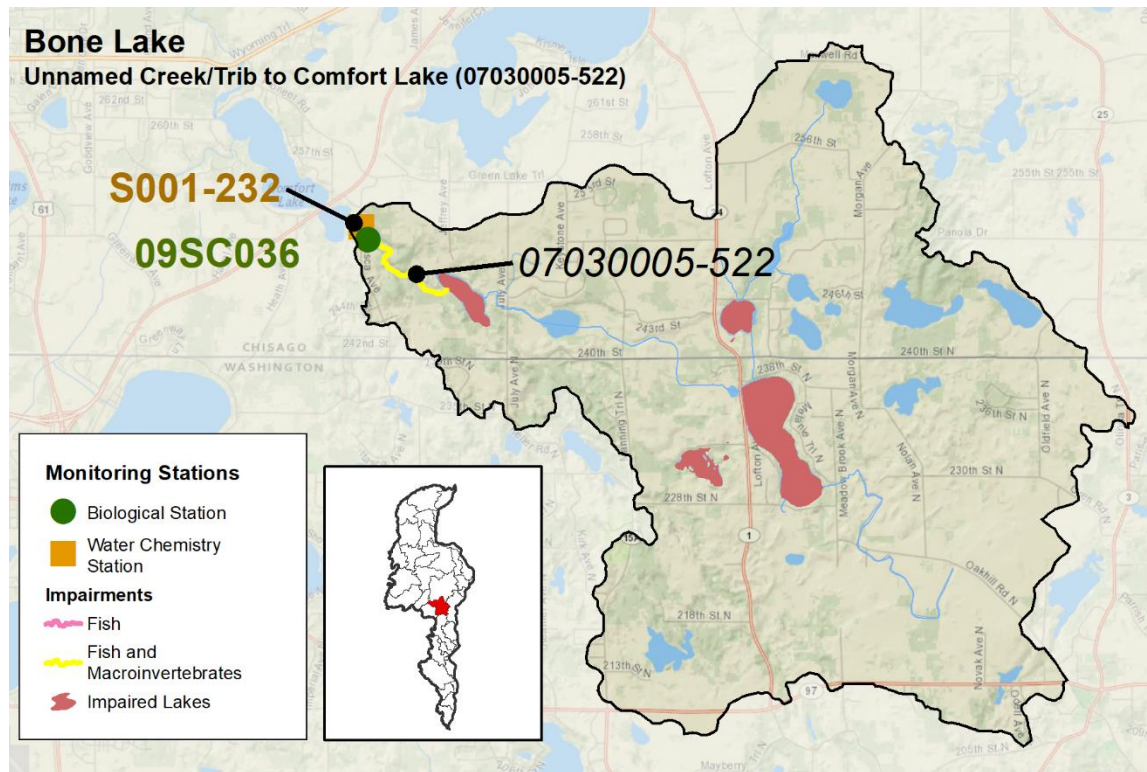
species, most often found in coldwater reaches like this stream, cannot effectively handle the increased amounts of both nitrates and suspended solids, creating a much more tolerant biotic assemblage. BMPs that help reduce both nitrate and sediment load are needed to help improve conditions.

Unnamed Creek/Trib to Comfort Lake (07030005-522)

Biological Community Summary

Unnamed Creek/Trib to Comfort Lake (-522) in the Bone Lake Subwatershed is a 1.30-mile reach that is impaired for aquatic life use due to the degraded fish and macroinvertebrate assemblages. The FIBI scores were 30.5 in 2019 and 32 in 2009 at site 09SC036. These scores were both below the class threshold (42). The MIB score was 16 in 2019, which is well below the MIB class threshold (37). See Figure 6 for a map of Bone Lake Subwatershed.

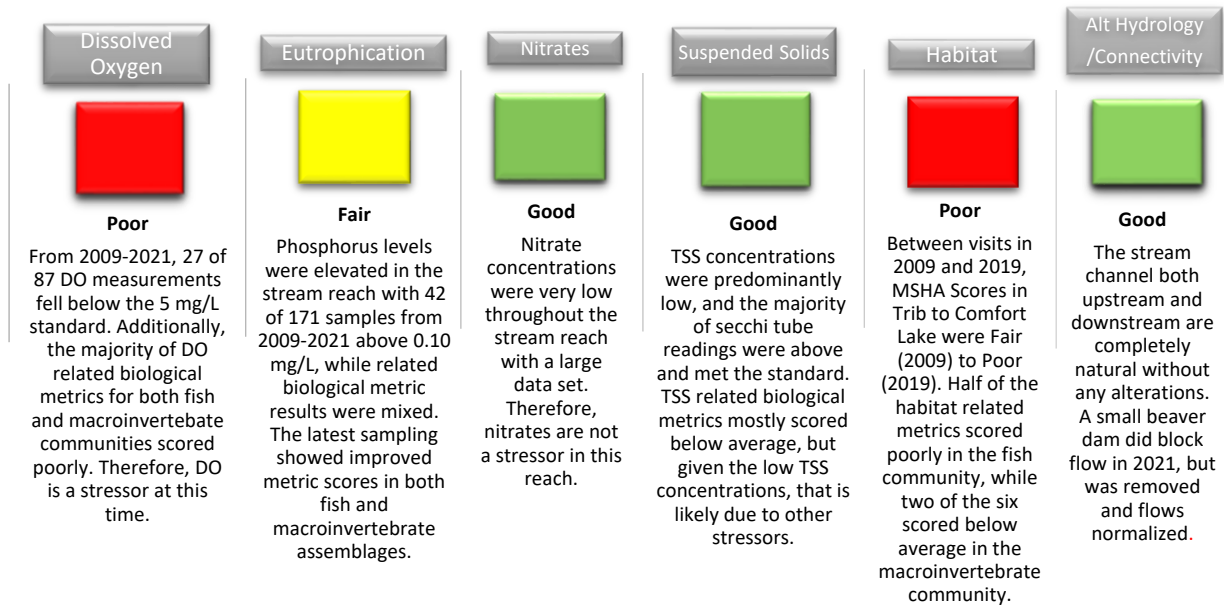
Figure 6: Map of Bone Lake Subwatershed with impairments.



What stressors are of concern?

SID work was not completed in Unnamed Creek/Trib to Comfort Lake during C1 SID. The goal of C2 SID work was to get additional information on DO, eutrophication, nitrates, connectivity, and stream transparency. In this reach, DO, Habitat, and to a lesser extent, Eutrophication were the identified stressors at this time (Figure 7).

Figure 7: Biological stressor determinations for Unnamed Creek/Trib to Comfort Lake. Red boxes indicate poor conditions and therefore, a stressor to aquatic life. Yellow boxes indicate fair conditions and indicate a secondary stressor. Green boxes indicate good conditions and not a stressor to aquatic life. Grey boxes indicate that the parameter is inconclusive as a stressor.



Summary of stream health in Unnamed Creek/Trib to Comfort Lake

Additional water chemistry information taken in 2021 in Unnamed Creek/Trib to Comfort Lake identified additional focus areas for DO and habitat issues, with eutrophication being a potentially larger stressor in the future. Prioritization of future work should consider these stressor impacts at various locations in the watershed.

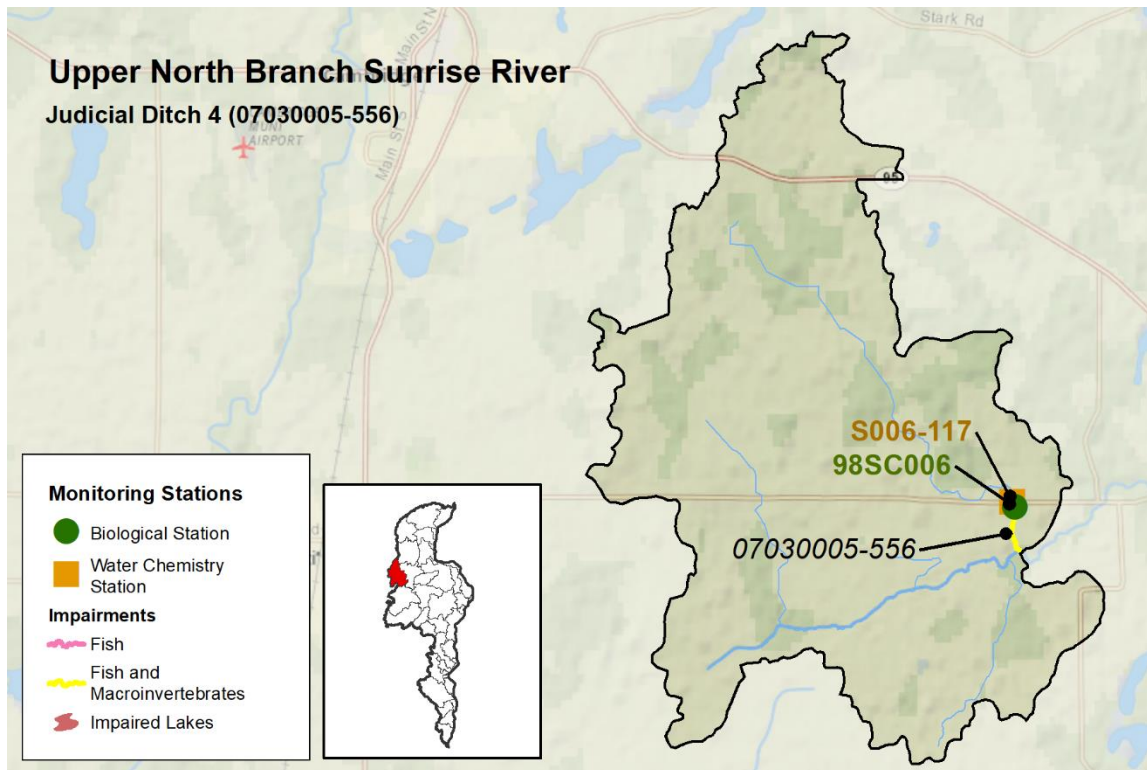
- Unnamed Creek/Trib to Comfort Lake is downstream of School Lake, which is impaired for nutrients due to high levels of chlorophyll-a. Elevated levels of chlorophyll-a and phosphorus can lead to eutrophic conditions and oxygen depletion. This stream reach was experiencing this as DO levels frequently fell below the standard, while phosphorus levels were often elevated.
- Habitat conditions were considered fair in 2009 and then poor in 2019. Limiting the habitat at this site was the sand and silt substrates, severe embeddedness, heavy siltation, moderate channel stability, limited depth variability, no riffles present, poor sinuosity, and channel development. Habitat improvement projects could help further develop and provide more diversity to the biotic communities in this reach.
- A beaver dam has also been present in the culvert under Itasca Ave. This reduces water flow between the two lakes and can also foster low DO and eutrophic conditions.

Judicial Ditch 4 (07030005-556)

Biological Community Summary

Judicial Ditch 4 (-556) is a 0.74-mile reach in the Upper North Branch Sunrise River Subwatershed that is impaired for aquatic life use due to the low fish and macroinvertebrate assemblage scores. The FIBI score was 35 and scored below the general use threshold. The community lacked diversity and was dominated by tolerant species, though a single sensitive species (mottled sculpin) was present in the sample. The MIBI scores were 39 and 40 during sampling visits in 2019 and 2020 at 98SC006. Both scores were below the class threshold of 43. See Figure 8 for a map of the Upper North Branch Sunrise River Subwatershed.

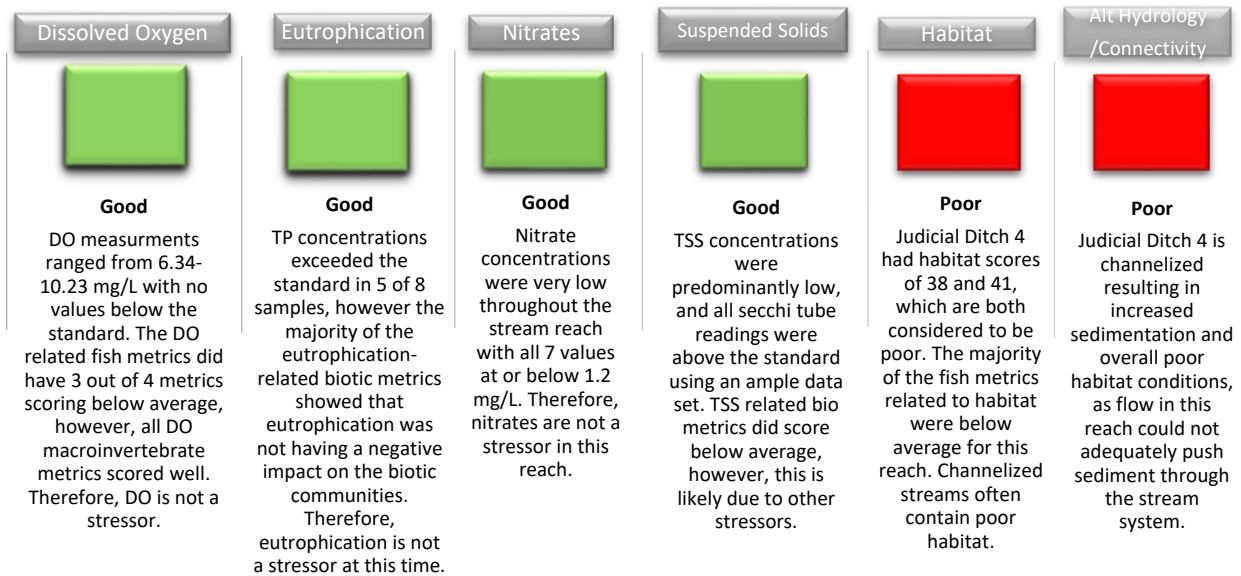
Figure 8: Map of Upper North Branch Sunrise River Subwatershed with impairments.



What stressors are of concern?

SID work was not completed in Judicial Ditch 4 (-556) during C1 SID. The goal of C2 SID work was to gather and analyze the biological and chemical data to determine the likely cause of stress to the impaired fish and macroinvertebrate communities. Based on the information collected and analyzed, it was determined that the negative impacts of stream channelization, as well as poor habitat, are the stressors to biology in Judicial Ditch 4 (Figure 9).

Figure 9: Biological stressor determinations for Judicial Ditch 4. Red boxes indicate poor conditions and therefore, a stressor to aquatic life. Yellow boxes indicate fair conditions and indicate a secondary stressor. Green boxes indicate good conditions and not a stressor to aquatic life. Grey boxes indicate that the parameter is inconclusive as a stressor.



Summary of stream health Judicial Ditch 4

Additional analysis of the biological, water chemistry, and general stream conditions in Judicial Ditch 4 has pointed to the importance of proper flow and connectivity. Without proper flow and connectivity, additional stressors like poor habitat occur. Prioritizing a more natural system in this reach could lead to significant improvements.

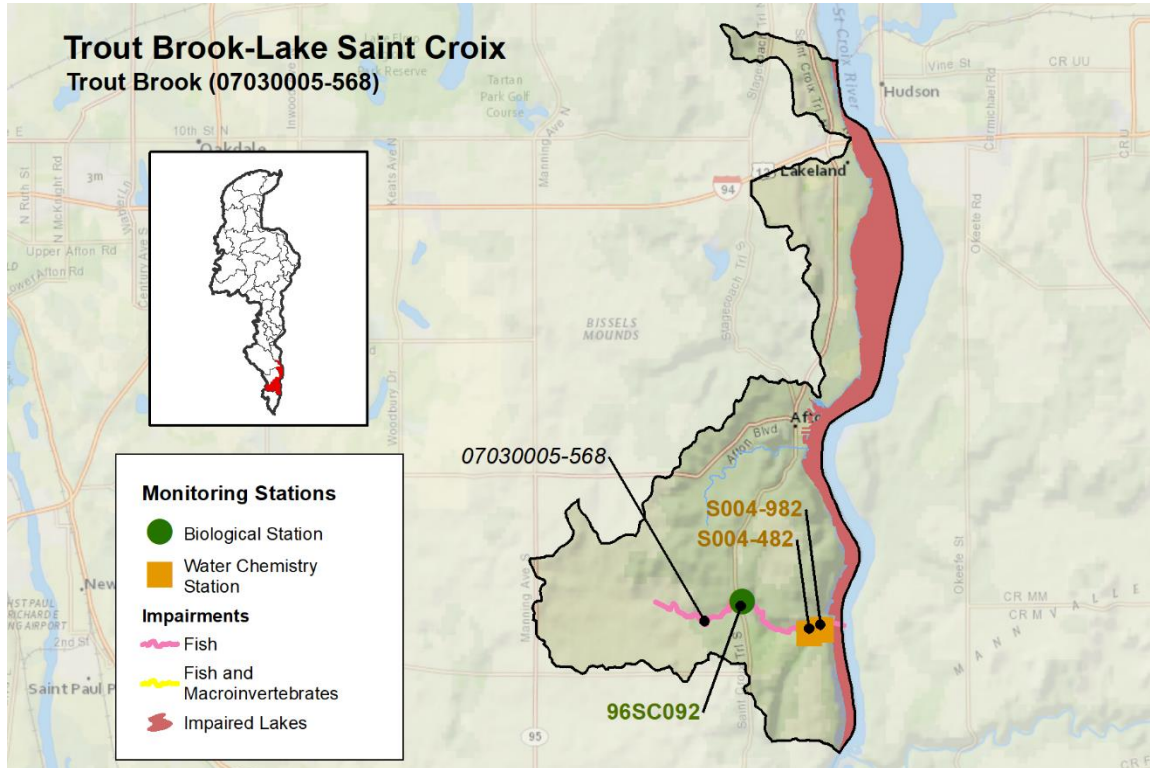
- Altered Hydrology is the driving stressor to aquatic life in Judicial Ditch 4. The prior channelization of this reach has changed the overall flow conditions and the ability of the stream to adequately push sediment through the system. This results in excess sediment settling in the channel limiting the habitat conditions. Restoring a more natural stream system and meanders would help alleviate some of these issues.
- The habitat conditions in Judicial Ditch 4 worsened at site 98SC006 from 1998 (55-fair) to 2020 (41.0-poor). This was primarily due to changes in channel morphology. The dredging of this reach reduced the stability, sinuosity, depth variability, and channel development. Poor habitat leads to tolerant and unhealthy fish and macroinvertebrate communities.

Trout Brook (07030005-568)

Biological Community Summary

Trout Brook (-568) in the Trout Brook – Lake Saint Croix Subwatershed is a 3.90-mile coldwater reach that is impaired for aquatic life use due to the low scoring fish assemblage at its one biological monitoring site, 96SC092. The FBI score at 96SC092 was 52.0 in 2009 before dropping down to 29.5 in 2019 resulting in impairment. The MIBI score at this site was 88.4, which is extremely good. See Figure 10 for a map of Trout Brook-Lake Saint Croix Subwatershed.

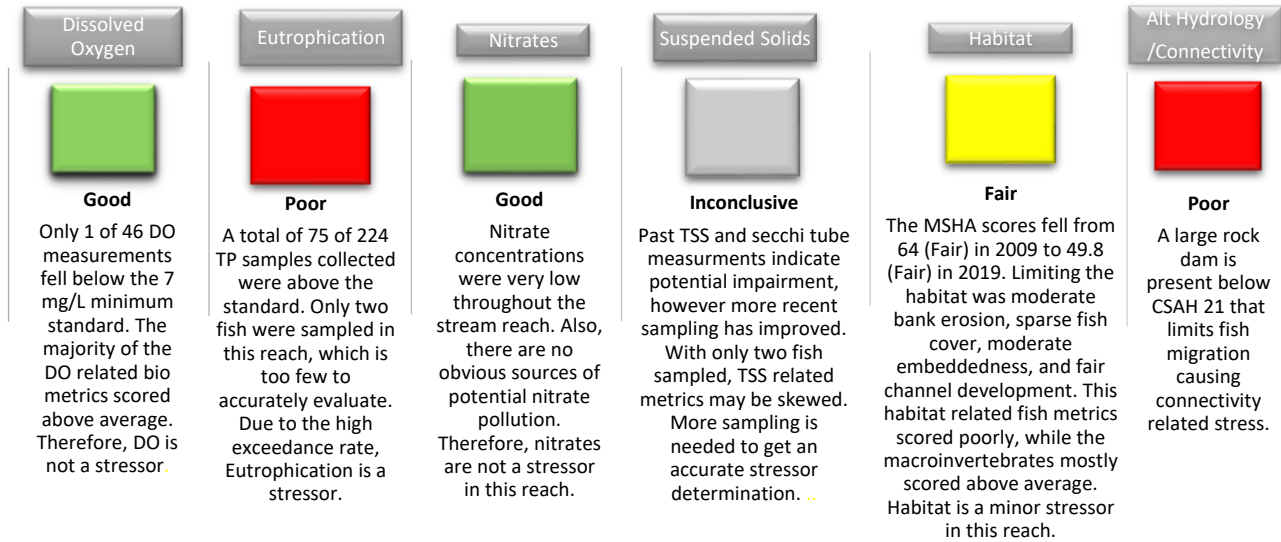
Figure 10: Map of Trout Brook-Lake Saint Croix Subwatershed with impairments.



What stressors are of concern?

SID work was not completed in Trout Brook during C1 SID. The goal of C2 SID work was to gather and analyze the biological and chemical data to determine the likely cause of stress to the impaired fish community. Habitat and Altered Hydrology/Connectivity were the identified stressors, while suspended solids was inconclusive. More suspended solids data is needed to determine if it is having a negative impact on aquatic life. and could also potentially have a negative impact on aquatic life (Figure 11).

Figure 11: Biological stressor determinations for Trout Brook. Red boxes indicate poor conditions and therefore, a stressor to aquatic life. Yellow boxes indicate fair conditions and indicate a secondary stressor. Green boxes indicate good conditions and not a stressor to aquatic life. Grey boxes indicate that the parameter is inconclusive as a stressor.



Summary of stream health in Trout Brook

Additional analysis of the biological, water chemistry, and general stream conditions in Trout Brook has pointed to the importance of connectivity. Barriers that limit fish migration can change fish community dynamics upstream of the barrier. Eutrophication and habitat issues were present along this reach. Additional transparency data is needed to more accurately determine if suspended solids are a significant stressor in Trout Brook.

- Connectivity is a stressor in Trout Brook. A large rock dam located below CSAH 21 is preventing the upstream migration of fish species upstream (Figure 12). Removal of this rock dam will allow for proper fish migration and movement throughout Trout Brook.
- The habitat conditions in Trout Brook worsened over 14 points from 2009 to 2019 at site 96SC092. This was primarily due to the lower substrate and cover amounts. The 2019 visits found a lot more sand and embeddedness, while also having much less fish cover and fewer habitat features present.
- Total phosphorus values exceeded the standard at a very high rate in Trout Brook. This high exceedance rate is likely having a negative impact on the biotic assemblages. These elevated values were found directly downstream of the ski hill. Improving the riparian buffer and limiting Phosphorus access to the stream will likely lead to much improved conditions regarding eutrophication.



Figure 12: Rock dam below CSAH 21 in Trout Brook.

Part 3: Conclusion and Recommendations

Summary of Stressors

The stressors for the biological impairments in the Lower St. Croix River Watershed are listed in Table 1. The most common stressor in the watershed was habitat (4), followed by flow alteration/connectivity (3), DO (2), eutrophication (2), nitrates (1), and suspended solids (1).

Table 1: Stressor determinations for the Lower St. Croix River Watershed.

		Stressors	Dissolved Oxygen	Eutrophication	Nitrate	Suspended Solids	Habitat	Flow Alteration /Connectivity	pH
Stream Name	AUID	Aquatic Life Impairment							
Cycle 2 SID (2021-2022)									
Beaver Creek/County Ditch 3	07030005-546	Fish, Macroinvertebrates	●	●	●	●	●	●	n/a
Unnamed Creek/Trib to Comfort Lake	07030005-522	Fish, Macroinvertebrates	●	●	---	---	●	---	n/a
Judicial Ditch 4	07030005-556	Fish, Macroinvertebrates	---	---	---	---	●	●	n/a
Trout Brook	07030005-568	Fish	---	●	---	○	●	●	n/a
Previous SID (2010-2016)									
Browns Creek*	07030005-520	Fish	●	○	●	●	●	●	n/a
Browns Creek**	07030005-587	Fish, Macroinvertebrates	●	○	●	●	●	●	n/a
Sunrise River, North Branch	07030005-501	Fish	●	○	---	●	●	●	○
Rush Creek	07030005-509	Fish, Macroinvertebrates	●	○	---	---	●	●	---
Goose Creek	07030005-510	Fish	●	●	○	---	●	●	---
Sunrise River	07030005-527	Fish, Macroinvertebrates	●	●	---	○	●	●	---
Sunrise River, West Branch	07030005-529	Fish, Macroinvertebrates	●	●	---	●	●	○	○
Sunrise River (Pool 3)	07030005-539	Fish	●	○	---	○	●	●	---
Sunrise River	07030005-540	Fish	○	---	---	○	---	●	---
Unnamed Creek	07030005-601	Fish	●	●	○	●	●	●	---
Unnamed Ditch	07030005-723	Fish	●	●	○	○	●	○	---

● = stressor; ○ = inconclusive stressor; --- = not an identified stressor

* Browns Creek (-520) also had water temperature and copper stressors

** Browns Creek (-587) also had a water temperature stressor

Recommendations and Additional Monitoring

In the Lower St. Croix River Watershed, the most common stressors identified were habitat, flow alteration/connectivity, DO, and eutrophication. These stressors are largely tied to land use activities in the watershed, as well as human-caused alterations to the stream channel and flow regime. Table 2 contains recommendations of possible solutions to these stressors.

Table 2. Recommended prioritization of restoration activities relative to the stressors contributing to the biological impairment in the Lower St. Croix River Watershed.

Stressor	Priority	Comment
Habitat	High	Re-establish quality riparian corridor to increase woody debris, stream stability, and stream shading. Protecting streambanks, reduce erosion and overall stream sedimentation, as well as potentially re-meandering channelized stream sections, specifically in Beaver Creek/County Ditch 3 and Judicial Ditch 4.
DO and Eutrophication	High	Utilize a variety of nutrient reducing BMPs such as filter strips, increased vegetative buffers and nutrient management targeting headwater reaches as well as Beaver Creek, Trib to Comfort Lake, and Trout Brook.
Flow Alteration/Connectivity	High	Removal of beaver dams, especially in Trib to Comfort Lake, will encourage more fish movement between the lakes. Additionally, the removal of the rock dam in Trout Brook will allow for improved fish migration and movement. Re-meandering channelized stream sections in the watershed will also prevent flashy flow regimes, create more channel stability, as well as improve habitat conditions.
Suspended Solids	Medium	Focus on reducing sediment input from riparian corridor and immediate stream channel (stream banks). Increased sediment stress was found in the Beaver Creek/County Ditch 3 stream system.
Nitrates	Medium	Focus on reducing nitrates and their access to Beaver Creek/County Ditch 3, specifically in the highly intensive sod farming areas.

For more information

WRAPS updates, including necessary TMDLs, follow the completion of the SID process. For more information, go to <https://www.pca.state.mn.us/watershed-information/lower-st-croix-river> or search for “Lower St. Croix River Watershed” on the MPCA website.

Details and specific monitoring information related to the SID analysis of this report is available from the contact person below.

Contact person

Michael Koschak
Minnesota Pollution Control Agency
michael.koschak@state.mn.us
651-757-2504



Document number: wq-ws5-07030005b

