

SID Update

Goose Creek Watershed 2022



The purpose of Cycle 2 stressor identification (SID) work is to perform SID in a way that supports Cycle 2 watershed restoration and protection efforts, with an emphasis on meeting local partner needs, protection of biotic integrity, and identifying changes in biotic condition. Cycle 2 SID work will provide sharper focus in adding value to local partner implementation planning efforts. SID staff will seek to strengthen local partnerships and provide scientific analyses and recommendations in a format and timeframe that is most useful to local partners.

Goose Creek Watershed was identified for Cycle 2 SID work via conversations with local partners and professional judgement from the Minnesota Pollution Control Agency (MPCA) staff. Factors that lead to selection included:

- Potential future implementation projects.
- Large drainage area with limited chemistry data.

Goals for Cycle 2 SID work in Goose Creek Watershed included:

- Summarize current chemical, biological, and physical conditions and identify changes between Cycle 1 and Cycle 2.
- Identify potential stressors and pollutant sources that threaten future biological condition; the goal is to keep fish and macroinvertebrates healthy and free of impairment.
- Identify any “hot spots” or areas contributing a disproportionate amount of a pollutant.
- Identify and prioritize protection areas.
- Provide value to local planning efforts.

This SID update document summarizes biological condition and provides monitoring highlights and stressor conclusions for Goose Creek Watershed. The Goose Creek Watershed is a warmwater ditch system with headwater lakes (Upper and Lower Twin); this watershed is dominated by agriculture and located near the Minnesota/Iowa border in the Southwest corner of the Shell Rock River Watershed.

Biological Communities

Fish and macroinvertebrate communities in the Goose Creek Watershed are meeting standards. There are four biological monitoring stations (04CD028, 07CD002, 09CD071, and 09CD081), all of which are located in the lower portion of the watershed (Table 1, Figure 1). All stations were sampled in Cycle 1, but only 09CD071 was sampled in Cycle 2. Also, only macroinvertebrates were sampled in Cycle 2 at station 09CD071; the macroinvertebrate index of biotic integrity (MIBI) scores improved from 20.9

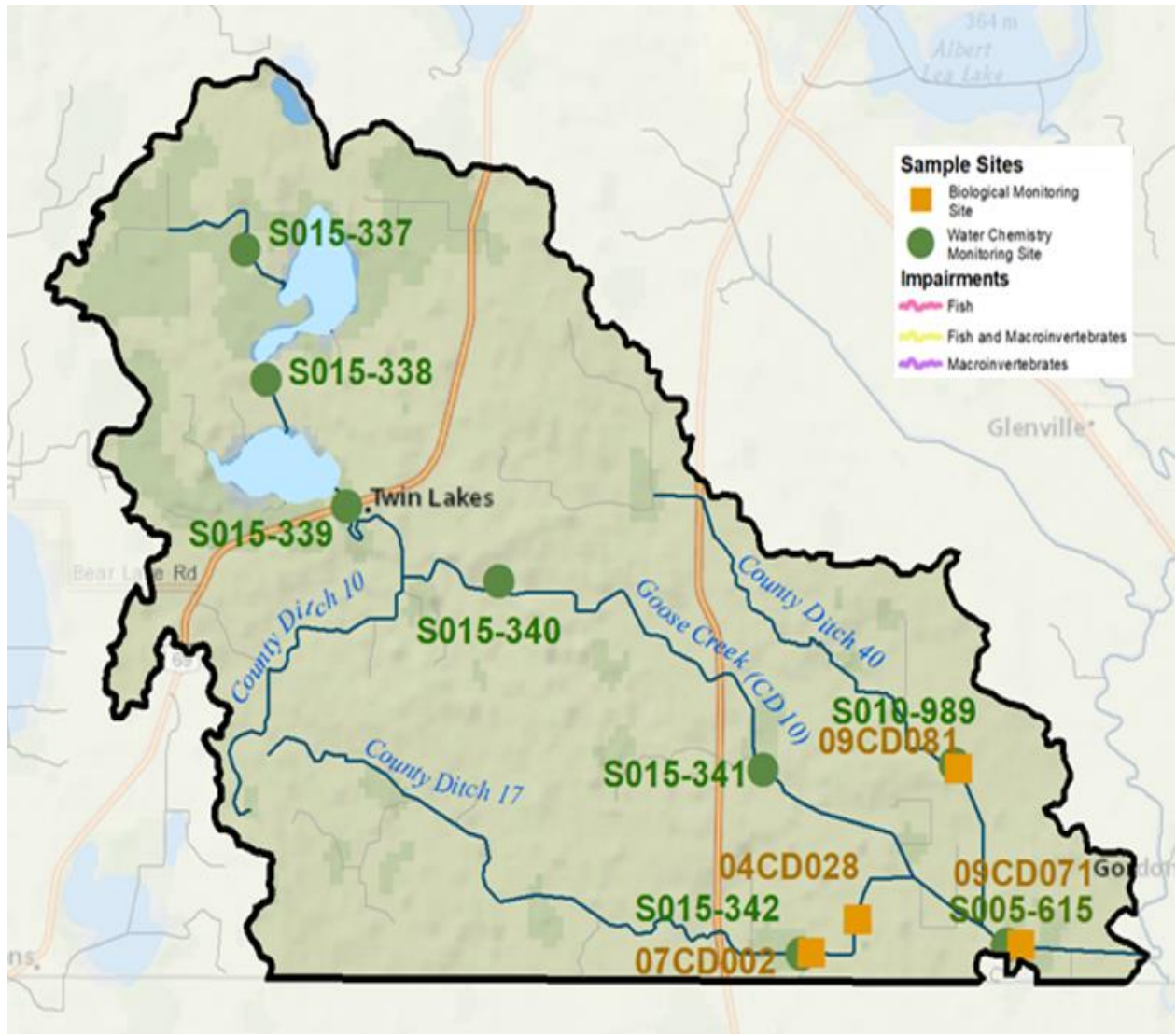
(Cycle 1) to 37.5 (Cycle 2). *Coenagrionidae* (damselflies) and *Hyalella* (amphipods) were the most abundant macroinvertebrates in Cycle 2. No recent fish data exists, but yellow perch and minnow/shiner (Cyprinidae) species comprised a large portion of fish communities sampled across the watershed in Cycle 1.

In general, biological communities in the Goose Creek Watershed are marginal. The stream reaches are considered “modified use” and therefore assessed against lower standards; all stations are close to impairment thresholds. Also of note, station 09CD071 is located on a class 7 (limited use) water and therefore not assessed for fish and macroinvertebrates; class 7 waters do not have biological standards.

Table 1: Fish and macroinvertebrate IBI scores in Goose Creek Watershed.

Waterbody	AUID	Biological Stations	Biological Impairment	Class	FIBI	FIBI Threshold	FIBI Year	MIBI	MIBI Threshold	MIBI Year
Goose Creek (County Ditch 10)	505	09CD071	None	7	57.4	NA	2009	20.9 37.5	NA	2009 2019
County Ditch 17	510	04CD028	None	2Bm	45.5	33	2004	30.4 32.1	30	2004 2004
		07CD002			39.7	33	2007	26.7	30	2009
					48.1		2009			
					30.7		2009			
County Ditch 40	532	09CD081	None	2Bm	33.4	15	2009	30.4 33.5	30	2009 2009

Figure 1: Goose Creek Watershed monitoring stations and biological impairments.



Monitoring Highlights

Stream Temperature

Several instantaneous (point) measurements were collected throughout the watershed over the last decade (2011 through 2020), and stream temperatures ranged from 0.2°C to 24.7°C (107 samples). There were zero values greater than 30°C (daily average warmwater standard); temperature is adequate to support warmwater biota.

TSS

Total suspended solids (TSS) samples were collected across the watershed as part of SID in 2019, with a goal to sample various flow conditions and establish a range of TSS concentrations (Figure 2). Concentrations ranged from 1 – 56 mg/L (average of 16.3 mg/L), and zero of the fifty-six samples exceeded the warmwater TSS standard (65 mg/L). In general, TSS concentrations were low across the watershed. It's important to note that although TSS concentrations are low, sediment is still a concern via habitat loss and degradation from an abundance of fine substrate and embeddedness (see habitat section below).

Nitrate

Nitrate samples were collected across the watershed as part of SID in 2019, with a goal to sample various flow conditions and establish a range of nitrate concentrations (Figure 2). Concentrations ranged from 0.05 – 12 mg/L (average of 2.9 mg/L), and only one (2%) of the fifty-six samples was above 10 mg/L. Station S015-337 (Inflow to Upper Twin Lake) had the only value greater than 10 mg/L, and was consistently higher than the other stations. In general, nitrate concentrations are moderate across the Goose Creek watershed with very low concentrations at the outflows of Upper and Lower Twin Lakes. The nitrogen poor water from the lakes is likely a result of denitrification and/or plant uptake; concentrations gradually increase moving downstream. Nitrate tolerant macroinvertebrates were limited on Goose Creek (station 09CD071), but abundant on County Ditch 17 (stations 04CD028 and 07CD002) and County Ditch 40 (station 09CD081).

TP

Total phosphorus (TP) samples were collected across the watershed as part of SID in 2019, with a goal to sample various flow conditions and establish a range of TP concentrations (Figure 2). Concentrations ranged from 0.04 – 0.964 mg/L (average of 0.187 mg/L), and twenty-five (45%) of the fifty-six samples exceeded the river eutrophication standard for the South Region (0.15 mg/L). All stations had multiple exceedances, which occurred during low flow and elevated flow conditions. In general, TP concentrations were elevated and eutrophic conditions were documented (Figure 3). Concentrations from Upper and Lower Twin Lakes were low during the early part of the year and elevated during summer and fall; increases in outflow concentrations are likely linked to plant/algal production in the lakes. Also, Goose Creek concentrations were consistently higher than the ditch tributaries (County Ditch 17 and 40).

DO

DO ranged from 0.6 mg/L to 7.7 mg/L across the watershed during early morning DO surveys in 2019. Early morning DO surveys were conducted on 7/23/19, 8/2/19, and 8/30/19 to characterize conditions and identify low DO. Several exceedances (50%) of the warmwater DO standard (5 mg/L) were identified, with most occurring in the upper part of the watershed near Upper Twin Lake and Lower Twin Lake. DO surveys were also conducted in 2020 near the mouth of Goose Creek (station S005-615) and all three samples were above the standard; however, low DO (3.9 mg/L) was documented at this station during a field visit in August 2021. There were also several instantaneous (point) measurements collected throughout the watershed over the last decade (2011 through 2020), and twenty-three (22%) were below 5 mg/L. In general, low DO tolerant fish and macroinvertebrates were abundant across the watershed.

Habitat

The MPCA Stream Habitat Assessment (MSHA) score at station 09CD071 decreased between Cycle 1 and Cycle 2; the Cycle 2 score was 17. Sub-category scores (Land Use, Riparian, Substrate, Cover, and Channel Morphology) were similar in both cycles with the exception of Cover which decreased significantly in Cycle 2. Overall, habitat is poor with limited cover and an abundance of fine substrate. In general, fish and macroinvertebrate metrics across the watershed are indicative of habitat stress with elevated burrowers and legless individuals, reduced clingers, and limited riffle species. Often times this type of metric response is associated with lack of coarse substrate and/or woody debris, fine substrate, embeddedness, channelization, etc.

Flow Alteration

The Goose Creek watershed is dominated by ditch systems. Channelization is often associated with poor habitat, an abundance of fine substrate, excess nutrients and productivity, altered DO regimes (low DO and high DO flux), and minimal flow time periods. Tile drainage is also common in these landscapes and typically a large source of the nitrogen load.

Figure 2: 2019 TSS (brown box plots), TP (purple box plots), and nitrate (green box plots) concentrations (mg/L) in Goose Creek Watershed. The red lines represent the TSS standard (65 mg/L), river eutrophication standard for the South Region (0.15 mg/L), and nitrate drinking water standard (10 mg/L).

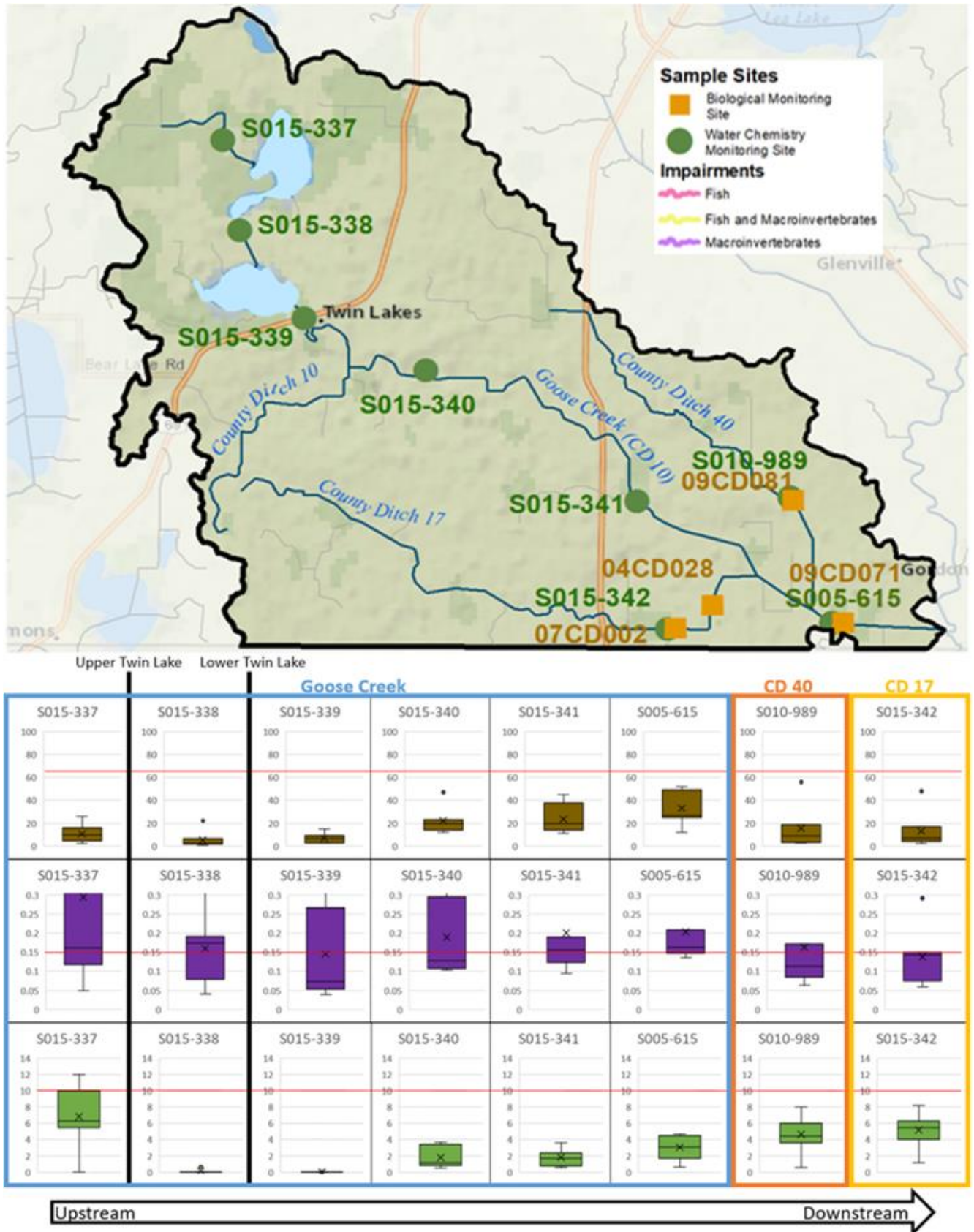


Figure 3: Algal productivity at station 09CD071 in 2009 (top left, top center) and 2019 (top right), station 09CD081 in 2009 (bottom center) and 2021 (bottom left), and station 07CD002 in 2021 (bottom right).



Summary

- Currently there are no biological impairments (thus no stressors per se), but excess nutrients (nitrate and total phosphorus [TP]), low dissolved oxygen (DO), poor habitat, and flow alteration are impacting fish and macroinvertebrate health in the Goose Creek Watershed. Although not impaired, the biological communities aren't great as many are close to or below modified use thresholds.
- Flow alteration has significant influence in the Goose Creek Watershed. Nitrate and habitat in particular are impacted by flow alteration through tile drainage and channelization. The Goose Creek Watershed is dominated by ditch systems. Channelization is often associated with poor habitat, an abundance of fine substrate, excess nutrients and productivity, altered DO regimes (low DO and high DO flux), and minimal flow time periods. Tile drainage is also common in these landscapes and typically a large source of the nitrogen load. All of these characteristics associated with channelization exist in the Goose Creek Watershed.
- Data suggest that Upper and Lower Twin lakes are a source of low DO and elevated TP during certain times of the year, which is likely linked to plant and/or algal production in the lakes. Very low flow conditions, which are common during summer/fall in drainage ditches, may also be driving low DO periods and environments.
- In addition to the lakes, other potential sources of TP include surface water runoff and tile water from agricultural lands, feedlots and associated manure application, point sources (Twin Lakes wastewater treatment plant (WWTP) and Albert Lea Travel Information Center), ponds/wetlands, and phosphorus release from ditch sediments.

- Nitrate concentrations in the Upper Twin inflow (station S015-337) were elevated and consistently higher than other stations, while the lake outflows had very low concentrations (likely due to denitrification and/or plant uptake).
- Although TSS concentrations are generally low, sediment is a concern via habitat loss and degradation from an abundance of fine substrate and embeddedness.
- Overall, reducing nitrate and phosphorus loading, improving in-stream habitat and DO conditions, and addressing flow alteration related issues (e.g. poor habitat, fine substrate, nitrogen rich tile water, etc.) are critical to ensure fish and macroinvertebrate communities remain healthy in the Goose Creek Watershed.

For more information

For more information, go to <https://www.pca.state.mn.us/water/watersheds/shell-rock-river>.

Contact person

Joe Magee
Minnesota Pollution Control Agency
joe.magee@state.mn.us
507-206-2601

