

April 2019

# Lake Brekken

(47.545261 N, -100.89404 W)

## McLean County

- Lake Brekken is a large, natural lake in central North Dakota (Figure 1). See map at (<https://gf.nd.gov/gnf/maps/fishing/lakecontours/brekken2003.pdf>)
- There is one paved, public boat ramp on the west side of Lake Brekken.
- The Lake Brekken watershed is about 1,200 acres of mostly grassland/pasture, open water agricultural land. The most common crops grown are spring wheat, soybeans and canola (Table 1).
- Lake Brekken is a Class II fishery, which are “capable of supporting natural reproduction and growth of cool water fishes (e.g., northern pike and walleye) and associated aquatic biota.”
- Lake Brekken is managed for walleye, with fingerlings stocked biennially. Yellow perch were also found during the last sample by the ND Game and Fish.
- Lake Brekken was previously assessed in 1994-1995 and 2005-2006.

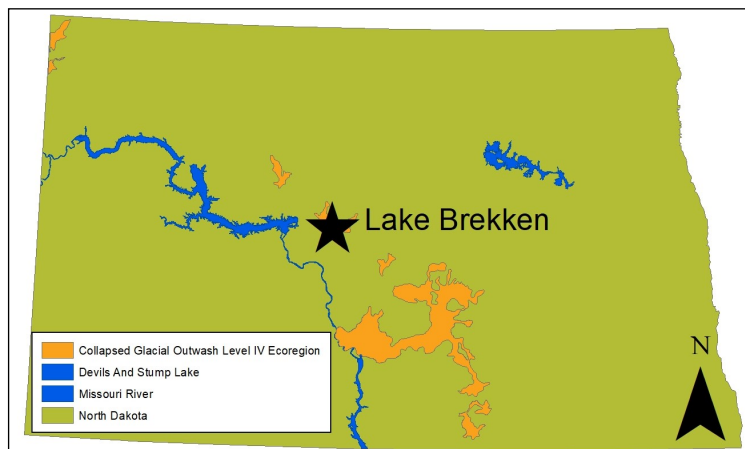


Figure 1. Location of Lake Brekken within the state

Table 1. Percentage of land cover in the watershed and near the lake (NASS, 2017). Value listed of crop type represents percentage of total production.

Land Cover Type	% in Watershed	% within 500 meters
Grassland/Pasture	53.1%	57.6%
Open Water	20.3%	7.5%
Agriculture	19.1%	23.4%
Spring Wheat	45.4%	36.4%
Soybeans	38.2%	8.8%
Canola	14.3%	NA
Developed	5.1%	8.5%
Wetlands	2.2%	2.9%
Forest	< 0.1%	0.1%

## Temperature and Dissolved Oxygen

- Lake Brekken stratifies in the summer, with warm, well-oxygenated water at the top of the water column, and cold, low-oxygen water near the bottom.
- There was thermal stratification in May of 2018. Temperature change in the water column was 10.51 degrees Celcius (°C), 0.67°C and 0.09°C in May, July and September, respectively.
- All samples showed most of the lake as well-oxygenated, with only near-bottom concentration being low during thermal stratification.

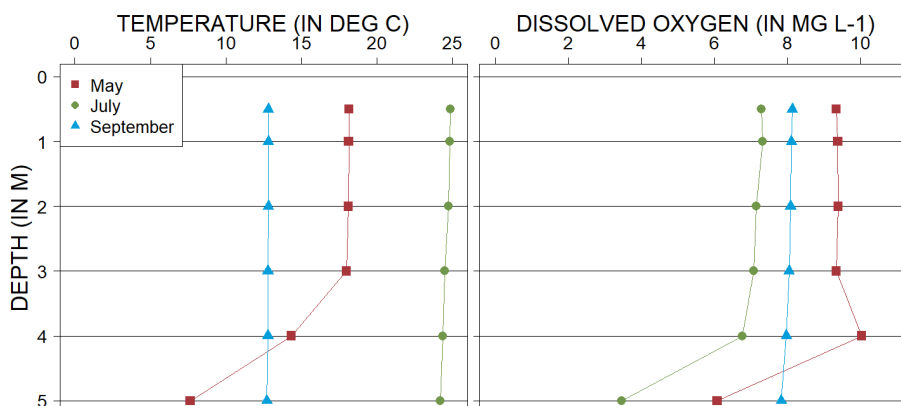


Figure 2. 2018 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter ( $mg L^{-1}$ )

## Trophic State Indices

- Trophic state is a measure used by scientists to assess the condition (where lower scores indicate better water quality) of a lake using three common measures: total phosphorus (TP), Secchi disk transparency and chlorophyll-a concentration.
- Lake Brekken is a eutrophic lake (Figure 3) that has moderate nutrient concentrations but low algal growth.
- Current trophic state has improved compared to historical indices.
- There have been no confirmed **harmful** algal (cyanobacteria) blooms at Lake Brekken.

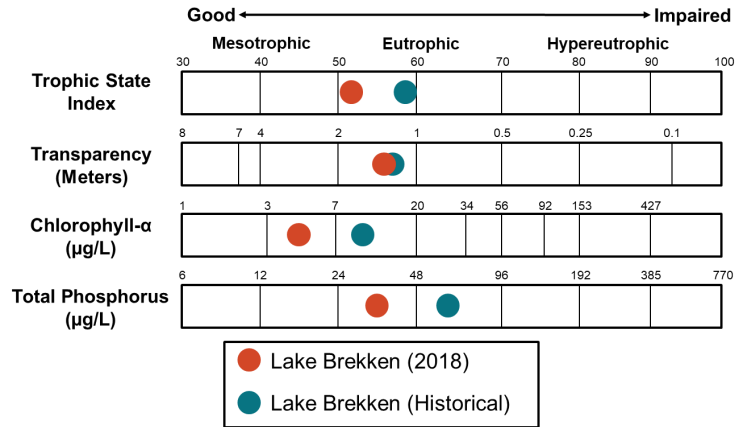


Figure 3. Trophic state indices for 2018 and historical samples

## Nutrients

- Median concentration of total nitrogen (TN) in 2018 was similar to the historical median but greater than the median for the Collapsed Glacial Outwash Level IV Ecoregion (hereafter, Glacial Outwash) where Lake Brekken is located (Figure 4).
- Median concentration of dissolved TN was slightly less than TN.
- Median TP concentration was lower in 2018 compared to historical concentrations and the median for the Glacial Outwash (Figure 4).
- Median concentration of dissolved phosphorus was slightly less than TP.
- Ammonia and nitrate plus nitrite were not detected in Lake Brekken in 2018.

### Nutrient Concentrations (in mg L<sup>-1</sup>) in Lake Brekken

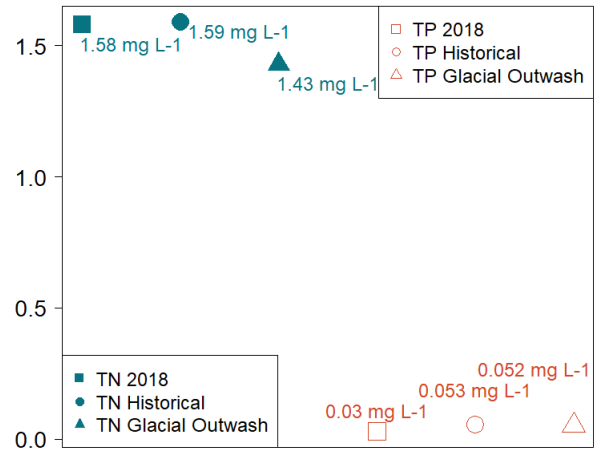


Figure 4. Median concentrations of TN and TP in mg L<sup>-1</sup> compared to regional medians

## Water Chemistry

Table 2. Median concentrations of selected constituents for 2018 and historical samples and from all Glacial Outwash lakes.

Measure	2018 Median	Historical Median	Ecoregion Median
Alkalinity	678 mg L <sup>-1</sup>	501 mg L <sup>-1</sup>	466 mg L <sup>-1</sup>
Bicarbonate (HCO <sub>3</sub> <sup>-</sup> )	657 mg L <sup>-1</sup>	471 mg L <sup>-1</sup>	464 mg L <sup>-1</sup>
Calcium (Ca <sup>2+</sup> )	25.8 mg L <sup>-1</sup>	32.6 mg L <sup>-1</sup>	25.3 mg L <sup>-1</sup>
Carbonate (CO <sub>3</sub> <sup>2-</sup> )	87 mg L <sup>-1</sup>	51 mg L <sup>-1</sup>	58 mg L <sup>-1</sup>
Conductivity	6,060 µS cm <sup>-1</sup>	4,010 µS cm <sup>-1</sup>	1,770 µS cm <sup>-1</sup>
Dissolved Solids	4,740 mg L <sup>-1</sup>	2,890 mg L <sup>-1</sup>	1,240 mg L <sup>-1</sup>
Magnesium (Mg <sup>2+</sup> )	112 mg L <sup>-1</sup>	66.8 mg L <sup>-1</sup>	88 mg L <sup>-1</sup>
Sodium (Na <sup>+</sup> )	1,460 mg L <sup>-1</sup>	834 mg L <sup>-1</sup>	163 mg L <sup>-1</sup>
Sulfate (SO <sub>4</sub> <sup>2-</sup> )	2,570 mg L <sup>-1</sup>	1,560 mg L <sup>-1</sup>	554 mg L <sup>-1</sup>

- Sulfate is the dominant anion in Lake Brekken, while sodium is the dominant cation (Figure 5).
- Median concentrations of most cations and anions are greater than the historical median for the lake and greater than the median for the Glacial Outwash.

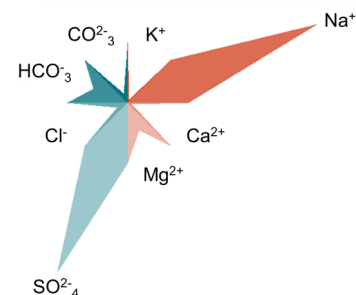


Figure 5. Maucha diagram showing ionic balance based on 2018 data