NORTH Dakota | Environmental Quality
Be Legendary.™

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December 2019

Clear Lake

(46.230804 N, -99.426581 W)

McIntosh County

- Clear Lake is a small natural lake in south-central North Dakota (Figure 1). See map at (https://gf.nd.gov/gnf/maps/fishing/lakecontours/clearmcintosh2011.pdf).
- There is one primitive lake access on Clear Lake on the southwest side of the lake.
- The Clear Lake watershed is about 3,800 acres of mostly grassland/pasture. There is some agricultural production in the watershed and the most common crops grown are other hay/non-alfalfa, soybeans and spring wheat (Table 1).
- Clear Lake is a Class III fishery, which are "capable of supporting natural reproduction and growth of warm water fishes (e.g., largemouth bass and bluegill) and associated aquatic biota."
- Clear Lake is managed mostly for northern pike, though adult yellow perch were stocked in 2017. Northern pike and yellow perch were captured during the last sample by the ND Game and Fish.
- Clear Lake was previously assessed in 2010.

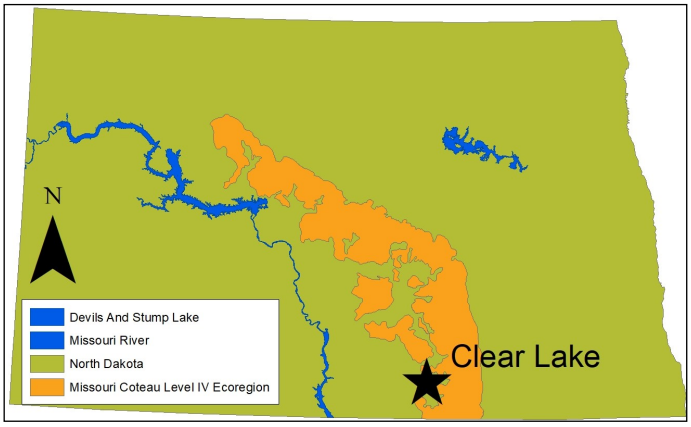

Figure 1. *Location of Clear Lake within the state*

Table 1. *Percentage of land cover in the watershed and near the lake (NASS, 2018). Value listed of crop type represents percentage of total production*

Land Cover Type	% in Watershed	% within 500 meters
Grassland/Pasture	79.9%	85.1%
Agriculture	8.2%	6.8%
Other Hay/Non-Alfalfa	*41.5%*	*36.2%*
Soybeans	*22.4%*	*10.5%*
Spring Wheat	*21.4%*	*42.4%*
Open Water	8.1%	2.7%
Developed	2.8%	3.6%
Shrubland	0.6%	1.3%
Wetlands	0.4%	0.4%

Temperature and Dissolved Oxygen

- Clear Lake rarely 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 no thermal stratification recorded at Clear Lake in 2019. Temperature change in the water column was 0.0 degrees Celsius (ºC), 0.3ºC and 0.3ºC in May, July and September, respectively.
- Dissolved oxygen concentrations remained relatively high throughout the water column during all samples.

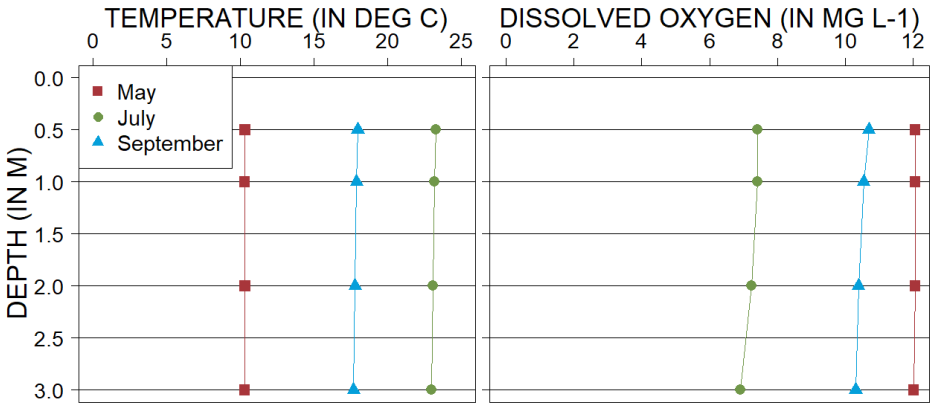

Figure 2. *2019 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter (mg L^{-1})*

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.
- Clear Lake is a eutrophic lake (Figure 3) that has moderate nutrient concentrations and moderate algal growth. High amounts of turbidity can make chlorophyll difficult to quantify in Clear Lake.
- Current trophic state is similar to historical indices.
- Clear Lake has not had a reported or confirmed ***harmful*** algal (cyanobacteria) blooms.

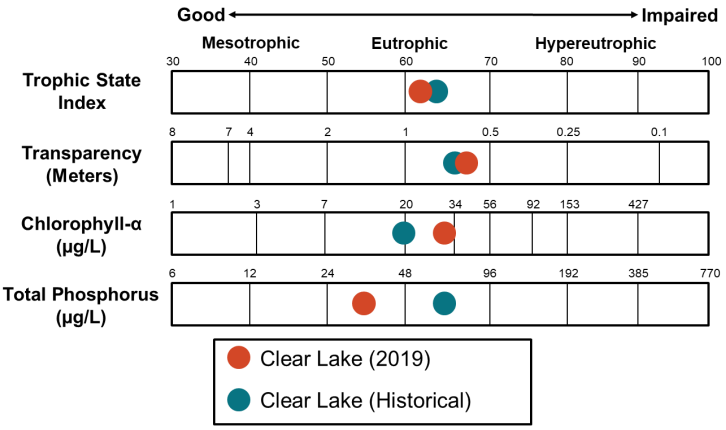

Figure 3. *Trophic state indices for 2019 and historical samples*

Nutrients

- Median concentration of total nitrogen (TN) in 2019 was less than the historical median for the lake but similar to the median for natural lakes in the Missouri Coteau Level IV Ecoregion (hereafter, Ecoregion) where Clear Lake is located (Figure 4).
- Median concentration of dissolved TN was less than TN.
- Median TP concentration in 2019 was less than the median for the lake but similar to the median for the Ecoregion (Figure 4).
- Median concentration of dissolved phosphorus was less than TP.
- Ammonia was detected once in 2019 at Clear Lake, while nitrate-plus-nitrite was not detected.

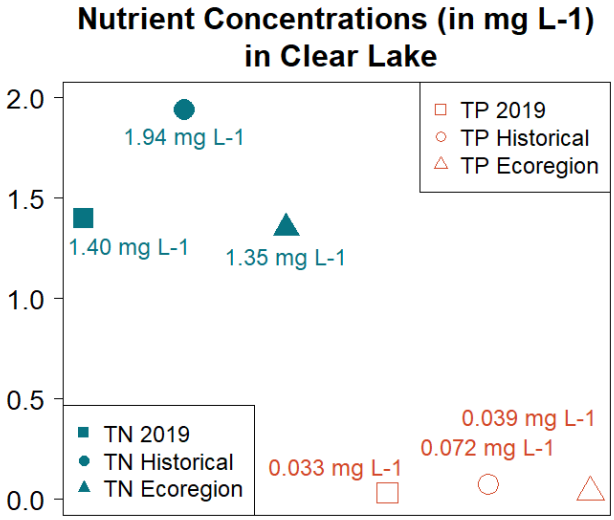

Figure 4. *Median concentrations of TN and TP in mg L^{-1} compared to regional medians*

Water Chemistry

Table 2. *Median concentrations of selected constituents for 2019 and historical samples and from all Ecoregion natural lakes.*

Measure	2019 Median	Historical Median	Ecoregion Median
Alkalinity	512 mg L^{-1}	540 mg L^{-1}	312 mg L^{-1}
Bicarbonate (HCO^-_3)	510 mg L^{-1}	514 mg L^{-1}	328 mg L^{-1}
Calcium (Ca^{2+})	15.8 mg L^{-1}	15.3 mg L^{-1}	38.8 mg L^{-1}
Carbonate (CO^{2-}_3)	58 mg L^{-1}	71 mg L^{-1}	26 mg L^{-1}
Conductivity	1,970 µS cm^{-1}	2,140 µS cm^{-1}	1,180 µS cm^{-1}
Dissolved Solids	1,330 mg L^{-1}	1,470 mg L^{-1}	784 mg L^{-1}
Magnesium (Mg^{2+})	69.2 mg L^{-1}	67.8 mg L^{-1}	81.9 mg L^{-1}
Sodium (Na^+)	330 mg L^{-1}	381 mg L^{-1}	118 mg L^{-1}
Sulfate (SO^{2-}_4)	532 mg L^{-1}	607 mg L^{-1}	364 mg L^{-1}

- Sulfate and bicarbonate are the dominant anions in Clear Lake, while sodium is the dominant cation (Figure 5).
- Median concentrations of most cations and anions are less than the historical median for the lake but greater than the median for the Ecoregion.

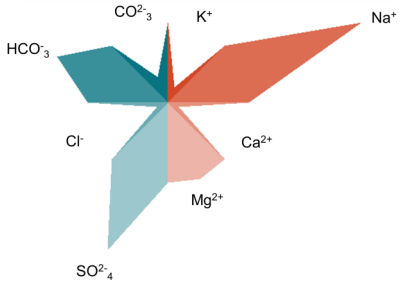

Figure 5. *Maucha diagram showing ionic balance based on 2019 data*