

November 2020

Carlson-Tande Dam

(47.66015 N, -98.09557 W)

Griggs County

- Carlson-Tande Dam is a small reservoir in northeast North Dakota (Figure 1). See map at (<https://gf.nd.gov/gnf/maps/fishing/lakecontours/carlsontandedam2013.pdf>).
- There is one primitive boat access on Carlson-Tande Dam on the west side of the lake near the dam.
- The Carlson-Tande Dam watershed is about 3,300 acres of mostly grassland/pasture and agriculture (Table 1). Agricultural production in the watershed is dominated by soybeans, spring wheat and corn.
- Carlson-Tande Dam is a Class III, warm-water fishery, which are “capable of supporting natural reproduction and growth of warm water fishes (e.g., largemouth bass and bluegill) and associated aquatic biota.”
- Carlson-Tande Dam is managed for a variety of fish, though only northern pike have been stocked since 2012. There were no fish captured during the last sample by the ND Game and Fish in 2018.
- Carlson-Tande Dam was previously assessed in 2010.

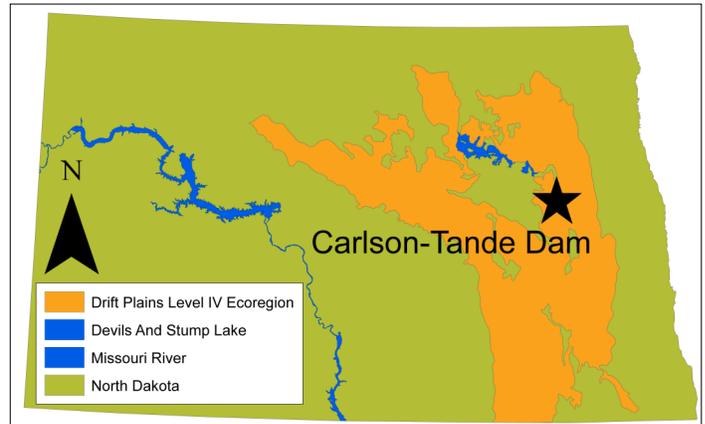


Figure 1. Location of Carlson-Tande Dam within the state

Table 1. Percentage of land cover in the watershed and near the lake (NASS, 2019). Value listed of crop type represents percentage of total production

Land Cover Type	% in Watershed	% within 500 meters
Agriculture	69.4%	13.9%
Soybeans	62.9%	2.8%
Spring Wheat	20.5%	12.9%
Corn	8.9%	NA
Grassland/Pasture	15.3%	77.9%
Wetlands	8.7%	2.2%
Developed	2.8%	0.7%
Forest	1.0%	4.5%
Shrubland	< 0.1%	0.1%
Barren	< 0.1%	NA

Temperature and Dissolved Oxygen

- Carlson-Tande Dam regularly stratifies in the summer being small, deep and well-protected.
- Thermal stratification was recorded in most samples in 2020. Top-to-bottom temperature changes of 10.5°C, 4.0°C, 9.4°C and 0.1°C were recorded in May, June, July and October, respectively.
- Dissolved oxygen concentrations declined sharply during times of the strongest thermal stratification, most notably in July.

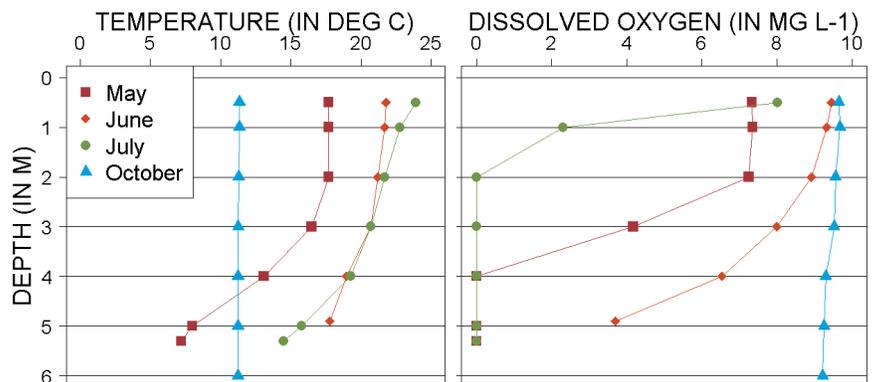


Figure 2. 2020 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter ($mg L^{-1}$)

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.
- Carlson-Tande Dam is a eutrophic lake (Figure 3) that has moderate nutrient concentrations and moderate algal growth.
- Trophic state has declined compared to historical data, driven by an increase in total phosphorus.
- There have been no confirmed **harmful** algal (cyanobacteria) blooms at Carlson-Tande Dam as of 2020.

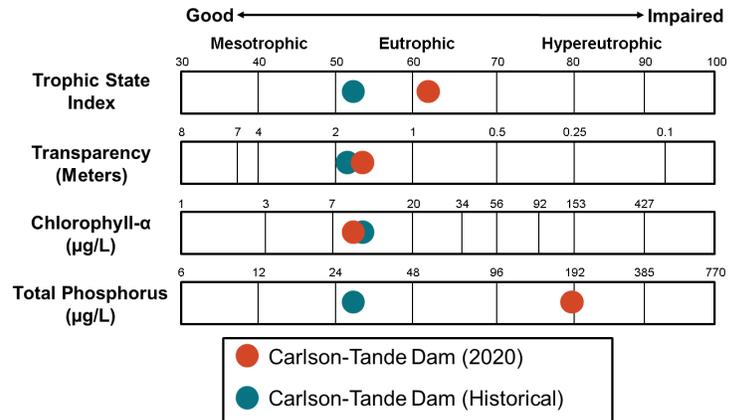


Figure 3. Trophic state indices for 2020 and historical samples

Nutrients

- Median concentration of total nitrogen (TN) in 2020 was greater than the historical median for the lake but less than the median for the Drift Plains Level IV Ecoregion (hereafter, Ecoregion) where Carlson-Tande Dam is located (Figure 4).
- Median concentration of dissolved TN was less than TN.
- Median total phosphorus (TP) concentration in 2020 was much greater than the median for the lake and less than the median for the Ecoregion (Figure 4).
- Median concentration of dissolved phosphorus was less than TP.
- Neither ammonia nor nitrate-plus-nitrite were detected at Carlson-Tande Dam in 2020.

Nutrient Concentrations (in mg L⁻¹) in Carlson-Tande Dam

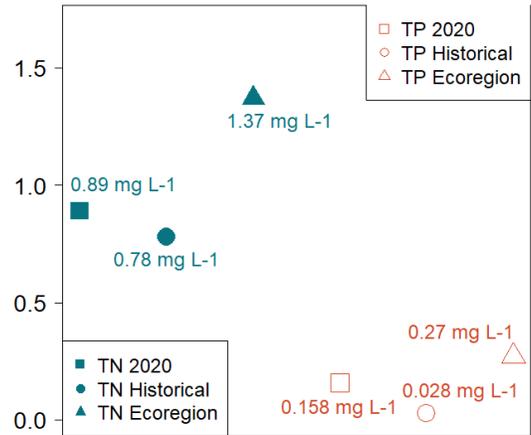


Figure 4. Median concentrations of TN and TP in mg L⁻¹ compared to regional medians

Water Chemistry

Table 2. Median concentrations of selected constituents for 2020 and historical samples and from all Ecoregion reservoirs.

Measure	2020 Median	Historical Median	Ecoregion Median
Alkalinity	334 mg L ⁻¹	247 mg L ⁻¹	328 mg L ⁻¹
Bicarbonate (HCO ₃ ⁻)	391 mg L ⁻¹	302 mg L ⁻¹	364 mg L ⁻¹
Calcium (Ca ²⁺)	109.5 mg L ⁻¹	69.3 mg L ⁻¹	73 mg L ⁻¹
Carbonate (CO ₃ ²⁻)	6.5 mg L ⁻¹	< 1 mg L ⁻¹	16 mg L ⁻¹
Conductivity	1,250 µS cm ⁻¹	1,090 µS cm ⁻¹	1,180 µS cm ⁻¹
Dissolved Solids	849 mg L ⁻¹	718 mg L ⁻¹	788.5 mg L ⁻¹
Magnesium (Mg ²⁺)	55.8 mg L ⁻¹	44.4 mg L ⁻¹	53.7 mg L ⁻¹
Sodium (Na ⁺)	92 mg L ⁻¹	90.6 mg L ⁻¹	114 mg L ⁻¹
Sulfate (SO ₄ ²⁻)	364 mg L ⁻¹	335 mg L ⁻¹	292 mg L ⁻¹

- Sulfate and bicarbonate are the dominant anions in Carlson-Tande Dam, while magnesium, calcium and sodium are the dominant cations (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.

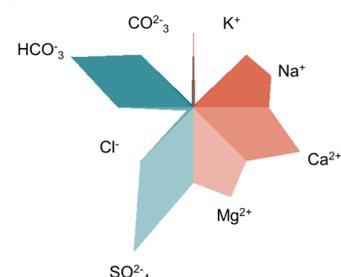


Figure 5. Maucha diagram showing ionic balance based on 2020 data