NORTH Dakota | Environmental Quality

Be Legendary.™

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April 2019

Bisbee Dam

(48.63413 N, -99.36362 W)

Towner County

- Bisbee Dam is a reservoir in northern North Dakota (Figure 1). See map at (https://gf.nd.gov/gnf/maps/fishing/lakecontours/bisbeebigcoulee2003.pdf).
- There is one public boat ramp on Bisbee Dam on the east side of the lake.
- The Bisbee Dam watershed is about 69,000 acres of mostly agricultural land. The most common crops grown are spring wheat, canola and soybeans (Table 1).
- Bisbee Dam 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."
- Bisbee Dam is managed for walleye, with fingerlings stocked annually. Walleye, yellow perch, northern pike, black crappie and white sucker were found during the last sample by the ND Game and Fish.
- Bisbee Dam was previously assessed in 1991-1992.

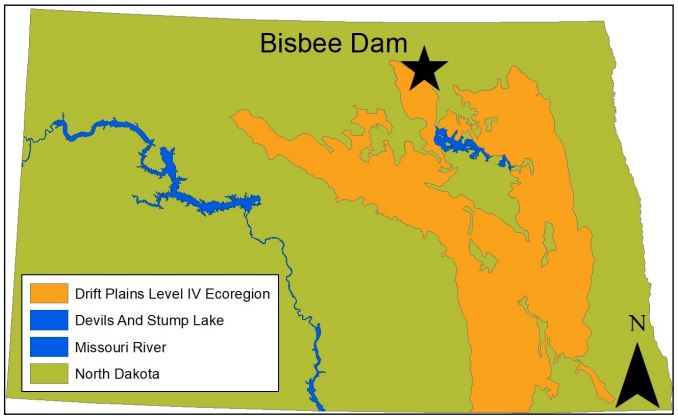

Figure 1. *Location of Bisbee Dam within the state*

Table 1. *Percentage of land cover in the watershed and near the lake (NASS, 2014). Value listed of crop type represents percentage of total production*

Land Cover Type	% in Watershed	% within 500 meters
Agriculture	67.5%	73.4%
Spring Wheat	*38.5%*	*45.9%*
Canola	*32.9%*	*28.4%*
Soybeans	*18.3%*	*20.2%*
Grassland/Pasture	12.2%	11.1%
Forest	8.7%	0.9%
Developed	4.6%	6.0%
Wetlands	4.1%	6.8%
Open Water	2.8%	1.8%
Barren	< 0.1%	NA

Temperature and Dissolved Oxygen

- Bisbee Dam regularly 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 2015. Temperature change in the water column was 2.72 degrees Celsius (ºC), 1.49ºC and 0.02ºC in May, July and September, respectively.
- Dissolved oxygen concentrations were relatively low in Bisbee Dam, with most concentration near or below the state's standard of 5 mg L^{-1}.

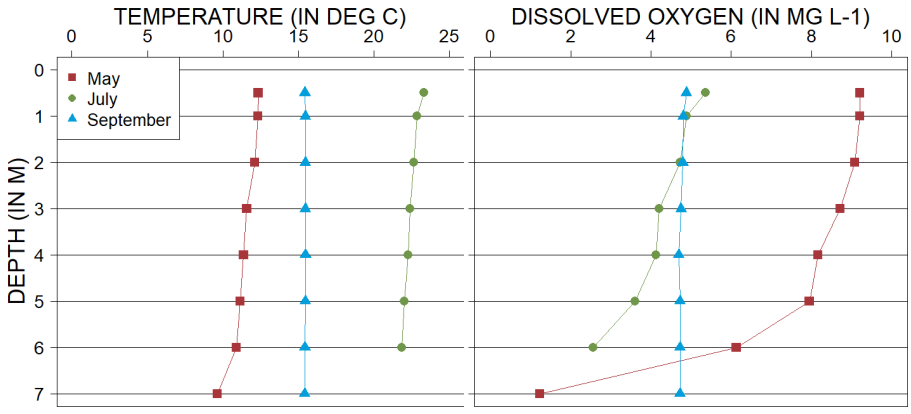

Figure 2. *2015 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter (mg L^{-1})*

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.
- Bisbee Dam is a eutrophic reservoir (Figure 3) that has high nutrient concentrations but moderate algal growth.
- Current trophic state has greatly improved compared to historical indices.
- There have been no confirmed ***harmful*** algal (cyanobacteria) blooms at Bisbee Dam.

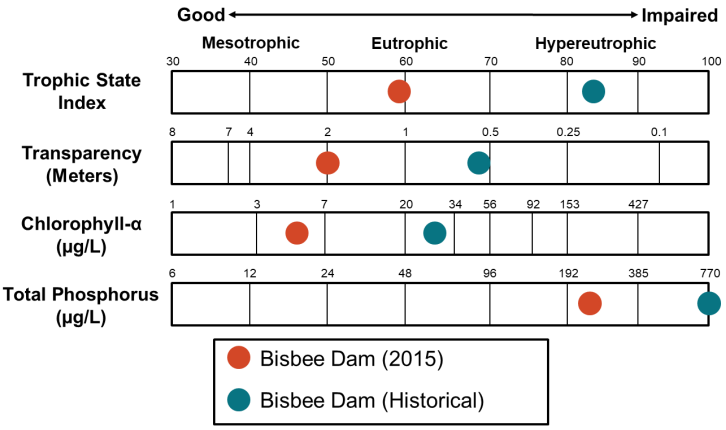

Figure 3. *Trophic state indices for 2015 and historical samples*

Nutrients

- Median concentration of total nitrogen (TN) in 2015 was less than the historical median for the lake but greater than the median for the Drift Plains Level IV Ecoregion (hereafter, Drift Plains) where Bisbee Dam is located (Figure 4).
- Median concentration of dissolved TN was slightly less than TN.
- Median TP concentration in 2015 was much less than the median for the lake but greater than the median for the Drift Plains (Figure 4).
- Median concentration of dissolved phosphorus was slightly less than TP.
- Ammonia was detected in all samples at Bisbee Dam in 2015, while there were two detections of nitrate plus nitrite.

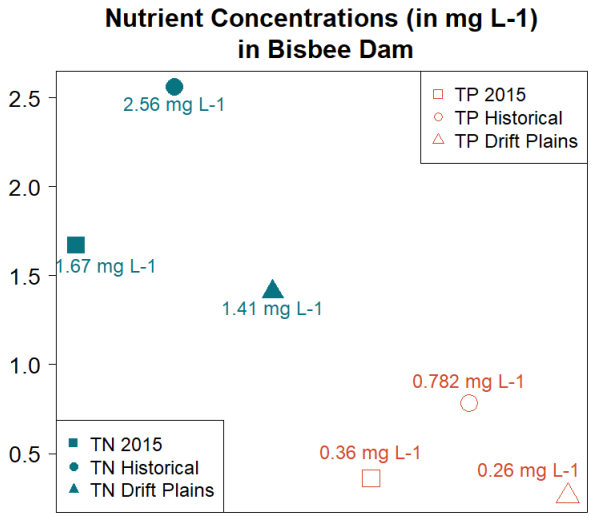

Figure 4. *Median concentrations of TN and TP in mg L^{-1} compared to regional medians*

Water Chemistry

Table 2. *Median concentrations of selected constituents for 2015 and historical samples and from all Drift Plains reservoirs.*

Measure	2015 Median	Historical Median	Ecoregion Median
Alkalinity	283 mg L^{-1}	279 mg L^{-1}	311 mg L^{-1}
Bicarbonate (HCO^-_3)	323 mg L^{-1}	316 mg L^{-1}	341 mg L^{-1}
Calcium (Ca^{2+})	109 mg L^{-1}	73 mg L^{-1}	73.8 mg L^{-1}
Carbonate (CO^{2-}_3)	11 mg L^{-1}	20.5 mg L^{-1}	14 mg L^{-1}
Conductivity	1,410 µS cm^{-1}	716 µS cm^{-1}	1,081 µS cm^{-1}
Dissolved Solids	978 mg L^{-1}	449 mg L^{-1}	713 mg L^{-1}
Magnesium (Mg^{2+})	93.3 mg L^{-1}	44.5 mg L^{-1}	52.5 mg L^{-1}
Sodium (Na^+)	76.4 mg L^{-1}	30.3 mg L^{-1}	106 mg L^{-1}
Sulfate (SO^{2-}_4)	473 mg L^{-1}	104.5 mg L^{-1}	271 mg L^{-1}

- Sulfate is the dominant anion in Bisbee Dam, while magnesium and calcium are co-dominant cations (Figure 5).
- Median concentrations of most cations and anions are much greater than the historical median for the lake and greater than the median for the Drift Plains.

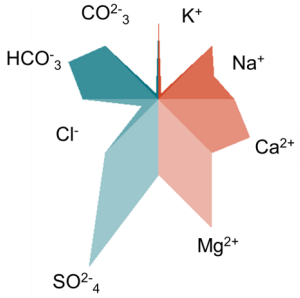

Figure 5. *Maucha diagram showing ionic balance based on 2015 data*