The water quality in Starvation Reservoir near the intake of the Duchesne Valley Water Treatment Plant was examined for the year 2019. Data was compiled and analyzed for the following parameters: phytoplankton, total phosphorus (TP), nitrate, total organic carbon (TOC), and a Trophic State Index (TSI). Water samples were collected at each of the gate depths as well as from the water surface (two-meter composite sample) and a bottom of the reservoir sample. Apart from phytoplankton all the 2019 parameters are compared to values collected in the previous seven years.

**Phytoplankton**

Currently there are no state or federal regulations that determine when algae begin to inhibit water quality. However, there is a current World Health Organization (WHO) guideline that states when cyanobacteria cell counts exceed 20,000 cells/mL it creates a negative impact on water quality as well as a potential threat to human health.

Phytoplankton samples were collected at each gate depth of the raw water inlet works for the Duchesne Valley Water Treatment Plant. Diatoms and Green Algae were found in the water column throughout the entire sample season (see figures 1 and 2). Cyanobacteria was only present during the months of August, September and October. The greatest number of cyanobacteria cells were present at the surface and gate 1 sample depths during the month of September with 12,171 cells/mL of *Lyngbya birgei* (see figure 3).
Figure 1: Diatom counts in Starvation Reservoir during the 2019 sample season.
Figure 2: Green algae counts in Starvation Reservoir during the 2019 sample season.
Figure 3: Cyanobacteria counts in Starvation Reservoir during the 2019 sample season.
Nutrients

Nutrient levels in the water column were averaged for each month that samples were collected. The Division of Water Quality has determined that Total Phosphorus (TP) levels start to impact water quality at 0.025 mg/L and Nitrate (NO₃) influences water quality at 4 mg/L. During September of 2018 following the Dollar Ridge fire and a large rain event that caused large amounts of sediment, debris and organic matter to enter the reservoir the average TP concentration peaked at .05 mg/L (Figure 4). This sampling event was the only time we saw the TP value surpass the 0.025 mg/L threshold over the last eight years. During 2019 the TP levels were similar to values before the 2018 fire with the highest value of 0.025 mg/L occurring in October. Nitrate levels in starvation reservoir continued to be minimal in 2018 even after the fire and rain events (Figure 5). Over the last eight years the NO₃ concentration has not come close to exceeding the State’s standard.

Figure 4

![Total Phosphorus averaged together for the entire water column for the last eight years.](image-url)
Figure 5: Nitrate averaged together for the entire water column. Over the last eight years nitrate concentrations have been low.
**Total Organic Carbon**

Total Organic Carbon (TOC) levels over the last eight years have ranged from 2.1 – 4.3 mg/L, with the highest value occurring in September 2019 (see figure 6). TOC values during 2019 were higher throughout the year compared to the previous seven years. This increase was expected due to the amount of organic material washed into the reservoir from the Dollar Ridge fire in 2018.

**Figure 6**

![Starvation Reservoir - TOC](image)

*Figure 6: Total Organic averaged together for the entire water column.*
Trophic State Index

The aquatic ecosystem productivity of a lake is often described by the terms: oligotrophic, mesotrophic and eutrophic. Oligo, as a prefix means, "few" and trophic is defined as: "relating to nutrition (or food)", thus oligotrophic means "little food" and eutrophic means "many foods" with mesotrophic being in the middle.

The Trophic State Index (TSI) is a tool that classifies lakes and reservoirs into different trophic levels. It is often calculated using water clarity, via secchi depth and phytoplankton biomass (chlorophyll $a$). Generally, the lower the TSI the greater the water clarity and the lower the phytoplankton biomass. A TSI value greater than 50 is considered Eutrophic and poor water quality. A value greater than 40 and less than 50 is Mesotrophic, and a value less than 40 is Oligotrophic. The State of Utah desires that all the reservoirs in the State be at least in the mesotrophic level. For the last several years Starvation Reservoir has varied between Mesotrophic and Oligotrophic. Based on the variableness of the data I am comfortable declaring Starvation as a Mesotrophic Reservoir.

Figure 7

*Figure 7:* Trophic State Index for Starvation Reservoir for the last 31 years.
Summary

While the long-term mesotrophic status continues for Starvation Reservoir, the Dollar Ridge Fire increased TOC and TP levels after the Dollar Ridge fire in 2018. While the TOC concentrations remained elevated throughout the 2019 sample season the TP levels returned to pre-fire levels. Fortunately, nitrate concentrations remained well below the State mandated pollution indicator during the last eight years. Diatom and Green algal cells were found throughout the water column during the 2019 season. Cyanobacteria levels peaked during the month of September with 12,171 cells/mL of Lyngbya birgei. While this is a higher value compared to diatoms and green algae it is still below the World Health Organization cyanobacteria threshold of 20,000 cells/mL.