

Provo River Watershed Water Quality Report



CENTRAL UTAH WATER
CONSERVANCY DISTRICT

2019

Prepared by,

Joe Crawford

Water quality in Jordanelle Reservoir, Deer Creek Reservoir and the Provo River was examined for the year 2018. When possible, the data were also compared to three previous years. This report includes the following water quality parameters: phytoplankton, total phosphorus (TP), nitrate (NO₃), dissolved total phosphorus (DTP), total organic carbon (TOC), and Trophic State Index (TSI).

JORDANELLE

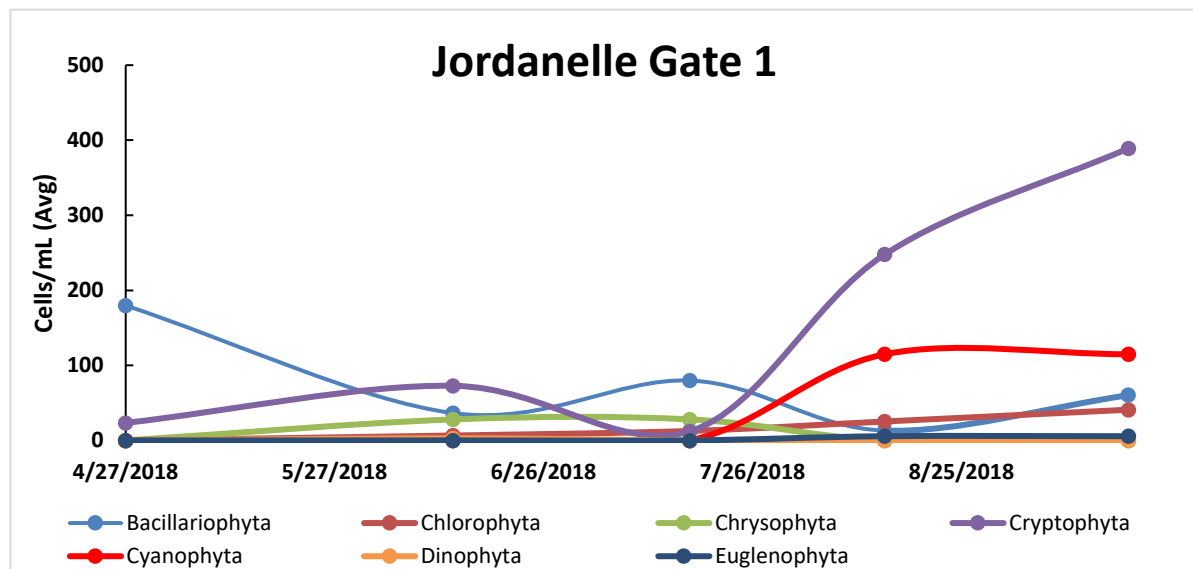
Water samples were collected from above the Jordanelle Reservoir dam at each gate elevation of the Select Level OutWork (SLOW) tower as well as from the surface and bottom of the water column.

Phytoplankton

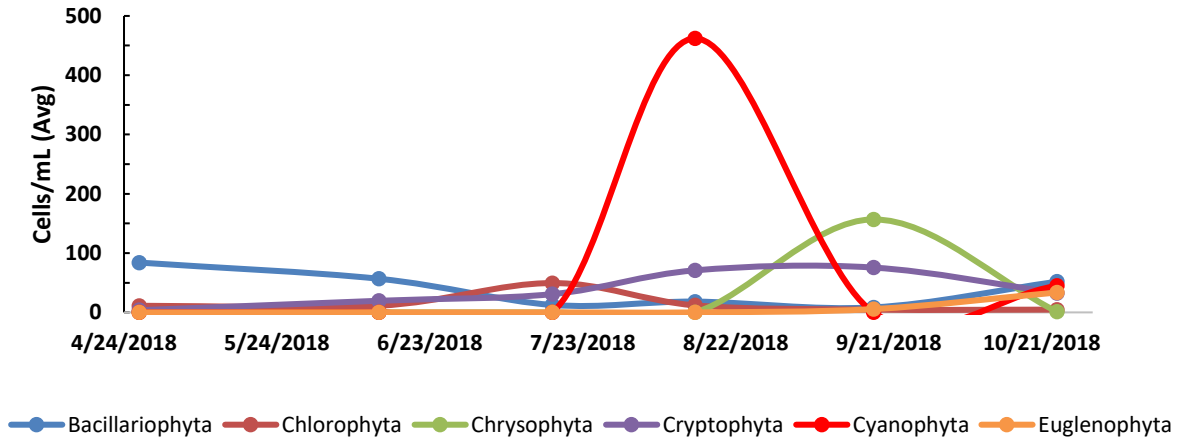
Gate 1 had the most phytoplankton richness with seven different taxa. Gates 2 and 3 had six phytoplankton taxa, while gates 4 – 6 had five. In the first part of the sampling season Bacillariophyta taxa dominated each gate depth. This is expected due to the cold-water temperatures during that time. As the water temperature increased the dominate taxa varied at each gate depth. Gate 2 was the only depth that Cyanophyta peaked higher than the other taxa. Cryptophyta and Chrysophyta were the most dominant taxa for the rest of the gates except for gate 5 where Chlorophyta dominated.

The World Health Organization (WHO) has set the value of 10,000 cells/mL as a water quality threshold for cyanobacteria. While 462 cells/mL is the highest Jordanelle cyanobacteria value recorded in 2018, it is still well below the WHO threshold.

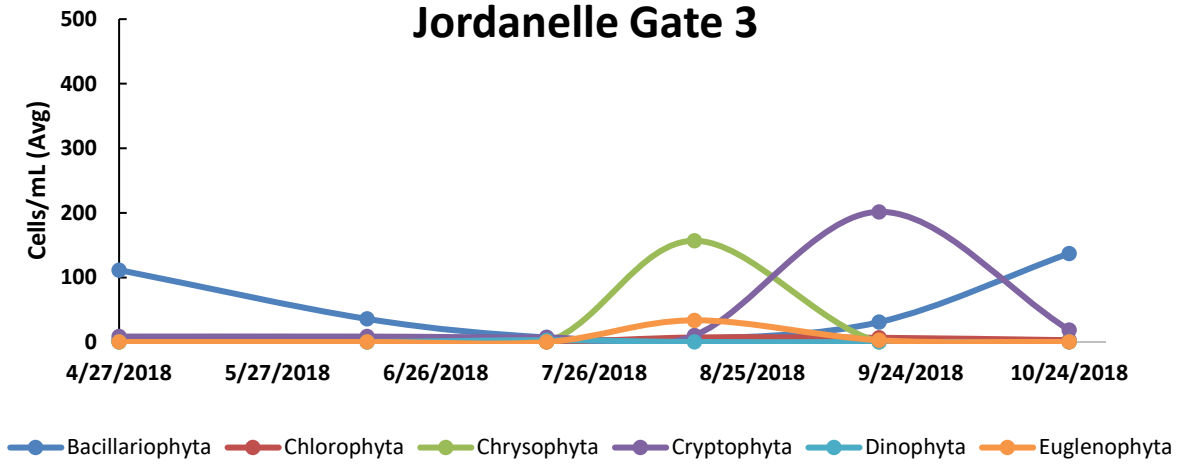
Figure 1



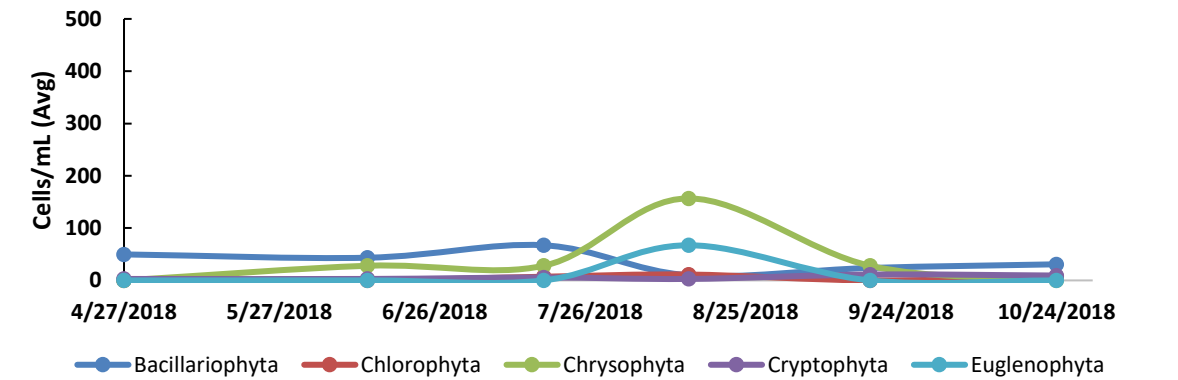
Jordanelle Gate 2



Jordanelle Gate 3



Jordanelle Gate 4



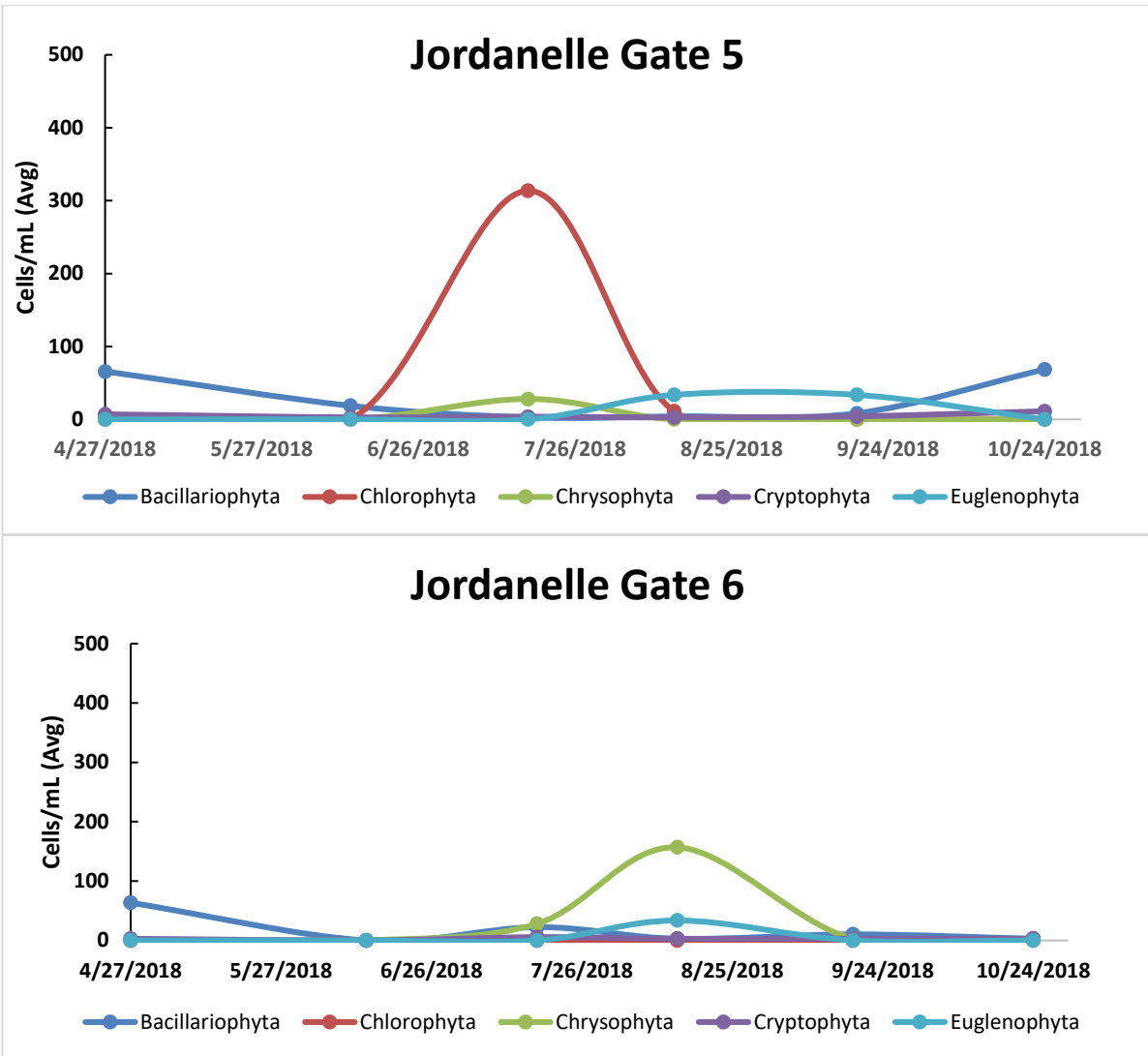


Figure 1: Phytoplankton cell counts measured at Jordanelle Reservoir. The highest cell count was during the month of August when the average Cyanophyta peaked at 462 cells/mL at gate 2.

Nutrients

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 October of 2016 the average TP concentration in the water column above the dam peaked at .03 mg/L (Figure 2). This sampling event was the only time we saw the TP value surpass the 0.025 mg/L threshold over the last four years. Over the last four years the NO₃ concentration has not come close to exceeding the State's standard of 4mg/L.

Figure 2

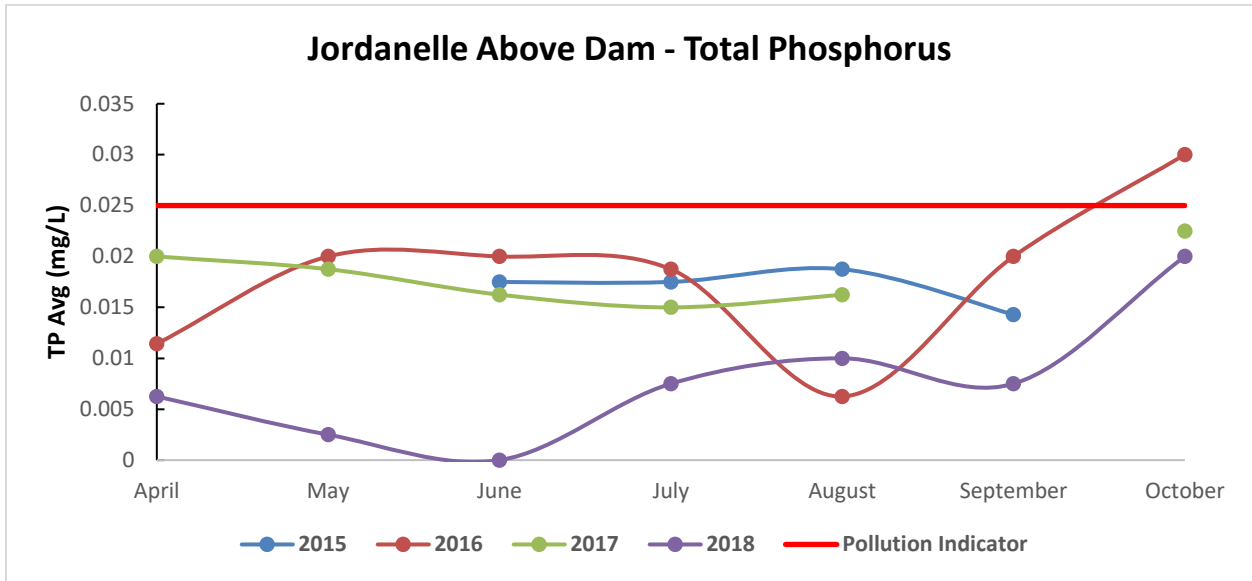


Figure 2: Total Phosphorus was measured at each gate depth and bottom of the reservoir and then averaged together for the entire water column. Phosphorus concentrations remain relatively low.

Figure 3

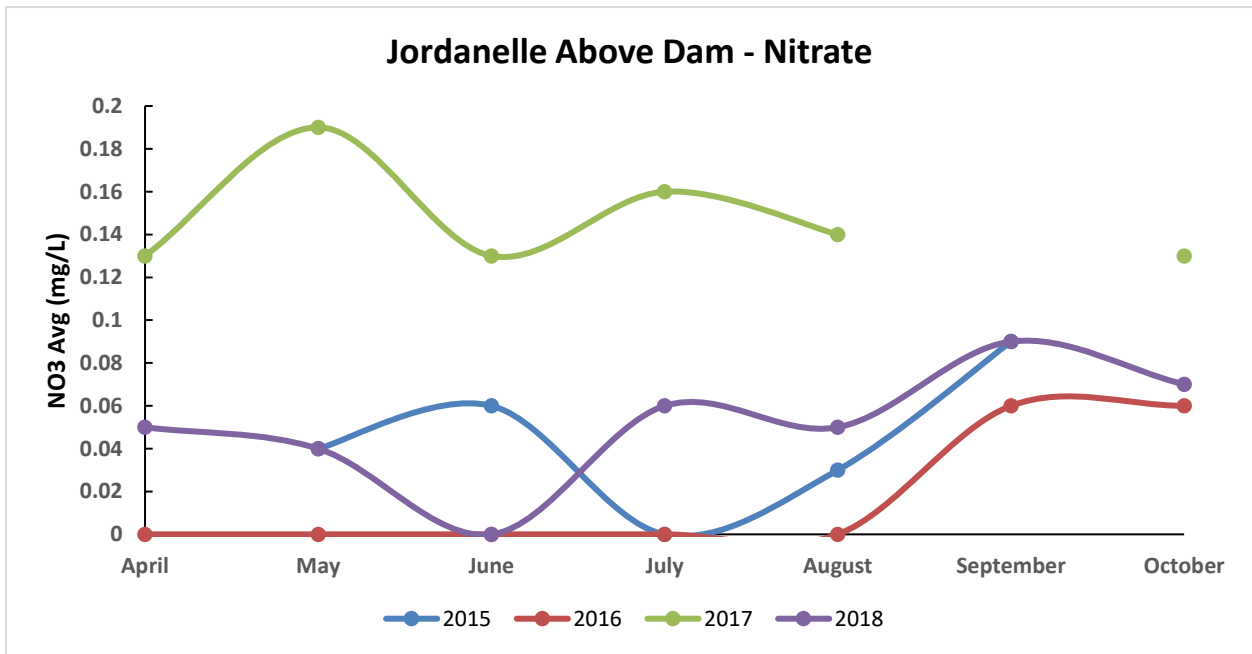


Figure 3: Nitrate was measured at each gate depth and bottom of the reservoir and then averaged together for the entire water column. Over the last four years nitrate concentrations have been low.

Total Organic Carbon

Total Organic Carbon (TOC) levels over the last four years have ranged from 2.0 – 4.4 mg/L. The highest values occurred in June 2018. This increase was expected due to the amount of organic material being washed into the reservoir after Spring Runoff.

Figure 4

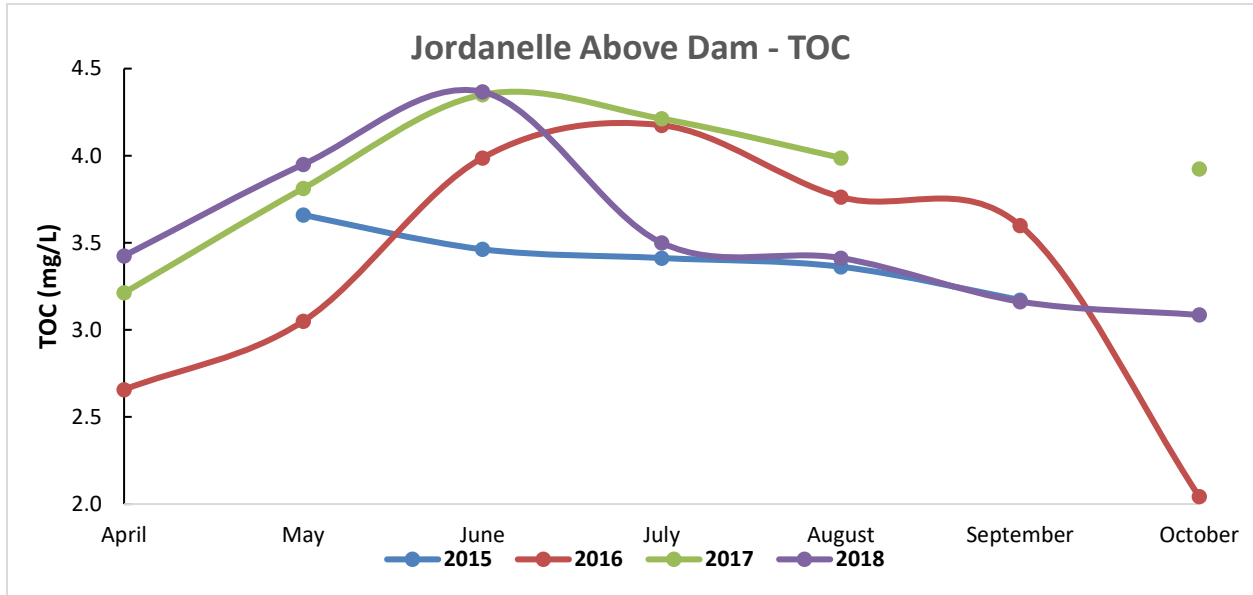


Figure 4: Total Organic was measured at each gate depth and bottom of the reservoir and then averaged together for the entire water column. The values have varied from 2.0 – 4.4 mg/L over the last four years.

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, a value greater than 40 and less than 50 is Mesotrophic, and a value less than 40 is Oligotrophic. For the last several years Jordanelle Reservoir has varied between Mesotrophic and Oligotrophic. Based on the variability of the chlorophyll *a* and secchi disk data I would be comfortable declaring Jordanelle as a Mesotrophic Reservoir.

Figure 5

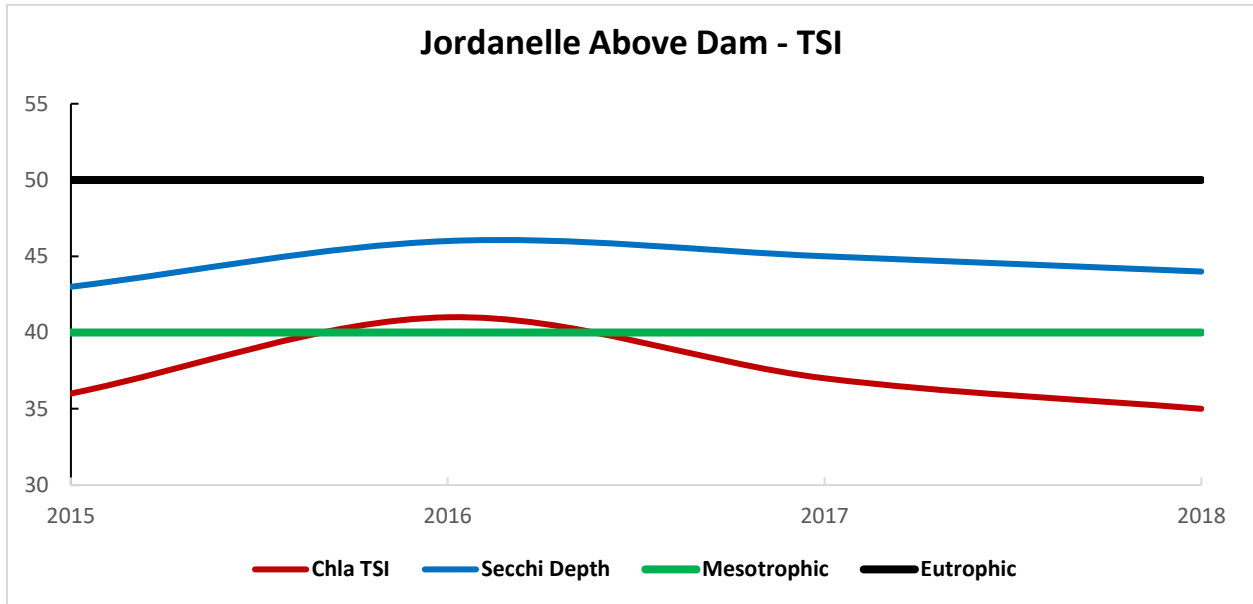


Figure 5: Trophic State Index for Jordanelle Reservoir for the last 4 years. The trend is varying between Oligotrophic and Mesotrophic.

DEER CREEK

Water samples were collected from Deer Creek Reservoir above the dam at the surface and bottom of the water column as well as from the elevation of the intake gate.

Phytoplankton

Phytoplankton taxa values were plotted as an average of all the samples collected in the water column. In the first part of the sampling season Bacillariophyta taxa dominated the water column. This is expected due to the cold-water temperatures during that time. As the water temperature increased Cyanophyta peaked higher than the other taxa with Chlorophyta being the next most abundant taxa. The World Health Organization (WHO) has set the value of 10,000 cells/mL as a water quality threshold for cyanobacteria. While 999.1 cells/mL is the highest Deer Creek cyanobacteria average value recorded in 2018, it is still well below the WHO threshold.

Figure 6

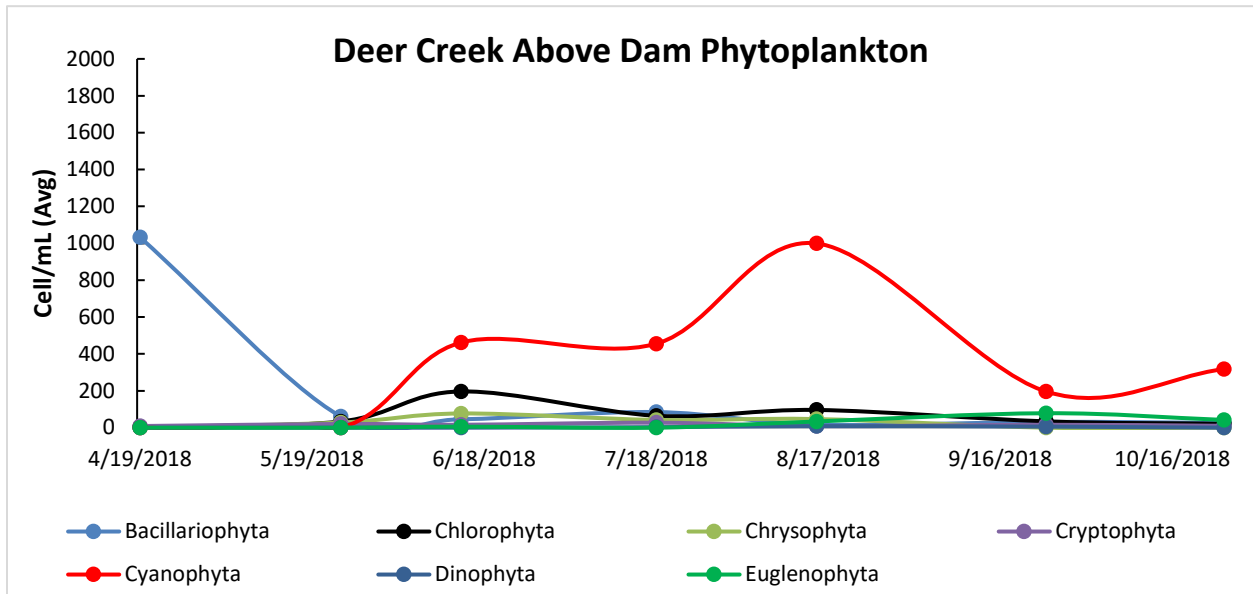


Figure 6: Average phytoplankton cell/mL at the Deer Creek Above Dam site. Bacillariophyta dominated the water column during the cold-water season. Cyanophyta was the most dominant taxa for the rest of the season.

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. In the previous four years the average TP concentration exceeded the TMDL threshold during the months of July and August, peaking at 0.048 mg/L in September 2017 (Figure 7). Over the last four years the NO₃ concentration has not come close to exceeding the State's standard of 4 mg/L (Figure 8).

Figure 7

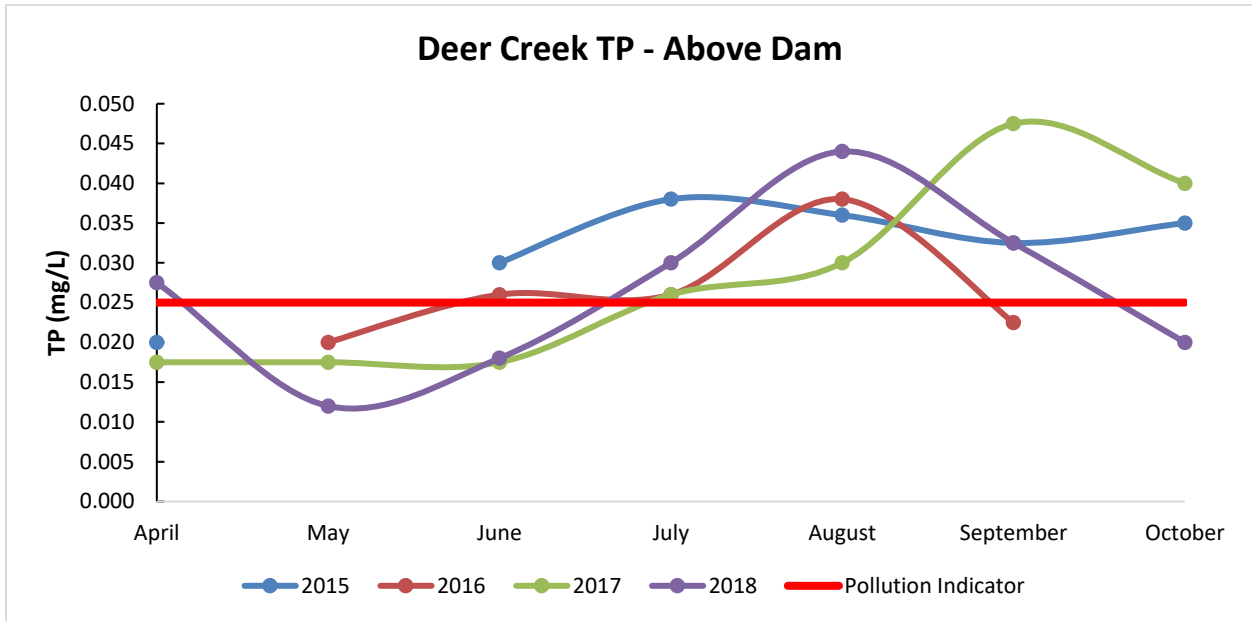


Figure 7: Total phosphorus concentrations in Deer Creek reservoir above the dam. Over the last four years the TP concentration has exceeded the Deer Creek TMDL threshold.

Figure 8

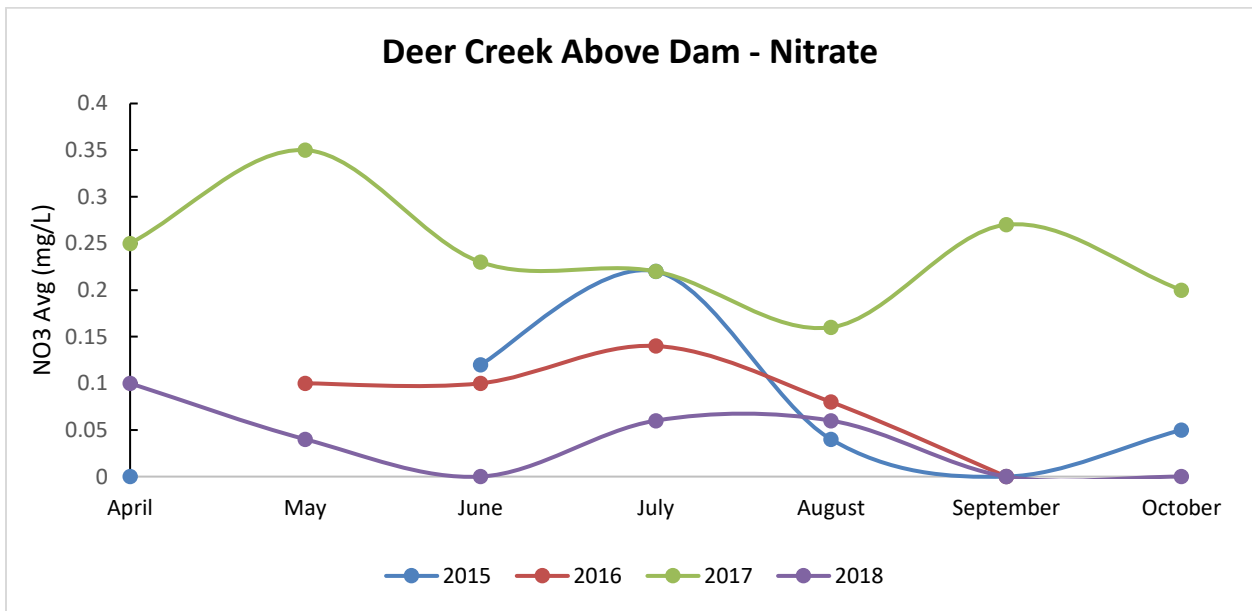


Figure 8: Nitrate concentration in Deer Creek reservoir above the dam. Nitrate levels over the last four years have stayed well below the TMDL threshold of 4 mg/L.

Total Organic Carbon

Total Organic Carbon (TOC) levels over the last four years have ranged from 2.4 – 3.6 mg/L. The highest values occurred in June 2018. This increase was expected due to the amount of organic material being washed into the reservoir after Spring Runoff.

Figure 9

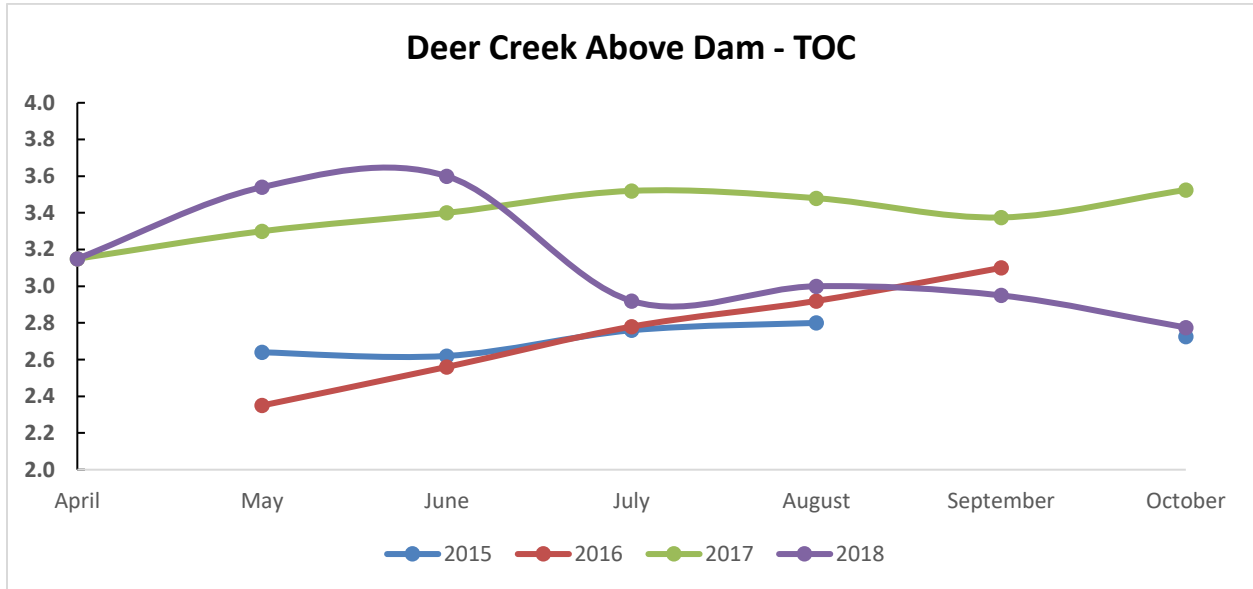


Figure 10: Total Organic Carbon concentrations for Deer Creek above the dam. The TOC values have been low with a minimum value of 2.4 mg/L in May 2016 and a maximum value of 3.6 mg/L in the August sample collection

Trophic State Index

For the last several years Jordanelle Reservoir has varied between Oligotrophic and Mesotrophic (Figure 11). Based on the variability of the chlorophyll *a* and secchi disk data I would be comfortable declaring Jordanelle as a Mesotrophic Reservoir.

Figure 10

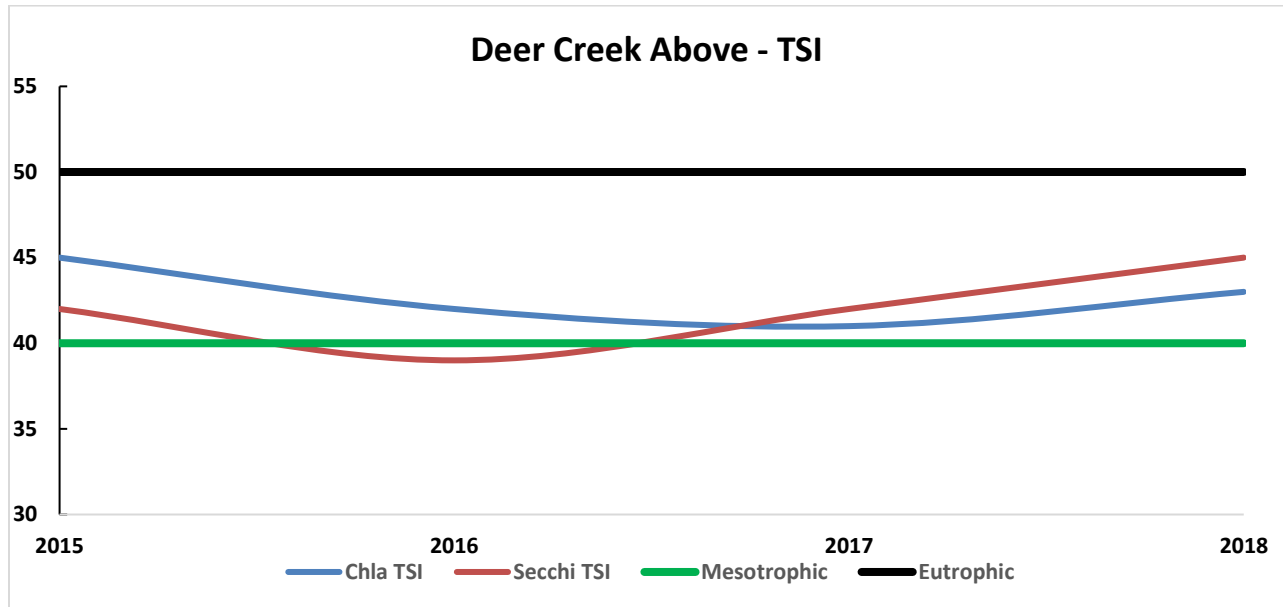


Figure 10: Trophic State Index for Deer Creek Reservoir. The reservoir is considered eutrophic.

PROVO RIVER

Water samples were collected from 21 sample upper locations from the and lower Provo River. Data in this report only includes data from the sites from Olmsted Diversion.

Phytoplankton

Phytoplankton taxa values were plotted as an average from the surface water samples collected. Bacillariophyta dominated the phytoplankton samples every month except for October when Chlorophyta was the dominant taxa. Dominance of Bacillariophyta is congruent with the raw water phytoplankton samples that are regularly analyzed in the Don A. Christiansen Regional Water Treatment Plant Laboratory.

Figure 11

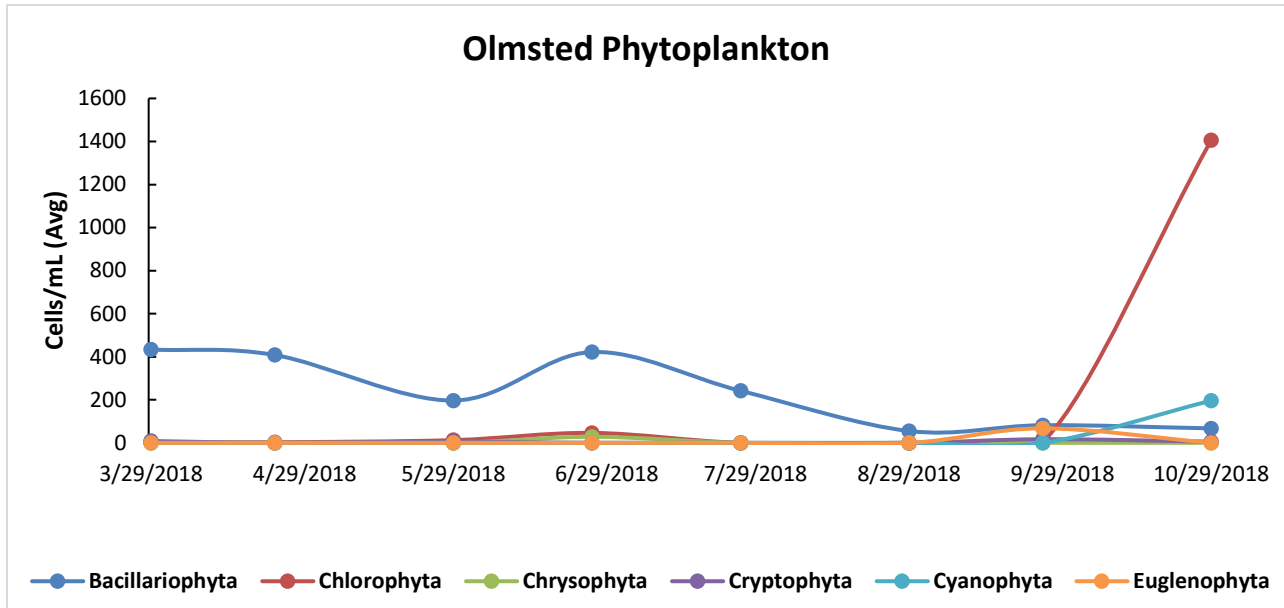


Figure 11: Average phytoplankton values in the Provo River at Olmsted Diversion. For the majority of the year Bacillariophyta was the dominant taxa.

Nutrients

Nutrient levels in the water column were measured for each month that samples were collected. In 2002 the Division of Water Quality implemented a Deer Creek TMDL that set the instream Total Phosphorus (TP) concentration threshold at 0.03 mg/L. The Division of Water Quality has also established that Nitrate (NO_3) influences water quality at 4 mg/L. In all the previous four years the average TP concentration exceeded the TMDL threshold during the months of July and August (Figure 12). Nitrate levels in the Provo River were minimal in all four years (Figure 13). Over the last four years the NO_3 concentration has not come close to exceeding the State's standard of 4mg/L.

Figure 12

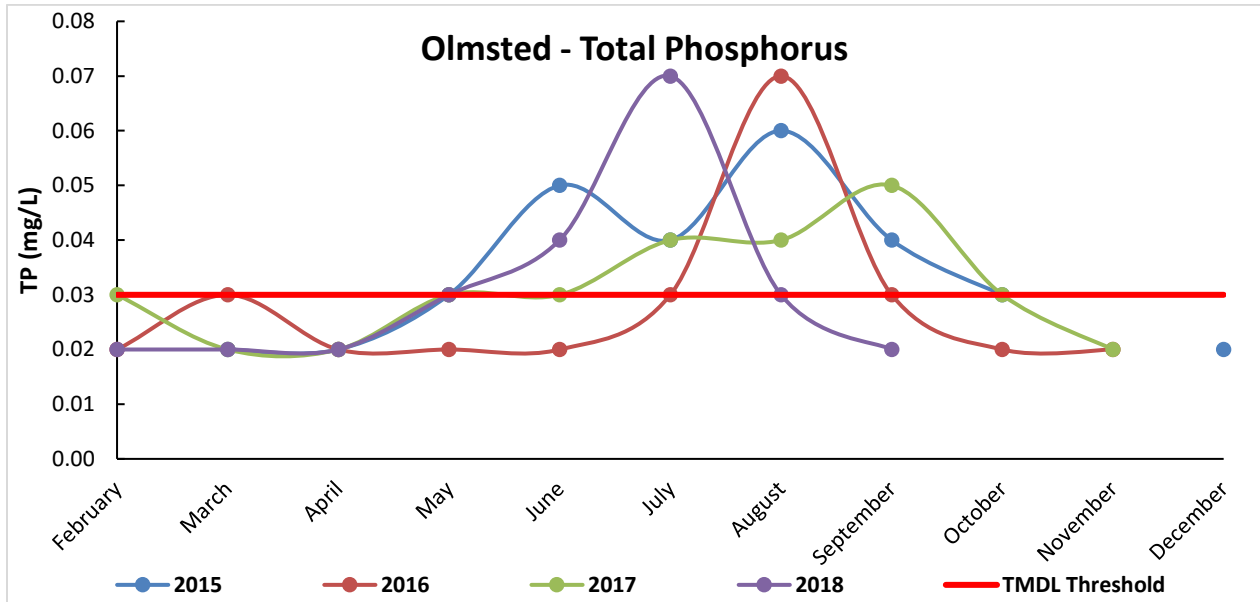


Figure 12: Total Phosphorus concentration in the Provo River at the Olmsted Diversion sample location. The TP concentration exceeded the Deer Creek in stream TMDL threshold value in all four years during the months of July and August.

Figure 13

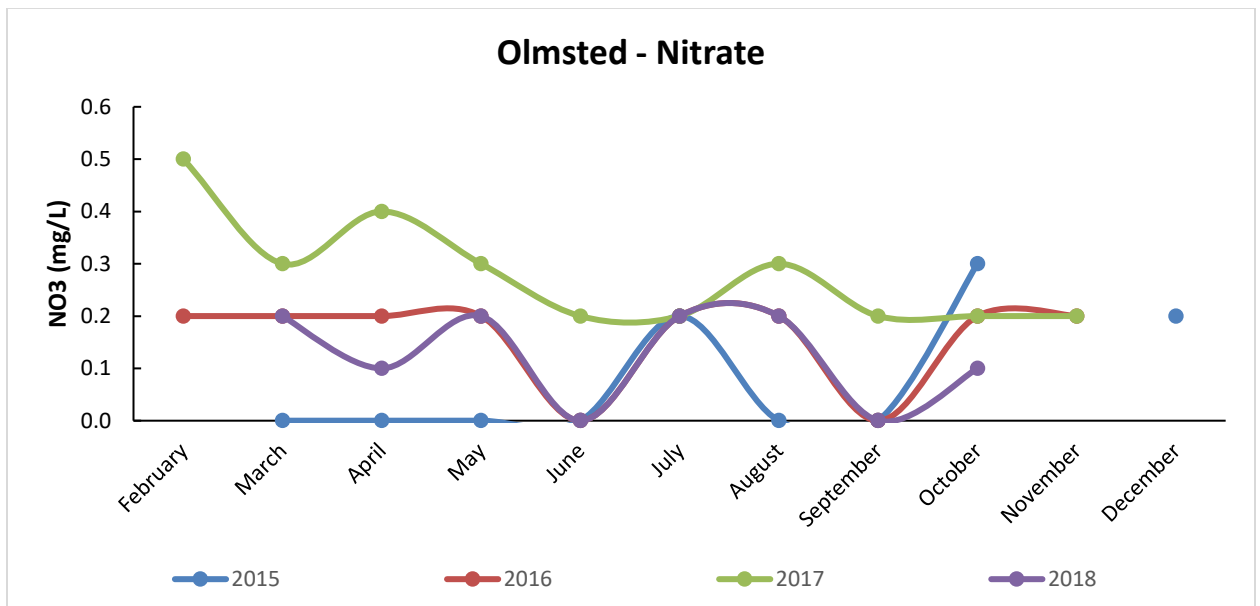


Figure 13: Nitrate concentrations in the Provo River at the Olmsted Diversion. Nitrate levels are well below the 4 mg/L threshold set by the Division of Water Quality.

Total Organic Carbon

Total Organic Carbon (TOC) levels have been relatively low over the last four years. The values have ranged from 1.8 – 3.5 mg/L. The highest values occurred in June 2018. This increase in 2018 was similar to the influx of TOC experienced within Deer Creek Reservoir.

Figure 14

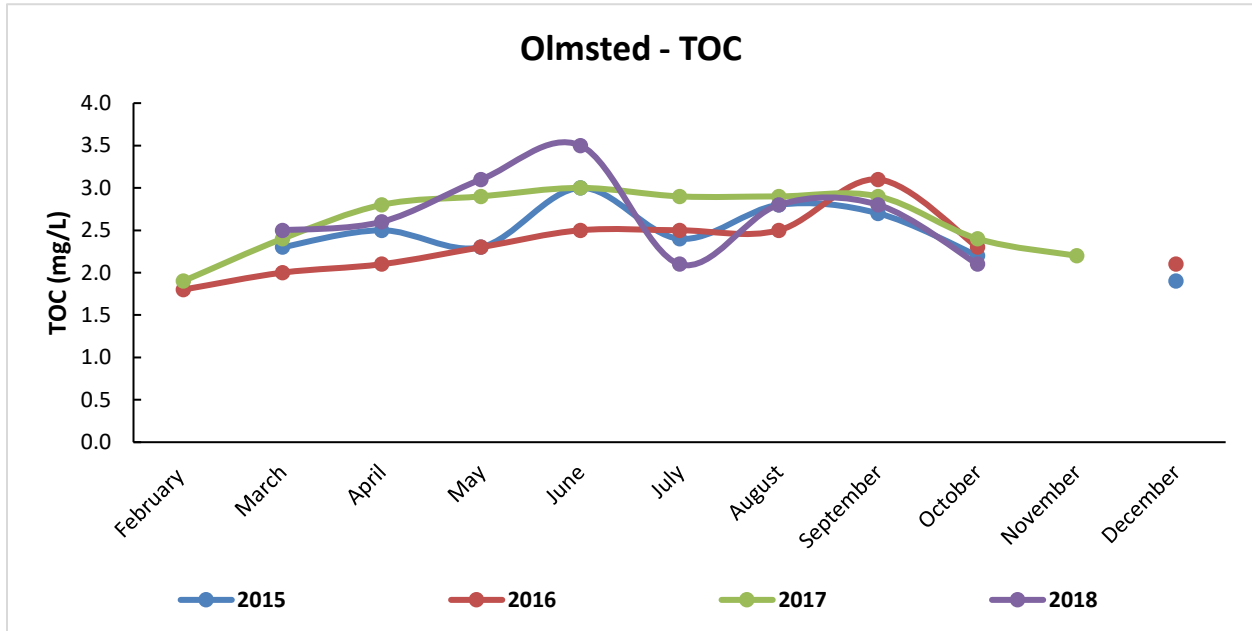


Figure 14: Total Organic Carbon in the Provo River at the Olmsted Diversion sample location. The TOC in the Provo River remains low.

SUMMARY

The water quality in the Provo River Watershed was monitored and analyzed for 2018. The phytoplankton counts in Jordanelle Reservoir, Deer Creek Reservoir and the Provo River remain low. During the late summer months, it is common to see an increase in cyanobacteria in the reservoirs. However, these elevated values do not exceed the World Health Organization threshold for human health.

Regularly there is an increase of phosphorus in Deer Creek and the Provo River during the irrigation season that frequently exceeds the TP state threshold for impacting water quality. Nitrate and TOC levels for all waterbodies measured remain low.

Overall, the water quality of the Provo River Watershed is in good condition. Moving forward we will continue to monitor the different water bodies within the watershed and make sure that we are working to improve water quality as much as possible.