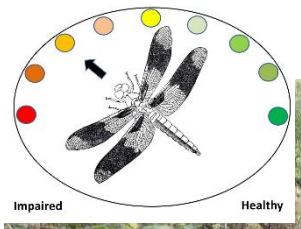
Munson Slough EcoSummary



The heavily urbanized Munson Slough and its tributaries are located in central Leon County and drain a portion of the City of Tallahassee. The Slough flows south into and out of Lake Munson, then continues to Eight Mile Pond. After exiting Eight Mile Pond, the Slough flows under Oak Ridge Road and enters Ames Sink, which is known to be connected to Wakulla Springs.

Approximately 54% of land use in the 38,790-acre basin is residential, commercial, industrial or transportation (as shown in **Figure 1**). These types of land uses are often attributed to increases in stormwater runoff and higher nutrient loads.

Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation.

Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff. Stressors can also include adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. State water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

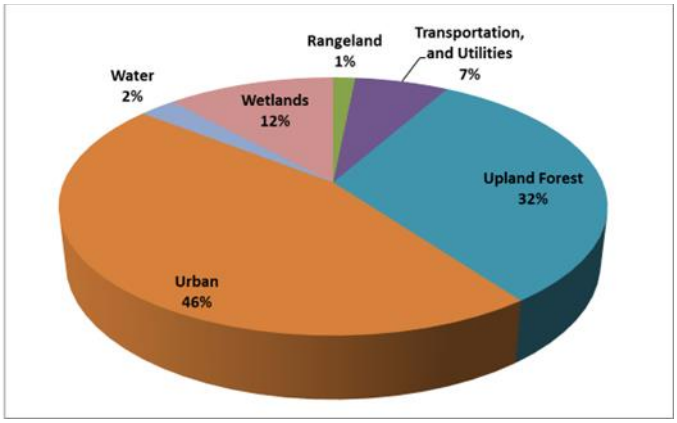


Figure 1. Munson Slough watershed land use.

Total Maximum Daily Loads (TMDLs)

The Florida Department of Environmental Protection (FDEP) issued several TMDLs for Munson Slough, including upstream and downstream of Lake Munson, between 2008 and 2013. The TMDLs are as follows:

TMDLs upstream of Lake Munson

Munson Slough upstream of the lake was verified as impaired for dissolved oxygen (DO), linked to nutrients and five-day biological oxygen demand (BOD_5), as well as fecal coliform.

The 2013 TMDL established target concentrations and reductions necessary to improve the DO including BOD_5 of 2.00 mg/L, Total Nitrogen (TN) of 0.72 mg/L, and Total Phosphorus (TP) of 0.15 mg/L.

The 2008 TMDL established target fecal coliform concentrations and reductions; however, the fecal coliform standard in Florida has been supplanted by standards developed for *Escherichia coli*.

Station MS1, located slightly upstream of Lake Munson, is used to determine if the water quality

upstream of Lake Munson meets the TMDL requirements.

TMDLs downstream of Lake Munson

Munson Slough downstream of the lake was verified as impaired for dissolved oxygen (linked to BOD_5) and un-ionized ammonia.

The 2013 TMDL set an in-stream concentration target for BOD_5 of 2.00 mg/L necessary to meet the dissolved oxygen criterion.

The un-ionized ammonia impairment will be addressed by reductions in total ammonia. The 2013 TMDL established an in-stream concentration of 0.32 mg/L necessary to meet the water quality criterion. However, the un-ionized ammonia criterion has been replaced with the Total Ammonia Nitrogen (TAN) criterion.

Stations MS2, MS4, and MS5 all located downstream of Lake Munson, are used to determine if the water quality downstream of Lake Munson meets the TMDL requirements.

Methods

Surface water samples are collected quarterly (as field conditions allow). This information is used to evaluate the health of Munson Slough and meets the requirements of FDEP.

Drawdown Water Quality Study

To ensure the long-term health of Lake Munson, Leon County conducted a drawdown in coordination with the State of Florida beginning November 1, 2022, originally anticipated to end Spring 2023, but extended to May 17, 2024. The drawdown is part of the County's ongoing and long-term Action Plan to protect and preserve Lake Munson both now and into the future.

At the March 21, 2023, Board of County Commission meeting, in conjunction with extension of the drawdown through Spring of 2024, the Board approved the addition of a Drawdown Water Quality Study to the Lake Munson Action Plan. The Study supplements the County's quarterly water chemistry sampling with additional sampling to attain monthly water quality data in Munson Slough both immediately upstream and downstream of Lake Munson for the remaining duration of the drawdown. The samples provide information on the water chemistry concentrations entering and leaving Lake Munson and provide insight into how the lake is reacting during the drawdown. The following results incorporate the results of the Drawdown Study into the regular quarterly sampling results.

Results

During periods of low water conditions, four temporally independent samples per year could not always be collected. When viewing tables and figures, the absence of data means there was not enough data collected to fulfill data requirements.

Water quality samples are currently collected at four stations along Munson Slough. As of 2010, Station MS3 is no longer sampled.

Nutrients

The nutrient thresholds and results are found in **Tables 1 and 2**.

The State of Florida uses Numeric Nutrient Criteria (NNC) to evaluate nutrients in waterbodies. NNC thresholds are set based on waterbody-specific characteristics and are used to determine if a waterbody meets water quality standards. The results of the four quarterly samples from a single year are used to calculate the annual geometric mean. According to FDEP requirements, the NNC threshold cannot be exceeded more than once in a three-year period.

The Munson Slough Total Nitrogen and Phosphorus levels occasionally exceeded the

NNC during the period of record. However, recent trends suggest that nutrient levels are dropping in the Slough.

Since 2016, all stations have met the NNC for both TN and TP, with the exception MS2 in 2016 and MS4 in 2023, both of which were slightly over the criteria for TP.

Nitrogen levels upstream of the lake at Station MS1 appear to be decreasing, and despite the occasional TMDL level exceedance of the quarterly samples in recent years (2017, 2018, and 2020), the nutrient levels are better than the TMDL target levels (**Figures 2 and 3**).

While the stations downstream of Lake Munson do not have nutrient TMDLs, it is helpful to compare these stations to the upstream MS1 station (**Figures 4 and 5**). During the Lake Munson drawdown, nutrient concentrations leaving the lake were often higher than the concentrations entering the lake, likely the result of the instability of the lake due to the drawdown. Unstable systems can be caused by changes in vegetation in the lakebed or rising and lowering water levels and can result in water quality parameter changes as the water moves through the lake. As the lake is refilled and the vegetation community stabilizes, it is anticipated that nutrient concentrations will stabilize.

Since the Munson Slough watershed is heavily urbanized, and the Slough itself has been significantly altered over the years, there are elevated nutrients in this system for several reasons. Urban runoff tends to have high nutrient loads due to fertilizers, lawn clippings, sediments, animal droppings, sewer overflows, etc. The past and ongoing significant investments in upstream improvements including stormwater facilities and Best Management Practices (BMPs) have contributed to lower nutrient levels.

Table 1. NNC threshold and Total Nitrogen results for Munson Slough. Results in bold signify exceedances of the NNC.

Munson Slough	**Instream Protection Criteria**				
	TN (1.03 mg/L)				
Year	**MS1**	**MS2**	**MS3**	**MS4**	**MS5**
2006	0.75	**1.44**	**1.32**	**1.43**	-
2007	**1.36**	**1.59**	-	-	-
2008	0.89	0.73	-	-	0.87
2009	0.62	0.73	0.74	-	-
2010	**1.09**	**1.35**	-	**1.35**	**1.14**
2011	0.80	-	-	-	-
2012	0.90	-	-	1.02	-
2013	**1.27**	-	-		
2014	0.97	**1.08**	-	**1.16**	**1.08**
2015	0.81	**1.41**	-	**1.39**	-
2016	-	0.89	-	0.89	-
2017	0.73	-	-	-	-
2018	0.69	0.63	-	0.60	-
2019	-	-	-	-	-
2020	0.51	-	-	-	-
2021-2022	-	-	-	-	-
2023	0.46	0.70	-	0.71	0.40

Table 2. NNC threshold and Total Phosphorus results for Munson Slough. Results in bold signify exceedances of the NNC.

Munson Slough	**Instream Protection Criteria**				
	TP (0.18 mg/L)				
Year	**MS1**	**MS2**	**MS3**	**MS4**	**MS5**
2006	0.16	**0.24**	**0.19**	**0.22**	-
2007	**0.21**	**0.28**	-	-	-
2008	0.12	**0.25**	-	-	**0.28**
2009	0.11	0.18	0.18	-	-
2010	0.13	0.16	-	0.17	0.18
2011	0.11	-	-	-	-
2012	**0.20**	-	-	0.17	-
2013	0.17	-	-	-	-
2014	0.14	**0.23**	-	**0.23**	**0.21**
2015	0.11	**0.23**	-	**0.23**	-
2016	-	**0.19**	-	0.18	-
2017	0.09	-	-	-	-
2018	0.11	0.09	-	0.08	-
2019	-	-	-	-	-
2020	0.08	-	-	-	-
2021-2022	-	-	-	-	-
2023	0.08	0.17	-	**0.19**	0.14

Biological Oxygen Demand (BOD)

Elevated BOD levels (**Figure 6**) during some sampling events showed that elevated microbiological activity may be contributing to changes in dissolved oxygen (DO). The microbial activity appears to have been stimulated by elevated levels of nitrogen and phosphorus. This became more prevalent during the lake drawdown.

Dissolved Oxygen (DO) and Chlorophyll-a

FDEP's DO criterion shows very few results that did not meet the threshold (**Figure 7**). However, this does not in any way invalidate the TMDL. Algal blooms represented by chlorophyll-a (**Figure 8**) can produce large amounts of oxygen during daylight hours via photosynthesis. Conversely, during nighttime hours, respiration occurs, and algal blooms remove DO from the water, which may lead to little or no oxygen in the water column. The chlorophyll-a result (503 µg/L) from Station MS2 during the February 2013 sampling event is the highest chlorophyll-a value recorded from any Leon County water quality station. Chlorophyll-a levels have been relatively low in recent years.

Total Ammonia Nitrogen (TAN)

The TAN criterion (0.29 mg/L and based on water temperature and pH) was exceeded (0.57 mg/L) during the 2nd quarter of 2015 at Station MS2. No exceedances were noted from 2016-2023.

Escherichia coli

An extremely high result was recorded during the June 2018 sampling event at station MS4. The result, 6,900/100 mL, exceeded the Class III water quality standard (410 in 10% or more samples) and was extremely unusual since other water quality parameters that could be associated with bacterial contamination (e.g., total suspended solids, biological oxygen demand) appeared normal for this site. Staff expects that it was an abnormal event, either related to wildlife, or possibly, a sampling or laboratory error. There have been no *E. coli* exceedances since.

Conclusions

Based on ongoing sampling, more recent results suggest that Munson Slough, apart from station MS4 in 2023, meets the nutrient thresholds for the East Panhandle Region.

During the Lake Munson drawdown, nutrient concentrations leaving the lake were often higher than the concentrations entering the lake, likely the result of the instability of the lake due to the drawdown. As the lake is refilled and the vegetation community stabilizes, it is anticipated that nutrient concentrations will stabilize.

Elevated BOD levels during some sampling events suggest that microbial activity appears to have been stimulated by elevated levels of nitrogen and phosphorus.

Other water quality parameters appear to be normal for the area and no other impairments were noted.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and Resources for More Information

www.LeonCountyWater.org

Click here to access the results for all water quality stations sampled in 2023.

Click here for a map of the watershed – Sample Sites MS1, MS2, MS4 and MS5.

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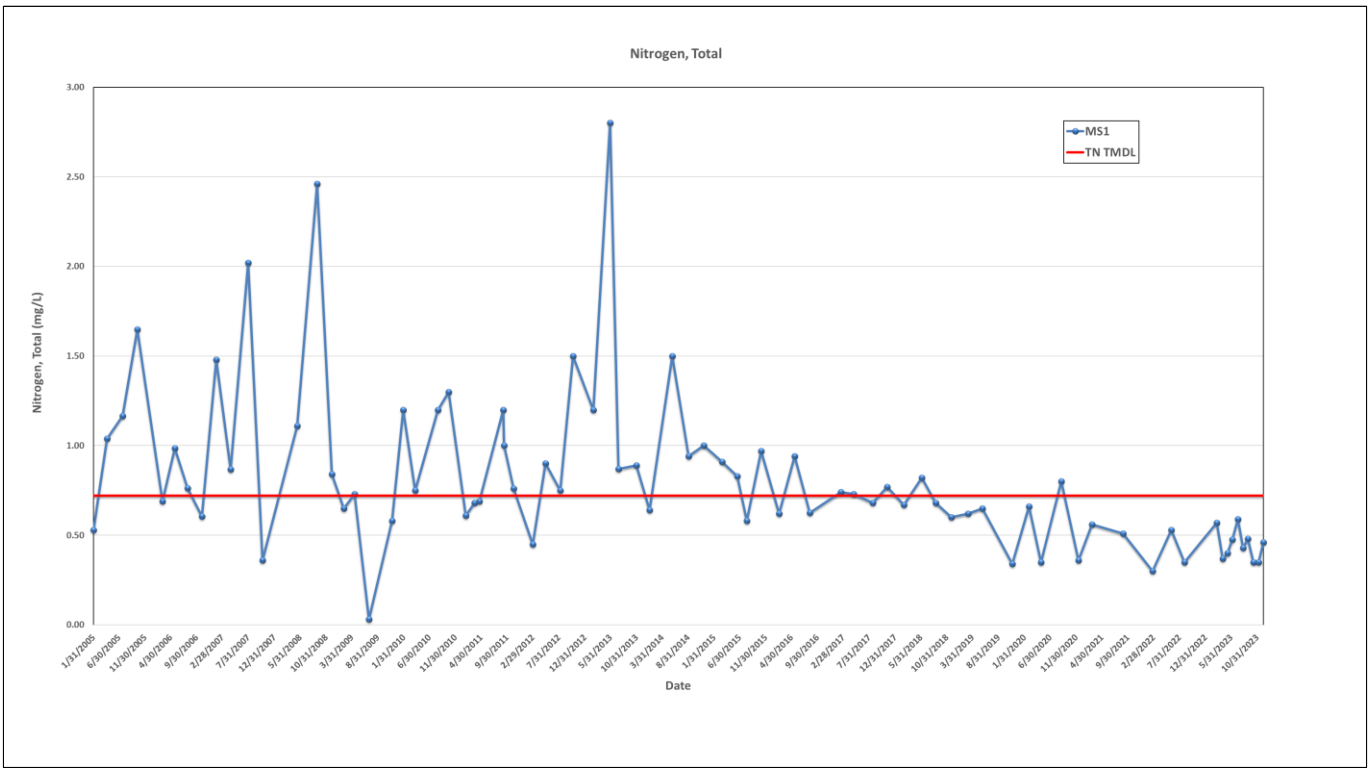

Figure 2. Total Nitrogen results for Munson Slough above the lake (Station MS1).

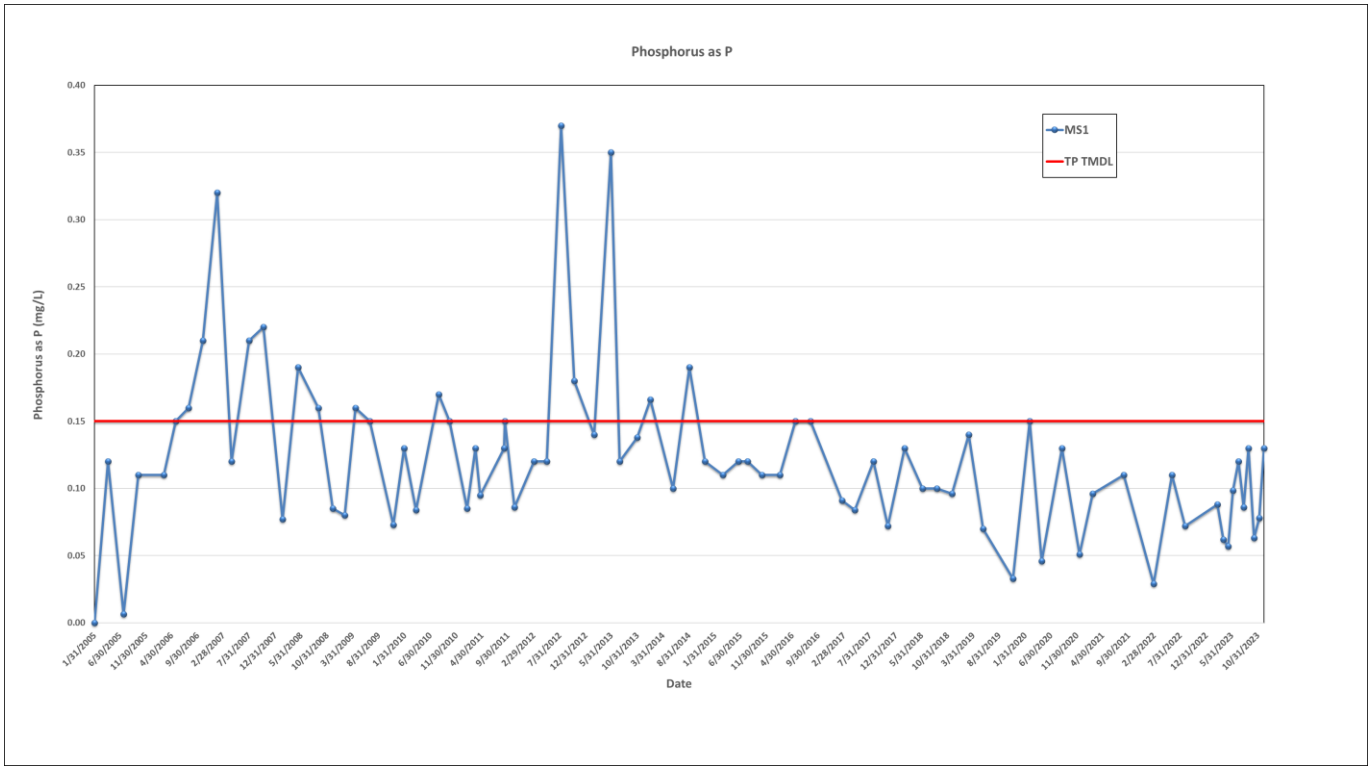

Figure 3. Total Phosphorus results for Munson Slough above the lake (Station MS1).

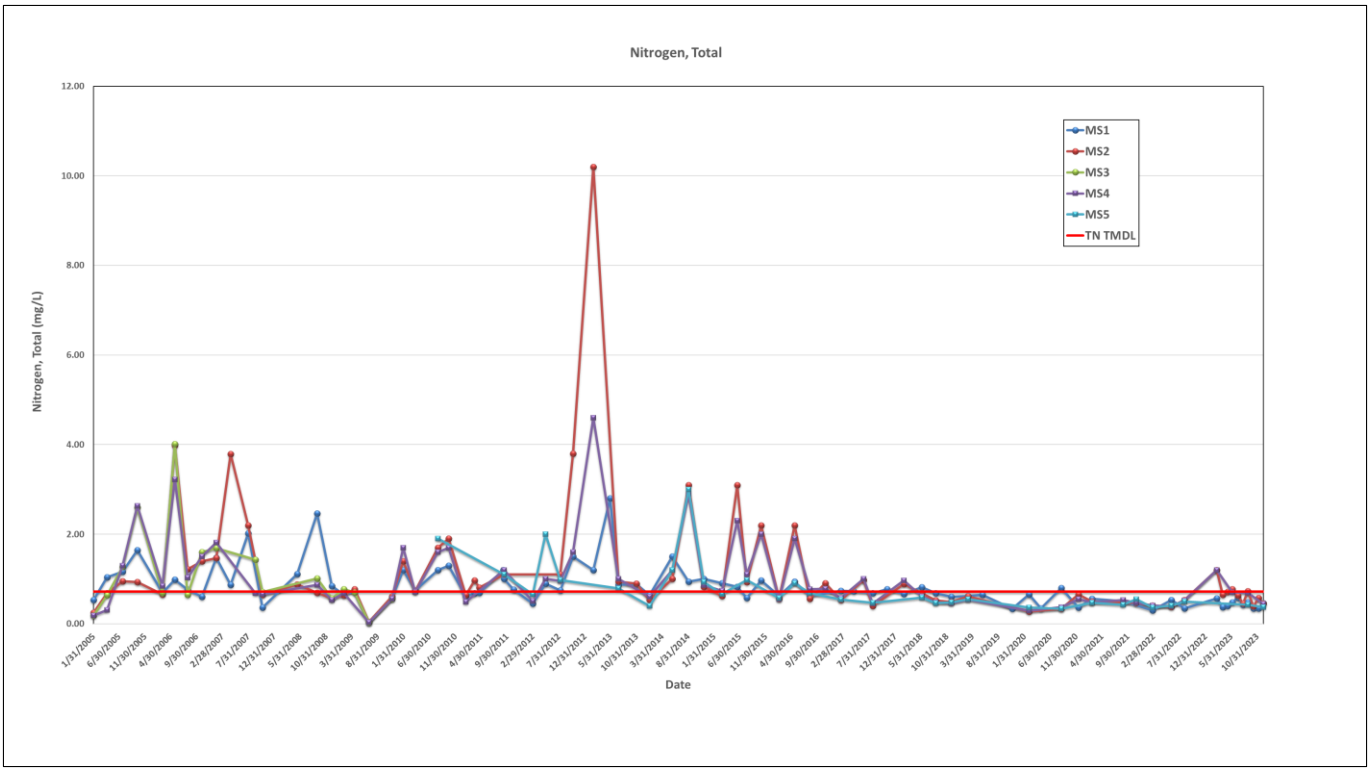

Figure 4. Total Nitrogen results for Munson Slough.

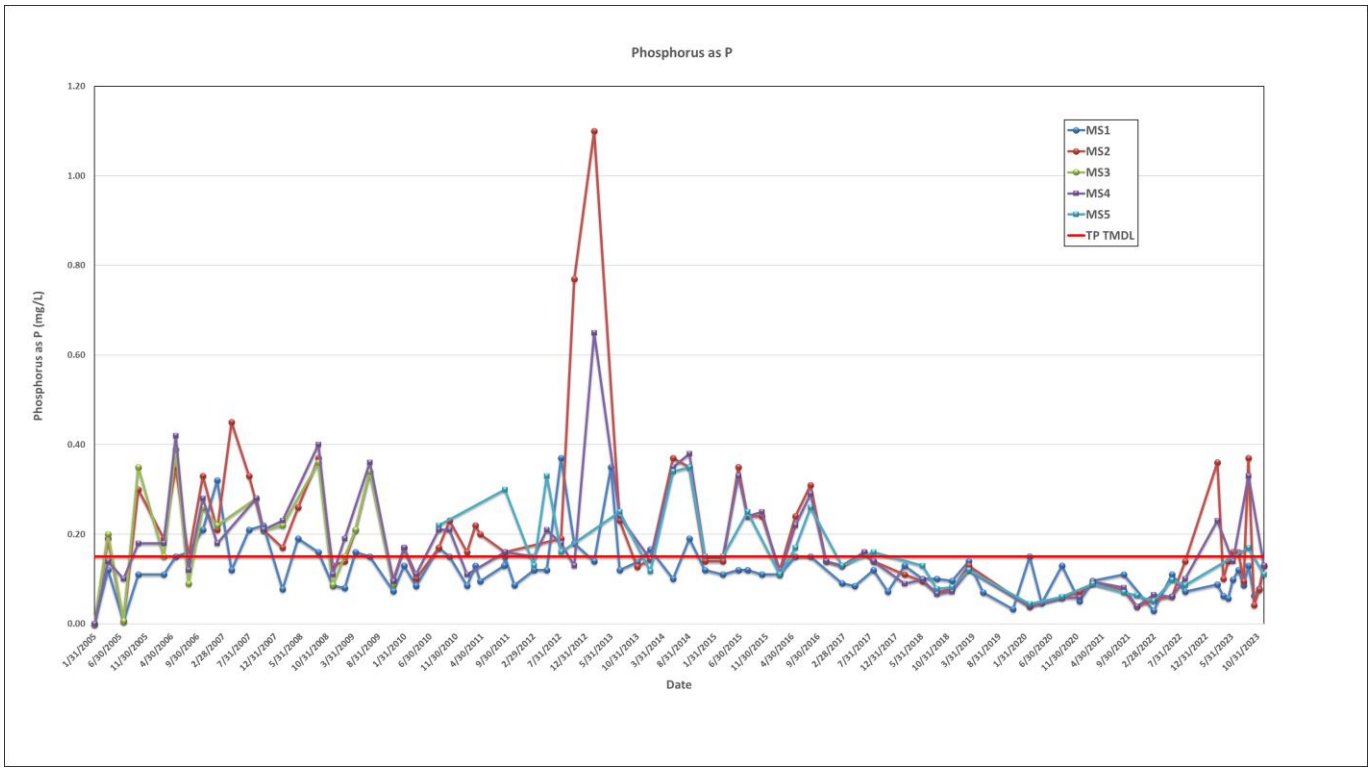

Figure 5. Total Phosphorus results for Munson Slough.

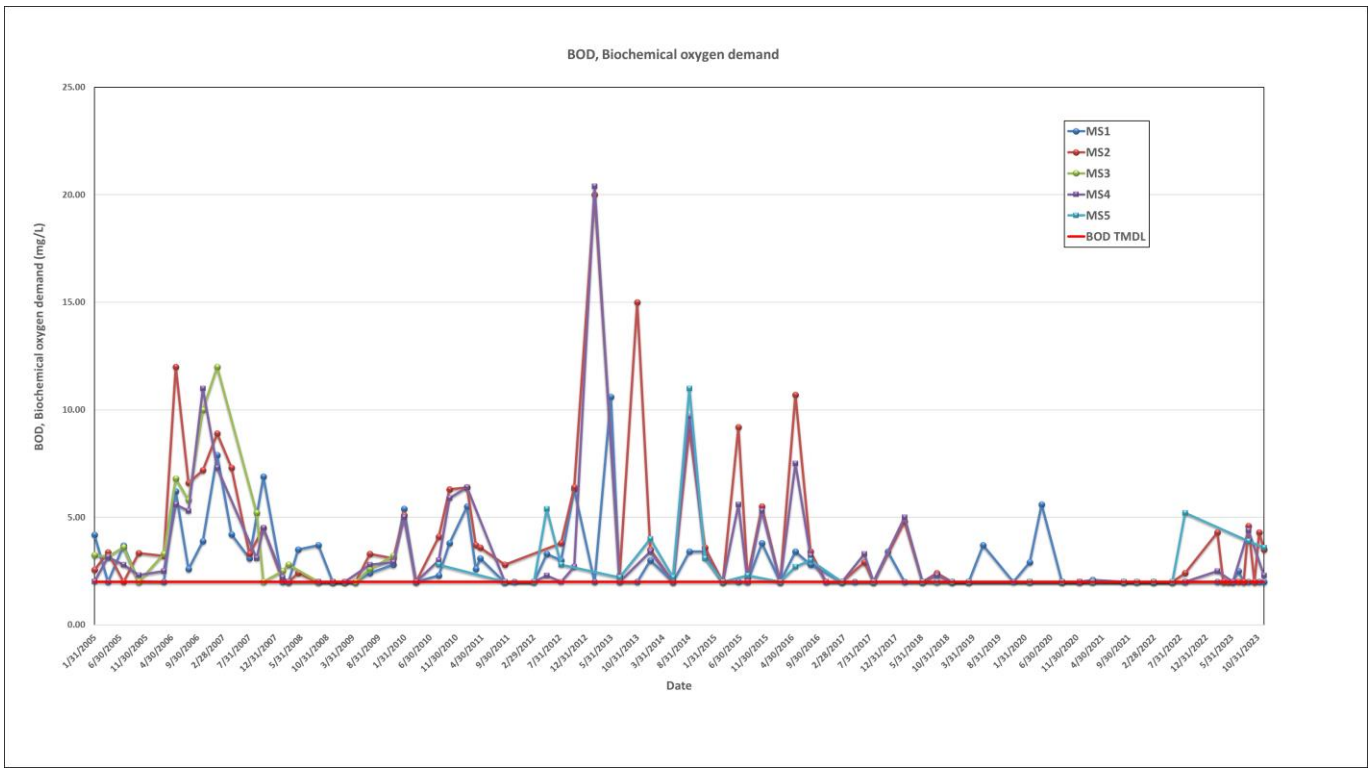

Figure 6. Biological Oxygen Demand results for Munson Slough.

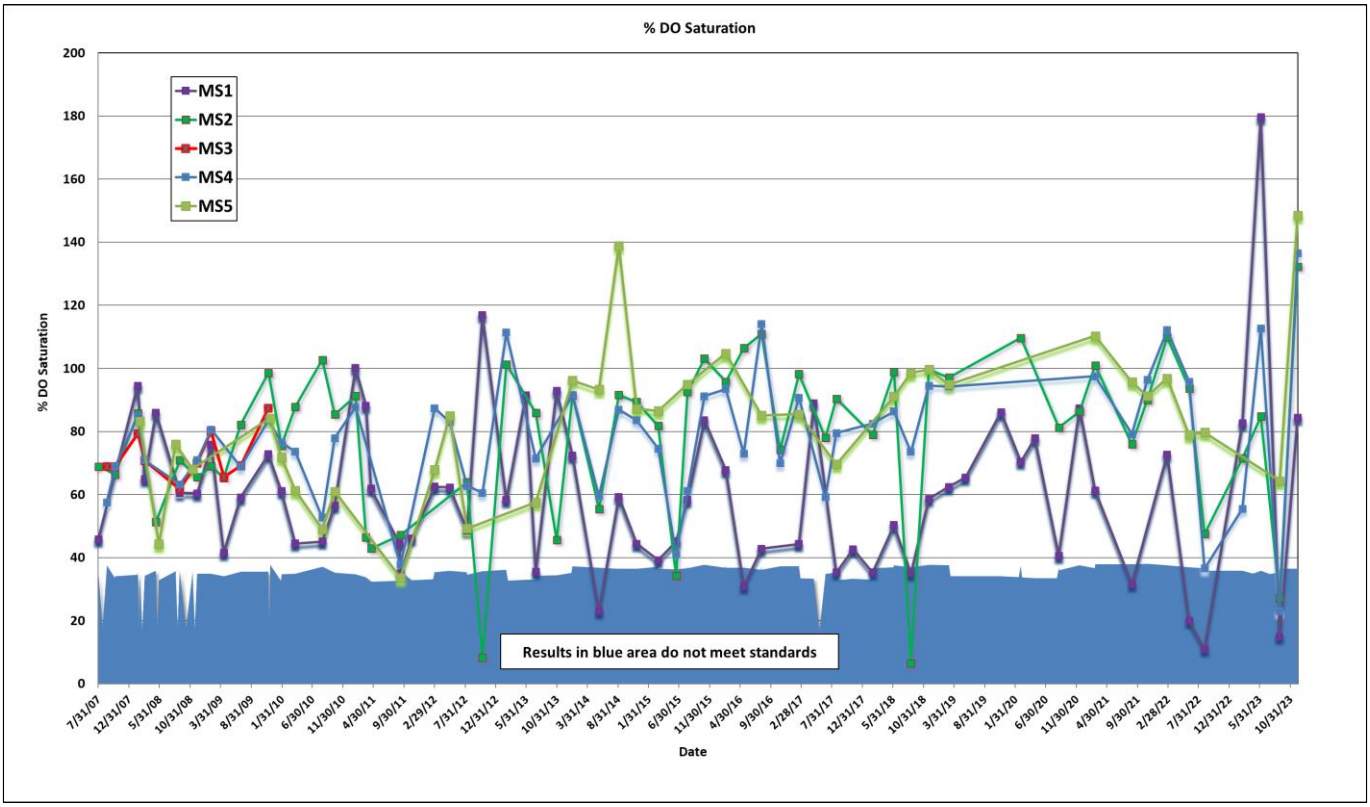

Figure 7. Dissolved Oxygen Percent Saturation results for Munson Slough.

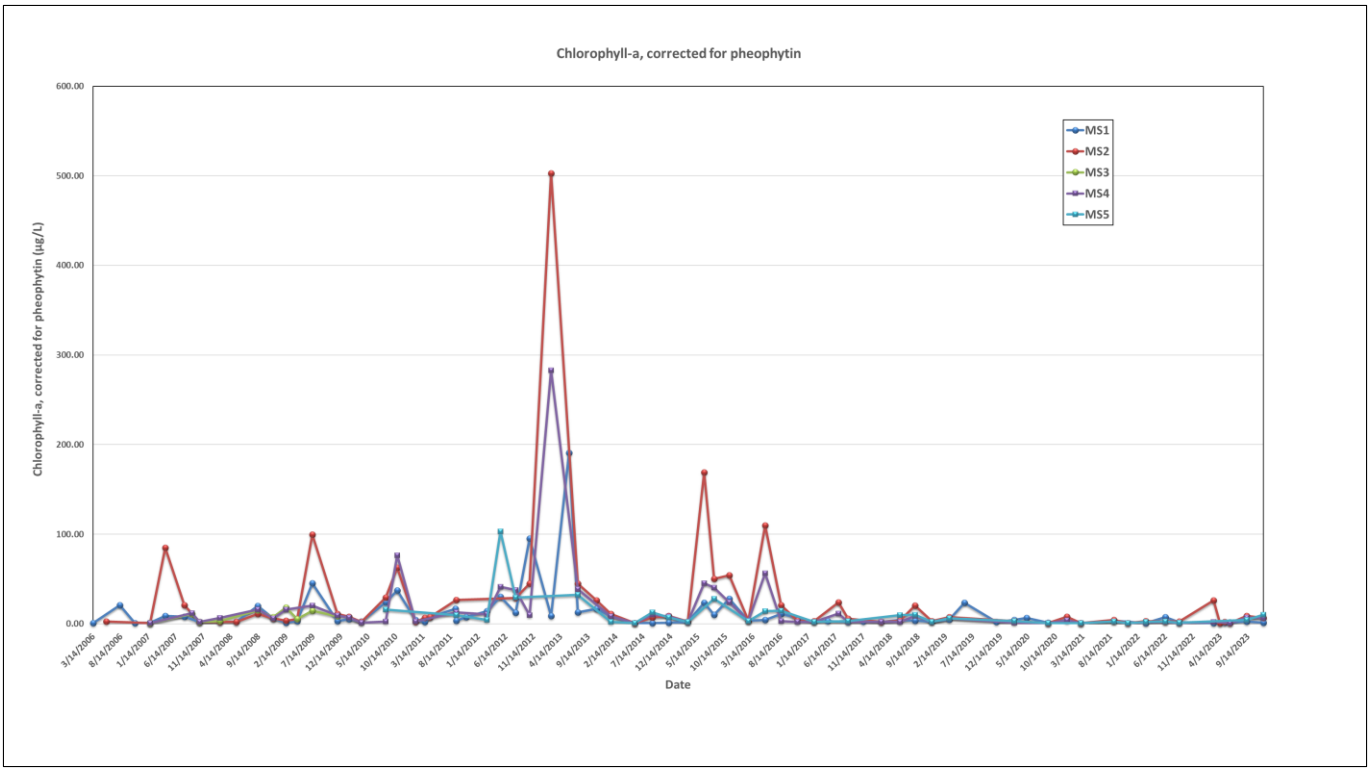

Figure 8. Chlorophyll-a results for Munson Slough.