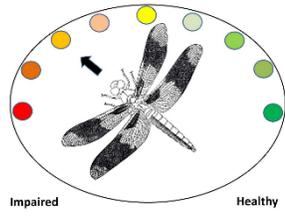


# Munson Slough EcoSummary



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.

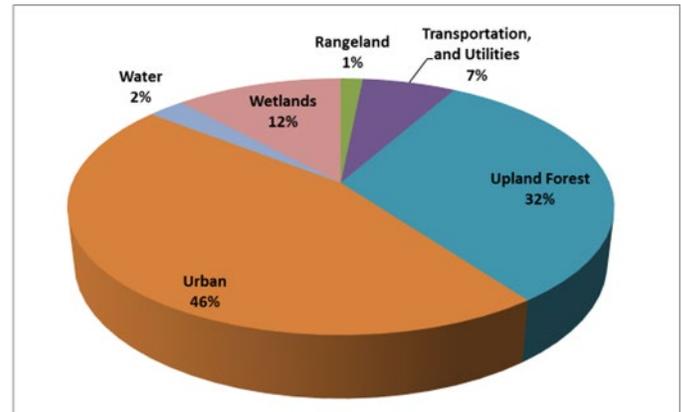
Approximately 54% of land use in the 38,790-acre basin is residential, commercial, industrial or transportation (as shown in **Figure 1**). These types of land uses are often attributed to increases in stormwater runoff and higher nutrient loads.

## 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 both upstream and downstream of Lake Munson. The TMDLs are as follows:

### TMDLs upstream of Lake Munson

The dissolved oxygen TMDL targets are 5-day biological oxygen demand (BOD<sub>5</sub>) of 2.00 mg/L, Total Nitrogen (TN) of 0.72 mg/L, and Total Phosphorus (TP) of 0.15 mg/L and are allocated as follows. To meet the dissolved oxygen TMDL criterion, water chemistry concentrations will require a 50 percent reduction for BOD<sub>5</sub>, an 8.35 percent reduction for TN, and a 17.53 percent reduction for TP at sources contributing to exceedances of the TMDLs.

The fecal coliform TMDL for portions of Munson Slough would require a 96.9 percent reduction at sources contributing to exceedances of the criteria where the Slough crosses under Springhill Road, and a 91.5 percent reduction at

the Slough where it crosses under Capital Circle southwest. However, the fecal coliform standard in Florida has been supplanted by standards developed for *Escherichia coli*.

#### *TMDLs downstream of Lake Munson*

The dissolved oxygen TMDL is an in-stream concentration for BOD<sub>5</sub> of 2.00 mg/L and is allocated as follows. In-stream concentrations must meet the dissolved oxygen criterion and BOD<sub>5</sub> TMDL concentrations will require a 52.9 percent reduction at sources contributing to exceedances.

The un-ionized ammonia impairment will be addressed by reductions in total ammonia. The total ammonia TMDL is an in-stream concentration of 0.32 mg/L and is allocated as follows. The in-stream un-ionized ammonia concentrations must meet the water quality criterion, which requires a 33.3 percent reduction of total ammonia at sources contributing to exceedances. However, the un-ionized ammonia criterion has been replaced with the Total Ammonia Nitrogen (TAN) criterion.

#### **Methods**

Surface water samples are collected quarterly (as field conditions allow). Leon County also conducted a biological survey to evaluate the health of aquatic invertebrate communities in Munson Slough. This information is used to determine the health of Munson Slough and meets the requirements of the Florida Department of Environmental Protection (FDEP).

#### **Results**

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.

Due to 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.

As of 2010, Station MS3 is no longer sampled.

#### *Nutrients*

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

The Munson Slough Total Nitrogen and Phosphorus levels exceeded the NNC at all stations during the period of record. However, recent trends suggest that nutrient levels are dropping in the Slough. The 2017, 2018 and 2020 nitrogen and phosphorus levels for station MS1 met the NNC. Stations MS2 and MS4 met the NNC for both nitrogen and phosphorus in 2018. While nitrogen levels occasionally exceeded TMDL levels in recent years (2017-2018), nutrient levels appear to be decreasing (**Figures 2 and 3**).

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. In recent years, improvements in upstream 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	<b>1.44</b>	<b>1.32</b>	<b>1.43</b>	-
2007	<b>1.36</b>	<b>1.59</b>	-	-	-
2008	0.89	0.73	-	-	0.87
2009	0.62	0.73	0.74	-	-
2010	<b>1.09</b>	<b>1.35</b>	-	<b>1.35</b>	<b>1.14</b>
2011	0.80	-	-	-	-
2012	0.90	-	-	1.02	-
2013	<b>1.27</b>	-	-	-	-
2014	0.97	<b>1.08</b>	-	<b>1.16</b>	<b>1.08</b>
2015	0.81	<b>1.41</b>	-	<b>1.39</b>	-
2016	-	0.89	-	0.89	-
2017	0.73	-	-	-	-
2018	0.69	0.63	-	0.60	-
2019	-	-	-	-	-
2020	0.51	-	-	-	-
2021-2022	-	-	-	-	-

**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	<b>0.24</b>	<b>0.19</b>	<b>0.22</b>	-
2007	<b>0.21</b>	<b>0.28</b>	-	-	-
2008	0.12	<b>0.25</b>	-	-	<b>0.28</b>
2009	0.11	0.18	0.18	-	-
2010	0.13	0.16	-	0.17	0.18
2011	0.11	-	-	-	-
2012	<b>0.20</b>	-	-	0.17	-
2013	0.17	-	-	-	-
2014	0.14	<b>0.23</b>	-	<b>0.23</b>	<b>0.21</b>
2015	0.11	<b>0.23</b>	-	<b>0.23</b>	-
2016	-	<b>0.19</b>	-	0.18	-
2017	0.09	-	-	-	-
2018	0.11	0.09	-	0.08	-
2019	-	-	-	-	-
2020	0.08	-	-	-	-
2021-2022	-	-	-	-	-

### *Chlorophyll-a data*

Water quality samples collected by Leon County are analyzed by Pace Analytical Services – Ormond Beach (Pace), with the analysis results provided back to the County for submission to FDEP. In June 2022, FDEP conducted a routine audit of the chlorophyll-a data. This audit revealed that from October 2014 through December 2020, the chlorophyll-a data was reported as “uncorrected chlorophyll-a” and not “corrected chlorophyll-a”, as it should have been. Pace has since rectified this error and beginning in January 2021, the chlorophyll-a data were properly reported as “corrected chlorophyll-a”. The laboratory also provided Leon County with the “correct chlorophyll-a” data from the affected dates and the information of this year’s Report has been changed to reflect this.

### *Total Ammonia Nitrogen (TAN)*

The TAN criterion (0.29 mg/L and based on water temperature & pH) was exceeded (0.57 mg/L) during the 2<sup>nd</sup> quarter of 2015 at Station MS2. No exceedances were noted from 2016-2022.

### *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.

### *Dissolved Oxygen (DO) and Chlorophyll-a*

FDEP's DO criterion shows very few results that did not meet the threshold (**Figure 4**). However, this does not in any way invalidate the TMDL. Algal blooms represented by chlorophyll-a (**Figure 5**) 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.

### *Biological Oxygen Demand (BOD)*

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

### *Habitat Assessment (HA) and Stream Condition Index (SCI)*

The results of the Habitat Assessment score for station MS1 characterize the stream habitat in the low Suboptimal to Marginal category (**Table 3**). Habitat availability was low with snags and aquatic vegetation being dominant. Hydrologic conditions leading up to the sample date resulted in the quantity of roots and leaves habitat being decreased compared to earlier sample events. Rock habitat, where present, was heavily silted and less productive compared to earlier events. Water velocity was slow. Channel characteristics were of a historically canalized system, though the number of expected pools were present. Bank sloughing was present and particularly conspicuous in the 40 – 60-meter sections of the 100-meter transect. Dissolved oxygen levels

were low at the station in both the surface and bottom layers of the water column. All other water quality parameters at the station were nominal.

The SCI score was 13.69, with a categorical score of Impaired (**Table 4**). This is likely a result of low dissolved oxygen levels and irregular precipitation events leading to the scouring of some habitats. The categorical SCI score for 2022 is comparable to the score received in fall of 2017 in contrast to the higher scores received in the winter of 2020.

The community represented in the SCI sample is consistent with the slow flow and the nature of the habitat present. The most abundant macroinvertebrates collected in both vials were the amphipod taxon *Hyaella azteca* complex and the freshwater snail species *Amnicola dalli*. Together, these two taxa accounted for 78% of all individuals collected from the sample. Within the sample, the two dominant taxa accounted for 244 individuals, and all other taxa (25) accounted for the remaining 65 individuals. From the total taxa collected (27), nine are listed as very tolerant and only one is listed as a sensitive taxon. No long-lived taxa were recovered from the SCI sample. No Plecoptera (stoneflies) were noted in the SCI. One Ephemeropteran (mayflies) species (*Caenis diminuta*) and one Trichopteran species (*Oecetis cinerascens*) were collected, resulting in an Ephemeroptera/Plecoptera/Trichoptera (EPT) score of two. *Caenis diminuta* is widely regarded as one of the most tolerant species of the Florida Ephemeropteran fauna.

[Click here for more information about the Stream Condition Index and Habitat Assessments.](#)

## Conclusions

Based on ongoing sampling, the more recent results suggest that Munson Slough meets the nutrient thresholds for the East Panhandle Region.

Nitrogen levels occasionally exceeded TMDL levels in recent years, but overall, nitrogen levels appear to be decreasing. Total Phosphorus has not exceeded the TMDL limit since 2016 and, like nitrogen, appears to be on a downward trend.

While nutrient levels have decreased in recent years, elevated BOD levels during some sampling events suggest that microbial activity appears to have been stimulated by elevated levels of nitrogen and phosphorus.

The results of the Habitat Assessment characterize the stream habitat in the Marginal/low Suboptimal category. In keeping with the habitat assessment, the Stream Condition Index score was Impaired.

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](http://www.LeonCountyWater.org)

[Click here to access the results for all water quality stations sampled in 2022.](#)

[Click here for a map of the watershed – Sample Sites MS1, MS2, MS4 and MS5.](#)

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**Table 3.** Munson Slough (MS1) Habitat Assessment Score.

MS1	Score	Category
Substrate Diversity	12	Suboptimal
Substrate Availability	5	Poor
Water Velocity	9	Marginal
Habitat Smothering	12	Suboptimal
Artificial Channelization	10	Marginal
Bank Stability	8, 5	Suboptimal, Marginal
Riparian Zone Width	10, 7	Optimal, Suboptimal
Riparian Vegetation Quality	9, 6	Optimal, Suboptimal
<b>Final Habitat Assessment Score</b>	<b>93</b>	
<b>Interpretation</b>	<b>Marginal/Suboptimal</b>	

**Table 4.** Munson Slough (MS1) Stream Condition Index Score.

MS1	Rep 1	Rep 2
<b>Stream Condition Index Metrics Scores</b>		
Total Taxa	0.00	0.87
Ephemeroptera Taxa	0.00	2.00
Trichoptera Taxa	1.43	0.00
% Filter Feeder	0.11	0.57
Long-lived	0.00	0.00
Clinger Taxa	0.00	0.00
% Dominance	4.81	1.70
% Tanytarsini Taxa	0.00	1.65
Sensitive Taxa	0	1
% Tolerant Taxa	5.49	5.56
SCI Vial Score	13.16	14.83
<b>Stream Condition Index Score</b>	<b>13.99</b>	
<b>Score Interpretation</b>	<b>Impaired</b>	

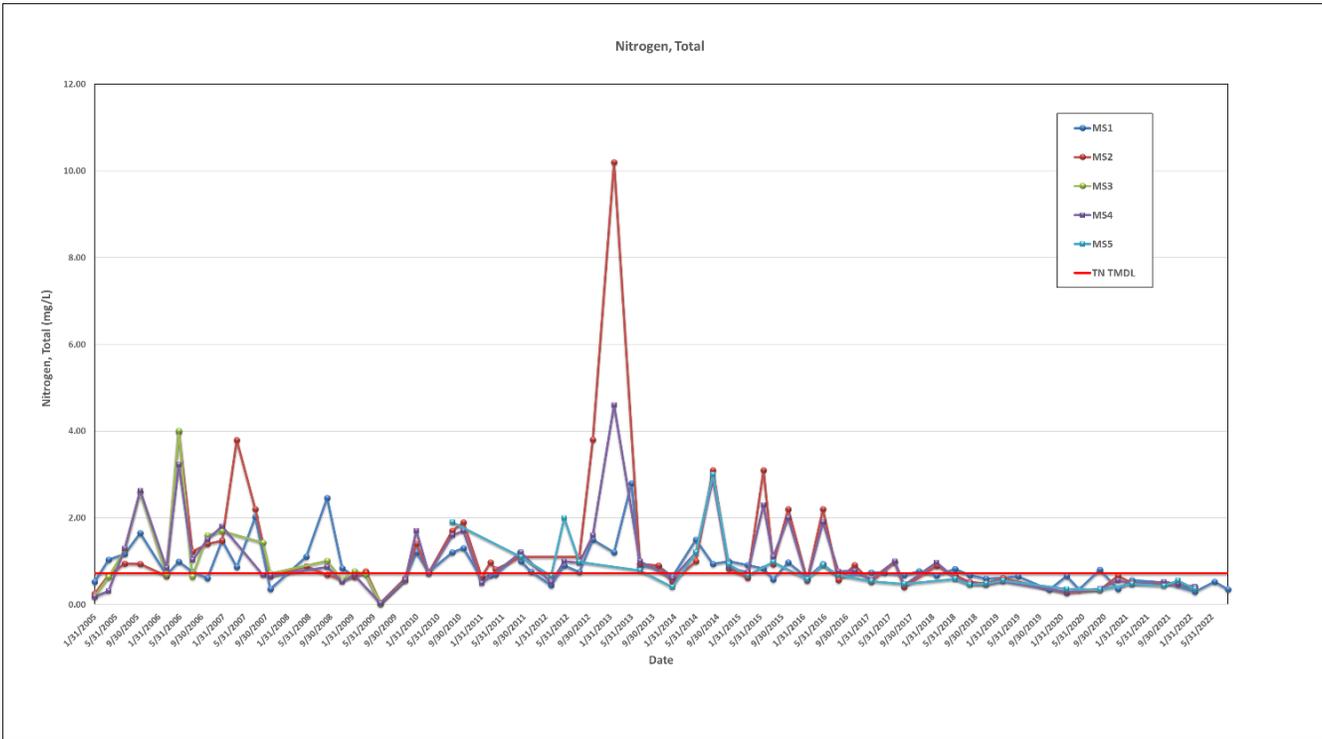


Figure 2. Total Nitrogen results for Munson Slough.

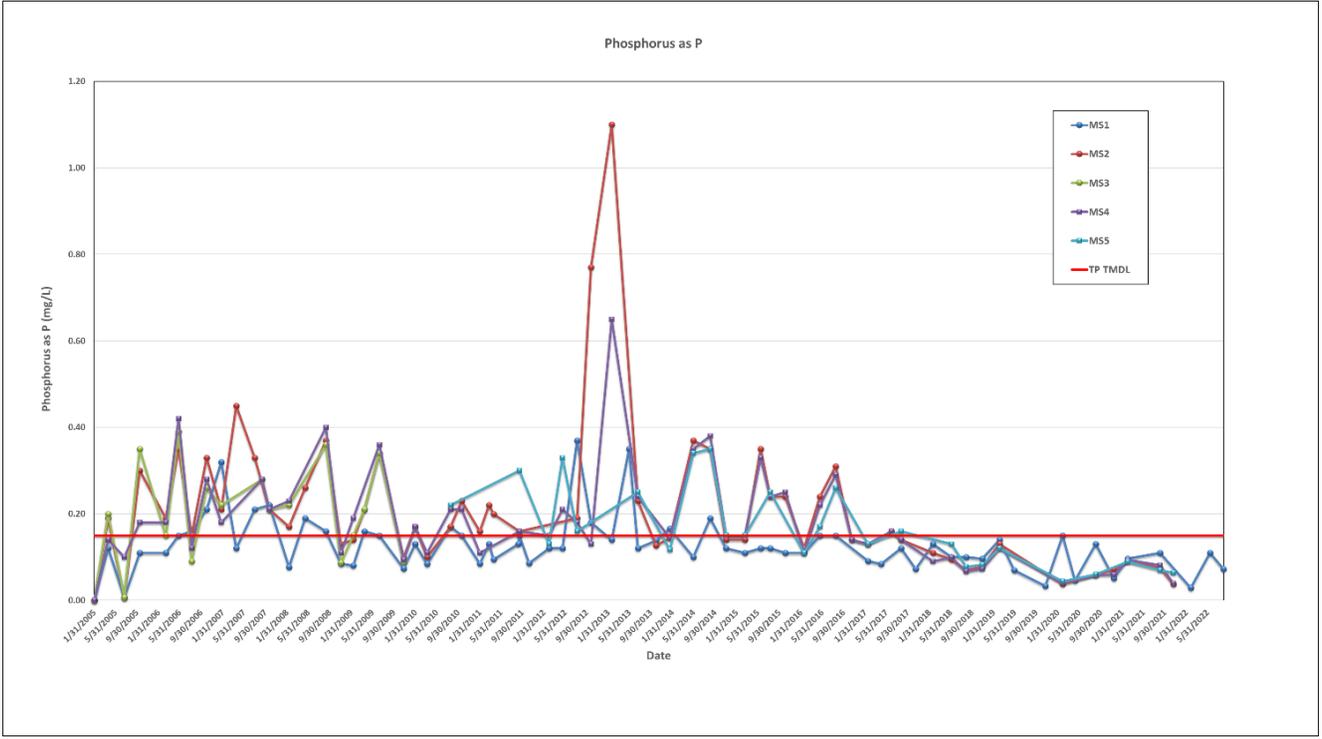


Figure 3. Total Phosphorus results for Munson Slough.

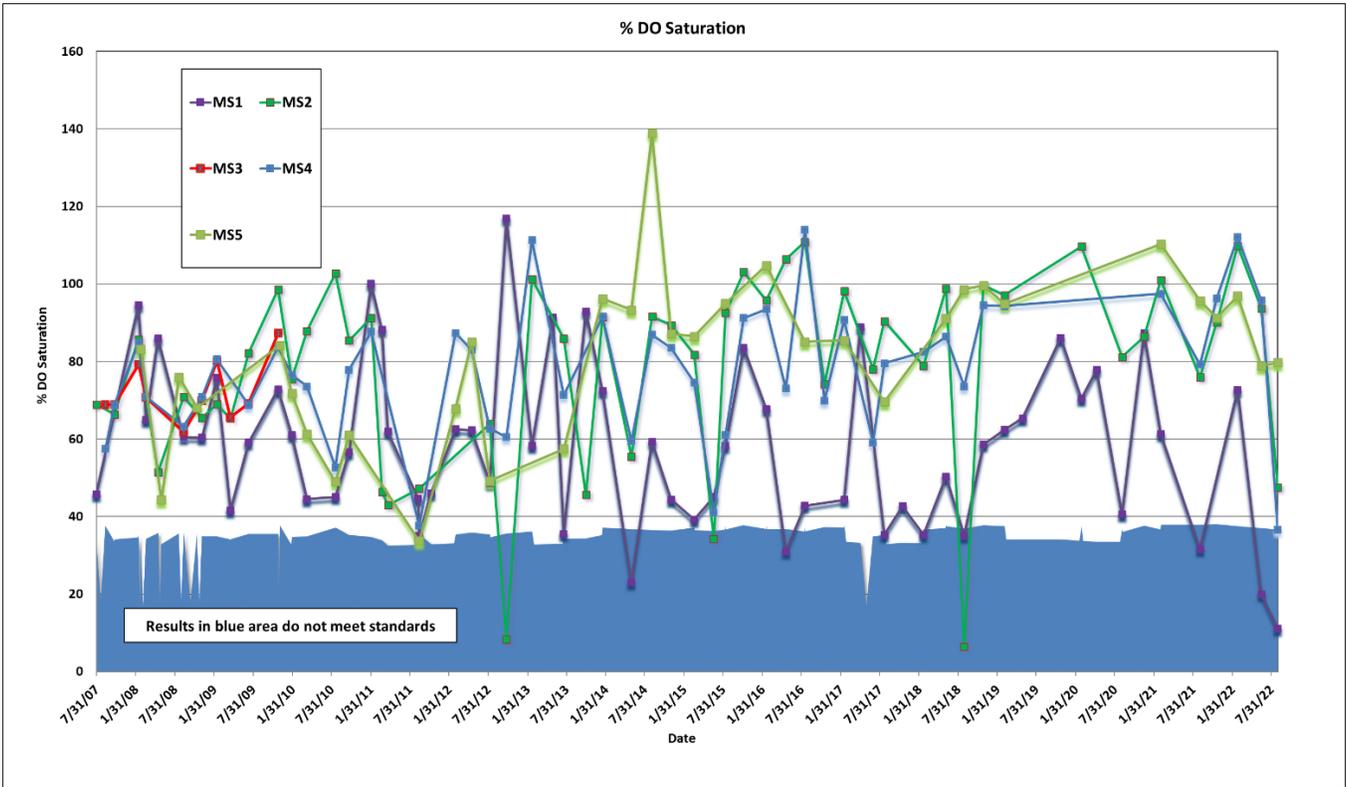


Figure 4. Dissolved Oxygen Percent Saturation results for Munson Slough.

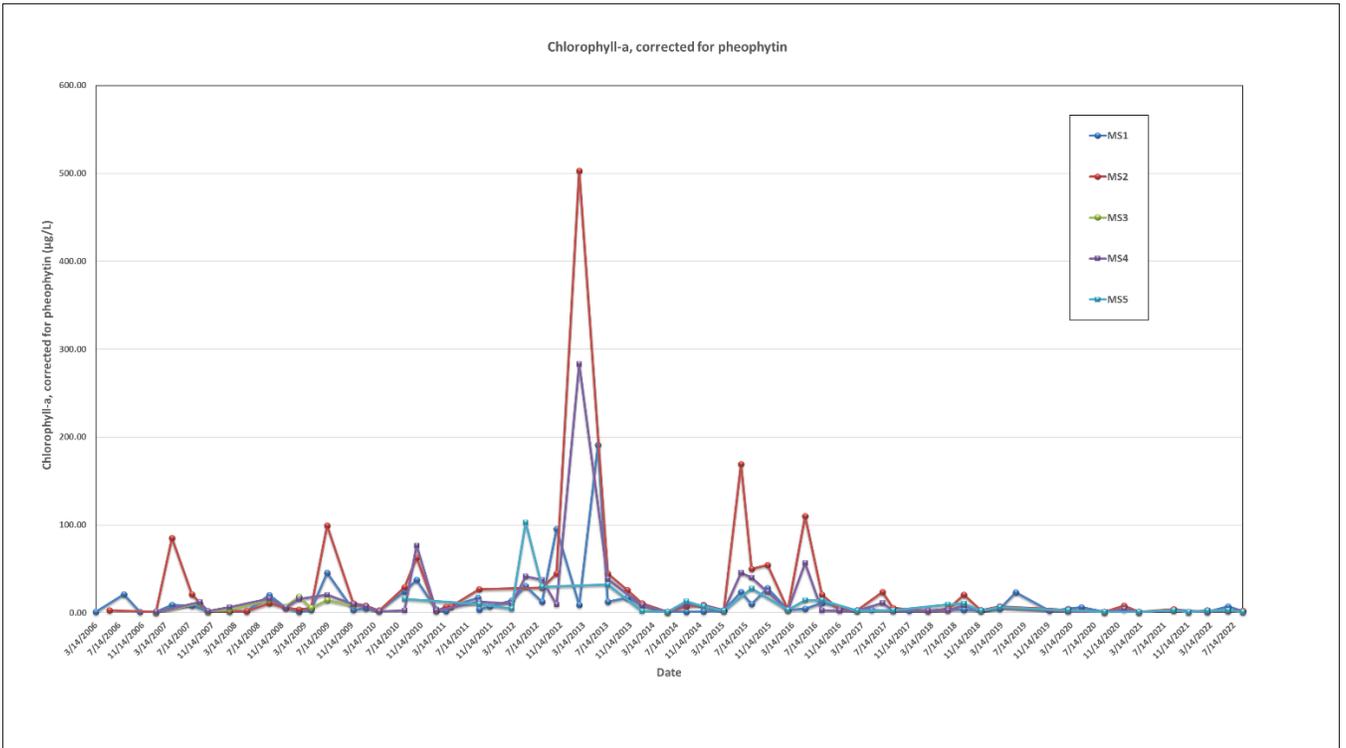


Figure 5. Chlorophyll-a results for Munson Slough.

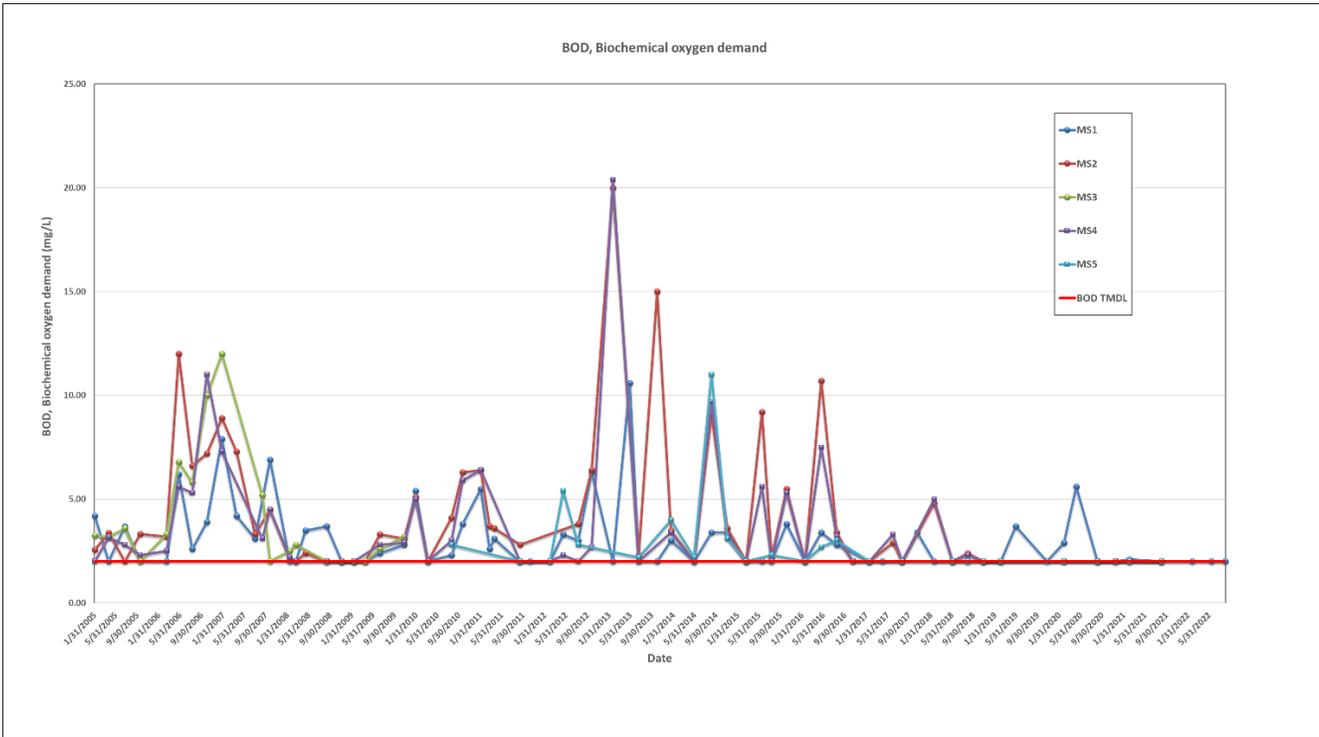


Figure 6. Biological Oxygen Demand results for Munson Slough.