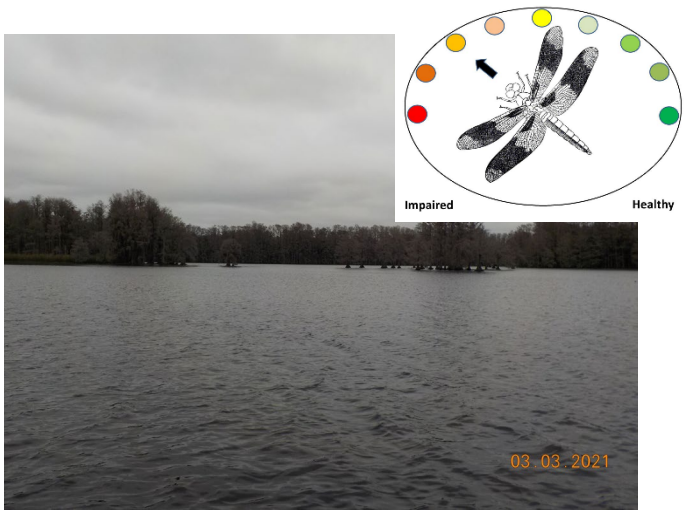
Waterbody: Lake Munson



Basin: Lake Munson

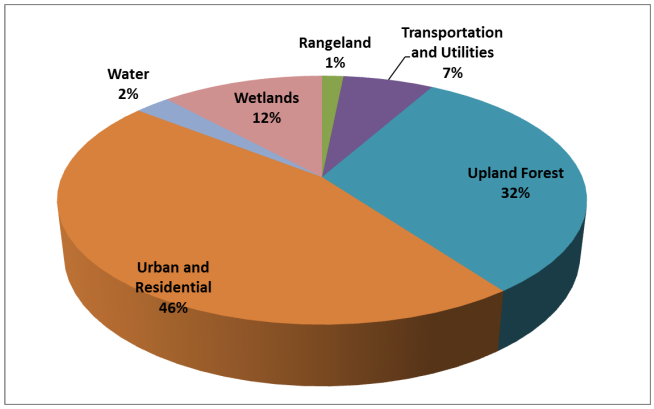
Lake Munson is an approximately 288-acre, cypress-rimmed, nitrogen-limited lake located south of the City of Tallahassee. The lake is believed to have originally been a cypress swamp but has since been impounded and now functions as a shallow man-made lake. Lake Munson receives much of its water from the heavily altered Munson Slough and its tributaries. Lake outflow continues southward via Munson Slough and finally drains into Ames Sink. Dye trace studies have confirmed a direct connection between Ames Sink and Wakulla Springs.

The lake has a history of severe water quality and ecological problems including fish kills, algal blooms, exotic vegetation and snails, high nutrient and bacterial levels, low game fish productivity, sediment contamination, and depressed oxygen levels.

As shown in the following pie chart, approximately 54% of land use in the 38,790-acre Lake Munson basin is rangeland, transportation, utilities, urban or residential. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.

Background

Healthy, well-balanced lake 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, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. 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.

The lake received a Total Maximum Daily Load (TMDL) by the Florida Department of Environmental Protection (FDEP) in 2013. The TMDL requires the lake to meet the dissolved oxygen criterion and nutrient TMDL concentrations, which, based on mean concentrations from the 2004-2008 period, will require a 50 percent reduction for Biological Oxygen Demand (BOD), a 32.5 percent reduction for Total Nitrogen (TN), a 76.7 percent reduction for Total Phosphorus (TP) and a 31.9 percent reduction in turbidity.

There has been a consensus that the organic and nutrient-rich sediments in Lake Munson are contributing to the poor water quality and that sediment removal would be the best way to improve the lake's water quality. Unfortunately, sediment removal would be logistically very difficult and extremely expensive. Another option is to periodically drain the lake. The lake drawdowns are expected to result in de-watering, compaction, and partial oxida-

tion of sediments thus creating a sediment "cap" that would serve to improve water quality and simultaneously generate suitable habitat for fish spawning.

On April 27, 2010, the Leon County Board of County Commissioners directed staff to implement the County's Science Advisory Committee lake drawdown recommendations. After additional meetings, which included staff and committee members from the Florida Fish and Wildlife Conservation Commission, FDEP, U.S. Forest Service, Leon County Science Advisory and Water Resource Committees, and the community surrounding the lake, it was decided to start the lake drawdown October 18, 2010. The drawdown continued until June 14, 2011. Sampling recommenced in the third quarter of 2011.

Algal blooms have been a long-term problem on Lake Munson. Due to the on-going algae problem and geographic location of the lake, Lake Munson was chosen as the original site for a pilot project presented by the Northwest Florida Water Management District (NWFWMD) in response to an innovative technology grant sponsored by the Florida Department of Environmental Protection (FDEP). The project was selected for grant funding and AECOM was selected by the NWFWMD for implementation. The objective of the project was to collect representative data of treatment system efficiency and demonstrate how the export of intact cellular algae using an algae harvesting and Harmful Algal Bloom (HAB) mitigation system would help achieve Total Maximum Daily Load (TMDL) goals for Lake Munson and Munson Slough. The official start-up, media and stake holder event was held on June 17, 2021. The event was the first day the harvester was up and running for any considerable amount of time but, ironically, was not run consistently since, due to low levels of algae in the lake. Because conditions at Lake Munson were not immediately conducive to demonstrate the effectiveness of this technology, AECOM and NWFWMD identified a pond with an active algae bloom at the Apalachee Regional Park. The relocation of the equipment to the selected pond was approved and contracts were amended, permits were updated and approved, with site preparation completed on October 12, 2021. The relocation was completed on November 2, 2021.

Results

Nutrients

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (NNC and expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period.

Geometric means of chlorophyll-a, total nitrogen, and total phosphorus exceeded the state criteria several times over the sampling period. The geometric mean for chlorophyll-a in 2013 (85.0 µg/L) was the highest reading on record. However, starting in 2017 there was a substantial drop in chlorophyll-a values. While total phosphorus values still exceeded the NNC values in 2017 and 2019, total phosphorus, total nitrogen, and chlorophyll-a values continue to drop over time. The 2020 and 2021 phosphorus and nitrogen NNC results are among the lowest levels recorded by Leon County staff. Staff believe that a combination of upstream nutrient reduction and the re-establishment of aquatic vegetation are contributing to the reduction of chlorophyll-a and water column nutrients.

As shown in Figures 1 through 4, past levels of BOD, total nitrogen, total phosphorus, and turbidity levels were consistently above the TMDL limits, but levels are slowly dropping. Algal blooms, represented by chlorophyll-a (Figure 5), continue to be a problem in Lake Munson, but values continue to drop.

Metals

Lake Munson (Station LMU7) exceeded Class III water quality criteria for both lead and copper during the 2nd quarter. Relict anthropogenic sources such as leaded gasoline are most likely to be the cause of the lead exceedance. The possible sources of the copper exceedance are unknown.

Click here for more information on metal levels in Leon County waterbodies.

Table 1. FDEP's chlorophyll-a, total nitrogen and phosphorus criteria for lakes applied to Lake Munson. Due to the lake drawdown, staff could not collect samples for the first and second quarters of 2011. Results in bold signify exceedances of the State criteria.

Clear Lakes High Alkalinity	Chl-a 20 µg/L	Total Nitrogen 1.05-1.91 mg/L	Total Phosphorus 0.03-0.09 mg/L
2004	3.6	0.35	0.06
2005	13.8	0.62	**0.11**
2006	12.4	1.38	**0.19**
2007	10.9	1.49	**0.30**
2008	13.1	0.76	**0.20**
2009	5.5	0.88	**0.17**
2010	8.7	1.07	**0.16**
2011	-	-	-
2012	**39.0**	**1.08**	**0.18**
2013	**85.0**	**1.51**	**0.24**
2014	13.9	1.27	**0.24**
2015	**54.3**	**1.37**	**0.22**
2016	**24.9**	0.70	**0.15**
2017	8.0	0.50	**0.11**
2018	19.2	0.60	0.09
2019	11.1	0.52	**0.11**
2020	5.6	0.38	0.05
2021	1.4	0.49	0.06

Fish Consumption Advisory

The Florida Department of Health (FDOH) has issued consumption limits for certain fish in Lake Munson due to elevated levels of mercury.

Click here for more information about fish consumption advisories.

State agencies performed fish tissue sampling in 2019 to revisit the need to continue the consumption advisories for polychlorinated biphenyls (PCBs). FDOH determined in 2021 that PCB levels in fish tissues were at very low levels and that the current mercury advisories would be protective of human health.

Floral Assessment

The Lake Vegetation Index score for Lake Munson was 43, a substantial decline from the previous year's (2020) score of 53, placing the lake's vegetative community in the lower end of the Healthy category.

Fifty species were found during the 2021 survey vs. the sixty-six species that were found in 2020. Units surveyed can vary from year to year with the resultant change in number of taxa, so while this is somewhat surprising, the drop in taxa found in 2021 is not the main reason for decline in the LVI score.

In 2020, the native species coontail (*Ceratophyllum demersum*) and pond cypress (*Taxodium ascendens*) were the most dominant species in the lake but, several invasive exotic plants were quickly establishing themselves in the water. The two most prevalent plants in the system in 2021 were hydrilla (*Hydrilla verticillata*), and water hyacinth (*Eichhornia crassipes*). Leon County staff were concerned with the rapid proliferation of these and other exotics, so in the latter part of 2020, the Florida Fish and Wildlife Conservation Commission (FWC) was contacted about the overabundance of exotic vegetation in the lake. The FWC sent teams out in October of 2020 to apply herbicides to the emergent and submersed invasive exotics in Lake Munson. A substantial amount of exotic plants were treated, and it was hoped that natives would continue to proliferate in the water column. Unfortunately, the Category I Invasive Exotic hydrilla (*Hydrilla verticillata*), quickly reestablished itself in the early part of 2021. An additional herbicide treatment was performed in late August for water hyacinth. Due to the rapid proliferation of hydrilla, the 2021 survey showed that coontail and the exotic hydrilla were now either the dominant or codominant species found in the lake.

Consequently, the LVI score is substantially lower than in past years.

Exotic apple snails

In 2006 - 2007 the exotic apple snail *Pomacea maculate* (previously misidentified as *P. canaliculata*), consumed most vegetation in Lake Munson, allowing the lake to transition from macrophytic vegetation dominated community to a community dominated by algae. Ironically, Lake Munson's past LVI scores were influenced by the invasive exotic apple snail. Historically, Lake Munson was dominated by exotic vegetation. Over time, the snails consumed all vegetation in the water column including water hyacinth (*Eichhornia crassipes*), water lettuce (*Pistia stratiotes*) and hydrilla (*Hydrilla verticillata*), all listed as Category I Invasive Exotics by the Florida Exotic Pest Control Council. The presence of these species would have contributed to a lower LVI score. The snail also consumed native plants including the American lotus (*Nelumbo lutea*), but the overwhelming abundance of exotic plants in the water column would probably have negated any positive effects the native vegetation would have had on the LVI. Efforts to eradicate the exotic apple snails were met with little success, but there was a precipitous decline (probably due to a lack of food) in apple snails beginning in the latter part of 2015. While still present in the watershed, and for reasons unknown, the snails have been unable to reestablish themselves to their previous numbers. The decline allowed native emergent and floating plants to proliferate in the lake including the welcome additions of southern waternymph (*Najas guadalupensis*) and coontail (Ceratophyllum demersum). Unfortunately, with the advent of the native submersed plants, hydrilla and water hyacinth have also reestablished themselves and are currently overwhelming the native species.

For a complete list of plants found during the LVI survey, please see Table 2.

For additional information about the LVI please go to the Florida Department of Environmental Protection webpage: https://floridadep.gov/dear/water-quality-standards-program/documents/lake-vegetation-index-primer

For additional information about exotic Category I and II invasive exotic plants, please go to the Florida Exotic Pest Plant Council: http://www.fleppc.org/list/list.htmhttps://myfwc.com/wildlifehabitats/habitat/invasive-plants/.

Click here for more information on the Lake Munson LVI.

Click here for more information on common exotic and invasive plants in Leon County wetlands and waterbodies.

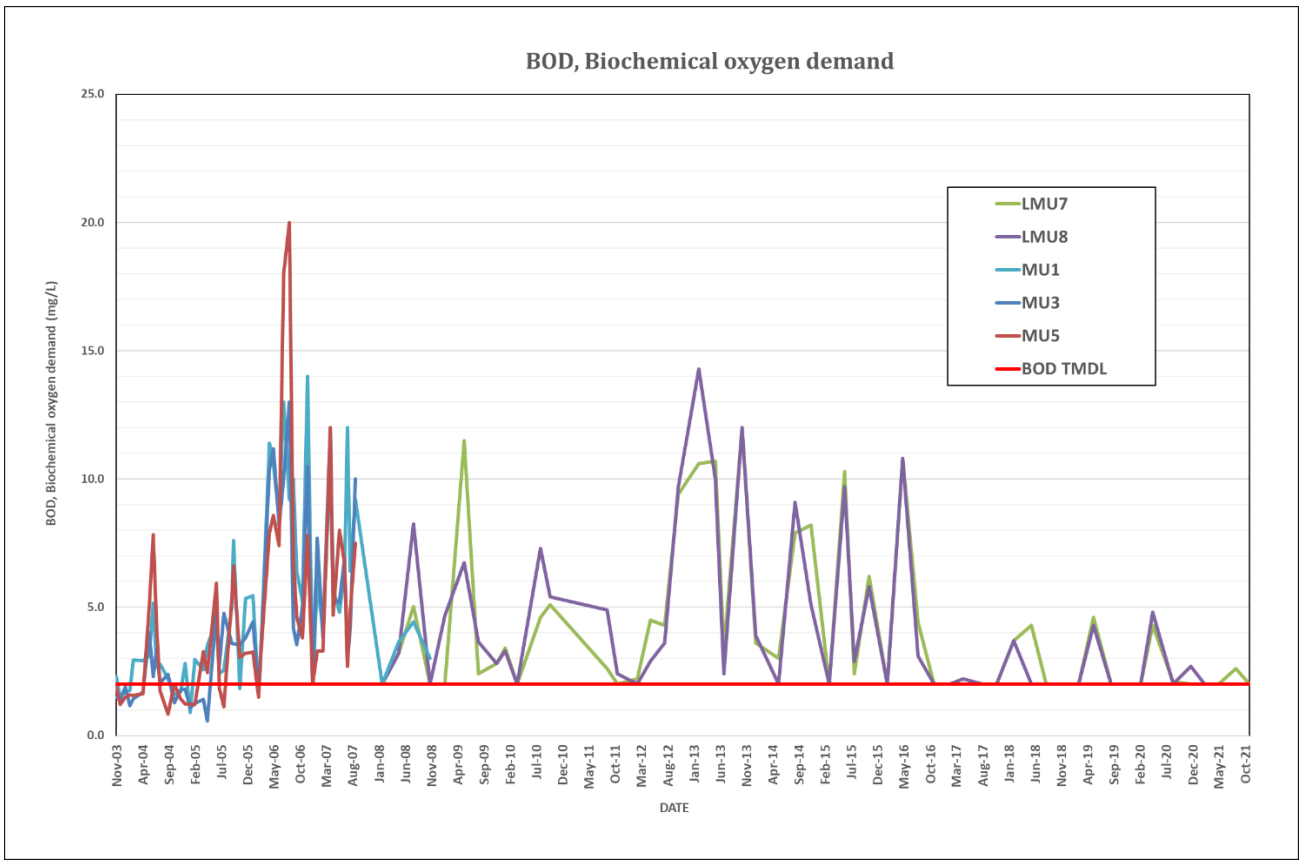


Figure 1. BOD results for Lake Munson.

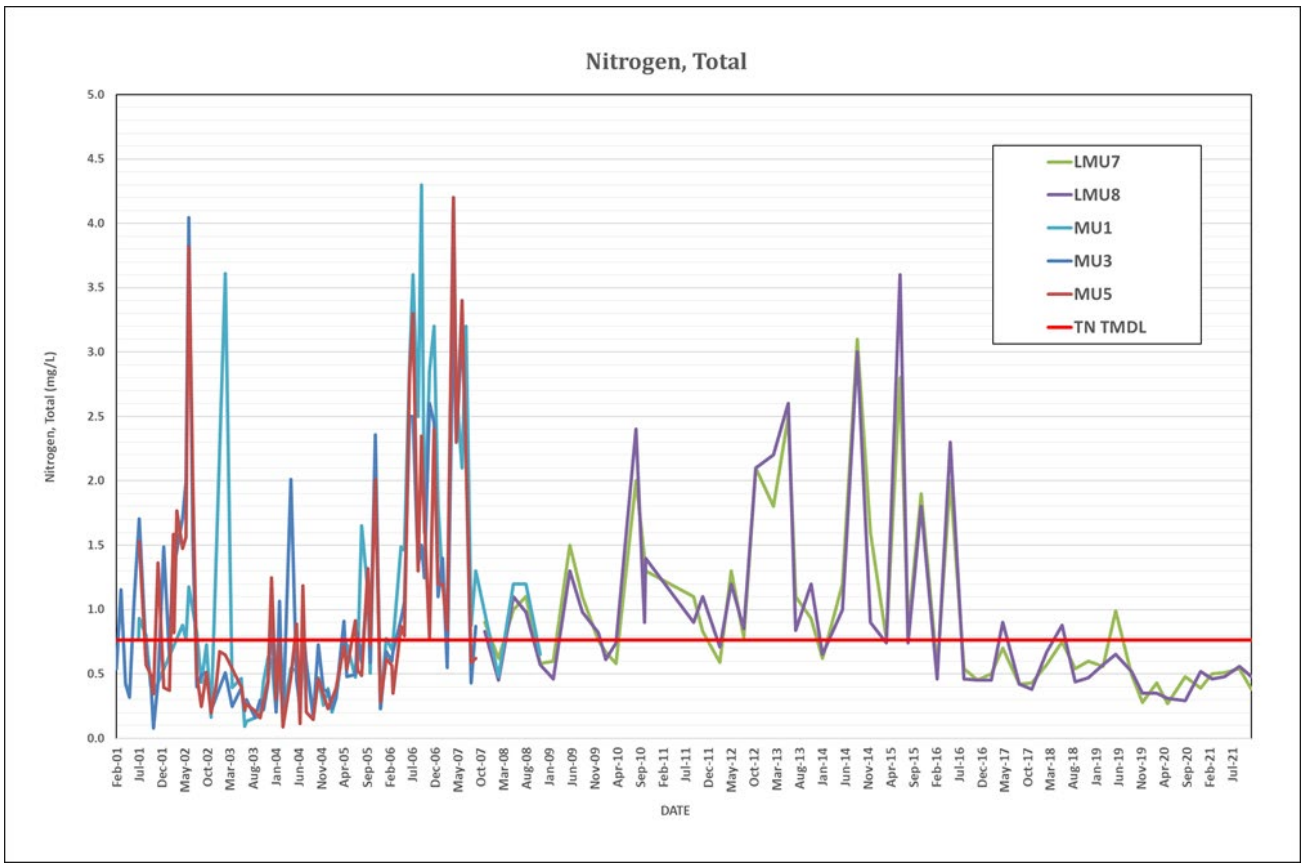


Figure 2. Total Nitrogen results for Lake Munson.

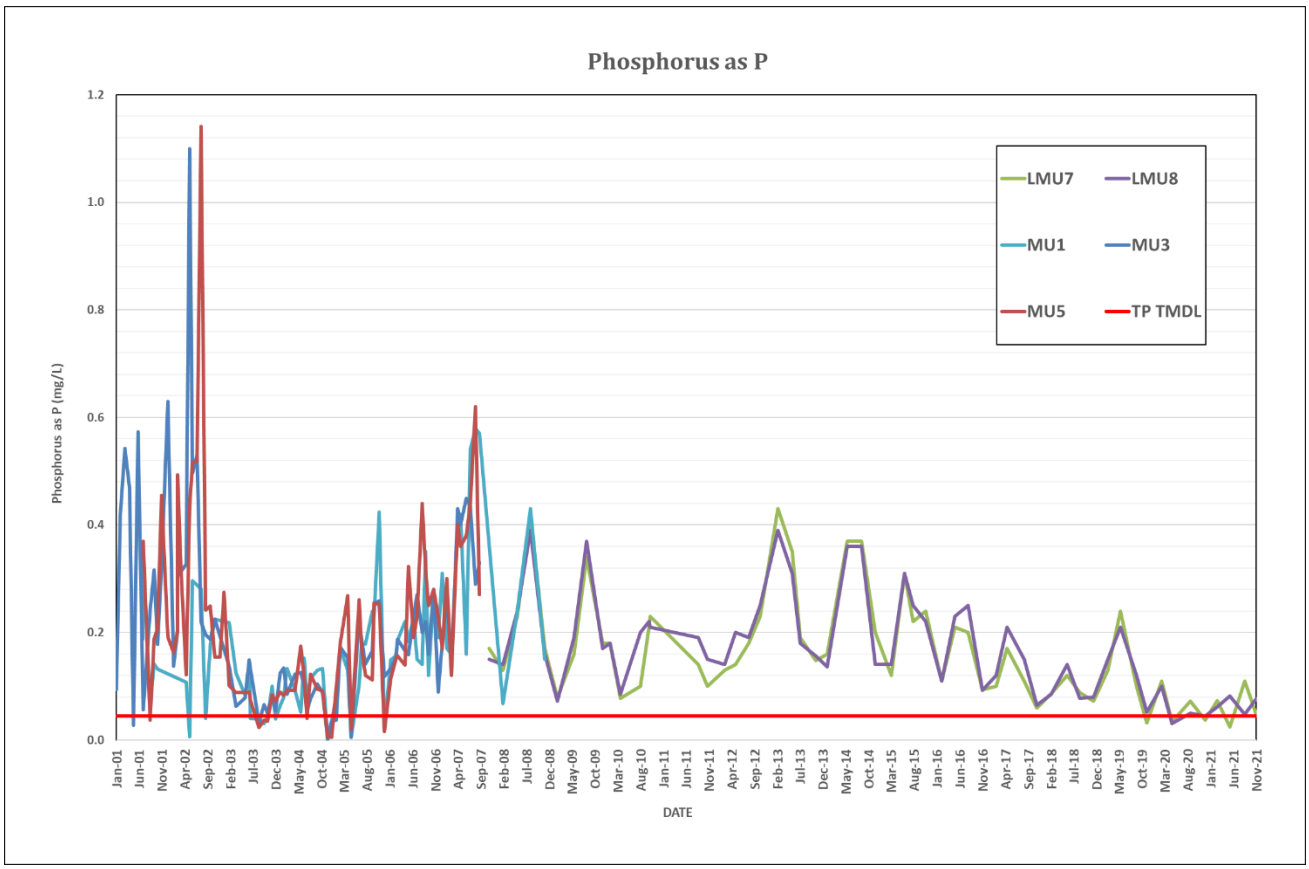


Figure 3. Total phosphorus results for Lake Munson.

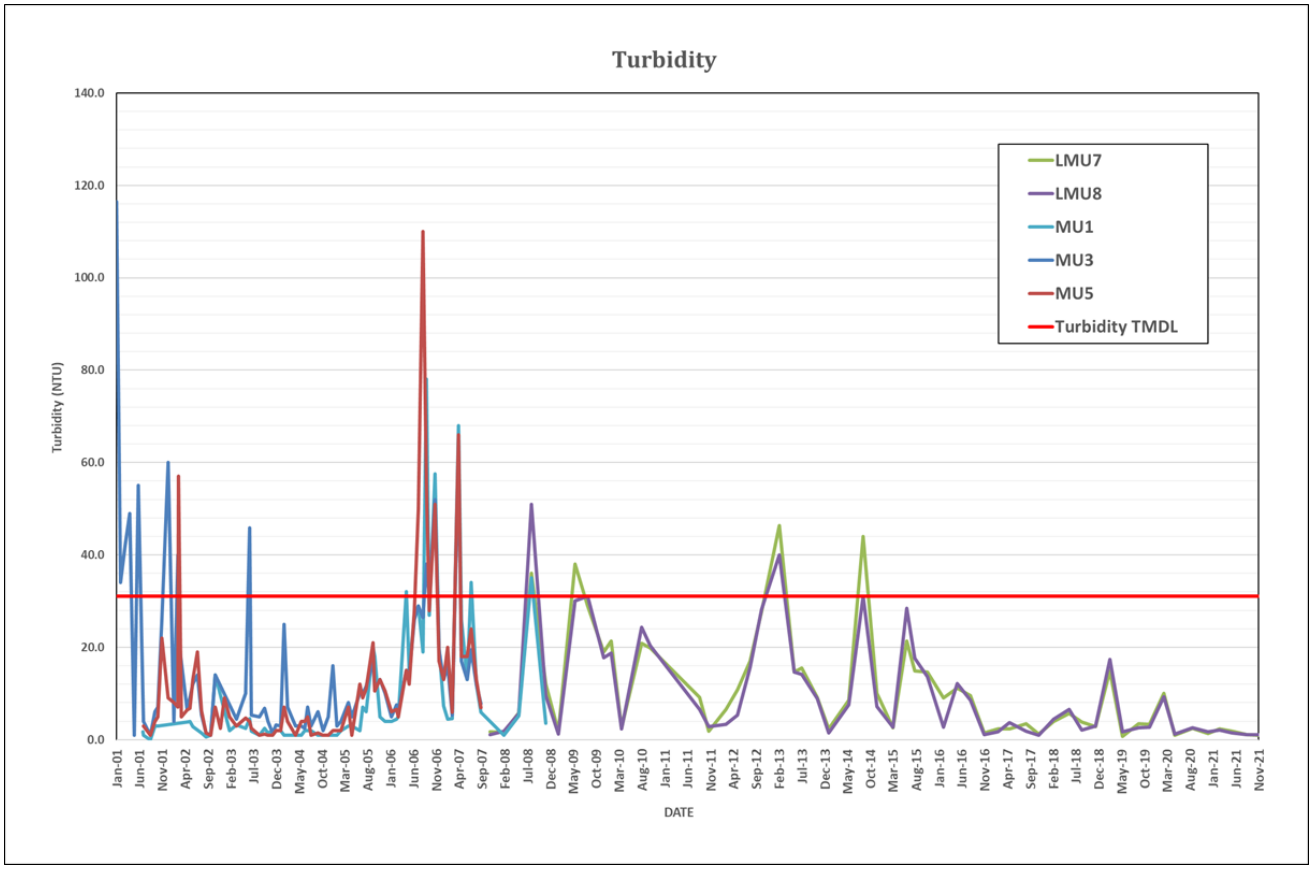


Figure 4. Turbidity results for Lake Munson.

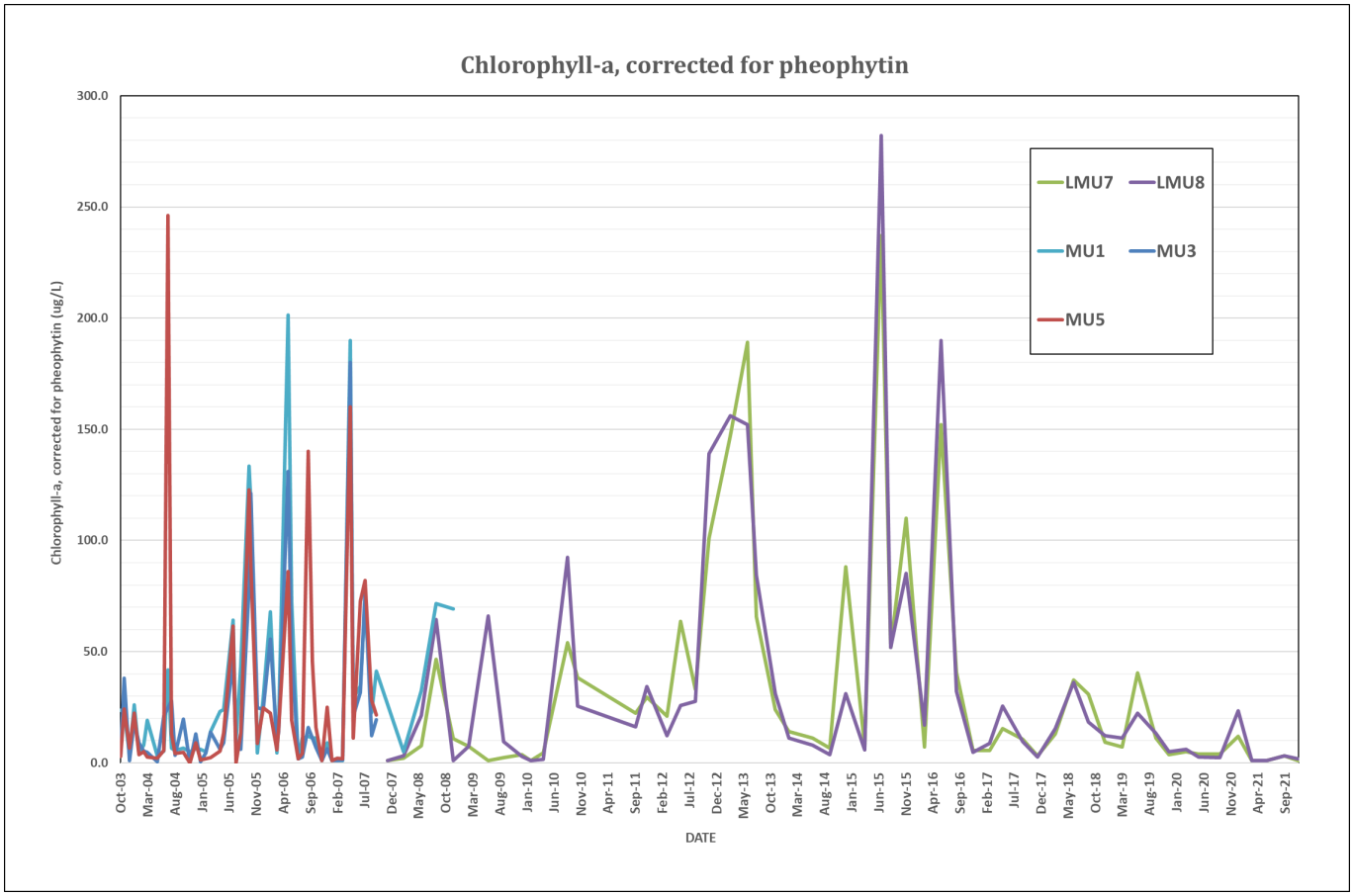


Figure 5. Chlorophyll-a results for Lake Munson.

Conclusions

Nutrient and chlorophyll-*a* values did not exceed NNC limits in 2021. Staff believe that a combination of upstream nutrient reduction and the re-establishment of aquatic vegetation are contributing to the reduction of chlorophyll-a and water column nutrients.

Lake Munson (Station LMU7) exceeded Class III water quality criteria for both lead and copper during the 2nd quarter of 2021. Relict anthropogenic sources such as leaded gasoline are most likely to be the cause of the lead exceedance. The possible sources of the copper exceedance are unknown.

The LVI score for Lake Munson was 43, a substantial decline from the previous year's (2020) score of 53, placing the lake's vegetative community in the lower end of the Healthy category. Due to the rapid proliferation of hydrilla, coontail and the exotic hydrilla were now either the dominant or codominant species found in the lake. Consequently, the LVI score is substantially lower than in past years.

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 2021.

Click here for a map of the watershed – Sample Sites LMU7 and LMU8.

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