LAKE ECOSUMMARY

McKethan Lake

WBID 1371A

Hernando County

July 28, 2016 & June 13, 2017



Figure 1. McKethan Lake in Hernando County.

DEP conducted water quality and biological sampling at McKethan Lake (Figure 1), (WIN/STORET TPMCTHN01L) in Hernando County on July 28, 2016 and June 13, 2017 to assess attainment of designated uses. This lake was sampled as part of a reference lake sampling project. Overall, the water quality and plant community data indicated that the lake met expectations for a healthy, well-balanced lake.

Background

Healthy, well-balanced lake communities may be maintained with some level of human activity, but excessive human disturbance may result in lake degradation. Human stressors include increased inputs of nutrients, sediments and/or pesticides from watershed runoff, undesirable removal of native shoreline and/or upland buffer vegetation, and introduction of nuisance (generally exotic) plants and animals. DEP has methods to evaluate if human activities have resulted in a specific waterbody exceeding water quality criteria (Chapter 62-302, Florida Administrative Code [F.A.C.]), including whether adverse impacts to biological communities have occurred. DEP water quality standards are designed to protect designated uses of the waters of the state (*e.g.,* recreation, aquatic life support), and exceedances of these standards are associated with interference with the designated use. DEP assesses the health of plant communities in Florida lakes, as one indication of whether adverse impacts to biological communities have occurred.

Site Description



Figure 2. Location of McKethan Lake in Hernando County.

McKethan Lake, located in Hernando County, is approximately 57 acres. It is entirely within the Withlacoochee State Forest which is open to the public for passive recreational use (hiking, kayaking, and fishing).

The Withlacoochee State Forest was purchased as part of the Withlacoochee Land Use Demonstration Project under Franklin D. Roosevelt's New Deal in 1934. Because of overuse and depletion of natural resources due to the turpentine industry, the lands purchased were reforested by employing local civilians through the

Works Progress Administration (WPA) (Figure 3). This act resulted in conservation of the lands as well as providing income for many recovering from the Great Depression (Harrison and Wynne, 1988).



Figure 3. Chickee hut used to shelter WPA workers on McKethan Lake, 1930s.

Methods

Water Quality

This lake was sampled on July 28, 2016 and June 13, 2017 by the DEP Southwest Regional Operations Center. Surface water samples were collected from the center of the lake for analysis of nutrients, metals, chlorophyll *a*, color, alkalinity, fluoride, ammonia, nitrogen, phosphate, bromide, chloride and sulfate following DEP Standard Operating Procedures (SOPs; see http://dep.state.fl.us/water/sas/sop/sops.htm). Sampling and analyses met DEP quality assurance/quality control standards. Results were compared with applicable Class III water quality criteria contained in 62-302, F.A.C., including nutrients, dissolved oxygen, and other indicators.

Chlorophyll *a* is a measure of algal biomass in the water column. Chapter 62-302.531, F.A.C., provides numeric criteria for chlorophyll *a*, total nitrogen (TN), and total phosphorus (TP) in lakes, and is dependent upon the long term mean color and alkalinity of the lake (Table 1). If the annual geometric mean chlorophyll *a* (calculated with at least four samples, representing seasonal variability) does not exceed the chlorophyll *a* value for the lake type in Table 1, then the TN and TP criteria for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in Table 1. If there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in Table 1 for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in Table 1. Based on long term (over 20 years), historical color and alkalinity results, McKethan Lake has changed from a dark color (>40 PCU), low alkalinity (≤20 mg/L) lake to low color (≤40 PCU), low alkalinity lake. The lake is currently being assessed as a low color, low alkalinity lake.

These values can most likely be attributed to the lake's location along the Southern Brooksville Ridge where waters tend to be low in color (≤ 40 PCU) and high in alkalinity (>20 mg/L) and often exhibit an abundance of submerged macrophytes.

Table 1. Numeric nutrient criteria in lakes, 62-302.531 (2)(b)(1), F.A.C. AGM = annual geometric mean

Long Term Geometric Mean Lake Color and Alkalinity	AGM Chlorophyll *a*	AGM TP Range	AGM TN Range
> 40 Platinum Cobalt Units	20 µg/L	0.05 to 0.16[1] mg/L	1.27 to 2.23 mg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$	20 µg/L	0.03 to 0.09 mg/L	1.05 to 1.91 mg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$	6 µg/L	0.01 to 0.03 mg/L	0.51 to 0.93 mg/L

[1] For lakes with color > 40 PCU in the West Central Region, the maximum TP limit is 0.49 mg/L

Dissolved Oxygen

Rule 62-302.533 (1), F.A.C., states that no more than 10 percent of the daily average percent dissolved oxygen (DO) saturation values shall be below 67 percent in the Panhandle West bioregion, 38 percent in the Peninsula

and Everglades bioregions, or 34 percent in the Northeast and Big Bend bioregions. This site is in the Peninsula region for DO criteria assessment. Percent saturation factors in such components as temperature, atmospheric pressure, and salinity. For lakes, the daily average DO level shall be calculated as the average of measurements collected in the upper two meters of the water column at the same location on the same day.

The daily average freshwater DO criteria is preferentially assessed using daily average values calculated from full days of diel (collected over a 24-hour period) monitoring data. If diel monitoring data are not available as was the case for this report, instantaneous samples are used to assess the DO criterion by comparing the instantaeous value with a time-of-day-specific translation of the daily average criterion (62-303.420(9), F.A.C.), and a spreadsheet calculator for this purpose is available at: https://floridadep.gov/dear/water-quality-standards-program/documents/do-saturation-calculator%C2%A0

Lake Vegetation Index

The Lake Vegetation Index (LVI) assesses how closely the plant community of a lake resembles a native undisturbed community. The LVI was sampled and calculated per DEP SOP LVI 1000 and calculated per DEP SOP LVI 2000. Species lists were developed for four of twelve sections of the lake (Figure 4), and the following information was derived from those lists: percent native species, percent Category 1 invasive exotic species as identified by the Florida Exotic Pest Plant Council (FLEPPC), percent sensitive species, and the coefficient of conservatism (C of C; a measure of how tolerant a species is of disturbance) of the dominant or co-dominant species. Chapter 62-303.330 and 62-303.430, F.A.C., provide that a LVI score of 43 or greater meets the expectation of a healthy, well balanced community, and scores below 43 are considered impaired.

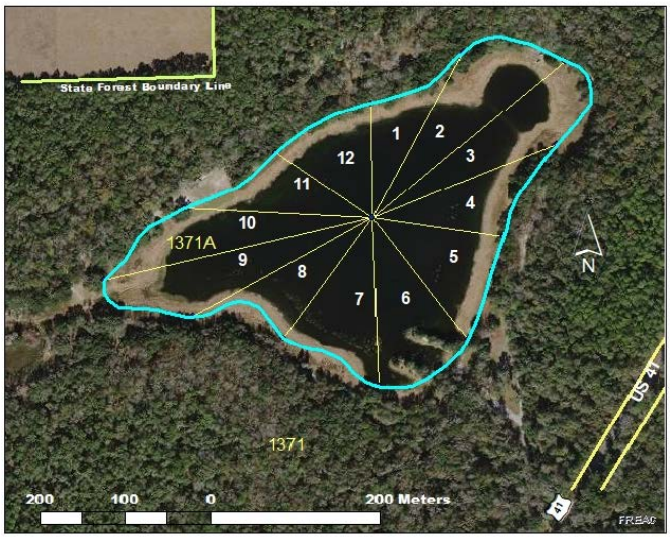


Figure 4. LVI sampling map of McKethan Lake. Sections 2,5,8,11 and 3,6,9,12 were sampled for the Lake Vegetation Index. The water quality sample was collected from the lake center.

Results

Water Quality

The water quality results are shown in Table 2. Based on these two sampling events, the lake values are above the nutrient thresholds for low color, low alkalinity lakes; however, the thresholds represent annual geometric mean concentrations (minimum of four samples) not to be exceeded more than once in any three-calendar year period. DEP's Watershed Assessment Section will evaluate the complete dataset for this lake to assess compliance with nutrient criteria.

Table 2. Water quality results from July 28, 2016 and June 13, 2017 at Lake McKethan.

Analyte	Result 07/28/16	Result 06/13/17	Applicable Class III Water Quality Criteria
Field Temperature (°C)	33.2	28.4	N/A
Field pH (SU)	6.7	6.4	Within 1 SU of natural background
Field Dissolved Oxygen (% saturation)	95	95	* > 95, 94

Field Specific Conductance (µmhos/cm)	26	29	50% above background or 1275 µmhos/cm, whichever is greater
Alkalinity (mg $CaCO_3$/L)	5.4	3.4	Shall not be reduced by more than 25% in natural alkalinity lakes
Color (PCU)	12	28	N/A
Chlorophyll a (µg/L)	6.2	15	≤ 6 µg/L for clear lakes
Total Phosphorus (mg/L) as P	0.017	0.024	≤ 0.01
Nitrate+Nitrite (mg/L) as N	0.004 U	0.017	N/A
Ammonia (mg/L) as N	0.003	0.008	**≤ 2.20, 3.10
Total Kjeldahl Nitrogen (mg/L) as N	0.74	1.1	N/A
Total Nitrogen (mg/L) as N	0.74	1.12	≤ 0.51

* Instantaneous DO criterion calculated per DO Saturation Calculator.

** Total ammonia criterion calculated per Total Ammonia Nitrogen Calculator

U - Indicates that the compound was analyzed for but not detected.

Lake Vegetation Index

The LVI scores for this lake were **45** and **48** out of a possible 100 points, corresponding with a **"Healthy"** designation. Tables 3 and 4 contain the species list and occurrence information for each sampling event. In 2016, just one FLEPPC exotic species (*Eichhornia crassipes*) was observed, and in 2017, two were found (*Alternathera philoxeroides*, *Urochloa mutica*). None of these exotic species were dominant in the lake.

Table 3. Species list for the July 28, 2016 and June 13, 2017 LVI at McKethan Lake. An asterisk (*) indicates an invasive exotic plant species. P = present, D = dominant, C = codominant.

McKethan Lake, July 28, 2016		**Sections**			
Scientific Name	Common Name	2	5	8	11
Azolla caroliniana	Water fern	P	P	P	
Cephalanthus occidentalis	Button Bush	P	P	P	P
Echinochloa walteri	Barnyard Grass		P		
**Eichhornia crassipes*	Water Hyacinth		P		P
Eleocharis baldwinii	Hairgrass	P	P		P
Eleocharis submersed viviparous (species unknown)	Spikerush	D	D	D	D
Eupatorium capillifolium	Dog Fennel	P		P	P
Hydrocotyle	Water Pennywort	P	P		P
Liquidambar styraciflua	Sweetgum		P		
Ludwigia (unknown nativity)	Ludwigia	P			P
Najas guadalupensis	Southern Naiad	P	P		
Panicum hemitomon	Maiden cane	P	P	P	P
Polygonum hydropiperoides	Smartweed		P		P
Sagittaria graminea	Grassy Arrowhead	P	P	P	P
Salix caroliniana	Willow		P		P
** Oxycaryum cubense*	Cuban bulrush	P	P	P	P

McKethan Lake, June 13, 2017		**Sections**			
Scientific Name	**Common Name**	3	6	9	12
**Alternanthera philoxeroides*	Alligator weed			P	
**Cyperus esculentus*	Yellow Nut-grass			P	
Cyperus haspan	Jointed Flat Sedge		P	P	P
Cyperus odoratus	Flat Sedge	P	P	P	P
Cyperus retrorsus	Flat Sedge		P	P	
Eleocharis baldwinii	Hairgrass	P	P	P	P
Eleocharis submersed viviparous (species unknown)	Spikerush	D	D	D	D
Eupatorium capillifolium	Dog Fennel	P	P	P	P
Hydrocotyle	Water Pennywort	P	P	P	P
Lemna	Duck Weed		P	P	P
Ludwigia arcuata	Ludwigia		P	P	P
Luziola fluitans	Water Grass		P		P
Nelumbo lutea	Water Lotus	P	P	P	
Panicum hemitomon	Maiden Cane		P	P	P
Paspalum distichum	Joint Paspalum	P	P		
Phyllanthus urinaria	Waterleaf-flower	P	P	P	P
Sagittaria filiformis	Variable-leaf Arrowhead	P	P	P	P
** Oxycaryum cubense*	Cuban bulrush	P	P	P	
**Urochloa mutica*	Para Grass	P	P	P	

The Florida Forest Service management practices consist of a multiple-use management approach which includes but is not limited to: timber management; recreation; water-resource protection, research, and forest-ecosystem protection. Multiple-use management is mandated under Chapter 589.04(3), F.A.C. Ecosystem protection mandates conservation and protection of environmentally unique and irreplaceable lands that contain native, relatively unaltered, flora and fauna representing natural areas unique to, or scarce within this geographic area. McKethan Lake (Figure 4 and Figure 5) is surrounded by a natural forested area that provides rookery habitat and foraging opportunities for many species of wading birds. Lake management is conducted annually to control exotic invasive species such as *Eichornia crassipes* and *Oxycaryon cubense*; approximately 3 acres have been treated with herbicide since 2016.



Figure 4. McKethan Lake

Conclusions

Sampling at McKethan Lake indicates that the lake may not meet the applicable nutrient water quality criteria, but more data is needed to fully assess attainment.

Water quality results were in exceedance for chlorophyll *a* annual geometric mean (AGM) limit of 6 µg/L for both sampling events. This could be due to seasonal algal blooms on the lake. Total nitrogen and total phosphorus results also exceeded the AGM limits of 0.51 mg/L and 0.01 mg/L, respectively, during both sampling events. Note that these results are not conclusive since only one sample per year was collected and analyzed rather than the required 4 samples for a complete assessment. The Lake Vegetation Index score indicated plant communities were in the lower range of a healthy, well-balanced lake.



Figure 5. McKethan Lake, 1950s.

Thank you for your interest in maintaining the water quality of Florida's lakes. Please contact us if you have any questions.

Literature Cited

"Withlacoochee: South Florida's New Deal Legacy, " Tampa Bay. History, 1988. Co-authored with Guy Porcher Harrison and Lewis N. Wynne.

Contact and resources for more information:

DEP publications on Best Management Practices and

DEP biological assessment resources:
http://www.dep.state.fl.us/water/bioassess/index.htm

FWCC Aquatic Plant Management:
http://myfwc.com/wildlifehabitats/invasive-plants/

Freshwater Algal Bloom information:
http://www.dep.state.fl.us/water/bgalgae/index.htm