LAKE ECOSUMMARY

Low Flying Plane Lake

WBID 1223, Wakulla County

8/23/2017, 8/28/2018, 7/17/2019



Figure 1. Low Flying Plane Lake in Wakulla County, July 2019

DEP conducted water quality and biological sampling at Low Flying Plane Lake (WIN WAK17LOW1, SBIO nickname LOWFLYNPLN) in Wakulla County on August 23, 2017, August 28, 2018, and July 17, 2019, to assess attainment of designated uses. This lake was sampled as part of the DEP 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

Low Flying Plane Lake is a small lake in coastal Wakulla County and is part of the Dickerson Bay watershed in the Ochlockonee-St. Marks Basin (Figures 1 and 2). It is in the Gulf Coast Lowlands Lake Region, which is characterized by lakes that have high color, low pH, low alkalinity, and low to moderate nutrients. Low Flying Plane Lake is within the Panacea Unit of the St. Marks Wildlife Refuge. The surface area of the lake is approximately 7.5 hectares.

The predominant land uses surrounding Low Flying Plane Lake are pine flatwoods, hydric pine flatwoods, freshwater marshes, and other coastal lakes. This lake is not currently listed for any parameter on the Impaired Waters Verified List (November 15, 2019). Additional information about this WBID is available in the TMDL Tracker application (http://prodenv.dep.state.fl.us/DearTmdl/welcomehz.do)

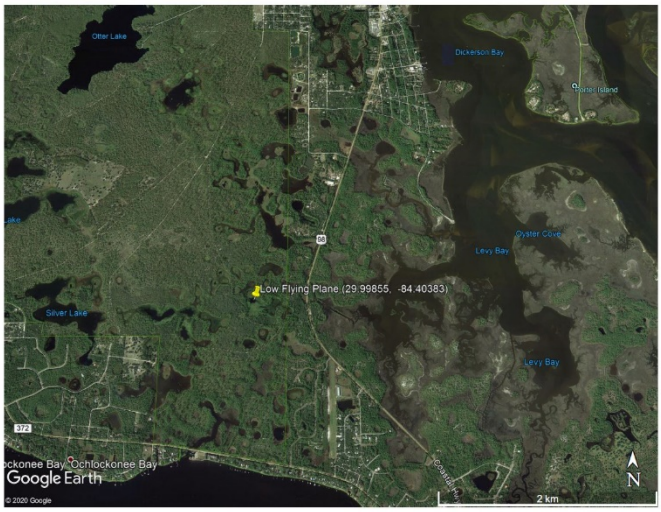


Figure 2. Location of Low Flying Plane Lake in Wakulla County.

Methods

Water Quality

This lake was sampled on August 23, 2017, August 28, 2018, and July 17, 2019 by DEP's Aquatic Ecology and Quality Assurance Section. Surface water samples were collected from the center of the lake for analysis of alkalinity, color, chlorophyll *a*, ammonia, nitrate+nitrite, total phosphorus, ortho-phosphate, and total Kjeldahl nitrogen (TKN) following DEP Standard Operating Procedures (SOPs; see https://floridadep.gov/dear/quality-assurance/content/dep-sops). 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 the color and alkalinity data collected during these sampling events and presented in this report, Low Flying Plane Lake is a high color, low alkalinity lake.

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 Big Bend region for DO criteria assessment. Percent saturation incorporates factors such 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 3), 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, 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.

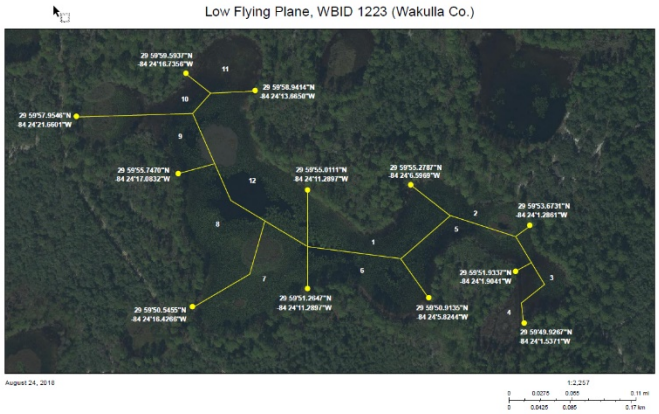


Figure 3. LVI sampling map of Low Flying Plane Lake. Sections 2, 5, 8, and 11 were sampled for the Lake Vegetation Index in 2017 and 2018, and sections 3, 6, 9, and 12 were sampled in 2019. The water quality sample was collected from the lake center.

Results

Water Quality

The water quality results are shown in Table 2. Based on these three sampling events, the lake met the nutrient thresholds (chlorophyll a, TP, and TN) for high color 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. The DO criterion was exceeded on 7/17/2019 (Table 2). The specific conductance was very high on 7/17/2019, compared to previous sampling events (Table 2). The high specific conductance, as well as high sodium and chloride levels (not included in this report), suggest saltwater intrusion in the lake. The color was also dramatically lower in 2019 than in previous years, also suggesting evidence of an influx of clearer marine water. The source of the change in the water quality at Low Flying Plane Lake is likely Hurricane Michael, which hit the area in October 2018. DEP will continue to monitor water quality in Low Flying Plane Lake.

Table 2. Water quality results from August 23, 2017, August 28, 2018, and July 17, 2019 at Low Flying Plane Lake.

Analyte	Result [8/23/2017]	Result [8/28/2018]	Result [7/17/2019]	Applicable Class III Water Quality Criteria
Field Temperature (°C)	33.8	32.8	31.4	N/A
Field pH (SU)	4.67	5.06	4.08	Within 1 SU of natural background
Field Dissolved Oxygen (% saturation)	52.6	54	24.7	*Big Bend Criterion: 38.3%, 36%, 31%
Field Specific Conductance (µmhos/cm)	54.1	47	3317	50% above background or 1275 µmhos/cm, whichever is greater

Alkalinity (mg $CaCO_3$/L)	1.3 I	1.2 I	0.65 U	Shall not be depressed below 20
Color (PCU)	220	230	45	N/A
Chlorophyll a (µg/L)	1.6 I	2.5	1.6 I	≤ 20 µg/L for colored and alkaline clear lakes
Total Phosphorus (mg/L) as P	0.008	0.012	0.008	0.16 mg/L
Nitrate+Nitrite (mg/L) as N	0.004 U	0.004 U	0.004 U	N/A
Ammonia (mg/L) as N	0.005 I	0.005 I	0.003 I	**2.19 mg/L, 2.33 mg/L, and 2.55 mg/L
Total Kjeldahl Nitrogen (mg/L) as N	0.68	0.77	0.49	N/A
Total Nitrogen (mg/L) as N	0.68	0.78	0.49	2.23 mg/L

* Instantaneous DO criterion calculated per DO Saturation Calculator
** Total ammonia criterion calculated per https://floridadep.gov/dear/water-quality-standards-program/documents/total-ammonia-nitrogen-calculator%C2%A0

U – Indicates that the compound was analyzed for but not detected.
I – The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

Phytoplankton

The algal community in the water column consisted of 34.7% cyanobacteria (blue-green algae), 45.2% green algae, and 15.8% diatoms in the August 23, 2017 sample. The algal community in the water column consisted of 33.8% cyanobacteria, 43% green algae, and 16.7% diatoms in the August 28, 2018 sample. In the July 17, 2019 sample, the algal community in the water column consisted of 5.2% cyanobacteria, 28.3% green algae, and 20.8% diatoms. Dominance in algal groups varies naturally throughout the year, but prolonged dominance of cyanobacteria may be associated with a higher risk for harmful algal blooms.

Lake Vegetation Index

The LVI scores for this lake were 76 on August 23, 2017, 87 on August 28, 2018, and 88 on July 17, 2019, out of a possible 100 points, corresponding with "Healthy" (2017) and "Exceptional" (2018 and 2019) designations. The LVI indicated plant communities consistent with expectations for a healthy, well-balanced lake. Tables 3-5 contain the species list and occurrence information for these sampling events. There were no invasive exotic plants observed in the lake, during any of the sampling events. Despite the high LVI scores, there is evidence of a shift in the plant community likely attributable to saltwater intrusion from Hurricane Michael in October 2018, and a continued connection to nearby brackish marshes. *Utricularia floridana* was completely absent from the lake in 2019, after being present throughout and codominant in one section in previous years. In addition, *U. cornuta* was present in one section on a floating island in 2017 and 2018, and was absent in 2019, and *U. purpurea* was reduced in its abundance. *Utricularia* is a genus known to be sensitive to brackish or saltwater flooding (Florida Institute for Regional Conservationhttps://www.regionalconservation.org/beta/nfyn/plantdetail.asp?tx=Utripurp). The aquatic plant community at Low Flying Plane Lake may be in transition, and will be continued to be monitored by DEP.

Table 3. Plant Species List for LVI sampling at Low Flying Plane Lake on August 23, 2017. P=Present, D=Dominant, C=Codominant.

Plant Species list		Sections			
Scientific Name	**Common Name**	**2**	**5**	**8**	**11**
Bacopa caroliniana	LEMON BACOPA	P	P	P	
Cladium jamaicense	JAMAICA SWAMP SAWGRASS	P	P	P	P
Cyrilla racemiflora	TITI	P		P	P
Decodon verticillatus	WILLOW-HERB; SWAMP LOOSESTRIFE				P
Dichanthelium	PANIC GRASS	P	P		
Eleocharis cellulosa	GULF COAST SPIKERUSH	P		P	P
Eleocharis elongata	SLIM SPIKERUSH	P	P	P	
Fuirena scirpoidea	SOUTHERN UMBRELLASEDGE	P		P	P
Habenaria repens	WATERSPIDER FALSE REINORCHID		P		
Hypericum fasciculatum	SANDWEED; PEELBARK ST.JOHN'S-WORT	P		P	
Lachnanthes caroliniana	CAROLINA REDROOT		P		
Ludwigia alata	WINGED PRIMROSEWILLOW	P	P	P	P
Lyonia lucida	FETTERBUSH	P		P	
Magnolia virginiana	SWEETBAY		P		
Myrica cerifera	SOUTHERN BAYBERRY; WAX MYRTLE	P		P	P
Nymphaea odorata	AMERICAN WHITE WATERLILY	D	D	C	D
Nymphoides aquatica	BIG FLOATINGHEART		P	P	
Polygonum punctatum	DOTTED SMARTWEED	P	P		
Rhynchospora inundata	NARROWFRUIT HORNED BEAKSEDGE		P	P	P
Rhynchospora nitens	SHORTBEAK BEAKSEDGE; BALDRUSH		P		
Sagittaria lancifolia	BULLTONGUE ARROWHEAD	P	P		
Scleria	NUT RUSH			P	
Spartina bakeri	SAND CORDGRASS	P	P	P	P
Triadenum virginicum	VIRGINIA MARSH ST.JOHN'S-WORT	P	P	P	
Typha	CATTAIL	P	P	P	
Utricularia cornuta	HORNED BLADDERWORT		P		
Utricularia floridana	FLORIDA BLADDERWORT	P	P	P	P
Utricularia purpurea	PURPLE BLADDERWORT	P	P	C	P
Woodwardia areolata	NETTED CHAIN FERN			P	P
Woodwardia virginica	VIRGINIA CHAIN FERN	P	P		
Xyris	YELLOWEYED GRASS	P	P	P	P

Table 4. Plant Species List for LVI sampling at Low Flying Plane Lake on August 28, 2018. P=Present, D=Dominant, C=Codominant.

Plant Species list		Sections			
Scientific Name	**Common Name**	**2**	**5**	**8**	**11**
Andropogon	BROOM GRASS	P		P	P
Bacopa caroliniana	LEMON BACOPA; BLUE WATERHYSSOP	P			
Bidens mitis	SMALLFRUIT BEGGARTICKS	P			
Centella asiatica	SPADELEAF	P			
Cephalanthus occidentalis	PANIC GRASS		P		
Ceratophyllum demersum	COONTAIL			P	
Cladium jamaicense	JAMAICA SWAMP SAWGRASS	P	P	P	P
Cyrilla racemiflora	TITI	P	P	P	P
Eleocharis cellulosa	GULF COAST SPIKERUSH	P	P	P	C
Eleocharis elongata	SLIM SPIKERUSH	P	P	P	P
Eleocharis interstincta	KNOTTED SPIKERUSH	P			
Fuirena scirpoidea	SOUTHERN UMBRELLASEDGE	P			
Habenaria repens	WATERSPIDER FALSE REINORCHID				P
Hypericum fasciculatum	SANDWEED; PEELBARK ST.JOHN'S-WORT	P		P	P
Juncus scirpoides	NEEDLEPOD RUSH	P			
Lachnanthes caroliniana	CAROLINA REDROOT	P			P
Ludwigia microcarpa	SMALLFRUIT PRIMROSEWILLOW	P			P
Myrica cerifera	SOUTHERN BAYBERRY; WAX MYRTLE	P	P	P	P
Nymphaea odorata	AMERICAN WHITE WATERLILY	C	C	C	P
Nymphoides aquatica	BIG FLOATINGHEART	P			
Pinus elliottii	SLASH PINE	P			
Proserpinaca	NUT RUSH	P			
Rhexia mariana	PALE MEADOWBEAUTY	P			
Rhynchospora microcephala	BUNCHED BEAKSEDGE	P			P
Rhynchospora tracyi	CATTAIL			P	P
Sacciolepis striata	AMERICAN CUPSCALE	P			
Sagittaria isoetiformis	QUILLWORT ARROWHEAD	P			
Sagittaria lancifolia	BULLTONGUE ARROWHEAD	P	P		
Spartina bakeri	SAND CORDGRASS	P	P	P	P
Triadenum virginicum	VIRGINIA MARSH ST.JOHN'S-WORT	P			P
Typha	CATTAIL		P		
Utricularia cornuta	HORNED BLADDERWORT				P
Utricularia floridana	FLORIDA BLADDERWORT	C	P	P	P
Utricularia gibba	HUMPED BLADDERWORT		P		
Utricularia purpurea	PURPLE BLADDERWORT	P	C	C	C
Woodwardia virginica	VIRGINIA CHAIN FERN	P	P		
Xyris	YELLOWEYED GRASS	P	P	P	P

Table 5. Plant Species List for LVI sampling at Low Flying Plane Lake on July 17, 2019. P=Present, D=Dominant, C=Codominant.

Plant Species List		Sections			
Scientific Name	**Common Name**	**3**	**6**	**9**	**12**
Andropogon	BROOMGRASS	P		P	
Cladium jamaicense	JAMAICA SWAMP SAWGRASS	P	P	P	P
Cyrilla racemiflora	TITI	P	P	P	P
Dichanthelium	PANIC GRASS			P	
Eleocharis cellulosa	GULF COAST SPIKERUSH		P		P
Eleocharis elongata	SLIM SPIKERUSH	C	P	C	P
Fuirena scirpoidea	SOUTHERN UMBRELLASEDGE			P	
Hypericum fasciculatum	SANDWEED; PEELBARK ST.JOHN'S-WORT	P		P	
Lyonia lucida	FETTERBUSH	P	P		
Myrica cerifera	SOUTHERN BAYBERRY; WAX MYRTLE	P	P	P	
Nymphaea odorata	AMERICAN WHITE WATERLILY	C	D	P	D
Nymphoides aquatica	BIG FLOATINGHEART			P	
Nyssa sylvatica biflora	SWAMP TUPELO			P	
Osmunda regalis	ROYAL FERN	P	P		
Panicum	PANIC GRASS			P	
Persea palustris	SWAMP REDBAY	P	P		P
Rhynchospora fascicularis	FASCICLED BEAKSEDGE			P	
Rhynchospora tracyi	TRACY'S BEAKSEDGE	P		P	
Sagittaria lancifolia	BULLTONGUE ARROWHEAD	P			
Spartina bakeri	SAND CORDGRASS	P	P	P	P
Stillingia aquatica	WATER TOOTHLEAF; CORKWOOD			P	
Triadenum virginicum	VIRGINIA MARSH ST.JOHN'S-WORT	P	P		
Typha	CATTAIL		P		
Utricularia purpurea	PURPLE BLADDERWORT	P	P	C	P
Woodwardia virginica	VIRGINIA CHAIN FERN	P	P		
Xyris	YELLOWEYED GRASS			P	

Conclusions

Sampling at Low Flying Plane Lake indicates that the lake met applicable State Water Quality Criteria. Water quality results were well within acceptable limits for chlorophyll *a*, total nitrogen and total phosphorus on August 23, 2017, August 28, 2018, and July 17, 2019. The Lake Vegetation Index indicated plant communities that are consistent with expectations for a healthy, well-balanced lake, although they appear to be experiencing a shift in structure due to saltwater intrusion from 2018 hurricane impacts.

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

Contact and resources for more information

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DEP biological assessment resources:
https://floridadep.gov/dear/bioassessment

FWCC Aquatic Plant Management:
http://myfwc.com/wildlifehabitats/invasive-plants/
Freshwater Algal Bloom information:
https://floridadep.gov/dear/algal-bloom