LAKE ECOSUMMARY

Lake Godwin, WBID 1758K, Polk County, 09/08/2015, 10/09/2017, and 10/25/2017



Figure 1. Lake Godwin in Polk County, Florida

DEP conducted water quality, sediment, and biological sampling at Lake Godwin, WIN/STORET IDs 48228 and 52061, in Polk County on 09/08/2015 and 10/25/2017, respectively, to assess attainment of designated uses (Figure 1). The associated 2017 plant community data were collected during a separate event on 10/09/2017. Sediment sampling results for Lake Godwin are not included in this report. Complete chemistry, biology, and sediment results are available from the Watershed Information Network (WIN) website (http://prodenv.dep.state.fl.us/DearWin/public/welcomeGeneralPublic?calledBy=GENERALPUBLIC). Lake Godwin was sampled as part of the statewide Status Monitoring Network. The purpose of the Status Network is to characterize the environmental condition of Florida's freshwater resources and to determine how these conditions change within a region of the state, as well as statewide, over the long term. This network is designed to address questions regarding the proportions of waters that meet environmental thresholds or designated uses. Overall, the water quality and plant community data indicated that the lake met the 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

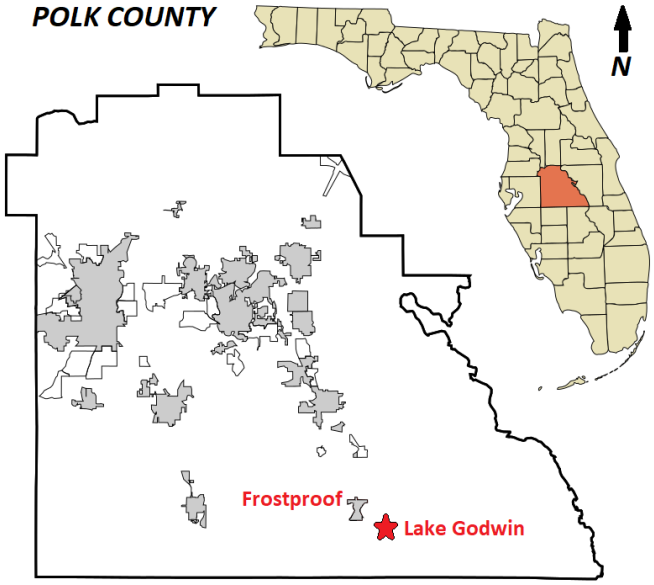


Figure 2. Location of Lake Godwin in Polk County and nearby townships (grey and white areas).

Lake Godwin is in Polk County, Florida, approximately 7 miles southeast of Frostproof and 2 miles west of Lake Arbuckle (Figure 2). The predominant land uses surrounding Lake Godwin are mesic pine flatwoods, shrub and brushland, and improved pastures. Lake Godwin is approximately 23 acres in size, with depths of up to 6 meters.

Situated within the Arbuckle Tract of the Lake Wales Ridge State Forest, Lake Godwin is managed by the Florida Forest Service division of Florida Department of Agriculture and Consumer Services (FDACS). Access to the Arbuckle Tract is through the main entrance on Rucks Dairy Road. Management practices include selective pine harvesting, native pine plantings, prescribed burns, and invasive exotic plant control. Invasive exotic plant control includes mechanical removal and chemical treatment focused on, but not limited to, *Imperata cylindrica* (Cogongrass) and *Lygodium microphyllum* (Old World climbing fern). Public day use is permitted on and around the lake to include primitive camping at designated sites, hiking, biking, horseback riding, hunting, and fishing. This lake and its associated WBID are not currently listed for any parameters on the Impaired Waters Verified List. Additional information about this WBID is available in the TMDL Tracker application https://fdep.maps.arcgis.com/home/webmap/viewer.html?webmap=1b4f1bf4c9c3481fb2864a415fbeca77

Methods

Water Quality

This lake was sampled on 09/08/2015 and 10/25/2017 by the DEP South Regional Operational Center. Surface water samples were collected from the center of the lake for analysis of chlorophyll *a*, ammonia, nitrate/nitrite, total phosphorus (TP), total Kjeldahl nitrogen (TKN), total organic carbon (TOC), hardness, metals, alkalinity, turbidity, chloride, color, specific conductance, fluoride, sulfate, total dissolved solids (TDS), total suspended solids (TSS), and *Escherichia coli*. All sampling followed 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 color of the lake is greater than 40 Platinum Cobalt Units (PCU), the alkalinity of the lake is not a factor for the numeric criteria for chlorophyll *a,* TN, and TP. If the annual geometric mean (AGM) 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 AGM chlorophyll *a* for a given year or the AGM 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.

Insufficient data exists to calculate AGM. Numeric nutrient criteria are based on the 2015 and 2017 sampling events and thus the minimum values shown in Table 1 are applicable. Based on the color and alkalinity results presented in this report, Lake Godwin 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 Peninsula 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 (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 an LVI score of 43 or greater meets the expectation of a healthy, well balanced community, and scores below 43 are considered impaired.

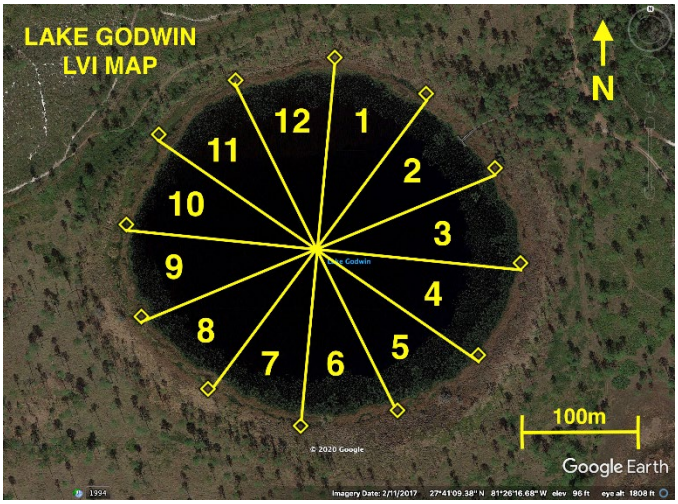


Figure 3. LVI sampling map of Lake Godwin. Sections 2, 5, 8, 11 were sampled during both assessments in 2015 and 2017. The water quality and sediment samples were collected from the lake center.

Results

Water Quality

The water quality results are shown in Table 2. Lake Godwin has insufficient data to calculate the AGM chlorophyll *a* and thus the applicable minimum values for TN and TP from Table 1 were used. Based on these two sampling events, the lake met the nutrient thresholds 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.

Table 2. Water quality results from 09/08/2015 and 10/25/2017 at Lake Godwin.

Analyte	Result 09/08/ 2015	Result 10/25/ 2017	Applicable Class III Water Quality Criteria
Field Temperature (°C)	28.9	24.94	N/A
Field pH (SU)	3.0	6.79	Within 1 unit of natural background
Field Dissolved Oxygen (% saturation)	71.0	72.7	*Peninsula Criteria: >33.69, >36.75
Field Specific Conductance (µmhos/cm)	54	65	50% above background or 1275, whichever is greater
Alkalinity (mg $CaCO_3$/L)	0.65 U	0.65 U	Shall not be reduced by more than 25%
Color (PCU)	330	360	N/A
Chlorophyll a (µg/L)	3.3	1.9	≤20 for colored lakes
Total Phosphorus (mg/L) as P	0.013	0.011	<0.05
Nitrate+Nitrite (mg/L) as N	0.004 U	0.004 U	N/A
Ammonia (mg/L) as N	0.007	0.024	**<3.00, <3.66
Total Kjeldahl Nitrogen (mg/L) as N	0.75	0.67	N/A
Total Nitrogen (mg/L) as N	0.75	0.67	<1.27

* Instantaneous DO criterion calculated per DO Saturation Calculator.

** Total ammonia criterion calculated per Total Ammonia Nitrogen Calculator

U – Material was analyzed for but not detected. The reported value is the method detection limit for the sample analyzed

NA – Not applicable

Lake Vegetation Index

The 2015 LVI score for this lake was 86 out of a possible 100 points, corresponding with a "Healthy" designation. Table 3 contains the species list and occurrence information for this sampling event. One invasive exotic plant was observed in the lake; *Alternanthera philoxeroides* (Alligator weed). There were no dominant plant species in any section of the lake.

Table 3. Species list for the 09/08/2015 LVI at Lake Godwin. An asterisk (*) indicates an invasive exotic plant species. P = present, D = dominant, C = codominant.

Lake Godwin, 09/08/2015		Sections			
Taxon Name	**Common Name**	**2**	**5**	**8**	**11**
*Alternanthera philoxeroides**	Alligator weed	P	P	P	P
Amphicarpum muhlenbergianum	Blue maidencane				P
Blechnum serrulatum	Swamp fern	P			
Cephalanthus occidentalis	Buttonbush		P	P	P
Eleocharis baldwinii	Road grass	P			
Eriocaulon decangulare	Hat pin	P		P	P
Fuirena scirpoidea	Southern umbrella sedge				P
Hydrocotyle	Dollarweed	P			
Hypericum fasciculatum	Peelbark St. John's Wort	P		P	
Lachnanthes caroliniana	Carolina redroot	P		P	P
Leersia hexandra	Haircut grass	P			P

Ludwigia alata	Winged primrose	P	P		P
Myrica cerifera	Southern wax myrtle	P			
Nuphar	Spatterdock	P	P	P	P
Nymphaea odorata	Fragrant water lily	P	P	P	P
Persea palustris	Swamp bay	P			
Pinus elliottii	Slash pine	P	P	P	P
Pluchea	Camphor weed	P		P	
Polygonum hirsutum	Hairy smartweed	P			
Pontederia cordata	Pickerel weed	P	P	P	P
Quercus	Oak	P	P	P	
Rhynchospora wrightiana	Wright's beaksedge				P
Sabatia grandiflora	Largeflower rose gentian	P	P	P	P
Sagittaria isoetiformis	Quillwort arrowhead				P
Sagittaria lancifolia	Duck potato		P		
Solidago	Goldenrod	P			
Spartina bakeri	Sand cordgrass	P	P		P
Sphagnum	Peat moss				P
Thelypteris palustris pubescens	Marsh fern	P			P
Utricularia olivacea	Piedmont bladderwort				P
Utricularia purpurea	Eastern purple bladderwort	P	P	P	P
Woodwardia virginica	Chain fern	P			
Xyris	Yelloweyed grass	P			P

The 2017 LVI score for this lake was 71 out of a possible 100 points, corresponding with a "Healthy" designation. Table 4 contains the species list and occurrence information for this sampling event. One invasive exotic plant was observed in the lake; *Hygrophila polysperma* (East Indian waterweed). There were no dominant plant species in any section of the lake.

Table 4. Species list for the 10/09/2017 LVI at Lake Godwin. An asterisk (*) indicates an invasive exotic plant species. P = present, D = dominant, C = codominant.

Lake Godwin, 10/09/2017		**Sections**			
Taxon Name	**Common Name**	**2**	**5**	**8**	**11**
Amphicarpum muhlenbergianum	Blue maidencane	P			P
Andropogon	Beard grass	P	P	P	P
Blechnum serrulatum	Swamp fern	P			
Brasenia schreberi	Snotbonnet	P			
Cephalanthus occidentalis	Buttonbush	P	P	P	P
Eleocharis baldwinii	Road grass	P	P	P	P
Eragrostis elliottii	Love grass	P	P		
Fuirena scirpoidea	Southern umbrella sedge	P			P
Hydrocotyle	Dollarweed	P			P
*Hygrophila polysperma**	East Indian Waterweed	P	P	P	P
Hypericum fasciculatum	Peelbark St. John's Wort	P	P	P	P
Leersia hexandra	Haircut grass	P			P
Ludwigia arcuata	Piedmont primrose	P			
Ludwigia leptocarpa	Anglestem primrose	P			
Ludwigia repens	Creeping primrose	P			
Myrica cerifera	Southern wax myrtle	P	P		P
Nuphar	Spatterdock	P	P	P	P
Nymphaea odorata	Fragrant water lily	P	P	P	P
Nymphoides aquatica	Banana lily	P			
Panicum hemitomon	Maidencane		P	P	P
Pinus elliottii	Slash pine	P	P	P	P
Polygonum glabrum	Denseflower knotweed	P	P	P	P
Pontederia cordata	Pickerelweed	P	P	P	P
Quercus	Oak	P			
Sabatia grandiflora	Largeflower rose gentian	P			
Sacciolepis striata	American cupscale grass	P	P	P	P
Sagittaria lancifolia	Duck potato		P	P	
Solidago fistulosa	Pinebarren goldenrod	P	P		
Utricularia purpurea	Eastern purple bladderwort	P	P	P	P
Woodwardia virginica	Chain fern	P			P

Conclusions

Analyses of the water quality and biological data at Lake Godwin indicate 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 09/08/2015 and 10/25/2017. The Lake Vegetation Index completed on 09/08/2015 and

10/09/2017 indicated plant communities that are consistent with expectations for a healthy, well-balanced lake. Though the LVI scores for the 2015 and 2017 event are similar, both placing the lake in the "Healthy" category, the observed plant species varied somewhat. The expectation for a lake in a low-impact area is for the plant communities to remain relatively stable over time. However, ecosystems still do change over time. Additionally, the LVI process is a rapid assessment tool. The process works well for spot-assessing the general biological health of a lake, but also lends itself to small differences in observations based on where the sampling team spends their time within the section being assessed. The excellent health of Lake Godwin can likely be attributed to the low-impact land use of the surrounding area coupled with terrestrial invasive exotic plant management. Lake vegetation, however, is not currently managed. Surface water and groundwater flow east from the Mid-Florida Ridge through a large natural riparian buffer. This sheet flow gives ample time for the uptake of nutrients resulting in a low concentration of TN and TP. The moderate dissolved oxygen (DO) levels, low chlorophyll *a* concentration, and low nutrient levels suggest the high color of the lake is not determined by the presence of algae or sediments, but by other constituents. The low pH and surrounding mesic flatwoods suggest the presence of tannins which increase the color. No definitive cause for the higher pH detected on 10/25/17 can be ascertained. Historically, the average pH of the lake is in the mid to low 4s. Samplers measured a pH of 4.0 on 10/09/17. A more recent sampling event took place on 9/05/19 and the measured pH was 4.23. There are no major surface water or stormwater inputs into Lake Godwin. The National Weather Service did not indicate any precipitation events the day of sampling or for two weeks prior. Further sampling and analyses will need to be performed to establish a more definitive assessment. DEP will continue to monitor and assess this waterbody to ensure compliance with Florida water quality standards.

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 publications on Best Management Practices and Environmental Stewardship and Education:
http://www.dep.state.fl.us/water/nonpoint/pubs.htm
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