LAKE ECOSUMMARY

Lake Beauclair, July 13, 2011

DEP conducted water quality and biological sampling at Lake Beauclair in Orange County on July 13, 2011, to assess attainment of designated uses. Overall, the water quality, plant community, and phytoplankton data indicated that the lake did not meet expectations for a healthy, well-balanced lake.

Background

Although healthy, well -balanced lake communities may be maintained with some level of human disturbance, human activities 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 the condition where a particular waterbody has exceeded water quality criteria (Chapter 62-302, Florida Administrative Code), 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.

Chlorophyll *a* is a measure of algal biomass in the water column. In clear, low alkalinity lakes (lakes where color is < 40 PCU and alkalinity is < 20 mg/L $CaCO_2$), a healthy system is expected to have ≤6 µg/L of chlorophyll *a*. In colored (≥40 PCU) lakes or clear, high alkalinity (≥ 20 mg/L $CaCO_2$) lakes, healthy systems are expected to have ≤20 µg/L of chlorophyll *a*. Chlorophyll *a* values greater than those shown above may result in unwanted shading of aquatic plants and/or greater potential for harmful algal blooms. The Lake Vegetation Index (LVI) assesses how closely the plant community of a lake resembles a native undisturbed community. These tools are often used in conjunction with one another because it is possible to detect imbalance in the plant community while the algal community appears healthy (and vice versa).

Methods

Lake Beauclair was sampled on July 13, 2011, by the DEP Central District Office. Surface water samples were collected for analysis of nutrients, chlorophyll *a,* color, and algal community composition following DEP Standard Operating Procedures (SOPs; see http://www.dep.state.fl.us/water/sas/qa/sops.htm). Sampling and analyses met DEP quality assurance/quality control standards (see http://www.dep.state.fl.us/water /sas/qa/index.htm). For the LVI, species lists were developed for four of twelve sections of the lake (Figure 1), and the following information was derived from those lists: percent native species, percent invasive exotic species, percent sensitive species, and the coefficient of conservatism (C of C; a measure of how tolerant a species is to disturbance) of the dominant species. According to DEP SOP LT 7000, the LVI score ranges and categories are: (78-100) Exceptional; (38-77) Healthy; and (0-37) Impaired. DEP's new draft F.A.C. Chapter 62.302 requires at least two temporally independent LVIs with an average score of 43 or above in order to meet the expectation of a healthy, well balanced community. The LVI was sampled per DEP SOP FS7310 and calculated per DEP SOP LT7000.

Site Information

Lake Beauclair, located in central Florida approximately 25 miles northwest of Orlando, is part of the Upper Ocklawaha River Basin. Lake Beauclair has a drainage basin of approximately 9,296 acres. The lake has a surface area of approximately 1,085 acres and an average depth of 2.05 m (6.7ft). Surface water enters the lake through the Apopka-Beauclair canal and from Lake Carlton. Surface water leaves the lake through the Dora Canal into Lake Dora.

Lake Beauclair was verified as impaired by nutrients, and was included on the verified list of impaired waters for the Ocklawaha Basin that was adopted by DEP Secretarial Order on August 28, 2002. The total maximum daily load (TMDL) process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies the sources of the pollutant, and recommends regulatory or other actions to achieve compliance with applicable water quality standards based on the relationship between pollution sources and in-stream water quality conditions. A target goal for Total Phosphorus (TP) concentration was adopted (32 µg/L) with expectations of reducing the amount of chlorophyll *a* to levels more consistent with healthy lakes.

To meet the restoration targets specified in the TMDL report, Lake Beauclair was included in the Upper Ocklawaha Basin Management Action Plan (BMAP). The action plan was developed in partnership with cities, counties, the St. Johns River Water Management District, Lake County Water Authority, Florida Department of Transportation, Florida Department of Agriculture and Consumer Services, Florida Fish and Wildlife Conservation Commission and other local stakeholders. The BMAP was adopted on August 14, 2007. The primary contributor of phosphorus to Lake Beauclair is surface water flow from Lake Apopka through the Apopka-Beauclair Canal. A Nutrient Reduction Facility was constructed on the canal and is expected to treat over 90% of Lake Apopka's discharge removing at least 67% of the phosphorus from the treated water.

Lake County Water Authority has an Aquatic Enhancement Project scheduled to be completed by May, 2012. Fine-grained, organic-bearing sediments will be removed from an estimated 255.4 acres in the western portion of the lake, and from an additional 6.3 acres of combined residential canal segments, all by hydraulic dredge. These sediments are compromising the quality of the aquatic habitat in Lake Beauclair and are impeding navigation during low water conditions.

Results

Water Quality

The concentrations of total nitrogen and total phosphorus in the sample collected July 13, 2011, exceeded the proposed state water quality criteria and the established TMDL Total Phosphorus concentration (Table 1, note that compliance with lake numeric nutrient criteria involves an annual geometric mean, and is not based on single samples). The chlorophyll *a* concentration was 110 µg/L, over five times the proposed annual geometric mean standard of 20 µg/L.

Phytoplankton

The algal community in the water column consisted of 97.01% cyanobacteria (blue-green algae), 0.33% green algae, 1.66% diatoms, and 0.33% cryptomonads. 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. During the July 13, 2011 sample event, Lake Beauclair's algal community was dominated by cyanobacteria.

Table 1. Water quality results July 13, 2011 at Lake Beauclair

Analyte	Result	Comments	Applicable Class III Water Quality Criteria
Field Temperature (°C)	30.7		
Field pH (SU)	8.46		
Field Dissolved Oxygen (mg/L)	8.77		≥ 5
Field Specific Conductance (µmhos/cm)	421		
Alkalinity (mg $CaCO_3$/L)	94		
Color (PCU)	27	A	
Chlorophyll a (µg/L)	110	A	*20
Total Phosphorus (mg/L)	0.045		**0.032
Nitrate+Nitrite (mg/L)	0.004	U	
Ammonia (mg/L)	0.013	I	
Total Kjeldahl Nitrogen (mg/L)	2.5		
Total Nitrogen (mg/L)	2.5		*1.05

*proposed 62-302 thresholds for Annual Geometric Mean Total

** TMDL Established Concentration

U - Material was analyzed for but not detected. The reported value is the method detection limit for the sample analyzed.
I - The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
A - Value reported is the mean of two or more determinations

Lake Vegetation Index

The LVI score for this lake was 42 out of a possible 100 points, corresponding with a category III "Impaired" designation. Table 2 contains the species list and occurrence information for this sampling event. A total of 10 invasive exotic plants were observed in the lake. Co-dominance of *Valisneria americana* in two sections raised the LVI score despite the high frequency of exotics. Further expansion of beneficial submersed aquatic plants such as this will further improve Lake Beauclair's LVI score.

Table 2. Species list for the July 13, 2011, LVI at Lake Beauclair. An asterisk (*) indicates an invasive exotic plant species. P = present, D = dominant, C = codominant.

Species	Common Name	2	5	8	11
Acer rubrum	RED MAPLE	P	P	P	P
Alternanthera philoxeroides*	ALLIGATOR WEED		P	P	P
Amaranthus	PIG WEED	P		P	P
Baccharis	SALT MYRTLE				P
Cephalanthus occidentalis	COMMON BUTTONBUSH	P	P	P	
Ceratophyllum demersum	COONTAIL	P	P	P	P
Cladium jamaicense	JAMAICA SWAMP SAWGRASS	P			P
Colocasia esculenta*	TARO; WILD TARO		P	P	
Cornus	DOGWOOD		P		
Cyperus alternifolius*	UMBRELLA SEDGE		P	P	
Cyperus odoratus	FRAGRANT FLATSEDGE				P
Dioscorea bulbifera*	AIR-POTATO	P	P	P	P
Eleocharis baldwinii	BALDWIN'S SPIKERUSH		P		P
Erechtites hieraciifolia	FIREWEED			P	
Eupatorium capillifolium	DOGFENNEL				P
Habenaria repens	WATERSPIDER FALSE REINORCHID				P
Hibiscus grandiflorus	SWAMP ROSEMALLOW			P	P
Hydrocotyle	MARSHPENNYWORT	P	P	P	P
Lemna	DUCKWEED				P
Ludwigia octovalvis	MEXICAN PRIMROSEWILLOW				P
Ludwigia peruviana*	PERUVIAN PRIMROSEWILLOW	P	P	P	
Magnolia virginiana	SWEETBAY		P		
Mikania scandens	CLIMBING HEMPVINE			P	
Myrica cerifera	WAX MYRTLE		P	P	P
Najas guadalupensis	SOUTHERN WATERNYMPH	P		P	P
Nuphar	COW LILY			P	
Nymphaea odorata	AMERICAN WHITE WATERLILY			P	
Nyssa sylvatica biflora	SWAMP TUPELO	P		P	
Osmunda regalis	ROYAL FERN		P		
Panicum hemitomon	MAIDENCANE		P		
Panicum repens*	TORPEDO GRASS	P	P	P	P
Paspalidium geminatum	EGYPTIAN PASPALIDIUM	P	P	P	
Pinus	PINE	P			P
Pistia stratiotes*	WATER-LETTUCE	P		P	
Polygonum punctatum	DOTTED SMARTWEED		P	P	
Pontederia cordata	PICKERELWEED	P	P	P	P
Sabal palmetto	CABBAGE PALM	P	P	P	P
Sacciolepis striata	AMERICAN CUPSCALE		P		
Sagittaria lancifolia	BULLTONGUE ARROWHEAD	P	P	P	P
Salix caroliniana	CAROLINA WILLOW	P	P	P	P
Salvinia minima*	WATER SPANGLES			P	P
Sambucus canadensis	ELDERBERRY			P	
Schinus terebinthifolius*	BRAZILIAN PEPPER	P		P	P
Schoenoplectus californicus	GIANT BULLRUSH	C		C	C
Schoenoplectus tabernaemontani	BULLRUSH		P		
Taxodium	CYPRESS	P	P	P	P
Thelypteris	FERN		P		
Toxicodendron vernix	POISON SUMAC			P	
Typha	CATTAIL	P	D	C	P
Urochloa mutica*	PARA GRASS		P		P
Utricularia biflora	TANGLED BLADDERWORT				P
Utricularia foliosa	LEAFY BLADDERWORT			P	
Utricularia inflata	SWOLLEN BLADDERWORT	P		P	P
Vallisneria americana	TAPEGRASS; AMERICAN EELGRASS	C	P	P	C
Vitis	GRAPEVINE			P	

Summary

Nutrient levels in Lake Beauclair were associated with imbalances in the lake's floral and algal community. Chlorophyll *a* measured in Lake Beauclair (110 µg/L) on July 13, 2011, indicates that phytoplankton has become the primary consumer of the lake's elevated nutrients instead of beneficial, submersed native plants.

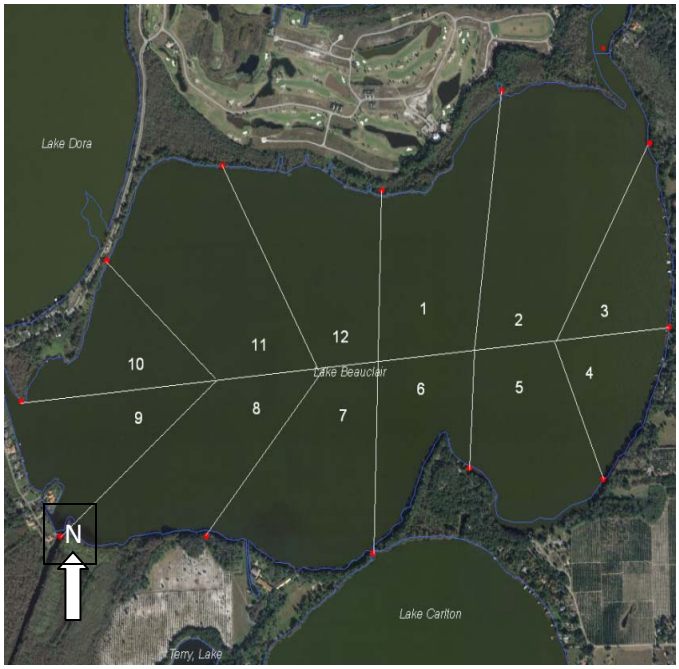


Figure 1. Sampling map of Lake Beauclair. Sections 2,5,8,11 were sampled for the Lake Vegetation Index. The water quality sample was collected from the lake center.

Consequently, the LVI score (42) was less than expected for a healthy lake. The lake was also dominated by blue-green algae (including *Cylindrospermopsis raciborskii*), which have the potential to produce toxins (although toxins were not analyzed). Lake Beauclair will benefit from implementing the nutrient TMDL, and from a management plan focused on promotion of native submersed and littoral vegetation and upland buffers, and control of submersed and emergent exotic vegetation.

The successful completion of Lake County Water Authority's Aquatic Enhancement Project and continued success of the Nutrient Reduction Facility should contribute to better water quality in Lake Beauclair and have a positive influence on downstream lakes.

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

Contact and resources for more information

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Lake Beauclair TMDL document:
http://www.dep.state.fl.us/water/tmdl/docs/tmdls/final/gp1/beauclair-tp-tmdl.pdf

Basin Management Action Plan for Upper Ocklawaha River basin;
http://www.dep.state.fl.us/water/watersheds/docs/bmap/AdoptedUpOcklawahaBMAP.pdf 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/habitat/invasive-plants/aquatic-plant/

Freshwater Algal Bloom information:
http://www.dep.state.fl.us/labs/biology/hab/index.htm