LAKE ASSESSMENT REPORT FOR LAKE OSCEOLA IN HILLSBOROUGH COUNTY, FLORIDA

Date Assessed: July 6, 2007
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Reviewed by: Jim Griffin, Ph.D.

INTRODUCTION

This assessment was conducted to update existing physical and ecological data for Lake Osceola on the Hillsborough County Watershed Atlas (**http://www.hillsborough.wateratlas.usf.edu/**). The project is a collaborative effort between the University of South Florida's Center for Community Design and Research and Hillsborough County Stormwater Management Section. The project is funded by Hillsborough County and the Southwest Florida Water Management District's Northwest Hillsborough, Hillsborough River and Alafia River Basin Boards. The project has, as its primary goal, the rapid assessing of up to 150 lakes in Hillsborough County during a five year period. The product of these investigations will provide the County, lake property owners and the general public a better understanding of the general health of Hillsborough County lakes, in terms of shoreline development, water quality, lake morphology (bottom contour, volume, area etc.) and the plant biomass and species diversity. These data are intended to assist the County and its citizens to better manage lakes and lake centered watersheds.

Figure 1. Photograph of Lake Osceola taken on July 6, 2007.

The first section of the report provides the results of the overall morphological assessment of the lake. Primary data products include: a contour (bathymetric) map of the lake, area, volume and depth statistics, and the water level at the time of assessment. These data are useful for evaluating trends and for developing management actions such as plant management where depth and lake volume are needed.

The second section provides the results of the vegetation assessment conducted on the lake. These results can be used to better understand and manage vegetation in the lake. A list is provided with the different plant species found at various sites around the lake. Potentially invasive, exotic (non-native) species are identified in a plant list and the percent of exotics is presented in a summary table. Watershed values provide a means of reference.

The third section provides the results of the water quality sampling of the lake. Both field data and laboratory data are presented. The trophic state index (TSI) [i] is used to develop a general lake health statement, which is calculated for both the water column with vegetation and the water column if vegetation were removed. These data are derived from the water chemistry and vegetative submerged biomass assessments and are useful in understanding the results of certain lake vegetation management practices.

The intent of this assessment is to provide a starting point from which to track changes in the lake, and where previous comprehensive assessment data is available, to track changes in the lake's general health. These data can provide the information needed to determine changes and to monitor trends in physical condition and ecological health of the lake.

Section 1: Lake Morphology

Bathymetric Map[ii]. Table 1 provides the lake's morphologic parameters in various units. The bottom of the lake was mapped using a Lowrance LCX 26C HD Wide Area Augmentation System (WAAS)[iii] enabled Global Positioning System (GPS) with fathometer (bottom sounder) to determine the boat's position, and bottom depth in a single measurement. The result is an estimate of the lake's area, mean and maximum depths, and volume and the creation of a bottom contour map (Figure 2). Besides pointing out the deeper fishing holes in the lake, the morphologic data derived from this part of the assessment can be valuable to overall management of the lake vegetation as well as providing flood storage data for flood models. Table 1 provides the lake's morphologic parameters in various units.

Table 1. Lake Morphologic Data (Area, Depth, and Volume)

Parameter	Feet	Meters	Acres	Acre-ft	Gallons
Surface Area (sq)	2583671.1	240030.8	59.3		
Mean Depth	8.23	2.51			
Maximum Depth	22.07	6.73			
Volume (cubic)	19610395.3	555304.6		450.2	146696960.8
Gauge (above datum)	44.19				

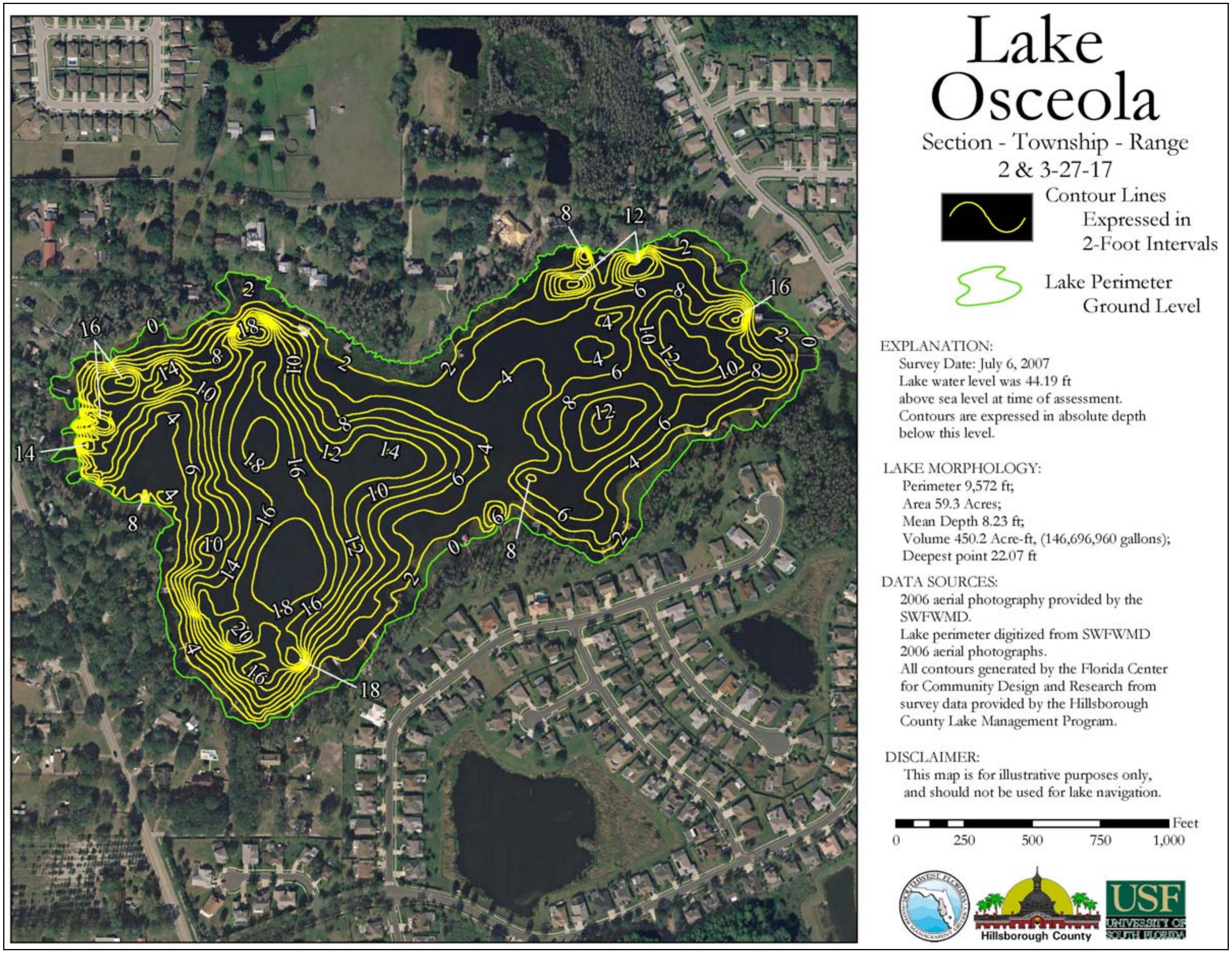


Figure 1. Contour map for Lake Osceola. The mapping technique used in 2007 employs a standard DGPS for horizontal position and a fathometer for depth.

Section 2: Lake Ecology (vegetation)

The lake's apparent vegetative cover and shoreline detail are evaluated using the latest lake aerial photograph as shown in Figure 3 and by use of WAAS enabled GPS. Submerged vegetation is determined from the analysis of bottom returns from the Lowrance 26c HD combined GPS/fathometer described earlier. As depicted in Figure 3, ten vegetation assessment sites were chosen for intensive sampling based on the *Lake Assessment Protocol* (copy available on request) for a lake of this size. The site positions are set using GPS and then loaded into a GIS mapping program (ArcGIS) for display. Each site is sampled in the three primary vegetative zones (emergent, submerged and floating)[iv]. The latest aerials high resolution aerial photos are used to provide shore details (docks, structures, vegetation zones) and to calculate the extent of surface vegetation coverage. The primary indices of submerged vegetation cover and biomass for the lake, percent area coverage (PAC) and percent volume infestation (PVI), are determined by transiting the lake by boat and employing a fathometer to collect "hard and soft return" data. These data are later analyzed for presence and absence of vegetation and to determine the height of vegetation if present. The PAC is determined from the presence and absence analysis of 100 sites in the lake and the PVI is determined by measuring the difference between hard returns (lake bottom) and soft returns (top of vegetation) for sites (within the 100 analyzed sites) where plants are determined present.

The data collected during the site vegetation sampling include vegetation type, exotic vegetation, predominant plant species and submerged vegetation biomass. The total number of species from all sites is used to approximate the total diversity of aquatic plants and the percent of invasive-exotic plants on the lake (Table 2). The Watershed value in Table 2 only includes lakes sampled during the lake assessment project begun in May of 2006. These data will change as additional lakes are sampled. Tables 3 through 7 detail the results from the 2007 aquatic plant assessment for you lake. These data are determined from the 10 sites used for intensive vegetation surveys. The tables are divided into Floating Leaf, Emergent and Submerged plants and contain the plant code, species, common name and presence (indicated by a 1) or absence (indicated by a blank space) of species and the calculated percent occurrence (number sites species is found/number of sites) and type of plant (Native, Non-Native, Invasive, Pest). In the "Type" category, the term invasive indicates the plant is commonly considered invasive in this region of Florida and the term "Pest" indicates that the plant has a greater than 55% occurrence in your lake and is also considered a problem plant for this region of Florida, or in a non-native invasive that is or has the potential to be a problem plant in your lake and has at least 40% occurrence. These two terms are somewhat subjective; however, they are provided to give lake property owners some guidance in the management of plants on their property. Please remember that to remove or control plants in a wetland (lake shoreline) in Hillsborough County the property owner must secure an Application To Perform Miscellaneous Activities In Wetlands (http://www.epchc.org/forms_documents.htm) permit from the Environmental Protection Commission of Hillsborough and for management of in-lake vegetation outside the wetland fringe (for lakes with an area greater than 10 acres), the property owner must secure a Florida Department of Environmental Protection permit (http://www.dep.state.fl.us/lands/invaspec/).

Table 2 Total diversity, percent exotics, and number of Exotic Pest Plants Council pest plants

Parameter	Lake	Watershed
Total Plant Diversity (# of Taxa)	74	103
Total Non-Native Plants	14.86%	14.56%
Total Pest Plant Species	5	6

Figure 3. 2006 six-inch resolution aerial photograph showing location of the vegetation assessment sites on Lake Osceola. Major emergent and floating vegetation zones as well as structures such as docks are also observable in this aerial.

Table 3. List of Floating Leaf Zone Aquatic Plants Found

Floating Leaved Vegetation

Code	Native, Non-Native (NN), Invasive (I), Pest (P)	Plant Species	Common Name	1	2	3	4	5	6	7	8	9	10	% Occurrence
NOA	Native, P	Nymphaea odorata	American White Water lily, Fragrant Water Lily	1	1	1	1	1	1	1	1	1	1	100%
HYE	Native	Hydrocotyl umbellata	Manyflower Marshpennywort, Water Pennywort	1	1	1				1	1	1	1	70%
NLA	Native	Nelumbo lutea	Lotus Lilly, American Lotus		1	1		1	1	1	1			60%
NNA	Native	Nymphoides aquatica	Banana Lily, Big Floatingheart				1	1	1			1		40%
LEN	Native	Lemna spp.	Common Duckweed						1	1		1		30%
NLM	Native	Nuphar lutea var. advena	Spatterdock, Yellow Pondlily							1			1	20%
SPI	Native	Spirodela polyrhiza	Giant Duckweed						1	1				20%
SMA	NN, I	Salvinia minima	Water Spangles, Water Fern								1			10%

Figure 4. *Nymphoides aquatica,* Banana Lily, Big Floatingheart, is a native species, however there are several very similar species which have been introduced to Florida wetlands by the plant trade for ornamental ponds.

Figure 5. *Nelumbo lutea,* Lotus Lilly, American Lotus, is a native floating leaved vegetation in Florida usually found in the shallows of lakes and ponds. This species provides shelter for fish and its seeds are a favorite of water fowl.

Table 4 List of Emergent Zone Aquatic Plants Found

Emergent Vegetation

Code	Native, Non-Native (NN), Invasive (I), Pest (P)	Plant Species	Common Name	1	2	3	4	5	6	7	8	9	10	% Occurrence
BCA	Native	Bacopa caroliniana	Lemon Bacopa	1	1	1	1	1	1	1	1	1	1	100%
TDM	Native	Taxodium distichum	Bald Cypress	1	1	1	1	1	1	1	1	1	1	100%
PCA	Native	Pontederia cordata	Pickerel Weed	1	1	1	1	1	1	1	1		1	90%
PRS	NN, I, P	Panicum repens	Torpedo Grass	1	1	1	1	1	1	1	1	1		90%
LPA	Native, P	Ludwigia peruviana	Peruvian Primrosewillow	1	1	1		1	1	1	1	1	1	90%
BLS	Native	Blechnum serrulatum	Swamp Fern	1	1		1	1	1	1	1	1		80%
APS	NN, I, P	Alternanthera philoxeroides	Alligator Weed	1	1	1	1			1	1	1	1	80%
EBI	Native	Eleocharis baldwinii	Baldwin's Spikerush, Roadgrass		1	1	1	1	1	1	1	1		80%
SLA	Native	Sagittaria lancifolia	Bulltongue Arrowhead, Duck Potato	1		1	1	1				1	1	60%
FSR	Native	Fuirena scirpoidea	Southern Umbrellasedge, Rush Fuirena	1		1	1	1	1			1		60%
ACE	Native	Acer rubrum var. trilobum	Southern Red Maple			1	1	1		1		1	1	60%
BOC	Native	Boehmeria cylindrica	Bog Hemp, False Nettle	1	1				1	1	1	1		60%
CAA	Native	Centella asiatica	Asian Pennywort, Coinwort, Spadeleaf	1		1	1				1		1	50%
WAX	Native	Myrica cerifera	Wax Myrtle			1		1	1	1		1		50%
LOP	Native	Ludwigia spp.	Water Primroses, Primrosewillow	1					1		1		1	40%
LAA	Native	Ludwigia arcuata	Ludwigia	1	1	1				1				40%
PNA	Native	Phyla nodiflora	Frog-fruit, Carpetweed, Turkey Tangle Fogfruit	1		1					1			30%
WTA	NN, I	Sphagneticola (Wedelia) trilobata	Creeping Oxeye	1		1						1		30%
JES	Native	Juncus effusus var solutus	Soft Rush				1				1	1		30%
ICE	Native	Ilex cassine	Dahoon Holly			1		1		1				30%
QLO	Native	Quercus laurifolia	Laurel oak				1		1			1		30%

Table 5. List of Emergent Zone Aquatic Plants Found

Emergent Vegetation

Code	Native, Non-Native (NN), Invasive (I), Pest (P)	Plant Species	Common Name	1	2	3	4	5	6	7	8	9	10	% Occurrence
CCA	NN, I	Cinnamomum camphora	Camphor-tree	1	1								1	30%
MEL	NN, I	Melaleuca quinquenervia	Punk Tree, Melaleuca		1	1	1							30%
EWI	Native	Echinochloa walteri	Coast Cockspur-Grass						1	1	1			30%
BMI	Native	Bacopa monnieri	Common Bacopa, Herb-Of-Grace		1	1								20%
BID	Native	Bidens spp.	Bur Marigold								1	1		20%
COM	Native	Commelina spp.	Dayflower							1			1	20%
PHN	Native	Panicum hemitomon	Maidencane		1	1								20%
POL	Native	Polygonum spp.	Smartweed, Knotweed							1			1	20%
JUM	Native	Juncus marginatus	Shore Rush, Grassleaf Rush								1	1		20%
JUN	Native	Juncus spp.	Rush							1	1			20%
TYP	Native	Typha spp.	Cattails								1		1	20%
AST	Native	Aster spp.	Aster spp., Elliot's Aster								1	1		20%
STS	NN, I	Schinus terebinthifolius	Brazilian Pepper		1								1	20%
MSS	Native	Mikania scandens	Climbing Hempvine			1							1	20%
LYS	Native	Lycopus rubellus	Water-Hoarhound			1				1				20%
DVA	Native	Diodia virginiana	Buttonweed			1								10%
EAA	Native	Eclipta alba (prostrata)	False Daisy, Yerba De Tajo			1								10%
LAC	Native	Lachnocaulon spp.	Bog Buttons		1									10%
RHE	Native	Rhexia spp.	Meadow Beauties								1			10%
RF	Native	Osmunda regalis	Royal Fern							1				10%

Table 6. List of Emergent Zone Aquatic Plants Found

Emergent Vegetation

Code	Native, Non-Native (NN), Invasive (I), Pest (P)	Plant Species	Common Name	1	2	3	4	5	6	7	8	9	10	% Occurrence
OCA	Native	Osmunda cinnamomea	Cinnamon Fern							1				10%
CJE	Native	Cladium jamaicense	Jamaica Swamp Saw Grass										1	10%
HCS	Native	Luziola fluitans	Watergrass								1			10%
BMA	NN, I	Urochloa mutica	Para Grass							1				10%
URL	NN, I	Urena lobata	Caesar's Weed								1			10%
CYO	Native	Cyperus odoratus	Fragrant Flatsedge										1	10%
CYP	Native	Cyperus spp.	Sedge									1		10%
EIA	Native	Eleocharis interstincta	Knotted Spikerush, Giant-Spikerush		1									10%
SCS	Native	Scirpus cubensis	Burhead Sedge, Cuban Scirpus								1			10%
SSP	Native	Scirpus validus	Soft-stem Bulrush				1							10%
COS	Native	Cephalanthus occidentalis	Common Buttonbush					1						10%
GLS	Native	Gordonia lasianthus	Loblolly Bay										1	10%
MVA	Native	Magnolia virginiana	Sweetbay Magnolia										1	10%
PBA	Native	Persea borbonia	Redbay					1						10%
PIN	Native	Pinus spp.	Pine Tree			1								10%
SAL	Native	Salix spp.	Willow									1		10%
SAM	Native	Sambucus canadensis	Elderberry							1				10%
IDA	Native	Ilex decidna	Possum-Haw			1								10%
PCM	NN, I	Psidium cattleianum	Strawberry Guava			1								10%

Table 7. List of Submerged Zone Aquatic Plants Found

Submerged Vegetation

Code	Native, Non-Native (NN), Invasive (I), Pest (P)	Plant Species	Common Name	1	2	3	4	5	6	7	8	9	10	% Occurrence
VAA	Native	Vallisneria americana	Tapegrass	1	1	1	1	1	1	1	1	1	1	100%
UTF	Native	Utricularia floridiana	Bladderwort	1	1	1	1	1	1	1	1	1	1	100%
NGS	Native	Najas guadelupensis	Southern Waternymph	1			1	1		1		1	1	60%
HVA	NN, I, P	Hydrilla verticillata	Hydrilla, water thyme	1	1	1	1					1		50%
ALG	Native	Algal Spp.	Algal Mats, Floating				1	1	1		1			40%
PPS	Native	Potamogeton pusillus	Small Pondweed	1		1	1							30%

Figure 6. *Hydrilla verticillata,* Hydrilla, water thyme, is a non-native invasive submerged plant from Asia. Hydrilla possesses many physiological adaptations that increases its competitive advantage. This species displaces native submerged vegetation by growing up to 1 inch per day and subsequently shading out competitors. In addition, Hydrilla can spread by fragmentation, which allows this plant to be spread across several waterbodies by traveling on boats and trailers.

Section 3: Lake Water Chemistry

A critical element in any lake assessment is the long-term water chemistry data set. The primary source of water quality trend data for Florida Lakes is the Florida LAKEWATCH volunteer and the Florida LAKEWATCH water chemistry data. Hillsborough County is fortunate to have a large cadre of volunteers who have collected lake water samples for significant time period. These data are displayed and analyzed on the Water Atlas as shown in Figure 7 for Lake Osceola. Additional data, when available, is also included on the Water Atlas; however, the LAKEWATCH data remains the primary source. By the trend data shown in the figure, the lake may be considered in good health in terms of the trophic state index. This lake is a clear water lake and as such it must maintain a TSI of below 40 to not be considered impaired by the State of Florida guidelines[v]. The lake's long term water quality data does not indicate enough violations of these criteria to be classified by Florida DEP as impaired. The overall trend for the lake is towards an improving nutrient chemistry and a reduced TSI.

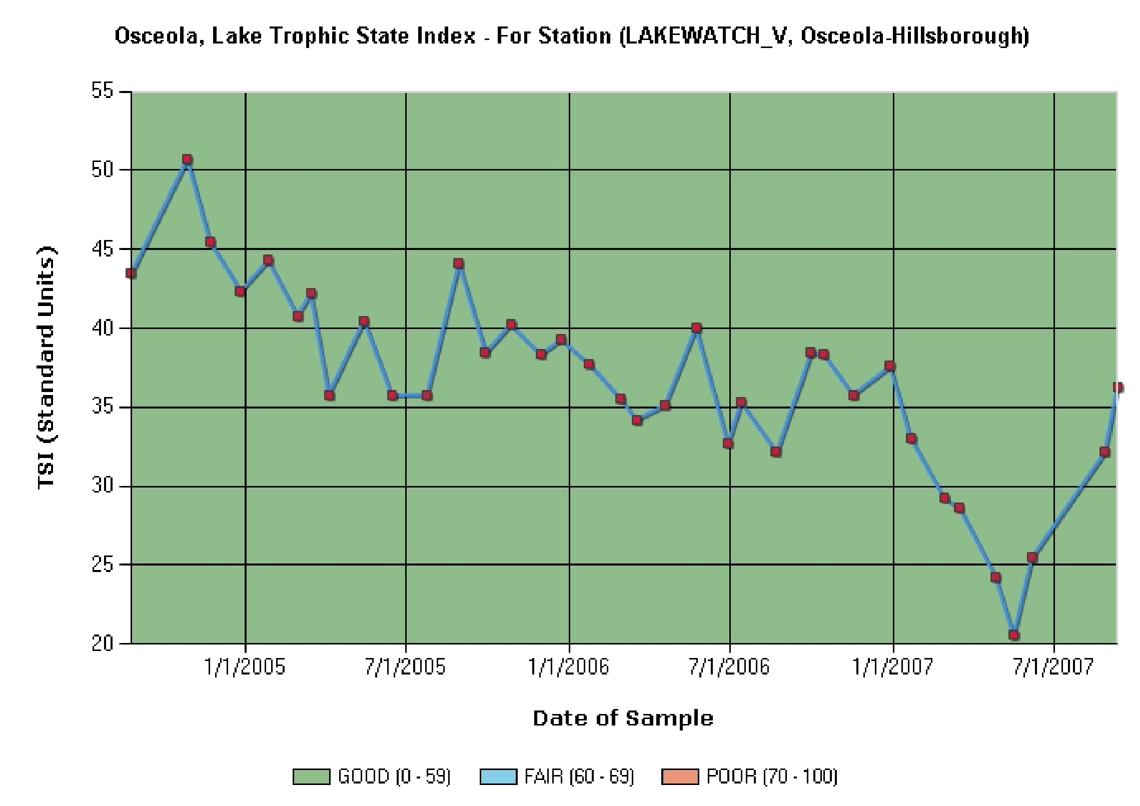


Figure 7. Recent Trophic State Index (TSI) graph from Hillsborough Watershed Atlas. For the latest date go to: (http://www.hillsborough.wateratlas.usf.edu/lake/waterquality.asp?wbodyid=5030&wbodyatlas=lake)

Note: The graph above includes benchmarks for using verbal descriptors of "good", "fair" and "poor". The verbal descriptors for these benchmarks are based on an early determination by stakeholders of the generally acceptable and understood terms for describing the state of lakes. The same benchmarks are used for nutrient graphs (Nitrogen and Phosphorus), chlorophyll graphs and trophic state index (TSI) graphs. The TSI is a calculated index of lake condition based on nutrient and chlorophyll (a) concentrations (please see "Learn more about Trophic State Index"). The benchmarks are established based on the TSI range that relates to a specific descriptor. The source for the TSI concentration relationships is the Florida Water Quality Assessment, 1996, 305(b) (Table 2-8).

As part of the lake assessment the physical water quality and chemical water chemistry of a lake are measured. These data only indicate a snap shot of the lakes water quality; however they are useful when compared to the trend data available from LAKEWATCH or other sources. Table 8 contains the summary water quality data and index values and adjusted values calculated from these data. The total phosphorus (TP), total nitrogen (TN) and chlorophyll (a) water chemistry sample data are the results of chemical analysis of samples taken during the assessment and analyzed by the Hillsborough County Environmental Protection Commission laboratory. These data compare well with the mean data from the LAKEWATCH data set for the lake. The trophic state index (TSI) calculated from the sample data (33.24) is well within the values shown in the figure above.

Table 9 contains the field data taken in the center of the lake using a multi-probe (we use either a YSI 6000 or a Eureka Manta) which has the ability to directly measure the temperature, pH, dissolved oxygen (DO), percent DO (calculated from DO, temperature and conductivity) and Turbidity. These data are listed for three levels in the lake and twice for the surface measurement. The duplicate surface measurement was taken as a quality assurance check on measured data. These data indicate a well mixed lake with moderate productivity and little or no anoxic bottom area.

Table 8. Water Quality Parameters (Laboratory)

Summary Table for Water Quality Parameter	Value	Comment
TP ug/L	12.00	
TN mg/L	0.60	
Chla ug/L	2.80	
Chla TSI	31.63	
TP TSI	34.84	
TN TSI	48.62	
Secchi Disk (SD)	12.46	
TSI	33.24	P limited
PAC	79%	
PVI	25%	
Adj TP	12.21	P from Veg Added
Adj TSI	41.52	With additional P

Table 9. Water Quality Parameters (Field-YSI)

Sample Location	Time	Temp (^{o}C)	Conductivity (mS/cm3)	Dissolved Oxygen (%)	DO (mg/L)	PH (SU)	ORP (ORP)	Turbidity (NTU)	Secchi Depth (ft)
Surface	14:01	31.2	0.238	97.4	7.21	7	100.7	0	
Mid	14:04	30.92	0.237	97.2	7.23	7.04	93.7	0	
Bottom	14:06	30.11	0.237	77.7	5.84	6.71	98.3	0.3	
Surface	14:08	31.27	0.238	98.6	7.31	7.06	86.2	0.1	
Mean Value		30.875	0.2375	92.725	6.8975	6.9525	94.725	0.1	12.46

Table 8 also provides data derived from the vegetation assessment which is used to determine an adjusted TSI. This is accomplished by calculating the amount of phosphorus that could be released by existing submerged vegetation if this vegetation were treated with an herbicide or managed by the addition of Triploid Grass Carp (*Ctenopharyngodon idella*). While it would not be expected that all the vegetation would be turned into available phosphorus by these management methods, the data is useful when planning various management activities. Approximately 79 % of the lake has submerged vegetation present and this vegetation represents about 25 % of the available lake volume. The vegetation holds enough phosphorus to add about 12.21µg/L of the nutrient to the water column. Because the growth of algae in the water is regulated by the availability of phosphorus, the lake is phosphorus limited and the release of this nutrient would stimulate algal growth. These changes in the water chemistry and biology would be indicated by an increased TSI from 33.2 to about 41.5. The lake water clarity which is indicated by the Secchi Disk (SD) value at 12.46 feet would be significantly reduced under these conditions. It is highly recommended that the County or University be informed if any type of submerged plant management is planned for the lake.

To better understand many of the terms used in this report, we recommend that you visit the Hillsborough Watershed Atlas (http://www.hillsborough.wateratlas.usf.edu) and explore the "Learn More" areas which are found on the resource pages. Additional information can also be found using the Digital Library on the website.

Section 4: Conclusion

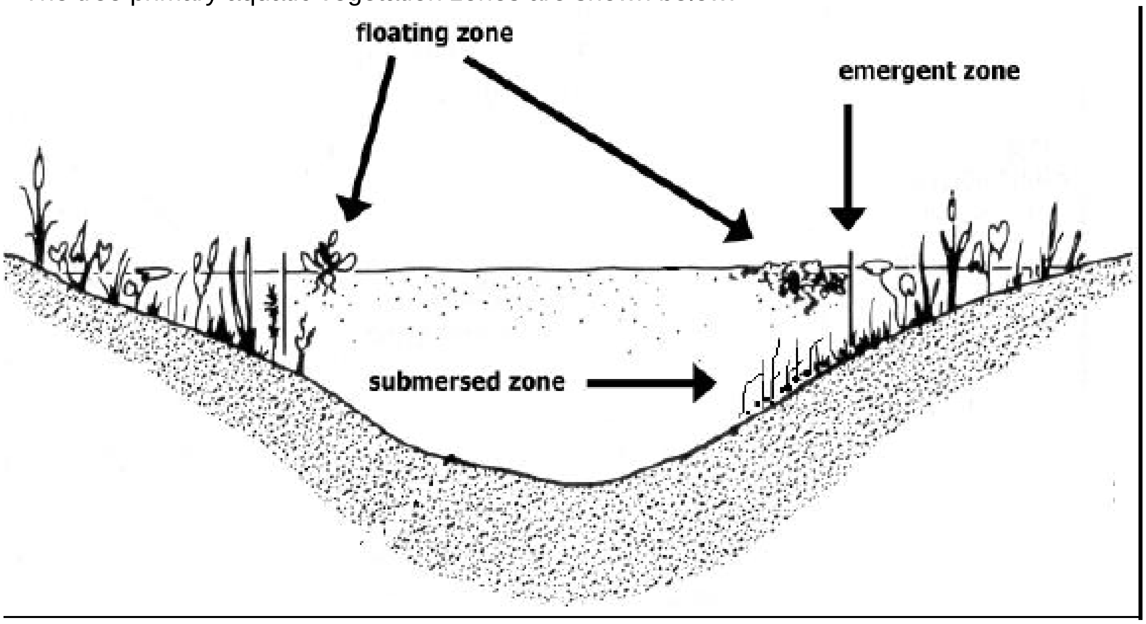
Lake Osceola is a medium-large area (59.3 acre) lake that would be considered in the low mesotrophic or good category of lakes based on water chemistry. It has a normal and healthy concentration of aquatic vegetation. About 79% of the open water areas contain submerged vegetation. Vegetation helps to maintain the nutrient balance in the lake as well as provide good fish habitat. The lake has many open water areas that support various types of recreation and has a good diversity of plant species. The primary Pest plants in the lake include *Nymphaea odorata, Panicum repens, Ludwigia peruviana, Alternanthera philoxeroides* and *Hydrilla verticillata*. For more information and recent updates please see the Hillsborough Watershed Atlas (water atlas) website at: http://www.hillsborough.wateratlas.usf.edu .

i "Trophic" means "relating to nutrition." The Trophic State Index (TSI) takes into account chlorophyll, nitrogen, and phosphorus, which are nutrients required by plant life. For more information please see *learn more* at: http://www.hillsborough.wateratlas.usf.edu/lake/default.asp?wbodyid=5030&wbodyatlas=lake

ii A bathymetric map is a map that accurately depicts all of the various depths of a water body. An accurate bathymetric map is important for effective herbicide application and can be an important tool when deciding which form of management is most appropriate for a water body. Lake volumes, hydraulic retention time and carrying capacity are important parts of lake management that require the use of a bathymetric map.

iii WAAS is a form of differential GPS (DGPS) where data from 25 ground reference stations located in the United States receive GPS signals form GPS satellites in view and retransmit these data to a master control site and then to geostationary satellites. The geostationary satellites broadcast the information to all WAAS-capable GPS receivers. The receiver decodes the signal to provide real time correction of raw GPS satellite signals also received by the unit. WAAS enabled GPS is not as accurate as standard DGPS which employs close by ground stations for correction, however; it was shown to be a good substitute when used for this type of mapping application. Data comparisons were conducted with both types of DGPS employed simultaneously and the positional difference was determined to be well within the tolerance established for the project.

iv The tree primary aquatic vegetation zones are shown below:



v A lake is impaired if " (2) For lakes with a mean color less than or equal to 40 platinum cobalt units, the annual mean TSI for the lake exceeds 40, unless paleolimnological information indicates the lake was naturally greater than 40, or

For any lake, data indicate that annual mean TSIs have increased over the assessment period, as indicated by a positive slope in the means plotted versus time, or the annual mean TSI has increased by more than10 units over historical values. When evaluating the slope of mean TSIs over time, the Department shall use a Mann's one-sided, upper-tail test for trend, as described in Nonparametric Statistical Methods by M. Hollander and D. Wolfe (1999 ed.), pages 376 and 724 (which are incorporated by reference), with a 95% confidence level."

Excerpt from Impaired Water Rule (IWR). Please see: http://www.dep.state.fl.us/water/tmdl/docs/AmendedIWR.pdf