LAKE ASSESSMENT REPORT FOR LAKE PINE IN HILLSBOROUGH COUNTY, FLORIDA

Date Assessed: May 28, 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 Pine 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 Pine May 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 your 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. Lake Morphologic Data (Area, Depth and Volume)

Parameter	Feet	Meters	Acres	Acre-ft	Gallons
Surface Area (sq)	358,672.3	33,669.9	8.32		
Mean Depth	4.68	1.43			
Maximum Depth	10.32	3.15			
Volume (cubic)	1,493,972	42,308		34.30	11,175,768

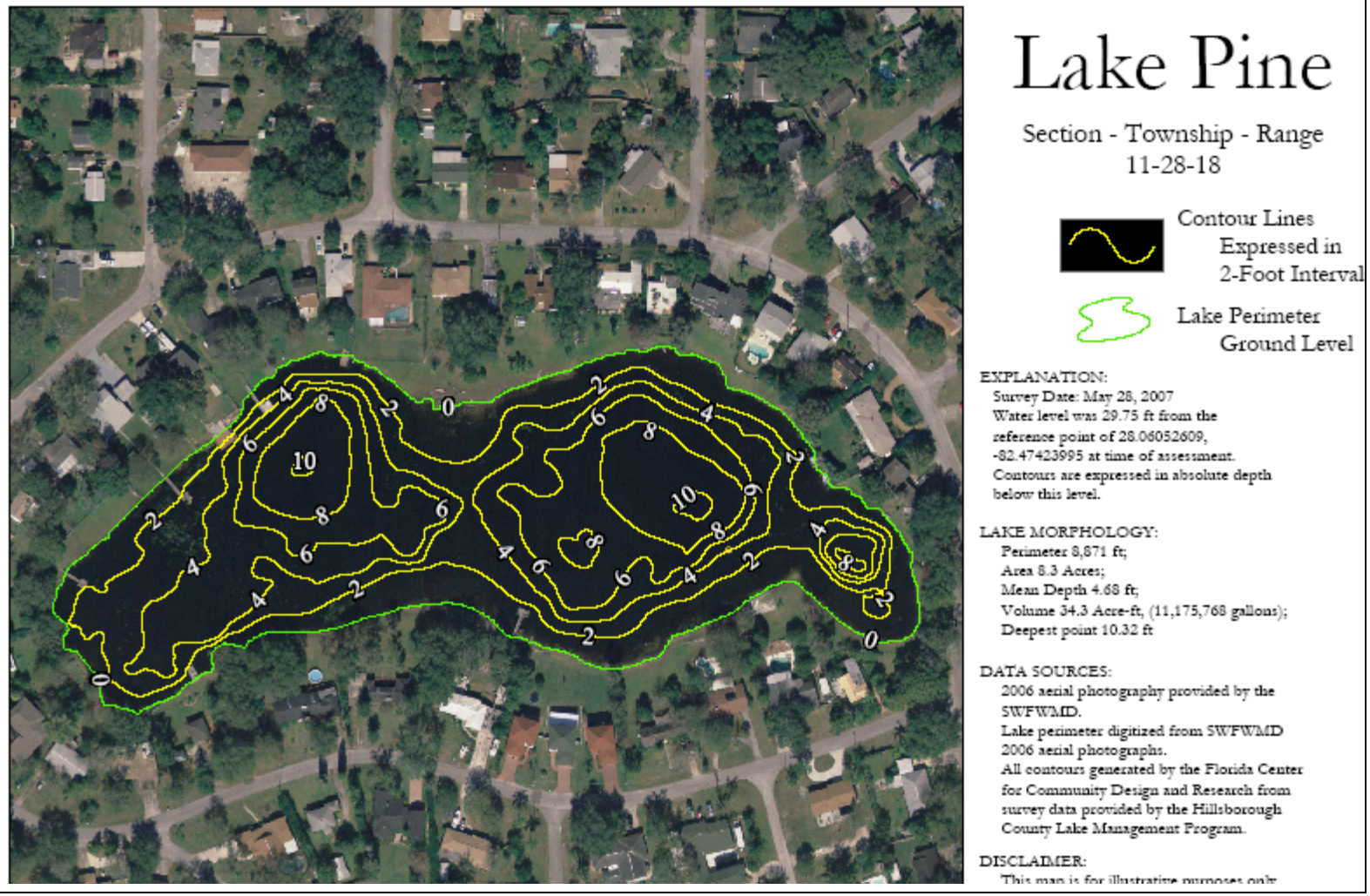


Figure 2. Lake Bathymetry for Lake Pine.

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, seven 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 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 (Figure 6).

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 5 detail the results from the 2007 aquatic plant assessment for you lake. These data are determined from the seven 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 EPPC pest plants

Parameter	Lake	Watershed
Total Plant Diversity (# of Taxa)	56	105
% Non-Native Plants	17.86%	17.14%
Total Pest Plant Species	5	11

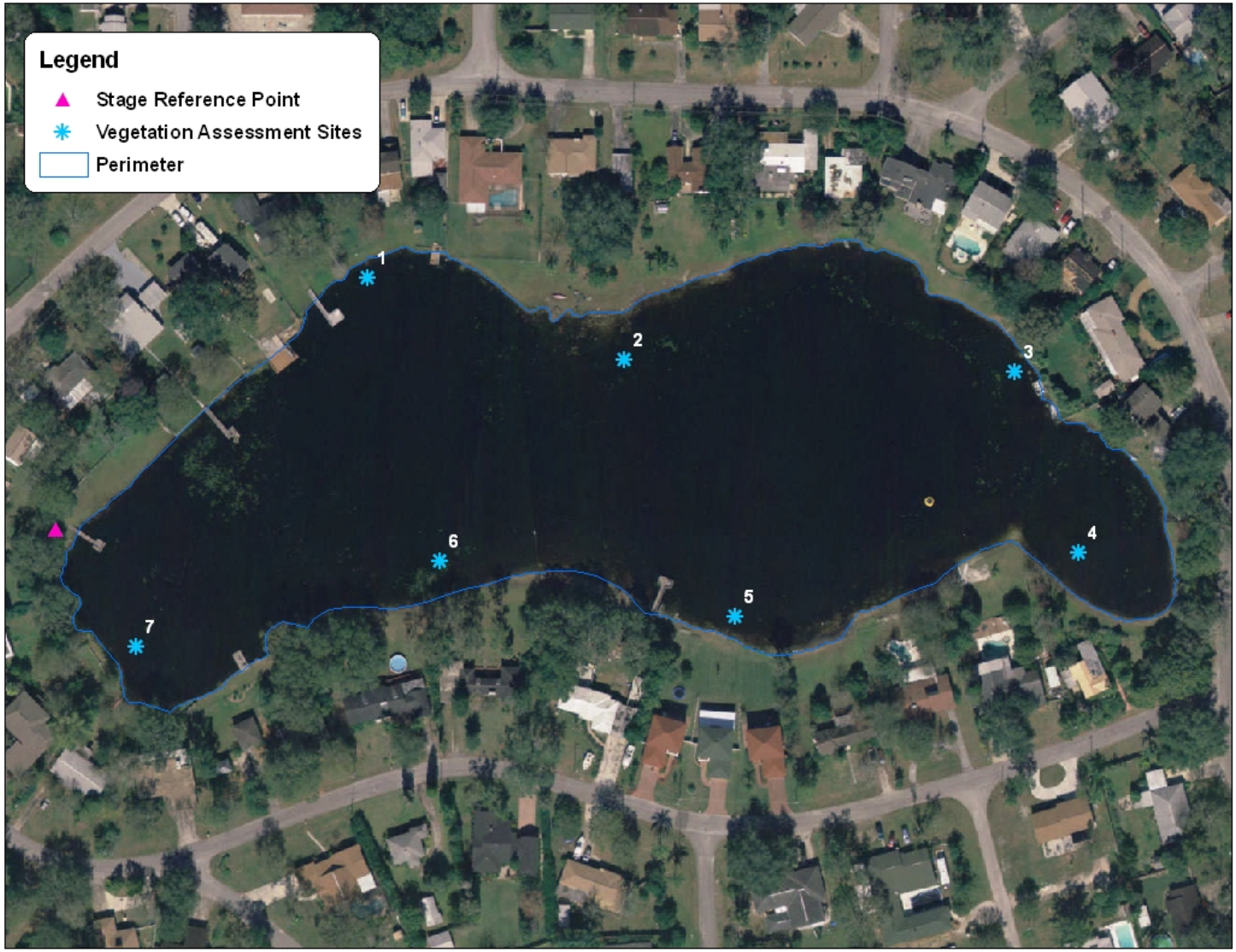


Figure 3. 2006 six-inch resolution aerial photograph showing location of vegetation assessment sites and stage reference point on Lake Pine. Major emergent and floating vegetation zones as well as structures such as docks are also observable in this aerial.

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	% Occurrence
HYE	Native	Hydrocotyl umbellata	Manyflower Marshpennywort, Water Pennywort	1	1	1	1	1	1	1	100.00%
NLM	Native, P	Nuphar lutea var. advena	Spatterdock, Yellow Pondlily	1	1	1	1	1	1	1	100.00%

Figure 4. *Nuphar lutea var. advena,* Spatterdock, Yellow Pondlily, is a native floating leaved vegetation which serves as an important source of habitat for several species of fish and invertebrates at various life stages. Although native, this species is capable of dominating much of the surface of waterbodies, causing submerged vegetation to decline due to decreased light levels.

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	% Occurrence
PNA	Native	Phyla nodiflora	Frog-fruit, Carpetweed, Turkey Tangle Fogfruit	1	1	1	1	1	1	1	100.00%
PRS	NN, I, P	Panicum repens	Torpedo Grass	1	1	1	1	1	1	1	100.00%
EBI	Native	Eleocharis baldwinii	Baldwin's Spikerush, Roadgrass	1	1	1	1	1	1	1	100.00%
FSR	Native	Fuirena scirpoidea	Southern Umbrellasedge, Rush Fuirena	1	1	1	1	1	1	1	100.00%
BMI	Native	Bacopa monnieri	Common Bacopa, Herb-Of-Grace	1	1	1	1	1	1		85.71%
PCA	Native	Pontederia cordata	Pickerel Weed	1		1	1	1	1	1	85.71%
ACE	Native	Acer rubrum var. trilobum	Southern Red Maple	1	1	1	1	1	1		85.71%
CAA	Native	Centella asiatica	Asian Pennywort, Coinwort, Spadeleaf	1		1	1		1		57.14%
CYP	Native	Cyperus spp.	Sedge	1	1		1		1		57.14%
LPA	Native, P	Ludwigia peruviana	Peruvian Primrosewillow	1	1	1				1	57.14%
LOP	Native	Ludwigia spp.	Water Primroses, Primrosewillow	1	1			1	1		57.14%
QLO	Native	Quercus laurifolia	Laurel oak		1			1	1	1	57.14%
LGA	Native	Lindernia graniflora	Savannah False Pimpernel	1	1		1		1		57.14%
NSS	Native	Nephrolepsis spp.	Sword Fern	1		1				1	42.86%
PHN	Native	Panicum hemitomon	Maidencane		1				1	1	42.86%
LOS	Native	Ludwigia octovalvis	Mexican Primrosewillow, Long-stalked Ludwigia	1	1		1				42.86%
TAS	Native	Taxodium ascendens	Pond Cypress	1		1				1	42.86%
MSS	Native	Mikania scandens	Climbing Hempvine			1	1	1			42.86%

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	% Occurrence
LAA	Native	Ludwigia arcuata	Ludwigia	1	1				1		42.86%
GTM	Native	Galium tinctorium	Marsh Bedstraw			1	1		1		42.86%
BID	Native	Bidens spp.	Bur Marigold		1	1					28.57%
DVA	Native	Diodia virginiana	Buttonweed				1		1		28.57%
RHE	Native	Rhexia spp.	Meadow Beauties		1	1					28.57%
BMA	NN, I	Urochloa mutica	Para Grass			1				1	28.57%
APS	NN, I	Alternanthera philoxeroides	Alligator Weed						1	1	28.57%
PIN	Native	Pinus spp.	Pine Tree		1				1		28.57%
MEL	NN, I	Melaleuca quinquenervia	Punk Tree, Melaleuca			1		1			28.57%
CPS	Native	Cyperus polystachyos	Flat Sedge				1		1		28.57%
CAS	NN, I	Cyperus alternifolius	Umbrella Sedge			1				1	28.57%
CAM	Native	Crinum americanum	Swamp lily			1					14.29%
DCS	Native	Drosera capillaris	Pink Sundew		1						14.29%
HRS	Native	Habenaria repens	Waterspider False Reinorchid		1						14.29%
LAC	Native	Lachnocaulon spp.	Bog Buttons		1						14.29%
SLA	Native	Sagittaria lancifolia	Bulltongue Arrowhead, Duck Potato							1	14.29%
IRI	Native	Iris spp.	Flag			1					14.29%
OCA	Native	Osmunda cinnamomea	Cinnamon Fern			1					14.29%
POL	Native	Polygonum spp.	Smartweed, Knotweed			1					14.29%

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	% Occurrence
CYO	Native	Cyperus odoratus	Fragrant Flatsedge	1							14.29%
FSC	Native	Fuirena spp.	Rush Fuirena	1							14.29%
JES	Native	Juncus effusus var solutus	Soft Rush							1	14.29%
SCS	Native	Scirpus cubensis	Burhead Sedge,Cuban Scirpus				1				14.29%
SAM	Native	Sambucus canadensis	Elderberry				1				14.29%
CCA	Native	Cinnamomum camphora	Camphor-tree						1		14.29%
SSM	Native	Sapium sebiferum	Popcorn Tree, Chinese Tallow Tree				1				14.29%
STS	NN, I	Schinus terebinthifolius	Brazilian Pepper					1			14.29%
FAS	Native	Fimbristylis autumnails	Fringe-Rush				1				14.29%
EQS	Native	Erigeron quercifolius	Daisy Fleabean						1		14.29%
CPR	NN, I	Cyperus prolifer	Dwarf Papyrus			1					14.29%
CSS	Native	Cyperus sirinamensis	Flat Sedge				1				14.29%

Figure 5. *Fuirena scirpoidea,* Southern Umbrellasedge, Rush Fuirena, is a native sedge that grows along lakeshores in Florida typically in shallow water.

Figure 6. *Cyperus prolifer,* Dwarf Papyrus, is an invasive exotic plant that has increased in abundance but has not yet altered native plant communities. As such it is listed as a Category II Invasive by the Florida Exotic Pest Plant Council.

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	% Occurrence
NGS	Native, P	Najas guadelupensis	Southern Waternymph	1	1	1	1	1	1	1	100.00%
POT	Native	Potamogeton spp.	Pond Weed	1	1	1	1		1	1	85.71%
NIT	NN, P	Nitella spp.	Nitella	1		1	1	1		1	71.43%
ALG	Native	Algal Spp.	Algal Mats, Floating		1				1		28.57%
CHA	Native	Chara spp.	Muskgrass		1	1					28.57%

Figure 7. Algal mats such as this one can be a sign of increased nutrients in the water column. Typically the source of these nutrients is runoff from lawns along the lakeshore containing fertilizers, causing a bloom in the water.

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 8 for Lake Pine. Although Lake Pine does not have a consistent dataset, the data is adequate to make some trend statements. 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 indicates enough violations of these criteria to be classified by Florida DEP as impaired. The more recent trends indicate an improving trend; however, the lake remains impaired based on TSI.

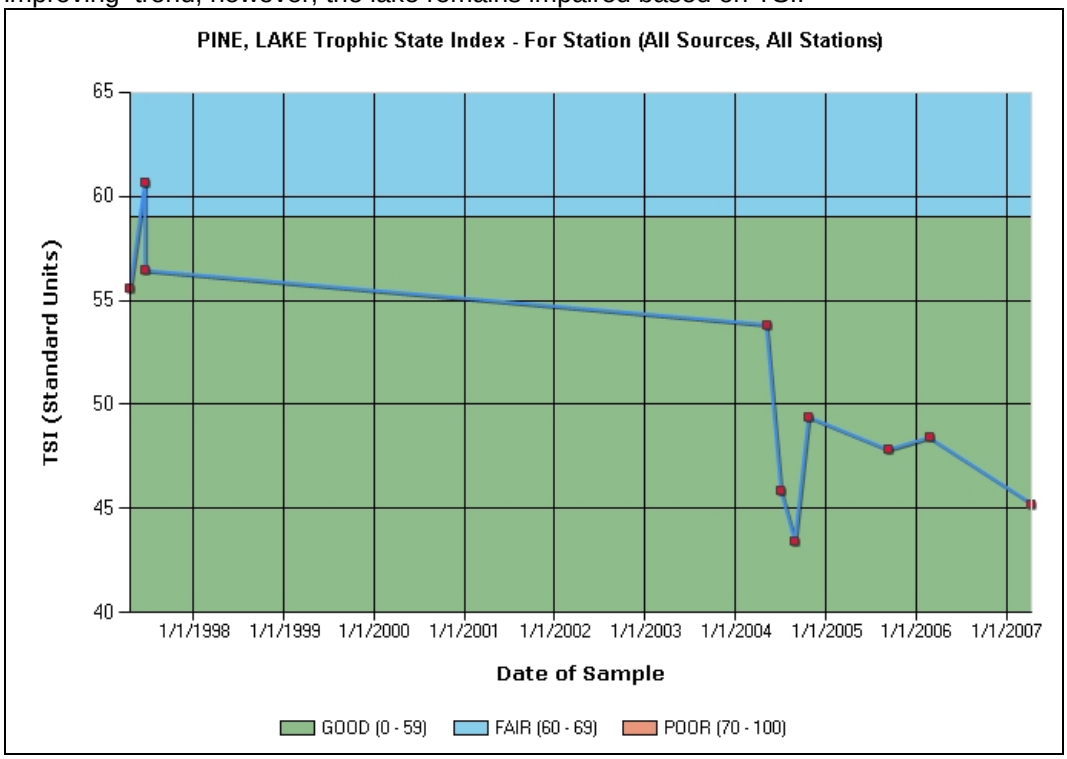


Figure 8. Recent Trophic State Index (TSI) graph from Hillsborough Watershed Atlas. For the latest date go to: (http://www.hillsborough.wateratlas.usf.edu/lake/waterquality.asp?wbodyid=5390&wbodyatlas=lake)
Note: The graph above includes benchmarks for using verbal descriptors of "good", "fair" and "poor". 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 are higher than the most recent LAKEWATCH TSI data and more representative of earlier LAKEWATCH data sets for the lake. The trophic state index (TSI) calculated from the sample data (56.39) is higher than the mean TSI (50.88) of LAKEWATCH data. Table 9contains the field data taken in the center of the lake using a multi-probe (YSI 6000) which has the ability to directly measure the temperature, pH, dissolve 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. The YSI data indicates a well mixed productive system.

Table 8. Water Quality Parameters (Laboratory)

Summary Table for Water Quality		
Parameter	Value	Comment
TP ug/L	40.00	
TN mg/L	0.99	
Chla ug/L	9.70	
Chla TSI	49.52	
TP TSI	63.26	
TN TSI	59.32	
Secchi Disk (SD)	7.04	
TSI	56.39	P limited
PAC	44%	
PVI	18%	
Adj TP	1.25	P from Veg Added
Adj TSI	56.75	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	15:44	27.16	0.239	102.9	8.18	7.6	103.9	1.2	
Mid	15:47	27.11	0.239	101.9	8.11	7.52	101.7	1.1	
Bottom	15:49	26.47	0.238	87.3	7.02	7.24	111.1	1.2	
Surface	15:51	27.15	0.239	105.3	8.37	7.54	98.6	1.2	
Mean Value		26.9725	0.23875	99.35	7.92	7.475	103.825	1.175	7.04

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 44 % of the lake has submerged vegetation present and this vegetation represents about 18 % of the available lake volume. The vegetation holds enough phosphorus to add about 1.25 μg/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), the release of this nutrient would

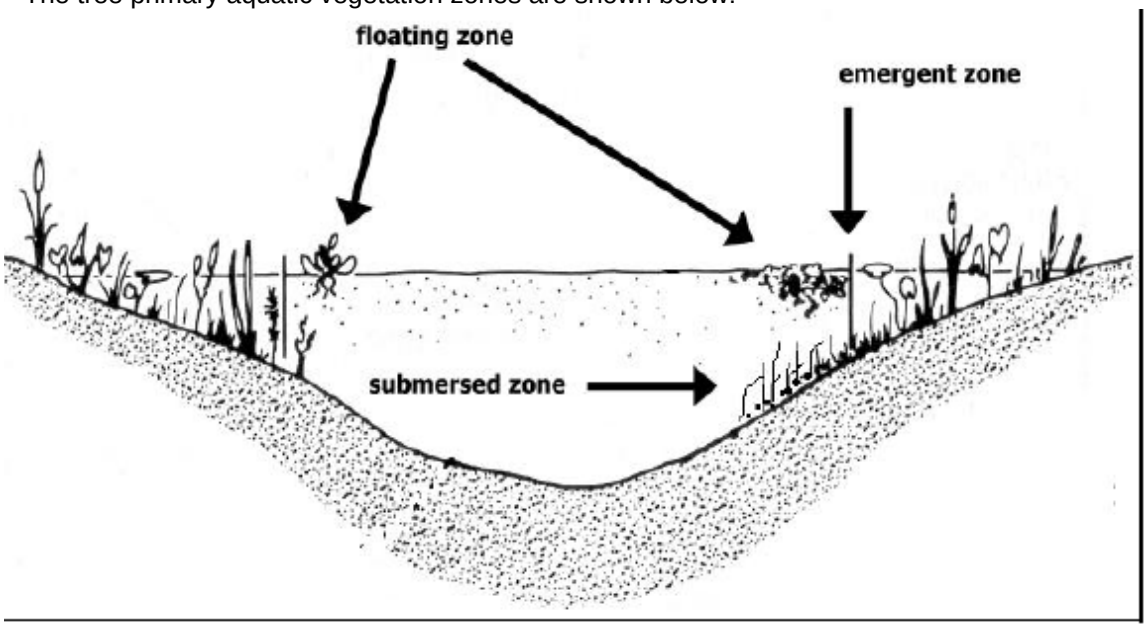
slightly stimulate algal growth. These changes in the water chemistry and biology would be indicated by a slight increase in TSI and little or know change in water clarity which is indicated by the Secchi Disk (SD) value at 7.04 feet.

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 Pine is a small area (8.3 acre) lake that would be considered in the high mesotrophic (good) category of lakes based on water chemistry. It has a normal concentration of aquatic vegetation. About 44% 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 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 *Nuphar lutea var. advena, Panicum repens, Ludwigia peruviana, Nitella spp*. and *Najas guadelupensis*. For more information and recent updates please see the Hillsborough Watershed Atlas (water atlas) website at: http://www.hillsborough.wateratlas.usf.edu .

[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