

November 14, 2003

MEMORANDUM

TO: File

**FROM: Doug Leeper, Senior Environmental Scientist
Resource Conservation and Development Department
Southwest Florida Water Management District**

**SUBJECT: Proposed minimum and guidance levels for Moon Lake in
Pasco County, Florida**

Moon Lake

General Description

Moon Lake (Figure 1) is located in the Coastal Rivers Basin of the Southwest Florida Water Management District (SWFWMD or District) in Pasco County, Florida (Sections 21 & 28, Township 25S, Range 17E). The area surrounding the lake is categorized as the Land-O-Lakes subdivision of the Tampa Plain in the Ocala Uplift Physiographic District (Brooks 1981). The subdivision is a region of many lakes on a moderately thick plain of silty sand overlying Tampa Limestone. As part of the Florida Department of Environmental Protection's Lake Bioassessment/Regionalization Initiative, the area has been identified as the Weeki Wachee Hills lake region, and described as a region of Pleistocene sand dunes with numerous solution basins containing clear-water lakes with circumneutral pH, low alkalinity and low nutrient levels (Griffith *et al.* 1997).

Uplands surrounding the lake have been cleared and are currently used for residential development (Figure 2). Forested wetlands contiguous with the lake have been dredged or filled. A public boat ramp and swimming beach are maintained along the northeastern lakeshore by the Pasco County Parks and Recreation Department. The Southwest Florida Water Management District maintains a regulatory water-level gauge along the lake's west shore.

Moon Lake is located in the Pithlachascotee River drainage basin, and has a drainage area of 0.3 square miles (Florida Board of Conservation 1969). Inlets include a ditch/culvert/canal system that connects the lake to a large cypress-dominated wetland east of the lake when the water elevation in the lake or wetland exceeds about 38.4 ft above the National Geodetic Vertical Datum of 1929 (NGVD). A series of ditches and culverts initiating along the lakes south shore drain the lake through several wetland ponds, and ultimately to the Pithlachascotee River. There are no surface water

withdrawals from the lake currently permitted by the District. There are, however, several permitted groundwater withdrawals in the area, including major withdrawals associated with Tampa Bay Water's operation of the Starkey Wellfield.

The 1954 United States Geological Survey 1:24,000 Fivay, Fla. and the 1954 (photorevised 1988) Fivay Junction quadrangle maps include a water level elevation of 41 ft above NGVD for Moon Lake. The "Gazetteer of Florida Lakes" (Florida Board of Conservation 1969, Shafer *et al.* 1986) lists the lake area as 99 acres at this elevation. Based on a topographic map of the basin generated in support of minimum levels development, the lake extends over 127 acres when it is staged at 41 ft above NGVD (Figure 3). Data used for production of the topographic map were obtained from field surveys conducted in August 2002 and February 2003, and March 2003 and 1:200 aerial photograph maps containing one-foot contour lines prepared using photogrammetric methods.

Figure 1. Location of Moon Lake in Pasco County, Florida.

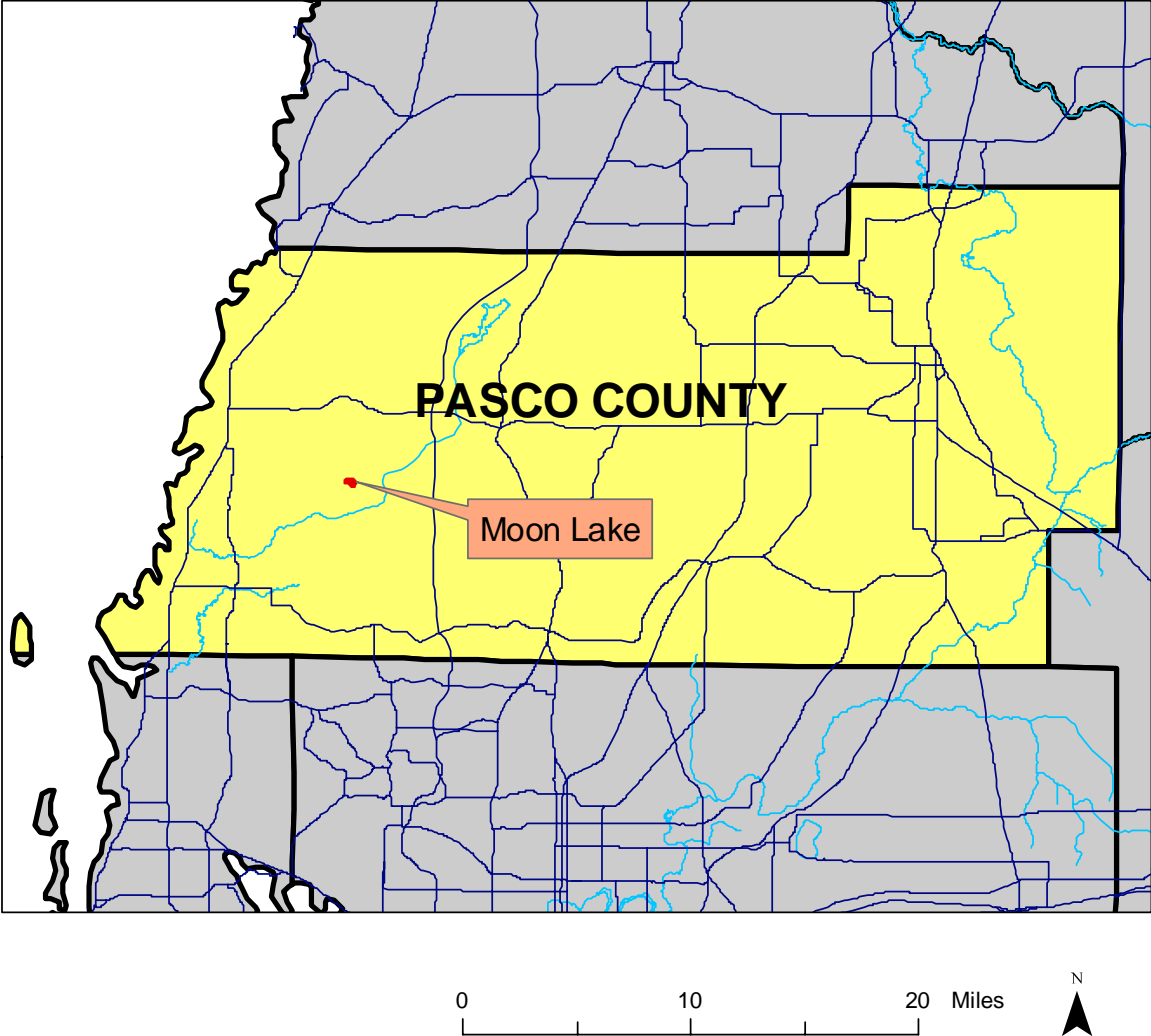
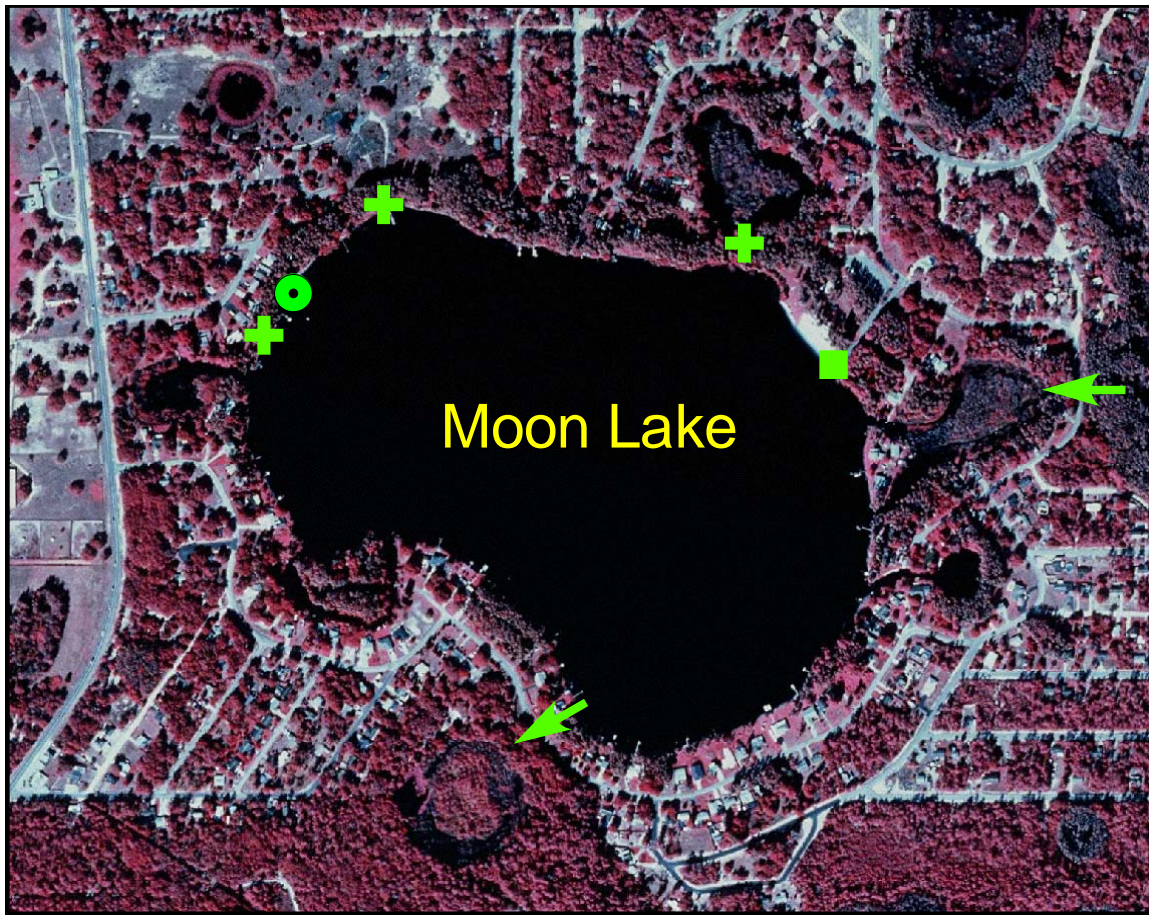



Figure 2. Location of District lake-level gauge, inlet, outlet, public park, boat ramp and sites where hydrologic indicators were measured at Moon Lake in Pasco County, Florida.



 Lake-Level Gauge

 Inlets/Outlets

 Hydrologic Indicators

 Public Park and Boat Ramp

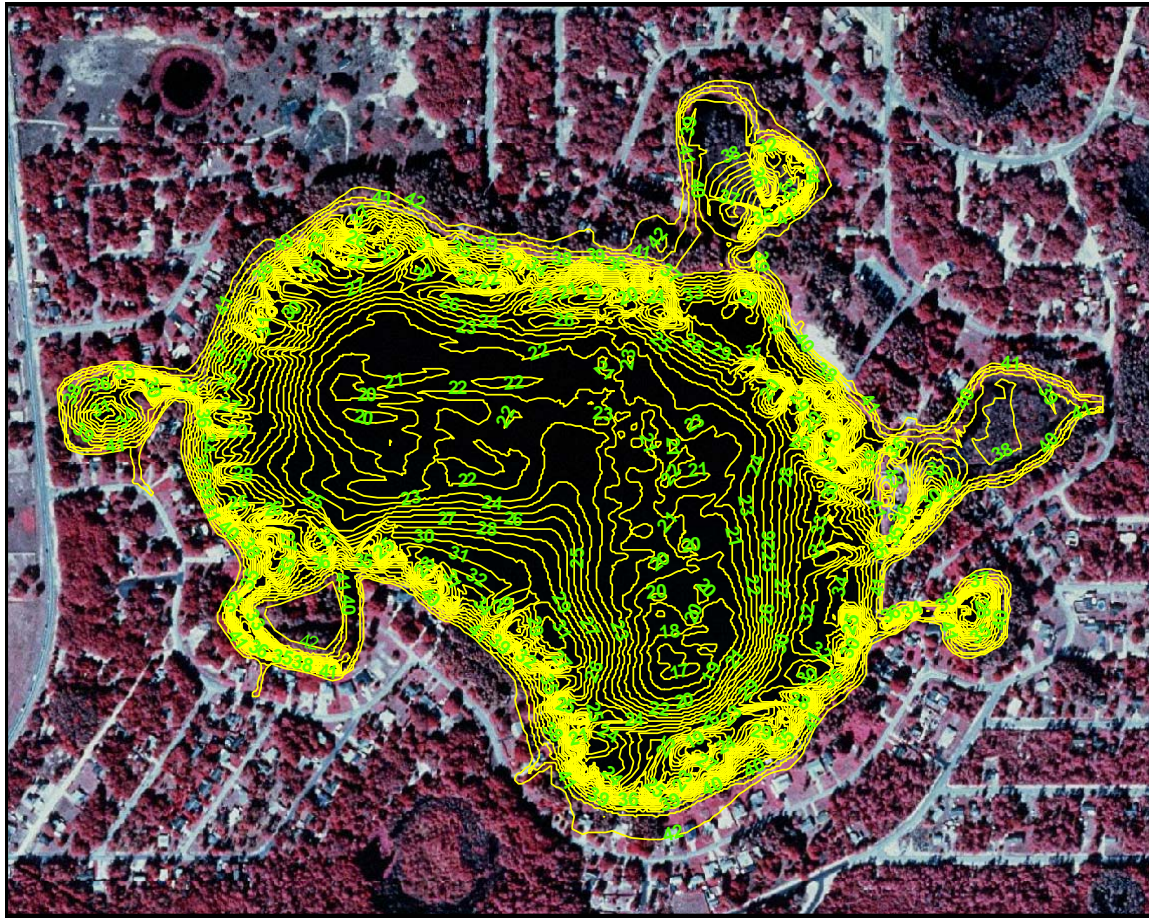
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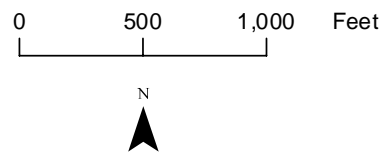
Aerial photography from 1999 USGS
Digital Orthophotograph.

Map prepared November 13, 2003

Figure 3. One-foot contours within the Moon Lake basin in Pasco County, Florida. Values shown are elevations, in feet above the National Geodetic Vertical Datum of 1929.



Map prepared June 17 2003 using 1999 USGS digital orthophotography, 1974 and 1977 SWFWMD one-foot contours maps (Sheet Nos. 28-25-17 and 21-25-17), and elevation data collected by SWFWMD staff in August 2002, February 2003 and March 2003.



Previously Adopted Lake Management Levels

Based on work conducted in the 1980s (see SWFWMD 1996), the District Governing Board adopted management levels (currently referred to as Guidance Levels) for Moon Lake in November 1984 (Table 1). A Maximum Desirable Level of 40.00 ft above NGVD was also developed, but was not adopted by the Governing Board.

Table 1. Adopted guidance levels and associated surface areas for Moon Lake in Pasco County, Florida.

Level	Elevation (feet above NGVD)	Total Lake Area (acres)
Ten Year Flood Guidance Level	41.00	127
High Level	40.50	124
Low Level	37.50	105
Extreme Low Level	35.50	98

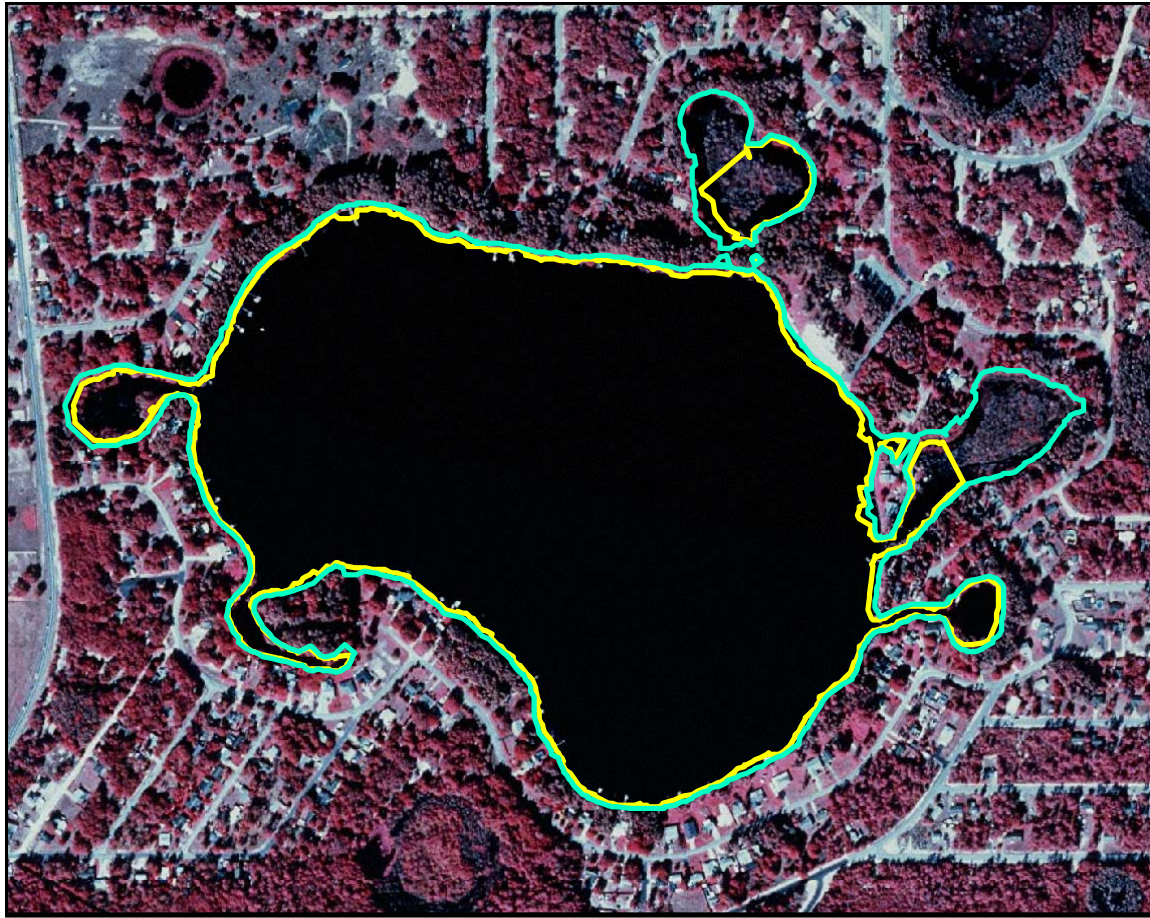
Proposed Minimum and Guidance Levels

Proposed Minimum and Guidance Levels were developed for Moon Lake using the methodology for Category 3 Lakes described in Leeper *et al.* (2001), in accordance with modifications outlined by Dierberg and Wagner (2001). Proposed levels, along with lake surface area values for each level are listed in Table 2. Contour lines corresponding the proposed minimum level elevations are shown within the basin in Figure 4.

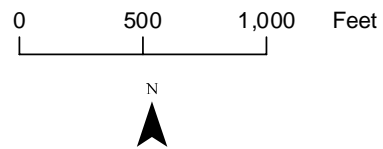
Table 2. Proposed minimum levels, guidance levels and associated surface areas for Moon Lake in Hillsborough County, Florida.

Level	Elevation (feet above NGVD)	Lake Area (acres)
Ten Year Flood Guidance Level	41.7	132
High Guidance Level	39.9	119
High Minimum Lake Level	39.9	119
Minimum Lake Level	38.3	107
Low Guidance Level	36.2	101

Figure 4. Approximate location of the proposed Minimum Lake Level (yellow) and proposed High Minimum Lake Level (blue) for Moon Lake in Pasco County, Florida.





Map prepared November 14, 2003 using 1999 USGS digital orthophotography, 1974 and 1977 SWFWMD one-foot contours maps (Sheet Nos. 28-25-17 and 21-25-17), and elevation data collected by SWFWMD staff in August 2002, February 2003 and March 2003.



Legend

Contour

-  38.3 ft above NGVD
-  39.9 ft above NGVD

Summary of Data and Analyses Supporting Recommended Minimum and Guidance Levels

Hydrologic data are available for Moon Lake (District Universal ID Number STA 419 420) from January 1965 through September 1970 (no data are available for January 1967 and February 1968) and from October 1971 to the present date (Figure 5, see Figure 2 for current location of the SWFWMD lake-level gauge). Monthly mean water surface elevations, along with proposed guidance and minimum levels are graphed in Figure 6. For the entire period of record, the hydrologic data are classified as Historic data. Historic data collected through January 2002 were used to calculate the Historic P10, P50, and P90 (Table 3).

The Category 3 Lake Normal Pool elevation was established at 41.3 ft above NGVD based on elevations associated with the buttressing of large cypress (*Taxodium* sp.) trees along the west and north shores of the lake (Table 4, Figure 2). The low floor slab elevation, extent of structural alteration and the control point elevation (39.8 ft above NGVD) were determined using available one-foot contour interval aerial maps and field survey data (Table 3, Figure 7). The Category 3 Lake Normal Pool elevation is above the control point elevation, so the lake is considered to be Structurally Altered.

Based on the availability of Historic data, the High Guidance Level was established at the Historic P10 elevation of 39.9 ft above NGVD (Table 3). The Historic P50 and Low Guidance Level, 38.3 and 36.2 ft above NGVD, respectively, were also established using Historic data.

The Ten Year Flood Guidance Level was established for Moon Lake at 41.7 ft above NGVD using the methodology for open basin lakes described in current District Rules (Chapter 40D-8, Florida Administrative Code). For the analysis, the District used the flood routing model, NETWORK. Model output was based on a ten-year storm event with a 120-hour duration and an 11.3-inch rainfall depth. Based on available lake stage data, the Ten Year Flood Guidance Level has not been exceeded during the past 38 years (Figures 5 and 6). The highest surface elevation for Moon Lake included in the District Water Management Database, 41.06 ft above NGVD, occurred on March 26, 1998. The low of record, 33.88 ft above NGVD, occurred on May 30, 2001.

Moon Lake is not contiguous with cypress-dominated wetlands of 0.5 or more acres in size and is therefore classified as a Category 3 Lake for the purpose of minimum levels development. Aquatic macrophytes, including cattail (*Typha* sp.), torpedograss (*Panicum repens*), southern naid (*Najas quadrelupensis*) and spatterdock (*Nuphar luteum*) occur throughout the basin.

Dock-Use, Species Richness, Aesthetics, Recreation/Ski, Basin Connectivity and Mixing Standards were evaluated for minimum levels development (Table 3). The Dock-Use Standard was established at 39.3 ft above NGVD, based on the elevation of sediments at the end of 90% of the 36 docks at the lake (35.2 ft above NGVD, Table 5), the difference between the Historic P50 and Historic P90 (2.1 ft), a clearance value of 2 ft

based on use of powerboats in the lake. The Aesthetic-Standard for the lake was established at the Low Guidance Level elevation of 36.2 ft above NGVD. The Species Richness Standard was established at 33.3 ft above NGVD, based on limiting reduction in lake surface area to less than a 15% decrease from the area at the Historic P50 elevation. The Recreation/Ski Standard was established at 30.1 ft above NGVD, based on the elevation within the basin at which the lake would contain a 200 ft wide, 2,000 ft long ski corridor with a water depth of five feet, and the difference between the Historic P50 and P90 (2.1 ft). The Basin Connectivity Standard was established at 26.1 ft above NGVD, based on the elevation that ensures connectivity among the two major sub-basins of the lake (22 ft above NGVD), a two-foot clearance value for use of powerboats on the lake, and the difference between the Historic P50 and P90 (2.1 ft). Based on basin morphology, a Mixing Standard for preventing potential re-suspension of sediments was established at 22.6 ft above NGVD (Figure 8).

Review of the relationships between lake stage and potential herbaceous wetland area or the area available for aquatic macrophyte colonization indicated that with the exception of the Mixing Standard, all standards would be appropriate for minimum levels development. At the Mixing Standard elevation, the entire inundated area would be available for colonization by emergent and/or floating-leaved macrophytes (Figure 8), and this would be expected to adversely impact values associated with the other standards.

The Dock-Use Standard, the most conservative (*i.e.*, highest) of the appropriate standards, is higher than the Historic P50 elevation, so the Historic P50 elevation was used to establish the proposed Minimum Lake Level at 38.3 ft above NGVD. The proposed High Minimum Lake Level was established at 39.9 ft above NGVD, an elevation corresponding to the Minimum Lake Level plus the difference between the Historic P10 and Historic P50 (1.6 ft). The proposed High Minimum Lake Level is 2.1 ft below the Low Floor Slab elevation and 2.5 ft below the low spot on the paved roads that encircle the lake. At the High Minimum Lake Level, the water surface would be 0.9 ft below the top of the public boat ramp located along the northeastern lakeshore.

Figure 5. Surface water elevation at Moon Lake in Pasco County, Florida. Data through January 2003 are shown.

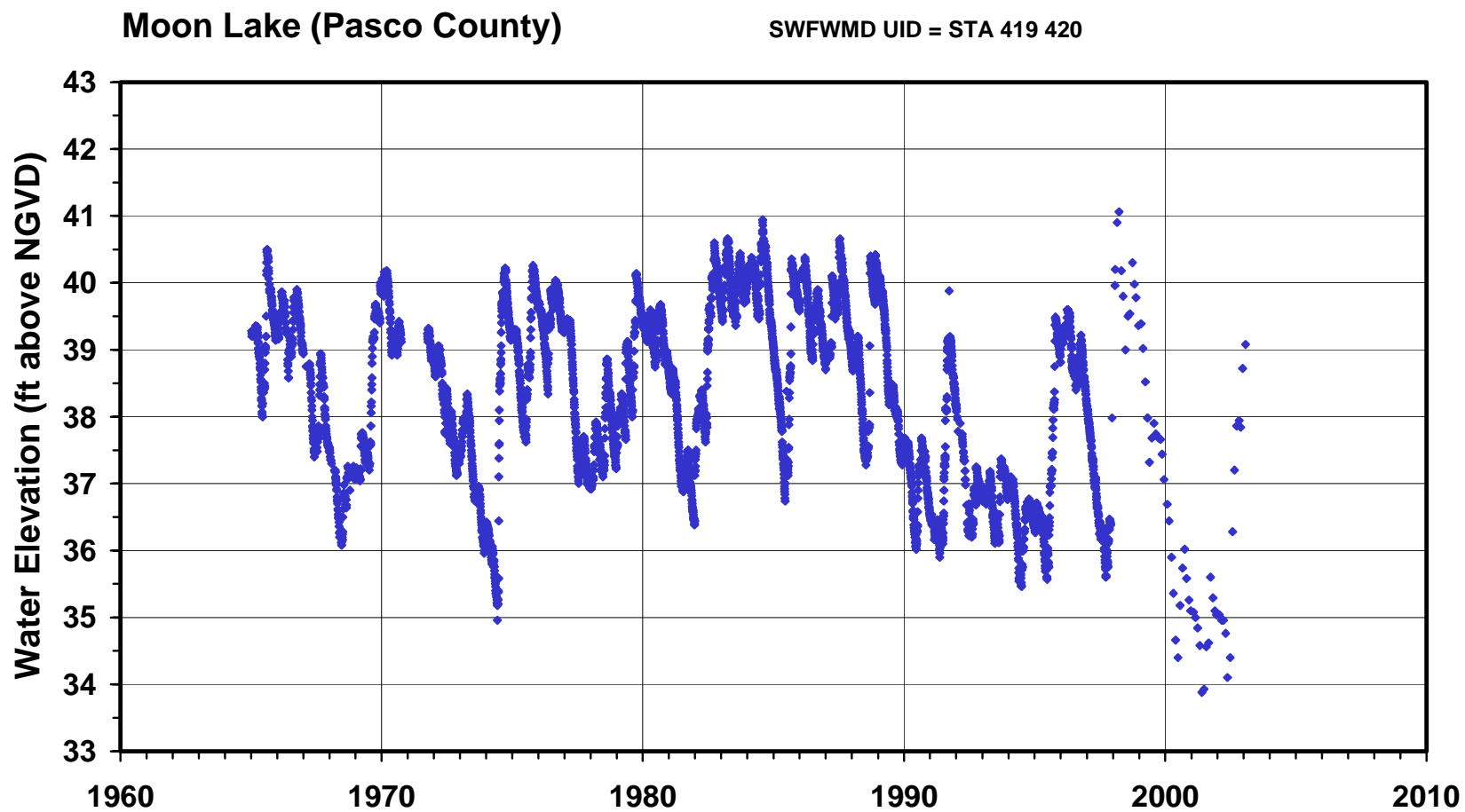


Figure 6. Mean monthly surface water elevation, and proposed guidance and minimum levels for Moon Lake in Pasco County, Florida. Proposed levels include the Ten Year Flood Guidance Level (10-YR), High Guidance Level (HGL), Low Guidance Level (LGL), High Minimum Lake Level (HMLL), and Minimum Lake Level (MLL).

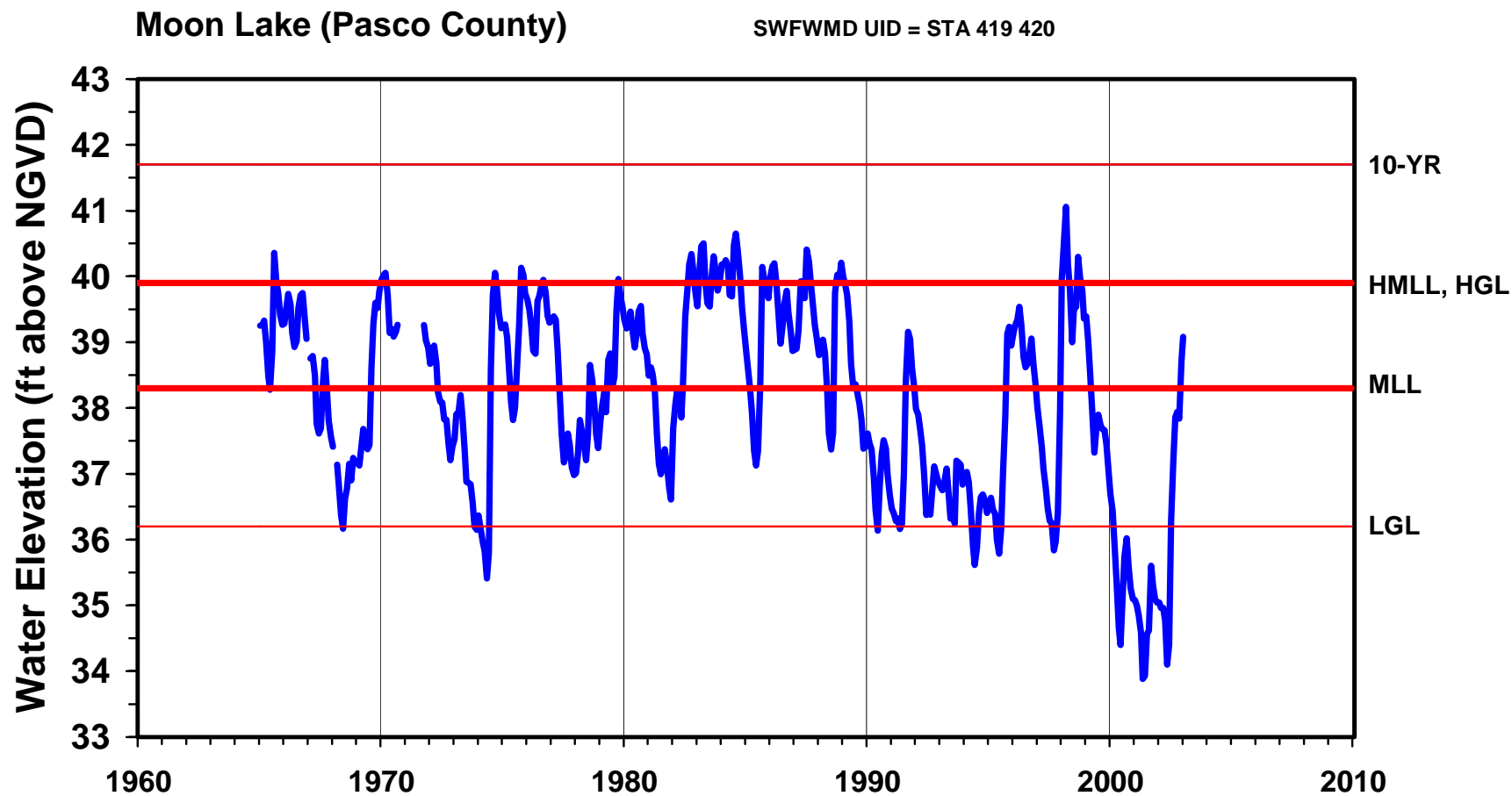


Table 3. Elevation data and associated area values used for establishing minimum levels for Moon Lake in Pasco County, Florida.

Level or Feature	Elevation (feet above NGVD)	Lake Area (acres)
Historic P10	39.93	119
Historic P50	38.27	107
Historic P90	36.17	101
Category 3 Lake Normal Pool	41.3	129
Low Road	42.4	136
Low Floor Slab	42.0	135
Low Other (garage slab)	42.0	135
Low Other (top of paved boat ramp)	40.8	126
Control Point	39.8	118
High Guidance Level	39.9	119
Historic P50	38.3	114
Low Guidance Level	36.2	101
Dock-Use Standard	39.3	114
Aesthetic Standard	36.2	101
Species Richness Standard	33.3	92
Recreation/Ski Standard	30.1	76
Connectivity Standard	26.1	14
Mixing Standard	22.6	32

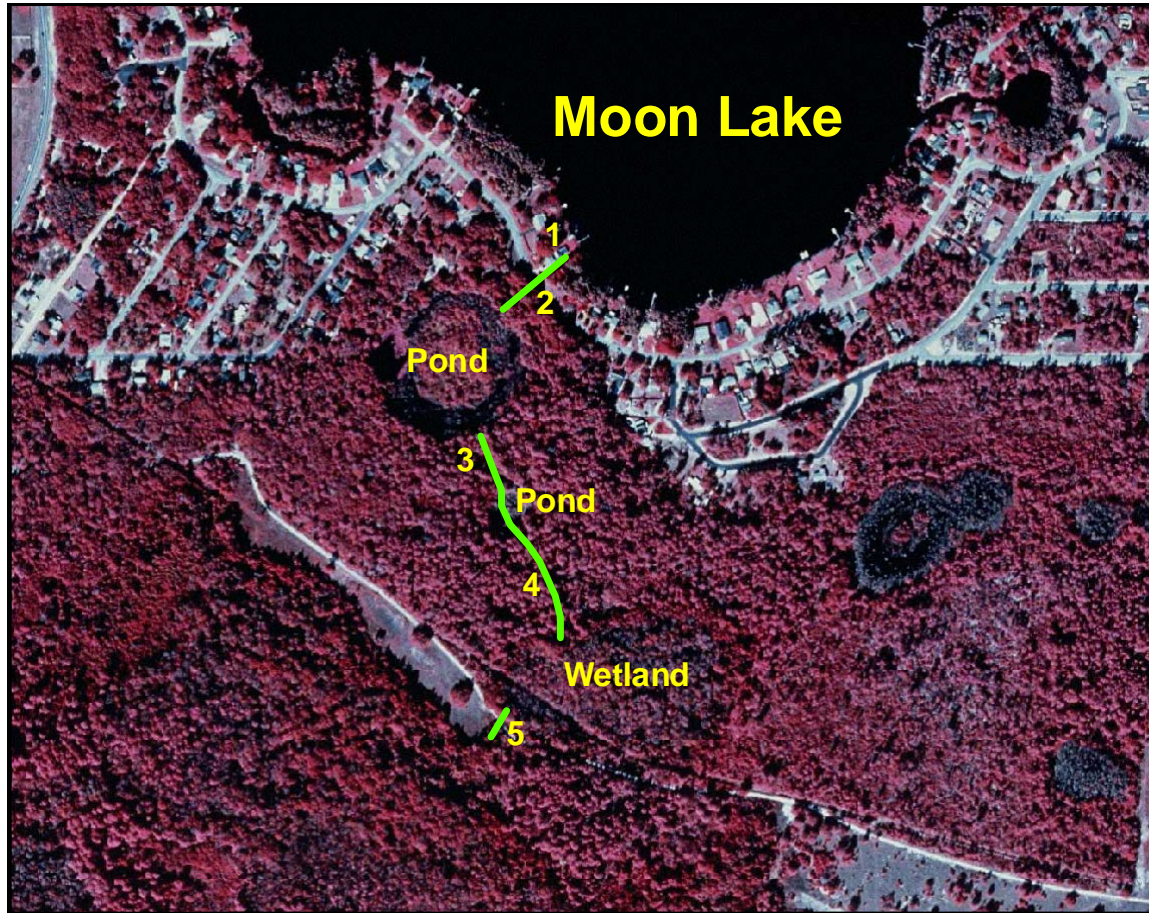
Table 4. Elevation data used for establishing the Category 3 Lake Normal Pool Elevation for Moon Lake in Pasco County, Florida. Data were collected at three sites by SWFWMD staff on August 29, 2002 and February 25, 2003.

Hydrologic Indicator	Elevation (feet above NGVD)
Normal pool based on cypress buttress	40.44
Normal pool based on cypress buttress	40.52
Normal pool based on cypress buttress	40.67
Normal pool based on cypress buttress	40.77
Normal pool based on cypress buttress	40.84
Normal pool based on cypress buttress	41.22
Normal pool based on cypress buttress	41.28
Normal pool based on cypress buttress	41.29
Normal pool based on cypress buttress	41.35
Normal pool based on cypress buttress	41.38
Normal pool based on cypress buttress	41.43
Normal pool based on cypress buttress	41.73
Normal pool based on cypress buttress	42.12
N	13
Median	41.3
Mean	41.2
Standard Deviation	0.49

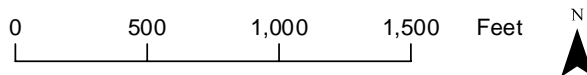
Table 5. Summary statistics for elevations associated with docks (n=36) at Moon Lake in Pasco County, Florida, based on data collected April 9, 2002 by SWFWMD staff. Percentiles (P10, P50, P90) represent elevations exceeded by 10, 50 and 90 percent of the docks.

Statistic	Elevation of Sediments at Dock Ends (feet above NGVD)	Elevation of Dock Platform (feet above NGVD)
Mean (SD)	33.9 (1.2)	41.0 (0.8)
P10	35.2	41.8
P50 (Median)	34.2	41.2
P90	31.9	40.0
Maximum	36.0	43.6
Minimum	31.2	39.2

Figure 7. Outlet conveyance system for Moon Lake in Pasco County, Florida. Ditched flow paths are indicated by green lines.



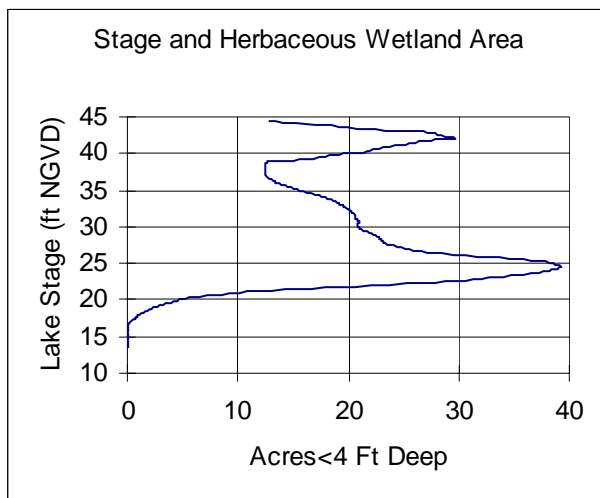
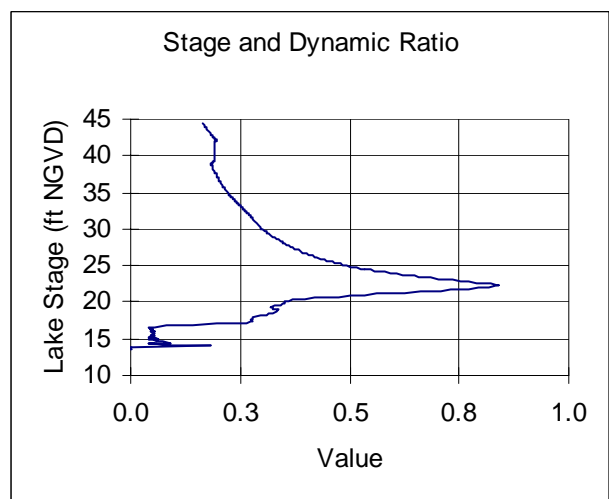
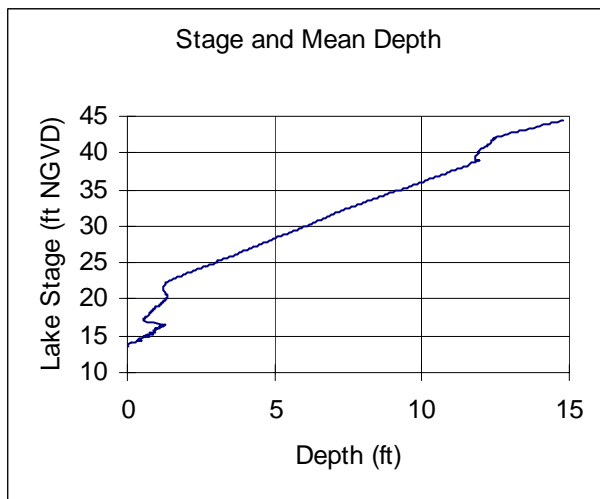
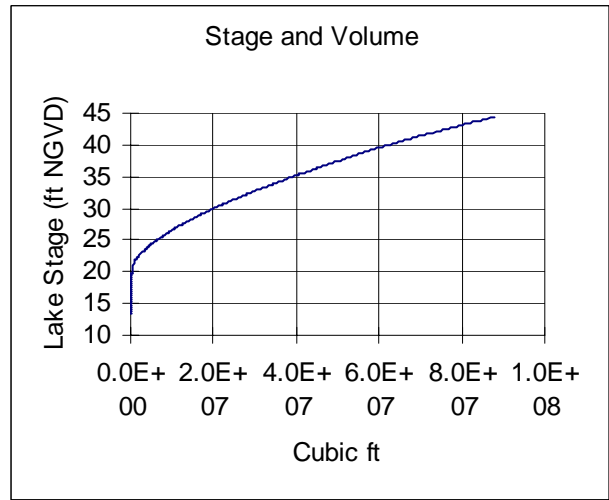
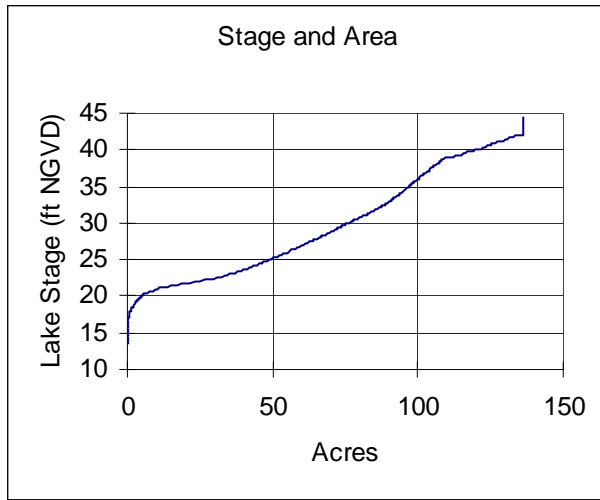
Aerial photography from 1999 USGS Digital Orthophotograph.



Map prepared November 13, 2003

Site	Description	Elevation (feet above NGVD)
1	Control point; high spot in ditch between Moon Lake and pond	39.8
2	Inverts at northeast and southeast ends of 40.5-ft long, 24-inch corrugated metal under Lacey Road	39.01, 38.64
3	High spot in ditch between two ponds	38.1
4	High spot in ditch between pond and wetland	37.6
5	Inverts at north ends of two 20-ft, 36-inch diameter plastic culverts under dirt road; inverts at south end of pipes are 33.67 and 34.09 ft above NGVD	33.97, 34.26

Figure 8. Surface area, volume, dynamic ratio (basin slope), and potential herbaceous wetland area versus lake stage for Moon Lake in Pasco County, Florida.



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