

April 9, 2004

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 Lake Pasadena and
Buddy Lake in Pasco County, Florida**

Lake Pasadena and Buddy Lake

General Lake Description

Lake Pasadena and Buddy Lake are located in Pasco County, Florida (Sections 8, 9, 16 and 17 Township 25 South, Range 21 East) in the Hillsborough River Basin of the Southwest Florida Water Management District (Figure 1). The area surrounding the lakes is categorized as the Dade City Hills subdivision of the Ocala Uplift Physiographic District (Brooks 1981). The subdivision is a region of internally drained, high sand hills (Brooks 1981). As part of the Florida Department of Environmental Protection's Lake Bioassessment/Regionalization Initiative, the area has been identified as the Southern Brooksville Ridge lake region and described as an area of neutral to alkaline, mesotrophic or meso-eutrophic lakes (Griffith *et al.* 1997).

Uplands adjacent to Lake Pasadena and Buddy Lake have, for the most part, been cleared of native vegetation and are used for residential development, citrus production, or livestock grazing (Figure 2). Public access to the lake is available at a private boat ramp site located on the north shore of Lake Pasadena.

Lake Pasadena and Lake Buddy are identified as internally drained by the U.S. Geological Survey, and collectively have a drainage area of 4.6 square miles (SWFWMD 1996). There are no major inlets to the lakes, although the greater lake basin, which contains both lakes, includes areas north of Clinton Avenue (County Road 52A) and west of that may drain to Lake Pasadena (Figure 2). Extensive wetland areas occur throughout the basin, including the region between Lake Pasadena and Buddy Lake. This inter-lake wetland area is inundated when the water surface in the basin exceeds 91-92 ft above the National Geodetic Vertical Datum of 1929 (NGVD). A shallow ditch breaches the remains of a low-lying berm that bisects the inter-lake wetland area. Although the lakes are typically internally drained, surface outflow from the southeast corner of Buddy Lake may occur when water level in the lake system

exceeds 99.9 ft above NGVD. Anecdotal accounts indicate that this last occurred in 1960. Currently, there is only one surface water withdrawal from the lake system permitted by the District (WUP No. 200009896.000). There are, however, numerous ground water withdrawals in the region.

The United States Geological Survey (USGS) 1960 1:24,000, 7.5 Minute Series (Topographic) Dade City Quadrangle map shows a lake surface elevation of 93 ft above NGVD for both Lake Pasadena and Buddy Lake. The "Gazetteer of Florida Lakes" (Florida Board of Conservation 1969, Shafer *et al.* 1986) lists areas of 373 acres and 90 acres for Lake Pasadena and Lake Buddy, respectively, at an elevation of 93 ft above mean sea level. Based on a topographic map of the basin generated in support of minimum levels development (Figure 3), the lakes have a combined surface area of 806 acres at an elevation of 93 ft above NGVD. Data used for production of the topographic map were obtained from field surveys and 1:200 aerial-photography maps of the basin containing one-foot contour lines prepared using photogrammetric methods.

Figure 1. Location of Lake Pasadena and Buddy Lake in Pasco County, Florida.

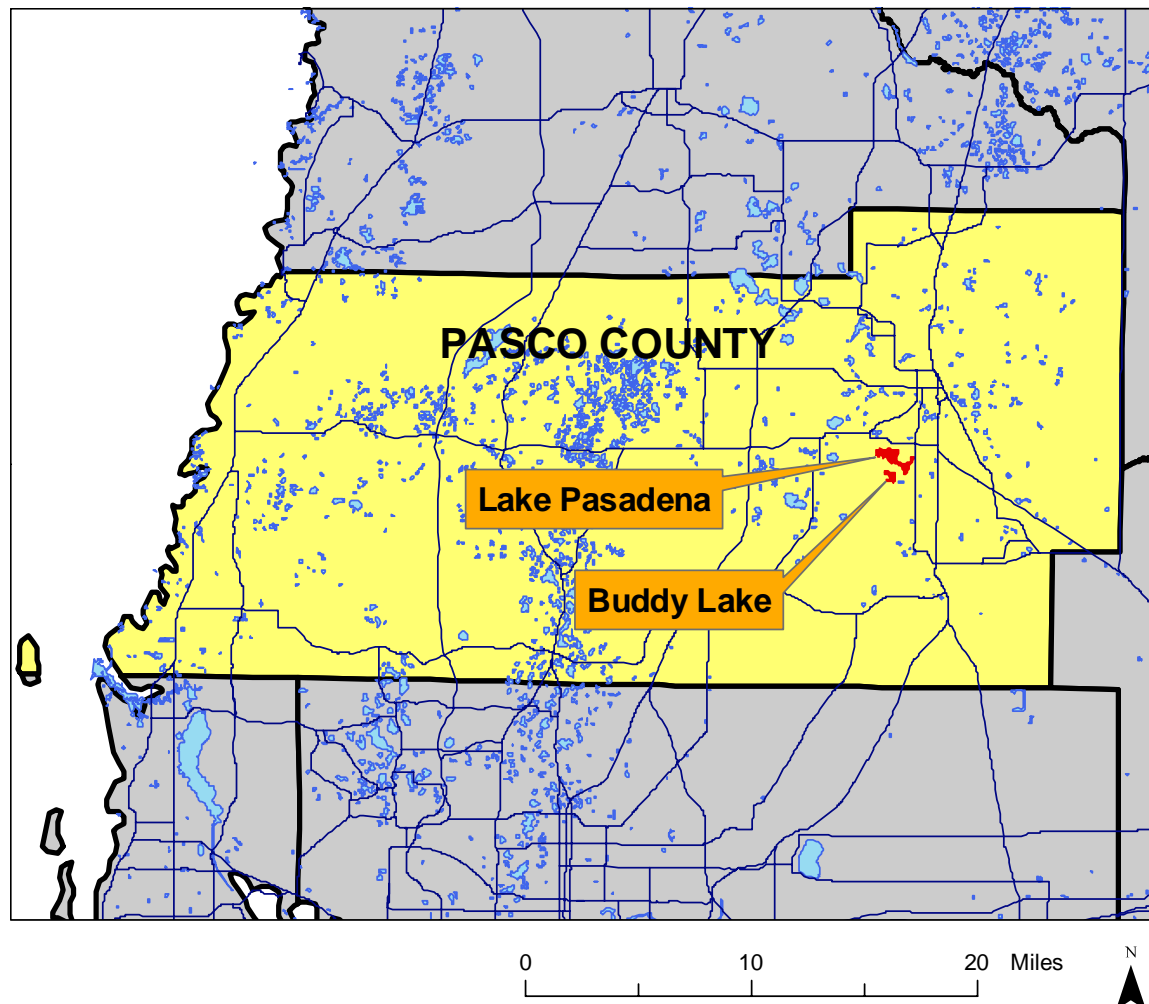
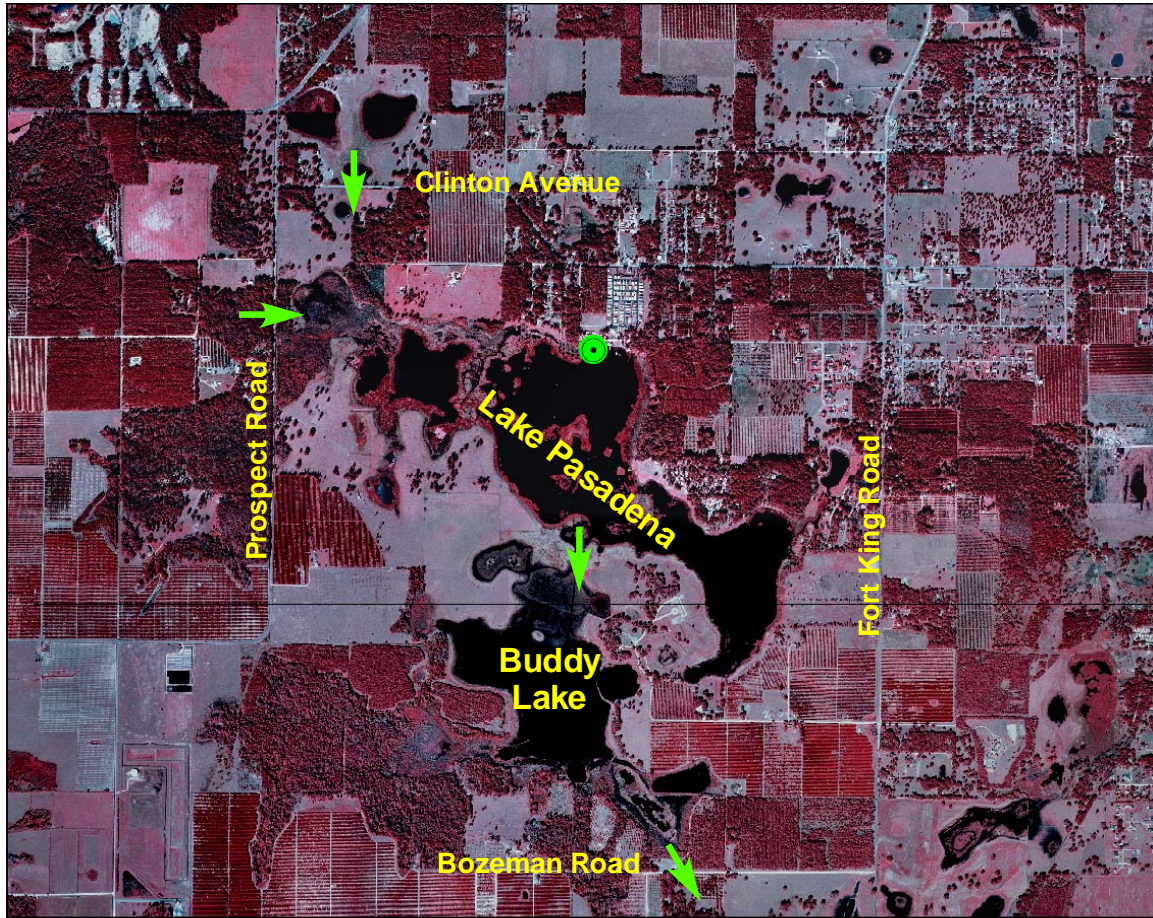


Figure 2. Location of District lake-level gauge, boat ramp site and inlets/outlets at Lake Pasadena and Buddy Lake in Pasco County, Florida.



 Lake gauge & Ramp Site

 Inlet/Outlet

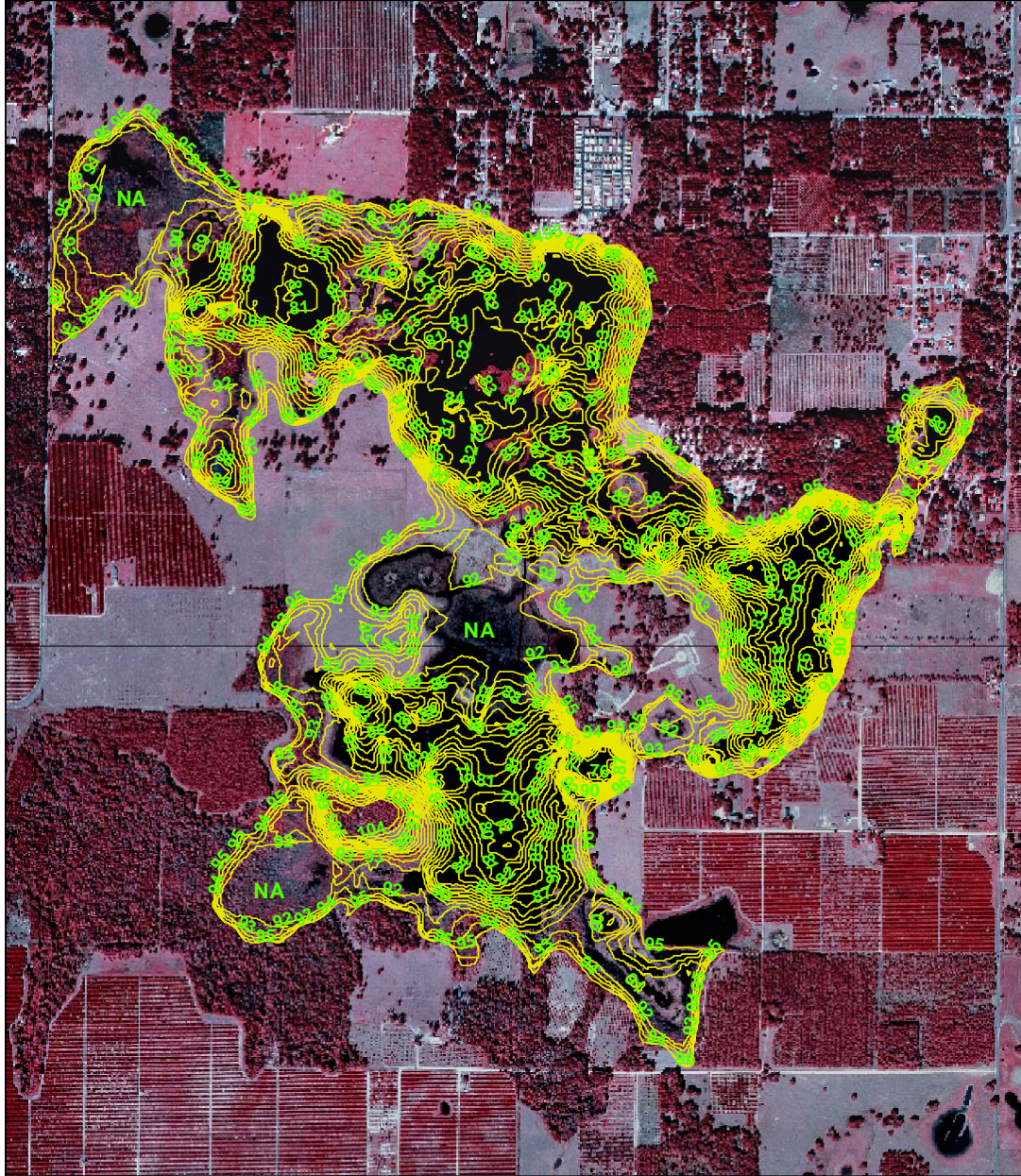
0 0.5 1 Miles



Aerial photography from 1999 USGS
Digital Orthophotograph.

Map prepared November 15, 2003

Figure 3. One-foot contours within the Lake Pasadena and Buddy Lake basins in Pasco County, Florida. Elevation data less than 92 ft above NGVD were not available for map development in areas marked as NA. Values shown are elevations in feet above the National Geodetic Vertical Datum of 1929.



Map prepared November 24, 2003 using 1999 USGS digital orthophotography, 1985 SWFWMD one-foot contours maps (Sheet Nos. 8-25-21, 9-25-21, 16-25-21 and 17-25-21), and elevation data collected by SWFWMD staff in March, April, June, August and November 2003.

0 1,000 2,000 Feet



Previously Adopted Lake Management Levels

Based on work conducted in the late 1980s (see SWFWMD 1996), the District Governing Board adopted management levels (currently referred to as Guidance Levels) for Lake Pasadena and Buddy Lake in August 1989 (Table 1). A Maximum Desirable Level of 94.00 ft above NGVD was also developed, but was not adopted by the Governing Board.

Table 1. Adopted Guidance Levels and associated surface areas for the Lake Pasadena and Buddy Lake in Pasco County, Florida.

Level	Elevation (ft above NGVD)	Lake Area (acres)
Ten Year Flood Guidance Level	97.20	NA
High Level	94.50	910
Low Level	91.50	541
Extreme Low Level	90.00	478

NA = not available

Proposed Minimum and Guidance Levels

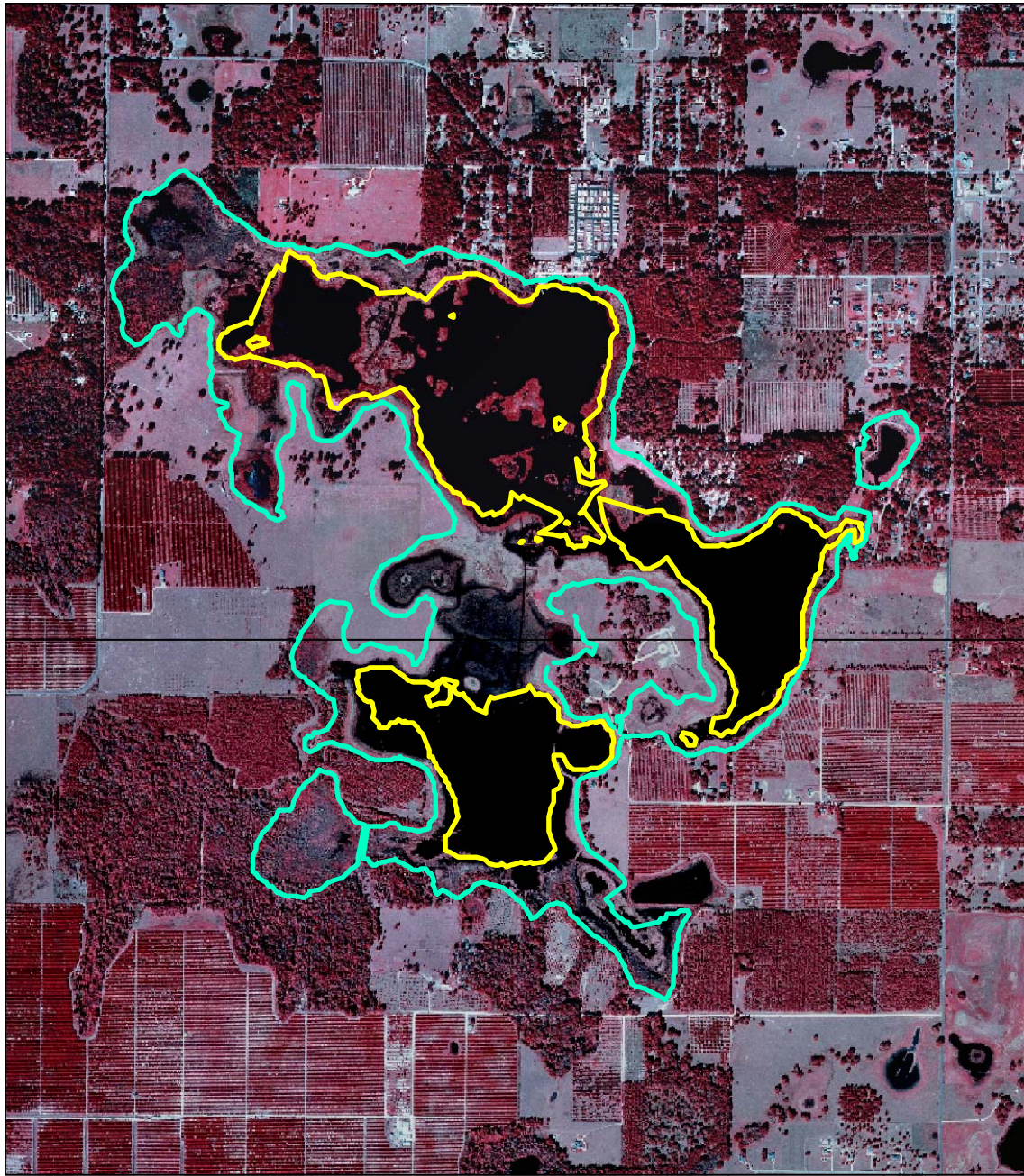
Proposed Minimum and Guidance Levels were developed for Lake Pasadena and Buddy Lake using the methodology for Category 3 Lakes described in current District rules (Chapter 40D-8, Florida Administrative Code). Proposed levels, along with lake surface area values for each level are listed in Table 2. Contour lines corresponding to the proposed minimum level elevations are shown within the lake basins in Figure 4.

Table 2. Proposed minimum levels, guidance levels and associated combined surface areas for the Lake Pasadena and Buddy Lake in Pasco County, Florida.

Level	Elevation (ft above NGVD)	Lake Area (acres)
Ten Year Flood Guidance Level	96.9	NA
High Guidance Level	93.7	860
High Minimum Lake Level	93.7	860
Minimum Lake Level	87.3	376
Low Guidance Level	83.9	223

NA = not available

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





0 1,000 2,000 Feet



Map prepared November 24, 2003 using 1999 USGS digital orthophotography, 1985 SWFWMD one-foot contours maps (Sheet Nos. 8-25-21, 9-25-21, 16-25-21 and 17-25-21), and elevation data collected by SWFWMD staff in March, April, June, August and November 2003.

Legend

-  87.3 ft above NGVD
-  93.7 ft above NGVD

Summary of Data and Analyses Supporting Development of the Proposed Minimum and Guidance Levels

Hydrologic data are available for Lake Pasadena (District Universal ID Number STA 489 491) from February 1984 to the present date (Figure 5; see Figure 2 for the location of the District water level gauge). The District does not maintain a lake-level gauge at Buddy Lake. Monthly mean water surface elevations for Lake Pasadena, along with proposed guidance and minimum levels for the two lakes are shown in Figure 6.

Based on water-use estimates and analysis of lake stage and ground water fluctuations, all available hydrologic data for the Lake Pasadena are classified as Historic data. Data collected through January 2003 were used to calculate the Historic P10, P50, and P90 (Table 3).

A Normal Pool elevation (Table 3) was not established for Lake Pasadena or Buddy Lake. Reliable Hydrologic Indicators of high water levels were not observed. Citrus trees were planted at relatively low elevations within the basins, although not as low as the lowest floor slab. Based on available lake-stage data, the Florida Department of Environmental Protection has recommended that an elevation of 93.5 ft above NGVD may be used as a provisional approximation of the ordinary high water line for Lake Pasadena (Maddox 1997).

The low floor slab elevation and extent of structural alteration were determined using available one-foot contour interval aerial maps, and field survey information (Table 3). Because Lake Pasadena and Buddy Lake are typically internally drained, a control point elevation was not established for the lake system. A low spot along Bozeman Road, at an elevation of 99.9 ft above NGVD, was identified as a potential high-stage discharge site for the lake system (Figure 2).

Based on the availability of Historic data, the High Guidance Level was established at the Historic P10 elevation of 93.7 ft above NGVD (Table 3). The Historic P50 and Low Guidance Level, 87.3 and 83.9 ft above NGVD, respectively, were also established using Historic data.

The Ten Year Flood Guidance Level for Lake Pasadena and Buddy Lake was established at 96.9 ft NGVD using the methodology for closed basin lakes described in current District Rules (Chapter 40D-8, Florida Administrative Code). In accordance with the closed-basin methodology, the 10-year flood level was based on frequency analysis of the lake stage values derived from a HSPF (Hydrologic Simulation Program Fortran) continuous simulation model and the available gauging record. Inputs to the model included standard watershed parameters (basin size, slope, infiltration rate, ground water recession rate, etc.) and rainfall records from the Brooksville National Weather Service site for the period from 1950 through 2003. Available stage data indicates that the Ten Year Flood Guidance Level has not been exceeded during the past twenty years (see Figures 5 and 6). The peak stage recorded for Lake Pasadena, 94.74 ft above NGVD, occurred on January 22, 1989. Anecdotal accounts indicate that the

lakes were staged above the Ten Year Flood Guidance Level in 1960. The low of record, 81.56 ft above NGVD, occurred on May 30, 2001.

The basin containing Lake Pasadena and Buddy Lake does not contain cypress-dominated wetlands of 0.5 or more acres in size, so the lakes are classified as Category 3 Lakes for the purpose of minimum levels development. Extensive wetland areas, dominated by maidencane (*Panicum hemitomon*), torpedo grass (*Panicum repens*), cattail (*Typha* sp.), spatterdock (*Nuphar luteum*), smartweed (*Polygynum* sp.), water lily (*Nymphaea* sp.), water pennywort (*Hydrocotyle* sp.), pickerelweed (*Pontederia cordata*), primrose willow (*Ludwigia* sp), and willow (*Salix* sp.) occur throughout the basin.

Basin Connectivity, Dock-Use, Recreation/Ski, Species Richness, Aesthetics, and Mixing Standards were evaluated for minimum levels development (Table 3, see Leeper *et al.* 2001 and Dierberg and Wagner 2001 for information on standard development). The Basin Connectivity Standard was established at 96.4 ft above NGVD, based on the elevation that ensures connectivity between Lake Pasadena and Buddy Lake (91.0 ft above NGVD), a 2-ft clearance values for use of powerboats on the lake, and the difference between the Historic P50 and Historic P90 elevations (3.4 ft). The Dock-Use Standard was established at 94.4 ft above NGVD, based on the elevation of sediments at the end of 90% of the 10 docks within the basin (89.0 ft above NGVD, Table 4), a clearance value of 2-ft based on use of powerboats in the lake, and the difference between the Historic P50 and Historic P90 elevations. A Recreation/Ski Standard for the basin was established at 90.4 ft above NGVD, based on the elevation at which the lake could contain a safe skiing area (87.0 ft above NGVD) and the difference between the Historic P50 and Historic P90 elevations. The Species Richness Standard was established at 86.0 ft above NGVD, based on limiting change in lake surface area to less than a 15% reduction from the area at the Historic P50 elevation. The Aesthetics Standard was established at the Low Guidance Level elevation of 83.9 ft above NGVD. The Mixing Standard was established at 77.4 ft above NGVD, based on review of dynamic ratio values (see Bachmann *et al.* 2000) for lake stages up to the Historic P50 elevation (Table 3, Figure 7).

Review of lake stage data, basin morphology and distribution of aquatic macrophytes within the basin indicated that use of the Basin Connectivity, Mixing and Recreation/Ski Standards would not be appropriate for minimum levels development. The Basin Connectivity Standard was not considered appropriate for minimum levels development because the standard exceeds the Historic P10 elevation. Use of the Mixing Standard was not considered appropriate, as the area of potential herbaceous wetland within the lake at the standard elevation would represent only 3% of the area of potential herbaceous wetland available at the Historic P50 elevation (Figure 7). The Recreation/Ski Standard was not considered to be appropriate due to the extensive stands of aquatic macrophytes in Lake Pasadena and Buddy Lake that would be expected to limit recreational skiing within the basins.

The Dock-Use Standard, the most conservative (*i.e.*, highest) of the appropriate standards, exceeded the Historic P50 elevation, so the proposed Minimum Lake Level

was established at the Historic P50 elevation (87.3 ft above NGVD). The proposed High Minimum Lake Level was established at 93.7 ft above NGVD, an elevation corresponding to the Minimum Lake Level plus the difference between the Historic P10 and Historic P50 elevations (6.4 ft). The proposed High Minimum Lake Level is equivalent to the High Guidance Level and is 2.7 feet below the floor slab of the lowest residential building in the immediate lake basin.

Figure 5. Surface water elevations through January 2003 at Lake Pasadena in Pasco County, Florida.

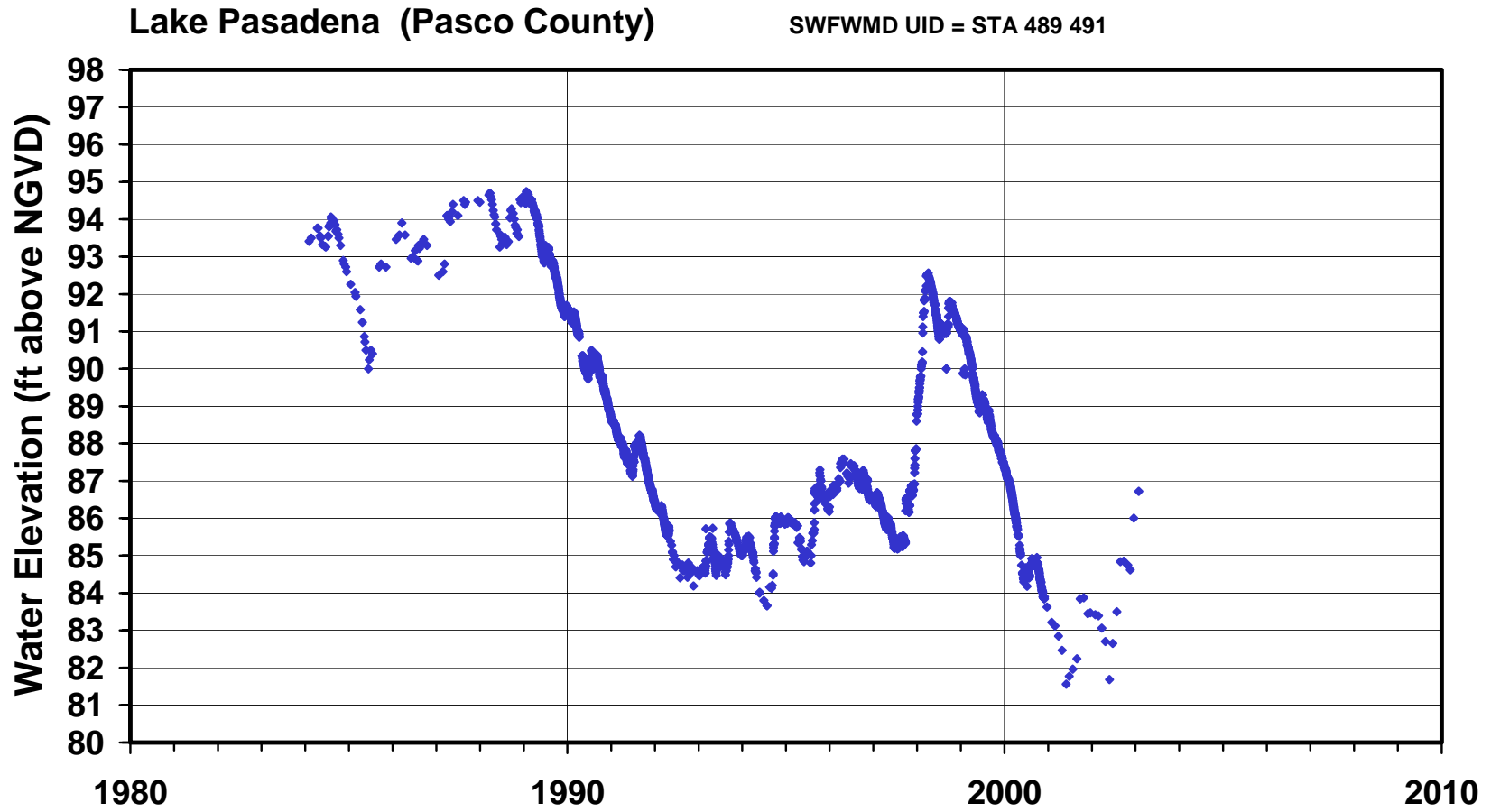


Figure 6. Mean monthly surface water elevations (through January 2003) at Lake Pasadena in Pasco County, Florida, and proposed guidance and minimum levels for Lake Pasadena and Buddy Lake. Proposed levels include the Ten Year Flood Guidance Level (10-YR), High Guidance Level (HGL), Low Guidance Level (LGL), High Minimum Lake Level, HMLL) and Minimum Lake Level (MLL).

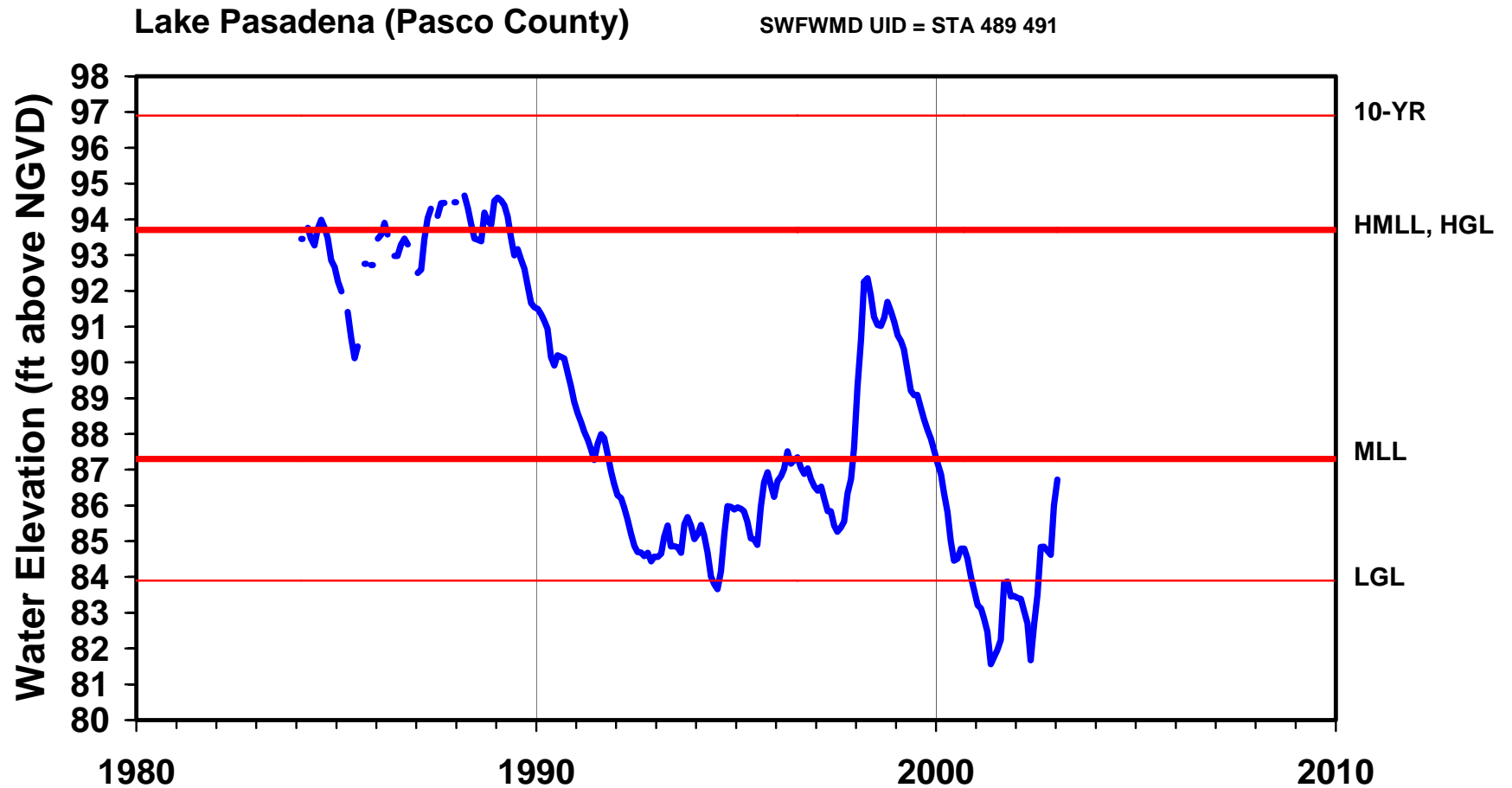


Table 3. Elevation data and associated area values used for establishing minimum levels for Lake Pasadena and Buddy Lake in Pasco County, Florida.

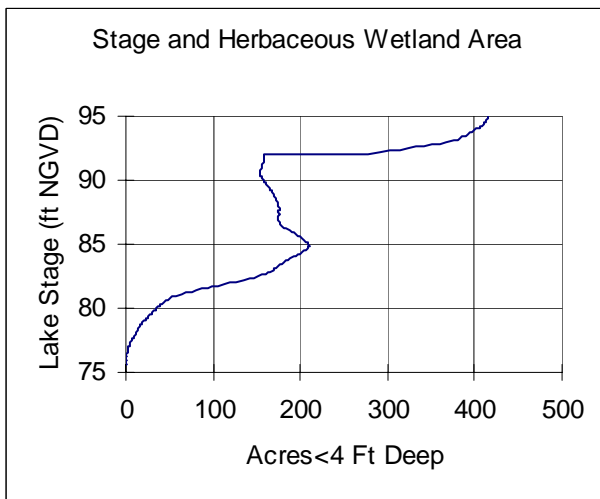
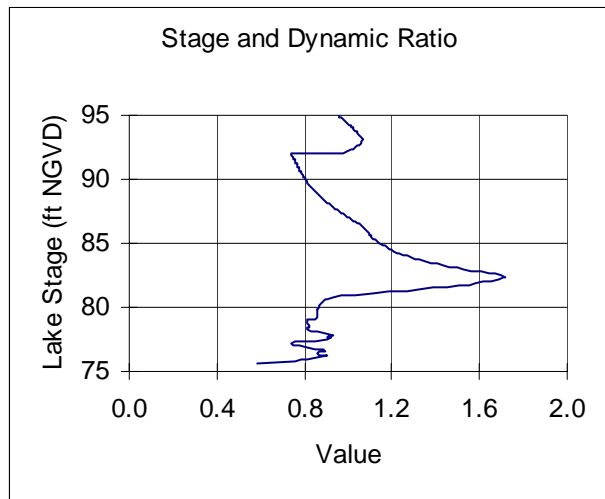
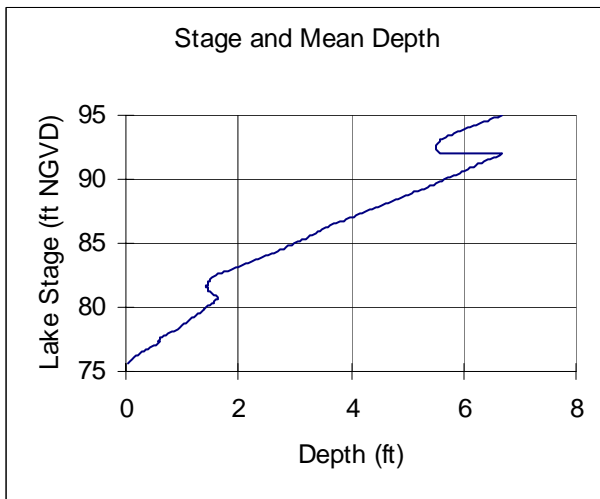
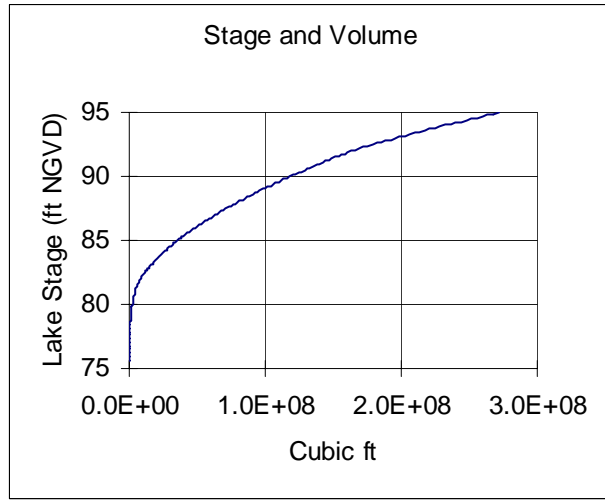
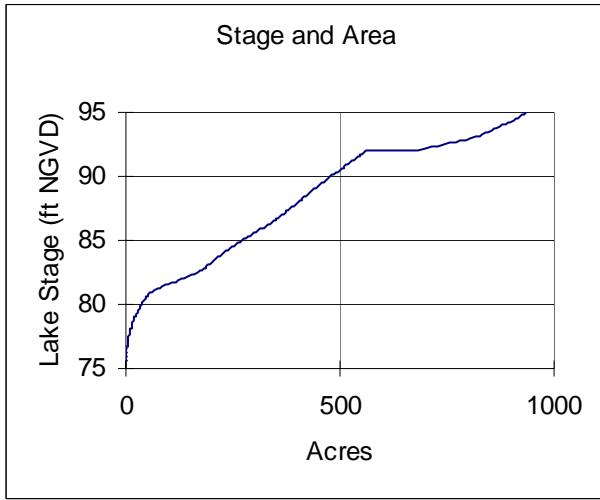
Level	Elevation (ft above NGVD)	Lake Area (acres)
Historic P10	93.68	860
Historic P50	87.27	376
Historic P90	83.92	223
Normal Pool	NA	NA
Low Floor Slab	96.43	NA
Low Road	99.9	NA
Control Point	NA	NA
High Guidance Level	93.7	860
Historic P50	87.3	376
Low Guidance Level	83.9	223
Basin Connectivity Standard	96.4	NA
Dock-Use Standard	94.4	904
Recreation/Ski Standard	90.4	495
Species Richness Standard	86.0	320
Aesthetics Standard	83.9	223
Mixing Standard	77.4	6

NA = not available/not applicable

Table 4. Summary statistics for elevations associated with docks (n=10) at Lake Pasadena in Pasco County, Florida, based on data collected by SWFWMD staff on April 7, 2003. Percentiles (P10, P50, P90) represent elevations exceeded by 10, 50 and 90 percent of the docks.

Statistic	Elevation of Sediments at Waterward End of Docks (feet above NGVD)	Elevation of Dock Platform (feet above NGVD)
Mean (SD)	87.2 (2.0)	95.0 (2.3)
P10	89.0	97.1
P50	87.9	95.5
P90	84.9	92.3
Maximum	89.5	98.0
Minimum	83.4	90.8

Figure 7. Surface area, volume, mean depth, dynamic ratio (basin slope), and potential herbaceous wetland area versus lake stage for the Lake Pasadena and Buddy Lake in Pasco County, Florida.



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