Minimum and Guidance Levels for

Lake Pretty

in Hillsborough County, Florida

Draft – September 2004

Ecologic Evaluation Section

Resource Conservation and Development Department

Southwest Florida
Water Management District

Minimum and Guidance Levels for Lake Pretty in Hillsborough County, Florida

Ecologic Evaluation Section
Resource Conservation and Development Department

Draft - June 2004

Proposed Minimum and Guidance Levels for Lake Pretty

State law (Section 373.042, Florida Statutes; hereafter F.S.) directs the Department of Environmental Protection or the water management districts to establish minimum flows and levels (MFLs) for lakes, wetlands, rivers and aquifers. As currently defined by statute, the minimum level of an aquifer or surface water body is "the level of groundwater in the aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area". Adoption of a minimum water level does not necessarily protect a water body from significant harm, however, protection, recovery or regulatory compliance can be gauged once a standard has been established.

Minimum flows and levels are to be established based upon the best available information and shall be developed with consideration of "…changes and structural alterations to watersheds, surface waters and aquifers, and the effects such changes or alterations have had, and the constraints such changes or alterations have placed on the hydrology of the affected watershed, surface water, or aquifer…", with the caveat that these considerations shall not allow significant harm caused by withdrawals (Section 373.0421, Florida Statues). Additional guidance for the establishment of minimum flows and levels is provided in the Florida Water Resources Implementation Rule (Chapter 62-40.473, Florida Administrative Code; hereafter F.A.C.), which requires that "consideration shall be given to the protection of water resources, natural seasonal fluctuations in water flows, and environmental values associated with coastal, estuarine, aquatic and wetland ecology, including: a) recreation in and on the water; b) fish and wildlife habitats and the passage of fish; c) estuarine resources; d) transfer of detrital material; e) maintenance of freshwater storage and supply; f) aesthetic and scenic attributes; g) filtration and absorption of nutrients and other pollutants; h) sediment loads; i) water quality; j) and navigation."

To address this legislative mandate within its jurisdictional boundaries, the Southwest Florida Water Management District (District or SWFWMD) has developed specific methodologies for establishing minimum flows and levels for lakes, wetlands, rivers and aquifers, and adopted them into it Water Levels and Rates of Flow Rule (Chapter 40D-8, F.A.C.) For lakes, methodologies have been developed for establishing Minimum Levels for systems with fringing cypress-dominated wetlands 0.5 acres or greater in size (Category 1 or 2 lakes), and for those without fringing cypress wetlands 0.5 acres or greater in size (Category 3 lakes). Lakes with fringing cypress wetlands where water levels currently rise to an elevation expected to fully maintain the integrity of the wetlands are classified as Category 1 lakes. Lakes with fringing cypress wetlands that have been structurally altered such that lake water levels do not rise to former levels are classified as Category 2 lakes. Lakes without fringing cypress wetlands 0.5 acres or greater in size are classified as Category 3 lakes. Chapter 40D-8, F.A.C. also provides for the establishment of Guidance Levels, which serve as advisory information for the District, lake shore residents and local governments, or to aid in the management or

control of adjustable water level structures. Typically two Minimum Levels and three Guidance Levels are established for lakes, and upon adoption by the District Governing Board, are incorporated into Chapter 40D-8, F.A.C. The levels, which are expressed as elevations in feet above the National Geodetic Vertical Datum of 1929 (NGVD), are described below.

The **Ten Year Flood Guidance Level** is provided as an advisory guideline for lake shore development. It is the level of flooding expected on a frequency of not less than the ten year recurring interval, or on a frequency of not greater than a ten percent probability of occurrence in any given year.

The **High Guidance Level** is provided as an advisory guideline for construction of lake shore development, water dependent structures, and operation of water management structures. The High Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ten percent of the time (P90) on a long-term basis.

The **High Minimum Lake Level** is the elevation that a lake's water levels are required to equal or exceed ten percent of the time (P10) on a long-term basis.

The **Minimum Lake Level** is the elevation that a lake's water levels are required to equal or exceed fifty percent of the time (P50) on a long-term basis.

The **Low Guidance Level** is provided as an advisory guideline for water dependent structures, information for lake shore residents and operation of water management structures. The Low Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ninety percent of the time (P90) on a long-term basis.

In accordance with Chapter 40D-8, F.A.C., proposed Minimum and Guidance Levels were developed for Lake Pretty (Table 1), a Category 1 lake located in Hillsborough County, Florida. The levels were established using best available information, including field data that were obtained specifically for the purpose of Minimum Levels development. Data and analyses used for development of the proposed Minimum and Guidance levels are described in the remainder of this report.

Table 1. Proposed Minimum and Guidance Levels for Lake Pretty.

Minimum and Guidance Levels	Elevation (feet above NGVD)
Ten Year Flood Guidance Level	45.8
High Guidance Level	44.3
High Minimum Lake Level	43.9
Minimum Lake Level	42.5
Low Guidance Level	42.2

NA = not available/not applicable

Data and Analyses Supporting Proposed Minimum and Guidance Levels for Lake Pretty

Lake Setting and Description

Lake Pretty (a.k.a. Pretty Lake) is located in Hillsborough County, Florida (Sections 25 and 26, Township 27S, Range 17E), in the Northwest Hillsborough River Basin of the Southwest Florida Water Management District (Figure 1). White (1970) classified the area of west-central Florida containing Lake Pretty as the Lower Rocky Creek physiographic region. Brooks (1981) characterized the area surrounding the lake as the Land-O-Lakes physiographic subdivision and described the subdivision as a plain with elevations between 50 and 80 feet with many small lakes despite the fact the silty sand overlying the limestone is moderately thick. As part of the Florida Department of Environmental Protection's Lake Bioassessment/Regionalization Initiative, the area has been identified as the Keystone Lakes region, and described as a small area of well-drained, sandy uplands, with slightly acidic, low nutrient, mostly clear water lakes (Griffith *et al.* 1997).

Lake Pretty lies within the Rocky Creek watershed. Rocky Creek flows through Rock Lake, Lake Josephine, Lake Pretty and Lake Armistead (Figure 2). Water discharged from Lake Pretty flows through a District water control structure and into Lake Armistead. In early 1998, during the 1997/1998 El Niño event, and again in late 2002 through mid 2003, Horse Lake was augmented with surface water from Lake Pretty as a temporary flood control measure for the Lake Pretty basin. During these wet periods, the District pumped water from Lake Pretty to Horse Lake, which is located to the west of Lake Pretty, and from Horse Lake to Lake Raleigh. Tampa Bay Water then pumped water from Lake Raleigh to Lake Rogers. The District and Tampa Bay Water currently have an on-going cooperative funding project (Rocky Creek Lake Enhancement Project – B027) to construct a diversion system to allow for the transfer of surface water from Rocky Creek/Lake Pretty into lakes Horse, Raleigh, Rogers, and nearby wetlands during wet periods. There are a number of permitted ground water withdrawals within the surrounding area, including those associated with the Cosme-Odessa Wellfield, located to the west of Lake Pretty. There are no surface water withdrawals from the lake currently permitted by the District.

The 1956 (photorevised 1987) United States Geological Survey 1:24,000 Citrus Park, Fla. quadrangle map does not show a surface water elevation for Lake Pretty. The "Gazetteer of Florida Lakes" (Florida Board of Conservation 1969, Shafer *et al.* 1986) lists the lake elevation at 40 ft above NGVD with a surface area of 80 acres at this elevation. A topographic map of the lake basin generated in support of minimum levels development (Figure 3) indicates that the lake extends over 82 acres at an elevation of 40 ft above NGVD.

Medium density residential development and agricultural lands dominate the area surrounding Lake Pretty (Figure 2). As a result of development, the majority of the lake

shoreline area has been altered. There is no public access to the lake. Wetland and aquatic vegetation observed along the shoreline and within the lake basin include, cypress (*Taxodium sp.*), maidencane (*Panicum hemitomon*), torpedo grass (*Panicum repens*), buttonbush (*Cephalanthus occidentalis*), pickerelweed (*Pontederia cordata*), para grass (*Brachiaria mutica*), alligator weed (*Alternanthera philoxeroides*), water primrose willow (*Ludwigia sp.*), spatterdock (*Nuphar luteum*), swamp fern (*Blechnum serrulatum*), and arrowhead (*Sagittaria lancifolia*) (Hillsborough County 2004).

Figure 1. Location of Lake Pretty in Hillsborough County, Florida.

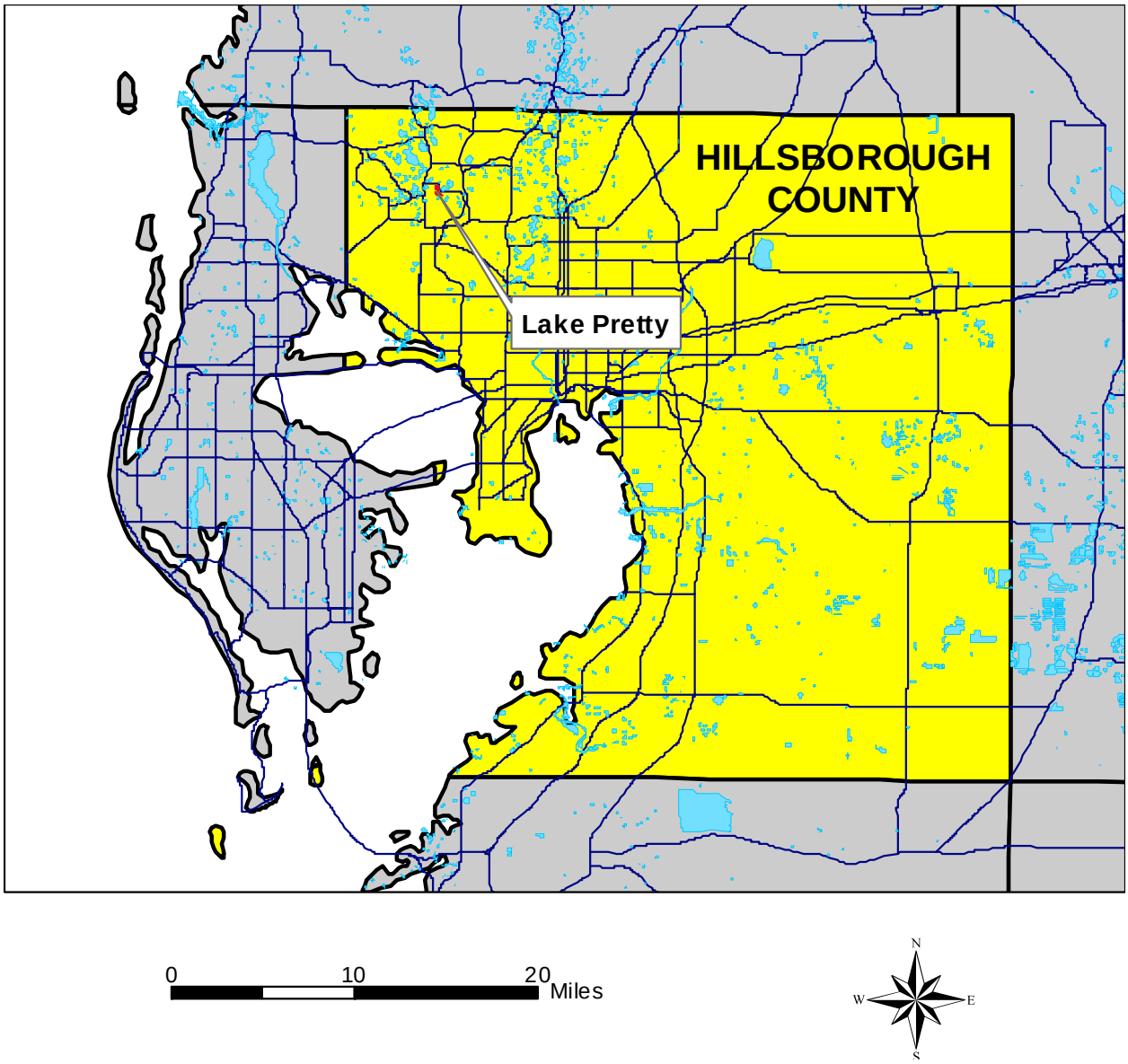
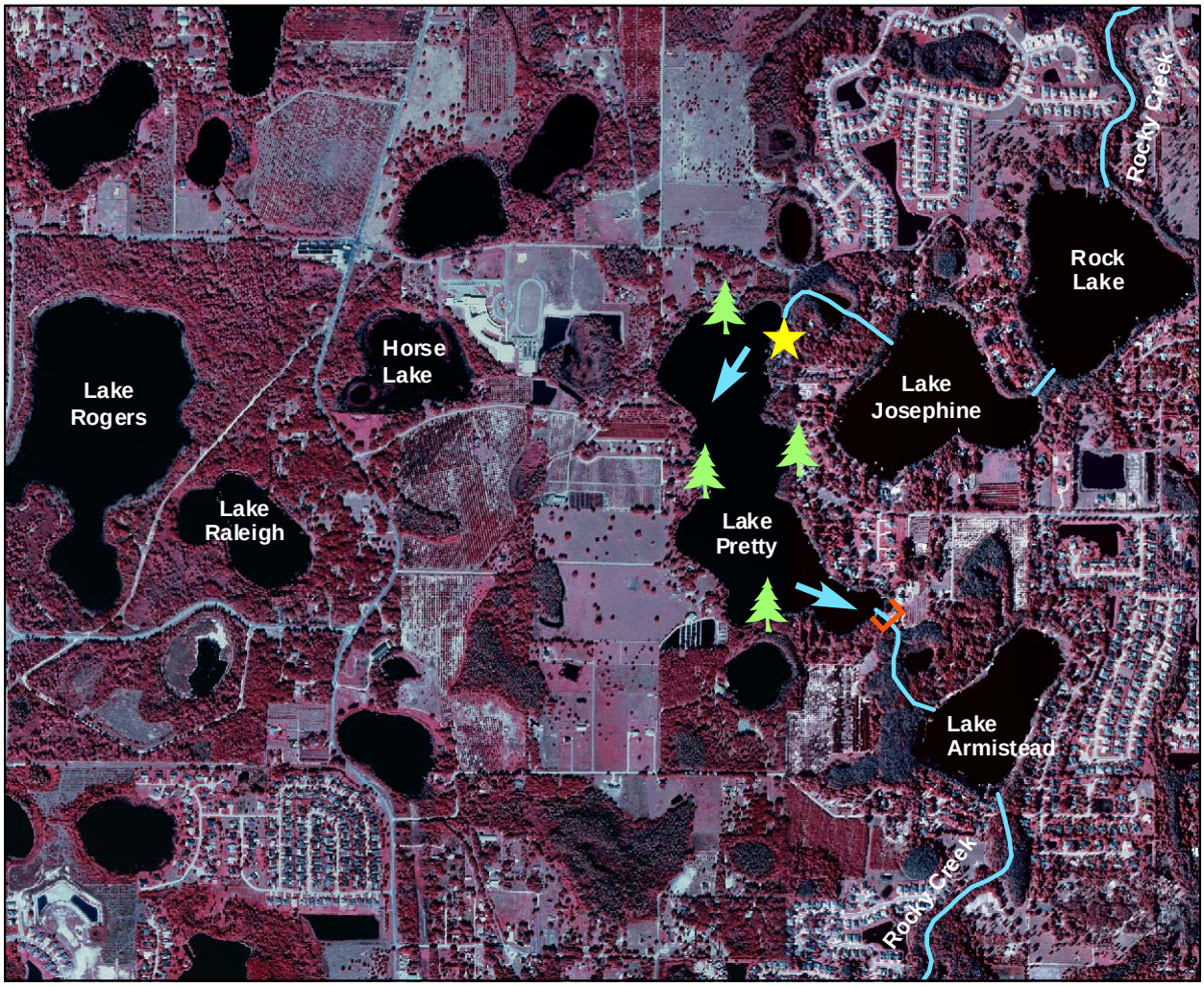


Figure 2. Location of lake water level gauge, hydrologic indicators, inlet, outlet, and water control structure for Lake Pretty.



Legend

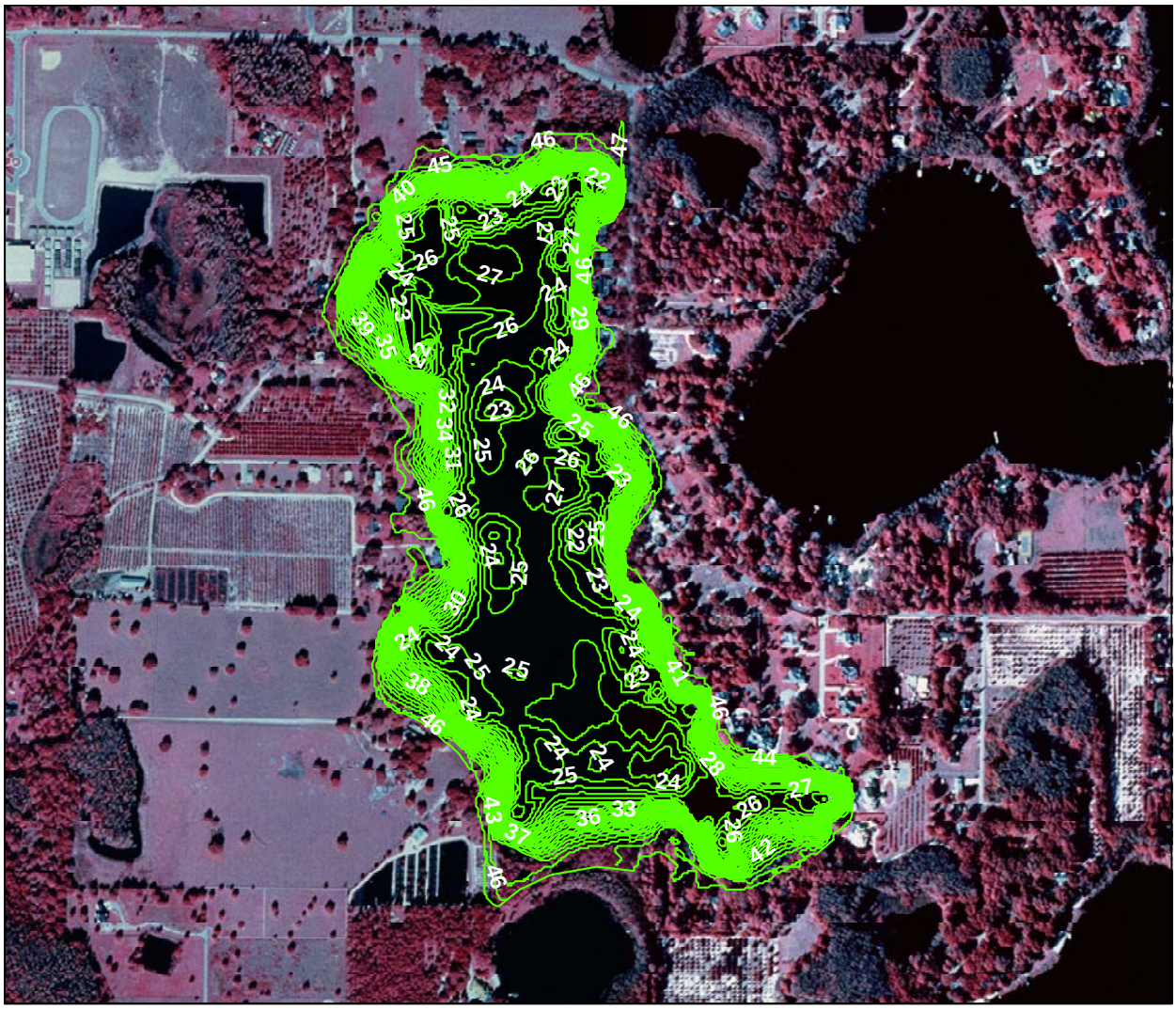
- Inlet, outlet
- Flow path
- Hydrologic indicators
- Staff gauge
- Structure

N
W E
S

0 0.25 0.5 1 Miles

Aerial photography from 1999 USGS Digital Orthophotography.

Figure 3. One foot contours within the Lake Pretty basin. Values shown are elevations in feet above the National Geodetic Vertical Datum of 1929.



Map prepared using 1999 USGS digital orthophotography, elevation data from 1989 SWFWMD aerial photography with contours maps (Sheet Nos. 25-27-17 and 26-27-17), and elevation data collected on June 16, 1998 by Hillsborough County Lake Management staff.

0 500 1,000 2,000 Feet

N W E S

Currently Adopted Lake Guidance Levels

The District has a long history of water resource protection through the establishment of lake management levels. With the development of the Lake Levels Program in the mid-1970s, the District began an initiative for establishing lake management levels based on hydrologic, biological, physical and cultural aspects of lake ecosystems. By 1996, management levels for nearly 400 lakes had been established.

Based on work conducted in the 1970s (see SWFWMD 1996), the District Governing Board adopted Guidance Levels for Lake Pretty in September 1980 (Table 2). A Maximum Desirable Level of 44.50 ft above NGVD was also developed, but was not adopted. The adopted Guidance Levels and Maximum Desirable Level were developed using a methodology that differs from the current District approach for establishing Minimum and Guidance Levels. The levels do not, therefore, necessarily correspond with levels developed using current methodologies. Minimum and Guidance Levels established during minimum levels development shall replace current Guidance Levels shown in Table 2 upon adoption by the District's Governing Board into Chapter 40D-8, F.A.C.

Annually since 1991, a list of stressed lakes has been developed to support the District's consumptive water use permitting program. As described in Chapter 40D-2, F.A.C., Consumptive Use of Water, "a stressed condition for a lake is defined to be chronic fluctuation below the normal range of lake level fluctuations". For lakes with adopted Guidance Levels, chronic fluctuation below the Low Level is considered a stressed condition. For lakes without adopted levels, determination of stressed condition is determined on a case-by-case basis. Lake Pretty is not included on the current Stressed Lakes List (Gant *et al.* 2004), nor has it been classified as a stressed lake in the past.

Table 2. Adopted Guidance Levels and associated surface areas for Lake Pretty.

Management Levels	Elevation (feet above NGVD)	Lake Area (acres)
Ten Year Flood Guidance Level	46.70	103
High Level	45.50	96
Low Level	42.75	88
Extreme Low Level	40.00	82

Development of Minimum and Guidance Levels

Proposed Minimum and Guidance Levels for Lake Pretty were developed using the methodology for Category 1 lakes described in Chapter 40D-8, F.A.C. and best available information in accordance with Section 373.042, F.S. Additional information gathered through field evaluations were also used. The levels and additional

information are listed in Table 3, along with surface areas for each elevation. Detailed descriptions of the development and use of these data are provided in the remainder of this report.

Table 3. Proposed Minimum and Guidance Levels, Historic P50, lake stage percentiles, normal pool and control point elevations, and significant change standards for Lake Pretty.

Levels	Elevation (feet above NGVD)	Lake Area (acres)
Lake Stage Percentiles		
Current P10	44.29	91
Current P50	43.19	89
Current P90	41.89	86
Other Levels		
Normal Pool	44.3	91
Control Point	NA	NA
Guidance Levels and Historic P50		
Ten Year Flood Guidance Level	45.8	97
High Guidance Level	44.3	91
Historic P50	43.3	89
Low Guidance Level	42.2	86
Significant Change Standards		
* Dock-Use Standard	42.7	87
Cypress Standard	42.5	87
* Aesthetics Standard	42.2	86
* Species Richness Standard	36.9	76
* Recreation/Ski Standard	32.1	65
* Basin Connectivity Standard	29.2	59
* Lake Mixing Standard	27.8	56
Minimum Levels		
High Minimum Lake Level	43.9	90
Minimum Lake Level	42.5	87

NA = not available/not applicable

* = Category 3 significant change standard developed for comparative purposes only

Lake Stage Data and Percentiles

Lake stage data, *i.e*., surface water elevations data for Lake Pretty (District Universal ID Number STA 361 362) were obtained from the District Water Management Data Base. The period of record for the data extends from July 1971 through the present date (Figure 4, see Figure 2 for current location of the SWFWMD lake water level gauge). The highest surface water elevation for Lake Pretty recorded in the District Water Management Data Base, 46.04 ft above NGVD, occurred on June 20, 2003. The low of record, 39.01 ft above NGVD, occurred on May 6, 1985. Based on available lake stage data, monthly mean lake surface elevations were calculated and graphed (Figure 5).

For the purpose of minimum levels determination, lake stage data are categorized as "Historic" for periods when there were no measurable impacts due to water withdrawals, and impacts due to structural alterations were similar to existing conditions. Lake stage data are categorized as "Current" for periods when there were measurable, stable impacts due to water withdrawals, and impacts due to structural alterations were stable. Historic lake stage data are not available for Lake Pretty because the lake occurs within an area where there are measurable impacts due to groundwater withdrawals (SWFWMD 1999). Lake stage data from January 1964 through the present date are classified as Current data for lakes affected by wellfields within this region.

Monthly mean lake surface elevations from January 1964 through December 2003 were used to calculate the **Current P10, P50, and P90** lake stage exceedance percentile elevations. The Current P10 elevation, the elevation the lake water surface equaled or exceeded ten percent of the time during the current period, was **44.29 ft above NGVD**. The Current P50 elevation, the elevation the lake water surface equaled or exceeded fifty percent of the time during the current period, was **43.19 ft above NGVD**. The Current P90 elevation, the elevation the lake water surface equaled or exceeded 90 percent of the time during the current period, was **41.89 ft above NGVD**.

Normal Pool and Control Point Elevations

The **Normal Pool** elevation, a reference elevation used for development of minimum lake and wetland levels, is established based on the elevation of Hydrologic Indicators of sustained inundation, including biological and physical features. Based on the median elevation of buttress inflection points for 14 cypress trees located at numerous sites along the shoreline of Lake Pretty, the Normal Pool elevation for the lake basin was established at **44.3 ft above NGVD** (Figure 2 and Table 4). The Normal Pool elevation is the same as the Current P10 elevation.

Table 4. Summary data used for development of the Normal Pool elevation for Lake Pretty.

Normal Pool Statistics	Elevations Based on 14 Cypress Buttresses (feet above NGVD)
Mean (Standard Deviation)	44.47 (0.39)
Median	44.30
Minimum	44.05
Maximum	45.05

The **Control Point** elevation is defined as the highest stable point along the outlet profile of a surface water conveyance system (*e.g.*, structure, ditch, culvert, or pipe) that principally controls lake water level fluctuations. For Lake Pretty, water discharges from the lake through a water control structure constructed as a gated spillway. The structure has four gates, two of which are drop gates that are lowered to control water surface elevations. The other two gates can be pulled up to increase flow through the structure during high water events. Because the structure is operated at various elevations to control water levels within the lake, **there is no single Control Point elevation**. Also, because the structure is operated the majority of the time at elevations that are lower than the Normal Pool elevation, **Lake Pretty is considered to be Structurally Altered**.

Proposed Guidance Levels and the Historic P50

The **Ten Year Flood Guidance Level** is provided as an advisory guideline for lake shore development. It is the level of flooding expected on a frequency of not less than the ten year recurring interval, or on a frequency of not greater than a ten percent probability of occurrence in any given year. The Ten Year Flood Guidance Level was established for Lake Pretty at **45.8 ft above NGVD** using the methodology for open basin lakes described in current District Rules (Chapter 40D-8, Florida Administrative Code). For the analysis, peak flood stages previously published by Hillsborough County were reviewed for accuracy. Review of the 10 year flood elevation consisted of confirming model input data, reviewing the results of model runs for various storm events, and comparing the results to gauging records and high water mark data. Hillsborough County's published elevations were calculated with their modified version of the Environmental Protection Agency's Stormwater Management Model (SWMM), version 4.31Q, (Hillsborough County 1999). Model input was based on a 24-hour duration storm event with a 7.5 inch rainfall depth. Based on available lake stage data, the Ten Year Flood Guidance Level has been exceeded twice during the past 33 years (Figures 4). Although undocumented, a local resident estimated Lake Pretty reached a high water elevation of 48.0 ft above NGVD, probably in 1960 (SWFWMD 1981).

The **High Guidance Level** is provided as an advisory guideline for construction of lake shore development, water dependent structures, and operation of water management structures. The High Guidance Level is the expected Historic P10 of the lake. Because

Historic data are not available for Lake Pretty and the lake is Structurally Altered, the High Guidance Level would be established at the higher of the Current P10 or the Control Point elevations. Because there is no specific Control Point elevation, the High Guidance Level was established at **44.3 ft above NGVD**, the Current P10 elevation.

The **Historic P50** elevation is the elevation that a lake's water levels are expected to equal or exceed fifty percent of the time on a long-term basis. It is derived to support development of minimum lake levels, and is established using Historic or Current data and, in some cases, reference lake water regime statistics. Reference lake water regime (RLWR) statistics are used to describe expected water level fluctuations for lakes that lack adequate Historic or Current data. The statistics include the RLWR50, RLWR5090, and RLWR90 and are derived using lake stage data for typical, regional lakes that exhibit little or no impacts from water withdrawals. Because Historic data are not available for Lake Pretty, and the difference between the Current P10 and the Current P50 (1.1 ft) is greater than the Northern Tampa Bay area Reference Lake Water Regime 50 (RLWR50) (1.0 ft, SWFWMD 1999), the Historic P50 was established at **43.3 ft above NGVD** by subtracting the difference between the Northern Tampa Bay area RLWR50 from the High Guidance Level (44.3 ft above NGVD).

The **Low Guidance Level** is provided as an advisory guideline for water dependent structures, information for lake shore residents and operation of water management structures. The Low Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ninety percent of the time (P90) on a long-term basis. Because Historic data are not available, and the difference between the Current P10 and the Current P90 (2.4 ft) is greater than the Northern Tampa Bay area Reference Lake Water Regime RLWR90 (2.1 ft, SWFWMD 1999), the Low Guidance Level was established at **42.2 ft above NGVD** by subtracting the Northern Tampa Bay area RLWR90 from the High Guidance Level (44.3 ft above NGVD).

Lake Categorization

For the purpose of Minimum Levels development, lakes are classified as Category 1, 2, or 3 lakes. Those with fringing cypress wetlands greater that 0.5 acres in size where water levels currently rise to an elevation expected to fully maintain the integrity of the wetlands (*i.e*., the Historic P50 is equal to or higher than the elevation 1.8 ft below the Normal Pool elevation) are classified as Category 1 lakes. Lakes with fringing wetlands greater than 0.5 acres in size that have been structurally altered such that the Historic P50 elevation is more than 1.8 ft below the Normal Pool elevation, are classified as Category 2 lakes. Lakes without fringing cypress wetlands or with cypress wetlands less than 0.5 acres in size, are classified as Category 3 lakes. Based on the occurrence of lake fringing cypress and because the Historic P50 (43.3 ft above NGVD) is greater than the elevation 1.8 ft below the Normal Pool elevation (42.5 ft above NGVD), Lake Pretty is classified as a **Category 1** lake.

Significant Change Standards and Other Information for Consideration

Lake-specific significant change standards and other available information are developed for establishing Minimum Levels. The standards are used to identifiy thresholds for preventing significant harm to cultural and natural system values associated with lakes in accordance with guidance provided in the Florida Water Resources Implementation Rule (Chapter 62-40.473, F.A.C.). Other information taken into consideration includes potential changes in the coverage of herbaceous wetland vegetation and aquatic plants.

For Category 1 or 2 lakes, a significant change standard is established at the elevation 1.8 ft below the Normal Pool elevation. This standard, operationally referred to as the Cypress Standard, is used to identify a desired median stage that may be expected to preserve the ecological integrity of lake fringing cypress wetlands. Because Lake Pretty is a Category 1 lake, the Cypress Standard was developed.

For Category 3 lakes, six significant change standards are developed, including a Species Richness Standard, an Aesthetics Standard, a Lake Mixing Standard, a Recreation/Ski Standard, a Dock-Use Standard, and a Basin Connectivity Standard. Potential changes in the coverage of herbaceous wetland vegetation and aquatic plants associated with use of standards for development of Minimum Levels for Category 3 lakes is also taken into consideration. Although Lake Pretty is a Category 1 lake, Category 3 lake standards were developed for comparative purposes but were not used for Minimum Levels development.

The **Dock-Use Standard** is developed to provide for sufficient water depth at the end of existing docks to permit mooring of boats and prevent adverse impacts to bottom-dwelling plants and animals caused by boat operation. The standard is based on the elevation of lake sediments at the end of existing docks, a clearance value for boat mooring, and use of Historic lake stage data or region-specific reference lake water regime statistics. Because Historic data are not available, the Dock-use Standard would be established at **42.7 ft above NGVD** by adding a clearance value of 2 ft and the Northern Tampa Bay area RLWR5090 (1.1 ft, SWFWMD 1999) to the elevation of sediments at the end of 90 percent of the 36 docks (39.6 ft) that were observed at the lake in March 2004.

Table 5. Summary statistics for elevations associated with docks (n = 36) at Lake Pretty. Percentiles (P10 and P90) represent elevations exceeded by 10 and 90 percent of the docks.

Statistic	Elevation of Sediments at Waterward End of Docks (feet above NGVD)	Elevation of Dock Platforms (feet above NGVD)
Mean (SD)	37.9 (1.6)	46.1 (0.6)
P10	39.6	46.8
P90	35.6	45.4
Maximum	41.0	47.5
Minimum	35.2	45.0

The **Cypress Standard** is the elevation 1.8 ft below the Normal Pool elevation based on the inflection point of cypress buttresses. For Lake Pretty, the Cypress Standard was established at **42.5 ft above NGVD**.

The **Aesthetics Standard** is developed to protect aesthetic values associated with the inundation of lake basins. The standard is intended to limit potential change in aesthetic values associated with the median lake stage from falling below the values associated with the lake when it is staged at the Low Guidance Level. The Aesthetic Standard would be established at the Low Guidance Level, which is **42.2 ft above NGVD**.

The **Species Richness Standard** is developed to prevent a decline in the number of bird species that may be expected to occur at or utilize a lake. Based on an empirical relationship between lake surface area and the number of birds expected to occur at Florida lakes, the standard is established at the lowest elevation associated with less than a 15 percent reduction in lake surface area relative to the lake area at the Historic P50 elevation. The Species Richness Standard would be established at **36.9 ft above NGVD**.

The **Recreation/Ski Standard** is developed to identify the lowest elevation within the lake basin that will contain an area suitable for safe water skiing. The standard is based on the lowest elevation (the Ski elevation) within the basin that can contain a five-foot deep ski corridor delineated as a circular area with a radius of 418 ft, or a rectangular area 200 ft in width and 2,000 ft in length, and use of Historic lake stage data or region-specific reference lake water regime statistics. Because Historic data are not available, the Recreation/Ski Standard would be established at **32.1 ft above NGVD**, based on the sum of the Ski elevation (31 ft above NGVD), and the Northern Tampa Bay area RLWR5090 (1.1 ft).

The **Basin Connectivity Standard** is developed to protect surface water connections between lake basins or among sub-basins within lake basins to allow for movement of aquatic biota, such as fish, and support recreational uses. The standard is based on the elevation of lake sediments at a critical high spot between lake basins or lake sub-

basins, clearance values for movement of aquatic biota or powerboats and other watercraft, and use of Historic lake stage data or region-specific reference lake water regime statistics. Because Historic data are not available, the Basin Connectivity Standard would be established at **29.2 ft above NGVD**, based on the sum of the critical high spot elevation (26.1 ft above NGVD), the clearance value for power boats and movement of biota (2 ft), and the Northern Tampa Bay area RLWR5090 (1.1 ft).

The **Lake Mixing Standard** is developed to prevent significant changes in patterns of wind-driven mixing of the lake water column and sediment resuspension. The standard is established at the highest elevation at or below the Historic P50 elevation where the dynamic ratio (see Bachmann *et al*. 2000) shifts from a value of <0.8 to a value >0.8, or from a value >0.8 to a value <0.8. The Lake Mixing Standard would be established at **27.8 ft above NGVD**, the elevation at which the dynamic ratio shifts from a value >0.8 to a value <0.8.

Herbaceous Wetland Information is taken into consideration to determine the elevation at which change in lake stage would result in substantial change in potential wetland area within the lake basin (*i.e*., basin area with a water depth less than or equal to four feet). Review of changes in potential herbaceous wetland area in relation to change in lake stage did not indicate that there would be a significant increase or decrease in the area of herbaceous wetland vegetation associated with use of the applicable significant change standards (Figure 6).

Submersed Aquatic Macrophyte Information is taken into consideration to determine the elevation at which change in lake stage would result in substantial change in the area available for colonization by submersed aquatic plants. Review of the area available for submersed aquatic plant colonization in relation to change in lake stage did not indicate that there would be a significant increase or decrease in the area of submersed aquatic plant vegetation associated with use of the applicable significant change standards (Figure 6).

Proposed Minimum Levels

The High Minimum Lake Level and the Minimum Lake Level are developed using lake-specific significant change standards, lake categorization, and other available information including substantial changes in the coverage of herbaceous wetland vegetation and aquatic macrophytes; elevations associated with residential dwellings, roads or other structures; frequent submergence of dock platforms; faunal surveys; aerial photographs; typical uses of lakes (*e.g.,* recreation, aesthetics, navigation, and irrigation); surrounding land-uses; socio-economic effects; and public health, safety and welfare matters.

The **Minimum Lake Level** is the elevation that a lake's water levels are required to equal or exceed fifty percent of the time on a long-term basis. The Minimum Lake Level for Category 1 lakes is established 1.8 ft below the Normal Pool elevation. For Lake Pretty, the Minimum Lake Level was established at **42.5 ft above NGVD** (Table 3,

Figures 5 and 7. The water level equaled or exceeded fifty percent of the time (P50) has been above the Minimum Lake Level for Lake Pretty over the last five long-term (10-year) periods (Table 6).

Table 6. Comparisons between the Minimum Lake Level for Lake Pretty and water surface elevations equaled or exceeded fifty percent of the time (P50) over the last five 10-year periods.

10-year Period			MLL Equaled or Exceeded ?	Feet P50 is above (+) or below (-) MLL
January 1994	through	December 2003	Yes	+1.4
January 1993	through	December 2002	Yes	+1.0
January 1992	through	December 2001	Yes	+1.0
January 1991	through	December 2000	Yes	+1.0
January 1990	through	December 1999	Yes	+1.0

The **High Minimum Lake Level** is the elevation that a lake's water levels are required to equal or exceed ten percent of the time on a long-term basis. The High Minimum Lake Level for Category 1 lakes is established 0.4 ft below the Normal Pool elevation. For Lake Pretty, the High Minimum Lake Level was established at **43.9 ft above NGVD** (Table 3, Figures 5 and 7). The water level equaled or exceeded ten percent of the time (P10) has been above the High Minimum Lake Level for Lake Pretty over the last five long-term (10-year) periods (Table 7).

Table 7. Comparisons between the High Minimum Lake Level for Lake Pretty and water surface elevations equaled or exceeded ten percent of the time (P10) over the last five 10-year periods.

10-year Period			HMLL Equaled or Exceeded ?	Feet P10 is above (+) or below (-) HMLL
January 1994	through	December 2003	Yes	+0.7
January 1993	through	December 2002	Yes	+0.6
January 1992	through	December 2001	Yes	+0.5
January 1991	through	December 2000	Yes	+0.5
January 1990	through	December 1999	Yes	+0.5

Comparison of the High Minimum Lake Level with Lake Basin Features

The elevations of various man-made features within the immediate Lake Pretty basin, were determined to evaluate the potential for flooding when the lake surface is at the proposed High Minimum Lake Level. Based on review of available one-foot contour interval aerial maps for the region and field survey data, the proposed High Minimum Lake Level is 2.0 ft below a stilt house along the lakeshore, 2.0 ft below a boat house, and 3.6 ft below the lowest spot on Hutchinson Road (Table 8).

Table 8. Elevations of lake basin features surrounding Lake Pretty.

Lake Basin Features	Elevation (feet above NGVD)
Low Floor Slab (stilt house)	45.88
Low Other (boat house)	45.85
Low Road (Hutchinson Road)	47.50

Figure 4. Surface water elevations through December 2003 for Lake Pretty.

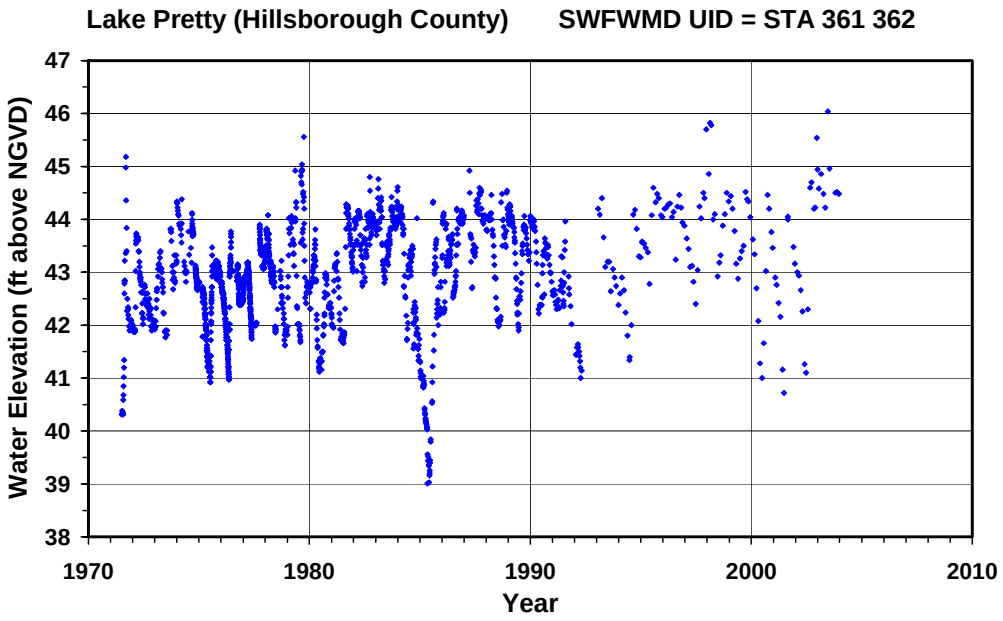


Figure 5. Mean monthly surface water elevations through December 2003, and proposed Guidance and Minimum Levels for Lake Pretty. Proposed levels include the Ten-Year Flood Guidance Level (10-YR), High Guidance Level (HGL), Low Guidance Level (LGL), High Minimum Lake Level (HMLL), and Minimum Lake Level (MLL).

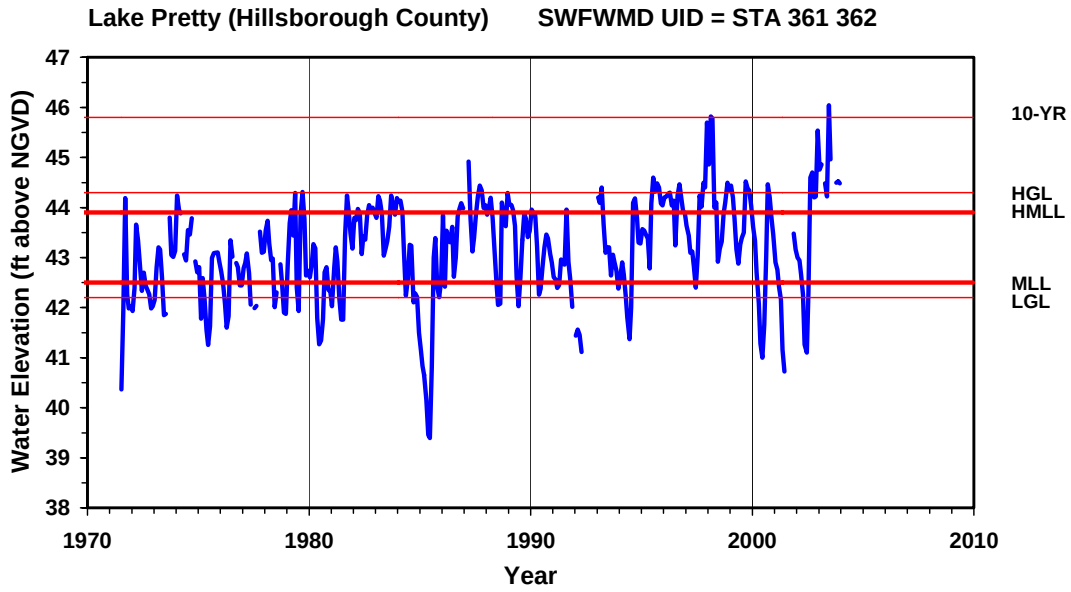


Figure 6. Surface area, volume, mean depth, dynamic ratio (basin slope), potential herbaceous wetland area, and potential aquatic macrophyte colonization area versus lake stage for Lake Pretty.

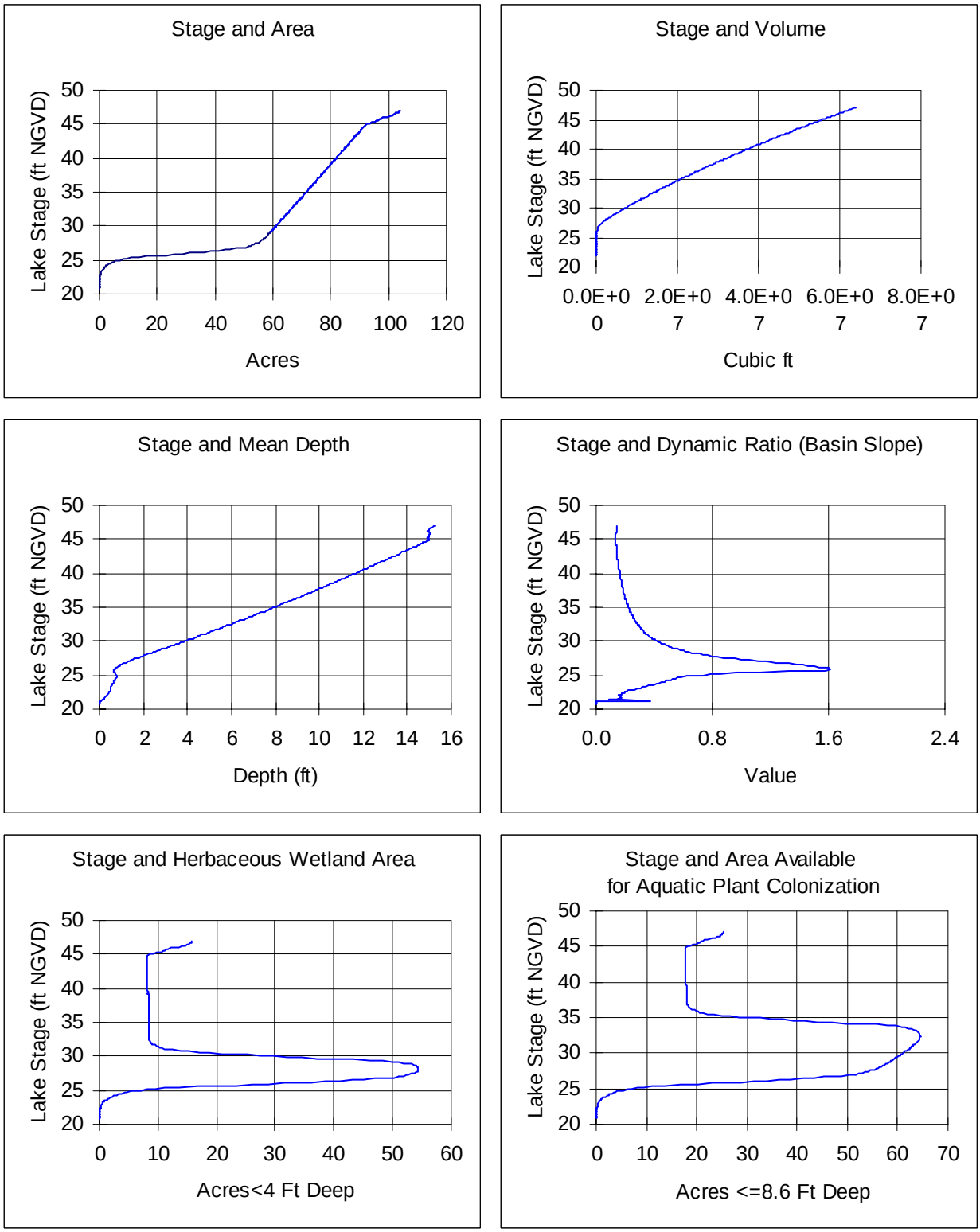
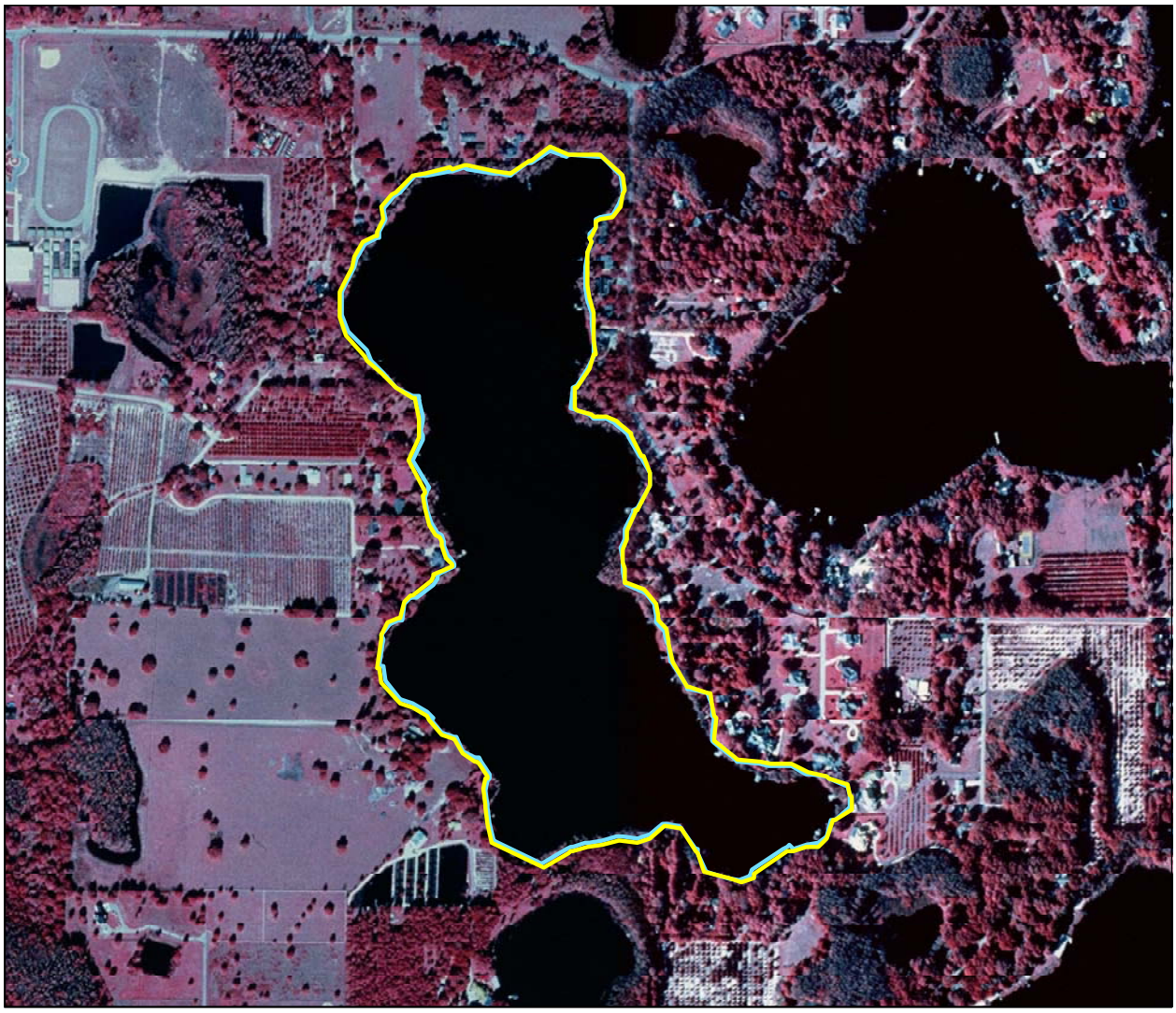


Figure 7. Approximate location of the proposed Minimum Lake Level (MLL) and High Minimum Lake Level (HMLL) for Lake Pretty.



Legend

Pretty Minimum Levels

- 42.5 ft above NGVD = MLL
- 43.9 ft above NGVD = HMLL

Map prepared using 1999 USGS digital orthophotography, elevation data from 1989 SWFWMD aerial photography with contours maps (Sheet Nos. 25 and 26-27-17), and elevation data collected on June 16, 1998 by Hillsborough County Lake Management Program staff.

0 500 1,000 2,000 Feet

Documents Cited and Reviewed for Development of Proposed Minimum and Guidance Levels

Arnold, D. 2004. Memorandum – FY 2004 lakes 10-yr flood elevations. Southwest Florida Water Management District, Brooksville Florida.

Ayers and Associates. 1998. Rocky/Brushy Creek area stormwater management master plan, Tampa, Florida.

Ayers and Associates. 2003. Integrated modeling and conceptual design for a water control structure at Lake Armistead. Prepared for the Southwest Florida Water Management District, Northwest Hillsborough River Basin Board, Tampa, Florida.

Bachmann, R. W., Hoyer, M. V., and Canfield, D. E., Jr. 2000. The potential for wave disturbance in shallow Florida lakes. Lake and Reservoir Management 16: 281-291.

Berryman & Henigar. 2001. Rocky Creek Lake Enhancement Project benthic sampling report. Prepared by Berryman & Henigar for Tampa Bay Water, Clearwater, Florida.

Berryman & Henigar. 2003. Rocky Creek Lake Enhancement Project Technical Memorandum Task 2- Benthic Sampling. Prepared by Berryman & Henigar for Tampa Bay Water, Clearwater, Florida.

Brooks, H. K. 1981. Physiographic divisions of Florida: map and guide. Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, Florida.

Camp, Dresser, and McKee. 1986. Rocky Creek stormwater management master plan, Tampa, Florida.

Cowell, B. C., S. N. Young, et al. 1973. Aquatic insect survey of Upper Tampa Bay Watershed Project and Brooker Creek Watershed. Brooksville, Florida, Prepared for the Southwest Florida Water Management District, Brooksville, Florida.

Dierberg, F. E. and Wagner, K. J. 2001. A review of “A multiple-parameter approach for establishing minimum levels for Category 3 Lakes of the Southwest Florida Water Management District” June 2001 draft by D. Leeper, M. Kelly, A. Munson, and R. Gant. Prepared for the Southwest Florida Water Management District, Brooksville, Florida.

Downing, H. C. 1996. Memorandum: lake enhancement project using Lakes Keystone and Pretty. Southwest Florida Water Management District, Brooksville, Florida.

Emery, S. 1992. Changes in land use/drainage in the vicinity of the Cosme-Odessa and Section 21 wellfield-final. Prepared for the City of St. Petersburg Utilities Department, St. Petersburg, Florida.

Florida Board of Conservation. 1969. Florida lakes, part III: gazetteer. Division of Water Resources, Tallahassee, Florida.

Florida Department of Agriculture and Consumer Services. 1938. Aerial photograph – Sections 26, 27, 34, and 35, Township 27 South, Range 17 East. Tallahassee, Florida.

Florida Department of Agriculture and Consumer Services. 1939. Aerial photograph – Sections 19, 24, 25, and 30, Township 27 South, Range 17 East. Tallahassee, Florida.

Gant, R., Hood, J. and Toole, D. 2004. Memorandum to Ralph Kerr, John Parke, Michael Balser and Scott Laidlow, dated January 29, 2004, regarding the 2004 Stressed Lakes List. Southwest Florida Water Management District, Brooksville, Florida.

Greeley and Hansen. 1998. Hydrologic enhancement of selected lakes in northwest Hillsborough County pilot project. Greeley and Hansen, Tampa, Florida.

Griffith, G., Canfield, D., Jr., Horsburgh, C., Omernik, and J. Azevedo, S. 1997. Lake regions of Florida (map). United States Environmental Protection Agency, University of Florida Institute of Food and Agricultural Sciences, Florida Lakewatch, Florida Department of Environmental Protection, and the Florida Lake Management Society. Gainesville and Tallahassee, Florida.

Hillsborough County Department of Public Works. 1997. Rocky/Brushy Creek watershed existing conditions model (Preliminary Report). Hillsborough County Department of Public Works, Tampa, Florida.

Hillsborough County Department of Public Works. 1998. Rocky/Brushy Creek watershed environmental conditions report (DRAFT). Hillsborough County Department of Public Works, Tampa, Florida.

Hillsborough County. 2004. Web site: Hillsborough Watershed Atlas. Horse Lake. Developed by Hillsborough County, University of South Florida, Florida Center for Community Design + Research, Tampa, Florida, and the Southwest Florida Water Management District, Brooksville, Florida.

Kucera International Photogrammetric Consultants. 1989. Aerial photography with contours. Northwest Hillsborough Basin, Northwest Re-Map II, Sheet Nos.: 25 and 26-27-17. Prepared for the Southwest Florida Water Management District, Brooksville, Florida.

Leeper, D., Kelly, M., Munson, A. and Gant, R. 2001. A multiple-parameter approach for establishing minimum levels for Category 3 Lakes of the Southwest Florida Water Management District, June14, 2001 draft. Southwest Florida Water Management District, Brooksville, Florida.

Leggette, B., & Graham, Inc. and Greeley & Hansen, Inc. 1995. Hydrologic conditions in the Northwest Hillsborough and South Pasco County areas. Prepared for the City of St. Petersburg by Leggette, Brashears & Graham, Inc. and Greeley & Hansen, Tampa, Florida.

Romie, K. 2000. Water chemistry of lakes in the Southwest Florida Water Management District. Southwest Florida Water Management District, Brooksville, Florida.

Shafer, M. D., Dickinson, R. E., Heaney, J. P., and Huber, W. C. 1986. Gazetteer of Florida lakes. Publication no. 96, Water Resources Research Center, University of Florida, Gainesville, Florida.

Shaw, R. 2002. Big pump quenches lake thirst. The Tampa Tribune, Tampa, Florida.

Southwest Florida Water Management District. 1973. Environmental assessment Upper Tampa Bay Watershed Hillsborough, Pasco and Pinellas Counties, Florida. Brooksville, Florida.

Southwest Florida Water Management District. 1981. An evaluation of lake regulatory stage levels on selected lakes in the Northwest Hillsborough Basin. Brooksville, Florida.

Southwest Florida Water Management District. 1991. Public facilities report, water control structures and facilities, Lake Pretty Structure. Brooksville, Florida.

Southwest Florida Water Management District. 1994. Upper Rocky Creek watershed specific criteria assessment. Brooksville, Florida.

Southwest Florida Water Management District. 1996. Lake Levels Program lake data sheets / 1977-1996, Northwest Hillsborough River Basin – 14, Volume #2 – Lakes I thru Z. Brooksville, Florida.

Southwest Florida Water Management District. 1999. Establishment of minimum levels for Category 1 and Category 2 lakes, *in* Northern Tampa Bay minimum flows and levels white papers: white papers supporting the establishment of minimum flows and levels for isolated cypress wetlands, Category 1 and 2 lakes, seawater intrusion, environmental aquifer levels, and Tampa Bypass Canal; peer-review final draft, March 19, 1999. Brooksville, Florida.

Southwest Florida Water Management District. 2001. Structure profile on the District water control facility Pretty, water control structure, Northwest Hillsborough River Basin (14), Hillsborough County, February 19, 2001, Brooksville, Florida.

Southwest Florida Water Management District. 2004. Special purpose survey, N. W. Hillsborough Basin, Lake Pretty, Minimum Flows and Levels. Acad File: 14-999-005.dwg.

Southwest Florida Water Management District. 2004. Survey Section Field Book 14/84 pages 39-60. Brooksville, Florida.

United States Geological Survey. 1956. Citrus Park quadrangle, Florida – Hillsborough County, 7.5 minute series (topographic) map, N2800-W8230/7.5, 1956, AMS 4440 II SE-Series V847. Department of Interior, Washington, D.C.

United States Geological Survey. 1956. Citrus Park quadrangle, Florida – Hillsborough County, 7.5 minute series (topographic) map, 28082-A5-TF-024, 1956, (photorevised 1987), DMA 4440 II SE-Series V847. Department of Interior, Washington, D.C.

Water and Air Research, I. 1997. Background water quality assessment for the lake enhancement pilot project water year 1997 (DRAFT). Gainesville, Florida, Prepared for WCRWSA, Clearwater, Florida.

Water and Air Research, I. 1997. Assessment report and preliminary design of the hydrologic enhancement of select lakes in northwest Hillsborough County. Gainesville, Florida, Prepared for WCRWSA, Clearwater, Florida.

Watson and Company. 1973. Lake Keystone water management study. Watson and Company, Architects, Engineers, Planners, Tampa, Florida.

White, W. A. 1970. The geomorphology of the Florida peninsula. Geological Bulletin, No. 51. Bureau of Geology, Florida Department of Natural Resources, Tallahassee, Florida.

Wylupek, Q. 2001. An evaluation of water quality effects of transferring water from Pretty Lake to Lakes Horse, Raleigh and Rogers in northwest Hillsborough County, Florida, Southwest Florida Water Management District, Brooksville, Florida.

Young, S. (1979). Relationship between abundance of crustacean zooplankton and trophic state in fourteen central Florida lakes. Department of Biology, University of South Florida, Tampa, Florida.