

April 23, 2004

MEMORANDUM

TO: File

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

**SUBJECT: Proposed minimum and guidance levels for Lake Charles in
Hillsborough County, Florida**

Lake Charles

General Description

Lake Charles (Figure 1) is located in the Upper Rocky Creek watershed in the Northwest Hillsborough River Basin of the Southwest Florida Water Management District (SWFWMD or District) in Hillsborough County, Florida (Sections 23, Township 27 South, Range 18 East). White (1970) classified the area of west-central Florida containing Lake Charles as the Northern Gulf Coastal Lowlands physiographic region. Brooks (1981) characterized the area surrounding the lake as the Land-O-Lakes subdivision of the Tampa Plain in the Ocala Uplift Physiographic District, and described the subdivision as 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 Land-O-Lakes lake region, and described as an area of numerous neutral to slightly alkaline, low to moderate nutrient, clear-water lakes (Griffith *et al.* 1997).

Most of the southern lakeshore has been cleared for residential development (Figure 2). Although much of the forested wetlands contiguous with the lake have been dredged or filled, an intact cypress-dominated wetland remains along the north lakeshore. Public access to the shoreline is not available.

Since 1968, Lake Charles has been augmented with groundwater pumped from the Floridan aquifer. Reported annual volumes pumped into the lake basin have ranged from 0.1 to 180 million gallons (Stewart and Hughes 1974, SWFWMD data). Surface inflow to the lake historically occurred from a ditch that conveyed water from Lake Brant to areas south of Lake Charles. Inflow to Lake Charles from the canal occurred as overland flow or discharge through a culvert/water control structure. The structure,

which was installed in 1966, was designed to prevent inflow of water from the open ditch system and also serve as an outlet for the lake. In the 1990s, the open ditch in the vicinity of Lake Charles was converted to a closed-culvert conveyance system, and the water control structure/culvert system was removed from the shoreline of Lake Charles. Currently, if the lake is staged higher than 57.2 ft above NGVD, overland flow may spill from the site of the former Lake Charles structure to an existing culvert system that discharges under Lake Charles Circle to the southwest through a series of wetlands that drain to the interceptor canal and Lake Heather. 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 the the well used for lake augmentation.

The 1956 (photorevised 1987) United States Geological Survey 1:24,000 Sulphur Springs quadrangle map includes an elevation of 53 ft above the National Geodetic Vertical Datum of 1929 (NGVD) for the lake surface. The "Gazetteer of Florida Lakes" (Shafer *et al.* 1986) lists the lake area as 15 acres at this elevation. A topographic map of the basin generated in support of minimum levels development (Figure 3) indicates that the lake extends over 21 acres at an elevation of 56 ft above NGVD. Data used for production of the topographic map were obtained from field surveys and aerial photography maps containing one-foot contour lines prepared using photogrammetric methods.

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

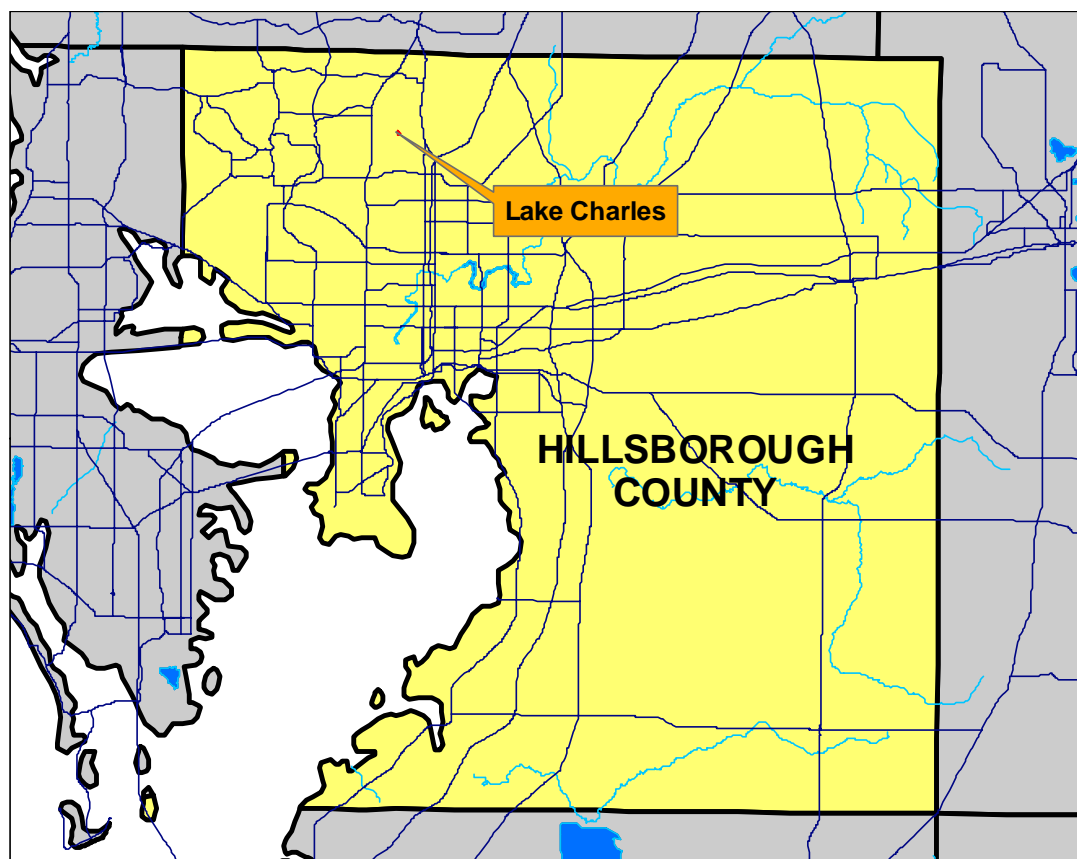
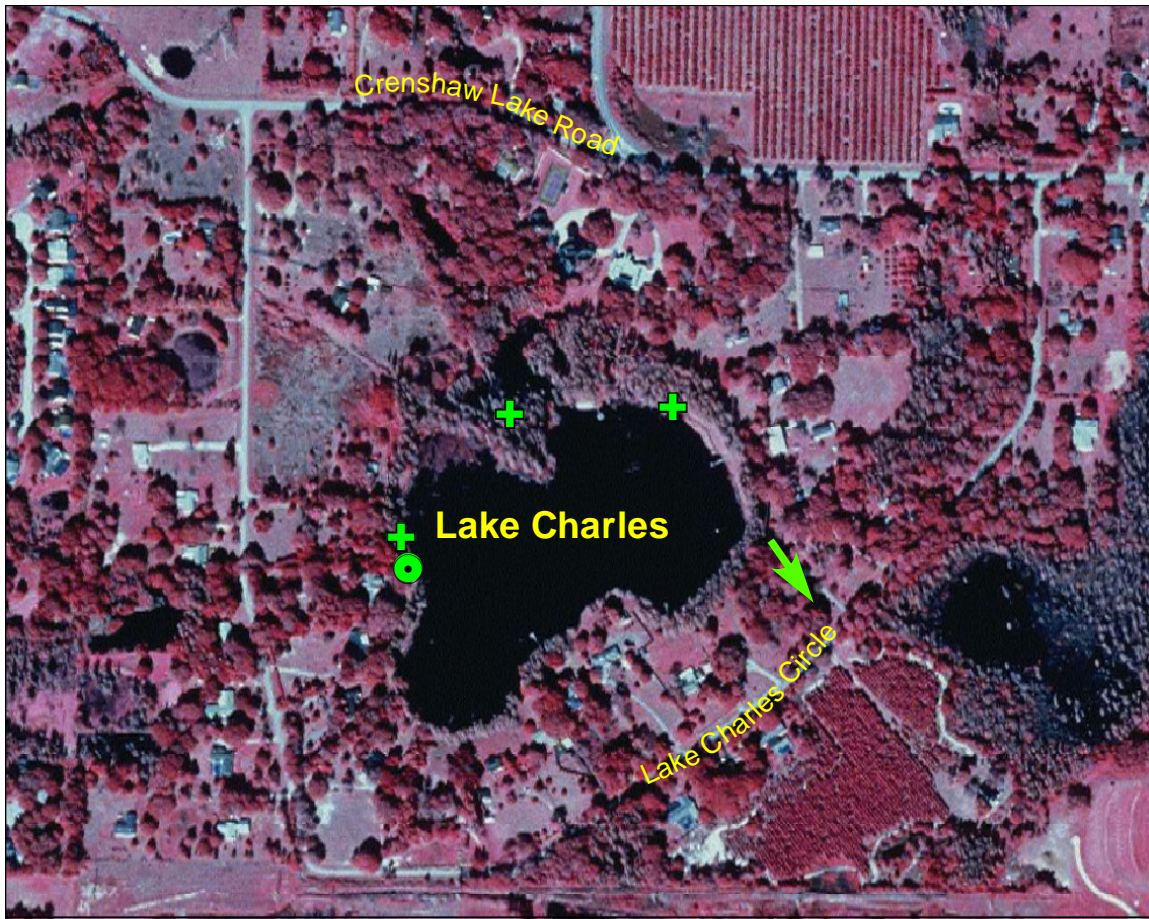


Figure 2. Location of District lake-level gauge, inlet/outlet, and sites where hydrologic indicators were measured at Lake Charles in Hillsborough County, Florida.



 Lake gauge

 Inlet/Outlet

 Hydrologic Indicators

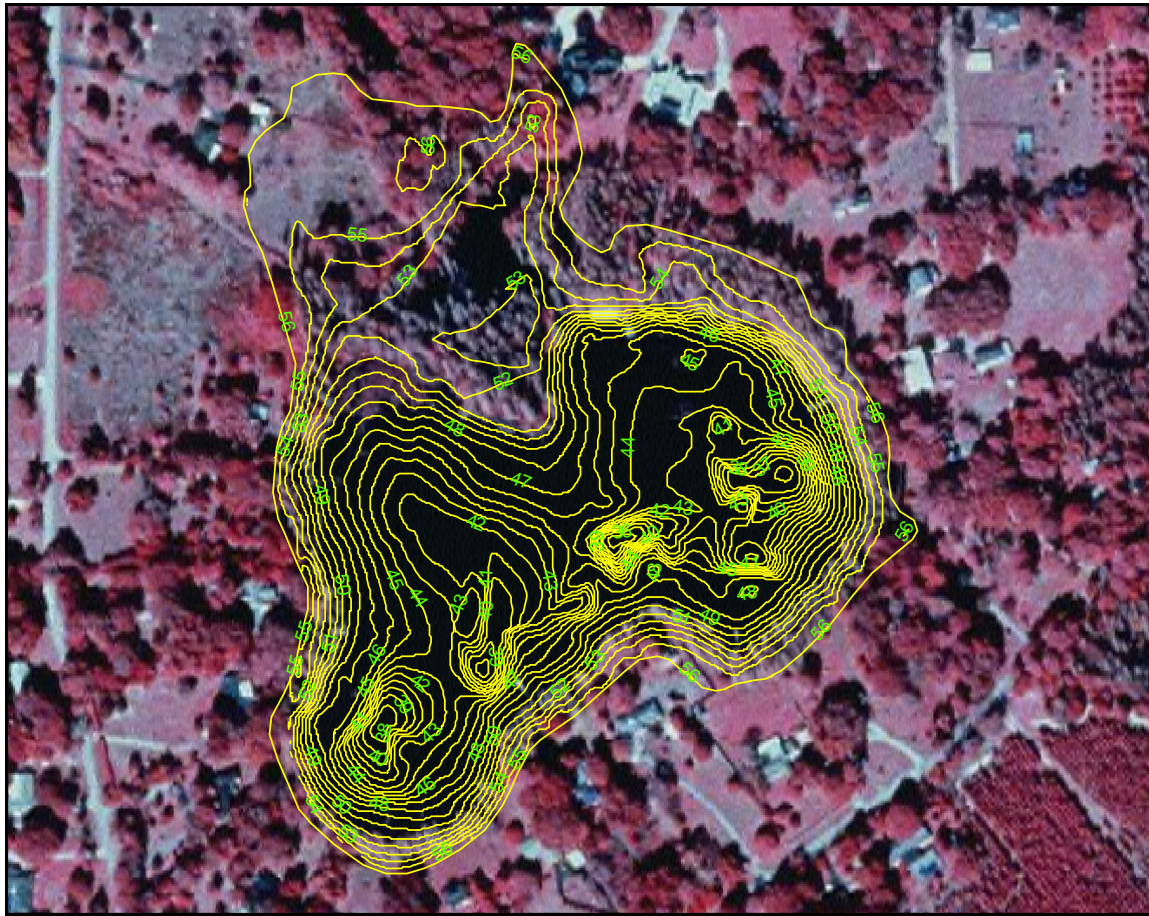
0 500 1,000 Feet

Aerial photography from 1999 USGS
Digital Orthophotograph.

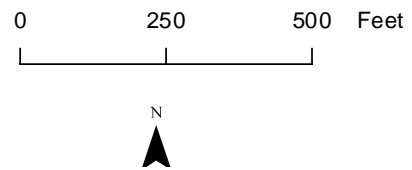
Map prepared March 3, 2004.



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



Map prepared February 2, 2004 using 1999 USGS digital orthophotography, elevation data from 1981 SWFWMD aerial photography with contours maps (Sheet Nos. 23-27-18), and elevation data collected on September 2, 1998 by the Hillsborough County Lake Management Program.



Previously Adopted Lake Management Levels

Based on work conducted in the 1970s (see SWFWMD 1996), the District Governing Board adopted management levels (currently referred to as Guidance Levels) for Lake Charles in September 1980 (Table 1). A Maximum Desirable Level of 54.00 ft above NGVD was also developed, but was not adopted by the Governing Board.

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

Level	Elevation (feet above NGVD)	Lake Area (acres)
Ten Year Flood Guidance Level	56.10	NA
High Level	54.75	18.3
Low Level	52.00	13.1
Extreme Low Level	50.00	11.2

NA = not available

Proposed Minimum and Guidance Levels

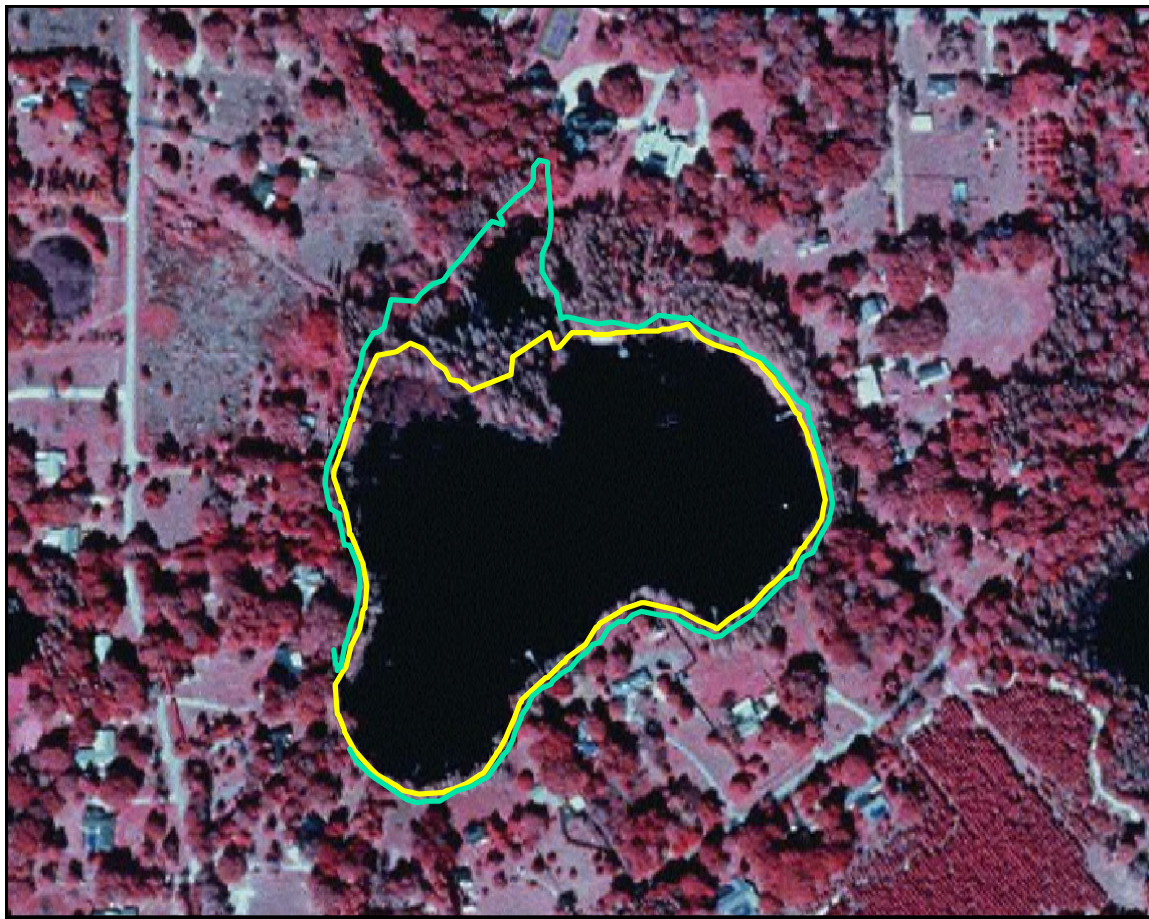
Proposed Minimum and Guidance Levels were developed for Lake Charles using the methodology for Category 1 Lakes described in SWFWMD (1999) and current District Rules (Chapter 40-D8, Florida Administrative Code). Proposed levels, along with lake surface area values for each level are listed in Table 2. Locations of the proposed minimum levels within the lake basin are shown in Figure 4.

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

Level	Elevation (feet above NGVD)	Lake Area (acres)
Ten Year Flood Guidance Level	56.2	NA
High Guidance Level	54.2	17.3
High Minimum Lake Level	53.8	16.7
Minimum Lake Level	52.4	13.8
Low Guidance Level	52.1	13.3

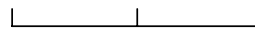
NA = not available

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



Map prepared February 2, 2004 using 1999 USGS digital orthophotography, elevation data from 1981 SWFWMD aerial photography with contours maps (Sheet Nos. 23-27-18), and elevation data collected on September 2, 1998 by the Hillsborough County Lake Management Program.

0 250 500 Feet



N



Legend

— 52.4 ft above NGVD

— 53.8 ft above NGVD

Summary of Data and Analyses Supporting Recommended Minimum and Guidance Levels

Hydrologic data are available for Lake Charles (District Universal ID Number STA 442 443) from June 1971 through 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. Historic data are not available. For the period of record from January 1974 through the present, the hydrologic data are classified as Current data. Current data collected through February 2002 were used to calculate the Current P10, P50, and P90 (Table 3).

The Normal Pool elevation was established at 54.2 ft above NGVD based on elevations associated with the buttressing of large cypress (*Taxodium* sp.) trees along the north and northwest shores of the lake (Table 4, Figure 2). The low floor slab elevation and extent of structural alteration were determined using available one-foot contour interval aerial maps and field survey data collected in July 2003 (Table 3). Because lake stage would have to exceed 57.2 ft above NGVD for water to flow from the basin at the site of the former structure, a control point elevation was not established for the lake (see Figures 7 and 8).

Based on the relationship between the Normal Pool elevation and the Current P10, the High Guidance Level was established at the Normal Pool elevation of 54.2 ft above NGVD (Table 3). The Historic P50 and Low Guidance Level were established at 53.2 and 52.1 ft above NGVD, respectively, using the High Guidance Level and the Northern Tampa Bay Region RLWR50 (1.0 ft) and RLWR90 (2.1 ft) statistics (see SWFWMD 1999 for a discussion of the reference lake water regime statistics).

The Ten Year Flood Guidance Level for Lake Charles was established at 56.2 ft above NGVD using the methodology for open basin lakes described in current District Rules (Chapter 40D-8, Florida Administrative Code). For the analysis, Hillsborough County's modified version of the Environmental Protection Agency's Stormwater Management Model (SWMM), version 4.31C (Hillsborough County 2000) was used. Model input 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 was exceeded in the late 1970s and 1990s (Figures 5 and 6). The highest surface elevation for Lake Charles included in the District water management database, 56.93 ft above NGVD, occurred on September 28, 1979. The low of record, 49.00 ft above NGVD, occurred on January 8, 1985.

Lake Charles contains diverse stands of aquatic macrophytes and other hydrophytes, including cattail (*Typha* sp.), pickerelweed (*Pontederia cordata*), *Potamogeton* sp., *Najas guadalupensis*, spatterdock (*Nuphar luteum*), maidencaine (*Panicum hemitomon*), water primrose (*Ludwigia* sp.), and wax myrtle (*Myrica cerifera*). The lake is also contiguous with cypress-dominated wetlands of 0.5 or more acres in size, so it is classified as a Category 1 or 2 Lake for the purpose of minimum levels development. Because the Historic P50 elevation is not more than 1.8 feet below the Normal Pool elevation, the

lake is classified as a Category 1 Lake. Note that herein, for discussion purposes, the elevation 1.8 ft below the Normal Pool elevation is identified as the Cypress Standard. For Lake Charles, this standard is established at 52.4 ft above NGVD. Based on the relationship between the Cypress Standard and the Historic P50 elevation, the proposed Minimum Lake Level was established at the Cypress Standard elevation (52.4 ft above NGVD). The proposed High Minimum Lake Level was established at 53.8 ft above NGVD, an elevation corresponding the Normal Pool minus 0.4 ft. The proposed High Minimum Lake Level is 4.0 ft below the Low Floor Slab elevation and 2.5 ft below the low spot on the roads encircling the lake.

For comparative purposes, minimum level standards used for establishing minimum levels for lakes without fringing cypress wetlands (see Leeper, *et al.* 2001) were developed for Lake Charles (Table 3). The Dock-Use Standard would be established at 55.1 ft above NGVD, based on the elevation of sediments at the end of 90% of the 8 docks at the lake (Table 5), a clearance value of 2 ft based on use of powerboats in the lake, and the Northern Tampa Bay area RLWR5090 (1.1 ft). The Species Richness Standard would be established at 52.3 ft above NGVD, based on limiting reduction in lake area to less than a 15% decrease in the area at the Historic P50 elevation. The Aesthetic Standard for the lake would be established at the Low Guidance Level elevation of 52.1 ft above NGVD. The Recreation/Ski Standard for safe skiing at Lake Charles is not applicable because Lake Charles is too small to accommodate a safe ski corridor (see Leeper *et. al* (2001). The Basin Connectivity Standard would be established at 47.1 ft above NGVD, based on a critical high-spot elevation of 45 ft above NGVD, a 1 ft clearance for use of non-motorized in the lake, and the Northern Tampa Bay area RLWR5090. Development of a Mixing Standard for preventing potential re-suspension of sediments would not be appropriate, based on dynamic ratio values (see Bachmann *et al.* 2000) estimated for lake stages up to 56 ft above NGVD (Figure 8). Review of changes in potential herbaceous wetland area associated with change in lake stage, and potential change in area available for aquatic macrophyte colonization did not indicate that use of any of the identified standards would be inappropriate for minimum levels development (Figure 9).

Figure 5. Surface water elevation at Lake Charles in Hillsborough County, Florida. Data through February 2003 are shown.

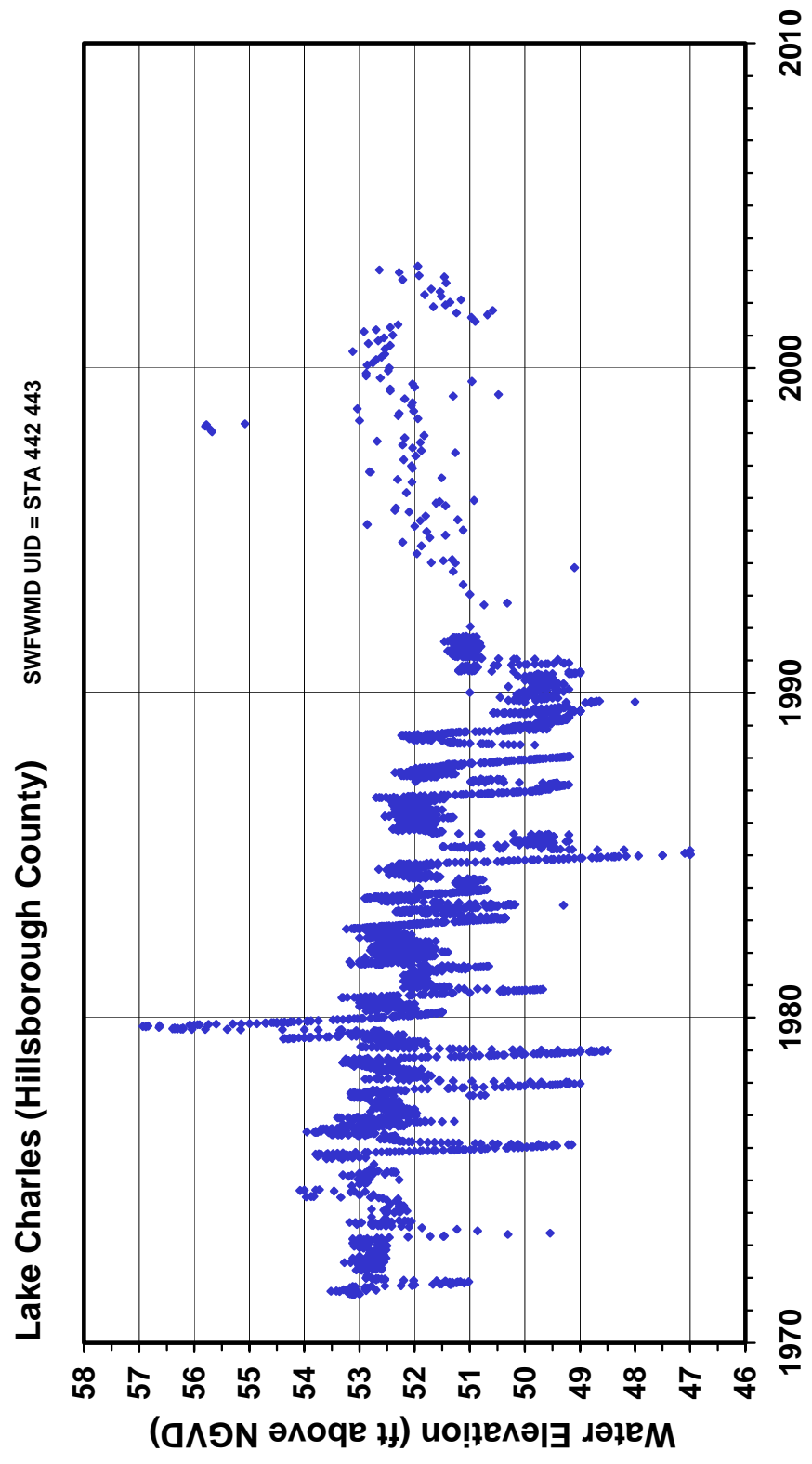


Figure 6. Mean monthly surface water elevations through February 2003, and proposed guidance and minimum levels for Lake Charles in Hillsborough County, Florida. Proposed levels include the Ten Year Flood Guidance Level (10-YR), High Guidance Level (HGL), High Minimum Lake Level (HMLL), Minimum Lake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

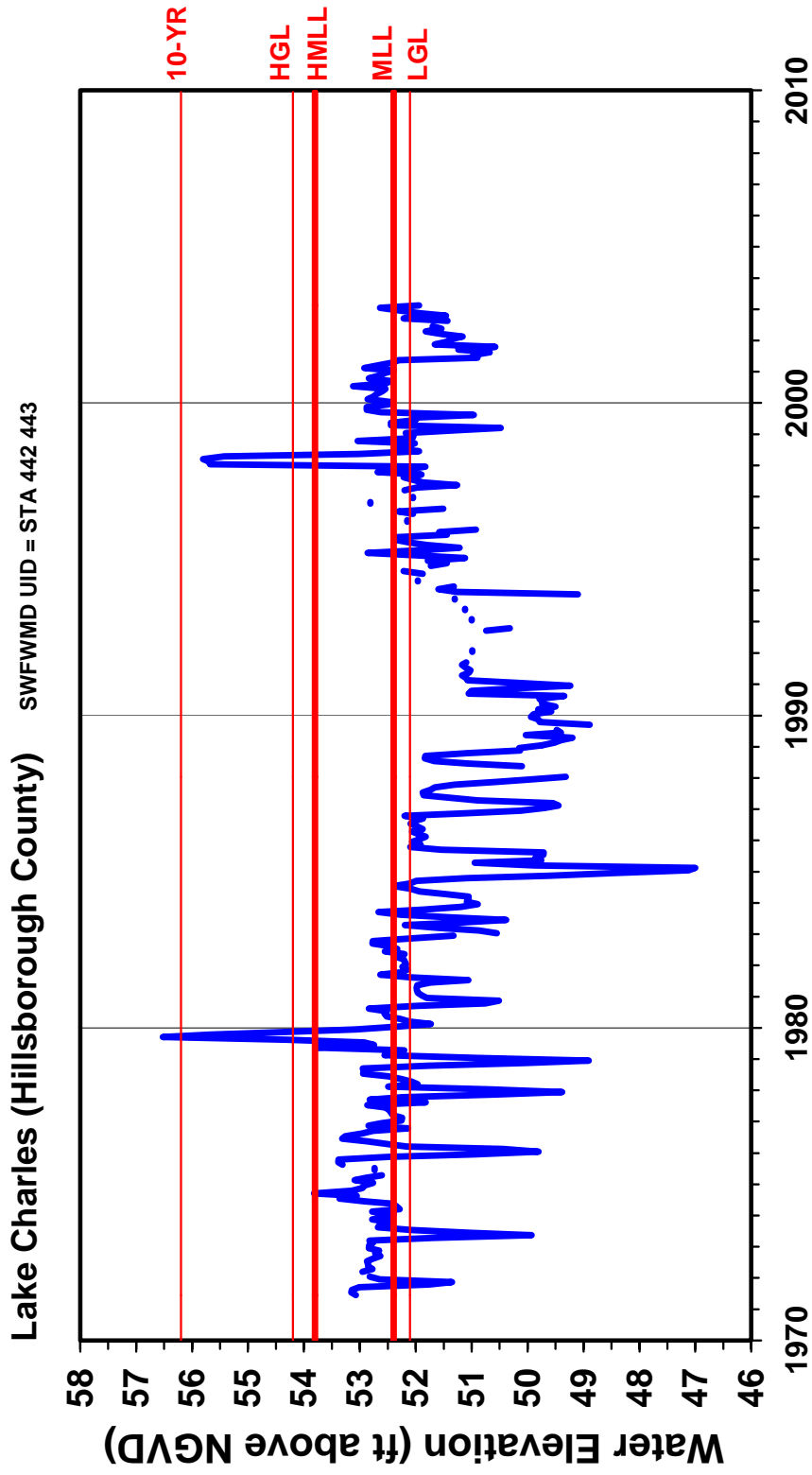


Table 3. Elevation data and associated area values used for establishing minimum levels for Lake Charles in Hillsborough County, Florida.

Level or Feature	Elevation (feet above NGVD)	Lake Area (acres)
Current P10	52.91	14.6
Current P50	51.97	13.1
Current P90	49.82	11.0
Normal Pool	54.2	17.3
Low Floor Slab	57.8	NA
Low Other (Shed behind 1009 Lake Charles Circle)	57.2	NA
Low Road	56.3	NA
Control Point	NA	NA
High Guidance Level	54.2	17.3
Historic P50	53.2	15.8
Low Guidance Level	52.1	13.3
Cypress Standard	52.4	13.8
*Dock-Use Standard	55.1	19.1
*Species Richness Standard	52.3	13.6
*Aesthetic Standard	52.1	13.3
*Connectivity Standard	47.1	8.2
*Recreation/Ski Standard	NA	NA

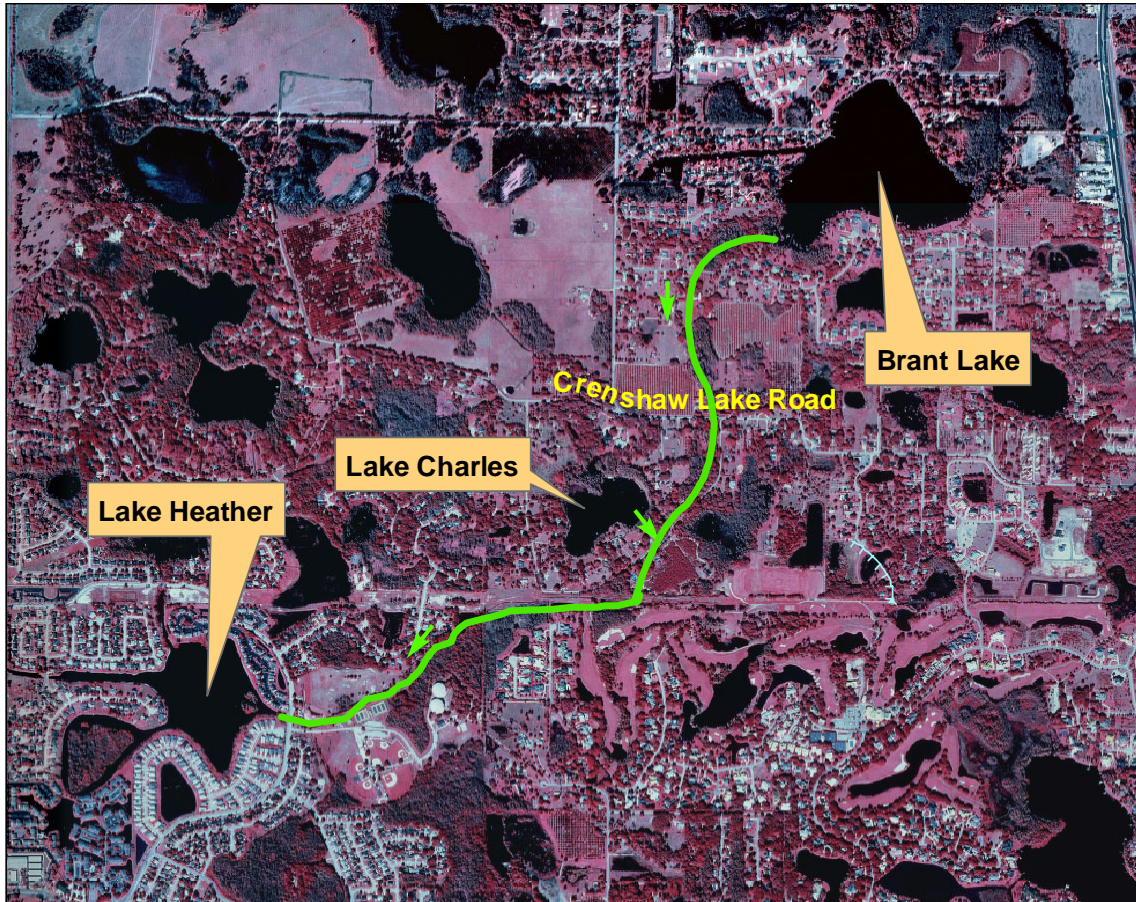
NA = not available/not applicable

* = Established for comparative purposes only; not used for minimum levels development



Table 4. Elevation data used for establishing the Normal Pool Elevation for Lake Charles in Hillsborough County, Florida. Data were collected at three sites by SWFWMD staff on September 16, 2002.

Hydrologic Indicator	Elevation (feet above NGVD)
Normal pool based on cypress buttress	54.93
Normal pool based on cypress buttress	54.71
Normal pool based on cypress buttress	54.62
Normal pool based on cypress buttress	54.45
Normal pool based on cypress buttress	54.45
Normal pool based on cypress buttress	54.44
Normal pool based on cypress buttress	54.39
Normal pool based on cypress buttress	54.29
Normal pool based on cypress buttress	54.22
Normal pool based on cypress buttress	54.17
Normal pool based on cypress buttress	54.08
Normal pool based on cypress buttress	54.00
Normal pool based on cypress buttress	53.90
Normal pool based on cypress buttress	53.86
Normal pool based on cypress buttress	53.80
Normal pool based on cypress buttress	53.70
Normal pool based on cypress buttress	53.60
Normal pool based on cypress buttress	53.40
N	18
Median	54.20
Mean	54.17
Standard Deviation	0.41

Figure 7. Flow conveyance way from Brant Lake to Lake Heather in the vicinity of Lake Charles, Hillsborough County, Florida.



0 1,000 2,000 3,000 4,000 Feet

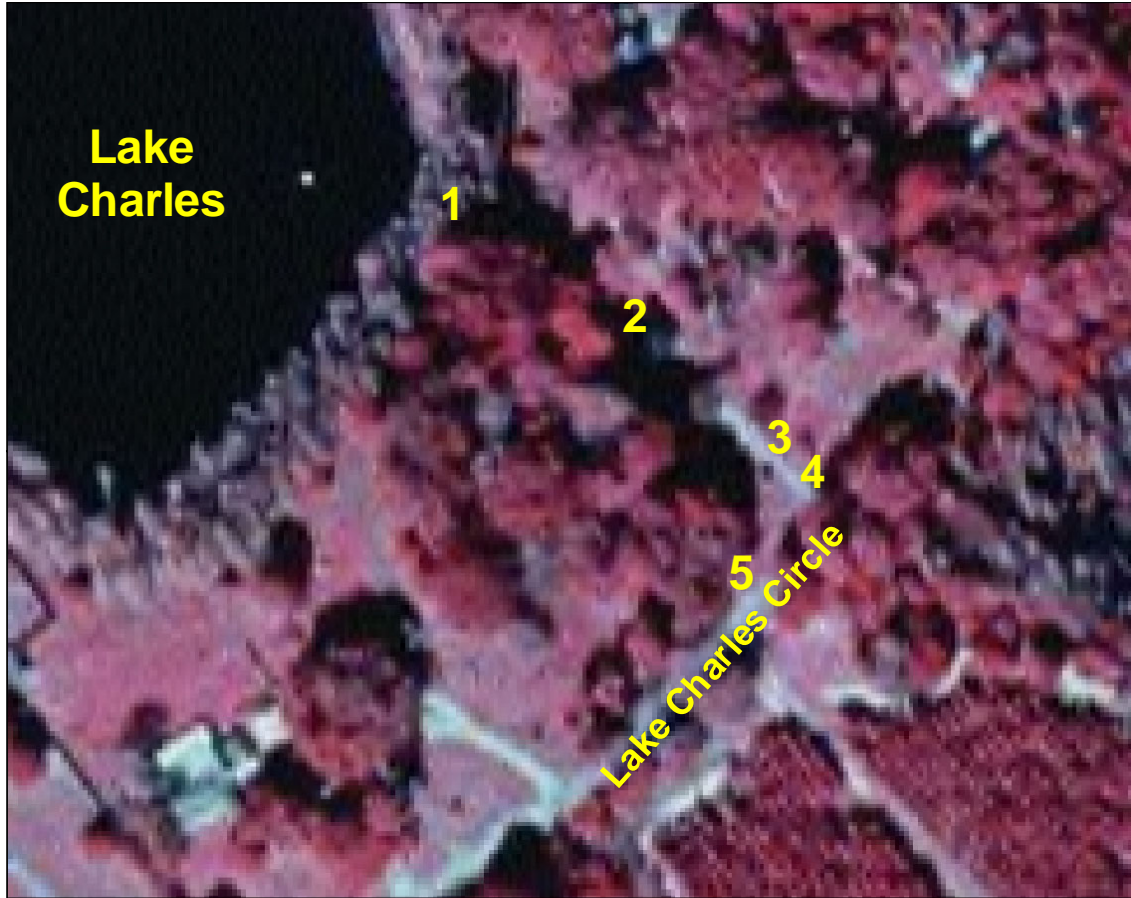
 Water Flow
 Approximate flow way

Aerial photography from 1999 USGS Digital Orthophotograph.

Map prepared February 2, 2004.



Figure 8. Potential outlet conveyance system for Lake Charles in Hillsborough County, Florida. Overland flow may occur from the lake through Sites 2, 3 and 4 if the lake is staged higher than 57.2 ft above the National Geodetic Vertical Datum of 1929.



Aerial photography from 1999 USGS Digital Orthophotograph.



0 100 200 300 Feet

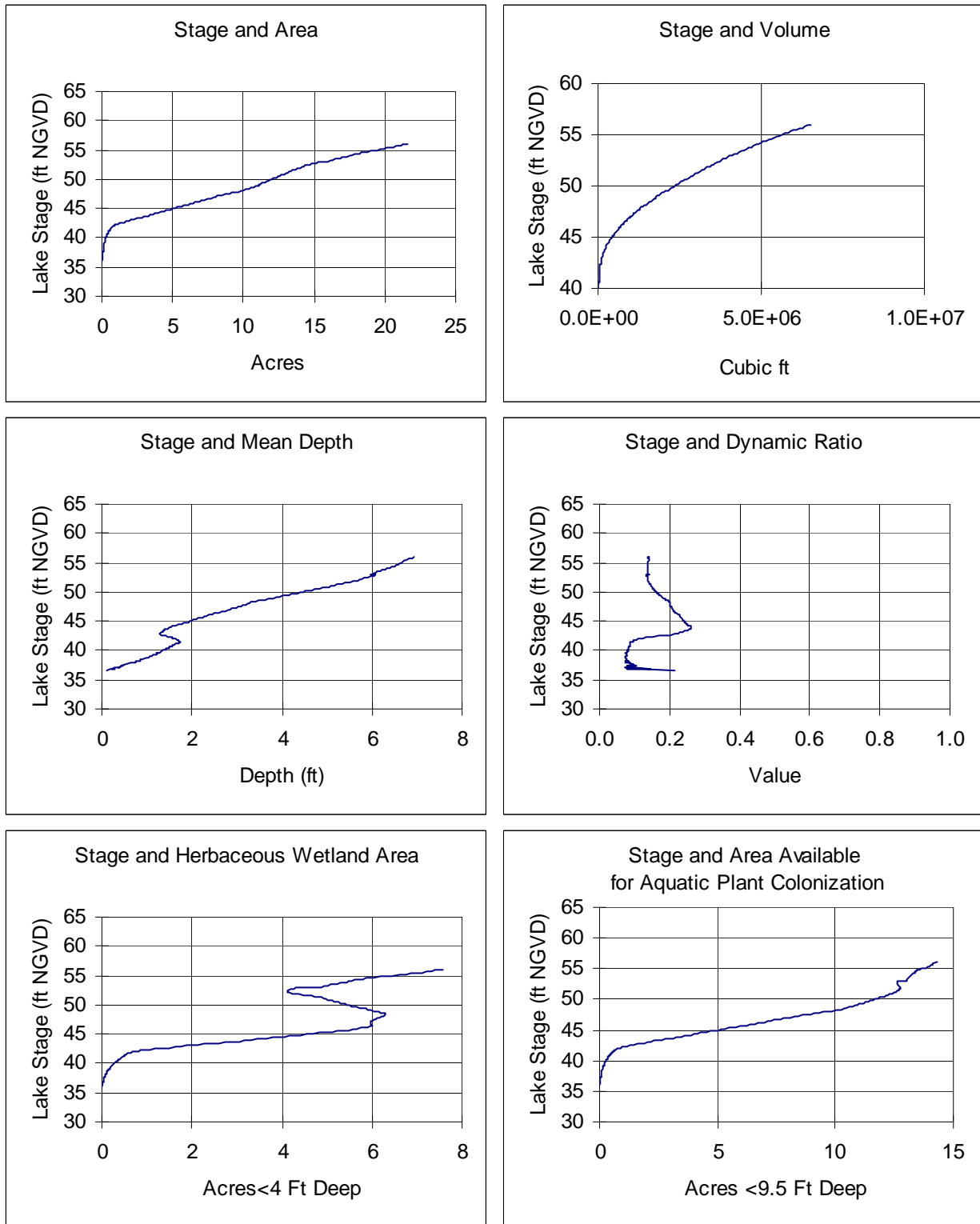
Map prepared March 3, 2004.

Site	Description	Elevation (feet above NGVD)
1	Site of former District structure.	Not applicable
2	Ground elevation; high spot in potential flow line from Lake Charles to swale identified as Site No. 4.	57.2
3	Ground elevation; high spot in potential flow line from Lake Charles to swale identified as Site No. 4.	57.2
4	Open swale and culverts. Site receives inflow through a culvert from wetland located between Brant Lake and Lake Charles and discharges through a culvert to a concrete drop box located north of Lake Charles Circle.	Not applicable
5	Concrete drop box with culvert that discharges to wetland south of Lake Charles Circle.	Not applicable

Table 5. Summary statistics for elevations associated with docks (n=8) at Lake Charles in Hillsborough County, Florida, based on data collected by SWFWMD staff on September 16, 2002. Percentiles (P10, P50, P90) represent elevations exceeded by 10, 50 and 90 percent of the docks.

Statistic	Elevation of Sediments at Water-ward End of Docks (feet above NGVD)	Elevation of Dock Platform (feet above NGVD)
Mean (SD)	53.9 (1.4)	60.3 (0.5)
P10	55.2	60.9
P50	53.9	60.3
P90	52.0	59.9
Maximum	56.5	61.2
Minimum	51.9	59.5

Figure 9. Surface area, volume, mean depth, dynamic ratio (basin slope), potential herbaceous wetland area, and area available for colonization by aquatic macrophytes versus lake stage for Lake Charles in Hillsborough County, Florida.



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