

February 4, 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 Lake Crenshaw in
Hillsborough County, Florida**

Lake Crenshaw

General Lake Description

Lake Crenshaw is located in the Northwest Hillsborough Basin in Hillsborough County, Florida in Section 22, Township 27S, Range 18E (Figure Crenshaw-1). 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); 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).

The lake has a drainage area of 1.3 square miles (SWFWMD 1996). Surface inflow occurs through two culverts under Van Dyke Road (Figure Crenshaw-2). An outlet ditch runs from the south lakeshore under Little Road to Saddleback Lake (Figure Crenshaw-2). There are currently no surface water withdrawals from the lake permitted by the District. There are, however, several groundwater withdrawals in the vicinity of the lake, including those associated with the Section 21 Wellfield. An augmentation well along the north shore has been used intermittently to supply the basin with water from the Floridan Aquifer during the past thirty years (SWFWMD WUP No. 203375).

The lake is not included in the "Gazetteer of Florida lakes" (Florida Board of Conservation 1969, Shafer *et al.* 1986). The 1956 United States Geological Survey (photorevised 1987) 1:24,000 Sulphur Springs, Fla. quadrangle map indicates a water level elevation of 56 ft above mean sea level for the lake while the 1974 (photorevised

1987) Lutz, Fla. quadrangle map shows the lake at 53 ft above mean sea level. These elevations correspond to lake surface areas of approximately 39 and 30 acres, respectively, based on a topographic map of the lake basin generated in support of minimum levels development (Figure Crenshaw-3). Data used for production of the topographic map were obtained from field surveys and 1:200 aerial photograph maps of the basin containing one-foot contour lines prepared using photogrammetric methods.

Figure Crenshaw-1. Location of Lake Crenshaw in Hillsborough County, Florida.

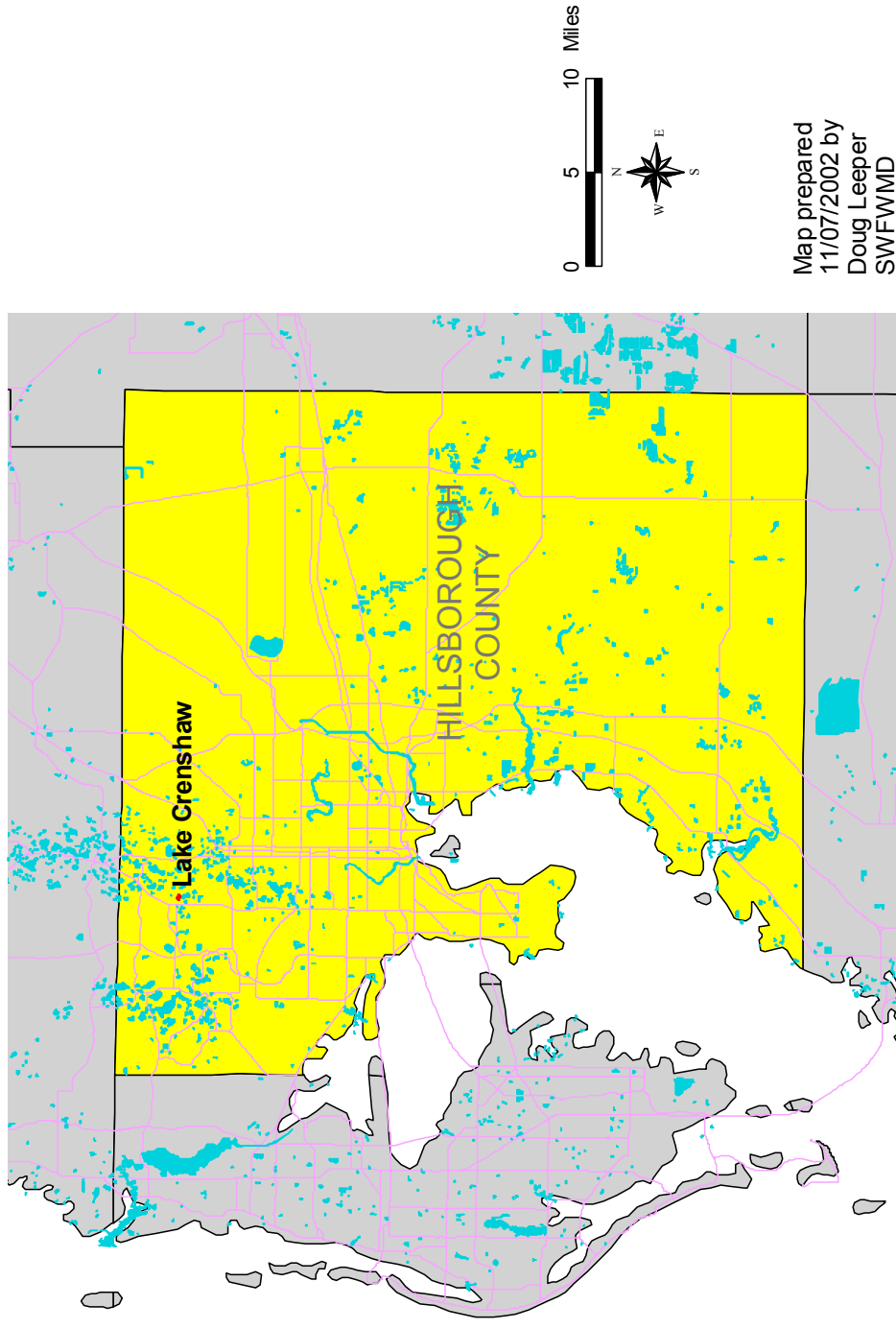


Figure Crenshaw-2. Location of District lake gauge, inlets, outlets and sites where hydrologic indicators were measured at Lake Crenshaw in Hillsborough County, Florida.

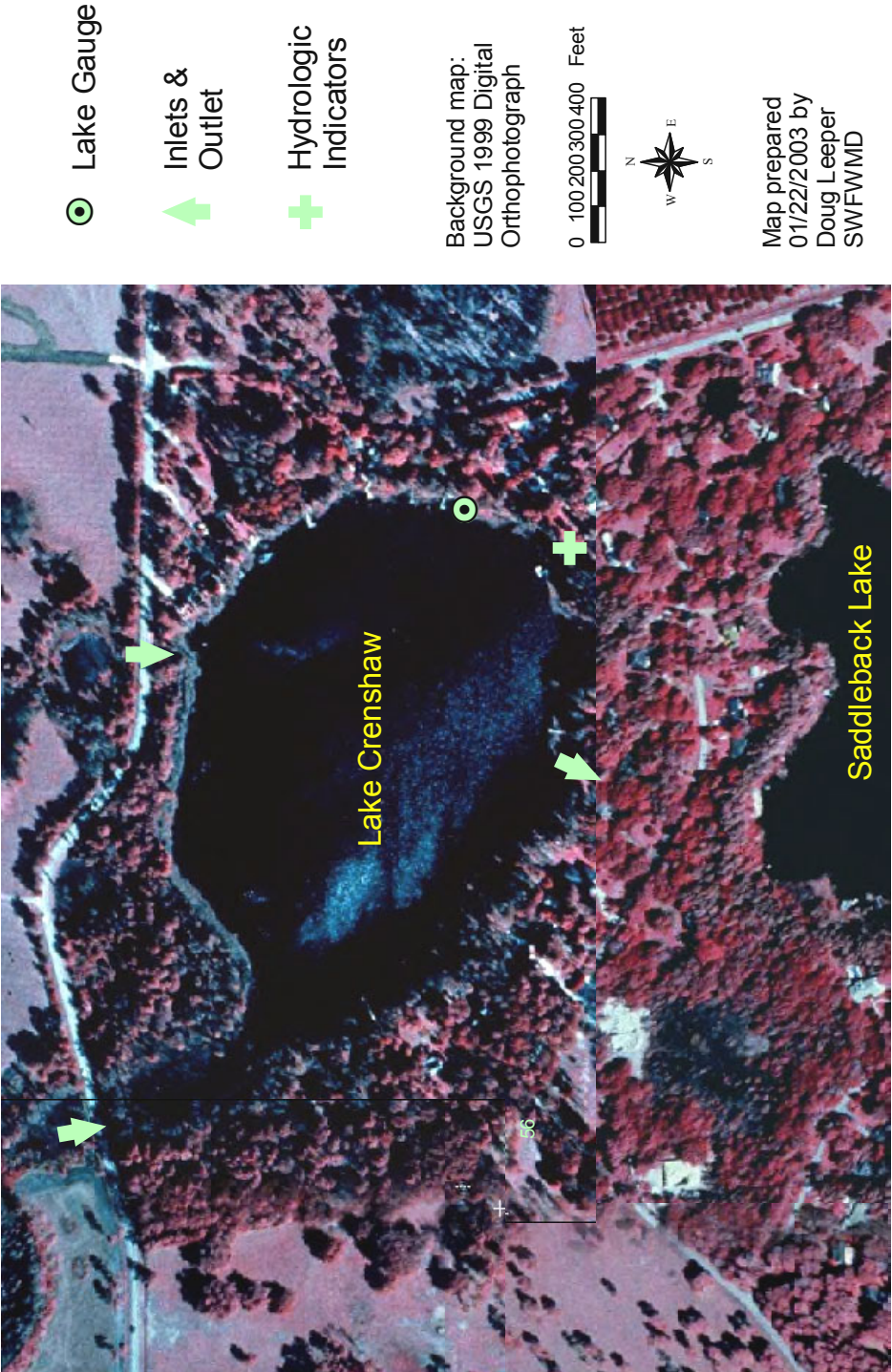
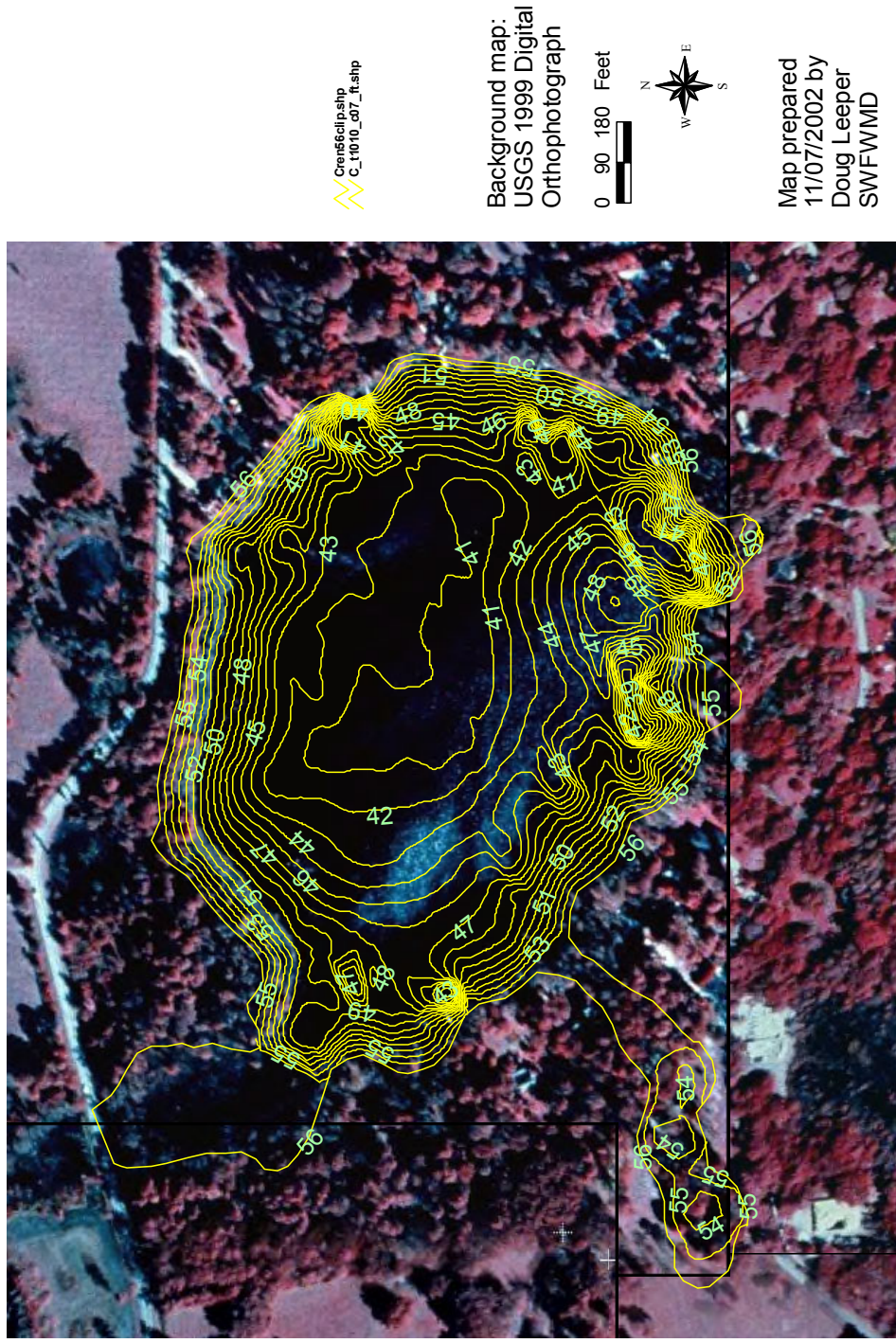


Figure Crenshaw-3. One-foot contour lines within the Lake Crenshaw basin, Hillsborough County, Florida. Values shown are elevations, in feet, relative to the National Geodetic Vertical Datum.



Previously Adopted Lake Management Levels

Based on work conducted in 1977 (see SWFWMD 1996), the District Governing Board adopted management levels (currently referred to as Guidance Levels) for Lake Crenshaw in September 1980 (Table Crenshaw-1). A Maximum Desirable Level of 56.00 ft above NGVD was also developed, but was not adopted by the Governing Board.

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

Level	Elevation (feet above NGVD)	Total Lake Area (acres)
Ten Year Flood Guidance Level	57.50	38*
High Level	56.25	36*
Low Level	54.50	32
Extreme Low Level	51.00	27

* Acreage values are based on extrapolated data

Proposed Minimum and Guidance Levels

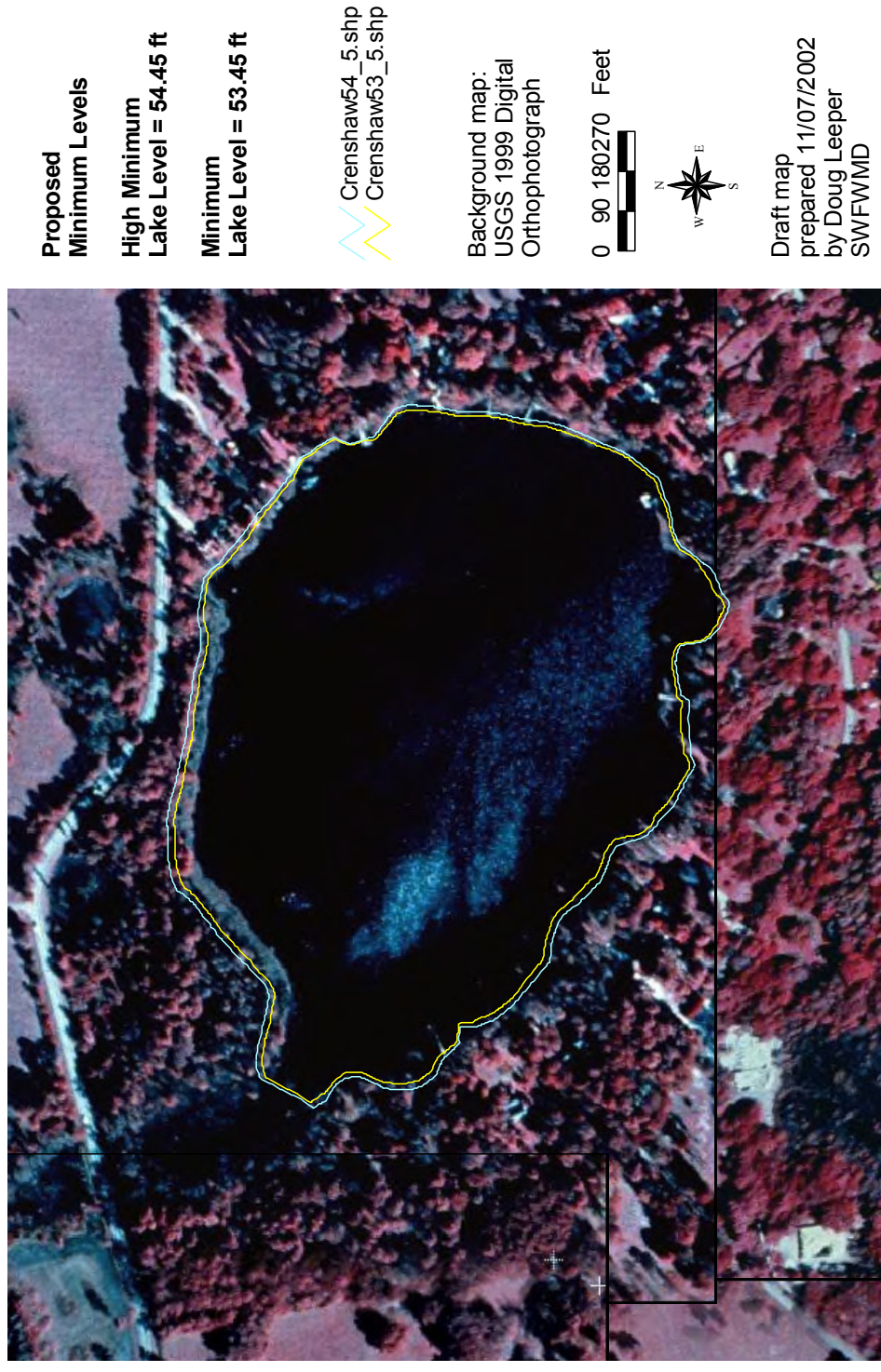
Proposed Minimum and Guidance Levels were developed for Lake Crenshaw using the methodology for Category 3 Lakes described in Leeper *et al.* (2001), in accordance with modifications outlined by Dierberg and Wagner (2001). Proposed levels, along with lake surface area values for each level are listed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

Table Crenshaw-2. Proposed Minimum Levels and Guidance Levels with associated lake surface areas for Lake Crenshaw in Hillsborough County, Florida.

Level	Elevation (feet above NGVD)	Total Lake Area (acres)
Ten-Year Flood Guidance Level	57.64	38*
High Guidance Level	55.50	34
High Minimum Lake Level	54.45	32
Minimum Lake Level	53.45	30
Low Guidance Level	53.40	30

* = acreage value estimated based on regression between lake stage and surface area

Figure Crenshaw-4. Approximate location of the proposed Minimum Lake Level (yellow) and the proposed High Minimum Lake Level (blue) for Lake Crenshaw, Hillsborough County, Florida. Elevations listed are in feet, relative to the National Geodetic Vertical Datum.



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

Hydrologic data are available for Lake Crenshaw (Southwest Florida Water Management District Universal Identification Number = STA 414 415) for the period from June 1971 through the present date (Figure Crenshaw-5; see Figure Crenshaw-2 for location of the District water level gauge). Note that a second District gauge is located south of the gauge identified in Figure Crenshaw-2. Stage records for this gauge are included in the hydrologic data set for site number STA 441 415. For the period from January 1974 to the present, the hydrologic data are classified as Current data. Current data through December 2001 were used to calculate the Current P10, P50, and P90 (Table Crenshaw-3).

The Category 3 Lake Normal Pool elevation was established based on morphology of large cypress trees along the southeastern shore of the lake (Tables Crenshaw-3 and Crenshaw-4, Figure Crenshaw-2). The low floor slab elevation, extent of structural alteration, and the control point elevation were determined using available one-foot contour interval aerial maps and field survey data (Tables Crenshaw-3 and Crenshaw-5, Figure Crenshaw-6). 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 relationship between the control point elevation, the Category 3 Lake Normal Pool elevation and the Current P10, the High Guidance Level was established at the Current P10 elevation (Table Crenshaw-3). The Historic P50 and Low Guidance Level were determined using the High Guidance Level and the Northern Tampa Bay Region RLWR50 (1.0 ft) and RLWR90 (2.1 ft) (see SWFWMD 1999 for a discussion of the reference lake water regime statistics).

The Ten Year Flood Guidance Level was established for Lake Crenshaw using the methodology for open basin lakes described in current District rules (Chapter 40D-8, Florida Administrative Code). The District used an existing hydrologic and hydraulic computer model of the Rocky Creek Watershed developed by Hillsborough County (Hillsborough County 1998). The Rocky Creek runoff hydrographs were computed using the NRCS Dimensionless Unit Hydrograph, a 256 shape factor, a 10.0-inch rainfall depth, and a 72-hour rainfall distribution developed by the South Florida Water Management District. The Rocky Creek conveyance system was simulated with the Hillsborough County modified version of EXTRAN, and the hydrodynamic routing component of the Environmental Protection Agency's Stormwater Management Model (SWMM), v.4.31. District staff modified the EXTRAN input data developed by Hillsborough County, by setting the initial elevation of Lake Crenshaw at the outlet control point elevation. The modified data set was then used to determine the 10-year flood level based on runoff hydrographs from the 10-year storm event.

The Ten Year Flood Guidance Level of 57.64 ft above NGVD has been equaled once during the period for which stage records are available. The lake was at 57.64 ft on December 29, 1997 (see figure Crenshaw-5 for the average monthly value for

December 1997). The lowest recorded stage for Lake Crenshaw, 46.97 ft above NGVD, occurred on June 26, 2001.

Lake Crenshaw is not contiguous with any cypress-dominated wetlands of more than 0.5 acres in size and is therefore classified as a Category 3 Lake for the purpose of minimum levels development. Panic grass (*Panicum* sp.), primrose willow (*Ludwigia* sp.) and other wetland plants are abundant throughout the basin.

Recreation/Ski, Dock-Use, Aesthetics, and Species Richness Standards were evaluated for minimum levels development. The Recreation/Ski Standard was established at 55.1 ft, based on a critical ski elevation of 54 ft and the RLWR5090 for the northern Tampa Bay area (1.1 ft). A Dock-Use Standard was established at 53.45 ft above NGVD, based on the Northern Tampa Bay area RLWR5090 and a Dock-End Sediment elevation of 50.35 ft, which was developed from measurement of 16 docks. The Aesthetic-Standard was established at the Low Guidance Level elevation of 53.4 ft. The Species Richness Standard was established at 51.1 ft, based on a 15% reduction in lake surface area from that at the Historic P50 elevation. Based on basin morphology, development of a Basin Connectivity Standard is not appropriate. Review of the dynamic ratio for lake stages bounded by the Current P10 and Current P90 elevations and the High and Low Guidance Levels did not indicate that potential changes in basin susceptibility to wind-induced sediment resuspension would be of concern for minimum levels development (Figure Crenshaw-7). 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 Crenshaw-7).

The Recreation/Ski Standard exceeds the Historic P50 elevation and was therefore not considered appropriate for minimum levels development. The Dock-Use Standard, the most conservative (*i.e.*, highest) of the appropriate standards was used to establish the proposed Minimum Lake Level at 53.45 ft above NGVD. Lake surface area at the proposed Minimum Lake Level is about 94% of that associated with the Historic P50 elevation. The proposed High Minimum Lake Level was established at 54.45 ft above NGVD, an elevation corresponding to the proposed Minimum Lake Level plus the RLWR50 (1.0 ft) for the northern Tampa Bay area. The proposed High Minimum Lake Level is 1.05 ft below the High Guidance Level. Lake surface area at the proposed High Minimum Lake Level is about 94% of that associated with the High Guidance Level. The proposed High Minimum Lake Level is approximately 2 ft below the slab of a masonry shed located relatively low in the basin, and 3.4 ft below the Low Floor Slab.

Figure Crenshaw-5. Mean monthly surface water elevation, and proposed guidance and minimum levels for the Lake Crenshaw in Hillsborough 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).

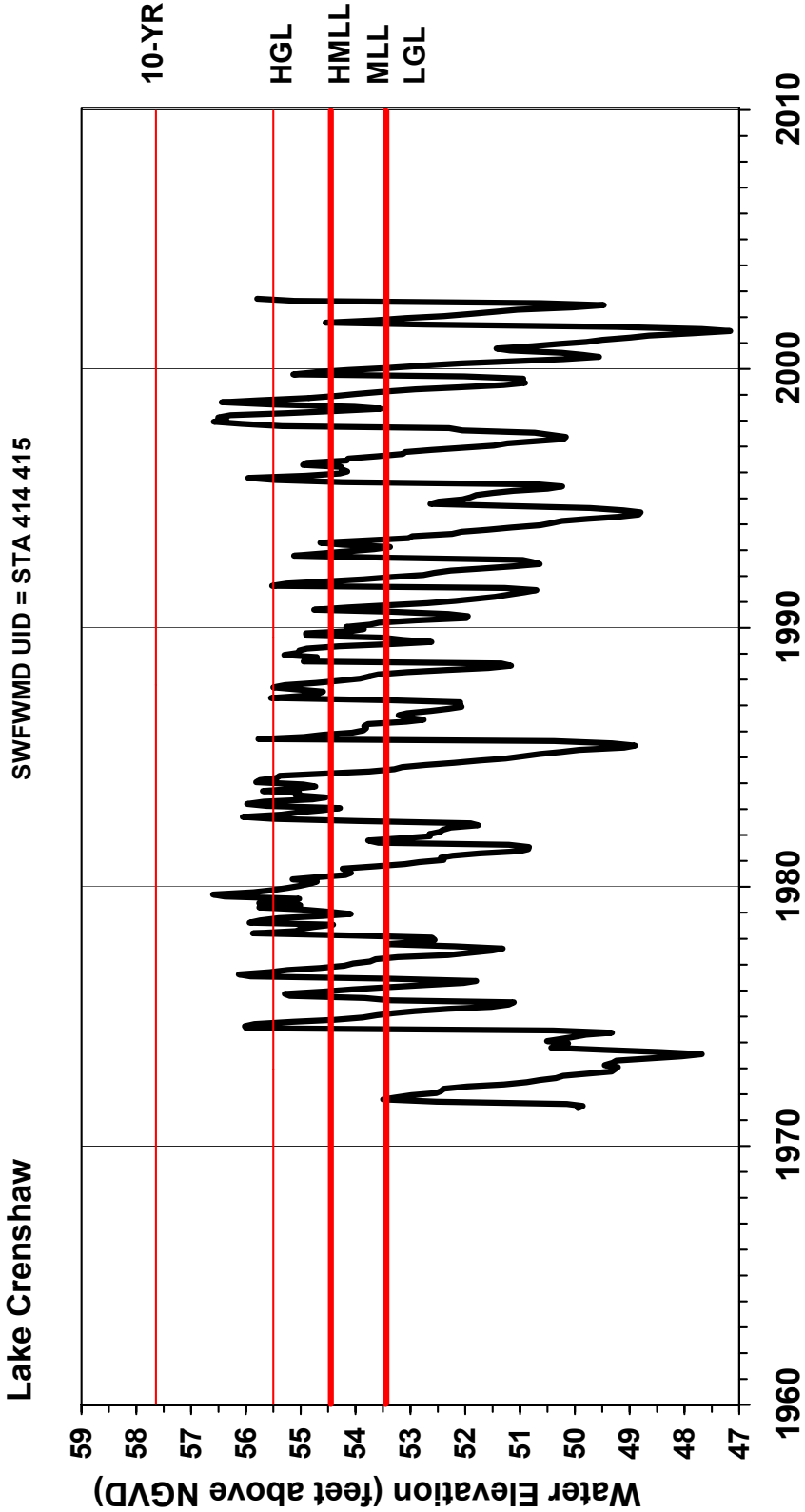


Table Crenshaw-3. Summary of elevation data and associated lake surface areas used for establishing minimum levels for Lake Crenshaw in Hillsborough County, Florida.

Level or Feature	Elevation (feet above NGVD)	Total Lake Area (acres)
Current P10	55.50	34
Current P50	53.41	30
Current P90	50.41	27
Category 3 Lake Normal Pool	57.33	38*
Low Floor Slab	57.82	NA
Low Other (masonry shed slab)	56.41	NA
Control Point	55.1	33
High Guidance Level	55.50	34
Historic P50	54.50	32
Low Guidance Level	53.40	30
Recreation/Ski Standard	55.1	33
Dock-Use Standard	53.45	30
Aesthetic Standard	53.4	30
Species Richness Standard	51.10	27

* = acreage value estimated based on regression between lake stage and surface area
NA = not available / not applicable

Table Crenshaw-4. Elevation data used for establishing the Category 3 Lake Normal Pool elevation for the Lake Crenshaw. Data were collected on August 12, 1999; water level was 50.91 ft above NGVD.

Hydrologic Indicator	Elevation (feet above NGVD)
Cypress buttress (normal pool) Church Lake	57.23
Cypress buttress (normal pool) Church Lake	57.53
Cypress buttress (normal pool) Church Lake	57.63
Cypress buttress (normal pool) Echo Lake	57.18
Cypress buttress (normal pool) Echo Lake	57.33
N	5
Mean	57.38
Standard Deviation	0.19
Median	57.33

Table Crenshaw-5. Summary of structural alteration / control point elevation information for the Lake Crenshaw. Numbers correspond to those shown in Figure Crenshaw-6.

No.	Description	Elevation (feet above NGVD)
1	Control point – ground elevation; high spot in ditch between Lake Crenshaw and Little Road	55.1
2	Invert at north end of 42" corrugated metal pipe under Little Road	53.80
3	Invert at south end of 42" corrugated metal pipe under Little Road	53.47
4	Ground elevation; high spot in ditch between Little Road and Saddleback Lake	54.1

Figure Crenshaw-6. Outlet conveyance system for Lake Crenshaw, Hillsborough County, Florida. Numbered sites are described in Table Crenshaw-5.

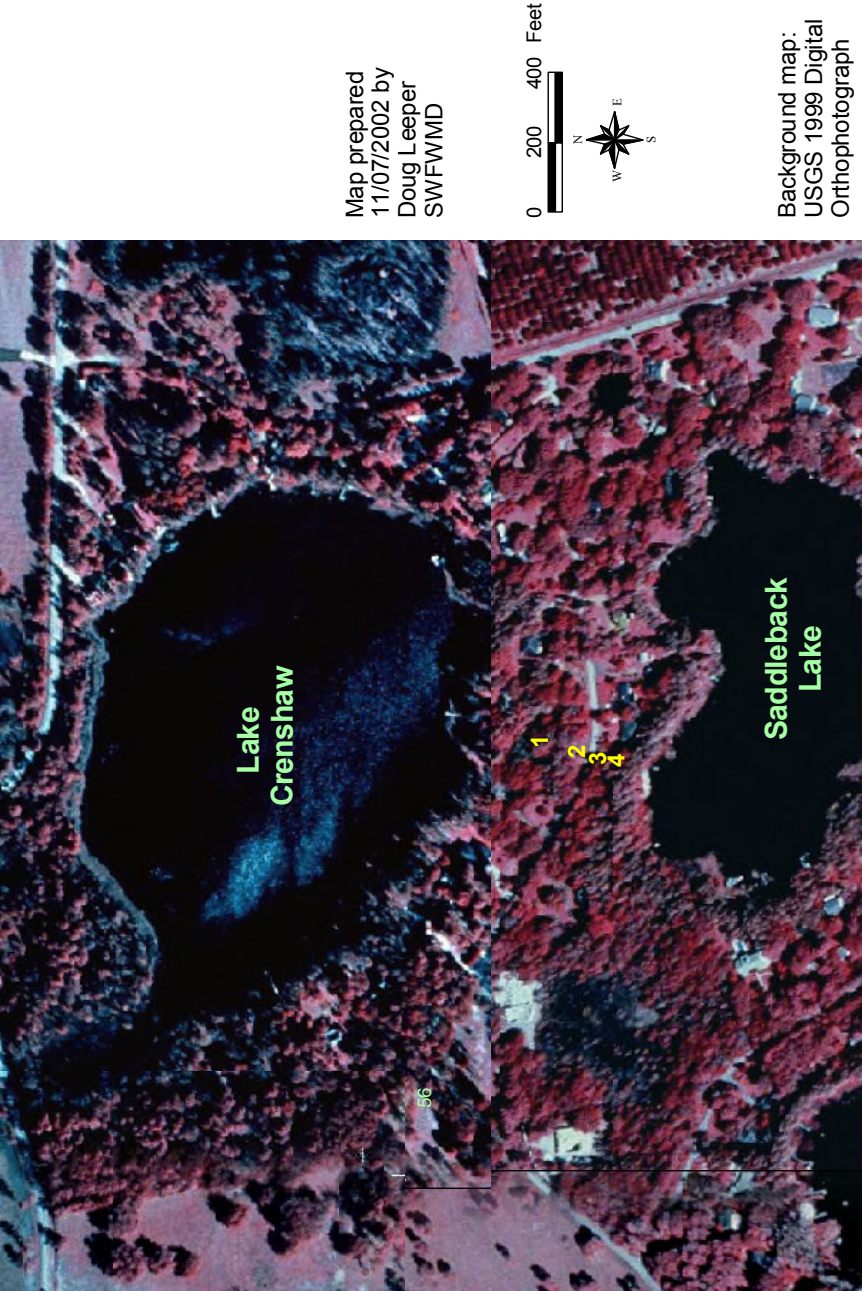
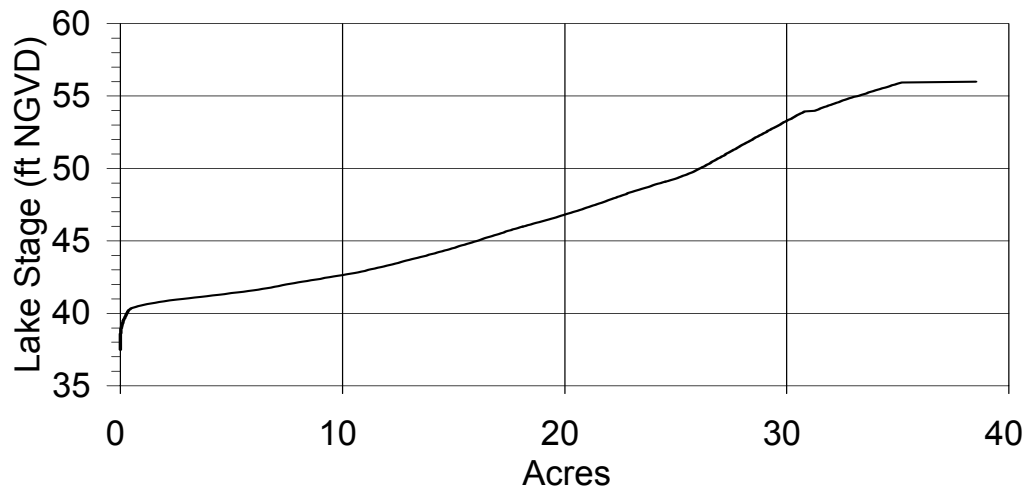


Figure Crenshaw-7. Surface area, volume, potential herbaceous wetland area, area potentially colonized by aquatic macrophytes, and dynamic ratio versus lake stage for Lake Crenshaw, Hillsborough County, Florida.

Stage and Area



Stage and Volume

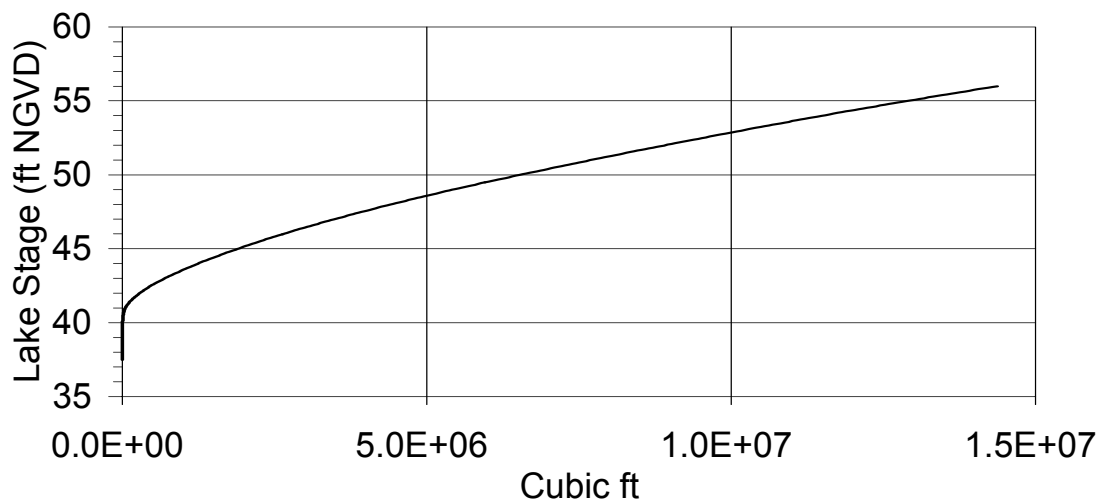
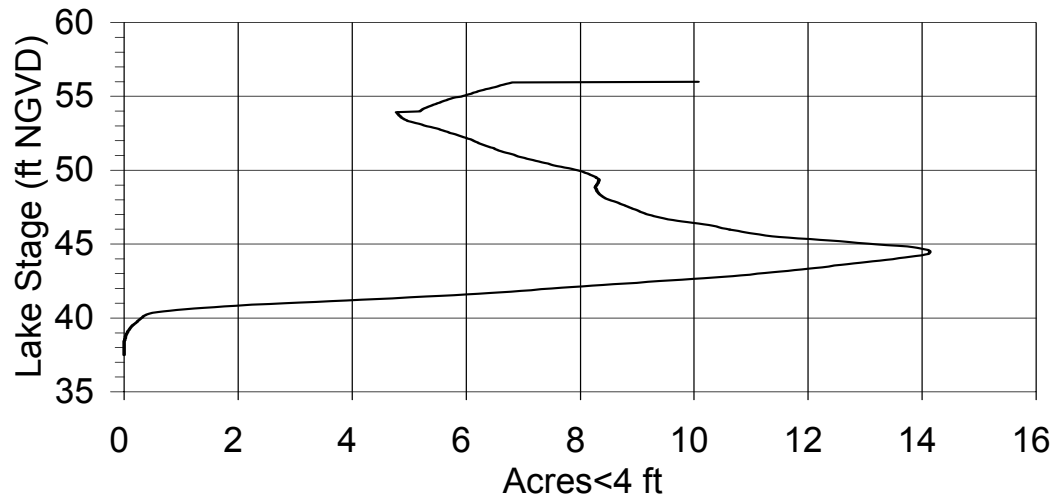


Figure Crenshaw-7. (continued)

Stage and Herbaceous Wetland Area



Stage and Area Available for Aquatic Plant Colonization

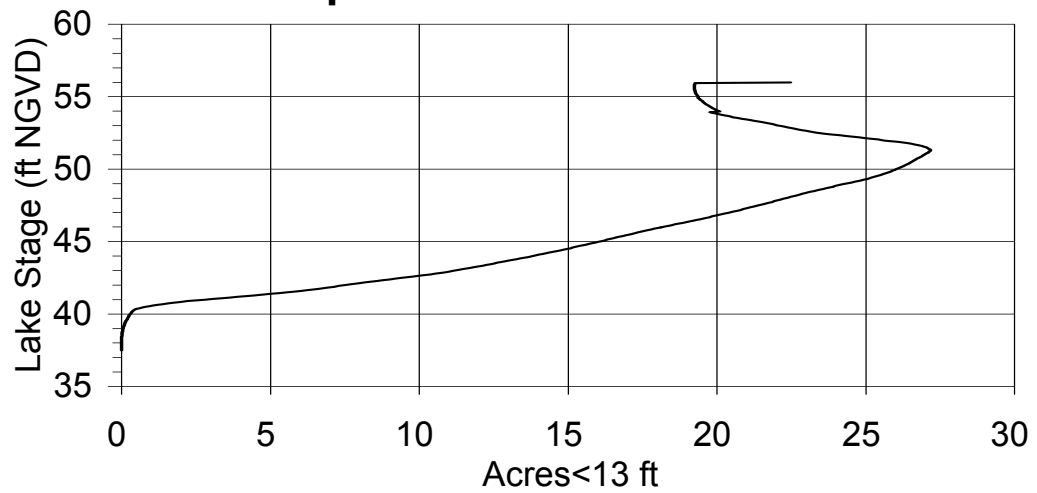
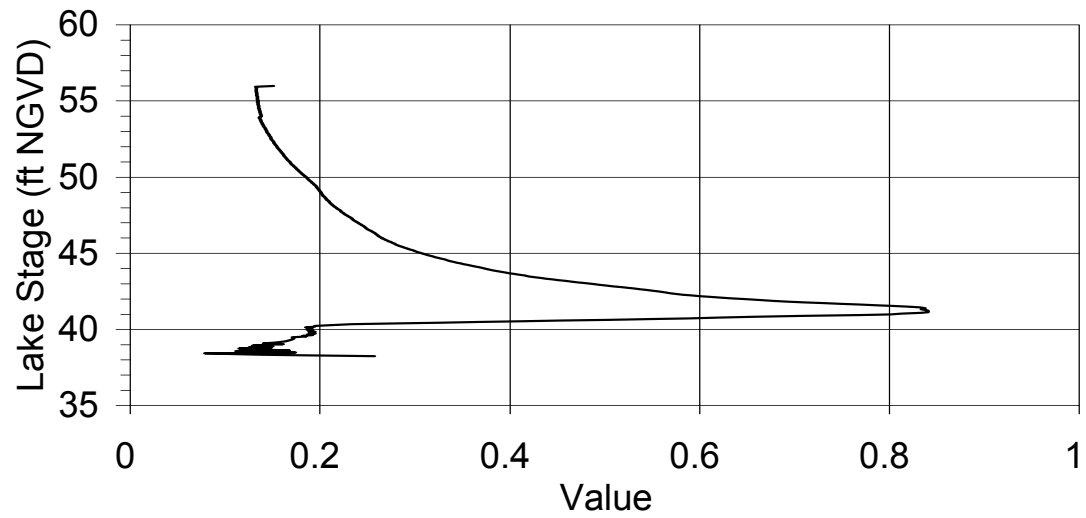


Figure Crenshaw-7. (continued)

Stage and Dynamic Ratio



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