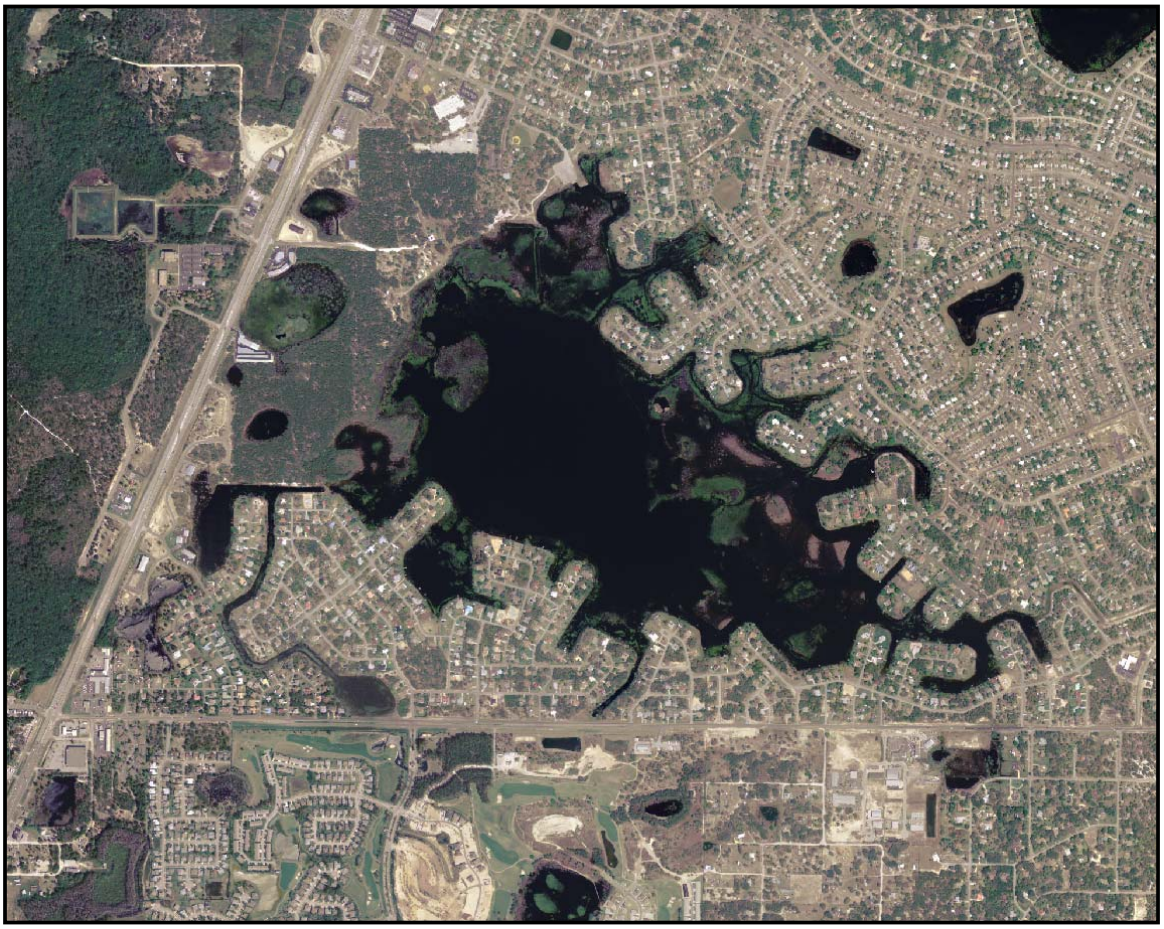
Minimum and Guidance Levels for Hunters Lake in Hernando County, Florida



July 2005

Ecologic Evaluation Section
Resource Conservation and Development Department

Southwest Florida
Water Management District

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Brooksville, Florida 34604-6899

Minimum and Guidance Levels for Hunters Lake

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 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, F.S.). 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; and j) 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 or levels for lakes, wetlands, rivers and aquifers, and adopted them into its Water Level 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 greater than 0.5 acre in size, and for those without fringing cypress wetlands. 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 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, lakeshore 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 lakeshore 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 lakeshore 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 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 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 on a long-term basis.

- The Low Guidance Level is provided as an advisory guideline for water dependent structures, information for lakeshore 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 on a long-term basis.

In accordance with Chapter 40D-8, F.A.C., Minimum and Guidance Levels were developed for Hunters Lake, a Category 3 Lake located in Hernando County, Florida and adopted by the Governing Board on December 14, 2004 (Table 1). 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 levels are described in the remainder of this report.

Table 1. Minimum and guidance levels for Hunters Lake in Hernando County, Florida

Level	Elevation (feet above NGVD)
Ten Year Flood Guidance Level	20.8
High Guidance Level	19.3
High Minimum Lake Level	19.3
Minimum Lake Level	17.1
Low Guidance Level	13.7

Data and Analyses Supporting Development of Minimum and Guidance Levels for Hunters Lake

Lake Setting and Description

Hunters Lake (Figure 1) is located in southwest Hernando County, Florida (Sections 28, 29, 32 and 33, Township 23S, Range 17E) in the Coastal Rivers Basin of the Southwest Florida Water Management District. White (1970) classified the area of west-central Florida containing Hunters Lake as the Northern Gulf Coastal Lowlands physiographic region. Brooks (1981) characterized the area surrounding the lake as the Weeki Wachee Dune Field subdivision of the Ocala Uplift Physiographic District, and described the subdivision as "an area of paleo sand dunes and solution basins" with sand pine and longleaf pine-turkey oak assemblages as the dominant vegetative communities. As part of the Florida Department of Environmental Protection's Lake Bioassessment/ Regionalization Initiative, the area has been identified as the Weeki Wachee Hills lake region and described as an area of Pleistocene sand dunes with mostly clearwater, circumneutral-pH lakes that have moderately low alkalinity and nutrient levels (Griffith *et al.* 1997).

Most of the lake shoreline has been cleared, dredged and filled for residential development (Figure 2; see Figure 3 for a historical perspective of the lake basin). Although extensive canalization has occurred in most of the basin, the western shoreline remains in a relatively natural state with distinct vegetative zonation evident. Public access to the lake is available along the north lakeshore at a boat ramp maintained by the Hernando County Government.

The drainage area for the lake is 2.3 square miles (Florida Board of Conservation 1969). Historically, Hunters Lake was an isolated system, with no major surface water inflows or outflows (Henderson 1986). Modifications associated with development of the region include the dredging of canals that convey water into the lake basin from several lakes to the north and east (*e.g.,* Hog Pond, Weekiwachee Prairie Lake, Lake Crescent and Lake Century) during extremely wet periods, and the dredging of an outlet conveyance system. A water control structure along the west shore of the lake separates Hunters Lake from the Baffin Waterway System, a system of dredged canals and lakes, including Dandelion Lake, Planter Lake, Caribbean Lake, and the Darnell Waterway, that drain to the Gulf of Mexico through coastal swamp systems west of U.S. Highway 19. There are no surface water withdrawals from the lake currently permitted by the District. Non-permitted (and presumably small magnitude) surface water withdrawals are common within the basin, based on the numerous withdrawals pipes observed along the lake shoreline during site visits in February and June 2003. There are a few permitted groundwater withdrawals in the vicinity of the lake.

The 1954 (photorevised 1988) United States Geological Survey 1:24,000 Port Richey NE, Fla. and Aripeka, Fla. quadrangle maps show a surface water elevation of 19 ft above the National Geodetic Vertical Datum of 1929 (NGVD) for Hunters Lake. The

"Gazetteer of Florida Lakes" (Florida Board of Conservation 1969, Shafer *et al.* 1986) lists the lake area as 302 acres at this elevation. Based on a recently developed topographic map of the basin, the lake extends over 429 acres when the water is staged at 19 ft above NGVD (Figure 4).

Figure 1. Location of Hunters Lake in Hernando County, Florida.

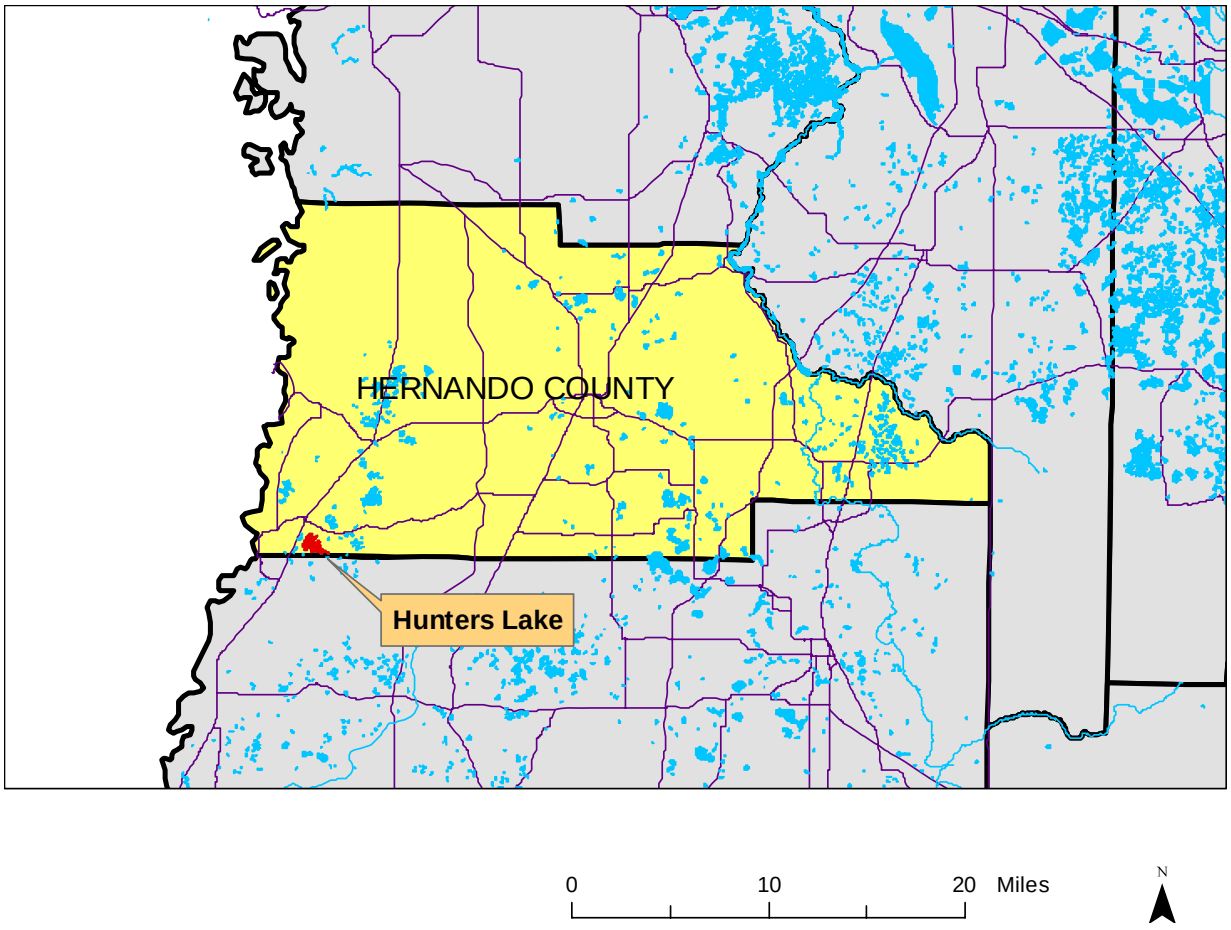
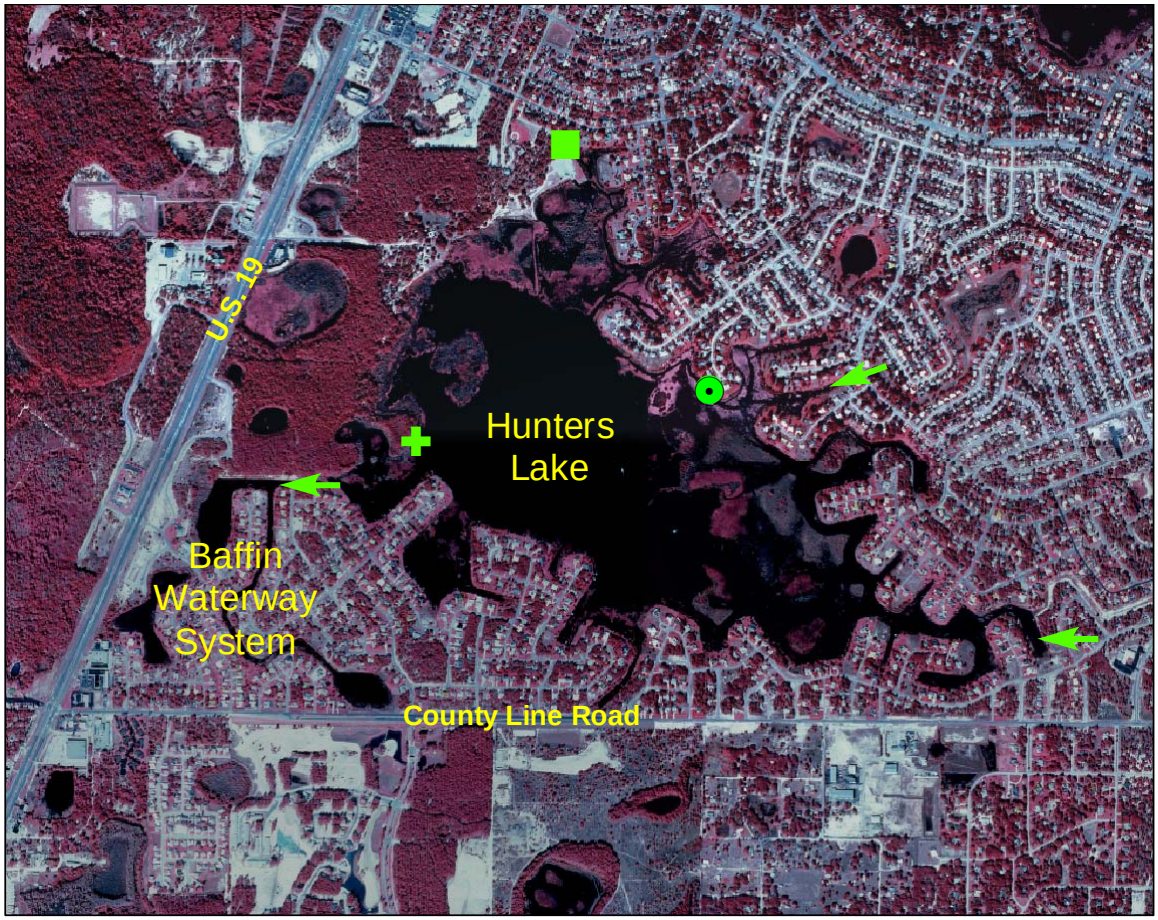


Figure 2. Location of District lake-level gauge, inlets, outlet, public boat ramp and site where hydrologic indicators were measured at Hunters Lake in Hernando County, Florida.



Lake gauge

Inlet & Outlet

Hydrologic Indicators

Public Boat Ramp

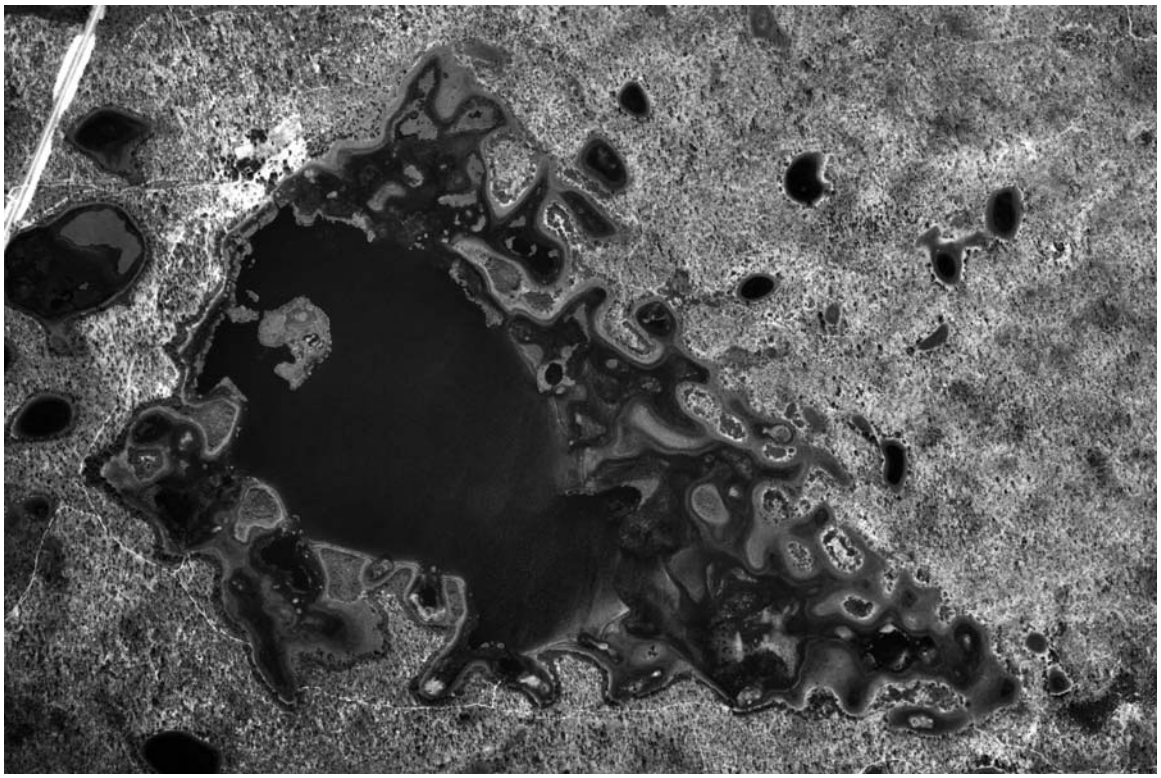
0 1,000 2,000 3,000 Feet

Aerial photography from 1999 USGS Digital Orhtophotograph.

Map prepared September 23, 2003

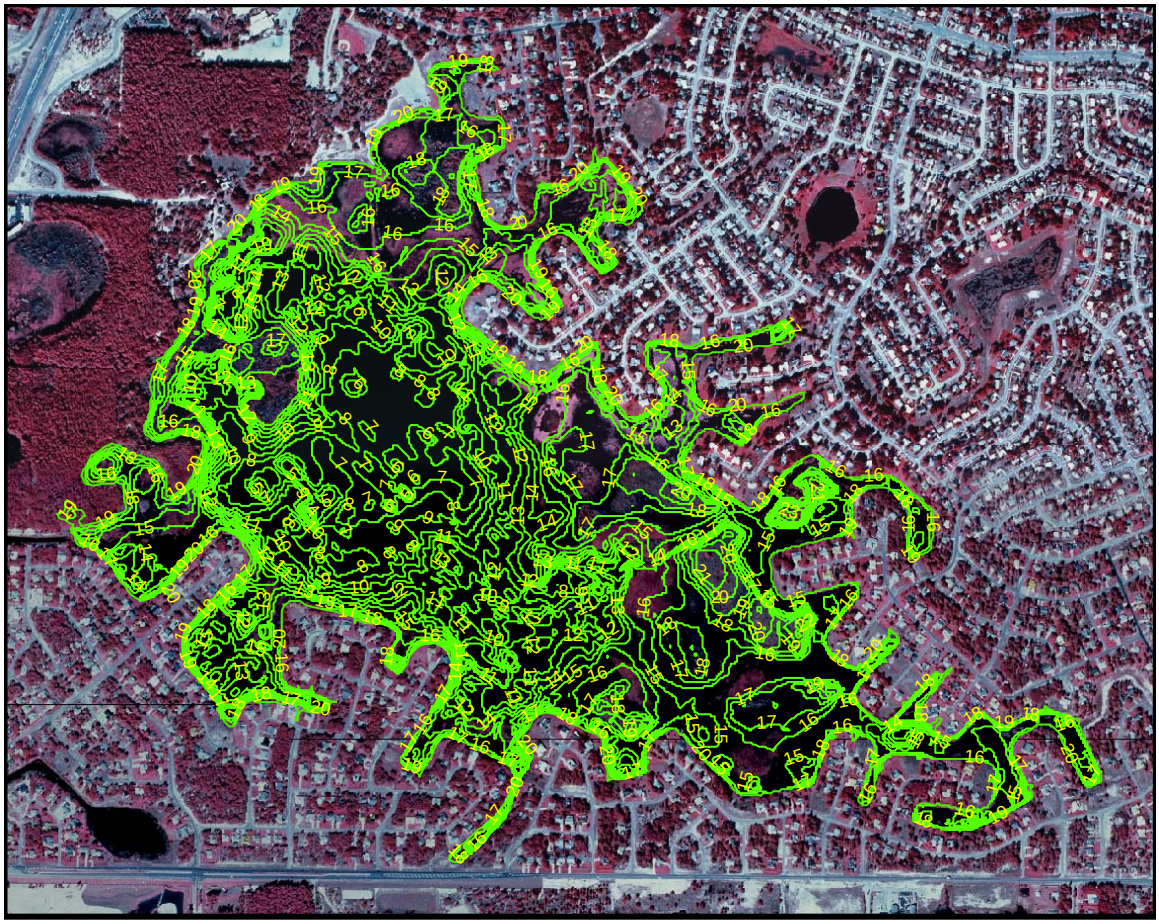
N

Figure 3. Aerial photograph from 1952 of Hunters Lake in Hernando County, Florida.

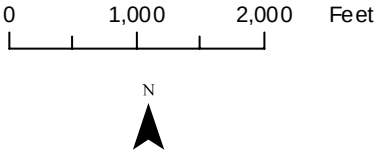


Aerial photography from Florida Department
of Agriculture and Consumer Services, 1952

Figure 4. One-foot contours within the Hunters Lake basin in Hernando County, Florida. Values shown are elevations, in feet above the National Geodetic Vertical Datum of 1929.



Map prepared June 30, 2003 using 1999 USGS digital orthophotography, elevation data from 1981 SWFWMD aerial photography with contours maps (Sheet Nos. 28-23-17, 29-23-17, 32-23-17 and 33-23-17), and elevation data collected on February 27, March 6 and June 26, 2003 by SWFWMD staff.



Previously Adopted Lake Management Levels

Based on work conducted in the 1980s (SWFWMD, unpublished data), lake management levels (currently referred to as Guidance Levels) were previously developed for Hunters Lake (Table 2). A Maximum Desirable Level of 20.00 ft above NGVD was also developed. The levels were developed for regulatory purposes, but were not adopted into District rules.

Table 2. Previously adopted guidance levels and associated surface areas proposed in the 1980s for Hunters Lake in Hernando County, Florida.

Level	Elevation (feet above NGVD)	Total Lake Area (acres)
Ten Year Flood Guidance Level	NA	NA
High Level	20.50	442
Low Level	17.50	387
Extreme Low Level	16.00	279

NA = not available

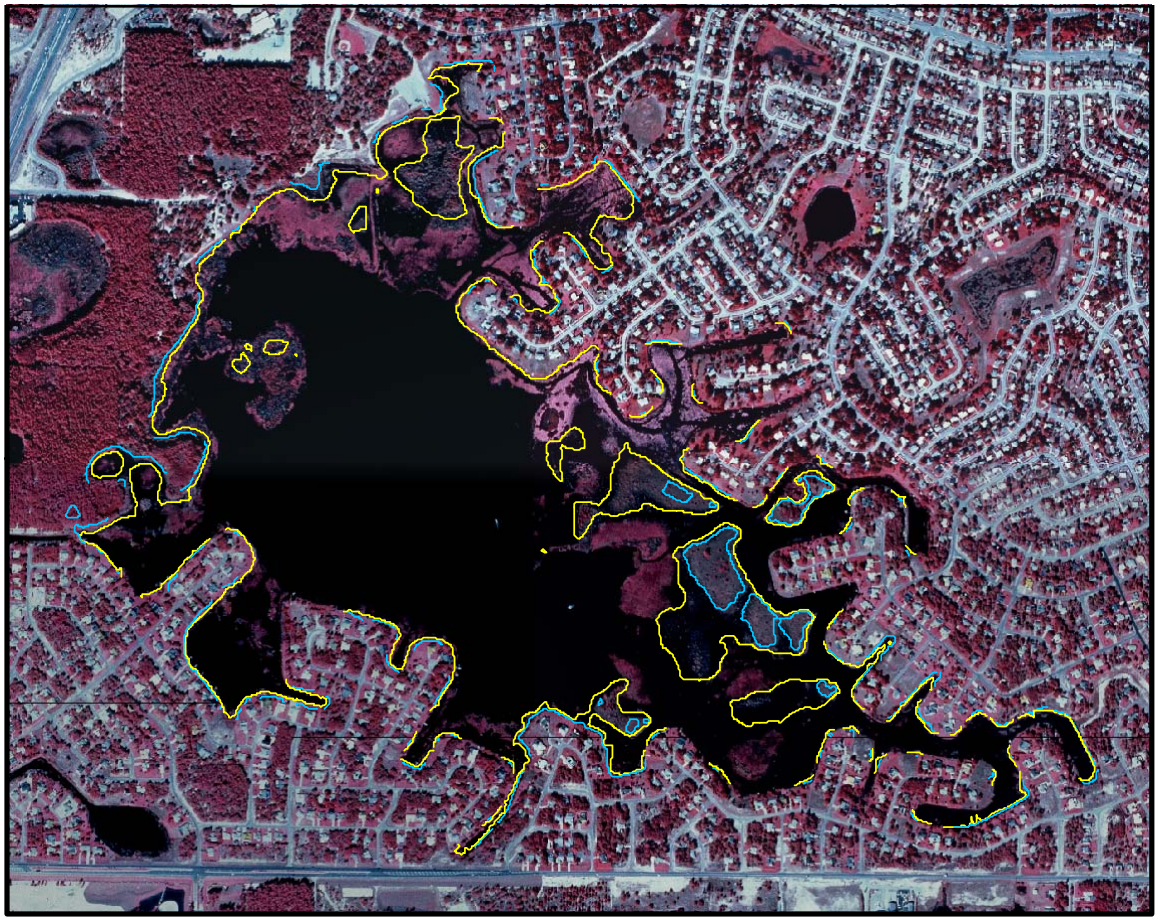
Currently Adopted Minimum and Guidance Levels

Minimum and Guidance Levels were developed for Hunters Lake using the methodology for Category 3 Lakes described in District rules (Chapter 40D-8, Florida Administrative Code). The levels, along with lake surface area values for each level are listed in Table 3. Contour lines corresponding to the minimum level elevations are shown within the basin in Figure 5.

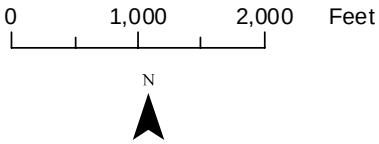
Table 3. Minimum levels, guidance levels and associated surface areas for Hunters Lake in Hernando County, Florida.

Level	Elevation (feet above NGVD)	Lake Area (acres)
Ten Year Flood Guidance Level	20.8	443
High Guidance Level	19.3	433
High Minimum Lake Level	19.3	433
Minimum Lake Level	17.1	375
Low Guidance Level	13.7	169

Figure 5. Approximate location of the Minimum Lake Level (yellow) and proposed High Minimum Lake Level (blue) for Hunters Lake in Hernando County, Florida. Elevations of contours are in feet above the National Geodetic Vertical Datum of 1929.



Map prepared June 30, 2003 using 1999 USGS digital orthophotography, elevation data from 1981 SWFWMD aerial photography with contours maps (Sheet Nos. 28-23-17, 29-23-17, 32-23-17 and 33-23-17), and elevation data collected on February 27, March 6 and June 26, 2003 by SWFWMD staff.



Legend

hunters_min_levels

CONTOUR

17.1 ft

19.3 ft

Summary Data for Development of Minimum and Guidance Levels

Hydrologic data are available for Hunters Lake (District Universal ID Number STA 257 257) from January 1965 through June 1966 and from June 1967 to the present date (Figure 6, see Figure 2 for current location of the SWFWMD lake-level gauge). The highest surface elevation for Hunters Lake included in the District Water Management Database, 20.70 ft above NGVD, occurred on March 30, 1970 and again on November 4, 1984. The low of record, 11.90 ft above NGVD, was recorded on June 25, 2001. Monthly mean water surface elevations, along with proposed guidance and minimum levels for the lake are shown in Figure 7. Based on evaluation of groundwater and lake stage data (Basso 2005), hydrologic data for the entire period of record were classified as Historic data. Historic data collected through January 2003 were used to calculate the Historic P10, P50, and P90 (Table 4).

The Normal Pool elevation was established at 23.0 ft above NGVD based on elevations of saw palmetto (*Serenoa repens*) shrubs along the west shore of the lake (Table 5). The control point and low floor slab elevation were determined using available one-foot contour interval aerial maps and field survey data (Table 4). The control point elevation was established at 19.2 ft above NGVD, based on the elevation at the top of the boards inserted in the riser of the structure located along the west shore of the lake (Figure 8). Based on conveyance through the structure to the Baffin Waterway System, Hunters Lake is classified as an open basin lake for the purpose of minimum levels development.

Based on the availability of Historic hydrologic data, the High Guidance Level was established at the Historic P10 elevation of 19.3 ft above NGVD (Table 4). The Historic P50 (17.1 ft above NGVD) and Low Guidance Level (13.7 ft above NGVD) were also determined using Historic hydrologic data.

The Ten Year Flood Guidance Level for Hunters Lake was established at 20.8 ft above NGVD, using the methodology for closed basin lakes described in current District Rules (Chapter 40D-8, Florida Administrative Code). Although the lake has an outlet, this approach was considered appropriate because the lake surface has typically been below the outlet control elevation of 19.2 feet above NGVD for extended periods. Peak flood elevations are therefore influenced more by long-term rainfall and evaporation patterns than single storm events, and the "closed-basin lake" methodology is applicable. In accordance with the closed-basin methodology, the 10-year flood level was based on a frequency analysis of available lake stage data and stage values derived from a HSPF (Hydrologic Simulation Program Fortran) continuous simulation model. 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**.** Based on available hydrologic data, the Ten Year Flood Guidance Level (20.8 ft above NGVD) has not been exceeded during the past forty years (see Figures 5 and 6).

Hunters Lake is not contiguous with cypress-dominated wetlands of 0.5 or more acres in size and is therefore classified as a Category 3 Lake for the purpose of minimum levels

development. Aquatic macrophytes, including cattail (*Typha* sp.), spatterdock (*Nuphar luteum*), fragrant water lily (*Nymphaea odorata*), banana lily (*Nymphoides aquatica*), pickerelweed (*Pontederia cordata*), torpedograss (*Panicum repens*), pennywort (*Hydrocotyle umbellata*), bladderwort (*Utricularia* sp.), sawgrass (*Cladium jamaicense*), cordgrass (*Spartina bakeri*), Tracy's beak-rush (*Rhynchospora tracyi*), wax myrtle (*Myrica cerifera*), and willow (*Salix* sp.) occur throughout the basin.

Dock-Use, Basin Connectivity, Mixing, Recreation/Ski, Species Richness, and Aesthetics Standards were evaluated for minimum levels development (Table 4). The Dock-Use Standard was established at 22.5 ft above NGVD, based on the elevation of sediments at the end of ninety percent of the 55 non-floating docks at the lake (17.1 ft above NGVD, Table 6), a clearance factor of 2 ft for use of powerboats in the lake, and the difference between the Historic P50 and Historic P90 elevations (3.4 ft). Floating docks were numerous within the basin (n=53), but were not used for development of the Dock-Use Standard. The Basin Connectivity Standard was established at 20.4 ft above NGVD, based on the elevation that ensures connectivity among the major lake sub-basins (15 ft above NGVD), a clearance value of 2 ft for use of power boats on the lake and the difference between the Historic P50 and Historic P90 elevations. Based on potential resuspension of sediments, the Mixing Standard was established at 15.1 ft above NGVD. The Recreation/Ski Standard was established at 16.4 ft above NGVD, based on the elevation at which the lake could contain a safe skiing area (13 ft above NGVD) and the difference between the Historic P50 and Historic P90 elevations. The Species Richness Standard was established at 16.2 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 Aesthetic-Standard for the lake was established at the Low Guidance Level elevation of 13.7 ft above NGVD. 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).

The Basin Connectivity and Dock-Use Standards are greater than the Historic P50 elevation, so the Minimum Lake Level was established at the Historic P50 elevation (17.1 ft above NGVD). The High Minimum Lake Level was established at 19.3 ft above NGVD, an elevation corresponding to the Minimum Lake Level plus the difference between the Historic P50 and the Historic P10 (2.2 ft). The High Minimum Lake Level is 3.7 ft below the below floor slab of the lowest residential building in the immediate lake basin. At the High Minimum Lake Level, the lake surface would be 1.7 ft below the top of the public boat ramp located along the north lakeshore. At the Minimum Lake Level, the water depth at the bottom of the ramp would be 3.9 ft.

Figure 6. Surface water elevation at Hunters Lake in Hernando County, Florida. Data through January 2003 are shown.

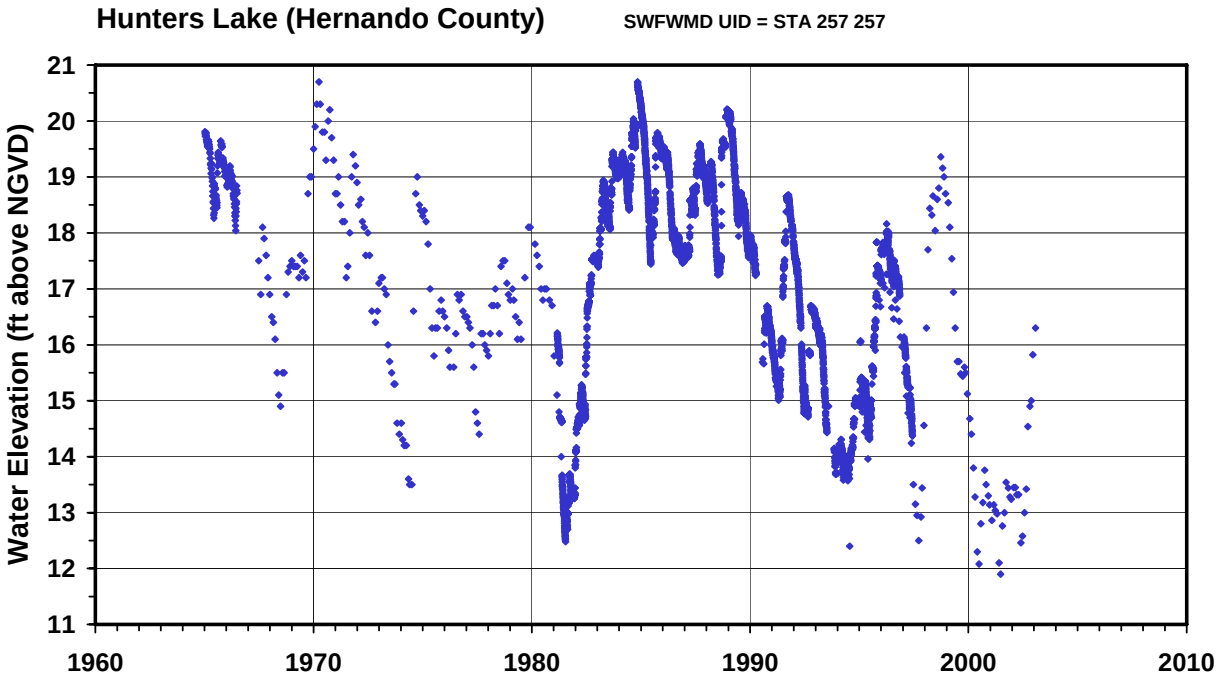


Figure 7. Mean monthly surface water elevation through January 2003, and proposed guidance and minimum levels for Hunters Lake in Hernando County, Florida. Proposed levels include the Ten Year Flood Guidance Level (10-YR), High Guidance Level (HGL), Low Guidance Level (LGL), High Minimum Lake Level (HMLL), and Minimum Lake Level (MLL).

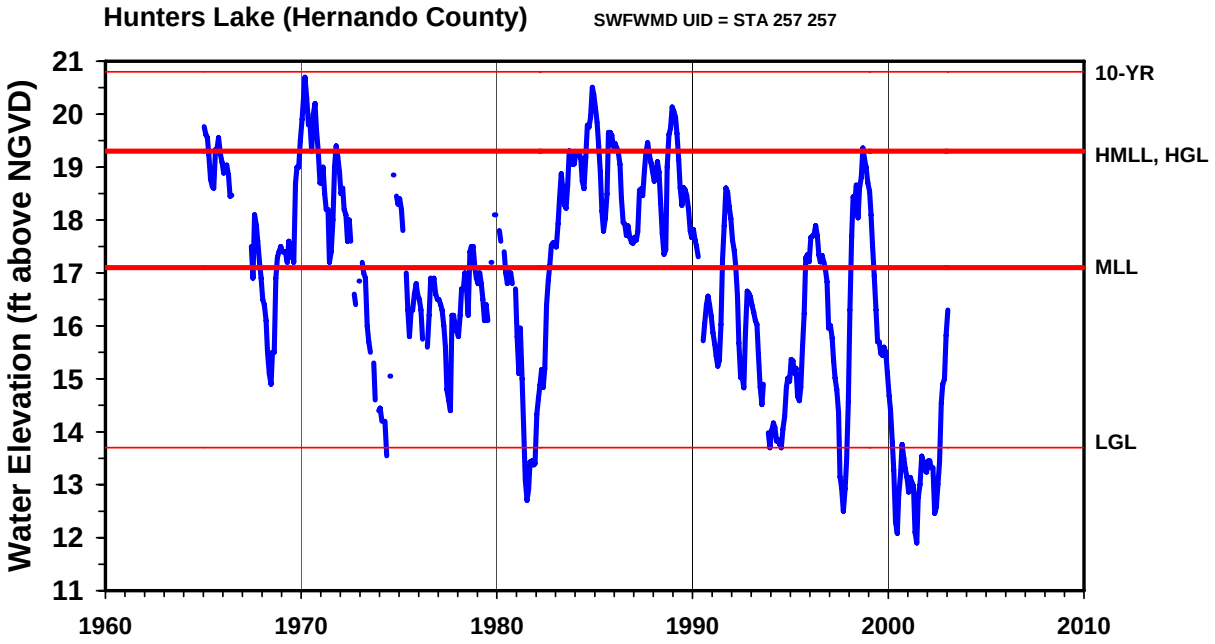


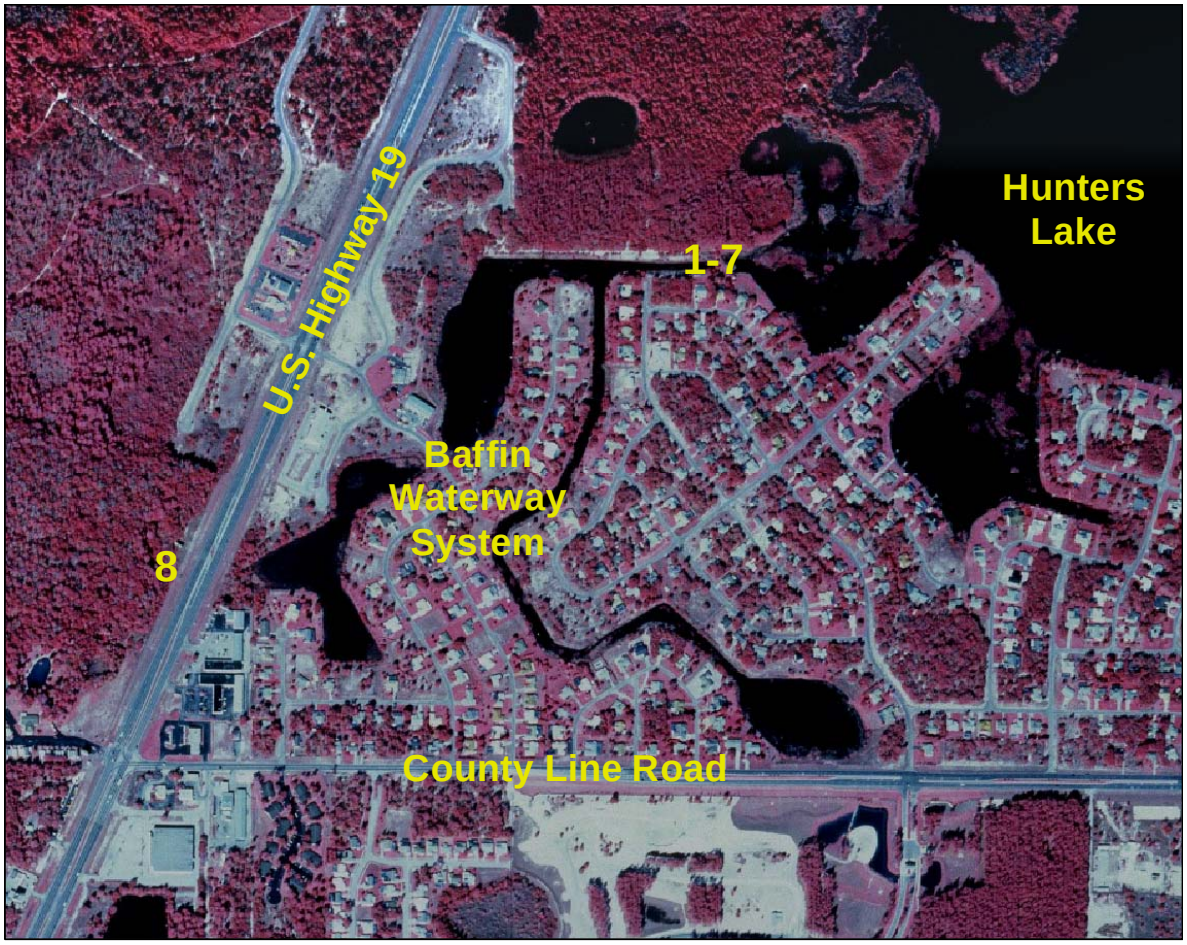
Table 4. Elevation data and associated area values used for establishing minimum and guidance levels for Hunters Lake in Hernando County, Florida.

Level or Feature	Elevation (feet above NGVD)	Lake Area (acres)
Historic P10	19.28	433
Historic P50	17.10	375
Historic P90	13.72	169
Normal Pool	23.0	445
Low Floor Slab	23.0	445
Low Other (top of paved public boat ramp)	21.0	443
Low Other (bottom of paved public boat ramp)	13.2	156
Control Point	19.2	432
Dock-Use Standard	22.5	445
Basin Connectivity Standard	20.4	442
Recreation/Ski Standard	16.4	333
Mixing Standard	15.1	222
Species Richness Standard	16.2	324
Aesthetic Standard	13.7	169

Table 5. Elevation data used for establishing the Normal Pool Elevation for Hunters Lake in Hernando County, Florida. Data were collected in February 2003 by SWFWMD staff.

Hydrologic Indicator	Elevation (feet above NGVD)
Base of saw palmetto along western lakeshore	22.33
Base of saw palmetto along western lakeshore	22.40
Base of saw palmetto along western lakeshore	22.53
Base of saw palmetto along western lakeshore	22.69
Base of saw palmetto along western lakeshore	22.69
Base of saw palmetto along western lakeshore	22.78
Base of saw palmetto along western lakeshore	22.82
Base of saw palmetto along western lakeshore	22.91
Base of saw palmetto along western lakeshore	22.93
Base of saw palmetto along western lakeshore	22.94
Base of saw palmetto along western lakeshore	22.99
Base of saw palmetto along western lakeshore	23.00
Base of saw palmetto along western lakeshore	23.05
Base of saw palmetto along western lakeshore	23.07
Base of saw palmetto along western lakeshore	23.16
Base of saw palmetto along western lakeshore	23.31
Base of saw palmetto along western lakeshore	23.49
Base of saw palmetto along western lakeshore	23.80
Base of saw palmetto along western lakeshore	23.82
Base of saw palmetto along western lakeshore	23.83
Base of saw palmetto along western lakeshore	24.21
N	**21**
Median	**23.0**
Mean	**23.1**
SD	**0.5**

Figure 8. Outlet conveyance system for Hunters Lake in Hernando County, Florida.



Aerial photography from 1999 USGS Digital Orhtophotograph.

Map prepared June 30, 2003

0 500 1,000 Feet

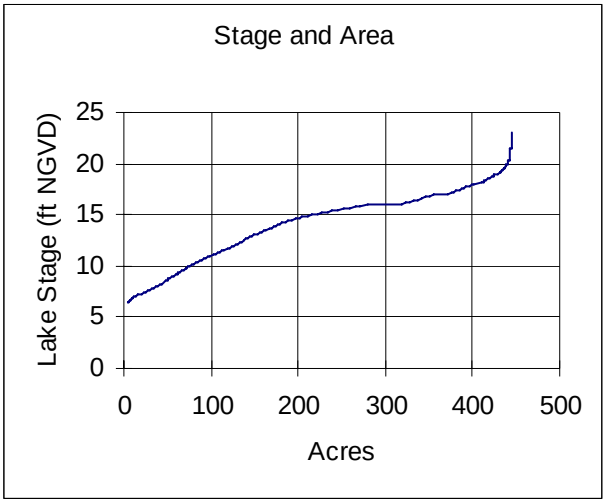
N

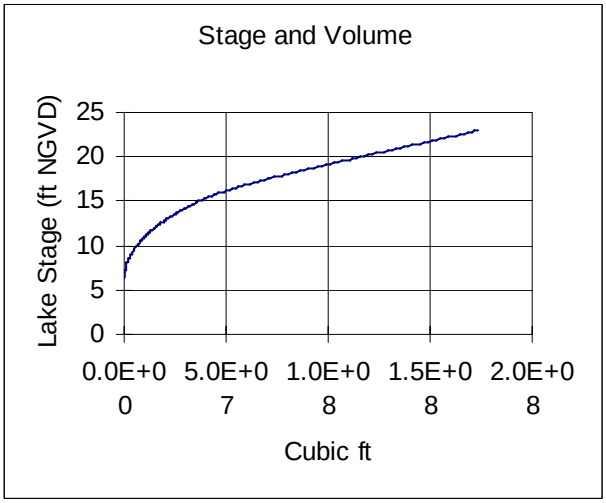
Site	Description	Elevation (feet above NGVD)
1	Invert at east end of culvert	15.24
2	Top of riser at structure (maximum board height)	21.18
3	Control point; top of boards in riser at structure on 1/11/2001	19.18
4	Ground elevation 25 ft east of culvert	15.87
5	Invert at west end of culvert	14.83
6	Ground elevation a west end of culvert	14.97
7	Ground elevation 25 ft west of culvert	13.67
8	Baffin Waterway outfall that drains to wetland system which ultimately drains to the Gulf of Mexico	Not Available

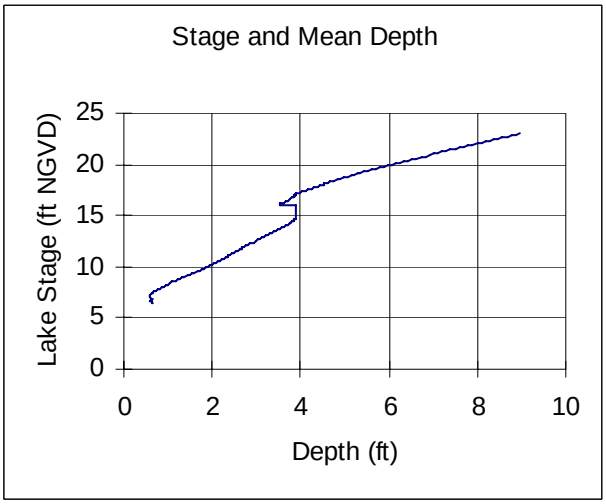
Table 6. Summary statistics for elevations associated with 55 docks at Hunters Lake in Hernando County, Florida. Data were collected in June 2003 by SWFWMD staff. Percentiles (P10, P50, P90) represent elevations exceeded by 10, 50 and 90 percent of the docks. Elevations for floating-type docks (n=53) were not used for summary statistic estimates.

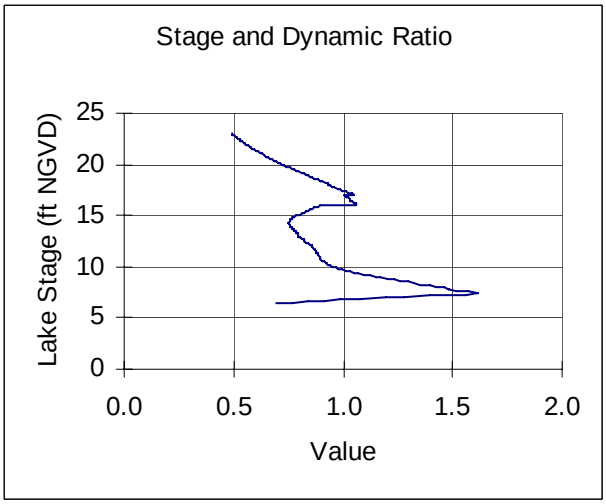
Statistic	Elevation of Sediments at Dock Ends (feet above NGVD)	Elevation of Dock Platform (feet above NGVD)
Mean (SD)	15.8 (1.5)	22.3 (1.2)
P10	17.1	20.9
P50 (Median)	15.8	20.2
P90	14.1	19.3
Maximum	21.2	26.2
Minimum	12.3	18.6

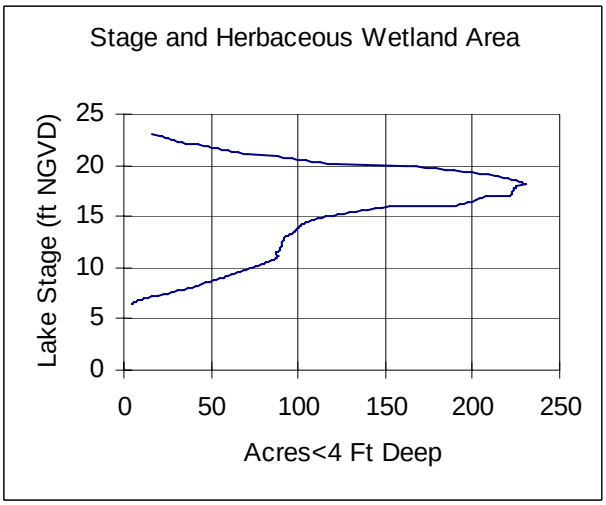
Figure 9. Surface area, volume, mean depth, dynamic ratio (basin slope), potential herbaceous wetland area, and area available for macrophyte colonization versus lake stage for Hunters Lake in Hernando County, Florida.

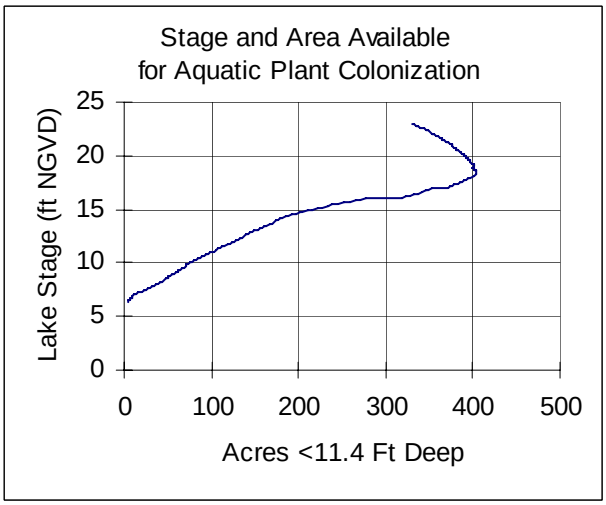












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